Ompompanoosuc River Corridor Plan

Thetford to Norwich, Vermont

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Town of Norwich

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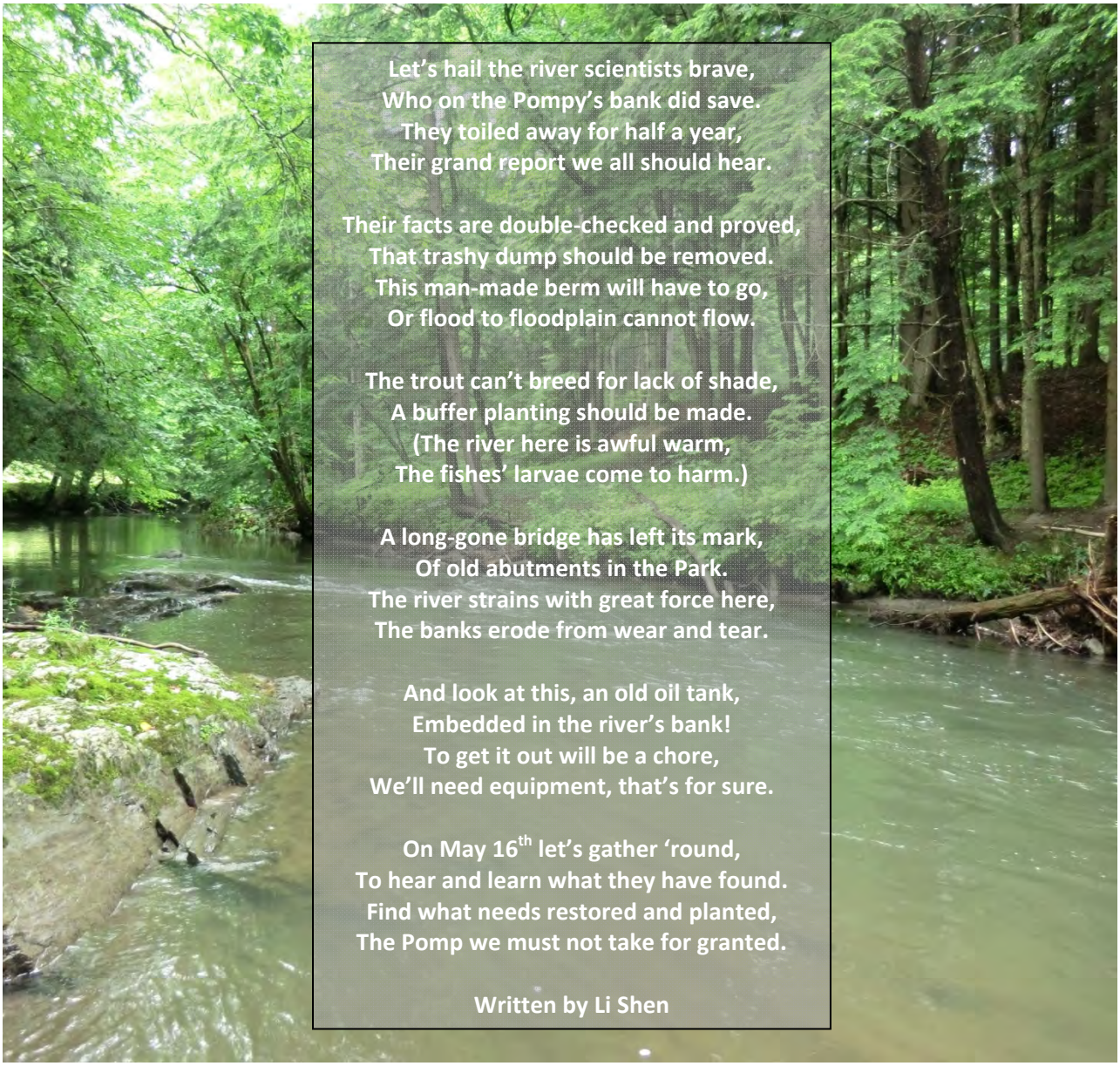

Let's hail the river scientists brave,
Who on the Pompy's bank did save.
They toiled away for half a year,
Their grand report we all should hear.

Their facts are double-checked and proved,
That trashy dump should be removed.
This man-made berm will have to go,
Or flood to floodplain cannot flow.

The trout can't breed for lack of shade,
A buffer planting should be made.
(The river here is awful warm,
The fishes' larvae come to harm.)

A long-gone bridge has left its mark,
Of old abutments in the Park.
The river strains with great force here,
The banks erode from wear and tear.

And look at this, an old oil tank,
Embedded in the river's bank!
To get it out will be a chore,
We'll need equipment, that's for sure.

On May 16th let's gather 'round,
To hear and learn what they have found.
Find what needs restored and planted,
The Pomp we must not take for granted.

Written by Li Shen

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Thetford to Norwich, Vermont

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1.0 EXECUTIVE SUMMARY

A stream geomorphic assessment of the lower Ompompanoosuc River was conducted by Bear Creek Environmental, LLC (BCE) in summer 2012. The study was funded by the State of Vermont Ecosystem Restoration Program, the Upper Connecticut Mitigation and Enhancement Fund, and the Town of Norwich and was prepared under contract to the Thetford Conservation Commission (TCC). A planning strategy based on fluvial geomorphic science (see glossary at end of report for associated definitions) was chosen because it provides a holistic, watershed-scale approach to identifying the stressors on river ecosystem health. The stream geomorphic assessment data can be used by resource managers, community watershed groups, municipalities and others to identify how changes to land-use alter the physical processes and habitat of rivers. The stream geomorphic assessment data will be used to help focus stream restoration activities within the watershed and assist with town planning. BCE conducted a stream geomorphic assessment for the upper Ompompanoosuc River in 2010 and prepared a similar report, *Ompompanoosuc River Corridor Plan: West Fairlee to Thetford, VT* (BCE, 2011).

The lower Ompompanoosuc River watershed was divided into fifteen reaches for the 2012 assessment, eleven on the main stem, two on the West Branch of the Ompompanoosuc River, and two on Avery Brook, a tributary to the Ompompanoosuc River. The study encompassed approximately 14 miles of stream channel. This assessment was helpful in identifying major stressors to geomorphic stability in the watershed. The primary problem relating to geomorphic stability and habitat condition in the lower Ompompanoosuc River watershed is channel straightening associated with the existence of agricultural fields and major roads. In some cases, this has caused minor to moderate channel degradation (lowering of the bed) resulting in sediment buildup, channel widening, and planform adjustment (lateral movement). The lower West Branch has been historically straightened in many areas and the river's energy has been redirected to sharp bends, where at least one channel avulsion has occurred. The Ompompanoosuc main stem downstream of the Union Village Flood Control Dam is impacted by reduced and controlled flows.

A list of 27 potential restoration and protection projects was developed during project identification. Types of projects include: river corridor easements, buffer plantings, stormwater management, stream clean-ups, culvert replacements or retrofits, and the removal of old bridge abutments, a berm, and ineffective bank armoring. Recommendations for additional Phase 2 assessments on tributaries are outlined at the end of the plan. Phase 3 surveys for active restoration projects may be required at some point in the near future for project design and permitting.

2.0 LOCAL PLANNING PROGRAM OVERVIEW

There are many scientific terms used in this river corridor plan, and the reader is encouraged to refer to the glossary at the end of the document. Important terms that are in the glossary are shown in italics the first time they are used in the text.

2.1 Overview

This project focuses on the lower Ompompanoosuc River watershed in Thetford and Norwich, Vermont. The main stem and the West Branch of the Ompompanoosuc River along with one small *tributary* (Avery Brook) were assessed using the Vermont Agency of Natural Resources Phase 2 Stream Geomorphic Assessment protocol during summer 2012 for a total of 14 river miles. The Vermont River Management program has developed state-of-the-art Stream Geomorphic Assessment (SGA) protocols that utilize the science of *fluvial geomorphology* (fluvial = water, geo = earth, and morphology = the study of structure or form). Fluvial geomorphology focuses on the processes and pressures operating on river systems. The Vermont protocol includes three phases:

1. Phase 1 – Remote sensing and cursory field assessment;
2. Phase 2 – Rapid habitat and rapid geomorphic assessments to provide field data to characterize the current physical condition of a river; and
3. Phase 3 – Detailed survey information for designing “active” channel management projects.

2.2 River Corridor Planning Team

Project partners for the stream geomorphic assessment of the Ompompanoosuc River watershed include the Thetford Conservation Commission, the Town of Norwich, the West Fairleee Conservation Commission, the Vermont Agency of Natural Resources (VANR), the White River Natural Resources Conservation District, the Connecticut River Watershed Council, Two Rivers-Ottauquechee Regional Commission, community members, and landowners. Funding for the lower Ompompanoosuc River main stem and tributaries project is provided through the State of Vermont Ecosystem Restoration Program, the Upper Connecticut Mitigation and Enhancement Fund, and the Town of Norwich. Gretchen Alexander (Vermont River Management Program), Ben Copans (ANR Watershed Coordinator), Li Shen (Thetford Conservation Commission), Ron Rhodes (Connecticut River Watershed Council), and Mary Childs (White River Natural Resources Conservation District) make up the lower Ompompanoosuc steering committee. Gretchen Alexander from the Vermont River Management Program of VANR provided a quality control/assurance review of the stream geomorphic assessment data.

2.3 Local Project Objectives

The stream geomorphic assessment data are useful to resource managers, community watershed groups, municipalities and others for identifying how changes to land-use alter the physical processes and *habitat* of rivers. Characterizing stream type, identifying stressors in the watershed, and assessing the health of aquatic habitat and the riparian corridor are essential for the preparation of an effective and long-term river corridor plan. The Thetford Conservation Commission, in collaboration with towns and other partners, have the opportunity to address and mitigate major watershed stressors through the design and implementation of r*estoration* and protection projects outlined in this corridor plan.

The Progress Report on River Basin Water Quality Management Planning During 2011 (VANR, 2012a) indicates that Basin 14, which includes the Ompompanoosuc River watershed, is in the Monitoring and Assessment stage of basin planning. The VANR has developed draft Fluvial Erosion Hazard (FEH) Zones for the Ompompanoosuc watershed. It is recommended that FEH zones be incorporated in town zoning and planning efforts. For more information about FEH zones, refer to Section 2.5.2 (Watershed Opportunities).

2.4 Goals of the Vermont River Management Program

The State of Vermont's River Management Program has set out several goals and objectives that are supportive of the local initiative in the Ompompanoosuc River Watershed. The state management goal is to, "manage toward, protect, and restore the fluvial geomorphic equilibrium condition of Vermont rivers by resolving conflicts between human investments and river dynamics in the most economically and ecologically sustainable manner" (Vermont Agency of Natural Resources, 2009b). The objectives of the Program include fluvial erosion hazard mitigation and sediment and nutrient load reduction, as well as aquatic and riparian habitat protection and restoration. The Program seeks to conduct river corridor planning in an effort to remediate the geomorphic instability that is largely responsible for problems in a majority of Vermont's rivers. Additionally, the Vermont River Management Program has set out to provide funding and technical assistance to facilitate an understanding of river instability and the establishment of well-developed and appropriately scaled strategies to protect and restore river equilibrium.

2.5 Preliminary Project Identification and Prioritization

2.5.1 Reach Level and Site Specific Opportunities

The stream *reaches* evaluated in this study present a variety of planning and management strategies which can be classified under one of the following categories: Active Geomorphic Restoration and Passive Geomorphic Restoration.

Active Geomorphic Restoration implies the management of rivers to a state of geomorphic equilibrium through active, physical alteration of the channel and/or *floodplain*. Often this approach involves the removal or reduction of human constructed constraints or the construction of *meanders*, floodplains or stable banks. Active riparian buffer revegetation and long-term protection of a river corridor is essential to this alternative.

Passive Geomorphic Restoration allows rivers to return to a state of geomorphic equilibrium by removing factors adversely impacting the river and subsequently using the river's own energy and watershed inputs to re-establish its meanders, floodplains and equilibrium conditions. In many cases, passive restoration projects may require varying degrees of active measures to achieve ideal results. Active riparian buffer revegetation and long-term protection of a river corridor are also essential to this alternative.

There are a number of federal, state, and local programs available for river restoration and protection. These programs are as follows:

- ANR River Corridor Easement Program (RCE)
- Ecosystem Restoration Program (formerly called Clean & Clear)
- Conservation Reserve Enhance Program (CREP)
- Trees for Streams (TFS)
- Environmental Quality Incentives Program (EQIP)
- Wildlife Habitat Incentives Program (WHIP)
- Wetland Reserve Program (WRP)
- Connecticut River Watershed Council (CRWC)

River Corridor Easement

The River Corridor Easement is designed to promote the long-term physical stability of the river by allowing the river to achieve a state of equilibrium (where sediment and water loads are in balance). River corridor easements are vital for a passive geomorphic restoration approach and can also be used for conserving rivers that are in good condition (equilibrium). Rivers that are in equilibrium have access to their floodplains and therefore experience less *erosion* and negative impacts from flooding events.

Corridor easements are a high priority for reaches that are not in equilibrium; these channels are experiencing channel adjustments, which are causing conflicts with current/future land-use expectations. Providing an easement on these reaches reduces the conflict and provides a long-term solution to sediment storage and flood water attenuation needs.

- Easements are in perpetuity, meaning the agreement stays with the land forever.
- A onetime payment is received by the landowner for transferal of channel management rights to a second party (a land trust).
- Transferal of channel management rights means that the landowner would no longer be able to rock line river banks or remove gravel for personal use.
- A RCE requires a minimum 50 foot buffer that floats with the river. No active land-use is allowed within the buffer. The buffer can be actively planted or allowed to revegetate passively.
- The easement does not take away the agricultural land-use rights, so the landowner could continue to crop or pasture the farm land mapped outside of the buffer, yet within the corridor, for as long as the river allows.

Ecosystem Restoration Program

The Ecosystem Restoration Program, formerly called the Clean and Clear Program, is a Vermont program designed to improve water quality by addressing one or more of the following areas: stream stability, protecting against flood hazards, enhancing in-stream and riparian habitat, reducing stormwater runoff, restoring riparian wetlands, enhance the environmental and economic sustainability of agricultural lands. Funding is available for project identification, project development and project implementation. Vermont municipalities, local or regional governmental agencies, non-profit organizations, and citizens groups are eligible to receive funding.

Conservation Reserve Enhancement Program

The USDA Farm Service administers a program called the Conservation Reserve Enhancement Program that helps agricultural producers to take farmland out of production in sensitive areas, such as river corridors. This helps to improve water quality and restore wildlife habitat.

- CREP can be either a 15 or 30 year contract to plant trees.
- 90% of the practice costs are covered with the remaining 10% either resting with the participants or could be paid by the US Partners for Fish and Wildlife. Examples of the practice costs include fencing, watering facilities, and trees. There are some costs that are capped, but generally all the practice costs can be paid through the program.
- To provide additional incentives to enroll in CREP, the program offers upfront and annual rental payments for the land where agricultural production is lost during the contract period.

Trees for Streams
Programs offered by the US Fish and Wildlife Service or through State of Vermont funding to work with local partners and landowners to restore native streamside vegetation along river banks.

Environmental Quality Incentives Program
EQIP is a voluntary program available through the Natural Resources Conservation Service (NRCS) that provides financial and technical assistance to implement conservation practices to meet local environmental regulations. Owners of land in agricultural or forest production are eligible for the program. Contracts with landowners can be up to ten years in length.

Wildlife Habitat Incentives Program
WHIP is a voluntary program offered to landowners to improve wildlife habitat on their land. Owners of agricultural land, nonindustrial private forest land, and Native American land are eligible. Technical assistance and up to 75 percent cost-share is available to improve fish and wildlife habitat. WHIP was not federally funded for 2013; however, funding for similar conservation practices can be retained though EQIP.

Wetland Reserve Program
WRP is a voluntary program offered by NRCS to landowners to protect, restore and enhance wetlands on their property. NRCS provides technical assistance and financial support for projects that establish long-term conservation and wildlife practices and protection.

Connecticut River Watershed Council
Restoration, protection, and enhancement of the river, wetlands, and shore lands within the Connecticut River watershed are supported by funds from the Connecticut River Watershed Council (CRWC). Typical projects include guiding development, preventing erosion, restoring stream passage, and making sure hydropower and industrial permits are aligned to protect natural heritage for future generations.

2.5.2 Watershed-Level Opportunities

There are a number of watershed-level opportunities available to improve the geomorphic stability and water quality of the Ompompanoosuc River watershed. Watershed opportunities include the development and adoption of Fluvial Erosion Hazard Zones, improved stormwater treatment, and community stream clean-up activities.

Fluvial Erosion Hazard Zones
The purpose of defining Fluvial Erosion Hazard Zones is to prevent increases in man-made conflicts that can result from development in identified fluvial erosion hazard

areas; minimize property loss and damage due to fluvial erosion; and prohibit land-uses and development in fluvial erosion hazard areas that pose a danger to health and safety. The basis of a Fluvial Erosion Hazard Zone is a defined river corridor which includes the course of a river and its adjacent lands. The width of the corridor is defined by the lateral extent of the river meanders, called the meander belt width, which is governed by valley landforms, *surficial geology*, and the length and slope requirements of the river channel. The width of the corridor is also governed by the stream type and *sensitivity* of the stream. River corridors, as defined by the Vermont Agency of Natural Resources (2008b), are intended to provide landowners, land-use planners, and river managers with a meander belt width which would accommodate the meanders and slope of a balanced or equilibrium channel, which when achieved, would serve to maximize channel stability and minimize fluvial erosion hazards. Information collected during the Phase 2 Assessment including reach sensitivity, reach condition, and stream type is used to develop these zones.

Gretchen Alexander of the Vermont River Management Section developed FEH zones for the Ompompanoosuc River watershed using the Phase 2 Stream Geomorphic Assessment data. Maps by town showing these draft zones dated October 31, 2013 are provided in the map pocket in the back of this corridor plan. The development of FEH overlay districts on the municipal level are recommended by the Vermont River Management Program (2010b) to improve stream stability, reduce flood losses, and enhance public safety. Additional information about FEH zones is available at (http://www.anr.state.vt.us/dec/waterq/rivers/docs/rv_vtfehqa.pdf).

Stormwater Management

Stormwater runoff rates are of particular concern in urbanized and agricultural watersheds because stormwater runs off from impervious surfaces rather than naturally infiltrating the soil. The cumulative effect of the increased frequency, volume, and rate of stormwater runoff results in increases in wash-off pollutant loading to streams and destabilization of stream channels. Improving stormwater management and construction practices in the Ompompanoosuc River watershed is recommended to reduce siltation of critical aquatic habitat and improve geomorphic stability. An added benefit of stormwater management is the reduction of peak flows in the channel.

3.0 BACKGROUND WATERSHED INFORMATION

3.1 Geographic Setting

3.1.1 Watershed Description

The Ompompanoosuc River is one of the major rivers in Vermont that drains into the Connecticut River (See Figure 3.1). The 25-mile long river drains approximately 137 square miles of land. Generally flowing from north to south, the Ompompanoosuc River originates on the eastern slopes of the Green Mountain Range in Vershire, Vermont, and empties into the Connecticut River in Norwich, Vermont. The lower portion of the watershed that was studied in 2012 includes reaches on the main stem, the West Branch of the Ompompanoosuc, and Avery Brook.

3.1.2 Political Jurisdictions

The part of the Ompompanoosuc River watershed that was assessed in 2012 focused on the river channel and *riparian corridor* within the towns of Thetford and Norwich in Orange and Windsor Counties, respectively.

3.1.3 Land-Use

A land cover layer (2002) was obtained from the Vermont Center for Geographic Information (VCGI) to present land-use within the Ompompanoosuc River watershed for the river corridor plan. The 2002 land cover data indicate that the watershed is dominated by forest land (Figure 3.2). Agriculture and developed land are sub-dominant land-uses. Developed areas are concentrated within the river corridor of the main stem, especially near the mouth of the Ompompanoosuc River, adjacent to the Lake Fairlee outlet, and in the village center of West Fairlee.

3.2 Geologic Setting

Geologic setting is described in Bear Creek Environmental, 2011.

3.3 Geomorphic Setting

Please refer to the Bear Creek Environmental, 2011, for a description of previous geomorphic studies. Table 1 shows an updated summary of the previous geomorphic studies conducted in the watershed. Figure 3.3 shows an updated map showing the location of the 2012 study area and past study areas. This report summarizes the 2012 Phase 2 study of the lower Ompompanoosuc River watershed, which focused on the main stem and West Branch of the Ompompanoosuc River as well as the lower two reaches of Avery Brook. The combined length of the 15 stream reaches assessed in 2012 is approximately 14 miles, with 11.7 miles in Thetford and 2.4 miles in Norwich (See Figure 3.4).

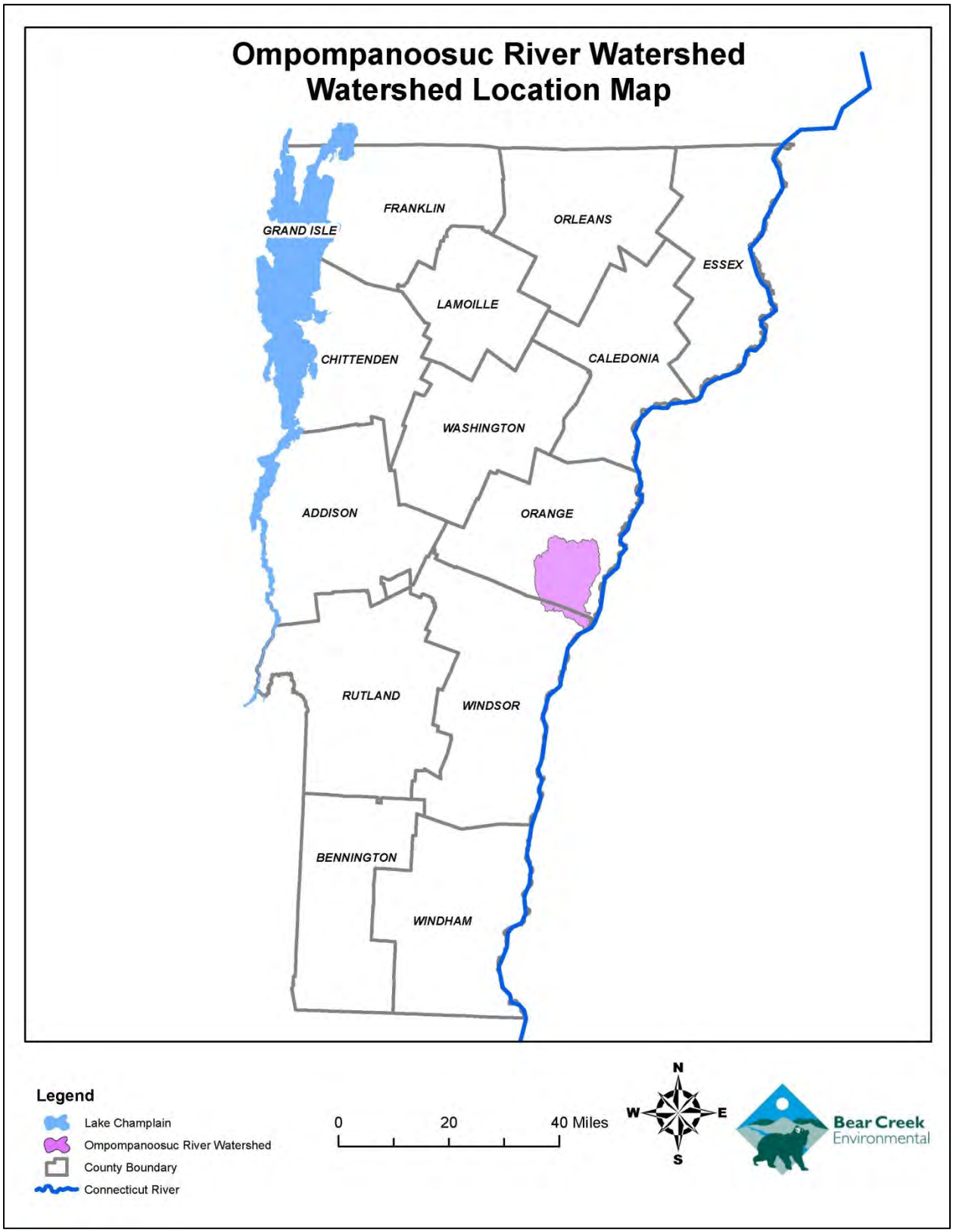

Figure 3.1. Ompompanoosuc River watershed location

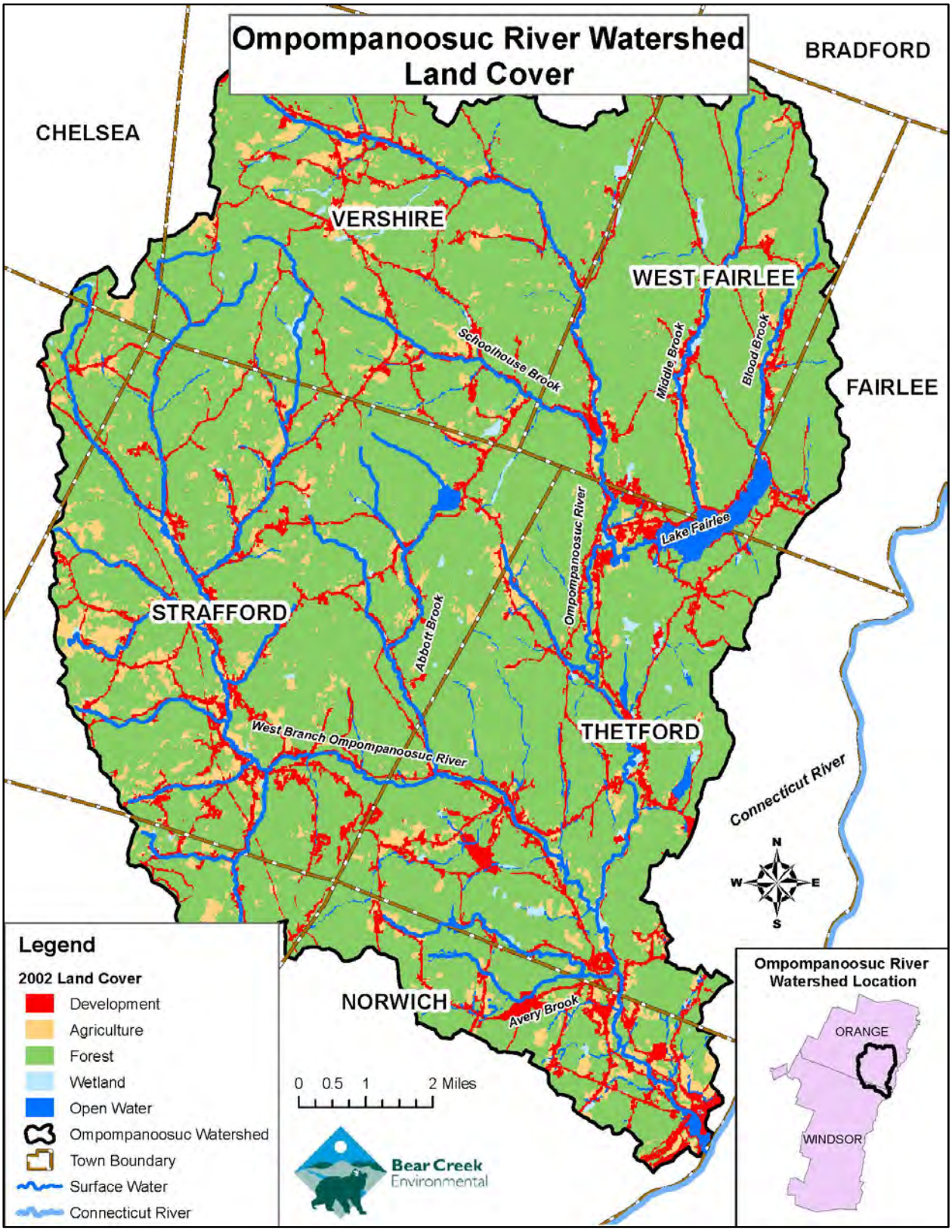

Figure 3.2. Land Cover and Land-Use Map for the Ompompanoosuc River watershed.

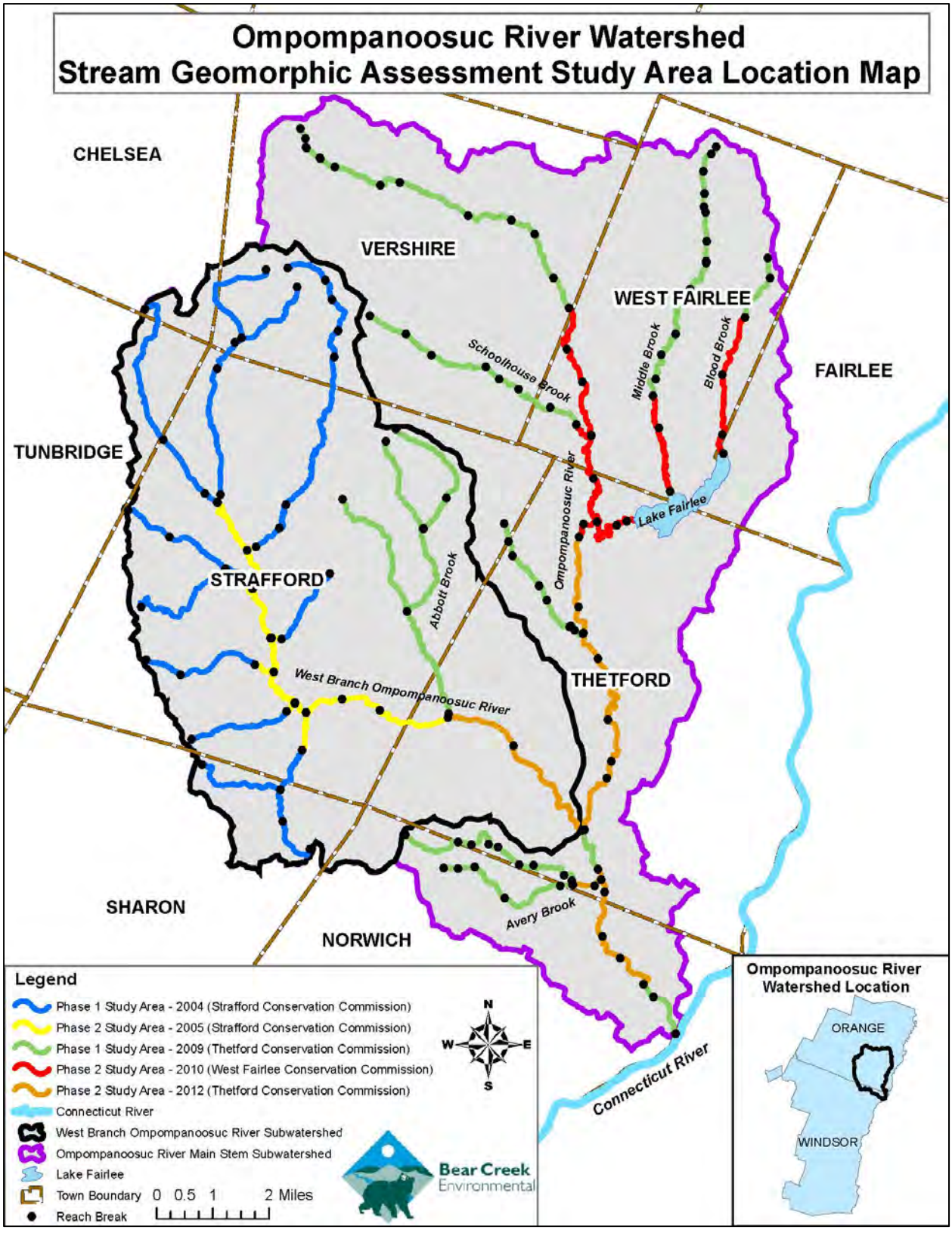

Figure 3.3. Stream geomorphic assessment locations in the Ompompanoosuc River watershed.

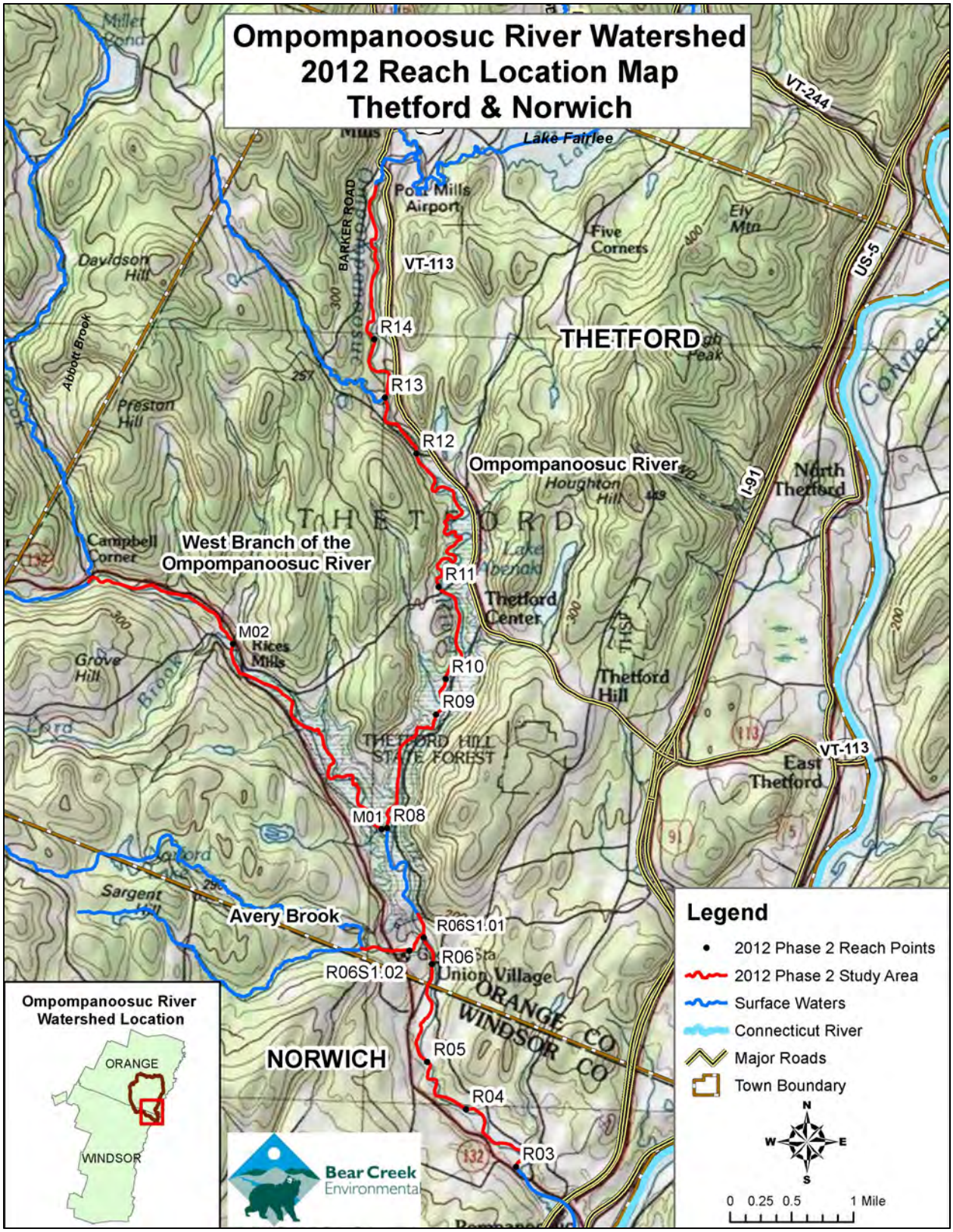

Figure 3.4. Reach Location Map for 2012 Phase 2 Ompompanoosic River watershed assessment.

Table 1.
Stream Geomorphic Assessment Summary[1]
Ompompanoosuc River Watershed

Lead Organization	Year	Phase	Channel Length (River Miles)	Number of Reaches
Stafford Conservation Commission	2004	1	46	40
Thetford Conservation Commission	2009	1	73	99
Strafford Conservation Commission	2005	2	11	16
West Fairlee Conservation Commission	2010	2	14	15
Thetford Conservation Commission	2012	2	14	15

[1]Refer to Figure 3.3 for location of study areas.

3.4 Hydrology

In order to better understand the flood history of the Ompompanoosuc River, long-term data from the U.S. Department of the Interior, U.S. Geological Survey (USGS), were obtained (USGS 2013). The Ompompanoosuc River has one *gaging station* that is located immediately downstream of the Union Village Reservoir in Thetford. At the location of the gage, the Ompompanoosuc River has a drainage area of 130 square miles. The reservoir is created by the Union Village Flood Control Dam, which began construction in 1946 and began regulating stream flows in 1949. According to the Basin 14: Little Rivers Water Quality Management Plan (VANR, 2008c), the Union Village Dam is operated by the U.S. Army Corps of Engineers and is a store and release dam. For the majority of the year, water flows freely through the dam. During certain flood events, which have occurred on average about once per year since the dam was in operation, the flow is controlled (VANR, 2008c). Flows are reduced during a period in the fall when the Union Village Reservoir is being filled; flows are increased in the spring when the reservoir is emptied. During the winter months the dam is still managed as "run-of-the-river" (VANR, 2008c). Figure 3.5 shows the annual peak stream flows from 1940 through 2012 at the gaging station location downstream of the Union Village Dam. As evident by Figure 3.5, annual peak stream flows before 1949 were often above 2,500 cfs; whereas after 1949 stream flows have not surpassed that rate, indicating the presence of a control. Daily discharge records are available for this gage from September 1940 through September 1989. Daily mean flow values from 1989 to current are not published.

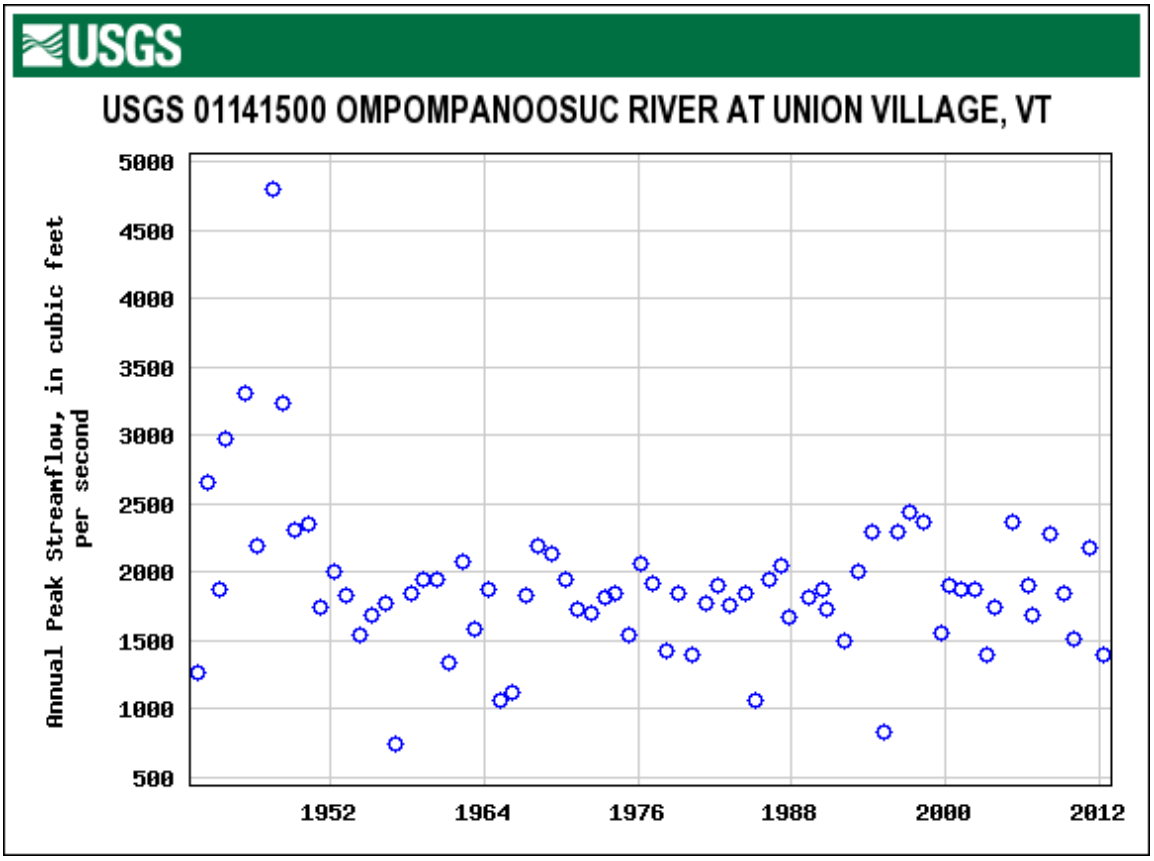

Figure 3.5. Annual peak stream flows for the Ompompanoosuc River below the Union Village Dam

A nearby USGS gage on Ayers Brook at Randolph, Vermont was selected to better understand the flood history of the 2012 Phase 2 study area because of the longer historical data record with peak flow data available for 72 years. The drainage area at the Ayers Brook gauge is 31 square miles, and is a good match with the drainage area of the main stem of the Ompompanoosuc River within the 2012 Phase 2 study area. Based on a cursory flood frequency analysis, the long term record for Ayers Brook (Figure 3.6) shows the peak discharge for water year[1] 1949 is close to a ten year recurrence interval. The annual peak discharge for 1952 and 2007 were near a 25 year recurrence interval. Large precipitation events in June 1973, June 1998, and August 2011 resulted in peak annual discharges that are the highest on record. The peak discharge for 1998 is close to the 100 year recurrence interval, while the highest instantaneous discharge in 2011 exceeded the 100 year event. The USGS is in the process of updating their flow statistics to take into account peak flow data from Tropical Storm Irene (personal communication with Scott Olson on December 21, 2012). Flood levels from Tropical Storm Irene equaled or approached the historic flood of 1927 (VANR, 2012b).

Of all the natural hazards experienced in Vermont, flooding is the most frequent, damaging, and costly. During the period of 1995-1998 alone, flood losses in Vermont totaled nearly $57 Million (Vermont Agency of Natural Resources, 2010b). The Vermont Agency of Administration

[1] A water year is the twelve month period from October 1 through September 30.

(2012) states that over 733 million dollars have been estimated in funding resources for Tropical Storm Irene recovery. While some flood losses are caused by inundation (i.e. waters rise, fill, and damage low-lying structures), most flood losses in Vermont are caused by "fluvial erosion". Fluvial erosion is caused by rivers and streams, and can range from gradual bank erosion to catastrophic changes in river channel location and dimension during flood events (Vermont Agency of Natural Resources, 2010b). The VANR (2010b) attribute the high cost and frequency of fluvial erosion in Vermont to its geography (mountainous setting with narrow valleys and extreme climate) and past land use practices (forest clearing).

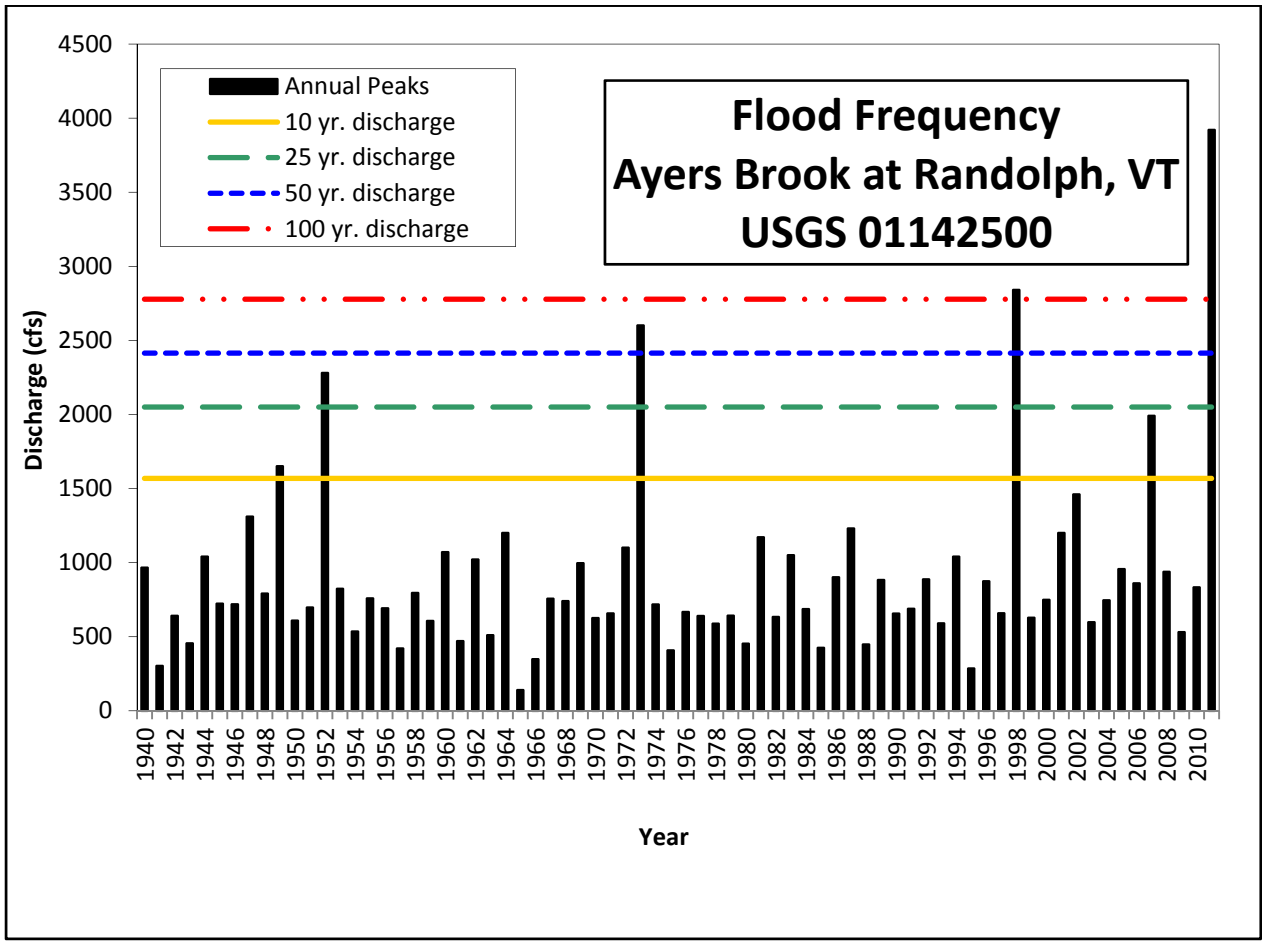

Figure 3.6. Flood frequency analysis for Ayers Brook at Randolph, Vermont.

3.5 Ecological Setting

Please refer to Bear Creek Environmental, 2011, for information about the Ecological Setting of the Ompompanoosuc River watershed.

A large portion of the Ompompanoosuc River watershed 2012 study area is encompassed by a 900-acre parcel of conserved land maintained by the US Army Corps of Engineers at and upstream of the Union Village Dam in Thetford, Vermont. The land is open to the public for many types of recreational activities (Ompompanoosuc River Watershed Council, 2007). Figure 3.7 shows the parcel of land managed by the US Army Corps of Engineers.

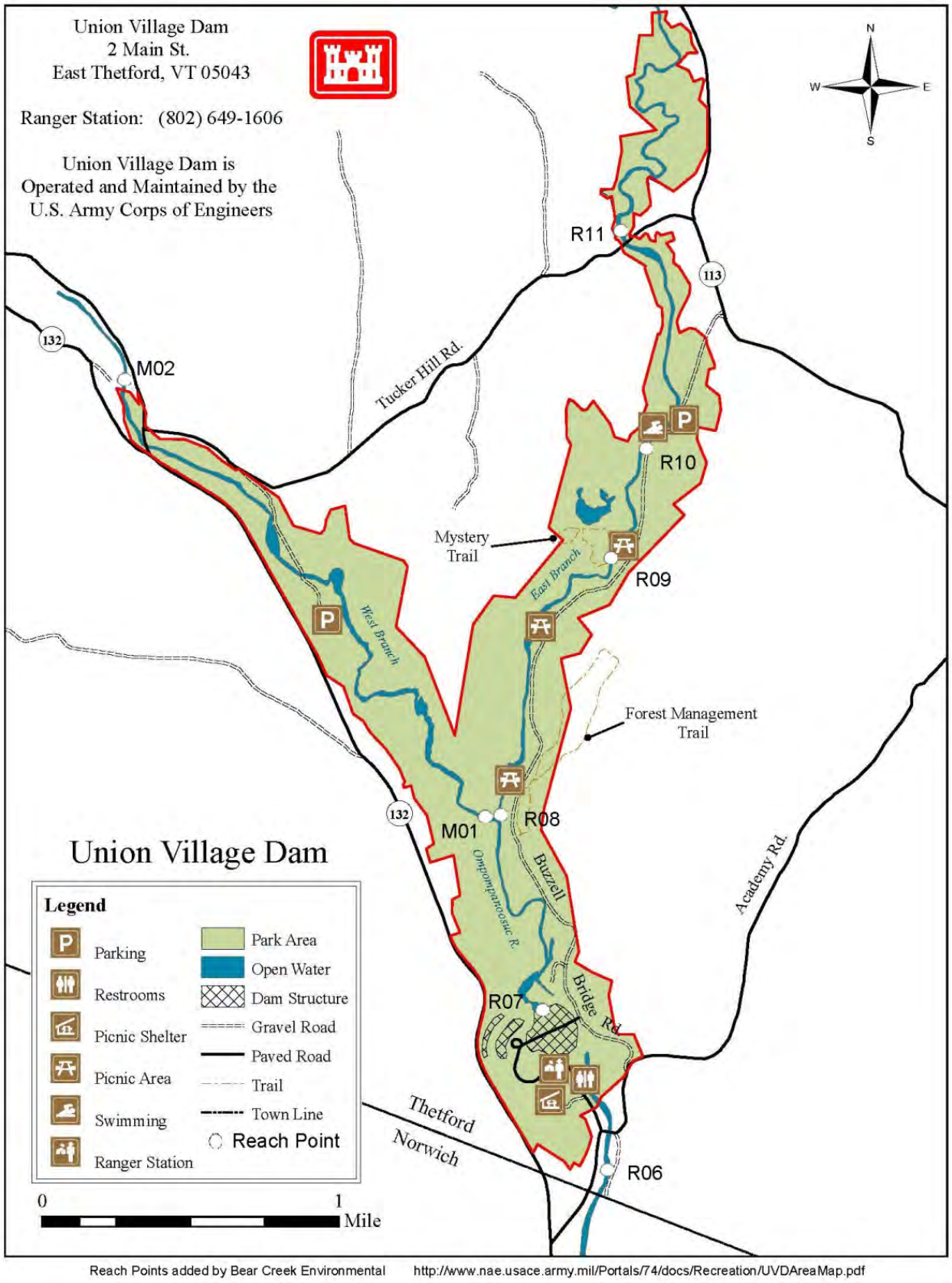

Figure 3.7. Area map of the Union Village Dam area owned by the US Army Corps of Engineers

4.0 METHODS

A summary of the Phase 1, Phase 2, and Bridge and *Culvert* methodologies is provided in the following sections.

4.1 Phase 1 Methodology

The Phase 1 assessment followed procedures specified in the Vermont Stream Geomorphic Assessment Phase 1 Handbook (Vermont Agency of Natural Resources, 2007), and used version 4.59 of the Stream Geomorphic Assessment Tool (SGAT). SGAT is an ArcView extension. Phase 1, the remote sensing phase, involves the collection of data from topographic maps and aerial photographs, from existing studies, and from very limited field studies, called "windshield surveys". The Phase 1 assessment provides an overview of the general physical nature of the watershed. As part of the Phase 1 study, stream reaches are determined based on geomorphic characteristics such as: valley confinement, valley slope, geologic materials, and tributary influence.

4.2 Phase 2 Methodology

The Phase 2 assessment of the Ompompanoosuc River watershed followed procedures specified in the Vermont Stream Geomorphic Assessment (SGA) Phase 2 Handbook (Vermont Agency of Natural Resources, 2009b), and used version 4.59 of the SGAT Geographic Information System (GIS) extension to index impacts within each reach. The geomorphic condition for each Phase 2 reach is determined using the Rapid Geomorphic Assessment (RGA) protocol, and is based on the degree of departure of the channel from its reference stream type (Vermont Agency of Natural Resources, 2009b). The study used the 2008 Rapid Habitat Assessment (RHA) protocol (Vermont Agency of Natural Resources, 2008a; Milone and MacBroom, Inc., 2008). Please see Bear Creek Environmental, 2011, for further information about the Phase 2 methodology. A submeter GPS unit (MobileMapper 100 series) was used in the 2012 assessment to map features in the field including valley walls.

To assure a high level of confidence in the Phase 2 SGA data, strict quality assurance/quality control (QA/QC) procedures were followed by BCE. These procedures involved a thorough in-house review of all data, which took place during February 2013. The Project Team conducted the assessment according to the approved Quality Assurance procedures specified in the Phase 2 handbook. Gretchen Alexander of the State of Vermont Watershed Management Division conducted a QA/QC review of the data collected by Bear Creek Environmental (BCE) for the Ompompanoosuc River in February and March 2013. A summary report of the QA/QC can be found on pages 127 through 134 of Appendix C.

4.3 Bridge and Culvert Methodology

Bridge assessments were conducted by BCE on all public and private crossings within the selected Phase 2 reaches. The Agency of Natural Resources Bridge and Culvert protocols (Vermont Agency of Natural Resources, 2009a) were followed. Latitude and Longitude at each of the structures was determined using a MobileMapper 100 GPS unit. The assessment included photo documentation of the inlet, outlet, upstream, and downstream of each of the structures.

A total of 7 stream crossings (five bridges and two culverts) were evaluated by BCE in 2012. The Vermont Culvert Geomorphic Compatibility Screening Tool (Milone and MacBroom, Inc. 2008) was used to determine geomorphic compatibility for each bridge and culvert. Bridges are not typically screened for geomorphic compatibility in the VTANR protocol because they are usually more robust and have less impact on stream channel function than culverts. Bridges also do not have potential to become perched above the water surface, because the bottom of the structure is natural substrate. Bridges in this study were screened using the geomorphic compatibility tool that was modified by BCE to exclude the slope parameter. Tables 1 through 4 in Appendix B explain how each bridge and culvert was scored using the Geomorphic Compatibility Screening Tool. The compatibility rating is based on five criteria: structure width in relation to bankfull channel width, sediment continuity, slope (culverts only), river approach angle, and erosion & armoring. The ratings span the following range:

- Fully Compatible
- Mostly Compatible
- Partially Compatible
- Mostly incompatible
- Fully Incompatible

The two culverts were evaluated for Aquatic Organism Passage (AOP) using the Vermont Culvert Aquatic Organism Passage Screening Tool (Milone and MacBroom, 2009). Table 5 in Appendix B explains how each culvert was scored using the screening tool. The screening guide has the four following categories:

- Full AOP for all organisms
- Reduced AOP for all aquatic organisms
- No AOP for all aquatic organisms except adult salmonids
- No AOP for all aquatic organisms

5.0 RESULTS

5.1 Stream Types

Reference stream types are based on the valley type, geology and climate of a region and describe what the channel would look like in the absence of human-related changes to the channel, floodplain, valley width, and/or watershed. Table 2 shows the typical characteristics used to determine reference stream types (Vermont Agency of Natural Resources, 2009b). Reference reach typing was based on both the Rosgen (1996) and the Montgomery and Buffington (1997) classification systems. Stream and valley characteristics including valley confinement, and slope were determined from digital United States Geological Survey (USGS) topographic maps (Table 2).

Table 2. Reference Stream Type

Stream Type	Confinement	Valley Slope	Bed Form
A	Narrowly Confined	Very steep > 6.5 %	Cascade
A	Confined	Very steep 4.0 - 6.5 %	Step-Pool
B	Confined or Semi-confined	Steep 3.0 – 4.0 %	Step-Pool
B	Confined, Semi-confined or Narrow	Moderate to Steep 2.0 – 3.0 %	Plane Bed
C or E	Unconfined (Narrow, Broad or Very Broad)	Moderate to Gentle <2.0 %	Riffle-Pool or Dune-Ripple
D	Unconfined (Narrow, Broad or Very Broad)	Moderate to Gentle <4.0 %	Braided Channel
F	Confined or Semi-confined	Moderate to Gentle <4.0 %	Variable

Table 3 lists the reference stream types for the 2012 assessed reaches in the Ompompanoosuc River watershed. All reaches assessed for Phase 2 in the Ompompanoosuc River watershed are “B” or “C” channels by reference. Reference “B” channels generally have narrow valleys with moderately steep to gently sloped terrain, low sinuosity and are moderately entrenched. Reference “C” channels have unconfined valleys with moderate to gentle valley slopes and moderate to high width to depth ratios and sinuosity. The confinement of the assessed portion of the Ompompanoosuc River ranges from Very Broad to Semi-Confined. All reaches have a reference bedform of *riffle-pool,* with the exception of the most upstream segment on Avery Brook, which was *step-pool*. The reference reach characteristics were refined during the Phase 2 Assessment.

Table 3: Geomorphic Setting of 2012 Assessed Reaches					
Stream	**Reach ID**	**Reference Stream Type**	**Confinement**	**Valley Slope (%)**	**Bedform**
Ompompanoosuc River	R14	B	Semi-confined	0.48	Riffle-Pool
	R13	B	Semi-confined	0.49	Riffle-Pool
	R12	B	Semi-confined	0.82	Riffle-Pool
	R11	C	Broad	0.30	Riffle-Pool
	R10	B	Semi-confined	1.30	Riffle-Pool
	R09	C	Very Broad	0.94	Riffle-Pool
	R08	C	Narrow	0.78	Riffle-Pool
	R06	B	Semi-confined	0.22	Riffle-Pool
	R05	C	Broad	0.34	Riffle-Pool
	R04	B	Narrow	0.10	Riffle-Pool
	R03	C	Very Broad	0.03	Riffle-Pool
West Branch of the Ompompanoosuc	M02	C	Broad	1.77	Riffle-Pool
	M01	C	Broad	1.13	Riffle-Pool
Avery Brook	R06.S1.02	B	Semi-confined	5.21	Step-Pool
	R06.S1.01	B	Very Broad	2.78	Riffle-Pool

During the 2012 Phase 2 assessment, the fifteen assessed reaches were broken into 41 segments based on detailed field observations. The existing stream types are based on channel dimensions measured during the Phase 2 assessment, unless the segment was not fully assessed. Seven segments were not able to be fully assessed due to impoundments and grade controls. When a segment is not assessed, administrative judgment is used to determine reference and existing stream type. A map of the reference and existing stream type for each assessed reach/segment is included on pages 1 through 3 of Appendix A.

Most of the segments in the 2012 assessment have the same reference and existing stream type. However, the existing stream type differs from the reference stream type in nine segments, five of which are on the West Branch of the Ompompanoosuc River. This indicates that a stream type departure has taken place in those areas. A stream type departure occurs when the channel dimensions deviate so far from the reference condition that the existing stream type is no longer the reference stream type. These stream type departures represent a significant change in floodplain access and stability. Watersheds which have lost attenuation or sediment storage areas due to human related constraints are generally more sensitive to erosion hazards, transport greater quantities of sediment and nutrients to receiving waters, and lack the sediment storage and distribution processes that create and maintain habitat (Vermont Agency of Natural Resources, 2009b).

5.2 Geomorphic Condition

The stream condition is determined using the scores on the rapid assessment field forms, and is defined in terms of departure from the reference condition. There are four categories to describe the condition (reference, good, fair and poor). These ratings are defined below.

- Reference – no departure
- Good – minor departure
- Fair – major departure
- Poor – severe departure

Geomorphic condition is determined based on the degree (if any) of channel degradation, aggradation, widening and planform adjustment. Degradation is the term used to describe the process whereby the stream bed lowers in elevation through erosion, or scour, of bed material. Aggradation is a term used to describe the raising of the bed elevation through an accumulation of sediment. The planform of a channel is its shape as seen from the air. Planform change can be the result of a straightened course imposed on the river through different channel management activities, or a channel response to other *adjustment processes* such as aggradation and widening. Channel widening is a result of channel degradation or sediment build-up in the channel. In both situations the stream's energy is concentrated into both banks.

Maps showing the existing geomorphic condition for each segment are presented on pages 4 and 5 of Appendix A. Many of the upstream assessed reaches on the Ompompanoosuc main stem and all segments on Avery Brook are in "good" or "reference" geomorphic condition. Avery Brook and Ompompanoosuc main stem segments R11-D through R14-C (except R14-B) are all located in areas where there are minimal to no corridor encroachments and buffer conditions are excellent. Reach R10 is also in "good" geomorphic condition because it is located in an area with minimal development. A short segment on the West Branch of the Ompompanoosuc River (M01-J) is in "good" geomorphic condition. Most segments on the main stem and the West Branch are in "fair" geomorphic condition as a result of varying degrees of corridor encroachment, channel straightening, human-caused change in valley type, floodplain loss, erosion, and aggradation. Segments R11-A through R11-C are located in an agricultural area and have been impacted by channel straightening. Segments downstream of the Union Village Dam (R03 - R06) have been impacted by reduced flows and channel degradation. The most downstream segment on the West Branch (M01-A) is in "poor" geomorphic condition as a result of historic channel straightening, which has led to extreme channel degradation and a complete loss of floodplain access. During the 2012 assessment, 7 segments were not fully assessed. In some cases, sections of the channel are unsuitable for a full Phase II assessment. This includes, but is not limited to, areas that are impounded by a manmade or beaver dam, dominated by a bedrock gorge, or predominately wetland. When a segment is not fully assessed administrative judgment of the geomorphic condition is given. All segments that were not fully assessed were judged to be in "good" geomorphic condition.

Functioning floodplains play a crucial role in providing long-term stability to a river system. Natural and anthropogenic impacts may alter the equilibrium of sediment and discharge in natural stream systems and set in motion a series of morphological responses (aggradation, degradation, widening, and/or planform adjustment) as the channel tries to reestablish a dynamic equilibrium. Small to moderate changes in slope, discharge, and/or sediment supply can alter the size of transported sediment as well as the geometry of the channel; while large changes can transform reach level channel types (Ryan, 2001). Human-induced practices that have contributed to stream instability within the Ompompanoosuc River watershed include:

- Channelization along agricultural fields and roads
- Removal of woody riparian vegetation
- Influence from the Union Village Dam

These anthropogenic practices have altered the balance between water and sediment discharges within the Ompompanoosuc River watershed. The *sediment regime* is the quantity, size, transport, sorting, and distribution of sediments. The sediment regime may be influenced by the proximity of sediment sources, the hydrologic characteristics of the region, and the valley, floodplain, and stream morphology (ANR, 2010a). Sediment can be supplied to the river through bank erosion, large flooding events, and stormwater inputs. Maps depicting the reference and existing sediment regimes and a departure analysis can be found on pages 6 through 10 of Appendix A. Reference and existing sediment regimes were derived from the Agency of Natural Resources Data Management System according to the sediment regime criteria established by the Vermont Agency of Natural Resources (2010a).

Channel morphologic responses to these anthropogenic practices and changes in sediment regimes contribute to channel adjustment that may further create unstable channels. All three adjustment processes, aggradation, widening and planform migration as a result of historic degradation within the channel are present within the Ompompanoosuc River watershed. The most extreme channel adjustment processes are seen on the West Branch. In several areas on the main stem and most of the lower West Branch, straightening along agricultural fields has significantly changed the river's ability to access its floodplain and its ability to meander. Channel straightening has resulted in major to extreme geomorphic adjustments in downstream areas, especially along river bends. Figure 5.1 shows an example of a channel avulsion that may have occurred as a result of channel straightening on the West Branch.

The reach condition ratings of the Ompompanoosuc River watershed indicate that most of the reaches/segments are actively or have historically undergone a process of minor or major geomorphic adjustment. Many of the reaches studied in the Ompompanoosuc River watershed are undergoing a channel evolution process in response to large scale changes in its sediment, slope, and/or discharge associated with the human influences on the watershed.

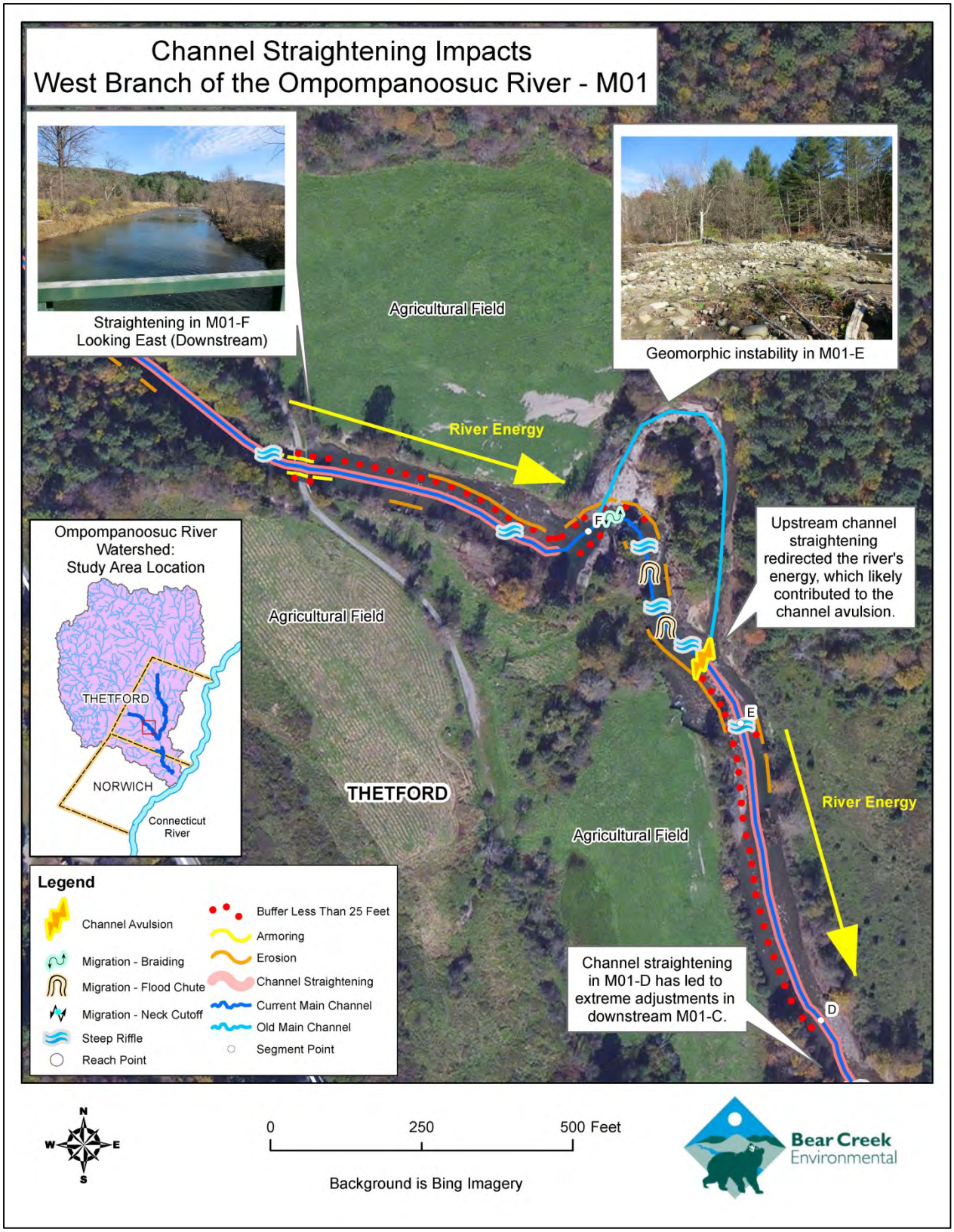

Figure 5.1. Impacts of channel straightening in M01 on the West Branch of the Ompompanoosuc River

Both the "D" stage and "F" stage channel evolution models (Vermont Agency of Natural Resources, 2009b; Vermont Agency of Natural Resources, 2004) are helpful for explaining the channel adjustment processes underway in the Ompompanoosuc River watershed. The "F" stage channel evolution model is used to understand the process that occurs when a stream degrades (*incises*). The common stages of the "F" channel evolution stage, as depicted in Figure 5.2 include:

- Stable (F-1) - a pre-disturbance period
- Incision (F-II) – channel degradation (head cutting)
- Widening (F-III) – bank failure
- Stabilizing (F-IV) – channel narrows through sediment build up and moves laterally building juvenile floodplain
- Stable (F-V) - gradual formation of a stable channel with access to its floodplain at a lower elevation

The "D-stage" channel evolution model applies to reaches where there may have been some minor historic incision; however, the more dominant active adjustment process is aggradation, which in turn leads to channel widening and planform adjustment. The D-stage adjustment process typically occurs in unconfined, low to moderate gradient valleys where the stream is not entrenched and has access to its floodplain or flood prone area at the 1-2 year flood stage.

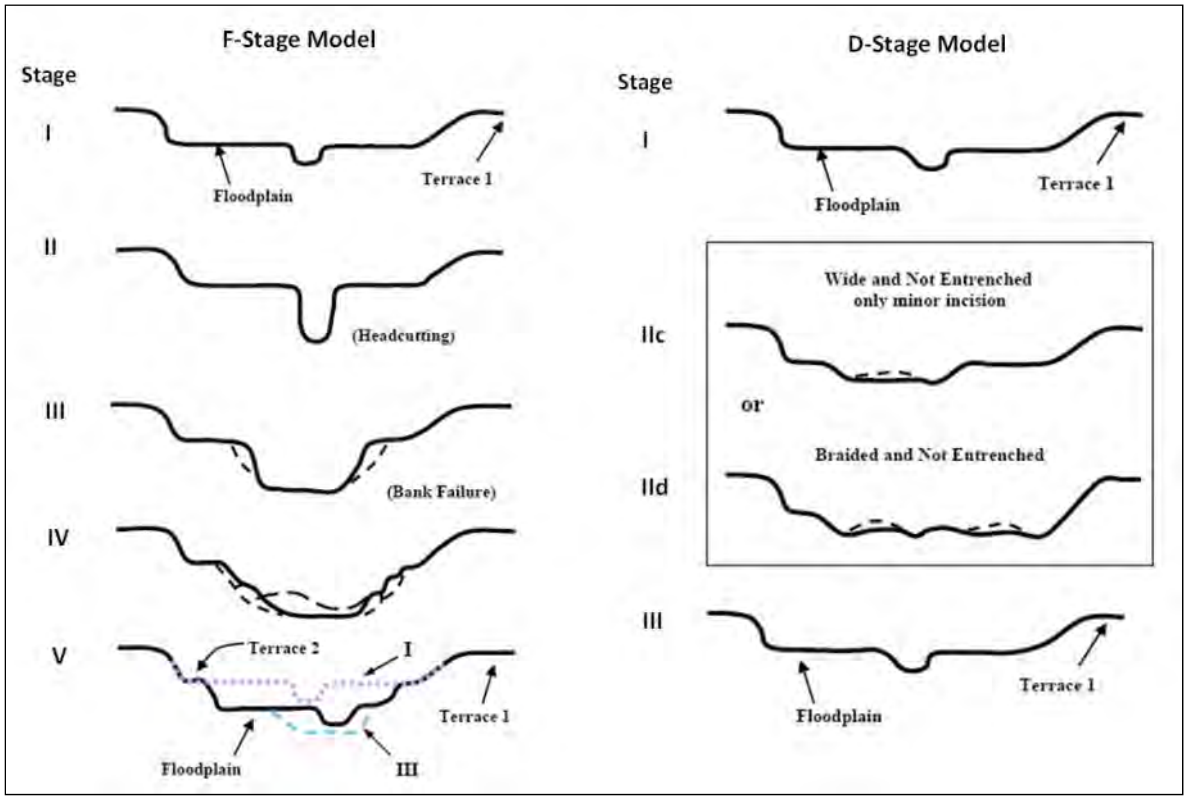

Figure 5.2 Typical channel evolution models for F-Stage and D-Stage (VANR, 2009b)

When stream channels are altered through straightening, it can set this evolution process into motion and cause adjustment processes to occur. The bed erosion that occurs when a meandering river is straightened in its valley is a problem that translates to other sections of the stream. Localized incision will travel upstream and into tributaries, thereby eroding sediments from otherwise stable streambeds. These bed sediments will move into and clog reaches downstream, leading to lateral scour and erosion of the stream banks. Channel evolution processes may take decades to play out. Even landowners that have maintained wooded areas along their stream and riverbanks may have experienced eroding banks as stream channel slopes adjust to match the valley slopes. It is difficult for streams to attain a new equilibrium where the placement of roads and other infrastructure has resulted in little or no valley space for the stream to access or to create a floodplain.

The channel evolution stage for each fully assessed Phase 2 segment was determined based on field data and observations. A summary of the channel evolution stage by segment is provided on pages 1 through 3 of Appendix C. In terms of the channel evolution model, five segments on the Ompompanoosuc River, one segment on the West Branch, and all segments on Avery Brook are in stage I of the "F-stage" channel evolution model. This means that these reaches have not undergone a channel incision process, and generally the sediment transport capacity is in equilibrium with the sediment load. Many of these segments are in relatively undisturbed areas. R14-C, R14-A, R13, R11-D, and R10-B on the Ompompanoosuc River main stem and M01-J on the West Branch are the segments that are in stage F-I.

In contrast, many segments have undergone historic degradation and are in stage II or III of the "F-stage" channel evolution model. These segments have generally lost floodplain access as a result of corridor encroachments. R09 is the only reach in stage II of the "F-stage" model. This reach is vertically adjusting, with no significant widening yet, as it responds to historic channel straightening from adjacent agricultural fields and a road. Stream power is increased within the channel due to the loss of some floodplain access. Eleven segments, most on the main stem, are in stage III of the "F-stage" channel evolution model. Most of these segments have undergone historic incision to some degree. Straightening along roads and agricultural fields likely led to this incision and the subsequent loss of floodplain access. In stage F-III, the entrenched channel begins to widen and migrate laterally through bank erosion caused by the increased stream power.

One segment on the Ompompanoosuc main stem and one on the West Branch have moved into stage IV of the "F-stage" channel evolution model. This means that the channel has stabilized itself by changes in its migration pattern and building a new floodplain at a lower elevation. The two segments where a 'new' floodplain was observed were R11-B and M01-F.

Three of the five segments below the Union Village Dam on the Ompompanoosuc main stem are in stage V of the "F-stage" channel evolution model. Although the channel evolution model F-V was chosen, it is important to note that in these cases the channel may not have gone through stages F-II, F-III, and F-IV. It appears that in these segments the channel is stable, which may be a result of controlled flows from the Union Village Dam.

Six segments within the Ompompanoosuc River watershed study area fall into the "D-stage" channel evolution model, where the more dominant active adjustment process is aggradation. This buildup of sediment leads to channel widening and planform adjustment. In the D-IIc stage, the channel becomes extremely depositional. The channel width narrows through aggradation as *bar* features develop. Transverse (*diagonal*) bars may be common. Segments R12-A and R12-B are in stage D-IIc. Vertical adjustment is limited in R12 as a result of multiple bedrock grade controls. On the West Branch, M01-C and M01-H are in stage D-IIc. Segments in stage D-IId (M01-E and M01-G) exhibit a high amount of aggradation and as a result are widening. Segments in the "D-stage" channel evolution model show minor to no incision.

A stream sensitivity rating was determined based on existing stream type, dominant sediment size, and geomorphic condition. Stream sensitivity ratings help identify the likelihood that a segment will undergo vertical and lateral adjustments driven by natural or human-induced fluvial processes (ANR, 2010a). Human activities such as: floodplain encroachment, channel straightening or armoring, changes in sediment or flow inputs, and/or disturbance of riparian vegetation may alter the natural adjustment rate of the channel. Streams that are actively adjusting are likely to have a heightened sensitivity. The sensitivity ratings are as follows: Very Low, Low, Moderate, High, Very High, and Extreme. Many segments on the Ompompanoosuc River main stem and Avery Brook had a sensitivity of Moderate, indicating that those segments are in a relatively stable condition and not as sensitive to adjustments. Reaches R11 and R09, which are located in agricultural areas have a sensitivity of Very High, as they are adjusting to channel straightening. R08-B has a sensitivity of Very High as it adjusts to straightening because of its proximity to Buzzel Bridge Road. Most segments on the West Branch have a sensitivity of High to Extreme because many of these segments are actively adjusting and are undergoing major or extreme channel adjustments as a result of channel straightening. Maps showing stream sensitivities can be found on pages 11 and 12 of Appendix A.

5.3 Habitat Condition

The habitat condition for each segment within the Ompompanoosuc River watershed 2012 study area is presented on pages 13 and 14 of Appendix A. Ten segments on the main stem, three segments on the West Branch, and two segments on Avery Brook are in "good" habitat condition. This is mainly because they have minimal to no corridor encroachments, allowing for high quality vegetated banks and buffers. The segments in "good" condition have high amounts of large woody debris in the channel, many deep *pools*, and good canopy cover, all of which provide habitat for aquatic life. Ten segments on the main stem, six segments on the West Branch, and two segments on Avery Brook are in "fair" habitat condition. Segments are in "fair" habitat condition mainly as a result of corridor encroachments, poor bank and buffer vegetation, invasive plants, erosion and revetments, and channel straightening. Four of the segments, all in M01 on the West Branch, that are in "fair" condition exhibit a stream habitat type departure. The influence of channel straightening along agricultural fields has led to a bedform departure from a reference type of riffle-pool to braided, which can be seen along the river bends (M01-C and M01-E). Braided segments are highly aggradational and sediment often

fills pools. M01-I lacked strong riffle-pool bedform features as a result of channel straightening with a berm. A stream habitat type departure from the reference type of riffle-pool to the existing plane bed bedform was observed. No segments were determined to be in "reference" or "poor" habitat condition.

As shown in Table 1 (Appendix C, pages 1 through 3), many of the segments have high width to depth ratios. This can be attributed to the geomorphic process of channel widening. The reduction in flows as a result of the Union Village Dam also has likely led (in part) to the high width to depth ratios observed in the segments below the dam. A high width to depth ratio indicates that the channel is relatively wide and shallow. Wide, shallow channels tend to have a reduced number of deep pools, canopy cover in the center of the stream, undercut banks, and sometimes a higher water temperature (Foster, Stein, & Jones, 2001). These factors can contribute to a lower habitat score.

5.4 Reach/Segment Descriptions

A description of each reach/segment is provided in this section along with a list of recommendations for restoration and protection strategies. The reaches/segments are listed from downstream to upstream. The reaches are broken into sections based on the stream they are located in: Ompompanoosuc River main stem, West Branch of the Ompompanoosuc River, and Avery Brook. Phase 2 Segment Summary Reports from the Agency of Natural Resources' Data Management System, which contain all the data for the Phase 2 steps, are included on pages 4 through 126 of Appendix C.

Proposed project location maps, project detail tables, and photo are provided on pages 1 through 29 of Appendix D. The Phase 2 stream geomorphic assessment provides a picture of the condition of the channel and the adjustment process occurring; however, it is not a comprehensive study for determining site specific actions. The Phase 2 study provides a foundation for project development, and additional work is recommended to further develop these projects.

The conditions encountered in the summer 2012 data collection were influenced by Tropical Storm Irene (TSI), which occurred in August 2011. In many areas, sediment deposition in the channel and floodplain may have affected results by changing channel dimensions. Post-flood recovery efforts also affected channel dimensions in some locations and included, but were not limited to dredging and gravel extraction. In every case, an effort was made to measure channel cross sections in locations that were the least impacted by the flood. Any uncertainties in accurate channel dimensions were noted.

Ompompanoosuc River Main Stem

R03

This reach was split into two segments because the lower half of the reach is impounded by the Wilder Dam on the Connecticut River. The reference confinement in this reach is Very Broad

and is not significantly changed by human impacts. The flows in this reach are controlled by the Union Village Dam in Thetford.

R03-A

This segment begins approximately 500 feet upstream of the Route 132 bridge (near Interstate 91) in Norwich and continues 2,500 feet upstream until the river is not impounded by the Wilder Dam anymore. This segment has good floodplain access and extensive wetlands on both sides (See Figure 5.3). Figure 5.4 shows a typical channel for the segment. This segment was not fully assessed because of the impoundment. Administrative judgment was used to determine reference and existing stream type, bed material, and bedform.

Figure 5.3. Extensive wetlands in R03-A.

Figure 5.4. Typical channel in segment R03-A, which is impounded by the Wilder Dam

*R03-A Data Summary	*NOT ASSESSED	Reference	Existing
Length: 2,504 ft Drainage Area: 137 sq. mi. Evolution Stage: NA Sensitivity: NA	Confinement	Very Broad	Very Broad
	Stream Type	C	C
	Entrenchment Ratio	> 2.2	NA
	Incision Ratio	< 1.2	NA
	Dominant Bed Material	Gravel	Sand
	Dominant Bedform	Riffle-Pool	NA - Impounded
Major Stressors:	**Poor Buffers, Channel Straightening , Flow Regulation**		

R03-B

This segment is the upper 2,100 feet of R03 that is not impounded by the Wilder Dam. The segment ends approximately 750 feet upstream of the area of Campbell Flats Road that is continuous with the northeastern bank, or where the Very Broad valley of R03-B changes to Narrow (R04-A). R03-B is in **fair** geomorphic condition with major **aggradation** and **widening** as the primary processes. **Historic incision** as a result of extensive channel straightening and reduction in flows from the Union Village Dam has led to the stream type departure. The river can no longer access its floodplain in this area (See Figure 5.5). This segment is in **fair** habitat condition mainly because of its lack of adequate riparian buffers and pools. This segment is also largely incised. Streambed incision is associated with accelerated stream bank erosion, which increases deposition and embeddedness in downstream locations, resulting in aquatic habitat loss (Vermont Agency of Natural Resources, 2008a).

Figure 5.5. High banks in R03-B restrict floodplain access.

R03-B Data Summary		Reference	Existing
Length: 2,077 ft Drainage Area: 137 sq. mi. Evolution Stage: F-III Sensitivity: Very High	Confinement	Very Broad	Very Broad
	Stream Type	C	F
	Entrenchment Ratio	> 2.2	1.3
	Incision Ratio	< 1.2	2.3
	Dominant Bed Material	Gravel	Gravel
	Dominant Bedform	Riffle-Pool	Riffle-Pool
Major Stressors:	**Poor Buffers, Invasive Plants, Erosion, Channel Straightening, Flow Regulation**		

R03 Project Identification:

- **Passive Restoration** by planting trees within the riparian corridor in areas where buffers are less than 25 feet wide in R03-A and river corridor protection through an easement (Map 1: Project #1).

R04

This reach was split into two segments to account for a change in valley width and buffer type. There is no significant human-caused change in valley width in this reach. The flows in this reach are controlled by the Union Village Dam in Thetford.

R04-A

The downstream segment in R04 begins approximately 750 upstream of where Campbell Flats Road is continuous with the Ompompanoosuc River on its northeastern bank and continues upstream 1,900 feet until the valley narrows and the river regains sinuosity. Most of this segment runs along a farm field and a residential home. This segment is in **good** geomorphic condition, with aggradation, widening, and planform adjustment all as minor processes. Extreme **historic incision** has occurred here, which may be a result of the reduction in flows from the Union Village Dam and upstream channel straightening; however, the channel appears to have stabilized and formed a new accessible floodplain at a lower elevation. This segment is in **fair** habitat condition, which can be attributed to areas of buffers less than 25 feet wide with sparse bank vegetation and a lack of large woody debris. Figure 5.6 shows a typical channel in R04-A.

R04-A Data Summary		Reference	Existing
Length: 1,914 ft Drainage Area: 133 sq. mi. Evolution Stage: F-V Sensitivity: Moderate	Confinement	Narrow	Narrow
	Stream Type	B	B
	Entrenchment Ratio	1.4 – 2.2	1.5
	Incision Ratio	< 1.2	2.2
	Dominant Bed Material	Cobble	Cobble
	Dominant Bedform	Riffle-Pool	Riffle-Pool
Major Stressors:	**Poor Buffers, Channel Straightening, Flow Regulation**		

Figure 5.6. Typical channel in R04-A.

R04-B

Segment R04-B begins as the valley type changes from Narrow to Semi-confined and continues upstream 1,400 feet until the valley widens again. This segment is located in a forested area with a wetland to the west of the channel. R04-B is in **good** geomorphic condition with aggradation, widening, and planform adjustment all as minor processes occurring. Extreme **historic incision** has occurred here, which may be a result of the reduction in flows from the Union Village Dam and upstream channel straightening; however, the channel appears to have stabilized. The segment is in **good** habitat condition and has excellent bank and buffer vegetation. A wetland was seen in the western corridor. Figure 5.7 shows a typical view in R04-B.

R04-B Data Summary		**Reference**	**Existing**
Length: 1,385 ft Drainage Area: 133 sq. mi. Evolution Stage: F-V Sensitivity: Moderate	Confinement	Semi-confined	Semi-confined
	Stream Type	B	B
	Entrenchment Ratio	1.4 – 2.2	1.4
	Incision Ratio	< 1.2	2.4
	Dominant Bed Material	Cobble	Cobble
	Dominant Bedform	Riffle-Pool	Riffle-Pool
Major Stressors:	**Flow Regulation**		

Figure 5.7. Excellent bank and buffer vegetation in R04-B.

R04 Project Identification:

- **Passive Restoration** by increasing the buffer width in R04-A (Map 1: Project #2).
- **Passive Restoration** by protecting the wetland that is in R04-B (Map 1: Project #3).

R05

Reach R05 begins as the valley type changes from Semi-confined (R04-B) to Broad and continues 4,700 feet upstream to approximately 230 feet downstream of the Union Village Covered Bridge (Academy Road). The flows in this reach are controlled by the Union Village Dam in Thetford. This reach has a reference valley type of Broad and was not segmented. Human-caused change in valley width does not significantly change the confinement, although Campbell Flats Road limits floodplain access in some locations. Much of this reach has likely been historically straightened. The downstream three quarters of this reach runs along several agricultural fields, while the upstream quarter runs through a residential area (See Figure 5.8). A short length of the channel at the downstream end of the reach is located in an undisturbed forested area (See Figure 5.9).

Figure 5.8. The upstream quarter of R05 is in a residential area. This is a property with sparse bank and buffer vegetation and is typical for this portion of the reach.

Figure 5.9. Relatively undisturbed forested area at downstream end of R05.

This reach is in **good** geomorphic condition with **widening** as the major process. Aggradation and planform adjustment are minor. Major **historic incision** has occurred here, which may be a result of the reduction in flows from the Union Village Dam and upstream channel straightening. This reach is in **good** habitat condition and can be in part attributed to a good amount of large woody debris in the channel and high quality buffers overall.

R05 Data Summary		Reference	Existing
Length: 4,705 ft Drainage Area: 132 sq. mi. Evolution Stage: F-III Sensitivity: Moderate	Confinement	Broad	Broad
	Stream Type	C	C
	Entrenchment Ratio	> 2.2	2.4
	Incision Ratio	< 1.2	1.9
	Dominant Bed Material	Cobble	Cobble
	Dominant Bedform	Riffle-Pool	Riffle-Pool
Major Stressors:	**Channel Straightening**		

R05 Project Identification:

- **Passive Restoration** by protecting the river corridor through an easement (Map 2: Project #1).
- **Passive Restoration** by planting trees within the riparian corridor in areas where buffers are less than 25 feet wide (Map 2: Project #2).

R06

This reach was split into two segments to account for the portion of the river that is below and the portion that is within the Union Village Dam. The reference valley type in this reach is Semi-confined. The flows in this reach are controlled by the Union Village Dam in Thetford.

R06-A

This segment begins about 230 feet downstream of the Union Village Covered Bridge (Academy Road) and continues about 1,800 feet upstream to a bedrock grade control that is just below the outflow for the Union Village Dam (See Figure 5.10). This segment has been historically straightened. Avery Brook, a small tributary of the Ompompanoosuc River, enters about 500 feet downstream of the Union Village Dam (See Figure 5.11).

Segment R06-A is in **good** geomorphic condition with **widening** as the major process occurring. Aggradation and planform adjustment are minor. Segment R06-A is in **fair** habitat condition as a result of some areas with buffers less than 25 feet wide and few deep pools.

R06-A Data Summary		Reference	Existing
Length: 1,766 ft Drainage Area: 131 sq. mi. Evolution Stage: F-V Sensitivity: Moderate	Confinement	Semi-confined	Semi-confined
	Stream Type	B	B
	Entrenchment Ratio	1.4 – 2.2	1.7
	Incision Ratio	< 1.2	1.2
	Dominant Bed Material	Cobble	Cobble
	Dominant Bedform	Riffle-Pool	Riffle-Pool
Major Stressors:	**Constriction, Channel Straightening, Flow Regulation**		

Figure 5.10. Outflow of the Union Village Dam.

Figure 5.11. Avery Brook enters the Ompompanoosuc River from the west in segment R06-A.

R06-B
This segment is located within the Union Village Dam and could not be assessed.

R06 Project Identification:

- **Passive Restoration** by planting trees within the riparian corridor in areas where buffers are less than 25 feet wide in R06-A (Map 2: Project #2).

R08
This reach was split into four segments to account for areas with numerous bedrock grade controls, changes in valley width, and changes in reference stream types. The reach is located in a primarily forested area. Buzzel Bridge Road runs along the channel to the east for the majority of the reach.

R08-A
This segment begins at the confluence with the West Branch of the Ompompanoosuc River and continues about 1,200 feet upstream through an area with numerous bedrock grade controls. In the short areas that did not have bedrock grade controls, the banks were extremely high and eroded. Figures 5.12 and 5.13 show typical views of the channel in R08-A. This segment was not fully assessed as a result of the significant amount of grade controls. Administrative judgment was used to determine reference and existing stream type, bed material, and bedform.

Figure 5.12. Bedrock grade controls in segment R08-A.

*R08-A Data Summary	*NOT ASSESSED	Reference	Existing
Length: 1,179 ft Drainage Area: 65 sq. mi. Evolution Stage: NA Sensitivity: NA	Confinement	Semi-confined	Semi-confined
	Stream Type	B	B
	Entrenchment Ratio	1.4 – 2.2	NA
	Incision Ratio	< 1.2	NA
	Dominant Bed Material	Cobble	Cobble
	Dominant Bedform	Step-Pool	Step-Pool
Major Stressors:	**Erosion**		

Figure 5.13. High banks in short sections of R08-A.

R08-B

Segment R08-B begins at the upstream end of the largest bedrock grade control in R08-A and continues 2,400 feet upstream until the valley narrows. This segment has likely been historically straightened as evident by several old gabions found in the channel. Gabions are wire cages filled with rocks that are often used along rivers as an erosion control measure. In many places the river has outflanked the gabions and they are no longer serving their original purpose (See Figures 5.14 and 5.15).

Segment R08-B is in **fair** geomorphic condition with extreme **historic incision** as a result of channel straightening. This has resulted in a loss of some floodplain access and a stream type departure from the reference C stream type to the existing B stream type. **Widening** and **planform adjustment** are major processes occurring as the river responds to the incision. Segment R08-B is in **fair** habitat condition as a result of a limited amount of aquatic organism refuge areas, a lack of adequate bank vegetation, and reduced buffer widths. The reduced buffer widths can mainly be attributed to the presence of Buzzel Bridge Road, which is to the east of the channel.

Figure 5.14. Gabions at the stream edge in segment R08-B likely contributed to historical channel straightening.

Figure 5.15. In some areas the river has outflanked the gabions and the channel flows on either side of them.

R08-B Data Summary		Reference	Existing
Length: 2,420 ft Drainage Area: 65 sq. mi. Evolution Stage: F-III Sensitivity: Very High	Confinement	Narrow	Narrow
	Stream Type	C	B
	Entrenchment Ratio	> 2.2	1.8
	Incision Ratio	< 1.2	2.0
	Dominant Bed Material	Gravel	Gravel
	Dominant Bedform	Riffle-Pool	Riffle-Pool
Major Stressors:	**Poor Bank Vegetation, Poor Buffers, Erosion, Tributary Rejuvenation, Channel Straightening**		

R08-C

This segment begins as the unconfined valley in R08-B transitions to Semi-confined and continues 1,350 feet upstream to the lower end of a large bedrock grade control. This segment is a subreach because its reference stream type is different than that of the whole reach. This stream channel in this segment was further away from Buzzel Bridge Road. Figure 5.16 shows a typical channel for this segment.

Segment R08-C is in **fair** geomorphic condition with major **historic incision**, which has not led to a stream type departure. Major **widening** is occurring as the river responds to the incision. This segment is in **fair** habitat condition (higher end of category) as a result of some areas of reduced buffer widths and poor bank vegetation and erosion on the banks.

Figure 5.16. Typical channel in R08-C shows generally good bank and buffer vegetation.

R08-C Data Summary		Reference	Existing
Length: 1,354 ft Drainage Area: 65 sq. mi. Evolution Stage: F-III Sensitivity: High	Confinement	Semi-confined	Semi-confined
	Stream Type	B	B
	Entrenchment Ratio	1.4 – 2.2	1.5
	Incision Ratio	< 1.2	1.6
	Dominant Bed Material	Cobble	Cobble
	Dominant Bedform	Riffle-Pool	Riffle-Pool
Major Stressors:	**Erosion**		

R08-D

This segment is within an area with several bedrock grade controls. The segment begins at the downstream end of the bedrock gorge (which is a popular swimming area) and continues 1,200 feet upstream until a small steel grate bridge for the "Mystery Trail." This segment was not fully assessed due to the presence of multiple grade controls. Administrative judgment was used to determine reference and existing stream type, bed material, and bedform. Figure 5.17 shows a portion of the largest bedrock grade control.

Figure 5.17. A portion of the upstream end of the large bedrock grade control in R08-D.

*R08-D Data Summary	*NOT ASSESSED	Reference	Existing
Length: 1,192 ft Drainage Area: 65 sq. mi. Evolution Stage: NA Sensitivity: NA	Confinement	Narrowly Confined	Narrowly Confined
	Stream Type	B	B
	Entrenchment Ratio	1.4 – 2.2	NA
	Incision Ratio	< 1.2	NA
	Dominant Bed Material	Cobble	Cobble
	Dominant Bedform	Step-Pool	Step-Pool
Major Stressors:	**None**		

R08 Project Identification:

- **Active Restoration** by removing the gabions in R08-B (Map 3: Project #1).

R09

This reach begins as the Narrowly Confined valley of R08-D opens up to a Very Broad valley in R09 and continues upstream for almost 1,800 feet. The reach ends as the valley narrows once again. There is no significant human-cause change in valley width. A large wetland is present to the west of the channel. This reach is characterized by a lack of adequate bank and buffer vegetation and erosion on the banks. Figure 5.18 shows a typical channel in the reach.

Figure 5.18. Typical eroded banks and limited bank and buffer vegetation in R09.

Reach R09 is in **fair** geomorphic condition and has undergone major **historic incision**. The incision is likely a result of historic channel straightening because of the road in the east corridor and the agricultural field in the west corridor at the upper end of the reach. Minor widening and planform adjustment are occurring in R09. This reach is in **fair** habitat condition as a result of poor bank and buffer vegetation and reduced buffer widths. Large amounts of invasive honeysuckle were present along the banks in this segment (See Figure 5.19).

Figure 5.19. Invasive honeysuckle is widespread in R09.

R09 Data Summary		**Reference**	**Existing**
Length: 1,765 ft Drainage Area: 64 sq. mi. Evolution Stage: F-II Sensitivity: Very High	Confinement	Very Broad	Very Broad
	Stream Type	C	C
	Entrenchment Ratio	> 2.2	4.8
	Incision Ratio	< 1.2	1.5
	Dominant Bed Material	Gravel	Gravel
	Dominant Bedform	Riffle-Pool	Riffle-Pool
Major Stressors:	**Poor Bank Vegetation, Poor Buffers, Invasive Plants, Erosion, Channel Straightening**		

R09 Project Identification:

- **Passive Restoration** by allowing vegetation to naturally reestablish in areas where buffers are less than 25 feet wide (Map 3: Project #2).

R10

This reach was split into three segments to account for changes in valley width and the presence of another area of numerous large grade controls.

R10-A

This segment begins as the Very Broad valley of R09 becomes generally Narrow and continues 2,279 feet upstream until the valley type changes to Semi-confined. The most downstream 450 feet of this segment is Narrowly Confined, but was not considered representative of the segment. R10-A is in **good** geomorphic condition with minor aggradation, widening, and planform adjustment as the processes occurring. The segment is in **fair** habitat condition (higher end of category) as a result of some areas of buffers less than 25 feet wide and sparse large woody debris in the channel. Figure 5.20 shows a typical channel for the segment.

Figure 5.20. Typical channel in R10-A.

R10-A Data Summary		Reference	Existing
Length: 2,279 ft Drainage Area: 63 sq. mi. Evolution Stage: F-I Sensitivity: Moderate	Confinement	Narrow	Narrow
	Stream Type	B	B
	Entrenchment Ratio	1.4 – 2.2	1.8
	Incision Ratio	< 1.2	1.0
	Dominant Bed Material	Cobble	Cobble
	Dominant Bedform	Riffle-Pool	Riffle-Pool
Major Stressors:	**Isolated Areas with Poor Buffers and Channel Straightening**		

R10-B

This segment begins as the Narrow valley changes to Semi-confined and continues 2,100 feet upstream to the lower end of an area with many bedrock grade controls. This segment is naturally straight, but likely was historically straightened in a short area of the segment that has a wider valley. An old logging road runs through the western corridor. This segment is characterized by excellent bank and buffer vegetation. Figure 5.21 shows a typical channel for the segment.

Figure 5.21. Typical channel in R10-B has a Semi-confined valley with excellent bank and buffer vegetation.

Segment R10-B is in **good** geomorphic condition with minor aggradation, widening, and planform adjustment occurring here. This segment is in **good** habitat condition as well. The

excellent bank and buffer vegetation and wide buffer widths are contributing to this as well as good canopy cover and the presence of several aquatic organism refuge areas.

R10-B Data Summary		Reference	Existing
Length: 2,094 ft Drainage Area: 63 sq. mi. Evolution Stage: F-I Sensitivity: Moderate	Confinement	Semi-confined	Semi-confined
	Stream Type	B	B
	Entrenchment Ratio	1.4 – 2.2	1.4
	Incision Ratio	< 1.2	1.0
	Dominant Bed Material	Cobble	Cobble
	Dominant Bedform	Riffle-Pool	Riffle-Pool
Major Stressors:	**None**		

R10-C

This segment is a 576-foot long segment at the upper end of R10 that is dominated by several large bedrock grade controls. The upstream end of the segment is approximately 130 upstream of the Sayers Covered Bridge on Tucker Hill Road. This segment was not fully assessed because of the grade controls. Administrative judgment was used to determine reference and existing stream type, bed material, and bedform. Figure 5.22 is a view looking upstream at a section of the grade control area. The section of the channel within the vicinity of the Sayers Covered Bridge has been straightened.

Figure 5.22. Looking upstream at a section of grade controls in R10-C.

*R10-C Data Summary	*NOT ASSESSED	Reference	Existing
Length: 576 ft Drainage Area: 63 sq. mi. Evolution Stage: NA Sensitivity: NA	Confinement	Semi-confined	Semi-confined
	Stream Type	A	A
	Entrenchment Ratio	< 1.4	NA
	Incision Ratio	< 1.2	NA
	Dominant Bed Material	Bedrock	Bedrock
	Dominant Bedform	Cascade	Cascade
Major Stressors:	**Revetments, Bedrock Constriction, Channel Straightening**		

R10 Project Identification:

- **No projects identified in R10.**

R11

This reach is a long sinuous reach that winds its way up from the Sayers Covered Bridge to the Sawnee Bean Road Bridge. The river meanders through forested areas and past agricultural fields. The reach was split into four segments to account for changes in valley width, buffer types, and channel dimensions. The valley type is generally Broad with no significant human-caused change in valley width. The most upstream segment has a valley type of Narrowly Confined.

R11-A

This segment begins approximately 130 feet upstream of the Sayers Covered Bridge and continues about 4,000 feet upstream through a Broad valley to where the eastern corridor changes from forested to a hay field. This channel in this segment flows through a forested area with excellent bank and buffer vegetation. R11-A is in **fair** geomorphic condition and has undergone major **historic incision**, which has not led to a stream type departure. Major **aggradation**, **widening**, and **planform adjustment** are the main processes occurring here. Widening and planform adjustment are seen through extensive lateral erosion. The segment is in **fair** habitat condition (higher end of category) because of the high amounts of erosion. In some areas, sediment is filling pools. Invasive honeysuckle is widespread. Figure 5.23 shows a mass failure seen on the bank. An old fuel tank was found in the channel in R11-A.

R11-A Data Summary		Reference	Existing
Length: 4,038 ft Drainage Area: 61 sq. mi. Evolution Stage: F-III Sensitivity: Very High	Confinement	Broad	Broad
	Stream Type	C	C
	Entrenchment Ratio	> 2.2	13.5
	Incision Ratio	< 1.2	1.7
	Dominant Bed Material	Gravel	Gravel
	Dominant Bedform	Riffle-Pool	Riffle-Pool
Major Stressors:	**Invasive Plants, Erosion, Mass Failure**		

Figure 5.23. Mass failure on the bank in R11-A.

R11-B

This segment begins where the eastern corridor changes from forest to a hay field and continues 2,650 feet upstream through a Very Broad valley. The segment ends as the channel becomes less incised. This segment is in **fair** geomorphic condition with major **historic incision**. As the channel responds to the incision it is undergoing major **aggradation** and **widening** as seen through erosion (See Figure 5.25)**.** The cross section (Figure 5.24) done in this segment indicates that the channel is starting to build a new floodplain. Segment R11-B is in **fair** habitat condition as a result of poor bank and buffer vegetation, reduced buffer widths, invasive honeysuckle, reduced bank canopy, and the presence of a very large mass failure on the valley wall (See Figure5.26).

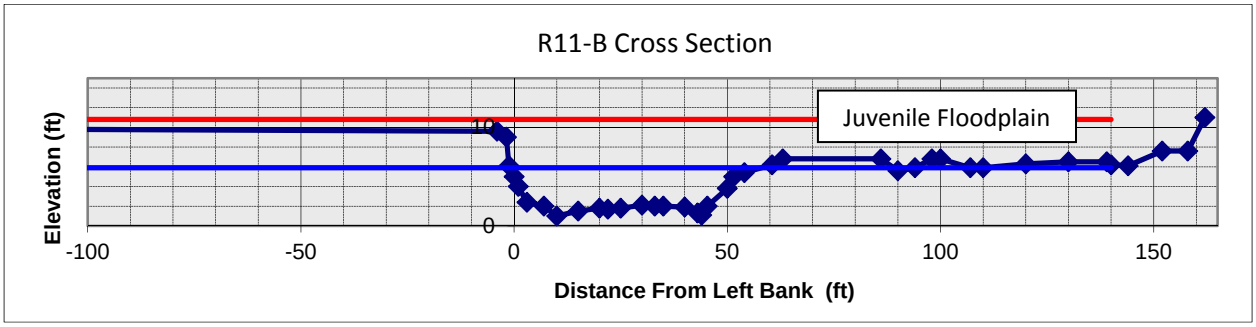

Figure 5.24. Cross section from R11-B indicates that channel is building a new floodplain.

Figure 5.25. Erosion on outside of bend and aggradation on inside of bend in R11-B.

Figure 5.26. Large mass failure on the valley wall.

R11-B Data Summary		Reference	Existing
Length: 2,646 ft Drainage Area: 61 sq. mi. Evolution Stage: F-IV Sensitivity: Very High	Confinement	Very Broad	Very Broad
	Stream Type	C	C
	Entrenchment Ratio	> 2.2	4.7
	Incision Ratio	< 1.2	1.8
	Dominant Bed Material	Gravel	Gravel
	Dominant Bedform	Riffle-Pool	Riffle-Pool
Major Stressors:	**Poor Buffers, Invasive Plants, Erosion, Mass Failure**		

R11-C

This segment begins as the channel becomes less incised and continues 2,755 feet upstream to where the valley changes from Broad to Narrowly Confined. A large portion of this segment has been historically straightened along the agricultural fields and many areas exhibit reduced buffer widths. This segment is in **fair** geomorphic condition with minor **historic incision**. **Planform adjustment** is major, with widening and aggradation as minor processes occurring. Cement blocks are lining a short area of the river bank and are contributing to geomorphic instability. The segment is in **fair** habitat condition (higher end of category) as a result of buffers less than 25 feet wide in many locations (See Figure 5.27).

Figure 5.27. Typical area with buffers less than 25 feet wide in R11-C.

R11-C Data Summary		Reference	Existing
Length: 2,755 ft Drainage Area: 61 sq. mi. Evolution Stage: F-III Sensitivity: Very High	Confinement	Broad	Broad
	Stream Type	C	C
	Entrenchment Ratio	> 2.2	10.2
	Incision Ratio	< 1.2	1.23
	Dominant Bed Material	Gravel	Gravel
	Dominant Bedform	Riffle-Pool	Riffle-Pool
Major Stressors:	**Poor Buffers, Invasive Plants, Channel Straightening**		

R11-D

The most upstream segment in R11 begins as the Broad valley changes to Narrowly Confined and continues 720 feet upstream to approximately 50 feet downstream of the Sawnee Bean Road crossing. This segment is located in a forested area and is naturally straight because of the confined valley. A private driveway in the western corridor is a source of sediment to the channel here. This segment is in **good** geomorphic condition. Minor aggradation and widening are occurring, but the segment is generally stable. Figure 5.28 shows a bedrock grade control that is helping to keep this segment in a stable condition. R11-D is in **good** habitat condition because of its excellent bank vegetation and buffer width.

Figure 5.28. Bedrock grade control in R11-D adds to vertical stability.

R11-D Data Summary		Reference	Existing
Length: 719 ft Drainage Area: 61 sq. mi. Evolution Stage: F-I Sensitivity: High	Confinement	Narrowly Confined	Narrowly Confined
	Stream Type	F	F
	Entrenchment Ratio	< 1.4	1.2
	Incision Ratio	< 1.2	1.0
	Dominant Bed Material	Cobble	Cobble
	Dominant Bedform	Riffle-Pool	Riffle-Pool
Major Stressors:	**Stormwater Inputs (sediment runoff from driveway)**		

R11 Project Identification:

- **Stream Clean-Up** of the old fuel tank in R11-A (Map 4: Project #1).
- **Active Restoration** by removing the line of cement blocks along the channel in R11-C (Map 5: Project #1).
- **Passive Restoration** by planting trees within the riparian corridor in areas where buffers are less than 25 feet wide in R11-C (Map 5: Project #2).
- **Passive Restoration** by protecting river corridor with an easement (Map 5: Project #3).
- **Stormwater Management** of driveway in western corridor in R11-D (Map 5: Project #4).

R12

Reach R12 was split into two segments to account for a change in confinement. The downstream segment is in a confined valley, whereas the upstream segment is in an unconfined valley.

R12-A

The segment begins just downstream of the Sawnee Bean Road crossing and continues 2,200 feet upstream to where the valley widens and becomes unconfined. This segment is characterized by being in a relatively undisturbed valley with good buffer vegetation. Sawnee Bean Road runs to the west of the channel for the majority of the segment, but it is located high up on the valley wall. At the lower end of the segment an old bridge abutment beneath the Sawnee Bean Road bridge is causing a channel constriction (See Figure 5.29). R12-A is in **good** geomorphic condition and is undergoing minor aggradation and planform adjustment. The multiple bedrock grade controls (Figure 5.30) in this segment are limiting vertical adjustment. R12-A is in **good** habitat condition because of its excellent bank vegetation and buffer widths. Good habitat for aquatic life is plentiful as there are numerous deep pools and many areas of the channel are shaded. Several stormwater inputs were identified along Sawnee Bean Road in this segment.

R12-A Data Summary		Reference	Existing
Length: 2,204 ft Drainage Area: 58 sq. mi. Evolution Stage: D-IIc Sensitivity: Moderate	Confinement	Semi-confined	Semi-confined
	Stream Type	B	B
	Entrenchment Ratio	1.4 – 2.2	1.4
	Incision Ratio	< 1.2	1.0
	Dominant Bed Material	Cobble	Cobble
	Dominant Bedform	Riffle-Pool	Riffle-Pool
Major Stressors:	**Revetments, Constrictions**		

Figure 5.29. Old bridge abutment beneath Sawnee Bean Road bridge is causing a channel constriction.

Figure 5.30. Grade controls are abundant in R12-A.

R12-B

This segment begins as the Semi-confined valley in R12-A opens up to a Narrow valley and continues 950 feet upstream to the confluence with Barker Brook (Figure 5.31). The segment is in **good** geomorphic condition with **aggradation** as the major adjustment process. Widening and planform adjustment are minor. R12-B is in **good** habitat condition with good bank vegetation and buffer widths. The western bank, which runs adjacent to a cleared area on private property, has abundant invasive honeysuckle.

Figure 5.31. Confluence with Barker Brook.

R12-B Data Summary		**Reference**	**Existing**
Length: 945 ft Drainage Area: 58 sq. mi. Evolution Stage: D-IIc Sensitivity: Moderate	Confinement	Narrow	Narrow
	Stream Type	B	B
	Entrenchment Ratio	1.4 – 2.2	1.6
	Incision Ratio	< 1.2	1.0
	Dominant Bed Material	Cobble	Cobble
	Dominant Bedform	Riffle-Pool	Riffle-Pool
Major Stressors:	**Invasive Plants**		

R12 Project Identification:

- **Active Restoration** by removing the old bridge abutment in R12-A (Map 5, Project #5).
- **Stormwater Management** off of Sawnee Bean Road (Map 5: Project #6).
- **Passive Restoration** by protecting the river corridor through an easement (Map 5: Project #7).

R13

This reach begins at the confluence with Barker Brook and continues 3,200 feet upstream to the reach break with R14. R13 is set in a Semi-confined valley and the corridor is forested. This stable segment is in **good** geomorphic condition with minor aggradation occurring (Figure 5.32). The segment is in **good** habitat condition with generally excellent bank vegetation and buffer widths. Invasive honeysuckle is prevalent along the stream banks in downstream areas of the reach.

Figure 5.32. R13 is a generally stable reach with minor aggradation occurring and excellent bank vegetation.

R13 Data Summary		Reference	Existing
Length: 3,216 ft Drainage Area: 55 sq. mi. Evolution Stage: F-I Sensitivity: High	Confinement	Semi-confined	Semi-confined
	Stream Type	B	B
	Entrenchment Ratio	1.4 – 2.2	1.7
	Incision Ratio	< 1.2	1.0
	Dominant Bed Material	Gravel	Gravel
	Dominant Bedform	Riffle-Pool	Riffle-Pool
Major Stressors:	**Invasive Plants (lower reach), Mass Failure**		

R13 Project Identification:

- **Passive Restoration** by planting trees in areas where buffers are less than 25 feet wide (Map 5: Project #8).

R14

This reach was split into three segments to account for changes in valley width and reference stream types. The reach is generally in a forested area.

R14-A

The most downstream segment begins at the R14 reach break and continues 4,700 feet upstream through a Semi-confined valley. The segment ends as the valley opens up and becomes unconfined. R14-A is naturally straight, running through its mainly forested valley with little human influence. This segment is in **reference** geomorphic condition because it is stable and not currently exhibiting any adjustments. Several bedrock grade controls (Figure 5.33) are limiting vertical adjustment, which contributes to the segment's stability. This segment is in **good** habitat condition because of its excellent bank vegetation and buffer widths. A short area (approximately 500 feet) of the western bank has buffers less than 25 feet wide. There are many deep pools and good canopy cover that provide good aquatic habitat.

R14-A Data Summary		Reference	Existing
Length: 4,693 ft Drainage Area: 55 sq. mi. Evolution Stage: F-I Sensitivity: Moderate	Confinement	Semi-confined	Semi-confined
	Stream Type	B	B
	Entrenchment Ratio	1.4 – 2.2	2.1
	Incision Ratio	< 1.2	1.0
	Dominant Bed Material	Cobble	Cobble
	Dominant Bedform	Riffle-Pool	Riffle-Pool
Major Stressors:	**None**		

Figure 5.33. Bedrock grade controls in R14-A help to keep this segment in a stable geomorphic condition.

R14-B

This segment begins as the Semi-confined valley in R14-A opens up to a Broad valley and continues 1,200 feet upstream to where the valley narrows again. This segment is a subreach because it has a reference stream type that is different from the majority of the reach. The segment is in **fair** geomorphic condition. Major **historic incision** as a result of channel straightening has limited floodplain access. This has led to a stream type departure from the reference stream type of C to the existing stream type of B. Aggradation, widening, and planform adjustment are minor processes occurring. The segment is in **good** habitat condition. The segment runs adjacent to a cleared area (western corridor), which has a reduced buffer width (Figure 5.34). A short area along the western bank contains an old dump, with household trash and car parts. Other than that, the segment has generally good bank vegetation and an abundance of large woody debris, which are providing good habitat for aquatic life.

R14-B Data Summary		Reference	Existing
Length: 1,192 ft Drainage Area: 55 sq. mi. Evolution Stage: F-III Sensitivity: Very High	Confinement	Broad	Broad
	Stream Type	C	B
	Entrenchment Ratio	> 2.2	1.9
	Incision Ratio	< 1.2	1.5
	Dominant Bed Material	Gravel	Gravel
	Dominant Bedform	Riffle-Pool	Riffle-Pool
Major Stressors:	**Poor Buffers, Invasive Plants, Channel Straightening**		

Figure 5.34. Reduced buffer width in western corridor in R14-B.

R14-C

R14-C begins as the Broad valley changes to a Semi-confined valley and continues upstream for 1,400 feet. This segment is a subreach because it has a reference bedform that is different from the majority of the reach. R14-C is in **reference** geomorphic condition because it is stable (Figure 5.35). No adjustment processes are occurring. Multiple grade controls limit vertical adjustment. The segment is in **good** habitat condition with excellent large woody debris cover, good bank vegetation, and reference buffer widths.

Figure 5.35. R14-C is stable and has good bank vegetation.

R14-C Data Summary		Reference	Existing
Length: 1,396 ft Drainage Area: 55 sq. mi. Evolution Stage: F-I Sensitivity: Moderate	Confinement	Semi-confined	Semi-confined
	Stream Type	B	B
	Entrenchment Ratio	1.4 – 2.2	1.8
	Incision Ratio	< 1.2	1.0
	Dominant Bed Material	Cobble	Cobble
	Dominant Bedform	Plane Bed	Plane Bed
Major Stressors:	**None**		

R14 Project Identification:

- **Passive Restoration** by planting trees within the riparian corridor in areas where buffers are less than 25 feet wide in R14-A and protecting the river corridor through an easement (Map 6: Project #1).
- **Passive Restoration** by planting trees within the riparian corridor in areas where buffers are less than 25 feet wide in R14-B and protecting the river corridor through an easement (Map 6: Project #2).
- **Stream Clean-Up** of the trash pile in R14-B (Map 6, Project #3).

West Branch of the Ompompanoosuc River

The West Branch is a major tributary to the Ompompanoosuc River. The 18.3-mile long river flows south from its source in Vershire through the Town of Strafford. The river takes an eastwardly flow before its confluence with the Ompompanoosuc River in Thetford. The West Branch of the Ompompanoosuc River drains sixty square miles of land.

M01

The most downstream reach on the West Branch was split into ten segments to account for changes in valley width, channel dimensions, and buffer types. In general, whenever the channel changes course (around a bend), braiding was observed. One segment was not fully assessed due to the presence of a bedrock gorge.

M01-A

This segment begins at the confluence with Ompompanoosuc River and continues 3,900 feet upstream to the downstream end of a bedrock gorge. This segment is characterized by very high eroded banks and no floodplain access. The buffer in the river corridor was likely an old farm field, but is currently regenerating. Invasive Japanese knotweed is in abundance in this segment. Figure 5.36 shows a typical channel for the segment. The upper portion of this segment exhibited several grade controls and islands.

Segment M01-A is in **poor** geomorphic condition. Extreme **historic incision** has led to a loss of floodplain access and stream type departure from a C to an F. **Aggradation** and **widening** are major geomorphic processes occurring, while **planform adjustment** with high lateral erosion is extreme. M01-A is in **fair** habitat condition because of the large presence of invasive plants and an incised channel.

Figure 5.36. High banks with limited floodplain access in M01-A. Japanese knotweed is seen on the east bank.

M01-A Data Summary		Reference	Existing
Length: 3,904 ft Drainage Area: 60 sq. mi. Evolution Stage: F-III Sensitivity: Extreme	Confinement	Broad	Broad
	Stream Type	C	F
	Entrenchment Ratio	> 2.2	1.1
	Incision Ratio	< 1.2	2.9
	Dominant Bed Material	Cobble	Gravel
	Dominant Bedform	Riffle-Pool	Riffle-Pool
Major Stressors:	**Poor Bank Vegetation (trees), Invasive Plants, Erosion, Poor Floodplain Access**		

M01-B

This segment was not fully assessed because it was considered a bedrock gorge with multiple large grade controls. The segment begins at the downstream end of a large grade control (Figure 5.37). This is where the Broad valley in M01-A changes to a Narrowly Confined valley in M01-B. The valley walls are extremely high and steep in this segment. The upstream end of M01-B is at the top of a smaller grade control at the point where the valley opens up again (Figure 5.38). Administrative judgment was used to determine stream type, dominant bed material, and dominant bedform.

Figure 5.37. Downstream end of M01-B is a large bedrock grade control.

Figure 5.38. Upstream end of segment M01-B.

*M01-B Data Summary	*NOT ASSESSED	Reference	Existing
Length: 883 ft Drainage Area: 60 sq. mi. Evolution Stage: NA Sensitivity: NA	Confinement	Narrowly Confined	Narrowly Confined
	Stream Type	F	F
	Entrenchment Ratio	> 2.2	NA
	Incision Ratio	< 1.2	NA
	Dominant Bed Material	Bedrock	Bedrock
	Dominant Bedform	Cascade	Cascade
Major Stressors:	**Constriction**		

M01-C

This segment begins as the Narrowly Confined valley in M01-B opens up to a Broad valley. This short segment is along a bend in the river and is characterized by a Braided bedform (Figure 5.39). The segment is in **fair** geomorphic condition. **Aggradation** and **widening** are extreme, while **planform adjustment** is major. The aggradation and widening have caused a stream type departure from the reference type of C to the existing type of D. The braided channel, which is evident by two islands and a mid-channel bar, is likely a result of upstream straightened areas. M01-C is in **fair** (higher end of category) habitat condition because of an increase in fine sediment (aggradation). The segment has good bank vegetation and buffer widths.

Figure 5.39. Channel splits around an island in M01-C.

M01-C Data Summary		Reference	Existing
Length: 833 ft Drainage Area: 60 sq. mi. Evolution Stage: D-IIc Sensitivity: Extreme	Confinement	Broad	Broad
	Stream Type	C	D
	Entrenchment Ratio	> 2.2	2.0
	Incision Ratio	< 1.2	1.1
	Dominant Bed Material	Cobble	Cobble
	Dominant Bedform	Riffle-Pool	Braided
Major Stressors:	**Channel Straightening (upstream)**		

M01-D

This segment is the short straightened segment between the two river bends that have Braided bedforms (M01-C and M01-E). The segment runs adjacent to an old agricultural field in the western corridor. The eastern corridor seems to be an area that was historically cleared, but is now regenerating. M01-D is in **fair** geomorphic condition. Extreme **historic incision** as a result of channel straightening has cut off floodplain access. This has led to a stream type departure from the reference type of C to the existing type of F. Figure 5.40 shows the high banks in M01-D. **Widening** is a major adjustment process in this segment, while planform adjustment and

aggradation are minor. M01-D is in **fair** habitat condition as a result of buffers less than 25 feet wide, a lack of large woody debris, and a low number of deep pools.

Figure 5.40. High banks in M01-D as a result of historic incision are restricting floodplain access.

M01-D Data Summary		Reference	Existing
Length: 516 ft Drainage Area: 60 sq. mi. Evolution Stage: F-III Sensitivity: Very High	Confinement	Very Broad	Very Broad
	Stream Type	C	F
	Entrenchment Ratio	> 2.2	1.2
	Incision Ratio	< 1.2	2.4
	Dominant Bed Material	Cobble	Cobble
	Dominant Bedform	Riffle-Pool	Riffle-Pool
Major Stressors:	**Poor Bank Vegetation, Poor Buffers, Invasive Plants, Channel Straightening**		

M01-E

Segment M01-E begins as the river becomes braided and sinuous upstream of M01-D. A channel avulsion was observed on the field maps and was seen the field as well. Currently, there are two channels in this segment, the main one being the southern one. The main channel follows the stream layer noted in Figure 5.1 (Section 5.2 Geomorphic Condition), while the other extends out to the northeast. The upstream end of the segment is where this smaller

channel branches out from the main channel. This short segment is along a bend in the river and is characterized by a Braided bedform. The segment is in **fair** geomorphic condition. **Widening** and **planform adjustment** are extreme, while **aggradation** is major. The aggradation and widening have caused a stream type departure from the reference type of C to the existing type of D. The braided channel, which is evident by an island (See Figure 5.41) and three mid-channel bars, is likely a result of upstream straightened areas. M01-E is in **fair** (higher end of category) habitat condition because of an increase in smaller sediments (aggradation) and extensive bank erosion.

Figure 5.41. A channel avulsion has created this island in M01-E. Major aggradation can be seen here as well.

M01-E Data Summary		**Reference**	**Existing**
Length: 470 ft Drainage Area: 60 sq. mi. Evolution Stage: D-IId Sensitivity: Extreme	Confinement	Very Broad	Very Broad
	Stream Type	C	D
	Entrenchment Ratio	> 2.2	2.0
	Incision Ratio	< 1.2	1.1
	Dominant Bed Material	Cobble	Cobble
	Dominant Bedform	Riffle-Pool	Braided
Major Stressors:	**Poor Buffers, Invasive Plants, Erosion, Channel Straightening (upstream)**		

M01-F

This segment is the straightened area of channel upstream of a Braided segment, M01-E. The 1,050-foot long segment continues upstream, underneath a metal grate bridge, and ends at the downstream end of a large island in the channel. This segment is in **fair** geomorphic condition. Channel straightening has led to major **historic incision.** An improved path limits floodplain access in the southern corridor in part of this segment; however, the channel still has floodplain access to the north (See Figure 5.42). A juvenile floodplain is developing here as the river adjusts back to equilibrium. **Aggradation** and **widening** are major processes, while planform adjustment is minor. M01-F is in **fair** habitat condition as a result of a lack of large woody debris, areas with buffers less than 25 feet wide, and bank erosion.

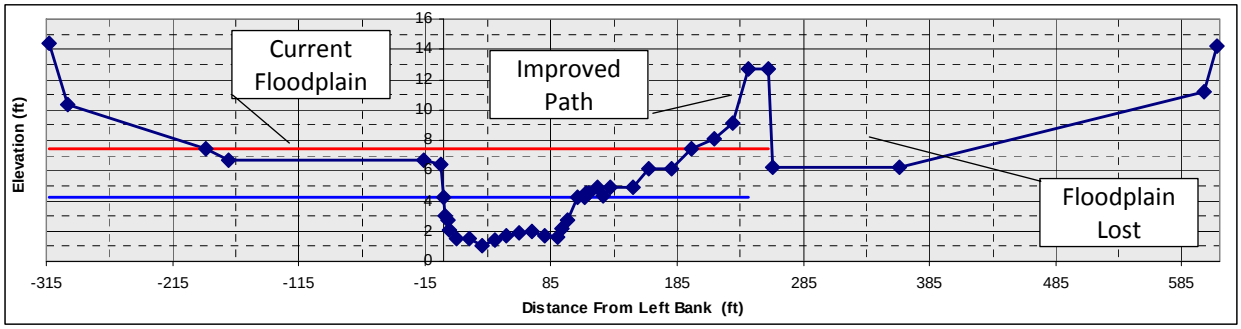

Figure 5.42. The cross section from M01-F shows how the improved path is restricting floodplain access.

M01-F Data Summary		**Reference**	**Existing**
Length: 1,046 ft Drainage Area: 60 sq. mi. Evolution Stage: F-IV Sensitivity: High	Confinement	Very Broad	Very Broad
	Stream Type	C	C
	Entrenchment Ratio	> 2.2	3.6
	Incision Ratio	< 1.2	1.6
	Dominant Bed Material	Cobble	Cobble
	Dominant Bedform	Riffle-Pool	Riffle-Pool
Major Stressors:	**Poor Buffers, Poor Bank Vegetation, Erosion, Constriction, Encroachment (Improved Path), Channel Straightening**		

M01-G

This segment begins at the downstream end of a large island, which is approximately 500 feet upstream of a metal bridge that accessed natural trails. The segment continues 960 feet upstream. This short segment is along a bend in the river and is characterized by a Braided bedform. The segment is in **fair** geomorphic condition. **Widening** and **planform adjustment** are extreme, while **aggradation** is major. The aggradation and widening have caused a stream type departure from the reference type of C to the existing type of D. The braided channel, which is evident by an island and a mid-channel bar, is likely a result of upstream straightened areas. M01-G is in **good** habitat condition because of the excellent bank vegetation and buffer widths. Refuge areas for aquatic life are plentiful in the deep pools. Figure 5.43 shows a typical view in M01-G.

Figure 5.43. M01-G has excellent bank and buffer vegetation.

M01-G Data Summary		Reference	Existing
Length: 960 ft Drainage Area: 60 sq. mi. Evolution Stage: D-IId Sensitivity: Extreme	Confinement	Narrow	Narrow
	Stream Type	C	D
	Entrenchment Ratio	> 2.2	2.0
	Incision Ratio	< 1.2	1.1
	Dominant Bed Material	Cobble	Cobble
	Dominant Bedform	Riffle-Pool	Braided
Major Stressors:	**Channel Straightening (upstream)**		

M01-H

This segment begins at the upstream end of a large flood chute and continues 990 feet upstream through a forested area with excellent floodplain access. The segment ends at the downstream end of an area that has a berm on one side and an old stone wall on the other. M01-H is in **fair** geomorphic condition with **aggradation** and **widening** as the main processes occurring. Planform adjustment is a minor process. Two ledge grade controls are keeping the channel from incising. M01-G is in **good** habitat condition because of the excellent bank vegetation and buffer widths. Large woody debris and deep pools create diverse habitat for aquatic life. Figure 5.44 shows a typical view in M01-H.

Figure 5.44. Excellent floodplain access in M01-H.

M01-H Data Summary		Reference	Existing
Length: 990 ft Drainage Area: 60 sq. mi. Evolution Stage: D-IIc Sensitivity: High	Confinement	Narrow	Narrow
	Stream Type	C	C
	Entrenchment Ratio	> 2.2	3.6
	Incision Ratio	< 1.2	1.1
	Dominant Bed Material	Cobble	Cobble
	Dominant Bedform	Riffle-Pool	Riffle-Pool
Major Stressors:	**Channel Straightening**		

M01-I

M01-I is begins at the lower end of a berm on the northern bank and continues almost 1,500 feet upstream to the Route 132 bridge in Thetford near the intersection of Route 132 and Tucker Hill Road. This segment is characterized by its floodplain access being restricted by the berm. Figure 5.45 shows the cross section for this segment with the berm on the east bank.

Segment M01-I is in **fair** geomorphic condition. Extreme **historic incision** as a result of channel straightening has led to a stream type departure from the reference C stream type to the existing F stream type. The influence from the berm (See Figure 5.46) is also contributing to the departure. **Widening** is a major process, while aggradation and planform adjustment are minor

in this segment. M01-I is in **fair** habitat condition and exhibits a stream habitat type departure. The channel straightening has changed the reference bedform of riffle-pool to the existing bedform of plane bed, which lacks key pool and riffle features that provide good fish habitat.

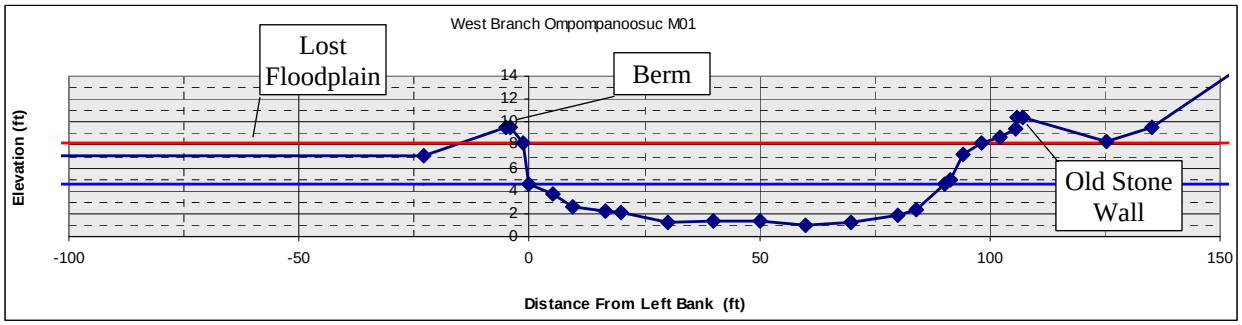

Figure 5.45. Cross section in M01-I shows how the berm on the northern bank is restricting floodplain access.

Figure 5.46. Material has been pushed up near the northern bank to create a berm.

M01-I Data Summary		Reference	Existing
Length: 1,447 ft Drainage Area: 60 sq. mi. Evolution Stage: F-III Sensitivity: Very High	Confinement	Narrow	Narrow
	Stream Type	C	C
	Entrenchment Ratio	> 2.2	3.6
	Incision Ratio	< 1.2	1.1
	Dominant Bed Material	Cobble	Cobble
	Dominant Bedform	Riffle-Pool	Riffle-Pool
Major Stressors:	**Berms, Channel Straightening**		

M01-J

This segment begins just downstream of the Route 132 bridge in Thetford and continues about 1,450 feet upstream to a large bedrock grade control, which is upstream reach point for M01. The segment is stable and in **good** geomorphic condition with some areas of major **widening.** Aggradation and planform adjustment are minor. The large grade control is contributing to vertical stability in M01-J. The segment is in **good** habitat condition with excellent bank vegetation and buffer widths. There were many deep pools providing good habitat for aquatic life. Figure 5.47 shows the large grade control at the upper end of the segment.

Figure 5.47. Bedrock grade control at the upper end of segment M01-J.

M01-J Data Summary		**Reference**	**Existing**
Length: 1,444 ft Drainage Area: 60 sq. mi. Evolution Stage: F-I Sensitivity: Moderate	Confinement	Broad	Broad
	Stream Type	C	C
	Entrenchment Ratio	> 2.2	3.6
	Incision Ratio	< 1.2	1.1
	Dominant Bed Material	Cobble	Cobble
	Dominant Bedform	Riffle-Pool	Riffle-Pool
Major Stressors:	**Constriction, Channel Straightening**		

M01 Project Identification:

- **Passive Restoration** by planting trees within the riparian corridor in areas where buffers are less than 25 feet wide in M01-F (Map 7: Project #1).
- **Active Restoration** by removing the berm in M01-I (Map 8, Project #1).

M02

Reach M02 begins about 1,500 feet upstream of the Route 132 bridge near the intersection of Route 132 and Tucker Hill Road. The reach continues 7,550 feet upstream, paralleling Route 132, and ends just upstream of the confluence with Abbot Brook. The channel generally flows through a Broad valley. Human-caused change in confinement due to the presence of Route 132 limits the channel's natural ability to meander. This section of the river has been straightened in many areas. An area at the upper end of the reach was significantly altered by Tropical Storm Irene impacts and a landowner states that major channel work, including sediment removal, was conducted post flood. M02 is in **fair** geomorphic condition. It appears that the channel has gone through an entire sequence of geomorphic response to the change in its confinement and is now stable and has developed a new floodplain. Major **aggradation** and **planform adjustment** have occurred, while widening is minor. Figure 5.48 shows a typical view for this reach. M02 is in **good** habitat condition with generally good bank vegetation and buffer widths. Refuge areas are abundant in the many deep pools and habitat debris jams.

Figure5.48. Route 132 (left) runs along the channel in M02 to the north, sometimes very close to the channel. The southern corridor (right) generally has good floodplain access and good buffer widths.

M02 Data Summary		Reference	Existing
Length: 7,547 ft Drainage Area: 60 sq. mi. Evolution Stage: F-V Sensitivity: Very High	Confinement	Broad	Narrow
	Stream Type	C4	C4
	Entrenchment Ratio	> 2.2	2.5
	Incision Ratio	< 1.2	1.2
	Dominant Bed Material	Gravel	Gravel
	Dominant Bedform	Riffle-Pool	Riffle-Pool
Major Stressors:	**Encroachments, Channel Straightening**		

M02 Project Identification:

- **Active Restoration** by removing the old bridge abutment along Ilsley Road (Map 8: Project #2).
- **Active Restoration** by restoring the stream channel that was impacted by flood work (Map 8, Project #3).

Avery Brook

Avery Brook is a small tributary that flows into the Ompompanoosuc River just downstream of the Union Village Dam outflow. The drainage area at the mouth of the Brook is 5.0 square miles.

R06.S1.01

The most downstream reach on Avery Brook is located in a valley that transitions from Narrow to Very Broad as Avery Brook enters the Ompompanoosuc River main stem. The reach was split into two segments to account for a change in stream type.

R06.S1.01-A

The most downstream segment on Avery Brook begins at the confluence with the Ompompanoosuc River and continues 300 feet upstream to just downstream of a box culvert that runs under the access road for the Union Village Dam. The segment has excellent floodplain access and is in **good** geomorphic condition. The stable segment is undergoing minor widening and planform adjustment, but is generally stable. The segment is in **fair** habitat condition mainly because of the overwhelming amount of invasive honeysuckle on both stream banks and in the riparian corridor (Figure 5.49).

R06.S1.01-A Data Summary		Reference	Existing
Length: 292 ft Drainage Area: 5 sq. mi. Evolution Stage: F-I Sensitivity: Moderate	Confinement	Very Broad	Very Broad
	Stream Type	C	C
	Entrenchment Ratio	> 2.2	6.6
	Incision Ratio	< 1.2	1.1
	Dominant Bed Material	Cobble	Cobble
	Dominant Bedform	Riffle-Pool	Riffle-Pool
Major Stressors:	**Invasive Plants, Erosion**		

Figure 5.49. Invasive honeysuckle is abundant in R06.S1.02-A.

R06.S1.01-B

This segment begins at the downstream end of the box culvert and continues 800 feet upstream to the lower end of a steep bedrock grade control. The segment is generally stable and in **good** geomorphic condition. Minor widening, planform adjustment, and aggradation are occurring. A poorly aligned old bridge abutment located mid-segment is contributing to a short section of geomorphic instability. The segment is in **fair** habitat condition because the presence of invasive honeysuckle along the banks and some areas of erosion. A large portion of the southern corridor has buffer widths that are less than 25 feet wide. A box culvert at the lower end is a channel constriction and blocks all aquatic organism passage according to the Milone & MacBroom AOP Screening Tool (2009) (See Section 5.5 for more information). Figure 5.50 shows the high amount of invasive honeysuckle present.

R06.S1.01-B Data Summary		**Reference**	**Existing**
Length: 801 ft Drainage Area: 5 sq. mi. Evolution Stage: F-I Sensitivity: Moderate	Confinement	Narrow	Narrow
	Stream Type	B	B
	Entrenchment Ratio	1.4 – 2.2	1.7
	Incision Ratio	< 1.2	1.0
	Dominant Bed Material	Cobble	Cobble
	Dominant Bedform	Riffle-Pool	Riffle-Pool
Major Stressors:	**Poor Buffers, Invasive Plants, Erosion, Revetments, Constriction, Channel Straightening**		

Figure 5.50. Invasive honeysuckle on the left bank in R06.S1.01-B.

R06.S1.01 Project Identification:

- **Active Restoration** by replacing or retrofitting the box culvert in R06.S1.01-B (Map 9: Project #1).
- **Passive Restoration** by planting trees within the riparian corridor in areas where buffers are less than 25 feet wide (Map 9: Project #2).
- **Active Restoration** by removing the old bridge abutment in R06.S1.01-B (Map 9: Project #3).

R06.S1.02

This reach is set in a confined valley and was split into three segments to account for changes in stream types.

R06.S1.02-A

This segment is a short segment, less than 300 feet in length, that is characterized by a large cascading bedrock grade control (Figure 5.51). The segment was not fully assessed for this reason.

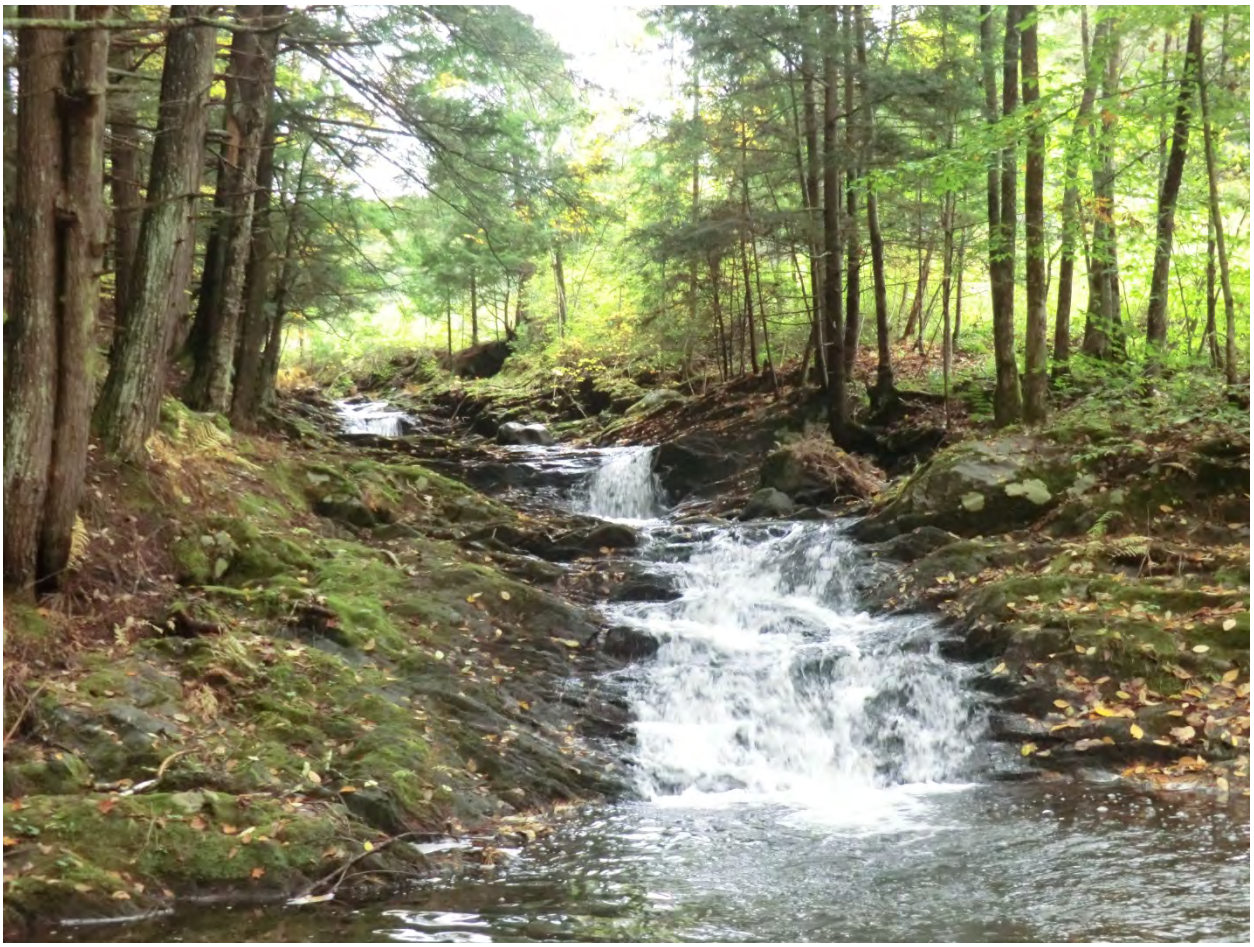

Figure 5.51. A large bedrock grade control dominates segment R06.S1.02-A.

R06.S1.02-A Data Summary		*NOT ASSESSED	Reference	Existing
Length:	276 ft	Confinement	Narrow	Narrow
Drainage Area:	5 sq. mi.	Stream Type	A	A
Evolution Stage:	NA	Entrenchment Ratio	< 1.4	NA
Sensitivity:	NA	Incision Ratio	< 1.2	NA
		Dominant Bed Material	Bedrock	Bedrock
		Dominant Bedform	Cascade	Cascade
Major Stressors:		**None**		

R06.S1.02-B

Segment B begins at the upstream end of the large grade control and continues about 1,000 feet upstream, ending about 400 feet upstream of a long box culvert that runs under Route 132. The channel is a "B" channel in a semi-confined valley and is stable. The segment is in **good** geomorphic condition with minor aggradation, widening, and planform adjustment in localized places. Several bedrock grade controls are limiting vertical adjustment in the majority of the segment. Overall, R06.S1.02-B is in **good** habitat condition because of an abundance of large woody debris in the channel as well as excellent vegetated stream banks and buffers. The major stressor to the segment is the 200-foot long box culvert located mid-segment. The

culvert is undersized, causing a channel constriction, and is impeding all aquatic organism passage based on the Milone & MacBroom AOP Screening Tool (2009) (See Section 5.5 for more information). Figure 5.52 shows a typical channel in R06.S1.02-B.

Figure 5.52. Stable segment R06.S1.02-B is located in a semi-confined valley and is geomorphically stable.

R06.S1.02-B Data Summary			**Reference**	**Existing**
Length:	990 ft	Confinement	Semi-Confined	Semi-Confined
Drainage Area:	5 sq. mi.	Stream Type	B	B
Evolution Stage:	F-I	Entrenchment Ratio	1.4 – 2.2	1.9
Sensitivity:	Moderate	Incision Ratio	< 1.2	1.0
		Dominant Bed Material	Cobble	Cobble
		Dominant Bedform	Step-Pool	Step-Pool
Major Stressors:		**Box Culvert - Revetments/Constriction/Channel Straightening**		

R06.S1.02-C

The most upstream segment assessed on Avery Brook is set in a semi-confined valley that is slightly narrower than the downstream segment. The 900-foot long segment has a reference stream type of F. The stable segment is in **good** geomorphic condition with minor aggradation and planform adjustment in localized areas. Multiple bedrock grade controls throughout the

segment are limiting vertical adjustment and contributing to the stability (Figure 5.53). R06.S1.02-C is in **good** habitat condition because of excellent vegetated stream banks and buffers as well as a variety of deep pools that are good for aquatic habitat.

Figure 5.53. Bedrock grade controls in R06.S1.02-C contribute to vertical stability.

R06.S1.02-C Data Summary			Reference	Existing
Length:	876 ft	Confinement	Semi-Confined	Semi-Confined
Drainage Area:	5 sq. mi.	Stream Type	F	F
Evolution Stage:	F-I	Entrenchment Ratio	< 1.4	1.2
Sensitivity:	High	Incision Ratio	< 1.2	1.0
		Dominant Bed Material	Cobble	Cobble
		Dominant Bedform	Step-Pool	Step-Pool
Major Stressors:		**None**		

R06.S1.02 Project Identification:

- **Active Restoration** by replacing or retrofitting the box culvert in R06.S1.02-B (Map 9: Project #4).

5.5 Stream Crossings

Table 6 in Appendix B summarizes the data collected for the assessed structures within the Phase 2 study area. The map on page 5 of Appendix B shows the location, geomorphic compatibility rating, and AOP rating (culverts only) of each structure. Of the 5 bridges assessed, three were determined to be "partially compatible" and two were "mostly compatible." The two box culverts assessed were considered "mostly incompatible" with No Aquatic Organism Passage, Including Adult Salmonids. Both culverts are located on Avery Brook. Figure 5.54 shows that the 200-foot long Route 132 box culvert (Segment R06.S1.02-B) is properly aligned with the stream's natural flow direction; however the downstream end is perched above the water surface, which limits aquatic organism passage. If the box culvert were to be retrofitted instead of replaced, the installation of baffles should be considered to reduce velocities and to retain bed material to improve aquatic organism passage.

Figure 5.54. The Route 132 box culvert on Avery Brook limits aquatic organism passage.

The most downstream box culvert on Avery Brook (within Segment R06.S1.01-B) also limits aquatic organism passage because it is perched at the downstream end. The walls of this structure are also deteriorating as shown in Figure 5.55.

Figure 5.55. The most downstream box culvert on Avery Brook is perched at the downstream end and is deteriorating along the walls inside the structure.

The replacements of the box culverts on Avery Brook have been included as potential restoration projects within the Ompompanoosuc River watershed. All of the information collected during the bridge and culvert assessments can be used by municipalities and the Vermont Agency of Transportation to prioritize bridge and culvert retrofits or replacements.

6.0 PROJECT IDENTIFICATION AND IMPLEMENTATION

6.1 Site Level Opportunities

Site specific projects were identified using the criteria outlined by the VANR in Chapter 6 – Preliminary Identification and Prioritization (Vermont Agency of Natural Resources 2010a). This planning guide is intended to aid in the development of projects that protect and restore river equilibrium. The goal of many of the projects is to provide the river with greater flood resiliency, which will help to minimize future storm event fluvial erosion conflicts such as river-road conflicts, floodplain encroachments, and undersized stream crossings. Project maps, tables, and photos (Appendix D) have been developed for the Ompompanoosuc River watershed. These maps were created using indexed data from the Phase 2 Stream Geomorphic Assessments along with existing data available from the Vermont Center for Geographic Information.

A total of 27 projects were identified by BCE to promote the restoration or protection of channel stability and aquatic habitat in the Ompompanoosuc River watershed. The projects are broken down by category as follows: 14 passive restoration (streamside plantings, natural buffer regeneration, corridor easements, and wetland protection); 2 stormwater improvement projects; 2 stream clean-ups; and 9 active restoration (three alternative analyses for old bridge abutment removals, one berm removal, two old bank armoring removals, two culvert replacement or retrofits, and a potential channel restoration).

6.2 Next Steps

There are many opportunities available to work towards restoring the Ompompanoosuc River, the West Branch, and Avery Brook to stable conditions. Preliminary reach level and site level projects have been identified and will form the basis for future project development. These preliminary projects are outlined in Section 6.1 and presented in more detail in Appendix D. On the watershed level, the implementation of fluvial erosion hazard zones avoids conflicts regarding land-use, and saves money spent on flood damage and river maintenance. The following are recommendations for next steps.

1. Project partners to provide outreach to private landowners and the public about the plan and potential projects.
2. Incorporate fluvial erosion hazard areas in town zoning and planning strategies.
3. Work with regulatory agencies on project design and permitting.
4. Acquire funding and hire contractors (river scientists and engineers) to prepare project design and implementation strategies for selected high priority projects.

5. Obtain funding and perform Phase 2 assessment of Abbot Brook and Barker Brook. Table 4 includes the rationale for a Phase 2 assessment on select reaches. Figure 6.1 shows Barker Brook just upstream of the confluence with the Ompompanoosuc River main stem. Figure 6.2 displays the location of completed Phase 1 and Phase 2 assessments, as well as locations of Abbot Brook and Barker Brook assessment recommendations. Bear Creek Environmental is currently working with the Vermont Department of Environmental Conservation and towns within the watershed to prioritize further Phase 2 assessment work.

Table 4. Phase 2 Reach Recommendations
Ompompanoosuc River Watershed

Stream	Reach	Length (miles)	Rationale for Phase 2 Assessment
Barker Brook	R12.S1.01	0.21	During the 2012 assessment, areas near and the mouth of Barker Brook were noted to be geomorphically unstable and appeared to be impacted by flooding or channel modifications (Figure 6.1). Following the Phase 1 assessment of the watershed (BCE, 2009), R12.S1.05 through R06.S1.07 were recommended for Phase 2 assessments. The recommended reaches on Barker Brook total 2.52 miles.
	R12.S1.02	0.16	
	R12.S1.04	0.79	
	R12.S1.05	0.31	
	R12.S1.06	0.75	
	R12.S1.07	0.30	
Abbot Brook	T1.01	2.34	Following the Phase 1 assessment of the watershed (BCE, 2009), T1.01 was recommended for Phase 2 assessment. Its sensitive location at the lower end of the Abbot Brook watershed makes it a high priority.

Figure 6.1. Aggradation near the mouth of Barker Brook

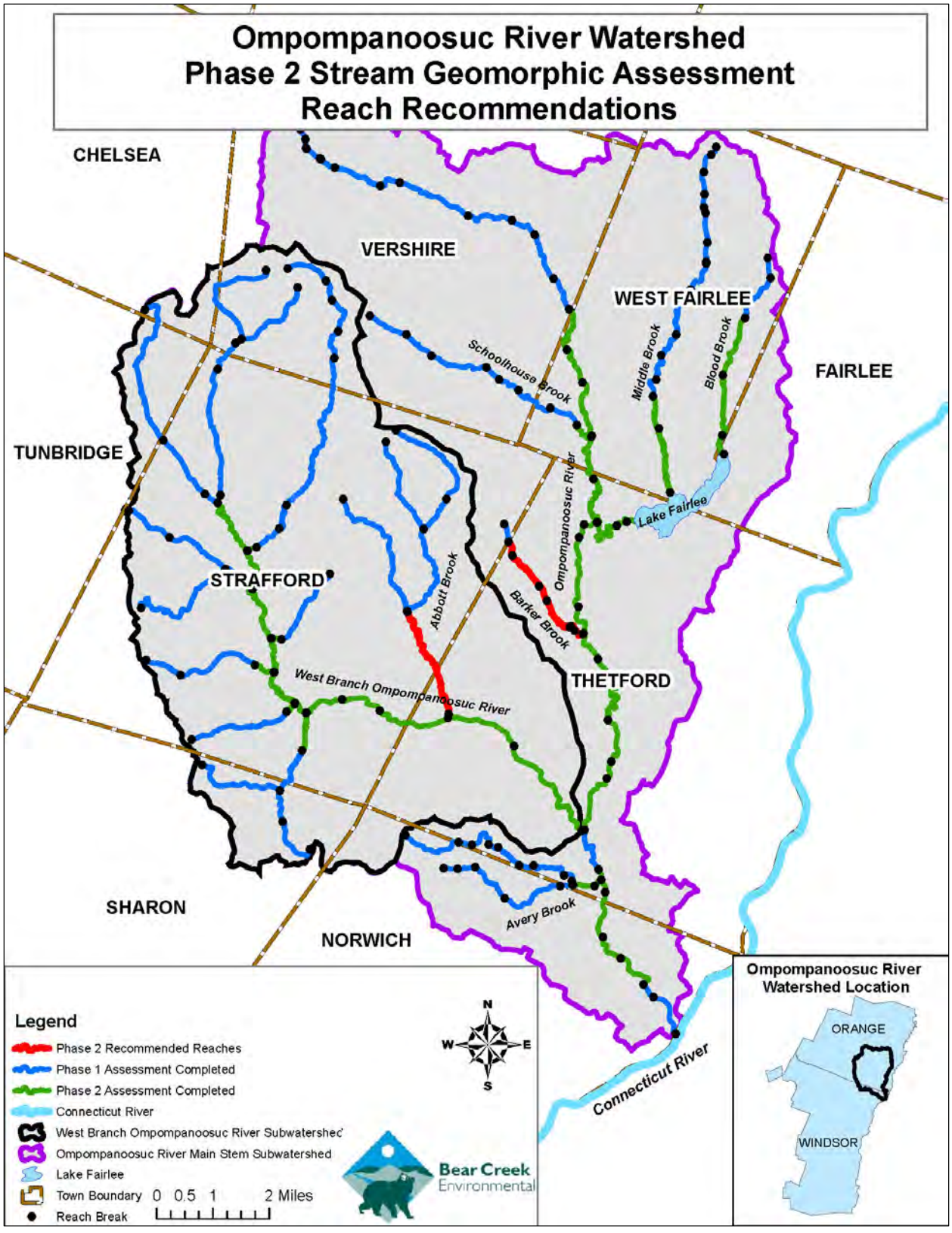

Figure 6.2. Recommended Phase 2 stream geomorphic assessment reaches.

For additional information about river restoration and protection opportunities within the Ompompanoosuc River watershed please contact:

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7.0 LIST OF ACRONYMS AND GLOSSARY OF TERMS

List of Acronyms

BCE – Bear Creek Environmental, LLC
CREP – Conservation Reserve Enchancement Program
CRWC – Connecticut River Watershed Council
EQIP – Environmental Quality Incentives Program
ERP – Ecosystem Restoration Program
FEH – Fluvial Erosion Hazard Zone
GIS – Geographic Information System
NCC – Norwich Conservation Commission
NWI – National Wetlands Inventory
QA/QC – quality assurance/quality control
RCE – ANR River Corridor Easement Program
RHA- Rapid Habitat Assessment
RGA-Rapid Geomorphic Assessment
SGA – Stream Geomorphic Assessment
SGAT – Stream Geomorphic Assessment Tool
TCC – Thetford Conservation Commission
TFS – Trees for Streams
USGS – United States Geological Survey
VANR – Vermont Agency of Natural Resources
VTDEC – Vermont Department of Environmental Conservation
WHIP – Wildlife Habitat Incentives Program
WRP – Wetland Reserve Program

Glossary of Terms

Adapted from:
Restoration Terms, by Craig Fischenich, February, 2000, USAE Research and Development Center, Environmental Laboratory, 3909 Halls Ferry Rd., Vicksburg, MS 39180
And
Vermont Stream Geomorphic Assessment Handbook, Appendix Q, 2009, VT Agency of Natural Resources, Waterbury, VT.
http://www.vtwaterquality.org/rivers/docs/assessmenthandbooks/rv_apxqglossary.pdf

Adjustment Process – type of change that is underway due to natural causes or human activity that has or will result in a change to the valley, floodplain, and/or channel condition (e.g., vertical, lateral, or channel plan form adjustment processes).

Aggradation - A progressive buildup or rising of the channel bed and floodplain due to sediment deposition. The geologic process by which streambeds are raised in elevation and floodplains

are formed. Aggradation indicates that the stream discharge and/or bed load characteristics are changing. Opposite of degradation.

Alluvial Fan – A fan-shaped accumulation of alluvium (alluvial soils) deposited at the mouth of a ravine or at the juncture of a tributary stream with the main stem where there is an abrupt change in slope.

Alluvial Soils – Soil deposits from rivers.

Alluvium – A general term for detrital deposits made by streams on riverbeds, floodplains, and alluvial fans.

Avulsion – A change in channel course that occurs when a stream suddenly breaks through its banks, typically bisecting an overextended meander arc.

Bank Stability – The ability of a stream bank to counteract erosion or gravity forces.

Bankfull Channel Depth - The maximum depth of a channel within a riffle segment when flowing at a bankfull discharge.

Bankfull Channel Width - The top surface width of a stream channel when flowing at a bankfull discharge.

Bankfull Discharge - The stream discharge corresponding to the water stage that overtops the natural banks. This flow occurs, on average, about once every 1 to 2 years and given its frequency and magnitude is responsible for the shaping of most stream or river channels.

Bar – An accumulation of alluvium (usually gravel or sand) caused by a decrease in sediment transport capacity on the inside of meander bends or in the center of an over wide channel.

Berms – Mounds of dirt, earth, gravel or other fill built parallel to the stream banks designed to keep flood flows from entering the adjacent floodplain.

Bifurcated Channel – a river channel that has split into two branches as a result of planform adjustment (i.e. split flow due to island).

Cascade – River bed form where the channel is very steep with narrow confinement. There are often large boulders and bedrock with waterfalls.

Channelization – The process of changing (usually straightening) the natural path of a waterway.

Culvert – A buried pipe that allows flows to pass under a road.

Degradation – (1) A progressive lowering of the channel bed due to scour. Degradation is an indicator that the stream's discharge and/or sediment load is changing. The opposite of aggradation. (2) A decrease in value for a designated use.

Delta Bar – A deposit of sediment where a tributary enters the main stem of a river.

Depositional Features – Types of sediment deposition and storage areas in a channel (e.g. mid-channel bars, point bars, side bars, diagonal bars, delta bars, and islands).

Diagonal Bar – Type of depositional feature perpendicular to the bank that is formed from excess sedimentation and within the channel and from the development of steep riffles.

Drainage Basin – The total area of land from which water drains into a specific river.

Dredging – Removing material (usually sediments) from wetlands or waterways, usually to make them deeper or wider.

Erosion – The wearing away of rock or soil by the gradual detachment of soil or rock fragments by water, wind, ice, and other mechanical, chemical, or biological forces.

Floodplain – Land built of sediment that is regularly covered with water as a result of the flooding of a nearby stream.

Floodprone Width – the wetted width of the channel when the water level is twice the maximum bankfull depth. For most channels this is associated with less than a 50 year return period (Rosgen, 1996).

Fluvial Geomorphology – the physics of flowing water, sediments, and other products of watersheds in relation to various land forms.

Gaging Station – A particular site in a stream, lake, reservoir, etc., where hydrologic data are obtained.

Grade Control - A fixed feature on the streambed that controls the bed elevation at that point, effectively fixing the bed elevation from potential incision; typically bedrock, dams or culverts.

Gradient – Vertical drop per unit of horizontal distance.

Habitat – The local environment in which organisms normally grow and live.

Headwater – Referring to the source of a stream or river.

Head Cut – Sudden change in elevation or knickpoint at the leading edge of a gully

Incised River – A river that erodes its channel by the process of degradation to a lower base level than existed previously or is consistent with the current hydrology.

Islands – Mid-channel bars that are above the average water level and have established woody vegetation.

Lacustrine Soils- Soil deposits from lakes.

Meander - The winding of a stream channel, usually in an erodible alluvial valley. A series of sine-generated curves characterized by curved flow and alternating banks and shoals.

Meander Migration – The change of course or movement of a channel. The movement of a channel over time is natural in most alluvial systems. The rate of movement may be increased if the stream is out of balance with its watershed inputs.

Meander Belt Width – The horizontal distance between the opposite outside banks of fully developed meanders determined by extending two lines (one on each side of the channel) parallel to the valley from the lateral extent of each meander bend along both sides of the channel.

Meander Wavelength - The lineal distance downvalley between two corresponding points of successive meanders of the same phase.

Meander Wavelength Ratio – The meander wavelength divided by the bankfull channel width.

Meander Width Ratio – The meander belt width divided by the bankfull channel width.

Mid-Channel Bar – Sediment deposits (bar) located in the channel away from the banks, generally found in areas where the channel runs straight. Mid-channel bars caused by recent channel instability are unvegetated.

Planform - The channel shape as if observed from the air. Changes in planform often involve shifts in large amount of sediment, bank erosion, or the migration of the channel.

Plane Bed – Channel lacks discrete bed features (such as pools, riffles, and point bars) and may have long stretches of featureless bed.

Point Bar –The convex side of a meander bend that is built up due to sediment deposition.

Pool -- A habitat feature (section of stream) that is characterized by deep, low-velocity water and a smooth surface.

Reach - Section of river with similar characteristics such as slope, confinement (valley width), and tributary influence.

Restoration – The return of an ecosystem to a close approximation of its condition prior to disturbance.

Riffle - A habitat feature (section of stream) that is characterized by shallow, fast-moving water broken by the presence of rocks and boulders.

Riffle-pool - Channel has undulating bed that defines a sequence of riffles, runs, pools, and point bars. Occurs in moderate to low gradient and moderately sinuous channels, generally in unconfined valleys with well-established floodplains.

Riparian Buffer – The width of naturally vegetated land adjacent to the stream between the top of the bank and the edge of other land-uses. A buffer is largely undisturbed and consists of the trees, shrubs, groundcover plants, duff layer, and naturally uneven ground surface.

Riparian Corridor – Lands defined by the lateral extent of a stream's meanders necessary to maintain a stable stream dimension, pattern, profile, and sediment regime.

Sediment Regime - the quantity, size, transport, sorting, and distribution of sediments.

Segment – A relatively homogeneous section of stream contained within a reach that has the same reference stream characteristics but is distinct from other segments in the reach.

Sensitivity – The valley, floodplain and/or channel condition's likelihood to change due to natural causes and/or anticipated human activity.

Side Bar – Unvegetated sediment deposits located along the margins or the channel in locations other than the inside of channel meander bends.

Step-Pool – Characterized by longitudinal steps formed by large particles (boulder/cobbles) organized into discrete channel-spanning accumulations that separate pools, which contain smaller sized materials. Often associated with steep channels in confined valleys.

Steep Riffle – Associated with aggradation where sediment has dropped out to form a steep face of sediment on the downstream side.

Surficial Sediment/Geology – Sediment that lies on top of bedrock.

Tributary – A stream that flows into another stream, river, or lake.

Tributary Rejuvenation – As the bed of the main stem is lowered, head cuts (incision) begin at the mouth of the tributary and move upstream.

Urban Runoff – Storm water from city streets and gutters that usually carries a great deal of litter and organic and bacterial wastes into the receiving waters.

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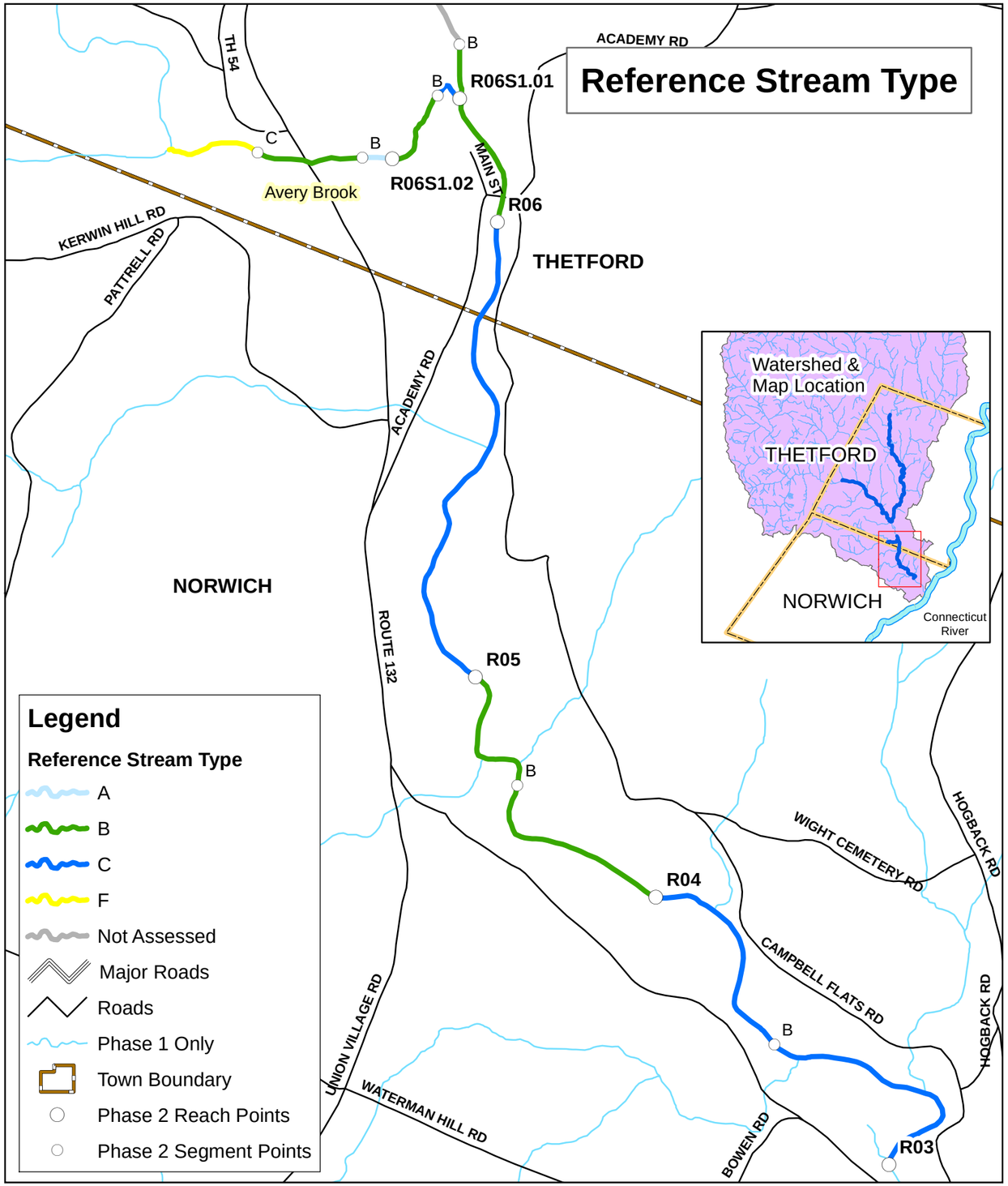
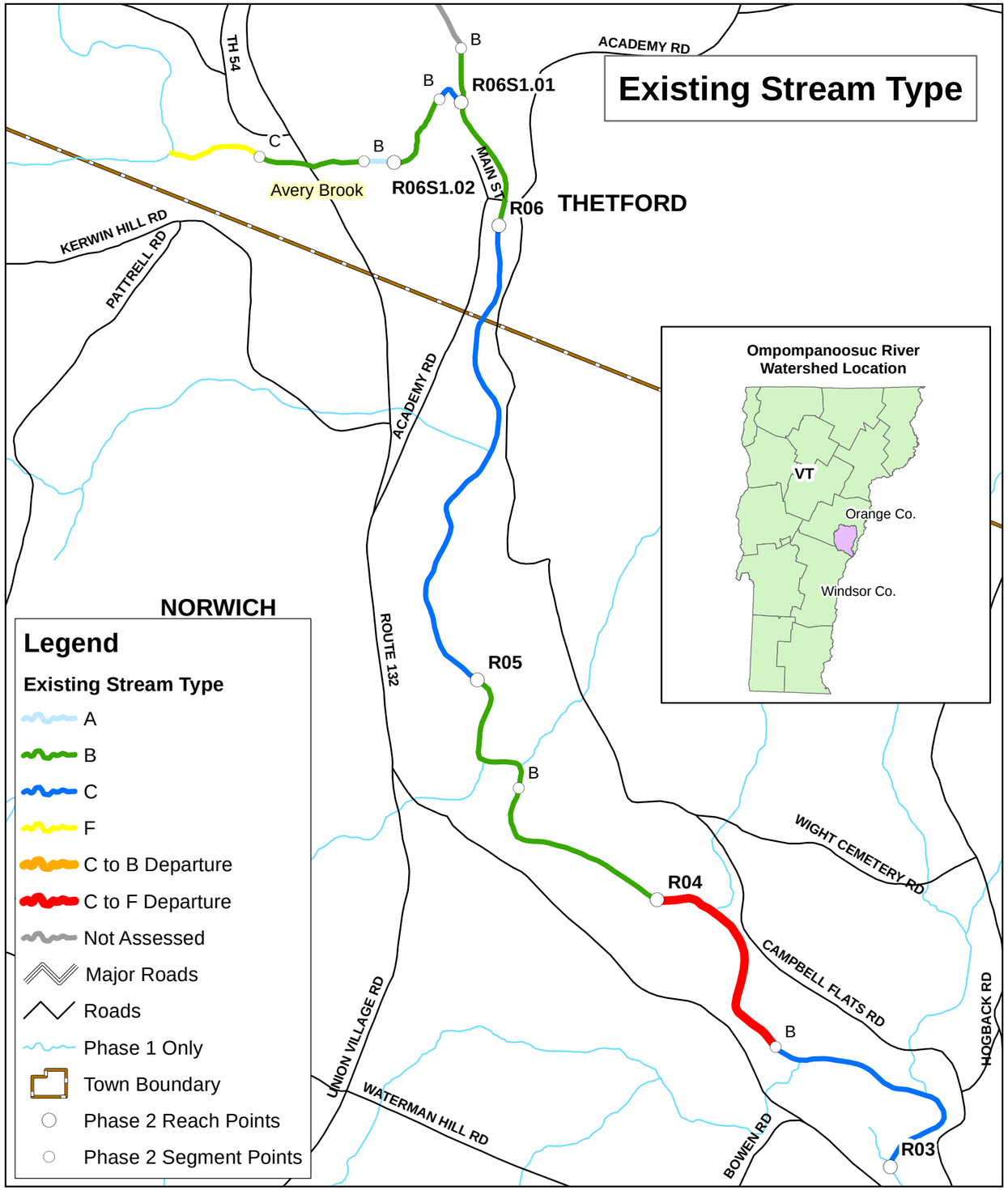
APPENDIX A

Maps

Reference Stream Type



Existing Stream Type



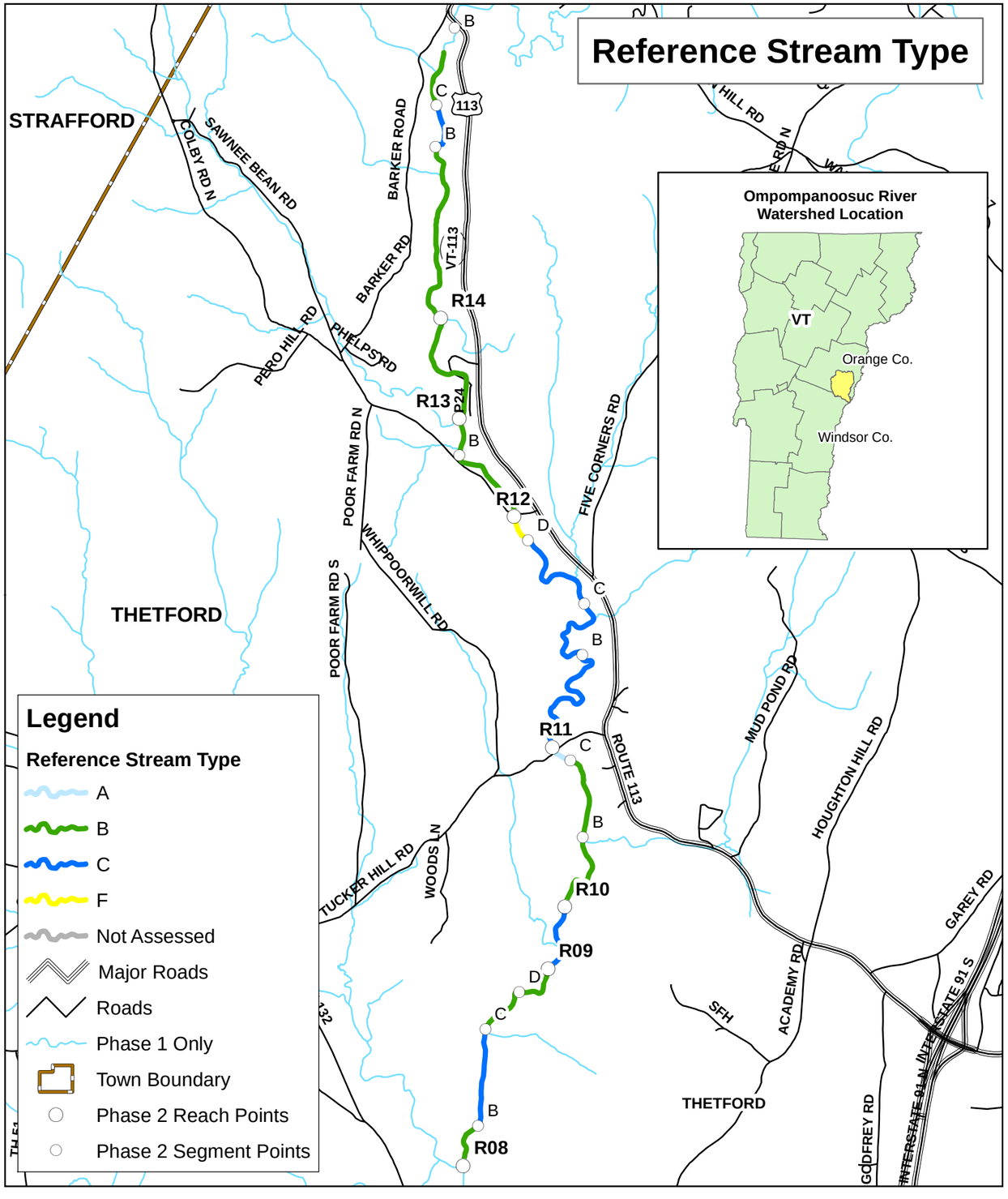
Ompompanoosuc River Mainstem (R03 - R06)
& Avery Brook (R06.S1.01 - R06.S1.02)
Stream Types - Norwich and Thetford, Vermont

N
W E
S

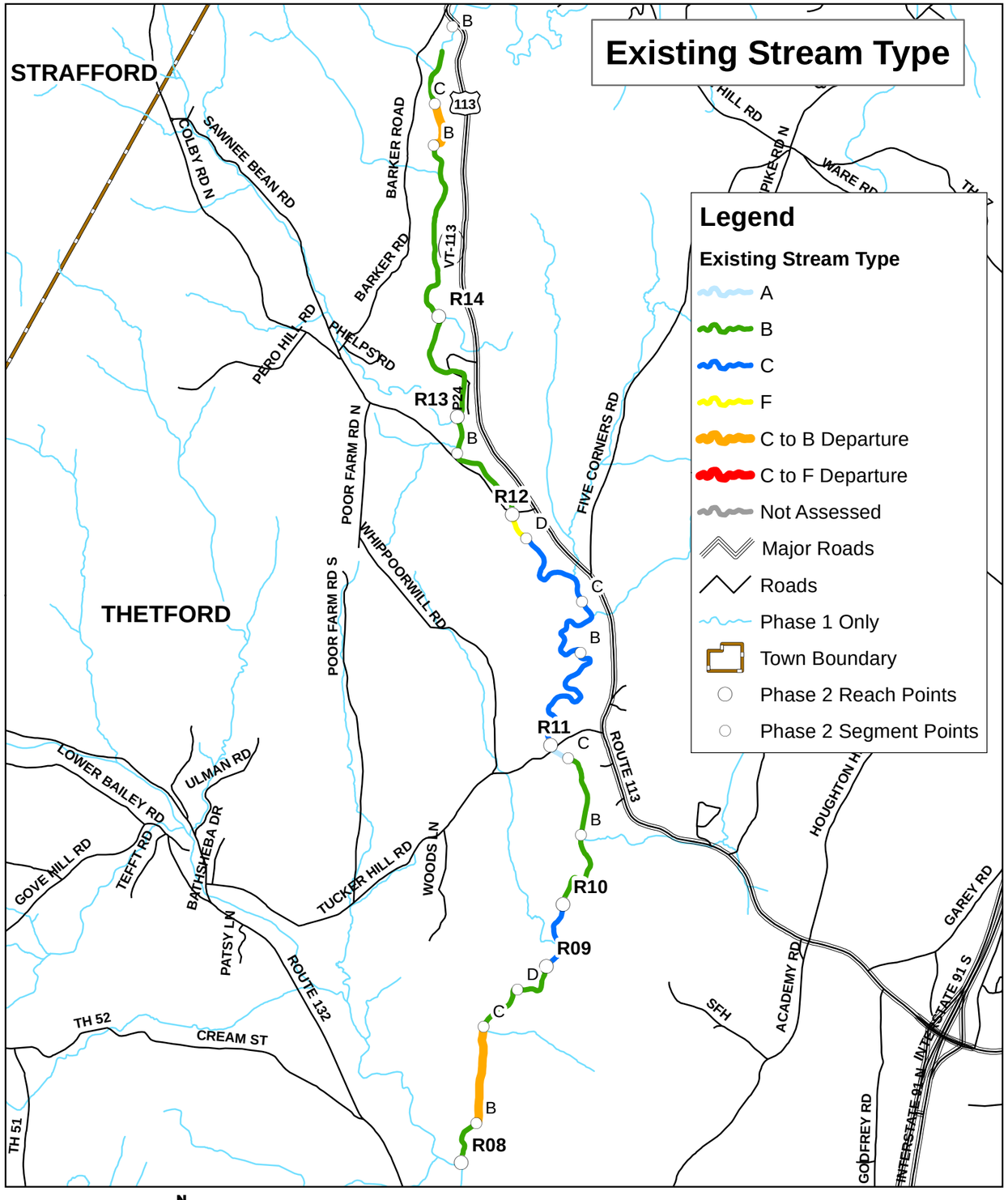
0 0.125 0.25 0.5 Mile

Bear Creek Environmenta

Reference Stream Type



Existing Stream Type



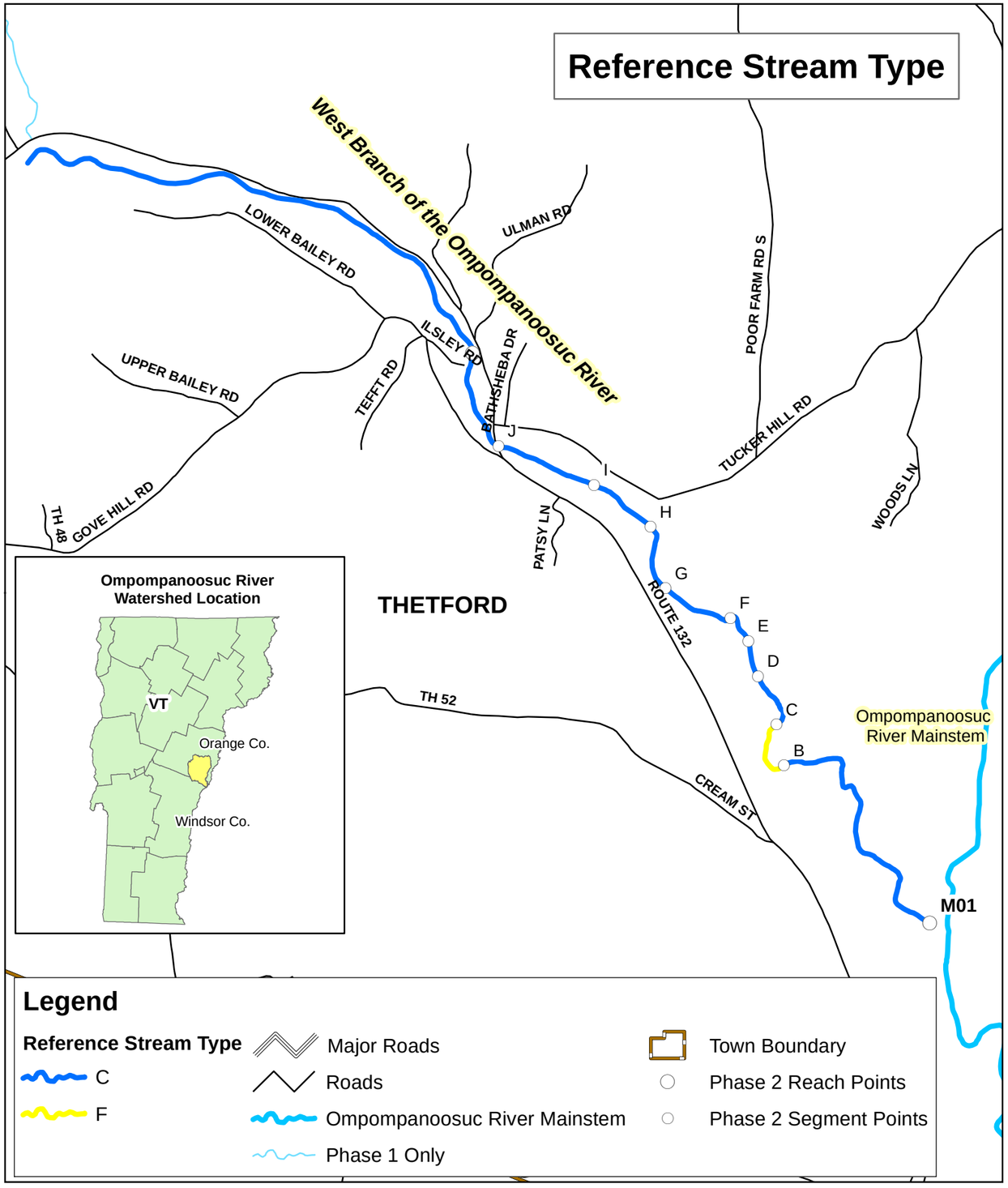
Ompompanoosuc River Mainstem (R08 - R14)
Stream Types - Thetford, Vermont

N
W E
S

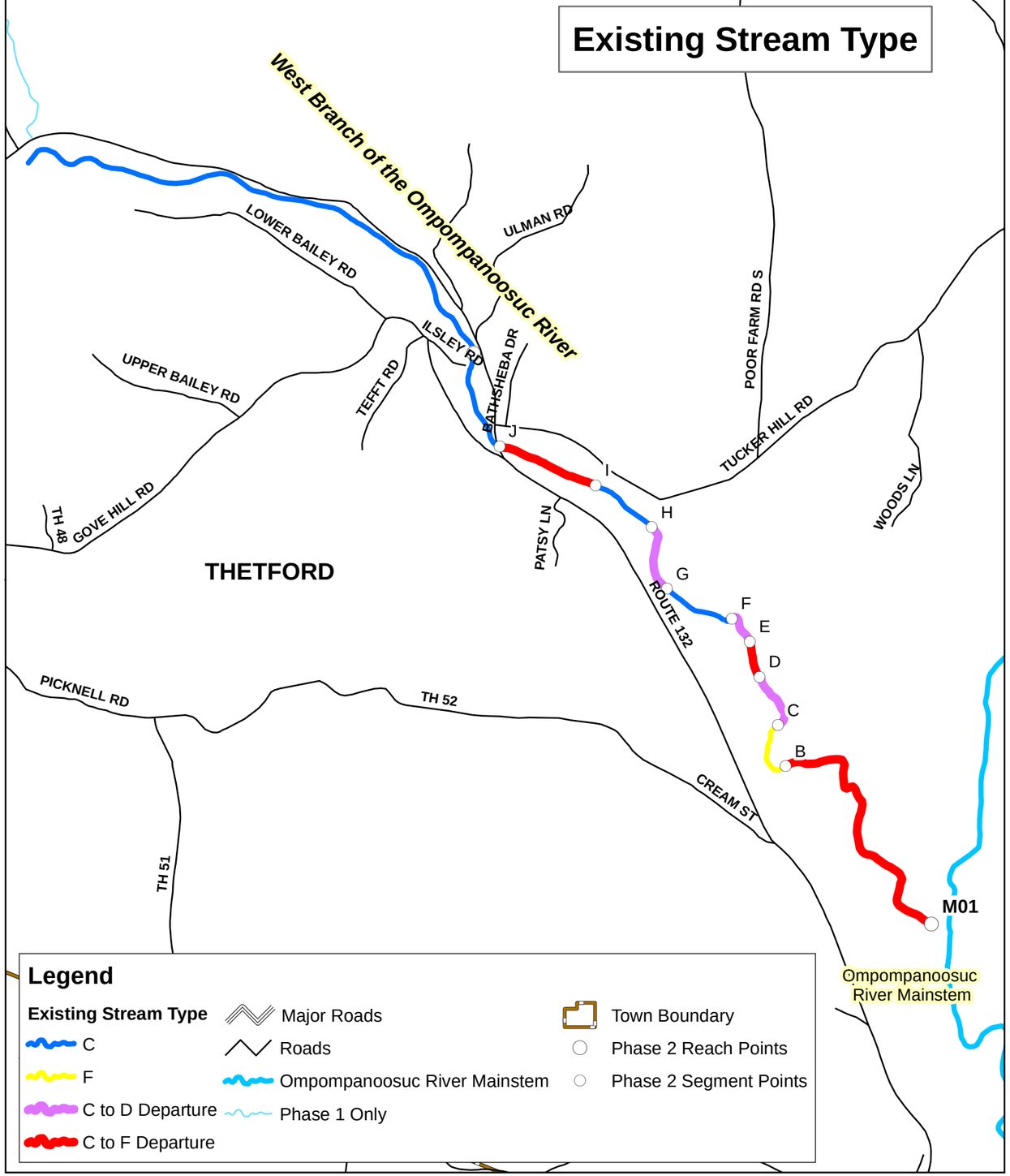
0 0.25 0.5 1 Mile

Bear Creek Environmenta

Reference Stream Type



Existing Stream Type



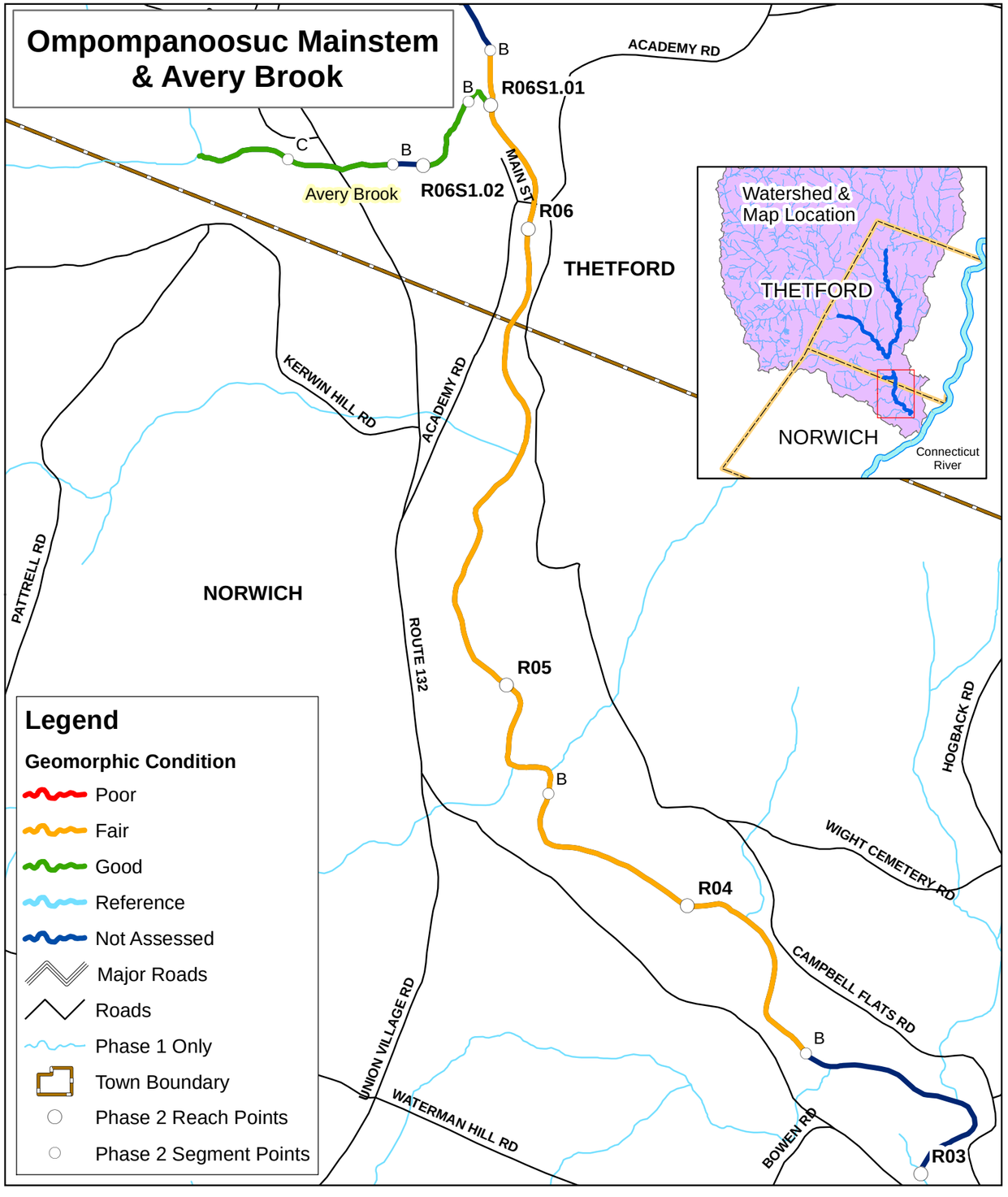
West Branch of the Ompompanoosuc River (M01 - M02)
Stream Types - Thetford, Vermont

N W E S

0 0.125 0.25 0.5 Mile

Bear Creek Environmenta

Ompompanoosuc Mainstem & Avery Brook

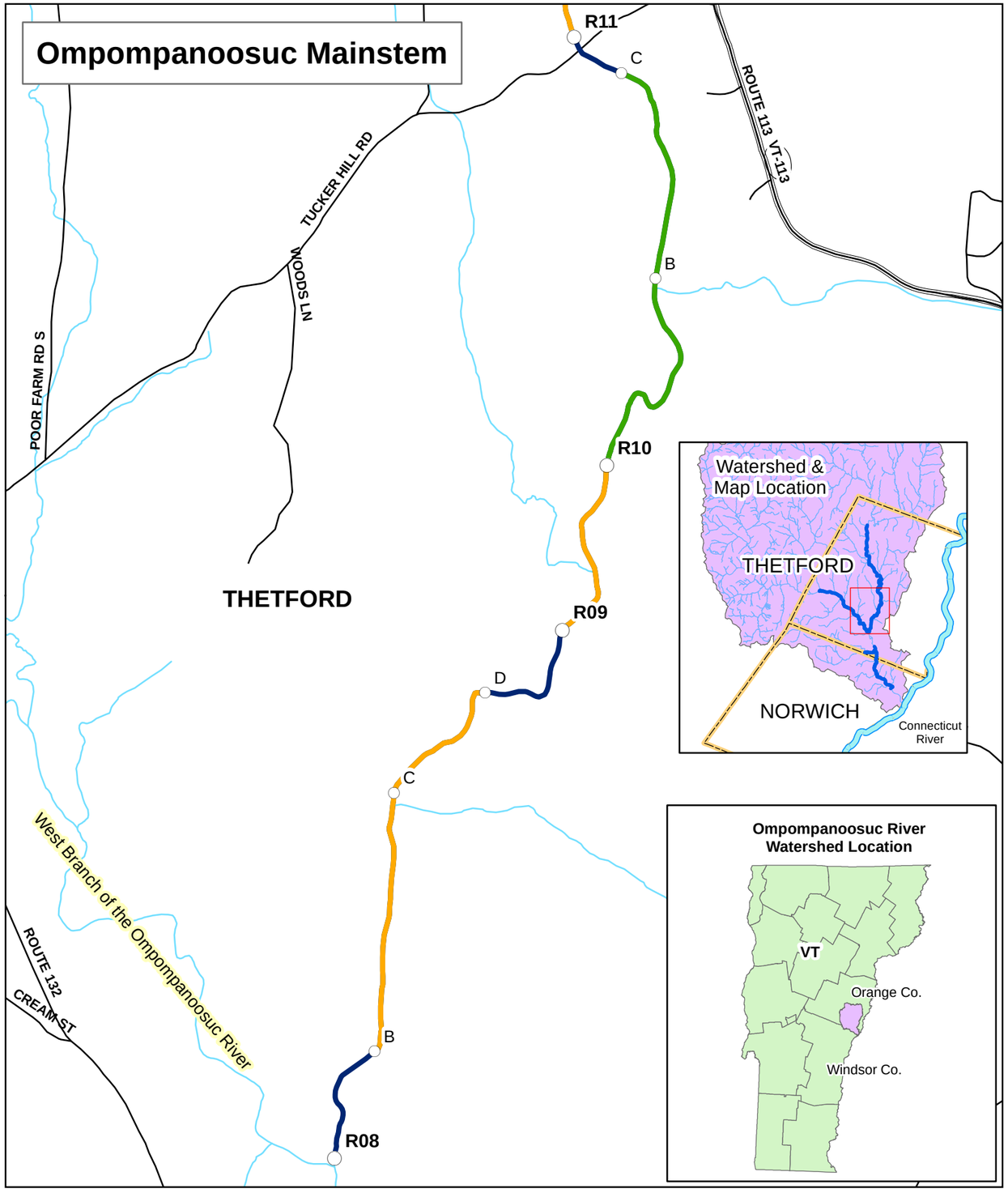


Legend

Geomorphic Condition

- Poor
- Fair
- Good
- Reference
- Not Assessed
- Major Roads
- Roads
- Phase 1 Only
- Town Boundary
- Phase 2 Reach Points
- Phase 2 Segment Points

Ompompanoosuc Mainstem



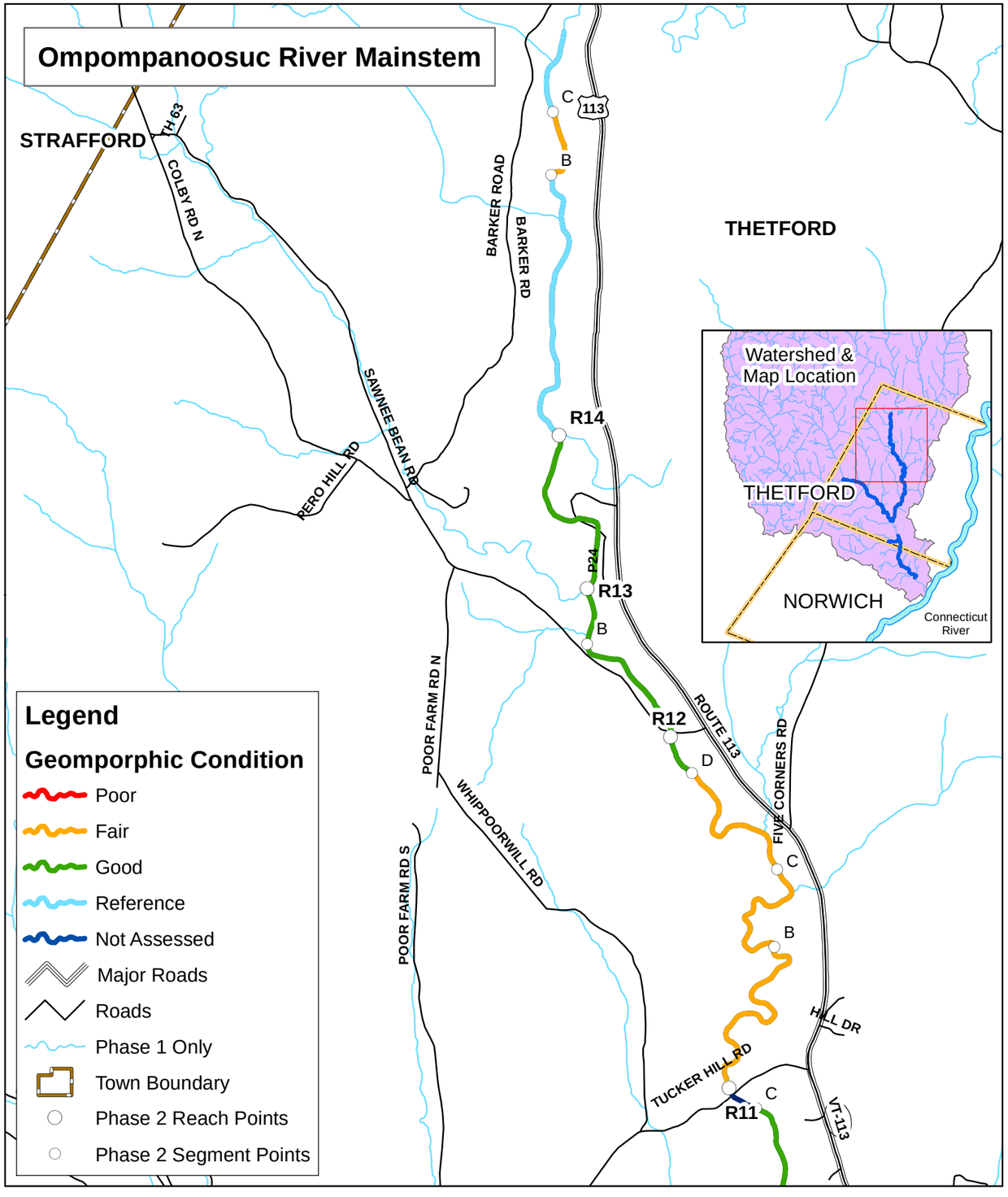
Ompompanoosuc River Watershed
Ompompanoosuc Mainstem (R03 - R10) & Avery Brook
2012 Geomorphic Condition

N W E S

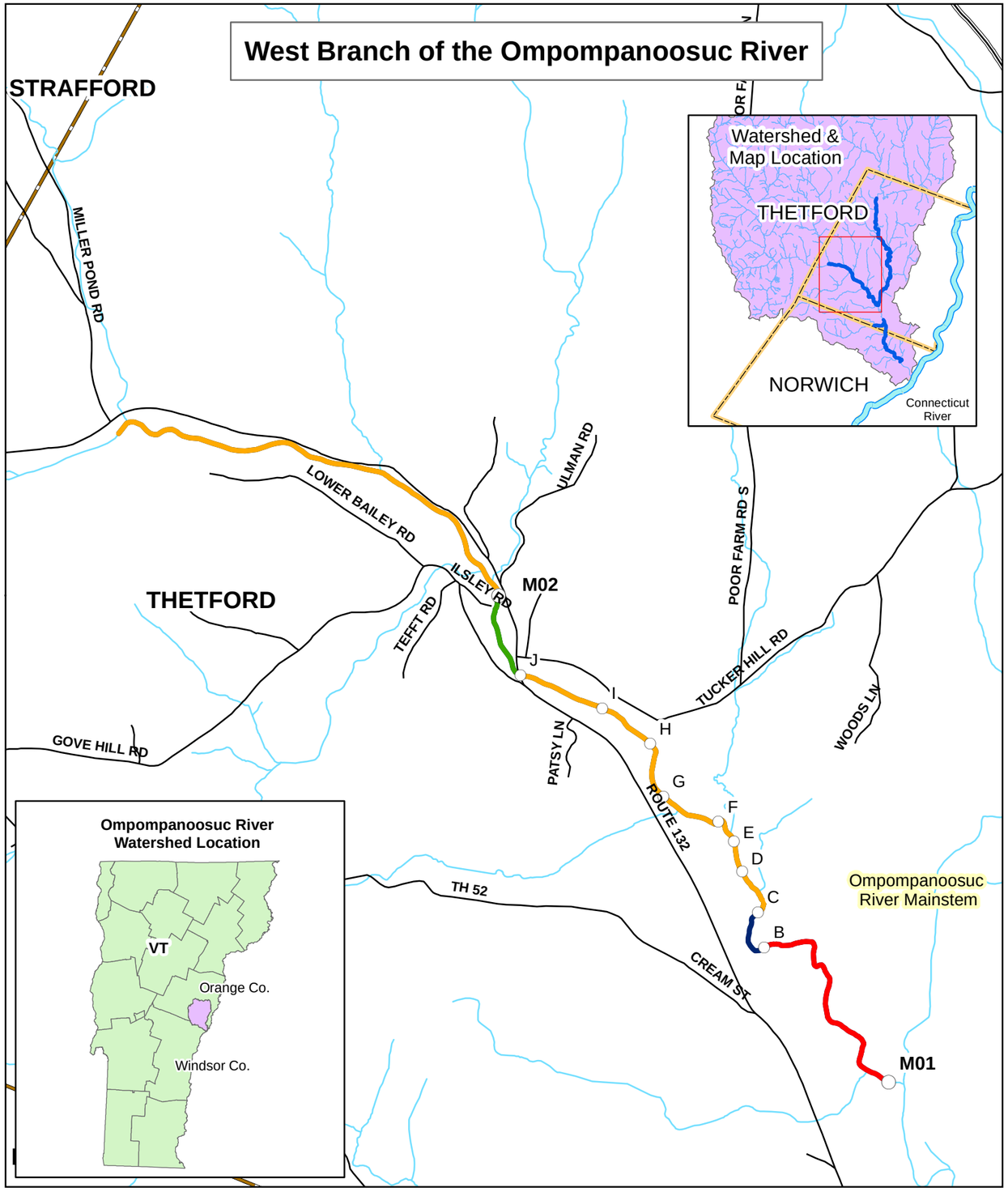
0 0.125 0.25 0.5 Mile

Bear Creek Environmenta

Ompompanoosuc River Mainstem



West Branch of the Ompompanoosuc River



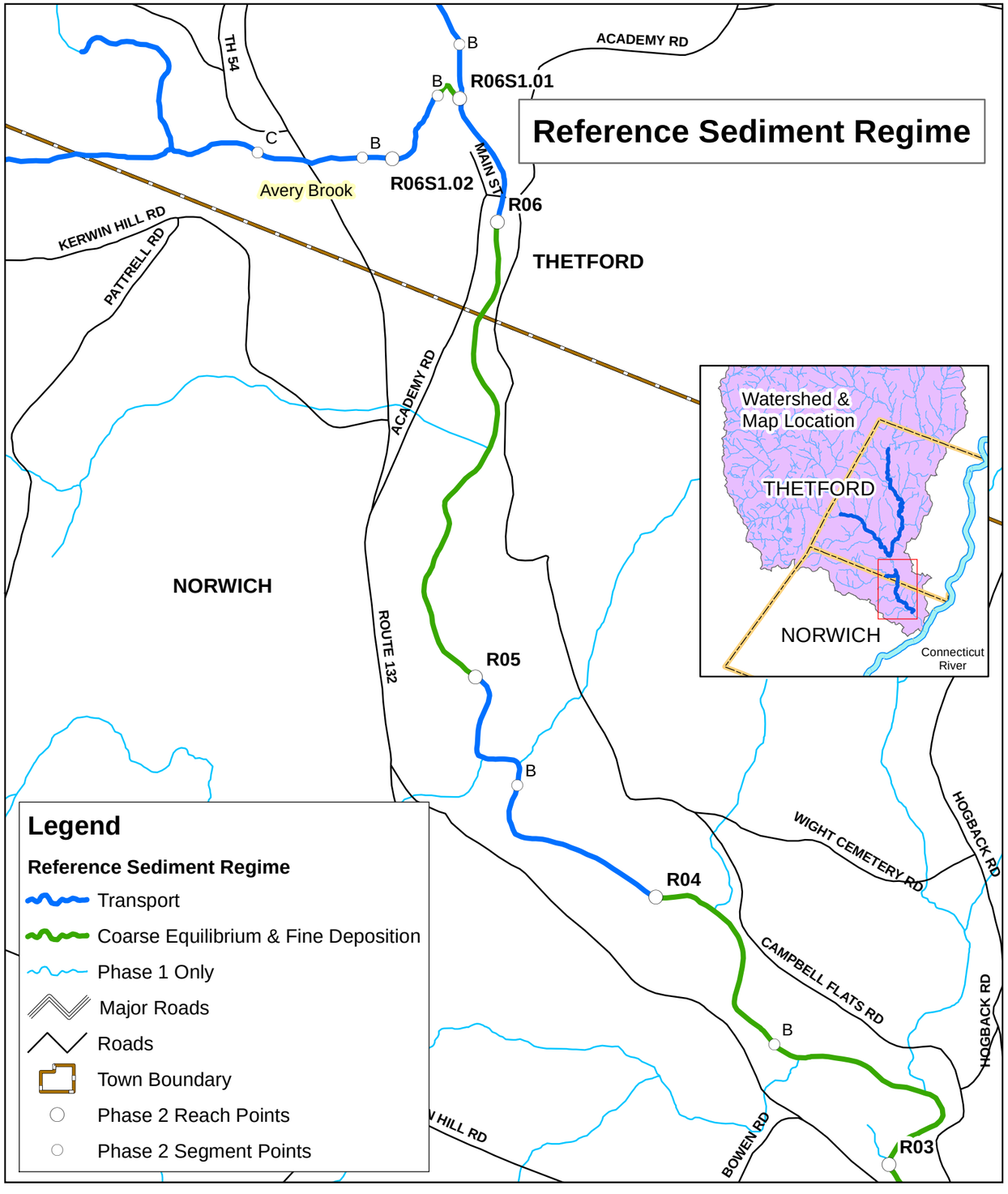
Ompompanoosuc River Watershed
Ompompanoosuc Mainstem (R11 - R14) & West Branch (M01 - M02)
2012 Geomorphic Condition

N W E S

0 0.25 0.5 1 Mile

Bear Creek Environmenta

Reference Sediment Regime

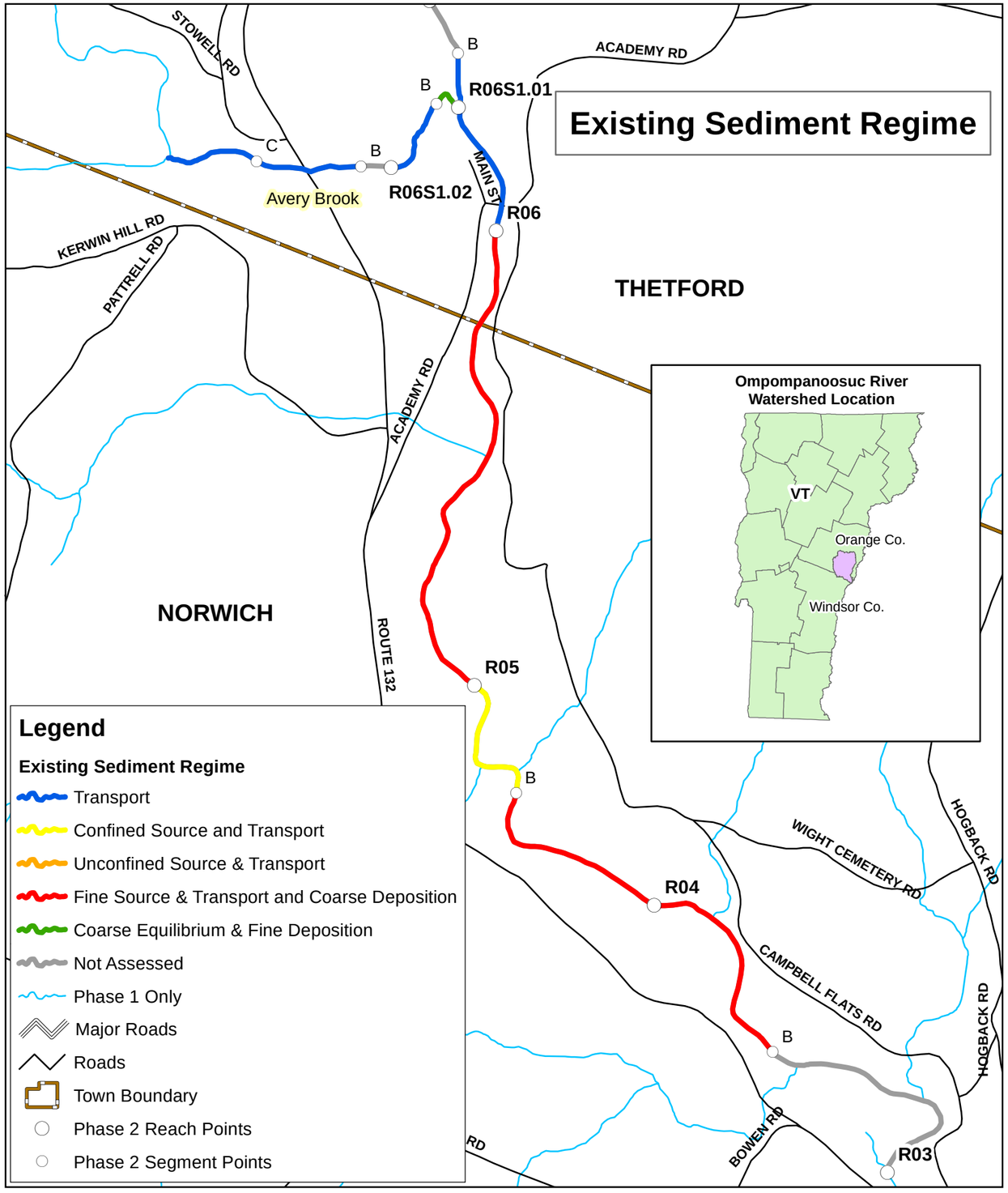


Legend

Reference Sediment Regime

- Transport
- Coarse Equilibrium & Fine Deposition
- Phase 1 Only
- Major Roads
- Roads
- Town Boundary
- Phase 2 Reach Points
- Phase 2 Segment Points

Existing Sediment Regime



Legend

Existing Sediment Regime

- Transport
- Confined Source and Transport
- Unconfined Source & Transport
- Fine Source & Transport and Coarse Deposition
- Coarse Equilibrium & Fine Deposition
- Not Assessed
- Phase 1 Only
- Major Roads
- Roads
- Town Boundary
- Phase 2 Reach Points
- Phase 2 Segment Points

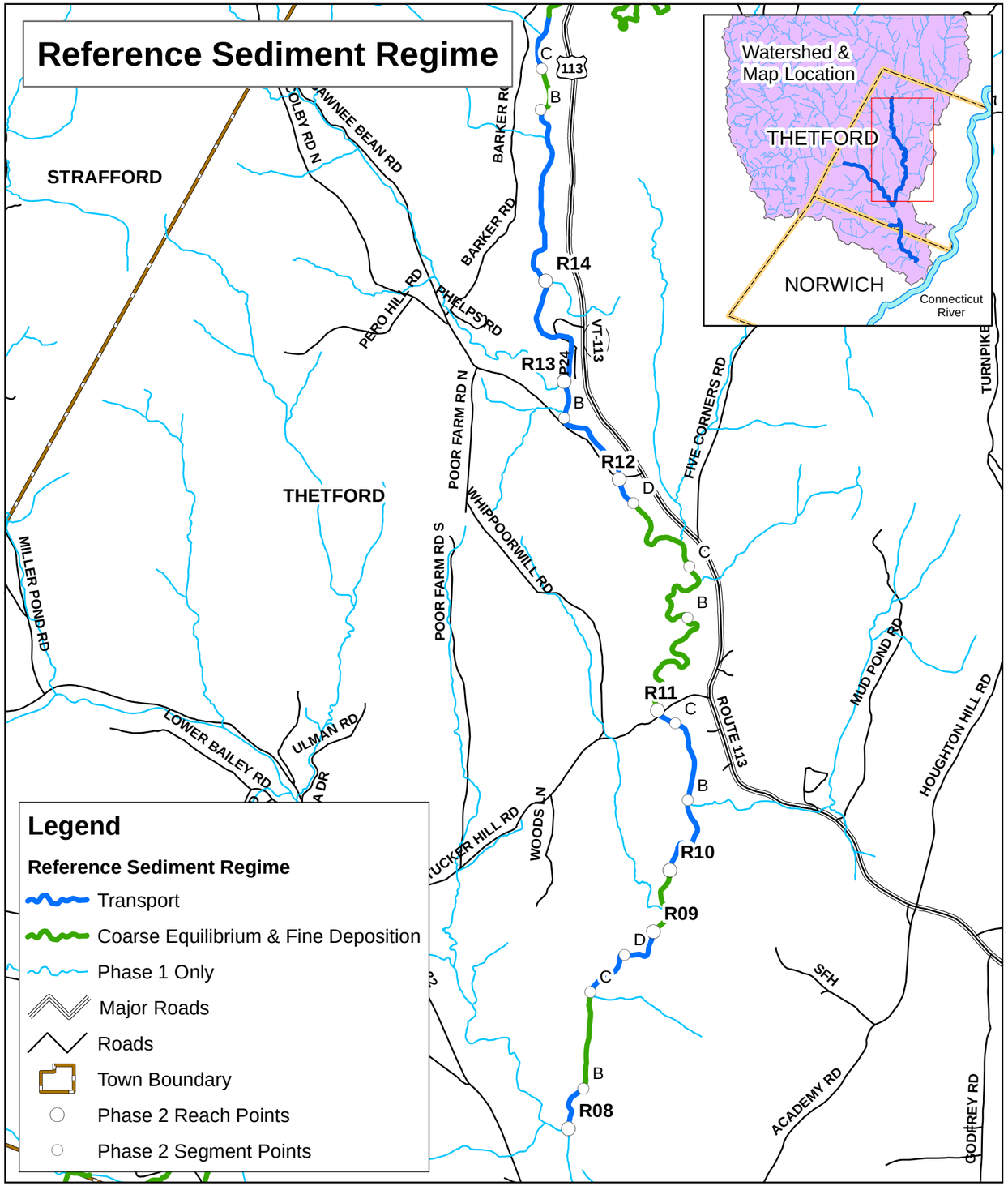
Ompompanoosuc River Mainstem (R03 - R06) & Avery Brook (R06.S1.01 - R06.S1.02) Sediment Regimes - Norwich and Thetford, Vermont

N W E S

0 0.125 0.25 0.5 Mile

Bear Creek Environmenta

Reference Sediment Regime

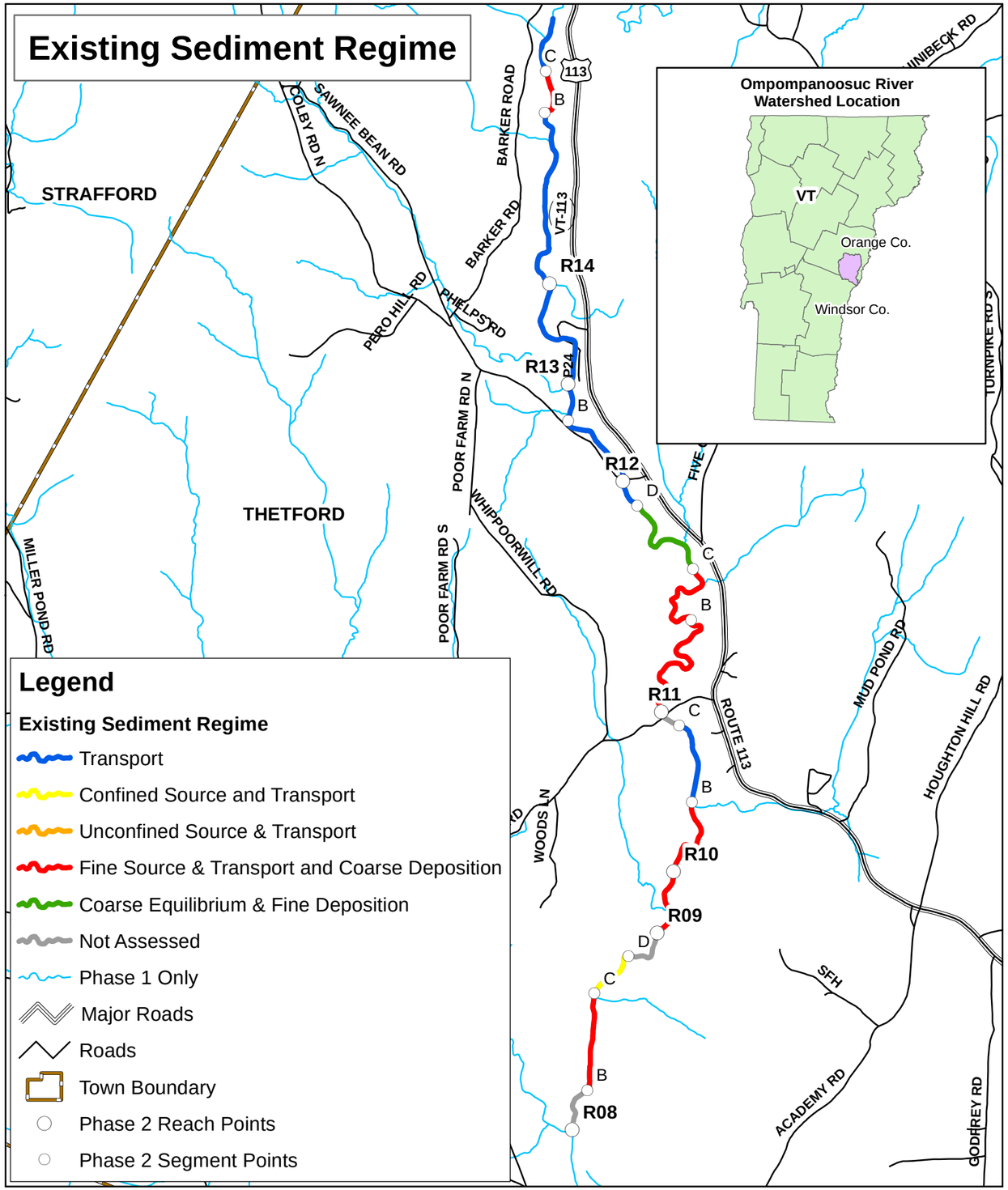


Legend

Reference Sediment Regime

- Transport
- Coarse Equilibrium & Fine Deposition
- Phase 1 Only
- Major Roads
- Roads
- Town Boundary
- Phase 2 Reach Points
- Phase 2 Segment Points

Existing Sediment Regime



Legend

Existing Sediment Regime

- Transport
- Confined Source and Transport
- Unconfined Source & Transport
- Fine Source & Transport and Coarse Deposition
- Coarse Equilibrium & Fine Deposition
- Not Assessed
- Phase 1 Only
- Major Roads
- Roads
- Town Boundary
- Phase 2 Reach Points
- Phase 2 Segment Points

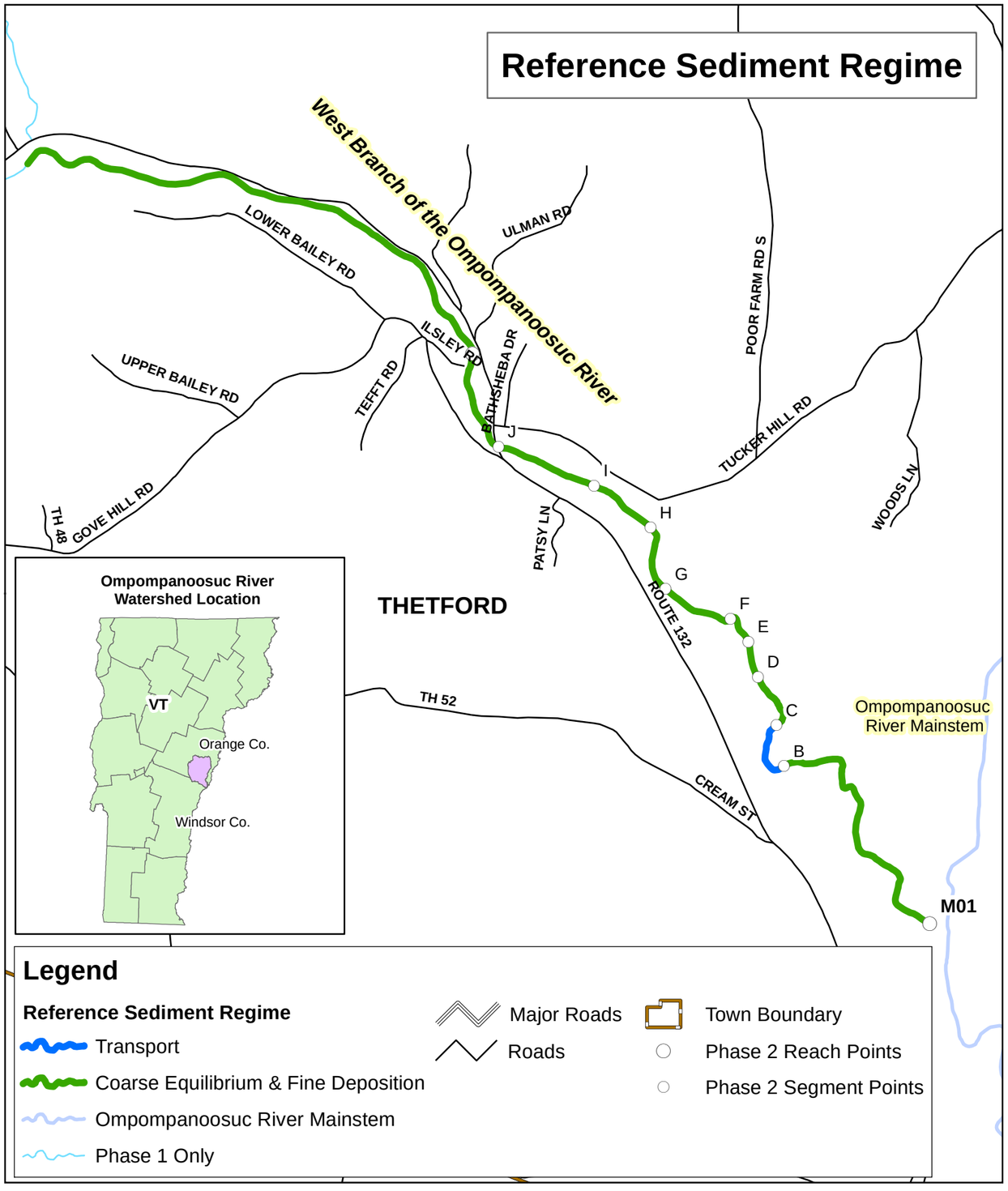
Ompompanoosuc River Mainstem (R08 - R14)
Sediment Regimes - Thetford, Vermont

N W E S

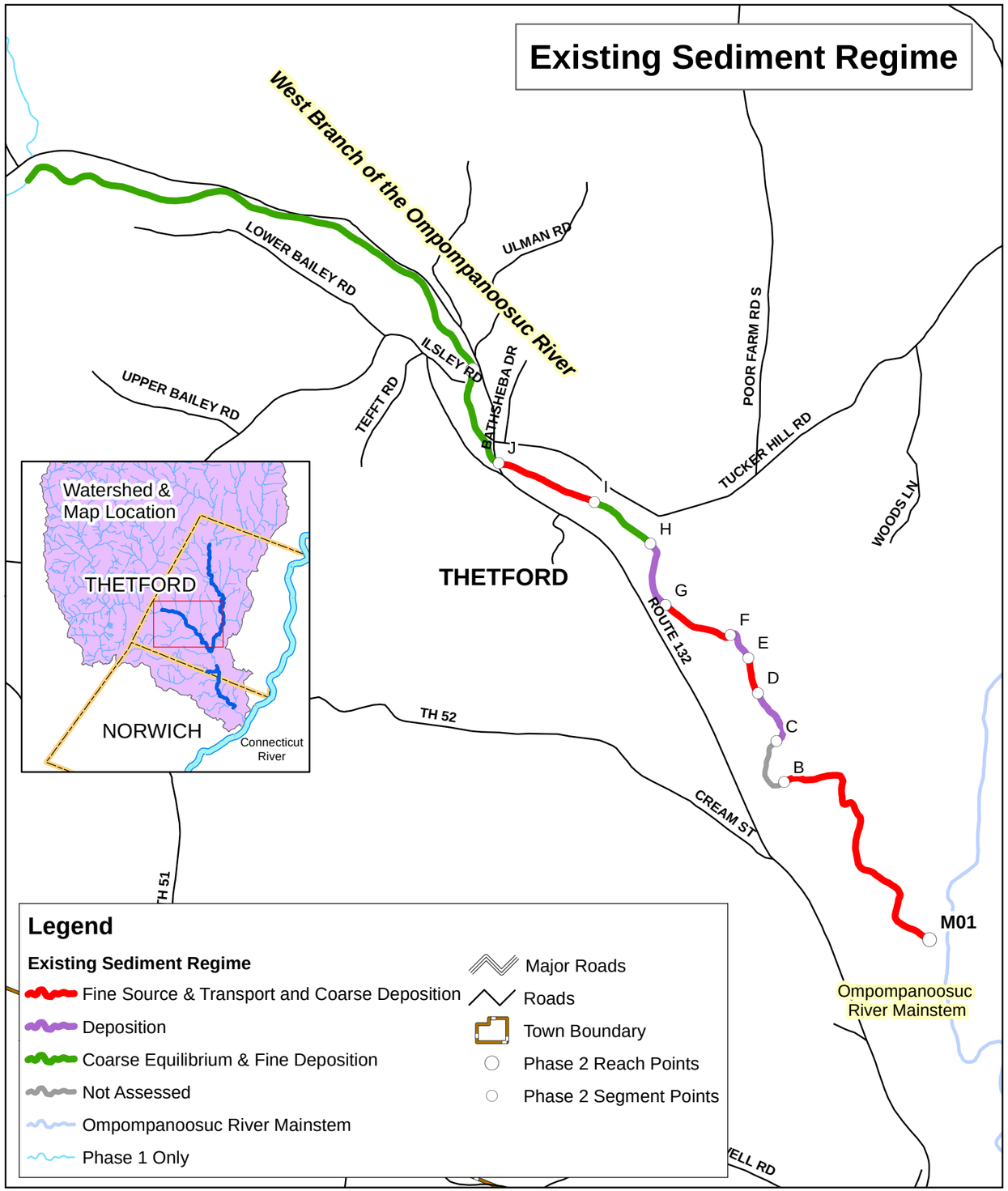
0 0.25 0.5 1 Mile

Bear Creek Environmenta

Reference Sediment Regime



Existing Sediment Regime



Legend

Reference Sediment Regime

- Transport
- Coarse Equilibrium & Fine Deposition
- Ompompanoosuc River Mainstem
- Phase 1 Only
- Major Roads
- Roads
- Town Boundary
- Phase 2 Reach Points
- Phase 2 Segment Points

Legend

Existing Sediment Regime

- Fine Source & Transport and Coarse Deposition
- Deposition
- Coarse Equilibrium & Fine Deposition
- Not Assessed
- Ompompanoosuc River Mainstem
- Phase 1 Only
- Major Roads
- Roads
- Town Boundary
- Phase 2 Reach Points
- Phase 2 Segment Points

West Branch of the Ompompanoosuc River (M01 - M02) Sediment Regimes - Thetford, Vermont

N W E S

0 0.25 0.5 Miles

Bear Creek Environmenta

Sediment Regime Departure Analysis

Ompompanoosuc Mainstem (R03 - R14)
West Branch of the Ompompanoosuc (M01 - M02)
Avery Brook (R06.S1.01 - R06.S1.02)

River corridor restoration and protection projects that are successful depend on a thorough understanding of the sources, volumes, and attenuation of flood flows and sediment loads within the stream network. If increased loads are transported through the network to a sensitive reach, where conflicts with human investments are creating a management expectation, the restoration project should be designed to accommodate the increased sediment load or find a way to attenuate the loads upstream. Modifications in watershed inputs in the form of peak flows or increased sediment can result in an imbalance of stream power and sediment in the channel. Changes in the shape of the channel may also lead to disequilibrium. Large channel adjustments, such as severe erosion and excessive deposition, are a result of this imbalance and often continue until the channel reaches a state of equilibrium (Vermont Agency of Natural Resources, 2010a).

The analysis of sediment regimes at the watershed scale is useful for summarizing the stressors affecting the equilibrium condition of river channels. Sediment regime mapping provides a context for understanding the sediment transport and channel evolution processes which govern changes in geometry and *planform* for river channels in a state of disequilibrium.

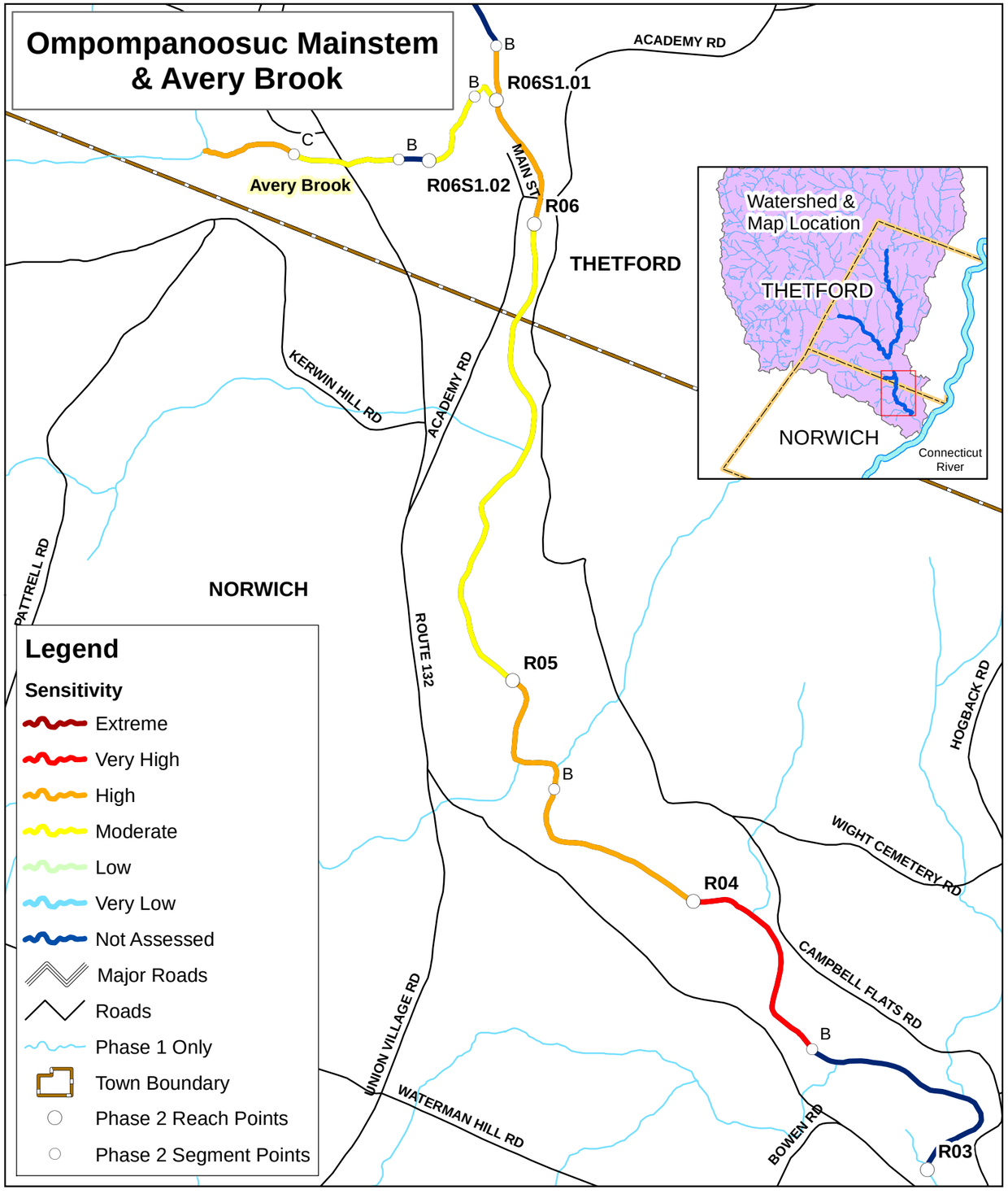
Reference and existing sediment regime maps have been prepared to show departure from reference conditions due to human alterations. In the reference condition, streams use available floodplain access as a means to store sediment within the watershed. Seventeen out of the 30 fully assessed reaches/segments of the Phase 2 study area have a reference sediment regime of *Coarse Equilibrium & Fine Deposition*. These channels are unconfined on at least one side and they transport and deposit sediment in equilibrium, where the stream power is balanced by the sediment load, sediment size, and channel boundary resistance. The remaining 13 reaches/segments have *Transport* as their reference sediment regime. These *Transport* channels are located throughout the watershed. *Transport* channels are steep, dominated by bedrock and boulder/cobble substrates, and are typically in confined valleys. Transport channels do not supply appreciable quantities of sediments to downstream reaches (Vermont Agency of Natural Resources, 2010a). The valley walls of these channels are confining with limited sediment storage capacity due to both channel slope and entrenchment (Vermont Agency of Natural Resources, 2010a).

Changes in hydrology (such as development and agriculture within the riparian corridor) and sediment storage within the watershed have altered the reference sediment regime types for some reach segments. All departures were derived from the DMS according to the sediment regime criteria established by the Vermont Agency of Natural Resources (2010a). Existing sediment regimes have not been established for reaches that were not assessed during the

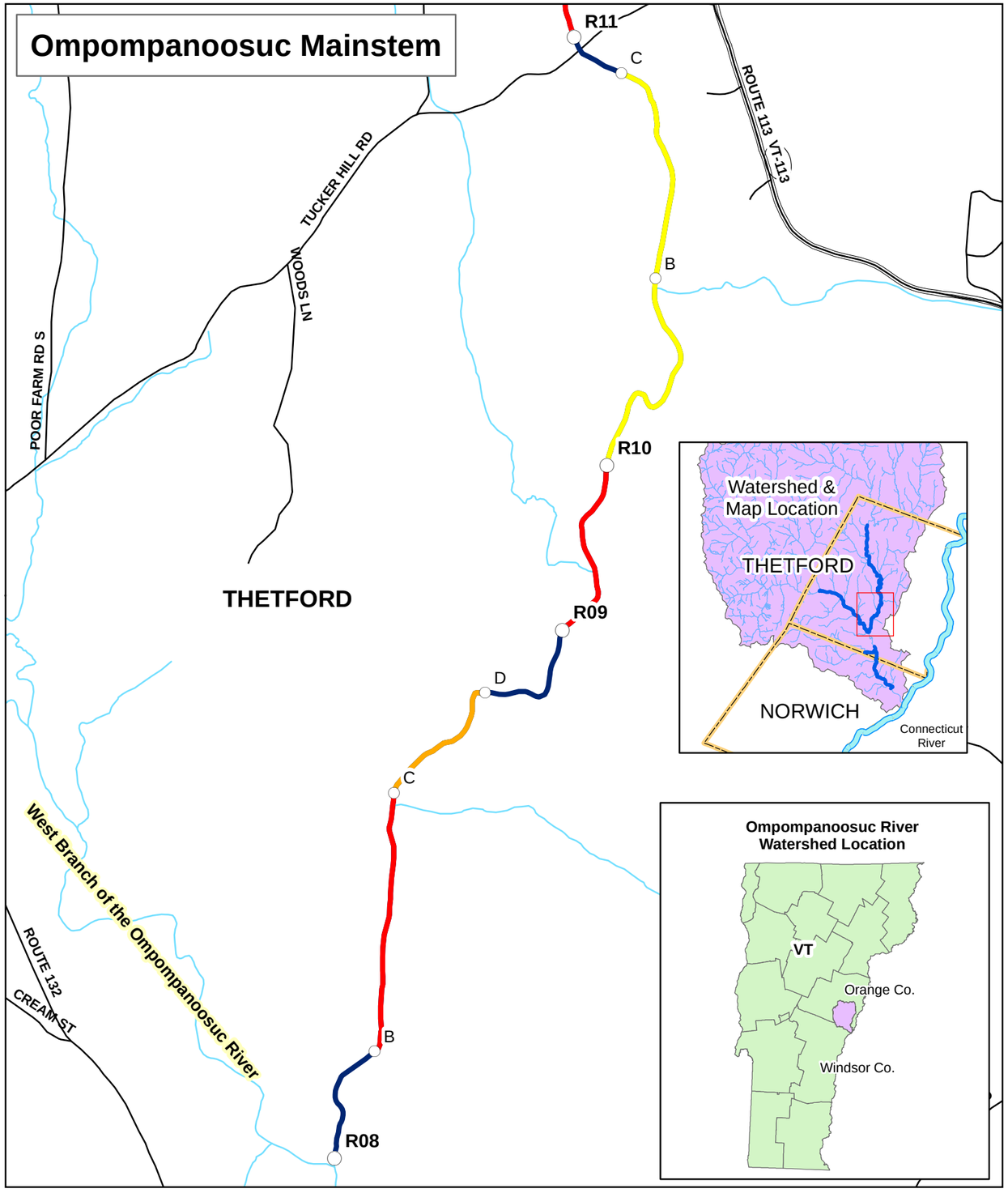
Phase 2 Stream Geomorphic Assessment. In general, many reaches/segments that were *Coarse Equilibrium & Fine Deposition* by reference and have gone through channel degradation have been converted to *Fine Source and Transport & Coarse Deposition (FSTCD)* sediment regimes. Some reaches that were *Transport* by reference were also converted to *FSTCD*. This means that most fine sediment entering the stream is transported through without being deposited as a result of channel incision and reduced floodplain access. Additionally, coarse sediment storage is increased due to increased load along with lower transport capacity. Some reaches/segments that were *Transport* by reference were converted to *Confined Source and Transport.* These channels have confining valley walls with limited sediment storage capacity due to both channel slope and entrenchment (Vermont Agency of Natural Resources, 2010a). Channel management practices such as straightening and encroachment which have resulted in a channel incision and loss of floodplain access has caused these changes in sediment regime. Since the channel can no longer access its floodplain, sediment storage capacity has been diminished and the reaches are acting more as transport reaches than sediment storage reaches. Another change in sediment regime occurred on the West Branch of the Ompompanoosuc River. Three segments that were *Coarse Equilibrium & Fine Deposition* experienced a change in sediment regime to *Deposition*. These channels are in unconfined valleys and have become over-widened and braided as a result of excessive aggradation.

The sediment regime for the Ompompanoosuc River watershed has been altered by reduced floodplain access, increased stream power, reduced boundary resistance, the Union Village Dam, and lateral constraints, such as roads, at various locations throughout the stream network. Watersheds which have lost attenuation or sediment storage areas due to human related constraints are generally more sensitive to erosion hazards, transport greater quantities of sediment and nutrients to receiving waters, and lack the sediment storage and distribution processes that create and maintain habitat (Vermont Agency of Natural Resources, 2010a).

Ompompanoosuc Mainstem & Avery Brook



Ompompanoosuc Mainstem



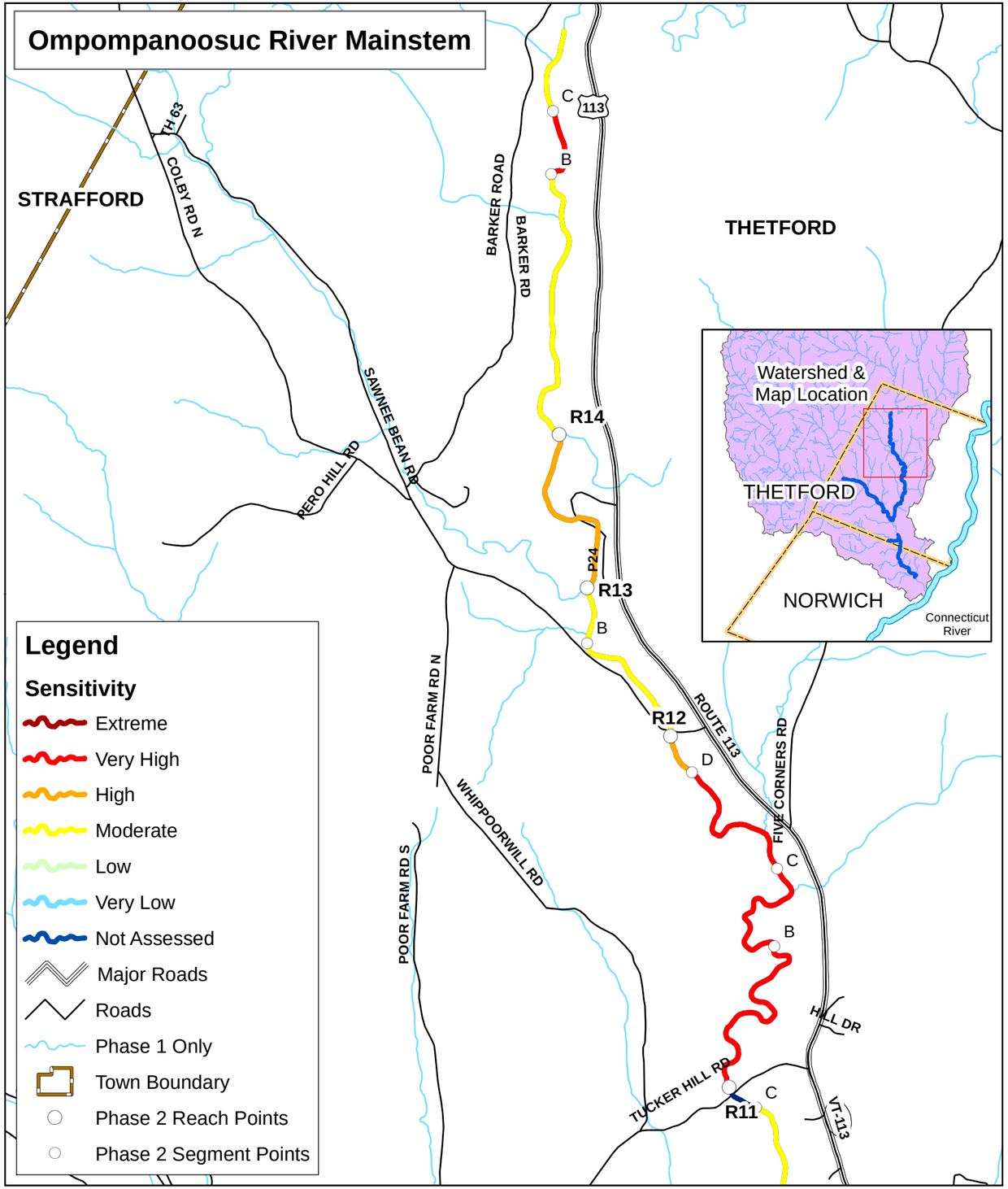
Ompompanoosuc Mainstem (R03 - R10) & Avery Brook (R06.S1.01 - R06.S1.02) 2012 Sensitivity Ratings

N W E S

0 0.125 0.25 0.5 Mile

Bear Creek Environmenta

Ompompanoosuc River Mainstem

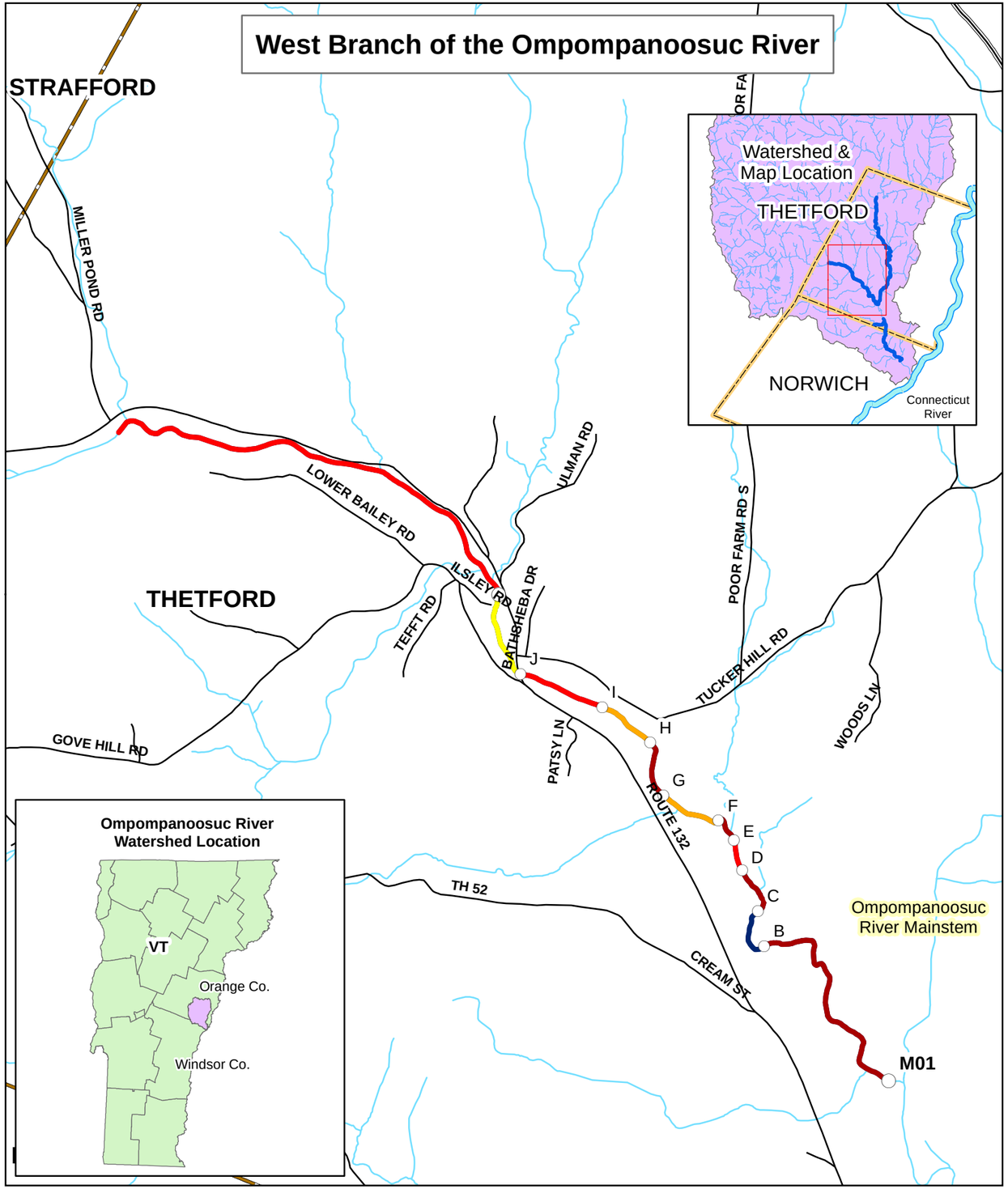


Legend

Sensitivity

- Extreme
- Very High
- High
- Moderate
- Low
- Very Low
- Not Assessed
- Major Roads
- Roads
- Phase 1 Only
- Town Boundary
- Phase 2 Reach Points
- Phase 2 Segment Points

West Branch of the Ompompanoosuc River



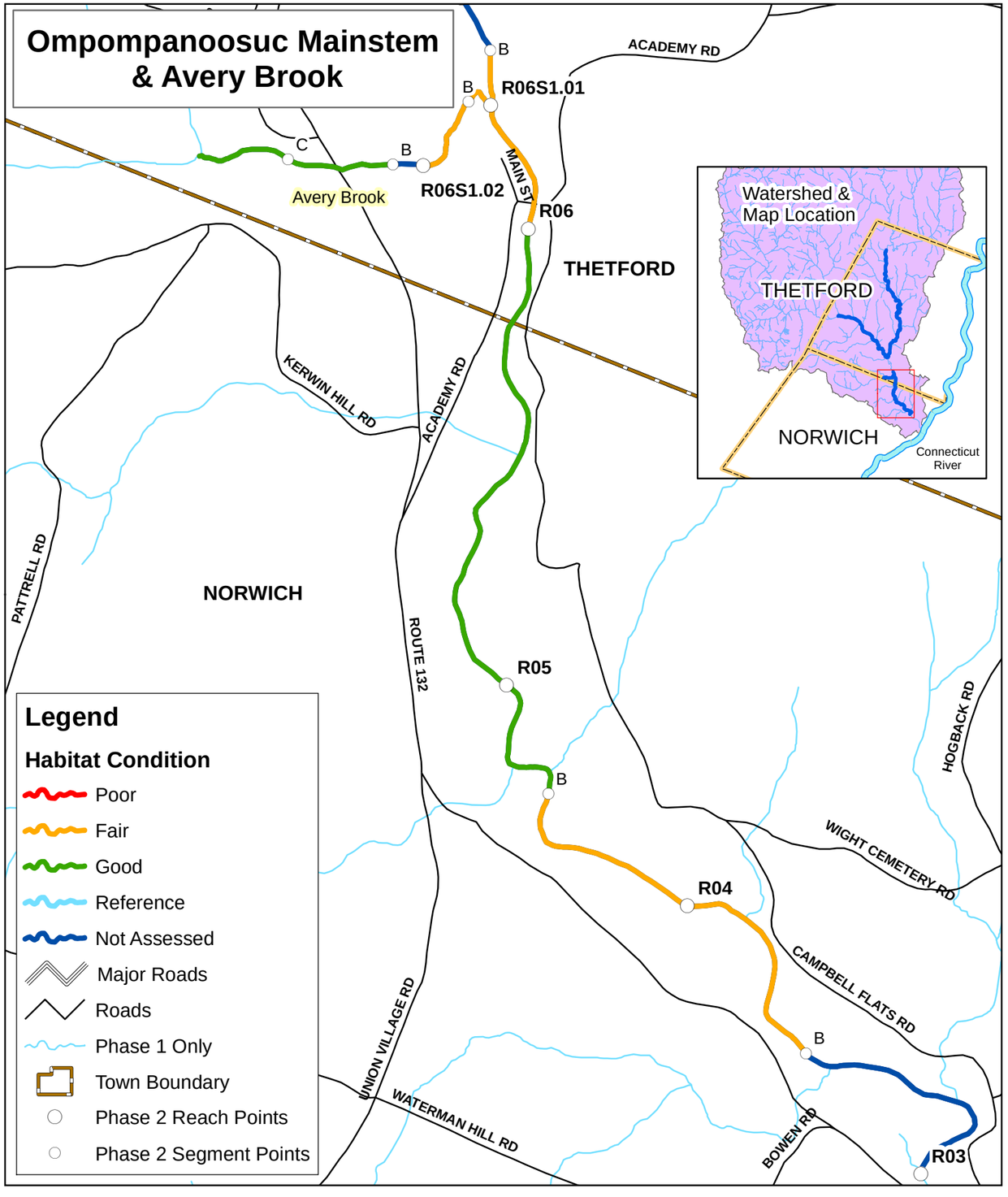
Ompompanoosuc River Watershed
Ompompanoosuc Mainstem (R11 - R14) & West Branch (M01 - M02)
2012 Sensitivity Ratings

N W E S

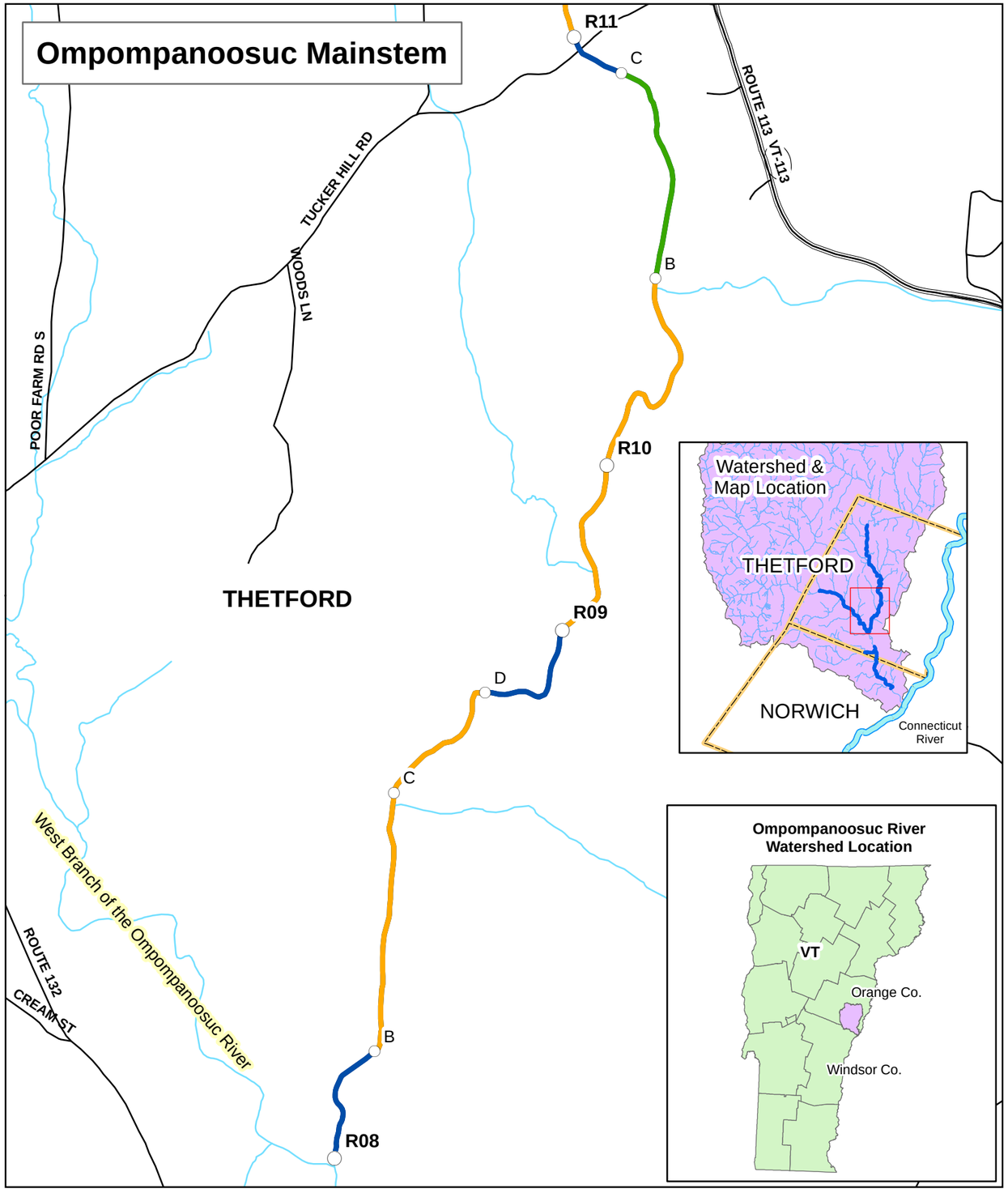
0 0.25 0.5 1 Mile

Bear Creek Environmenta

Ompompanoosuc Mainstem & Avery Brook



Ompompanoosuc Mainstem



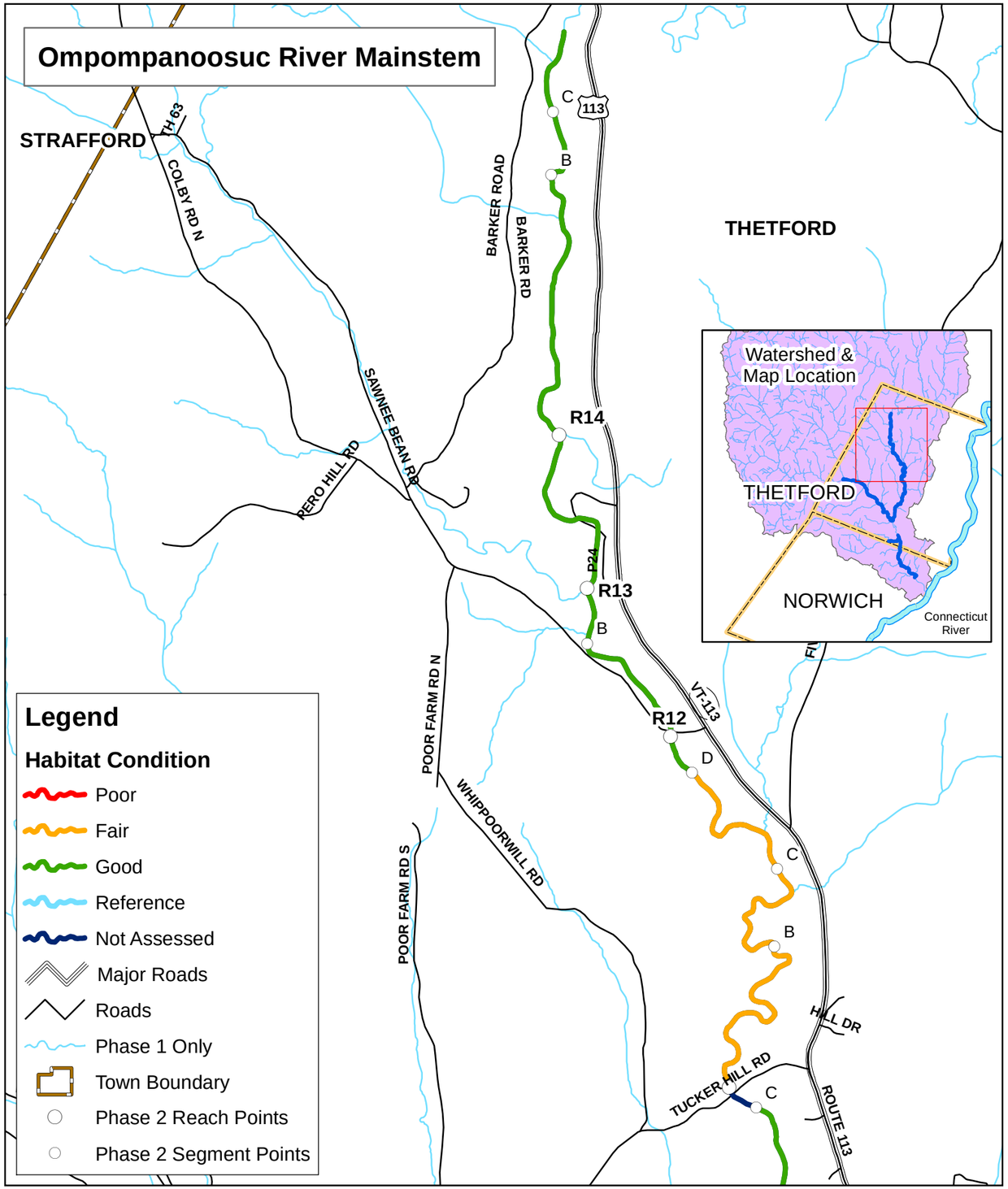
Ompompanoosuc River Watershed
Ompompanoosuc Mainstem (R03 - R10) & Avery Brook
2012 Habitat Condition

N W E S

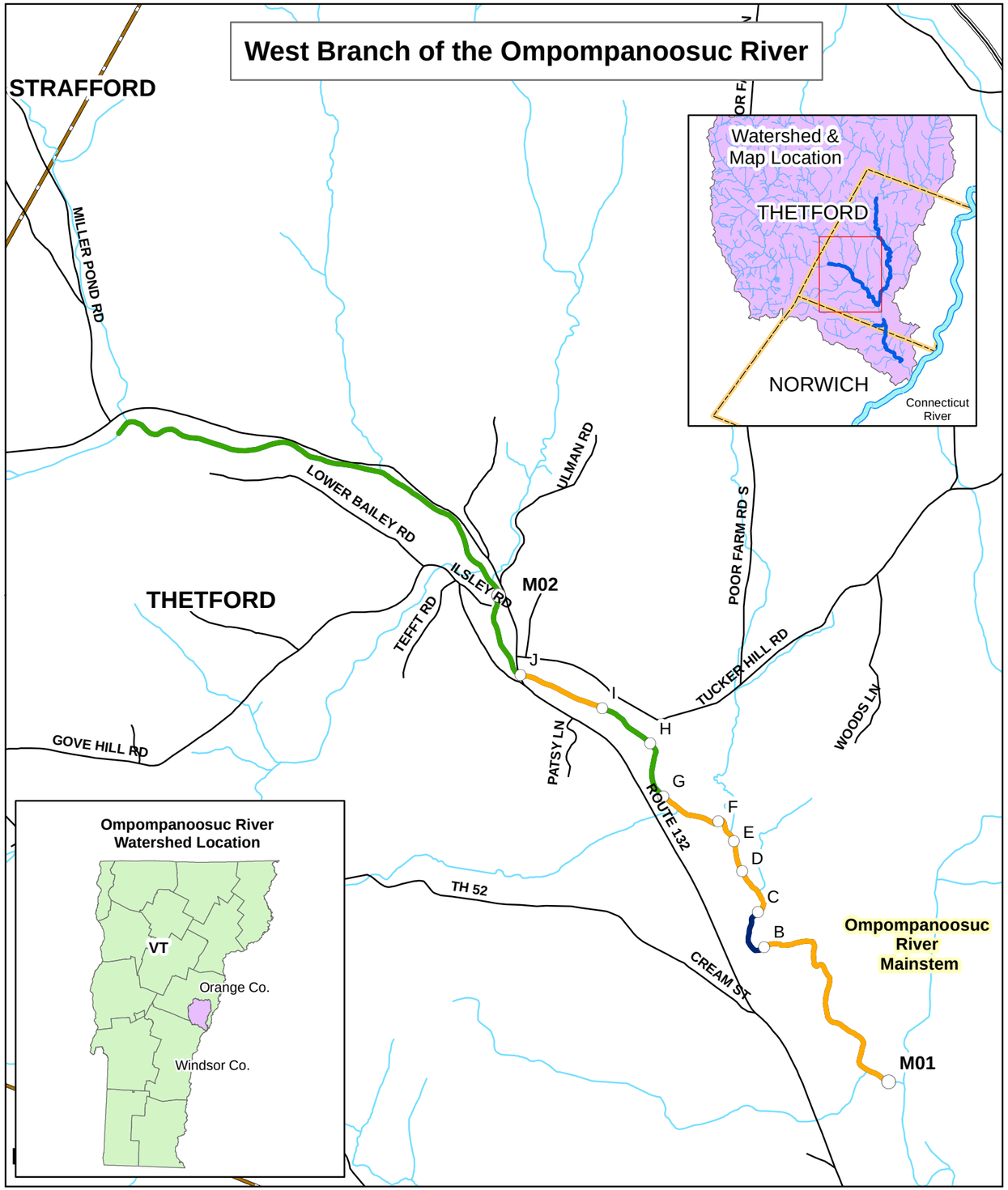
0 0.125 0.25 0.5 Mile

Bear Creek Environmental

Ompompanoosuc River Mainstem



West Branch of the Ompompanoosuc River



Ompompanoosuc River Watershed
Ompompanoosuc Mainstem (R11 - R14) & West Branch
2012 Habitat Condition

N W E S

0 0.25 0.5 1 Mile

Bear Creek Environmenta

APPENDIX B

Bridge & Culvert Assessment Data

Table 1. Scoring Table (Vermont Culvert Geomorphic Compatibility Screen Tool, adapted by BCE for bridges)				
Score	**% Bankfull Width**	**Sediment Continuity**	**Approach Angle**	**Erosion and Armoring**
5	%BFW ≥ 120	No upstream deposition or downstream bed scour	Naturally Straight	No erosion **or** armoring
4	100 ≤ %BFW < 120	**Either** upstream deposition **or** downstream bed scour, **without** upstream deposits taller than 0.5 bankfull height **or** high downstream banks	n/a	No erosion **and** intact armoring, **or** low upstream **or** downstream erosion **without** armoring
3	75 ≤ %BFW < 100	**Either** upstream deposition **or** downstream bed scour, **with** either upstream deposits taller than 0.5 bankfull height **or** high downstream banks	Mild bend	Low upstream **or** downstream erosion **with** armoring
2	50 ≤ %BFW < 75	**Both** upstream deposition **and** downstream bed scour, **without** upstream deposits taller than 0.5 bankfull height **or** high downstream banks	Channelized Straight	Low upstream **and** downstream erosion
1	30 ≤ %BFW < 50	**Both** upstream deposition **and** downstream bed scour, **with** upstream deposits taller than 0.5 bankfull height **or** high downstream banks	n/a	Severe upstream **or** downstream erosion
0	%BFW < 30	**Both** upstream deposition **and** downstream bed scour, **with** upstream deposits taller than 0.5 bankfull height **and** high downstream banks	Sharp Bend	Severe upstream **and** downstream erosion, **or** failing armoring upstream **or** downstream

Table 2. Compatibility Rating Results (Vermont Culvert Geomorphic Compatibility Screen Tool, adapted by BCE for bridges)			
Category Name	**Screen Score**	**Threshold Conditions**	**Description of Structure-channel Geomorphic Compatibility**
Fully Compatible	16<GC≤20	n/a	Structure fully compatible with natural channel form and process. There is a low risk of failure. No replacement anticipated over the lifetime of the structure. A similar structure is recommended when replacement is needed.
Mostly Compatible	12<GC≤16	n/a	Structure mostly compatible with current channel form and process. There is a low risk of failure. No replacement anticipated over the lifetime of the structure. Minor design adjustments recommended when replacement is needed to make fully compatible.
Partially Compatible	8<GC≤12	n/a	Structure compatible with either current form or process, but not both. Compatibility likely short term. There is a moderate risk of structure failure and replacement may be needed. Re-design suggested to improve geomorphic compatibility.
Mostly Incompatible	4<GC≤8	% Bankfull Width + Approach Angle scores ≤ 2	Structure mostly incompatible with current form and process, with a moderate to high risk of structure failure. Re-design and replacement planning should be initiated to improve geomorphic compatibility.
Fully Incompatible	0≤GC≤4	% Bankfull Width + Approach Angle scores ≤ 2 **AND** Sediment Continuity + Erosion and Armoring scores ≤ 2	Structure fully incompatible with channel and high risk of failure. Re-design and replacement should be performed as soon as possible to improve geomorphic compatibility.

Table 3. Scoring Table Vermont Culvert Geomorphic Compatibility Screen Tool (Milone & MacBroom, 2008)					
Score	**% Bankfull Width**	**Sediment Continuity**	**Slope**	**Approach Angle**	**Erosion and Armoring**
5	%BFW ≥ 120	No upstream deposition or downstream bed scour	Structure slope equal to channel slope, and no break in valley slope	Naturally Straight	No erosion **or** armoring
4	100 ≤ %BFW < 120	**Either** upstream deposition **or** downstream bed scour, **without** upstream deposits taller than 0.5 bankfull height **or** high downstream banks	n/a	n/a	No erosion **and** intact armoring, **or** low upstream **or** downstream erosion **without** armoring
3	75 ≤ %BFW < 100	**Either** upstream deposition **or** downstream bed scour, **with** either upstream deposits taller than 0.5 bankfull height **or** high downstream banks	Structure slope equal channel slope, with local break in valley slope	Mild bend	Low upstream **or** downstream erosion **with** armoring
2	50 ≤ %BFW < 75	**Both** upstream deposition **and** downstream bed scour, **without** upstream deposits taller than 0.5 bankfull height **or** high downstream banks	Structure slope higher or lower than channel slope, and no break in valley slope	Channelized Straight	Low upstream **and** downstream erosion
1	30 ≤ %BFW < 50	**Both** upstream deposition **and** downstream bed scour, **with** upstream deposits taller than 0.5 bankfull height **or** high downstream banks	n/a	n/a	Severe upstream **or** downstream erosion
0	%BFW < 30	**Both** upstream deposition **and** downstream bed scour, **with** upstream deposits taller than 0.5 bankfull height **and** high downstream banks	Structure slope higher or lower than channel slope, with local break in valley slope	Sharp Bend	Severe upstream **and** downstream erosion, **or** failing armoring upstream **or** downstream

Table 4. Geomorphic Compatibility Rating Results Vermont Culvert Geomorphic Compatibility Screen Tool (Milone & MacBroom, 2008)			
Category Name	**Screen Score**	**Threshold Conditions**	**Description of Structure-channel Geomorphic Compatibility**
Fully Compatible	20<GC≤25	n/a	Structure fully compatible with natural channel form and process. There is a low risk of failure. No replacement anticipated over the lifetime of the structure. A similar structure is recommended when replacement is needed.
Mostly Compatible	15<GC≤20	n/a	Structure mostly compatible with current channel form and process. There is a low risk of failure. No replacement anticipated over the lifetime of the structure. Minor design adjustments recommended when replacement is needed to make fully compatible.
Partially Compatible	10<GC≤15	n/a	Structure compatible with either current form or process, but not both. Compatibility likely short term. There is a moderate risk of structure failure and replacement may be needed. Re-design suggested to improve geomorphic compatibility.
Mostly Incompatible	5<GC≤10	% Bankfull Width + Approach Angle scores ≤ 2	Structure mostly incompatible with current form and process, with a moderate to high risk of structure failure. Re-design and replacement planning should be initiated to improve geomorphic compatibility.
Fully Incompatible	0≤GC≤5	% Bankfull Width + Approach Angle scores ≤ 2 **AND** Sediment Continuity + Erosion and Armoring scores ≤ 2	Structure fully incompatible with channel and high risk of failure. Re-design and replacement should be performed as soon as possible to improve geomorphic compatibility.

Table 5. Aquatic Organism Passage (AOP) Coarse Screen Tool (Milone & MacBroom, 2009)						
VT Aquatic Organism Passage Coarse Screen	**Full AOP**	**Reduced AOP**	**No AOP**			
Updated 2/25/2008	**for all aquatic organisms**	**for all aquatic organisms**	**for all aquatic organisms except adult salmonids**		**for all aquatic organisms including adult salmonids**	
AOP Function Variables / Values	**Green (if all are true)**	**Gray (if any are true)**	**Orange**		**Red**	
Culvert outlet invert type	at grade **OR** backwatered	cascade	free fall **AND**		free fall **AND**	
Outlet drop (ft)	= 0		> 0 $_1$ < 1 ft **OR**		≥ 1 ft **OR**	
Downstream pool present			= yes	(= yes **AND**	= no **OR**	(= yes **AND**
Downstream pool entrance depth / outlet drop			n/m	≥ 1)	n/a	< 1) **OR**
Water depth in culvert at outlet (ft)					< 0.3 ft	
Number of culverts at crossing	1	> 1				
Structure opening partially obstructed	= none	≠ none				
Sediment throughout structure	yes	no				

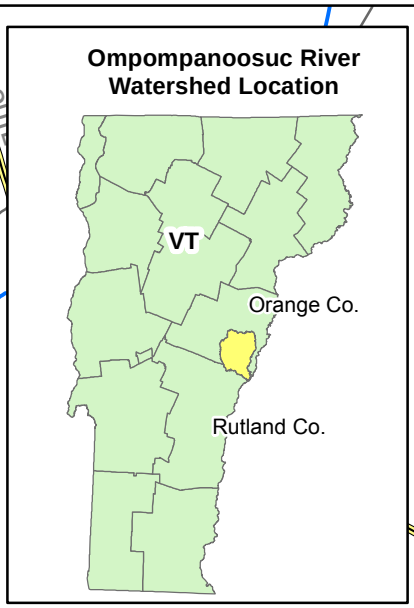
Notes:
Assessment completed during low flows
Outlet drop = invert of structure to water surface
Pool present variable is used alone if pool depths are not measured
n/m = not measured
n/a = not applicable

Table 6. Ompompanoosuc River Bridge & Culvert Assessment (2012)
Geomorphic Compatibility and Aquatic Organism Passage (Culverts Only)

Reach/ Segment Number	Town	Road Name	Structure Type and ID[1]	Percent Bankfull Channel Width[2]		Phase 2 Notes	Scoring Geomorphic Compatibility - Milone & MacBroom, 2008, adapted by BCE for bridges Aquatic Organism Passage - Milone & MacBroom, 2009							
				Constriction	Bridge Span or Culvert Width[3]		% Bankfull Width[5]	Sediment Continuity	Slope	Approach Angle	Erosion & Armoring	Total Score	Geomorphic Compatibility	Aquatic Organism Passage (AOP)
Ompompanoosuc River														
R06-A	Thetford	Academy Road (Union Village Covered Bridge)	Bridge 100911000709111	59	110	Deposition below. Scour below. Bridge is about 18 feet above the water surface.	2	5	NA	5	1	**13/20**	Mostly Compatible	n/a
R08-D	Thetford	n/a	Bridge n/a	49	57[4]	Bridge for "Mystery Trail" near Buzzel Bridge Rd. Bedrock outcrop underneath bridge creates constriction. High downstream banks are natural. Failing rip rap upstream.	2[6]	5	NA	3	0	**10/20**	Partially Compatible	n/a
R10-C	Thetford	Tucker Hill Road (Sayres Covered Bridge)	Bridge 100911002709111	133	154	Pier splits channel. No problems associated with bridge. Some failing rip rap downstream. Pier is creating a debris jam.	5	5	NA	2	0	**12/20**	Partially Compatible	n/a
West Branch of the Ompompanoosuc River														
M01-F	Thetford	n/a	Bridge n/a	60	60[4]	Bridge part of a natural area trail. Deposition above. Bedrock present on left bank above and in the structure.	2	4	NA	5	3	**14/20**	Mostly Compatible	n/a
M01-J	Thetford	Route 132	Bridge 200177000809112	91	283	Deposition above and below. Poorly aligned.	3	3	NA	2	3	**11/20**	Partially Compatible	n/a
Avery Brook														
R06.S1.01-B	Thetford	Main Street (road to Union Dam)	Culvert (box) n/a	41	41[4]	Deposition below and scour above. Structure is perched above water surface on downstream end, which creates a fish passage issue.	1	4	0	3	0	**8/25**	Mostly Incompatible	No AOP Including Adult Salmonids
R06.S1.02-B	Thetford	Route 132	Culvert (box) n/a	47	47[4]	195-foot long box culvert. Deposition above and scour below. Route 132 is at a much higher elevation than culvert. Structure is perched on downstream end, which creates a fish passage issue.	1	1	0	5	1	**8/25**	Mostly Incompatible	No AOP Including Adult Salmonids

[1]The structure ID is the identification number provided by the 2010 "TransStructures_TRANSTRUC" shapefile from the Vermont Center for Geographic Information, unless no number was available.
[2]Percent Bankfull Channel Width percentages are calculated based on the reference channel width for each reach. The constriction percentage is calculated by dividing the present constriction width by the reference channel width. The span percentage is calculated by dividing the bridge span by the reference channel width.
[3]The bridge span used for this calculation is based on the bridge span provided by the 2010 "TransStructures_TRANSTRUC" shapefile from the Vermont Center for Geographic Information, unless otherwise noted.
[4]The bridge spans for the Mystery Trail bridge (R08-D) and bridge in M01-F were measured in the field. Both culvert widths were measured in the field.
[5]The % bankfull width is based on the constriction calculation.
[6]The % bankfull width score for the Mystery Trail bridge is based on the bridge span because the constriction is a result of the bedrock underneath the bridge, not the bridge itself.

2012 Bridge & Culvert Assessment
Ompompanoosuc River Watershed



R11

Tucker Hill Road
Sayers Covered Bridge
100911002709111

M02

Route 132
200177000809112

R10

R09

Natural Area Bridge
n/a

Mystery Trail Bridge
n/a

Ompompanoosuc
Mainstem

West Branch
of the
Ompompanoosuc

THETFORD

M01 R08

Academy Road
Union Village Covered Bridge
100911000709111

Main Street
Box Culvert
n/a

R07

R06S1.01

R06S1.02

Route 132
Box Culvert
n/a

Avery
Brook

R06

TUCKER HILL RD
WOODS LN
ROUTE 132
TH 52
CREAM ST
STOWELL RD
TH 54
TH 87
OLD STRONG RD
MAIN ST

Aquatic Organism Passage (AOP) Rating:

Culverts Only

- Full AOP for all organisms
- Reduced AOP for all aquatic organisms
- No AOP for all aquatic organisms, except adult salmonids
- No AOP for all aquatic organisms

Geomorphic Compatibility Rating:

- Fully Compatible
- Mostly Compatible
- Partially Compatible
- Mostly Incompatible
- Fully Incompatible
- N/A - No Rating, Not Assessed

Legend

- Bridge
- Culvert
- Phase 2 Reach Points
- Major Roads
- Roads
- Phase 2 Study Area
- Phase 1 Only
- Town Boundary

0 0.25 0.5 1 Mile

The ID numbers are provided by the 2010 "TransStructures_TRANSTRUC"shapefile from the Vermont Center for Geographic Information, unless no number was available.

Geomorphic Compatibility Rating for bridges is adapted from the Vermont Culvert Geomorphic Compatibility Screening Tool (Miloneand MacBroom, Inc. 2008).

Aquatic Organism Passage Rating for culverts is from the Vermont Culvert Aquatic Organism Passage Screening Tool (Milone and MacBroom, 2009).

N W E

Bear Creek Environmenta

APPENDIX C

Phase 2 Geomorphic Assessment Data

Table 1. Stream Type and Channel Evolution Stage Summary Ompompanoosuc River Watershed							
Segment Number	**Entrenchment Ratio**	**Width to Depth Ratio**	**Reference Stream Type**	**Incision Ratio**	**Existing Stream Type**	**Channel Evolution Stage**	**Active Adjustment Process**
Ompompanoosuc River Mainstem, Upstream of Union Village Dam							
R14-C	1.8	21.2	B3	1.0	B3	F-I	None
R14-B	1.9	24.5	C4	1.5	B4	F-III	Aggradation Widening Planform
R14-A	2.1	23.6	B3	1.0	B3	F-I	None
R13	1.7	16.2	B4	1.0	B4	F-I	Aggradation
R12-B	1.6	26.0	B3	1.0	B3	D-IIc	**Aggradation** Widening Planform
R12-A	1.4	28.5	B3	1.0	B3	D-IIc	Aggradation Planform
R11-D	1.2	23.0	F3	1.0	F3	F-I	Aggradation Widening
R11-C	10.2	21.1	C4	1.2	C4	F-III	Aggradation Widening **Planform**
R11-B	4.7	20.3	C4	1.8	C4	F-IV	**Aggradation** **Widening** Planform
R11-A	13.5	20.2	C4	1.7	C4	F-III	**Aggradation** **Widening** **Planform**
R10-C[1]	NA	NA	A1	NA	A1	NA	NA
R10-B	1.4	14.6	B3	1.0	B3	F-I	Aggradation Widening Planform[2]
R10-A	1.8	20.2	B3	1.3	B3	F-III	Aggradation Widening Planform
R09	4.8	16.8	C4	1.5	C4	F-II	Widening Planform
R08-D[1]	NA	NA	B3	NA	B3	NA	NA
R08-C	1.5	15.0	B3	1.6	B3	F-III	Aggradation **Widening** Planform
R08-B	1.8	13.7	C4	2.0	B4	F-III	Aggradation **Widening** **Planform**
R08-A[1]	NA	NA	B3	NA	B3	NA	NA

Table 1. Stream Type and Channel Evolution Stage Summary Ompompanoosuc River Watershed							
Segment Number	**Entrenchment Ratio**	**Width to Depth Ratio**	**Reference Stream Type**	**Incision Ratio**	**Existing Stream Type**	**Channel Evolution Stage**	**Active Adjustment Process**
Ompompanoosuc River Mainstem, Downstream of Union Village Dam							
R06-B[1]	NA	NA	NA	NA	NA	NA	NA
R06-A	1.7	36.6	B3	1.2	B3	F-V	Aggradation **Widening** Planform
R05	2.4	46.1	C3	1.9	C3	F-III	Aggradation **Widening** Planform
R04-B	1.4	31.3	B3	2.4	B3	F-V	Aggradation Widening Planform
R04-A	1.5	44.0	B3	2.2	B3	F-V	Aggradation Widening Planform
R03-B	1.3	49.1	C4	2.3	F4	F-III	**Aggradation Widening** Planform
R03-A[1]	NA	NA	C4	NA	C5	NA	NA
Avery Brook							
R06.S1.02-C	1.2	18.1	F3	1.0	F3	F-I	Aggradation Planform
R06.S1.02-B	1.9	18.1	B3	1.0	B3	F-I	Aggradation Widening Planform
R06.S1.02-A[1]	NA	NA	A1	NA	A1	NA	NA
R06.S1.01-B	1.7	17.1	B3	1.0	B3	F-I	Aggradation Widening Planform
R06.S1.01-A	6.6	12.3	C3	1.1	C3	F-I	Widening Planform
West Branch							
M02	2.5	34.3	C4	1.2	C4	F-V	**Aggradation** Widening **Planform**
M01-J	3.6	44.5	C3	1.1	C3	F-I	Aggradation **Widening** Planform
M01-I	1.1	33.4	C3	1.7 [3]IHEF: 2.4	F3	F-III	Aggradation **Widening** Planform

Table 1. Stream Type and Channel Evolution Stage Summary
Ompompanoosuc River Watershed

Segment Number	Entrenchment Ratio	Width to Depth Ratio	Reference Stream Type	Incision Ratio	Existing Stream Type	Channel Evolution Stage	Active Adjustment Process
M01-H	3.6	44.5	C3	1.1	C3	D-IIc	**Aggradation Widening** Planform
M01-G	2.0	86.4	C3	1.1	D3	D-IId	**Aggradation Widening Planform**
M01-F	3.6	44.5	C3	1.6	C3	F-IV	**Aggradatin Widening** Planform
M01-E	2.0	86.4	C3	1.1	D3	D-IId	**Aggradation Widening Planform**
M01-D	1.2	44.3	C3	2.4	F3	F-III	Aggradation **Widening** Planform
M01-C	2.0	86.4	C3	1.1	D3	D-IIc	**Aggradation Widening Planform**
M01-B[1]	NA	NA	F1	NA	F1	NA	**NA**
M01-A	1.1	34.7	C3	2.9	F4	F-III	**Aggradation Widening Planform**

[1] Segment not assessed: R10-C, R08-D, R08-A, R06.S1.02-A, and M01-B due to presence of grade controls; R06-B due to presence of Union Village Dam; R03-B due to impoundment from the Wilder Dam on the Connecticut River. Existing stream type determined using administrative judgement.
[2] Upstream end of segment is contributing to adjustment processes; however, majority of segment is stable.
[3] HEF = Human Elevated Floodplain incision calculated to show change in incision as a result of a berm in M01-I.

Reference Ranges

	F Stream Type	B Stream Type	C Stream Type
Entrenchment Ratio	< 1.4	1.4 – 2.2	> 2.2
Width to Depth Ratio	> 12	< 12	< 12
Incision Ratio	< 1.2	< 1.2	< 1.2

Bold Red lettering – denotes severe adjustment process
Bold Black lettering – denotes major adjustment process
Black lettering (no bold) – denotes minor adjustment process
Red denotes severe incision ratio (≥2.0)
Blue denotes moderate incision ratio (1.4 – <2.0)
Green denotes no incision to minor incision (<1.4)
Orange denotes a stream type departure

Phase 2 Segment Summary Report Ompompanoosuc

Stream: **Ompompanoosuc River**
Reach: **R03-A**
Segment Length(ft): **2,504**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Bear Creek Environmental**
Observers: **Mary, Emily**
Completion Date: **10/24/2012**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**
Why Not Assessed: **impounded**

Step 0 - Location: **This segment begins approximately 500 feet above the Route 132 bridge (near I-91) and continues upstream 2,504 feet until the river is not impounded by the dam anymore.**

Step 5 - Notes:

Step 7 - Narrative:

Step 1. Valley and Floodplain

1.1 Segmentation: **Other Reason**

1.2 Alluvial Fan: **None**

1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	2,043	0	123	0
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	183		0	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Extr.Steep	Very Steep
Continuous w/ Bank:	Never	Never
Within 1 Bankfull W:	Sometimes	Never
Texture:	N.E.	N.E.

1.5 Valley Features

Valley Width (ft): **1,334**
Width Determination: **Measured**
Confinement Type: **VB**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls: **None**

Stream: **Ompompanoosuc River** Reach: **R03-A**

Step 2. Stream Channel

2.1Bankfull Width (ft.):		2.11 Riffle/Step Spacing:		2.13 Average Largest Particle on	
2.2 Max Depth (ft.):		2.12 Substrate Composition		Bed:	
2.3 Mean Depth (tf):		Bedrock:	%	Bar:	
2.4 Floodprone Width (ft.):		Boulder:	%	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):		Cobble:	%	Stream Type:	**C**
Human Elev FloodPln (ft.):		Coarse Gravel:	%	Bed Material:	**Sand**
2.6 Width/Depth Ratio:	**0.00**	Fine Gravel:	%	Subclass Slope:	**None**
2.7 Entrenchment Ratio:	**0.00**	Sand:	%	Bed Form:	**Riffle-Pool**
2.8 Incision Ratio:	**0.00**	Silt and Smaller:	%	Field Measured Slope:	
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:		2.15 Sub-reach Stream Type	
2.9 Sinuosity:		Detritus:	%	Reference Stream Type:	
2.10 Riffles Type:		# Large Woody Debris:		Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Moderate**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**472.3**	**92.2**	Dominant:	**Herbaceous**	**Herbaceous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**3.1**	**4.0**	Sub-dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**None**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**0.0**	Canopy %:	**26-50**	**26-50**
Material Type:	**Sand**	**Sand**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**26-50**	**>100**
Sub-Dominant	**>100**	**0-25**
W less than 25	**1,033**	**890**
Buffer Vegitation Type		
Dominant	**Herbaceous**	**Herbaceous**
Sub-Dominant	**Shrubs/Sapling**	**Deciduous**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Residential**	**Hay**	Mass Failures		
Sub-dominant	**Hay**	**Forest**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **Ompompanoosuc River** Reach: **R03-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Abundant**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**Abundant**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**0**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:	**No**		
Mid:	**3**	Delta:	**1**	Flood chutes:	**1**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**1**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**1,262**
Side:	**5**	Braiding:	**0**	Steep Riffles:	**0**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradiant Type	Left	Right
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score:	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating:				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Score	STD	Historic		
7.1 Channel Degradation				Geomorphic Rating	
7.2 Channel Aggradation				Channel Evolution Model	
7.3 Widening Channel				Channel Evolution Stage	
7.4 Change in Planforml				Geomorphic Condition	**Good**
Total Score				Stream Sensitivity	

Phase 2 Segment Summary Report Ompompanoosuc

Stream: Ompompanoosuc River
Reach: R03-B
Segment Length(ft): 2,077
Rain: Yes

SGAT Version: 4.56
Organization: Bear Creek Environmental
Observers: Mary, Emily
Completion Date: 10/24/2012
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional

Step 0 - Location: **This segment begins where the dam does not impound the river anymore and continues 2,077 feet upstream to the reach break with R04, or approximately 750 feet upstream of the area of Campbell Flats Road that is continuous with the northeastern river bank.**

Step 5 - Notes: **See Step 7 RGA comments. Incision ratio of 2.47 is due to historic incision as well as reduction of flows from flood control dam. Only one riffle in this segment.**

Step 7 - Narrative: **Extreme historic incision due to channel incising and reduction in flow (Union Village Dam). Stream type departure from C to F channel. Major aggradation as evident by diagonal bar on only riffle present. Bank erosion is contributing to widening. Right abandoned terrace (elevation 8.3) appears to be bankfull elevation prior to construction of flood control dam. Old berm at edge of field (left side) is noted on cross section, and was likely put there to restrict flooding into field. Based on the cross section, it appears channel incised and bankfull elevation was reestablished at a lower feature. This bankfull elevation is at 5.15 feet and has a cross-sectional area of approximately 80% of regional curve. The current bankfull elevation is at 3.65 feet or 50% of the regional curve. The calculated incision ratio of 2.27 is due both to incision the reduction of flows from the dam. It is unclear when the incision occurred.**

Step 1. Valley and Floodplain

1.1 Segmentation: Flow Status
1.2 Alluvial Fan: None
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	718	0	690	0
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	0		330	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Very Steep	Very Steep
Continuous w/ Bank:	Never	Never
Within 1 Bankfull W:	Sometimes	Never
Texture:	N.E.	N.E.

1.5 Valley Features
Valley Width (ft): 1,290
Width Determination: Measured
Confinement Type: VB
In Rock Gorge: No
Human Caused Change in Valley Width?: No

1.6 Grade Controls: None

Stream: **Ompompanoosuc River** Reach: **R03-B**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**110.07**	2.11 Riffle/Step Spacing:		2.13 Average Largest Particle on			
2.2 Max Depth (ft.):	**3.65**	2.12 Substrate Composition			Bed:	**10.6**	**inches**
2.3 Mean Depth (tf):	**2.24**	Bedrock:	**0.0 %**		Bar:	**1.78**	**inches**
2.4 Floodprone Width (ft.):	**142.60**	Boulder:	**3.0 %**	2.14 Stream Type			
2.5 Aband. Floodpn (ft.):	**8.30**	Cobble:	**45.0 %**	Stream Type:	**F**		
Human Elev FloodPln (ft.):		Coarse Gravel:	**44.0 %**	Bed Material:	**Gravel**		
2.6 Width/Depth Ratio:	**49.14**	Fine Gravel:	**0.0 %**	Subclass Slope:	**None**		
2.7 Entrenchment Ratio:	**1.30**	Sand:	**7.0 %**	Bed Form:	**Riffle-Pool**		
2.8 Incision Ratio:	**2.27**	Silt and Smaller:	**1.0 %**	Field Measured Slope:			
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type			
2.9 Sinuosity:	**Low**	Detritus:	**0.0 %**	Reference Stream Type:			
2.10 Riffles Type:	**Complete**	# Large Woody Debris:	**38**	Reference Bed Material:			
				Reference Subclass Slope:			
				Reference Bedform:			

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Moderate**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**1,072.3**	**734.2**	Dominant:	**Deciduous**	**Deciduous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**3.8**	**4.3**	Sub-dominant:	**Herbaceous**	**Shrubs/Sapling**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**None**	Bank Canopy		
Lower			Revetment Length:	**32.2**	**0.0**	Canopy %:	**51-75**	**51-75**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**51-100**	**51-100**
Sub-Dominant	**0-25**	**None**
W less than 25	**621**	**131**
Buffer Vegitation Type		
Dominant	**Deciduous**	**Deciduous**
Sub-Dominant	**Herbaceous**	**Herbaceous**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Residential**	**Hay**
Sub-dominant	**Hay**	**Residential**
(Legacy)	Amount	Mean Hieght
Failures	**None**	
Gullies	**None**	

	Left	Right
Mass Failures		
Height		
Gullies Number	**0**	
Gullies Length	**0**	

Stream: **Ompompanoosuc River** Reach: **R03-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**None**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs			
4.2 Adjacent Wetlands:	**None**	Flow Reg. Use:		Field Ditch:	**0**	Road Ditch:	**1**
4.3 Flow Status:	**Moderate**	Impoundments:		Other:	**0**	Tile Drain:	**0**
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	**0**	Urb Strm Wtr Pipe:	**0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:		**0**	
		(old) Upstrm Flow Reg.:		Affected Length (ft):		**0**	

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**1**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:	**No**		
Mid:	**1**	Delta:	**0**	Flood chutes:	**3**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**0**	Island:	**1**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**1,028**
Side:	**6**	Braiding:	**0**	Steep Riffles:	**1**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**3**	**C to F**	**Yes**	Geomorphic Rating	**0.39**
7.2 Channel Aggradation		**8**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**8**	**None**	**No**	Channel Evolution Stage	**III**
7.4 Change in Planforml		**12**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**31**			Stream Sensitivity	**Very High**

Phase 2 Segment Summary Report Ompompanoosuc

Stream: Ompompanoosuc River
Reach: R04-A
Segment Length(ft): 1,914
Rain: Yes

SGAT Version: 4.56
Organization: Bear Creek Environmental
Observers: Mary, Emily
Completion Date: 10/17/2012
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional

Step 0 - Location: **This segment begins approximately 750 feet upstream of where Campbell Flats Road is continuous with the Ompompanoosuc River and continues 1,914 feet upstream to where the valley narrows and the river becomes sinuous.**

Step 5 - Notes: **Evidence of beavers. Sand in interstitial places. Fining is fair. Bank erosion in some areas where buffer is less than 25 feet. The reduction in peak flows has altered the bankfull channel dimensions, making the river shallower than the expected reference bankfull channel depth. This in turn has increased the width to depth ratio, making the channel overwide. In addition to that, the reduction in flows has made it appear that the channel has incised.**

Step 7 - Narrative: **Historic degradation (due to both incision and flow reduction from dam). Minor aggradation, widening, and planform adjustment. Very stable segment. Bedrock along banks in some locations. High width to depth ratio is attributed to decreased bankfull depths due to flow regulation from Union Village Dam, rather than channel widening from bank erosion or increased sediment supply. The elevation of the original RAF was chosen to be at a change in slope, as shown on the cross section. The calculated incision ratio (2.2) reflects actual incision and a reduction in flow as a result of the dam. Based on the cross section, it appears channel incised and bankfull elevation was reestablished at a lower feature. This bankfull elevation is at 4.1 feet and has a cross-sectional area of approximately 80% of regional curve. The current bankfull elevation (where alders have grown) is at 3.1 feet or 50% of the regional curve. The calculated incision ratio of 2.23 is due both to incision the reduction of flows from the dam. It is unclear when the incision occurred. The CEM of F-V indicates that the channel here is stable – controlled flows are keeping this segment more stable than if the dam were not present. Although CEM is F-V, the segment may not have gone through stages F-III or F-IV.**

Step 1. Valley and Floodplain

1.1 Segmentation: Banks and Buffers
1.2 Alluvial Fan: None
1.3 Corridor Encroachments:

	Length (ft)	One	Height	Both	Height
Berm:	0			0	
Road:	751	0		444	0
Railroad:	0			0	
Imp. Path:	0			0	
Dev.:	305			0	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Steep	Very Steep
Continuous w/ Bank:	Never	Sometimes
Within 1 Bankfull W:	Never	Sometimes
Texture:	N.E.	N.E.

1.5 Valley Features

Valley Width (ft): 546
Width Determination: Measured
Confinement Type: NW
In Rock Gorge: No
Human Caused Change in Valley Width?: No

1.6 Grade Controls: None

Stream: **Ompompanoosuc River** Reach: **R04-A**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**108.73**	2.11 Riffle/Step Spacing:	**360 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**3.10**	2.12 Substrate Composition		Bed:	**14.6**	**inches**
2.3 Mean Depth (tf):	**2.47**	Bedrock:	**0.0 %**	Bar:	**9.3**	**inches**
2.4 Floodprone Width (ft.):	**158.40**	Boulder:	**8.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**6.90**	Cobble:	**53.0 %**	Stream Type:	**B**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**23.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**44.02**	Fine Gravel:	**6.0 %**	Subclass Slope:	**c**	
2.7 Entrenchment Ratio:	**1.46**	Sand:	**5.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**2.23**	Silt and Smaller:	**5.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**0.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Complete**	# Large Woody Debris:	**15**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**74.8**	**290.9**	Dominant:	**Coniferous**	**Coniferous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**2.0**	**2.0**	Sub-dominant:	**Deciduous**	**Deciduous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**None**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**0.0**	Canopy %:	**51-75**	**76-100**
Material Type:	**Gravel**	**Gravel**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**0-25**	**>100**
Sub-Dominant	**51-100**	**None**
W less than 25	**1,123**	**49**
Buffer Vegitation Type		
Dominant	**Deciduous**	**Coniferous**
Sub-Dominant	**Herbaceous**	**Deciduous**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Residential**	**Forest**	Mass Failures		
Sub-dominant	**Forest**	**Residential**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **Ompompanoosuc River** Reach: **R04-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**None**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**0**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**1**	Delta:	**0**	Flood chutes:	**0**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**0**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**680**
Side:	**2**	Braiding:	**0**	Steep Riffles:	**0**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**3**	**None**	**Yes**	Geomorphic Rating	**0.49**
7.2 Channel Aggradation		**12**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**12**	**None**	**No**	Channel Evolution Stage	**V**
7.4 Change in Planforml		**12**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**39**			Stream Sensitivity	**High**

Phase 2 Segment Summary Report Ompompanoosuc

Stream: Ompompanoosuc River
Reach: R04-B
Segment Length(ft): 1,385
Rain: Yes

SGAT Version: 4.56
Organization: Bear Creek Environmental
Observers: Mary, Emily
Completion Date: 10/17/2012
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional

Step 0 - Location: **This segment begins where the valley narrows in R04 and continues 1,385 feet upstream to the R05 reach break, where the river again loses its sinuosity.**

Step 5 - Notes: **Both point bars in segment are comprised of sand. Side bars are not well formed and are small. The cross section indicated that this segment's entrenchment ratio is on the cusp between a "B" and "F" stream type. A "B" stream type is more representative here. The majority of the segment had some floodplain access, but the cross section location was limited because the lower part of the segment was a long Rank 7 pool.**

Step 7 - Narrative: **Historic degradation (due to both incision and flow reduction from dam). Minor aggradation, widening, and planform adjustment. Very stable reach with minimal human influence other than flow regulation from Union Village Dam. Good banks & buffers. The bankfull width to depth ratio of 32.8 indicates widening is occurring, although is likely explained by a decrease in depth from flow regulation of Union Village Dam. The elevation of the original RAF was chosen to be at the elevation of the right terrace (8.5), as shown on the cross section. The calculated incision ratio (2.43) reflects actual incision and a reduction in flow as a result of the dam. Based on the cross section, it appears channel incised and bankfull elevation was reestablished at a lower feature. This bankfull elevation is at 4.5 feet and has a cross-sectional area of approximately 50% of regional curve. The calculated incision ratio of 2.43 is due both to incision the reduction of flows from the dam. It is unclear when the incision occurred. The CEM of F-V indicates that the channel here is stable – controlled flows are keeping this segment more stable than if the dam were not present. Although CEM is F-V, the segment may not have gone through stages F-III or F-IV.**

Step 1. Valley and Floodplain

1.1 Segmentation: Banks and Buffers
1.2 Alluvial Fan: None
1.3 Corridor Encroachments:

	Length (ft)	One Height	Both	Height
Berm:	0		0	
Road:	0		0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	44		0	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Very Steep	Very Steep
Continuous w/ Bank:	Sometimes	Never
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	N.E.	N.E.

1.5 Valley Features

Valley Width (ft):	337
Width Determination:	Measured
Confinement Type:	SC
In Rock Gorge:	No
Human Caused Change in Valley Width?:	No

1.6 Grade Controls: None

Stream: **Ompompanoosuc River** Reach: **R04-B**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**80.81**	2.11 Riffle/Step Spacing:	**484 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**3.50**	2.12 Substrate Composition		Bed:	**16.2**	**inches**
2.3 Mean Depth (tf):	**2.58**	Bedrock:	**0.0 %**	Bar:	**N/A**	**inches**
2.4 Floodprone Width (ft.):	**113.30**	Boulder:	**26.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**8.50**	Cobble:	**55.0 %**	Stream Type:	**B**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**11.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**31.32**	Fine Gravel:	**2.0 %**	Subclass Slope:	**c**	
2.7 Entrenchment Ratio:	**1.40**	Sand:	**6.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**2.43**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Moderate**	Detritus:	**0.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Complete**	# Large Woody Debris:	**13**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Moderate**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**0.0**	**52.4**	Dominant:	**Coniferous**	**Coniferous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**0.0**	**4.0**	Sub-dominant:	**Shrubs/Sapling**	**None**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**None**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**0.0**	Canopy %:	**76-100**	**76-100**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**None**	**None**
W less than 25	**0**	**0**
Buffer Vegitation Type		
Dominant	**Coniferous**	**Coniferous**
Sub-Dominant	**Shrubs/Sapling**	**None**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Forest**	**Forest**
Sub-dominant	**None**	**None**
(Legacy)	Amount	Mean Hieght
Failures	**None**	
Gullies	**None**	

	Left	Right
Mass Failures		
Height		
Gullies Number	**0**	
Gullies Length	**0**	

Stream: **Ompompanoosuc River** Reach: **R04-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**Abundant**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:	**None**	Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**0**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:	**No**		
Mid:	**2**	Delta:	**0**	Flood chutes:	**1**	Avulsion:	**0**	5.5 Straightening:	**None**
Point:	**2**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**0**
Side:	**5**	Braiding:	**0**	Steep Riffles:	**0**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Confined**	Score	STD	Historic		
7.1 Channel Degradation		**3**	**None**	**Yes**	Geomorphic Rating	**0.54**
7.2 Channel Aggradation		**13**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**13**	**None**	**No**	Channel Evolution Stage	**V**
7.4 Change in Planforml		**14**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**43**			Stream Sensitivity	**High**

Phase 2 Segment Summary Report Ompompanoosuc

Stream: Ompompanoosuc River
Reach: R05-0
Segment Length(ft): 4,705
Rain: Yes

SGAT Version: 4.56
Organization: Bear Creek Environmental
Observers: Mary, Emily
Completion Date: 10/17/2012
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional

Step 0 - Location: **Reach R05 begins just upstream of a short sinuous segment (R04-B) and continues upstream 4,705 feet to approximately 230 feet below the Academy Road covered bridge.**

Step 5 - Notes: **Academy Road considered Phase II valley wall. Campbell Flats Road not considered Phase II valley wall.**

Step 7 - Narrative: **Major historic incision due to flood control dam (due to incision and reduction in flow). Minor aggradation and planform adjustment. Some bank erosion (even with low banks). The width to depth ratio indicates that widening is occurring, although this may be more of a function of reduced bankfull flows from the dam. The left terrace appears to be the location of the former floodplain, prior to the Union Village Dam being constructed in the late 1940s. Significant channel straightening as evident by agricultural fields and nearby roads. The calculated incision ratio of 1.90 is due both to incision the reduction of flows from the dam. It is unclear when the incision occurred. The incision ratio of 1.9 is lower than downstream segments and may be a function of R05 being closer to the grade control/dam.**

Step 1. Valley and Floodplain

1.1 Segmentation: None
1.2 Alluvial Fan: None
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	548	0	2,066	0
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	2,455		408	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Very Steep	Very Steep
Continuous w/ Bank:	Sometimes	Never
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	N.E.	N.E.

1.5 Valley Features

Valley Width (ft):	888
Width Determination:	Measured
Confinement Type:	BD
In Rock Gorge:	No
Human Caused Change in Valley Width?:	No

1.6 Grade Controls: None

Stream: **Ompompanoosuc River** Reach: **R05-0**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**101.40**	2.11 Riffle/Step Spacing:	**437 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**2.90**	2.12 Substrate Composition		Bed:	**17.9**	**inches**
2.3 Mean Depth (tf):	**2.20**	Bedrock:	**0.0 %**	Bar:	**7.9**	**inches**
2.4 Floodprone Width (ft.):	**243.00**	Boulder:	**6.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**5.50**	Cobble:	**53.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**26.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**46.09**	Fine Gravel:	**9.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**2.40**	Sand:	**6.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.90**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**0.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Complete**	# Large Woody Debris:	**64**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Moderate**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**557.9**	**1,331.8**	Dominant:	**Deciduous**	**Deciduous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**4.1**	**4.5**	Sub-dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**171.9**	Canopy %:	**76-100**	**76-100**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**51-100**
Sub-Dominant	**51-100**	**0-25**
W less than 25	**455**	**1,203**
Buffer Vegitation Type		
Dominant	**Deciduous**	**Deciduous**
Sub-Dominant	**Herbaceous**	**Herbaceous**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Forest**	**Residential**
Sub-dominant	**Residential**	**Forest**
(Legacy)	Amount	Mean Hieght
Failures	**None**	
Gullies	**None**	

	Left	Right
Mass Failures		
Height		
Gullies Number	**0**	
Gullies Length	**0**	

Stream: **Ompompanoosuc River** Reach: **R05-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	**Abundant**	Flow Reg. Use:		Field Ditch: **0**	Road Ditch: **1**
4.3 Flow Status:	**Moderate**	Impoundments:		Other: **0**	Tile Drain: **0**
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow: **0**	Urb Strm Wtr Pipe: **0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**2**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**2**	Delta:	**0**	Flood chutes:	**2**	Avulsion:	**1**	5.5 Straightening:	**Straightening**
Point:	**1**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**4,340**
Side:	**6**	Braiding:	**0**	Steep Riffles:	**2**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**7**	**None**	**Yes**	Geomorphic Rating	**0.52**
7.2 Channel Aggradation		**13**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**8**	**None**	**No**	Channel Evolution Stage	**III**
7.4 Change in Planforml		**14**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**42**			Stream Sensitivity	**Moderate**

Phase 2 Segment Summary Report Ompompanoosuc

Stream: Ompompanoosuc River
Reach: R06-A
Segment Length(ft): 1,766
Rain: Yes

SGAT Version: 4.56
Organization: Bear Creek Environmental
Observers: Mary, Emily
Completion Date: 10/16/2012
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional

Step 0 - Location: **This segment begins about 230 feet below the Academy Road bridge in Thetford and continues upstream 1,766 feet until the Union Village Dam.**

Step 5 - Notes: **The grade control is located at the outflow of the Union Village Dam - the height was estimated. The Union Village Dam is a large flood control dam that operates as a store & release facility. The reduction in peak flows has altered the bankfull channel dimensions, making the river shallower than the expected reference bankfull channel depth. This in turn has increased the width to depth ratio, making the channel overwide (width to depth ratio of 36).**

Step 7 - Narrative: **Very minor incision from reduction in flow from flood control dam. This reach is a sediment transport reach. There are a few bars that are mostly small and sandy. The width to depth ratio is moderate. The reach is soft underfoot in slower velocity areas and cobble in riffles. There is some minor bank erosion. The top of this reach is a bedrock grade control and the Union Village Dam. This incision ratio is significantly lower than the IR for downstream reaches. This makes sense because the cross section was measured just downstream of the dam, which is acting as a large grade control. The reduction in peak flows has altered the bankfull channel dimensions, making the river shallower than the expected reference bankfull channel depth. This in turn has increased the width to depth ratio, making the channel overwide (width to depth ratio of 36). The CEM of F-V indicates that the channel here is stable – controlled flows are keeping this segment more stable than if the dam were not present. Although CEM is F-V, the segment may not have gone through stages F-III or F-IV.**

Step 1. Valley and Floodplain

1.1 Segmentation: Other Reason
1.2 Alluvial Fan: None
1.3 Corridor Encroachments:

	Length (ft)	One	Height	Both	Height
Berm:		0		0	
Road:		483	0	618	0
Railroad:		0		0	
Imp. Path:		0		0	
Dev.:		182		620	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Extr.Steep	Extr.Steep
Continuous w/ Bank:	Sometimes	Never
Within 1 Bankfull W:	Sometimes	Never
Texture:	N.E.	N.E.

1.5 Valley Features

Valley Width (ft):	396
Width Determination:	Measured
Confinement Type:	SC
In Rock Gorge:	No
Human Caused Change in Valley Width?:	No

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	8.0	5.0	Yes	

Stream: **Ompompanoosuc River** Reach: **R06-A**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**104.66**	2.11 Riffle/Step Spacing:	**570 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**3.90**	2.12 Substrate Composition		Bed:	**13.5**	**inches**
2.3 Mean Depth (tf):	**2.86**	Bedrock:	**2.0 %**	Bar:	**N/A**	**inches**
2.4 Floodprone Width (ft.):	**180.70**	Boulder:	**4.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**4.70**	Cobble:	**59.0 %**	Stream Type:	**B**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**15.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**36.59**	Fine Gravel:	**14.0 %**	Subclass Slope:	**c**	
2.7 Entrenchment Ratio:	**1.73**	Sand:	**6.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.21**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**0.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Complete**	# Large Woody Debris:	**23**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Moderate**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**225.6**	**216.5**	Dominant:	**Deciduous**	**Deciduous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**3.0**	**3.0**	Sub-dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Multiple**	**Multiple**	Bank Canopy		
Lower			Revetment Length:	**302.4**	**351.7**	Canopy %:	**76-100**	**51-75**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**0-25**
Sub-Dominant	**0-25**	**26-50**
W less than 25	**212**	**746**
Buffer Vegitation Type		
Dominant	**Coniferous**	**Deciduous**
Sub-Dominant	**Deciduous**	**Herbaceous**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Residential**	Mass Failures	**16.28**	
Sub-dominant	**Residential**	**None**	Height	**15.0**	
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**One**	**15.0**	Gullies Length	**0**	
Gullies	**None**				

Stream: **Ompompanoosuc River** Reach: **R06-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**None**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:	**None**	Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	**66**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Below,Scour Above**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types		Diagonal:	**0**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:	**No**
Mid:	**2**	Delta:	**0**	Flood chutes:	**0**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**0**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**1,766**
Side:	**1**	Braiding:	**0**	Steep Riffles:	**0**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Confined**	Score	STD	Historic		
7.1 Channel Degradation		**15**	**None**	**No**	Geomorphic Rating	**0.64**
7.2 Channel Aggradation		**13**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**10**	**None**	**No**	Channel Evolution Stage	**V**
7.4 Change in Planforml		**13**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**51**			Stream Sensitivity	**High**

Phase 2 Segment Summary Report Ompompanoosuc

Stream: **Ompompanoosuc River**
Reach: **R06-B**
Segment Length(ft): **554**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Bear Creek Environmental**
Observers: **Mary, Emily**
Completion Date: **10/16/2012**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**
Why Not Assessed: **Other (to be explained in comments)**

Step 0 - Location: **This segment is within the Union Village Dam.**

Step 5 - Notes: **This segment is mostly located inside of the Union Village Dam and was not accessible. We cannot make administrative judgement on what the reference stream type is and do not have any information for Steps 1 and 3-5.**

Step 7 - Narrative:

Step 1. Valley and Floodplain

1.1 Segmentation: **Other Reason**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

	Length (ft)	One Height	Both	Height
Berm:	0		0	
Road:	476	0	0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	0		0	

1.4 Adjacent Side	Left	Right
Hillside Slope:		
Continuous w/ Bank:		
Within 1 Bankfull W:		
Texture:	N.E.	N.E.

1.5 Valley Features
Valley Width (ft):
Width Determination:
Confinement Type:
In Rock Gorge:
Human Caused Change in Valley Width?:

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Dam	Mid-segment	170.0	165.0	No	

Stream: **Ompompanoosuc River** Reach: **R06-B**

Step 2. Stream Channel

2.1Bankfull Width (ft.):		2.11 Riffle/Step Spacing:		2.13 Average Largest Particle on	
2.2 Max Depth (ft.):		2.12 Substrate Composition		Bed:	
2.3 Mean Depth (tf):		Bedrock:	%	Bar:	
2.4 Floodprone Width (ft.):		Boulder:	%	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):		Cobble:	%	Stream Type:	
Human Elev FloodPln (ft.):		Coarse Gravel:	%	Bed Material:	
2.6 Width/Depth Ratio:	**0.00**	Fine Gravel:	%	Subclass Slope:	
2.7 Entrenchment Ratio:	**0.00**	Sand:	%	Bed Form:	
2.8 Incision Ratio:	**0.00**	Silt and Smaller:	%	Field Measured Slope:	
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:		2.15 Sub-reach Stream Type	
2.9 Sinuosity:		Detritus:	%	Reference Stream Type:	
2.10 Riffles Type:		# Large Woody Debris:		Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope:

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**0.0**	**0.0**	Dominant:		
Material Type:			Erosion Height (ft.):	**0.0**	**0.0**	Sub-dominant:		
Consistency:			Revetment Type:	**None**	**None**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**0.0**	Canopy %:		
Material Type:						Mid-Channel Canopy:		
Consistency:								

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant		
Sub-Dominant		
W less than 25	**0**	**0**
Buffer Vegitation Type		
Dominant		
Sub-Dominant		

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant			Mass Failures		
Sub-dominant			Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **Ompompanoosuc River** Reach: **R06-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:		4.5 Flow Regulation Type	**Large Store and Release**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:		Flow Reg. Use:	**Flood Control**	Field Ditch:	Road Ditch:
4.3 Flow Status:		Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions:

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:	**No**
Mid:	Delta:	Flood chutes:	**0**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	Island:	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**536**
Side:	Braiding: **0**	Steep Riffles:	**0**	Trib Rejuv.:		5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradiant Type	Left	Right
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score:	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating:				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Score	STD	Historic		
7.1 Channel Degradation				Geomorphic Rating	
7.2 Channel Aggradation				Channel Evolution Model	
7.3 Widening Channel				Channel Evolution Stage	
7.4 Change in Planforml				Geomorphic Condition	
Total Score				Stream Sensitivity	

Phase 2 Segment Summary Report Ompompanoosuc

Stream: Ompompanoosuc River
Reach: R08-A
Segment Length(ft): 1,179
Rain: Yes

SGAT Version: 4.56
Organization: Bear Creek Environmental
Observers: Pam, Emily
Completion Date: 7/31/2012
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional
Why Not Assessed: Other (to be explained in comments)

Step 0 - Location: **This segment begins at the confluence with the West Branch and continues 1,179 feet upstream through a grade control area. The segment ends at the top of a very large grade control.**

Step 5 - Notes: **This segment was not assessed because it was dominated by several large ledge grade controls. In between the grade controls were very deep Rank 7 pools. In short areas where there were no grade controls the banks were very high and were freshly eroded. The channel has possibly incised down to bedrock here. A similar area was observed on the most downstream reach of the West Branch of the Ompompanoosuc, which is near this segment.**

Step 7 - Narrative:

Step 1. Valley and Floodplain

1.1 Segmentation: Grade Controls
1.2 Alluvial Fan: None
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	1,179	0	0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	0		0	

1.4 Adjacent Side	Left	Right
Hillside Slope:	Very Steep	Very Steep
Continuous w/ Bank:	Never	Never
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	N.E.	N.E.

1.5 Valley Features	
Valley Width (ft):	248
Width Determination:	Measured
Confinement Type:	SC
In Rock Gorge:	No
Human Caused Change in Valley Width?:	No

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	6.0	4.0	Yes	
Ledge	Mid-segment	13.0	10.0	Yes	
Ledge	Mid-segment	2.0	1.0	Yes	
Ledge	Mid-segment	3.0	1.0	Yes	

Stream: **Ompompanoosuc River** Reach: **R08-A**

Step 2. Stream Channel

2.1Bankfull Width (ft.):		2.11 Riffle/Step Spacing:	**213 ft.**	2.13 Average Largest Particle on Bed:	
2.2 Max Depth (ft.):		2.12 Substrate Composition		Bar:	
2.3 Mean Depth (tf):		Bedrock:	**%**	2.14 Stream Type	
2.4 Floodprone Width (ft.):		Boulder:	**%**	Stream Type:	**B**
2.5 Aband. Floodpn (ft.):		Cobble:	**%**	Bed Material:	**Cobble**
Human Elev FloodPln (ft.):		Coarse Gravel:	**%**	Subclass Slope:	**c**
2.6 Width/Depth Ratio:	**0.00**	Fine Gravel:	**%**	Bed Form:	**Step-Pool**
2.7 Entrenchment Ratio:	**0.00**	Sand:	**%**	Field Measured Slope:	
2.8 Incision Ratio:	**0.00**	Silt and Smaller:	**%**	2.15 Sub-reach Stream Type	
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:		Reference Stream Type:	**B**
2.9 Sinuosity:		Detritus:	**0.0 %**	Reference Bed Material:	**Cobble**
2.10 Riffles Type:		# Large Woody Debris:		Reference Subclass Slope:	**c**
				Reference Bedform:	**Step-Pool**

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**563.9**	**627.9**	Dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**10.0**	**7.2**	Sub-dominant:	**None**	**None**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**None**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**0.0**	Canopy %:	**26-50**	**26-50**
Material Type:	**Bedrock**	**Bedrock**				Mid-Channel Canopy:	**Open**	
Consistency:	**Cohesive**	**Cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**51-100**	**>100**
Sub-Dominant	**>100**	**None**
W less than 25	**0**	**0**
Buffer Vegitation Type		
Dominant	**Shrubs/Sapling**	**Mixed Trees**
Sub-Dominant	**Mixed Trees**	**None**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Forest**	**Forest**
Sub-dominant	**Residential**	**None**
(Legacy)	Amount	Mean Hieght
Failures	**None**	
Gullies	**None**	

	Left	Right
Mass Failures		
Height		
Gullies Number	**0**	
Gullies Length	**0**	

Stream: **Ompompanoosuc River** Reach: **R08-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:	**None**	Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**1**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**	
Mid:	**1**	Delta:	**0**	Flood chutes:	**0**	Avulsion:	**0**	5.5 Straightening:	**None**
Point:	**0**	Island:	**1**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**0**
Side:	**2**	Braiding:	**1**	Steep Riffles:	**1**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradiant Type	Left	Right
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score:	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating:				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Score	STD	Historic		
7.1 Channel Degradation				Geomorphic Rating	
7.2 Channel Aggradation				Channel Evolution Model	
7.3 Widening Channel				Channel Evolution Stage	
7.4 Change in Planforml				Geomorphic Condition	**Fair**
Total Score				Stream Sensitivity	

Phase 2 Segment Summary Report Ompompanoosuc

Stream: Ompompanoosuc River
Reach: R08-B
Segment Length(ft): 2,420
Rain: Yes

SGAT Version: 4.56
Organization: Bear Creek Environmental
Observers: Pam, Emily
Completion Date: 7/31/2012
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional

Step 0 - Location: **This segment begins just upstream of a large grade control and continues 2,420 feet upstream through a straight area of the river. The segment ends as the valley narrows.**

Step 5 - Notes: **In this segment several small gabions were installed most likely to prevent erosion. They were probably more of them historically, but could have been outflanked during a flood event. This was not indexed as straightening because the river is not being significantly restricted/straightened by them at present day. The channel has eroded behind them and they are creating mid-channel bars in the stream.**

Step 7 - Narrative: **Extreme historic incision, banks are very high and there is an old very wide feature on the right side that is most likely the RAF. Channel has been extensively straightened and road encroachment may be why. This has led to a stream type departure from a**
C to a B. Channel is in stage F-III as channel continues to widen through extensive bank erosion. Major planform adjustment due to straightening. Aggradation occurring behind wire rock cages. The most downstream ~ 100 feet of this segment is impounded/being controlled by the large grade control that is in Segment R08-A.

Step 1. Valley and Floodplain

1.1 Segmentation: Valley Width
1.2 Alluvial Fan: None
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	2,050	0	0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	0		0	

1.4 Adjacent Side	Left	Right
Hillside Slope:	Extr.Steep	Very Steep
Continuous w/ Bank:	Never	Never
Within 1 Bankfull W:	Never	Sometimes
Texture:	N.E.	N.E.

1.5 Valley Features
Valley Width (ft): 488
Width Determination: Measured
Confinement Type: NW
In Rock Gorge: No
Human Caused Change in Valley Width?: No

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	3.0	2.0	Yes	

Stream: **Ompompanoosuc River** Reach: **R08-B**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**64.80**	2.11 Riffle/Step Spacing:	**301 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**6.10**	2.12 Substrate Composition		Bed:	**10.44**	**inches**
2.3 Mean Depth (tf):	**4.72**	Bedrock:	**0.0 %**	Bar:	**7.34**	**inches**
2.4 Floodprone Width (ft.):	**115.10**	Boulder:	**1.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**12.20**	Cobble:	**20.0 %**	Stream Type:	**B**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**31.0 %**	Bed Material:	**Gravel**	
2.6 Width/Depth Ratio:	**13.73**	Fine Gravel:	**18.0 %**	Subclass Slope:	**c**	
2.7 Entrenchment Ratio:	**1.78**	Sand:	**28.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**2.00**	Silt and Smaller:	**2.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**0.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Complete**	# Large Woody Debris:	**58**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**695.0**	**1,166.5**	Dominant:	**Herbaceous**	**Herbaceous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**4.8**	**5.7**	Sub-dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**None**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**0.0**	Canopy %:	**1-25**	**1-25**
Material Type:	**Sand**	**Sand**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**26-50**	**>100**
Sub-Dominant	**>100**	**None**
W less than 25	**65**	**0**
Buffer Vegitation Type		
Dominant	**Mixed Trees**	**Herbaceous**
Sub-Dominant	**None**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Residential**	**Shrubs/Sapling**	Mass Failures		
Sub-dominant	**Shrubs/Sapling**	**Forest**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **Ompompanoosuc River** Reach: **R08-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Abundant**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch: **0**	Road Ditch: **1**
4.3 Flow Status:	**Moderate**	Impoundments:	**None**	Other: **0**	Tile Drain: **0**
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow: **0**	Urb Strm Wtr Pipe: **0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**1**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**4**	Delta:	**1**	Flood chutes:	**0**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**0**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**2,339**
Side:	**5**	Braiding:	**0**	Steep Riffles:	**0**	Trib Rejuv.:	**Yes**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**3**	**C to B**	**Yes**	Geomorphic Rating	**0.38**
7.2 Channel Aggradation		**11**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**8**	**None**	**No**	Channel Evolution Stage	**III**
7.4 Change in Planforml		**8**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**30**			Stream Sensitivity	**Very High**

Phase 2 Segment Summary Report Ompompanoosuc

Stream: **Ompompanoosuc River**
Reach: **R08-C**
Segment Length(ft): **1,354**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Bear Creek Environmental**
Observers: **Pam, Emily**
Completion Date: **7/31/2012**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **This segment begins are the valley narrows and continues 1,354 feet upstream to another bedrock gorge/grade control area.**

Step 5 - Notes:

Step 7 - Narrative: **Major widening and historic incision. Erosion extensive both banks, no juvenile floodplain yet. Not confident on bankfull due to erosion. Cross-sectional area is higher than in other segments. If lowered bankfull elevation, still a B stream type.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Valley Width**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	1,213	0	0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	0		0	

1.4 Adjacent Side	Left	Right
Hillside Slope:	Very Steep	Extr.Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	N.E.	N.E.

1.5 Valley Features
Valley Width (ft): **300**
Width Determination: **Measured**
Confinement Type: **SC**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **No**

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	2.0	0.0	Yes	

Stream: **Ompompanoosuc River** Reach: **R08-C**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**82.00**	2.11 Riffle/Step Spacing:	**316 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**6.45**	2.12 Substrate Composition		Bed:	**14**	**inches**
2.3 Mean Depth (tf):	**5.46**	Bedrock:	**0.0 %**	Bar:	**7.5**	**inches**
2.4 Floodprone Width (ft.):	**120.20**	Boulder:	**7.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**10.25**	Cobble:	**58.0 %**	Stream Type:	**B**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**18.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**15.02**	Fine Gravel:	**5.0 %**	Subclass Slope:	**c**	
2.7 Entrenchment Ratio:	**1.47**	Sand:	**12.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.59**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**0.0 %**	Reference Stream Type:	**B**	
2.10 Riffles Type:	**Complete**	# Large Woody Debris:	**49**	Reference Bed Material:	**Cobble**	
				Reference Subclass Slope:	**c**	
				Reference Bedform:	**Riffle-Pool**	

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**1,063.3**	**302.6**	Dominant:	**Deciduous**	**Deciduous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**4.9**	**5.0**	Sub-dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**None**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**0.0**	Canopy %:	**76-100**	**76-100**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**0-25**	**None**
W less than 25	**211**	**0**
Buffer Vegitation Type		
Dominant	**Mixed Trees**	**Coniferous**
Sub-Dominant	**Shrubs/Sapling**	**None**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Forest**	**Forest**
Sub-dominant	**Residential**	**None**
(Legacy)	Amount	Mean Hieght
Failures	**None**	
Gullies	**None**	

	Left	Right
Mass Failures		
Height		
Gullies Number	**0**	
Gullies Length	**0**	

Stream: Ompompanoosuc River Reach: R08-C

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Minimal	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	None	Flow Reg. Use:		Field Ditch: 0	Road Ditch: 1
4.3 Flow Status:	Moderate	Impoundments:	None	Other: 0	Tile Drain: 0
4.4 # of Debris Jams:	0	Impoundment Loc.:		Overland Flow: 0	Urb Strm Wtr Pipe: 0
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0

4.8 Channel Constrictions: None

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	0	5.2 Other Features	Neck Cutoff:	0	5.4 Stream Ford or Animal Crossing:	No		
Mid:	1	Delta:	1	Flood chutes:	1	Avulsion:	0	5.5 Straightening:	Straightening
Point:	1	Island:	0	5.3 Steep Riffles and Head Cuts		Head Cuts:	0	Straightening Length (ft.):	317
Side:	1	Braiding:	0	Steep Riffles:	1	Trib Rejuv.:	No	5.5 Dredging:	None

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	0	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	0.00				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Confined	Score	STD	Historic		
7.1 Channel Degradation		10	None	Yes	Geomorphic Rating	0.59
7.2 Channel Aggradation		15	None	No	Channel Evolution Model	F
7.3 Widening Channel		9	None	No	Channel Evolution Stage	III
7.4 Change in Planforml		13	None	No	Geomorphic Condition	Fair
Total Score		47			Stream Sensitivity	High

Phase 2 Segment Summary Report Ompompanoosuc

Stream: **Ompompanoosuc River**
Reach: **R08-D**
Segment Length(ft): **1,192**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Bear Creek Environmental**
Observers: **Pam, Emily**
Completion Date: **7/31/2012**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**
Why Not Assessed: **bedrock gorge**

Step 0 - Location: **This segment begins just below a bedrock gorge (swimming area) and continues 1,192 feet upstream through the gorge and a grade control area. The segment ends at a bridge used for the Mystery Trail.**

Step 5 - Notes: **Segment not assessed because of large grade control area/bedrock gorge. Mystery Trail bridge is located in this segment; however, the constriction and associated problems are associated with the bedrock outcrop underneath and below the bridge (constriction width: 40').**

Step 7 - Narrative:

Step 1. Valley and Floodplain

1.1 Segmentation: **Grade Controls**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

	Length (ft)	One Height	Both	Height
Berm:	0		0	
Road:	1,030	0	0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	0		0	

1.4 Adjacent Side	Left	Right
Hillside Slope:	Extr.Steep	Extr.Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	N.E.	N.E.

1.5 Valley Features
Valley Width (ft): **137**
Width Determination: **Measured**
Confinement Type: **NC**
In Rock Gorge: **Yes**
Human Caused Change in Valley Width?: **No**

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	0.0	0.0	Yes	
Ledge	Mid-segment	0.0	0.0	Yes	
Ledge	Mid-segment	8.0	4.0	Yes	
Ledge	Mid-segment	12.0	8.0	Yes	
Ledge	Mid-segment	0.0	0.0	Yes	

Stream: **Ompompanoosuc River** Reach: **R08-D**

Step 2. Stream Channel

2.1Bankfull Width (ft.):		2.11 Riffle/Step Spacing:		2.13 Average Largest Particle on Bed:	
2.2 Max Depth (ft.):		2.12 Substrate Composition		Bar:	
2.3 Mean Depth (tf):		Bedrock:	%	2.14 Stream Type	
2.4 Floodprone Width (ft.):		Boulder:	%	Stream Type:	**B**
2.5 Aband. Floodpn (ft.):		Cobble:	%	Bed Material:	**Cobble**
Human Elev FloodPln (ft.):		Coarse Gravel:	%	Subclass Slope:	**c**
2.6 Width/Depth Ratio:	**0.00**	Fine Gravel:	%	Bed Form:	**Step-Pool**
2.7 Entrenchment Ratio:	**0.00**	Sand:	%	Field Measured Slope:	
2.8 Incision Ratio:	**0.00**	Silt and Smaller:	%	2.15 Sub-reach Stream Type	
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:		Reference Stream Type:	**B**
2.9 Sinuosity:		Detritus:	**0.0 %**	Reference Bed Material:	**Cobble**
2.10 Riffles Type:		# Large Woody Debris:		Reference Subclass Slope:	**c**
				Reference Bedform:	**Step-Pool**

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**143.4**	**0.0**	Dominant:	**Deciduous**	**Deciduous**
Material Type:	**Bedrock**	**Bedrock**	Erosion Height (ft.):	**5.0**	**0.0**	Sub-dominant:	**None**	**None**
Consistency:	**Cohesive**	**Cohesive**	Revetment Type:	**None**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**117.3**	Canopy %:	**76-100**	**76-100**
Material Type:	**Bedrock**	**Bedrock**				Mid-Channel Canopy:	**Open**	
Consistency:	**Cohesive**	**Cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**51-100**	**None**
W less than 25	**0**	**0**
Buffer Vegitation Type		
Dominant	**Deciduous**	**Deciduous**
Sub-Dominant	**None**	**None**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Forest**	Mass Failures		
Sub-dominant	**Residential**	**Residential**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **Ompompanoosuc River** Reach: **R08-D**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**None**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:	**None**	Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bedrock Outcrops	**43.5**	**No**	**Yes**	**Yes**	**No**	**Scour Above,Scour Below**
Bedrock Outcrops	**40**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Deposition Below,Scour Above,Scour Below**
Bedrock Outcrops	**20**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Scour Below**
Bedrock Outcrops	**48**	**No**	**Yes**	**Yes**	**No**	**Scour Above**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**0**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**1**	Delta:	**0**	Flood chutes:	**0**	Avulsion:	**0**	5.5 Straightening:	**None**
Point:	**1**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**0**
Side:	**1**	Braiding:	**0**	Steep Riffles:	**0**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradiant Type	Left	Right
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score:	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating:				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Score	STD	Historic		
7.1 Channel Degradation				Geomorphic Rating	
7.2 Channel Aggradation				Channel Evolution Model	
7.3 Widening Channel				Channel Evolution Stage	
7.4 Change in Planforml				Geomorphic Condition	**Good**
Total Score				Stream Sensitivity	

Phase 2 Segment Summary Report Ompompanoosuc

Stream: **Ompompanoosuc River**
Reach: **R09-0**
Segment Length(ft): **1,765**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Bear Creek Environmental**
Observers: **Pam, Emily**
Completion Date: **7/24/2012**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **This reach begins at the Mystery Trail bridge and continues 1,765 feet upstream through a wide valley. The reach ends as the valley narrows significantly again.**

Step 5 - Notes: **Although no rip rap observed in field, this segment was likely historically straightened because of the road in the east corridor and the agricultural field in the west corridor. Based on the fact that the reach has likely been historically straightened and sinuosity modified, it is difficult to tell whether the reference stream type is an E or C. We have kept this reach as a C by reference based on field observations. Large class 2 wetland on river right; however, high banks limit hydrologic connectivity.**

Step 7 - Narrative: **Early F-III. Major historic degradation; beginning to widen as seen through extensive bank erosion, especially on right bank. Planform adjustment is currently minor, but as erosion continues on outside bends it will likely become a major process. Flow was higher on this day and bars were not evident. Minor aggradation.**

Step 1. Valley and Floodplain

1.1 Segmentation: **None**

1.2 Alluvial Fan: **None**

1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	1,758	0	0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	0		0	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Steep	Hilly
Continuous w/ Bank:	Never	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	N.E.	N.E.

1.5 Valley Features

Valley Width (ft): **912**
Width Determination: **Measured**
Confinement Type: **VB**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **No**

1.6 Grade Controls: **None**

Stream: **Ompompanoosuc River** Reach: **R09-0**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**68.50**	2.11 Riffle/Step Spacing:	**551 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**4.60**	2.12 Substrate Composition		Bed:	**13.9**	**inches**
2.3 Mean Depth (tf):	**4.07**	Bedrock:	**0.0 %**	Bar:	**3.16**	**inches**
2.4 Floodprone Width (ft.):	**327.20**	Boulder:	**0.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**6.90**	Cobble:	**28.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**45.0 %**	Bed Material:	**Gravel**	
2.6 Width/Depth Ratio:	**16.83**	Fine Gravel:	**12.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**4.78**	Sand:	**8.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.50**	Silt and Smaller:	**7.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**0.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Complete**	# Large Woody Debris:	**28**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**271.7**	**837.6**	Dominant:	**Shrubs/Sapling**	**Herbaceous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**4.6**	**5.0**	Sub-dominant:	**Herbaceous**	**Shrubs/Sapling**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**86.5**	Canopy %:	**26-50**	**1-25**
Material Type:	**Mix**	**Mix**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**51-100**	**0-25**
Sub-Dominant	**>100**	**>100**
W less than 25	**266**	**1,418**
Buffer Vegitation Type		
Dominant	**Deciduous**	**Shrubs/Sapling**
Sub-Dominant	**Shrubs/Sapling**	**Herbaceous**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Shrubs/Sapling**	Mass Failures		
Sub-dominant	**Residential**	**Pasture**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **Ompompanoosuc River** Reach: **R09-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Abundant**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:	**None**	Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**0**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**0**	Delta:	**1**	Flood chutes:	**0**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**1**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**1,729**
Side:	**2**	Braiding:	**0**	Steep Riffles:	**0**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**8**	**None**	**Yes**	Geomorphic Rating	**0.63**
7.2 Channel Aggradation		**17**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**12**	**None**	**No**	Channel Evolution Stage	**II**
7.4 Change in Planforml		**13**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**50**			Stream Sensitivity	**Very High**

Phase 2 Segment Summary Report Ompompanoosuc

Stream: Ompompanoosuc River
Reach: R10-A
Segment Length(ft): 2,279
Rain: No

SGAT Version: 4.56
Organization: Bear Creek Environmental
Observers: Pam, Emily
Completion Date: 7/16/2012
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional

Step 0 - Location: **This segment begins in a very short (450 feet) confined section and continues 2,279 upstream through a 'narrow' valley. The segment ends as the valley narrows again and becomes 'semi-confined.'**

Step 5 - Notes: **Lower end of segment (approximately 450 feet) is narrowly confined.**

Step 7 - Narrative: **Minor historic degradation. Minor aggradation although some mid channel bars and diagonal bars. Widening is minor and due to some localized areas of erosion mostly on the left bank. Planform adjustment score is minor - channel straightening along the road limits natural planform adjustment in this segment.**

Step 1. Valley and Floodplain

1.1 Segmentation: Valley Width
1.2 Alluvial Fan: None
1.3 Corridor Encroachments:

Length (ft)	One Height	Both Height
Berm:	0	0
Road:	1,638 0	0
Railroad:	0	0
Imp. Path:	0	0
Dev.:	0	0

1.4 Adjacent Side	Left	Right
Hillside Slope:	Very Steep	Very Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	Sand	Sand

1.5 Valley Features	
Valley Width (ft):	388
Width Determination:	Measured
Confinement Type:	NW
In Rock Gorge:	No
Human Caused Change in Valley Width?:	No

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	3.0	1.0	Yes	

Stream: **Ompompanoosuc River** Reach: **R10-A**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**75.40**	2.11 Riffle/Step Spacing:	**282 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**5.10**	2.12 Substrate Composition		Bed:	**15.4**	**inches**
2.3 Mean Depth (tf):	**3.73**	Bedrock:	**2.0 %**	Bar:	**5.6**	**inches**
2.4 Floodprone Width (ft.):	**132.20**	Boulder:	**14.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**6.70**	Cobble:	**44.0 %**	Stream Type:	**B**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**21.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**20.21**	Fine Gravel:	**3.0 %**	Subclass Slope:	**c**	
2.7 Entrenchment Ratio:	**1.75**	Sand:	**14.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.31**	Silt and Smaller:	**2.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**0.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Complete**	# Large Woody Debris:	**21**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Moderate**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**637.3**	**161.1**	Dominant:	**Deciduous**	**Deciduous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**4.0**	**4.0**	Sub-dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**None**	Bank Canopy		
Lower			Revetment Length:	**32.2**	**0.0**	Canopy %:	**26-50**	**76-100**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**26-50**	**None**
W less than 25	**688**	**0**
Buffer Vegitation Type		
Dominant	**Shrubs/Sapling**	**Mixed Trees**
Sub-Dominant	**Mixed Trees**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Forest**	Mass Failures		
Sub-dominant	**Residential**	**None**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **Ompompanoosuc River** Reach: **R10-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Abundant**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Low**	Impoundments:	**None**	Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**1**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**1**	Delta:	**1**	Flood chutes:	**1**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**2**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**432**
Side:	**2**	Braiding:	**0**	Steep Riffles:	**1**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**14**	**None**	**Yes**	Geomorphic Rating	**0.69**
7.2 Channel Aggradation		**12**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**14**	**None**	**No**	Channel Evolution Stage	**III**
7.4 Change in Planforml		**15**	**None**	**No**	Geomorphic Condition	**Good**
Total Score		**55**			Stream Sensitivity	**Moderate**

Phase 2 Segment Summary Report Ompompanoosuc

Stream: Ompompanoosuc River
Reach: R10-B
Segment Length(ft): 2,094
Rain: No

SGAT Version: 4.56
Organization: Bear Creek Environmental
Observers: Pam, Emily
Completion Date: 7/16/2012
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional

Step 0 - Location: **This segment begins as the valley changes from 'narrow' to 'semi-confined' and continues 2,094 feet upstream to about 400 feet below the Tucker Hill Road bridge.**

Step 5 - Notes: **The very top of this segment is a short braided section just below the bedrock grade control segment that was not assessed (R10-C). There is a short (~400 feet) area of this segment that is "narrow." The rest is "semi-confined."**

Step 7 - Narrative: **Channel is mostly stable throughout except for upstream section, which is braided due to island formation. This is just downstream from grade control segment (R10-C) and probably formed islands due to sharp change in slope. The rest of the segment is not as wide and in good condition. Minor widening and planform as well as aggradation. No incision. Widening and planform change is major in braided section and has contributed to the minor scores throughout the segment.**

Step 1. Valley and Floodplain

1.1 Segmentation: Valley Width
1.2 Alluvial Fan: None
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	0		0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	0		0	

1.4 Adjacent Side	Left	Right
Hillside Slope:	Very Steep	Extr.Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	Sand	Sand

1.5 Valley Features
Valley Width (ft): 235
Width Determination: Measured
Confinement Type: SC
In Rock Gorge: No
Human Caused Change in Valley Width?: No

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	4.0	2.0	Yes	
Ledge	Mid-segment	3.0	1.0	Yes	
Ledge	Mid-segment	2.0	1.0	Yes	

Stream: **Ompompanoosuc River** Reach: **R10-B**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**68.50**	2.11 Riffle/Step Spacing:	**237 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**5.70**	2.12 Substrate Composition		Bed:	**17.9**	**inches**
2.3 Mean Depth (tf):	**4.69**	Bedrock:	**2.0 %**	Bar:	**6.4**	**inches**
2.4 Floodprone Width (ft.):	**97.90**	Boulder:	**11.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**5.70**	Cobble:	**35.0 %**	Stream Type:	**B**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**17.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**14.61**	Fine Gravel:	**15.0 %**	Subclass Slope:	**c**	
2.7 Entrenchment Ratio:	**1.43**	Sand:	**20.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.00**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**0.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Complete**	# Large Woody Debris:	**56**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**183.7**	**66.0**	Dominant:	**Deciduous**	**Deciduous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**4.0**	**1.3**	Sub-dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**None**	Bank Canopy		
Lower			Revetment Length:	**26.3**	**0.0**	Canopy %:	**76-100**	**76-100**
Material Type:	**Mix**	**Mix**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**None**	**None**
W less than 25	**0**	**0**
Buffer Vegitation Type		
Dominant	**Mixed Trees**	**Mixed Trees**
Sub-Dominant	**Shrubs/Sapling**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Forest**	**Forest**
Sub-dominant	**None**	**None**
(Legacy)	Amount	Mean Hieght
Failures	**None**	
Gullies	**None**	

	Left	Right
Mass Failures		
Height		
Gullies Number	**0**	
Gullies Length	**0**	

Stream: **Ompompanoosuc River** Reach: **R10-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Abundant**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Low**	Impoundments:	**None**	Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**2**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:	**No**		
Mid:	**1**	Delta:	**1**	Flood chutes:	**1**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**0**	Island:	**2**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**609**
Side:	**7**	Braiding:	**1**	Steep Riffles:	**2**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Confined**	Score	STD	Historic		
7.1 Channel Degradation		**18**	**None**	**No**	Geomorphic Rating	**0.71**
7.2 Channel Aggradation		**14**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**12**	**None**	**No**	Channel Evolution Stage	**I**
7.4 Change in Planforml		**13**	**None**	**No**	Geomorphic Condition	**Good**
Total Score		**57**			Stream Sensitivity	**Moderate**

Phase 2 Segment Summary Report Ompompanoosuc

Stream: Ompompanoosuc River
Reach: R10-C
Segment Length(ft): 576
Rain: No

SGAT Version: 4.56
Organization: Bear Creek Environmental
Observers: Pam, Emily
Completion Date: 7/16/2012
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional
Why Not Assessed: Other (to be explained in comments)

Step 0 - Location: **This segment begins about 400 feet below the Tucker Hill Road bridge and continues 576 feet upstream through a steep grade control area. The segment ends at the reach break about 130 feet upstream of the bridge.**

Step 5 - Notes: **Segment is not assessed because of a steep grade control/waterfall area below Tucker Hill Road bridge. Short area above grade control area is straightened (around Tucker Hill Road bridge). The FIT input - armoring - downstream of Tucker Hill Road bridge is hard bank armoring - an old abutment.**

Step 7 - Narrative:

Step 1. Valley and Floodplain

1.1 Segmentation: Grade Controls
1.2 Alluvial Fan: None
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	0		0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	273		255	

1.4 Adjacent Side	Left	Right
Hillside Slope:	Extr.Steep	Extr.Steep
Continuous w/ Bank:	Never	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	N.E.	N.E.

1.5 Valley Features
Valley Width (ft): 188
Width Determination: Measured
Confinement Type: SC
In Rock Gorge: Yes
Human Caused Change in Valley Width?: No

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	6.0	5.0	Yes	
Waterfall	Mid-segment	23.0	20.0	Yes	

Stream: **Ompompanoosuc River** Reach: **R10-C**

Step 2. Stream Channel

2.1Bankfull Width (ft.):		2.11 Riffle/Step Spacing:		2.13 Average Largest Particle on Bed:	
2.2 Max Depth (ft.):		2.12 Substrate Composition		Bar:	
2.3 Mean Depth (tf):		Bedrock:	%	2.14 Stream Type	
2.4 Floodprone Width (ft.):		Boulder:	%	Stream Type:	**A**
2.5 Aband. Floodpn (ft.):		Cobble:	%	Bed Material:	**Bedrock**
Human Elev FloodPln (ft.):		Coarse Gravel:	%	Subclass Slope:	
2.6 Width/Depth Ratio:	**0.00**	Fine Gravel:	%	Bed Form:	**Cascade**
2.7 Entrenchment Ratio:	**0.00**	Sand:	%	Field Measured Slope:	
2.8 Incision Ratio:	**0.00**	Silt and Smaller:	%	2.15 Sub-reach Stream Type	
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:		Reference Stream Type:	
2.9 Sinuosity:		Detritus:	**0.0 %**	Reference Bed Material:	
2.10 Riffles Type:		# Large Woody Debris:		Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**0.0**	**52.6**	Dominant:	**Deciduous**	**Deciduous**
Material Type:	**Bedrock**	**Bedrock**	Erosion Height (ft.):	**0.0**	**4.0**	Sub-dominant:	**Shrubs/Sapling**	**None**
Consistency:	**Cohesive**	**Cohesive**	Revetment Type:	**Multiple**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**229.5**	**35.2**	Canopy %:	**76-100**	**76-100**
Material Type:	**Bedrock**	**Bedrock**				Mid-Channel Canopy:	**Open**	
Consistency:	**Cohesive**	**Cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**51-100**	**51-100**
W less than 25	**0**	**0**
Buffer Vegitation Type		
Dominant	**Mixed Trees**	**Mixed Trees**
Sub-Dominant	**Shrubs/Sapling**	**None**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Forest**	Mass Failures		
Sub-dominant	**Residential**	**Residential**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **Ompompanoosuc River** Reach: **R10-C**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Abundant**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch: **0**	Road Ditch: **2**
4.3 Flow Status:	**Low**	Impoundments:	**None**	Other: **0**	Tile Drain: **0**
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow: **0**	Urb Strm Wtr Pipe: **0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bedrock Outcrops	**56**	**Yes**	**No**	**Yes**	**Yes**	**None**
Bridge	**108**	**Yes**	**Yes**	**No**	**Yes**	**Deposition Below,Scour Below**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**0**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**1**	Delta:	**0**	Flood chutes:	**1**	Avulsion:	**0**	5.5 Straightening:		**Straightening**
Point:	**0**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):		**195**
Side:	**3**	Braiding:	**0**	Steep Riffles:	**0**	Trib Rejuv.:	**No**	5.5 Dredging:		**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:		6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:					
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Score	STD	Historic		
7.1 Channel Degradation				Geomorphic Rating	
7.2 Channel Aggradation				Channel Evolution Model	
7.3 Widening Channel				Channel Evolution Stage	
7.4 Change in Planforml				Geomorphic Condition	**Good**
Total Score				Stream Sensitivity	

Phase 2 Segment Summary Report Ompompanoosuc

Stream: Ompompanoosuc River
Reach: R11-A
Segment Length(ft): 4,038
Rain: No

SGAT Version: 4.56
Organization: Bear Creek Environmental
Observers: Pam, Emily
Completion Date: 7/16/2012
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional

Step 0 - Location: **This segment begins about 130 feet upstream of the Tucker Hill Road bridge and continues 4,038 feet upstream through a generally broad valley, which is forested. The segment ends as the eastern corridor changes from forested to a hay field.**

Step 5 - Notes: **Phase 1 assessment indicates that there was a channel avulsion in this segment. This was not observed in the field. Wetlands are present in this segment as well as beaver activity.**

Step 7 - Narrative: **Major historic incision which has led to major widening. Aggradation is also major as seen through high bars and soft underfoot towards downstream end of segment. Major planform adjustment. Early F-IV. Phase 1 assessment indicates that there was a channel avulsion - this was not seen in the field, but was taken into consideration for the RGA.**

Step 1. Valley and Floodplain

1.1 Segmentation: Banks and Buffers
1.2 Alluvial Fan: None
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	0		0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	0		0	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Very Steep	Extr.Steep
Continuous w/ Bank:	Sometimes	Never
Within 1 Bankfull W:	Sometimes	Never
Texture:	Sand	Sand

1.5 Valley Features
Valley Width (ft): 702
Width Determination: Measured
Confinement Type: BD
In Rock Gorge: No
Human Caused Change in Valley Width?: No

1.6 Grade Controls: None

Stream: **Ompompanoosuc River** Reach: **R11-A**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**66.80**	2.11 Riffle/Step Spacing:	**691 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**5.20**	2.12 Substrate Composition		Bed:	**4.3**	**inches**
2.3 Mean Depth (tf):	**3.30**	Bedrock:	**0.0 %**	Bar:	**3.2**	**inches**
2.4 Floodprone Width (ft.):	**900.00**	Boulder:	**0.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**8.60**	Cobble:	**2.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**44.0 %**	Bed Material:	**Gravel**	
2.6 Width/Depth Ratio:	**20.24**	Fine Gravel:	**30.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**13.47**	Sand:	**18.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.65**	Silt and Smaller:	**6.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**Yes**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**High**	Detritus:	**0.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**90**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**594.0**	**1,018.0**	Dominant:	**Deciduous**	**Shrubs/Sapling**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**4.0**	**4.0**	Sub-dominant:	**Shrubs/Sapling**	**Deciduous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**34.1**	**179.2**	Canopy %:	**51-75**	**51-75**
Material Type:	**Sand**	**Sand**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**51-100**	**51-100**
W less than 25	**0**	**0**
Buffer Vegitation Type		
Dominant	**Shrubs/Sapling**	**Shrubs/Sapling**
Sub-Dominant	**Deciduous**	**Invasives**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Forest**	Mass Failures	**72.21**	
Sub-dominant	**Hay**	**None**	Height	**60.0**	
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**One**	**60.0**	Gullies Length	**0**	
Gullies	**None**				

Stream: **Ompompanoosuc River** Reach: **R11-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Low**	Impoundments:	**None**	Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**1**	5.2 Other Features		Neck Cutoff:	**1**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**2**	Delta:	**0**	Flood chutes:	**1**	Avulsion:	**1**	5.5 Straightening:	**Straightening**
Point:	**7**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**366**
Side:	**4**	Braiding:	**0**	Steep Riffles:	**1**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**8**	**None**	**Yes**	Geomorphic Rating	**0.45**
7.2 Channel Aggradation		**10**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**9**	**None**	**No**	Channel Evolution Stage	**III**
7.4 Change in Planforml		**9**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**36**			Stream Sensitivity	**Very High**

Phase 2 Segment Summary Report Ompompanoosuc

Stream: Ompompanoosuc River
Reach: R11-B
Segment Length(ft): 2,646
Rain: No

SGAT Version: 4.56
Organization: Bear Creek Environmental
Observers: Pam, Emily
Completion Date: 7/12/2012
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional

Step 0 - Location: **This segment begins where the eastern corridor changes from forest to a hay field and continues 2,646 feet upstream through a very broad valley.**

Step 5 - Notes: **Invasive Japanese knotweed along left bank. Right bank has invasive honeysuckle. Banks have more shrubs than trees.**

Step 7 - Narrative: **Major historic incision which led to major widening and aggradation. Large bars are greater than 1/2 bankfull. Beginning to develop a juvenile floodplain. Extensive erosion on outside bends.**

Step 1. Valley and Floodplain

1.1 Segmentation: Channel Dimensions
1.2 Alluvial Fan: None
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	0		0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	0		0	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Hilly	Extr.Steep
Continuous w/ Bank:	Never	Sometimes
Within 1 Bankfull W:	Never	Sometimes
Texture:	N.E.	Sand

1.5 Valley Features

Valley Width (ft):	904
Width Determination:	Measured
Confinement Type:	VB
In Rock Gorge:	No
Human Caused Change in Valley Width?:	No

1.6 Grade Controls: None

Stream: **Ompompanoosuc River** Reach: **R11-B**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**64.00**	2.11 Riffle/Step Spacing:	**246 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**4.90**	2.12 Substrate Composition		Bed:	**3.3**	**inches**
2.3 Mean Depth (tf):	**3.16**	Bedrock:	**0.0 %**	Bar:	**2.14**	**inches**
2.4 Floodprone Width (ft.):	**300.00**	Boulder:	**0.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**8.60**	Cobble:	**0.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**30.0 %**	Bed Material:	**Gravel**	
2.6 Width/Depth Ratio:	**20.25**	Fine Gravel:	**35.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**4.69**	Sand:	**35.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.76**	Silt and Smaller:	**%**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**Yes**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**High**	Detritus:	**0.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**43**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**1,070.0**	**497.7**	Dominant:	**Herbaceous**	**Herbaceous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**4.5**	**4.2**	Sub-dominant:	**Invasives**	**Invasives**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**None**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**0.0**	Canopy %:	**1-25**	**26-50**
Material Type:	**Sand**	**Sand**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**51-100**	**>100**
Sub-Dominant	**26-50**	**None**
W less than 25	**218**	**0**
Buffer Vegitation Type		
Dominant	**Herbaceous**	**Deciduous**
Sub-Dominant	**Shrubs/Sapling**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Hay**	**Forest**	Mass Failures		**232.8**
Sub-dominant	**Forest**	**None**	Height		**70.0**
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**One**	**70.0**	Gullies Length	**0**	
Gullies	**None**				

Stream: **Ompompanoosuc River** Reach: **R11-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Low**	Impoundments:	**None**	Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**2**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:	**No**		
Mid:	**1**	Delta:	**0**	Flood chutes:	**4**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**6**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**383**
Side:	**3**	Braiding:	**0**	Steep Riffles:	**2**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**10**	**None**	**Yes**	Geomorphic Rating	**0.46**
7.2 Channel Aggradation		**7**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**9**	**None**	**No**	Channel Evolution Stage	**IV**
7.4 Change in Planforml		**11**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**37**			Stream Sensitivity	**Very High**

Phase 2 Segment Summary Report Ompompanoosuc

Stream: **Ompompanoosuc River**
Reach: **R11-C**
Segment Length(ft): **2,755**
Rain: **No**

SGAT Version: **4.56**
Organization: **Bear Creek Environmental**
Observers: **Pam, Emily**
Completion Date: **7/12/2012**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **This segment begins as the valley narrows slightly (changing from very broad to broad) and continues 2,755 feet upstream to where the valley narrows again. The segment ends approximately 800 feet downstream of the Sawnee Bean Road bridge.**

Step 5 - Notes:

Step 7 - Narrative: **Early F-III. Minor incision, currently widening - renter says right bank is eating its way towards his house. low w/d ratio. Planform adjutment is major due to extensive historic channel straightening for agriculture.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Channel Dimensions**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	1,118	0	0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	736		108	

1.4 Adjacent Side	Left	Right
Hillside Slope:	Steep	Extr.Steep
Continuous w/ Bank:	Never	Never
Within 1 Bankfull W:	Never	Never
Texture:	N.E.	N.E.

1.5 Valley Features	
Valley Width (ft):	670
Width Determination:	Measured
Confinement Type:	BD
In Rock Gorge:	No
Human Caused Change in Valley Width?:	No

1.6 Grade Controls: **None**

Stream: **Ompompanoosuc River** Reach: **R11-C**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**64.00**	2.11 Riffle/Step Spacing:	**349 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**3.90**	2.12 Substrate Composition		Bed:	**15.8**	**inches**
2.3 Mean Depth (tf):	**3.03**	Bedrock:	**0.0 %**	Bar:	**7.14**	**inches**
2.4 Floodprone Width (ft.):	**650.00**	Boulder:	**0.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**4.80**	Cobble:	**44.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**31.0 %**	Bed Material:	**Gravel**	
2.6 Width/Depth Ratio:	**21.12**	Fine Gravel:	**15.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**10.16**	Sand:	**10.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.23**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Moderate**	Detritus:	**0.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**31**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**340.2**	**287.4**	Dominant:	**Invasives**	**Deciduous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**4.7**	**4.6**	Sub-dominant:	**Deciduous**	**Invasives**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**None**	Bank Canopy		
Lower			Revetment Length:	**212.8**	**0.0**	Canopy %:	**1-25**	**51-75**
Material Type:	**Gravel**	**Gravel**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**26-50**	**>100**
Sub-Dominant	**0-25**	**0-25**
W less than 25	**868**	**175**
Buffer Vegitation Type		
Dominant	**Herbaceous**	**Deciduous**
Sub-Dominant	**Deciduous**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Hay**	**Forest**	Mass Failures		
Sub-dominant	**Residential**	**Residential**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **Ompompanoosuc River** Reach: **R11-C**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Low**	Impoundments:	**None**	Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**5**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**2**	Delta:	**0**	Flood chutes:	**0**	Avulsion:	**0**	5.5 Straightening:		**Straightening**
Point:	**1**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):		**1,273**
Side:	**10**	Braiding:	**0**	Steep Riffles:	**6**	Trib Rejuv.:	**No**	5.5 Dredging:		**Gravel Mining**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**13**	**None**	**Yes**	Geomorphic Rating	**0.57**
7.2 Channel Aggradation		**12**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**12**	**None**	**No**	Channel Evolution Stage	**III**
7.4 Change in Planforml		**9**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**46**			Stream Sensitivity	**Very High**

Phase 2 Segment Summary Report Ompompanoosuc

Stream: **Ompompanoosuc River**
Reach: **R11-D**
Segment Length(ft): **719**
Rain: **No**

SGAT Version: **4.56**
Organization: **Bear Creek Environmental**
Observers: **Pam, Emily**
Completion Date: **7/10/2012**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **This segment begins approximately 800 feet downstream of the Sawnee Bean Road bridge and continues 719 feet upstream through a narrowly confined valley. The segment ends approximately 50 feet below the Sawnee Bean Road bridge.**

Step 5 - Notes: **There is a driveway in the western corridor of this segment. At the time of the assessment, the landowner was using machinery to 'repair' the driveway. There was at least 1 road ditch to the river down from the driveway. The landowner seemed to be excavating material from the valley wall (to the west of his driveway). There were at least two mass failures in the valley wall. This segment is mostly an F stream type, but may be a B at the very downstream end.**

Step 7 - Narrative: **Channel has not incised. Stable segment, but evidence of erosion and mass failures may indicate minor widening. No planform adjustment. Minor aggradation as seen through mid channel bar and diagonal bars. Driveway encroaches right buffer and stormwater inputs are common on right bank from driveway.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Subreach**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

	Length (ft)	One Height	Both	Height
Berm:	0		0	
Road:	719	0	0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	0		0	

1.4 Adjacent Side	Left	Right
Hillside Slope:	Extr.Steep	Extr.Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	N.E.	N.E.

1.5 Valley Features

Valley Width (ft):	106
Width Determination:	Measured
Confinement Type:	NC
In Rock Gorge:	No
Human Caused Change in Valley Width?:	No

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	3.0	1.0	Yes	

Stream: **Ompompanoosuc River** Reach: **R11-D**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**67.20**	2.11 Riffle/Step Spacing:		2.13 Average Largest Particle on			
2.2 Max Depth (ft.):	**4.00**	2.12 Substrate Composition			Bed:	**15.4**	**inches**
2.3 Mean Depth (tf):	**2.92**	Bedrock:	**15.0 %**		Bar:	**7.7**	**inches**
2.4 Floodprone Width (ft.):	**78.00**	Boulder:	**13.0 %**	2.14 Stream Type			
2.5 Aband. Floodpn (ft.):	**4.00**	Cobble:	**30.0 %**	Stream Type:	**F**		
Human Elev FloodPln (ft.):		Coarse Gravel:	**21.0 %**	Bed Material:	**Cobble**		
2.6 Width/Depth Ratio:	**23.01**	Fine Gravel:	**8.0 %**	Subclass Slope:	**None**		
2.7 Entrenchment Ratio:	**1.16**	Sand:	**13.0 %**	Bed Form:	**Riffle-Pool**		
2.8 Incision Ratio:	**1.00**	Silt and Smaller:	**0.0 %**	Field Measured Slope:			
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type			
2.9 Sinuosity:	**Low**	Detritus:	**0.0 %**	Reference Stream Type:	**F**		
2.10 Riffles Type:	**Complete**	# Large Woody Debris:	**37**	Reference Bed Material:	**Cobble**		
				Reference Subclass Slope:	**None**		
				Reference Bedform:	**Riffle-Pool**		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**263.9**	**89.2**	Dominant:	**Coniferous**	**Coniferous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**5.0**	**5.0**	Sub-dominant:	**None**	**None**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**None**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**0.0**	Canopy %:	**76-100**	**51-75**
Material Type:	**Mix**	**Mix**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**26-50**
Sub-Dominant	**None**	**None**
W less than 25	**0**	**0**
Buffer Vegitation Type		
Dominant	**Coniferous**	**Mixed Trees**
Sub-Dominant	**None**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Forest**	Mass Failures	**20.83**	**38.72**
Sub-dominant	**Residential**	**Residential**	Height	**12.0**	**12.0**
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**Multiple**	**12.0**	Gullies Length	**0**	
Gullies	**None**				

Stream: **Ompompanoosuc River** Reach: **R11-D**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Abundant**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	**None**	Flow Reg. Use:		Field Ditch: **0**	Road Ditch: **1**
4.3 Flow Status:	**Low**	Impoundments:	**None**	Other: **0**	Tile Drain: **0**
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow: **0**	Urb Strm Wtr Pipe: **0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**1**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**1**	Delta:	**2**	Flood chutes:	**0**	Avulsion:	**0**	5.5 Straightening:		**None**
Point:	**0**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):		**0**
Side:	**5**	Braiding:	**0**	Steep Riffles:	**0**	Trib Rejuv.:	**No**	5.5 Dredging:		**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Confined**	Score	STD	Historic		
7.1 Channel Degradation		**18**	**None**	**No**	Geomorphic Rating	**0.80**
7.2 Channel Aggradation		**14**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**15**	**None**	**No**	Channel Evolution Stage	**I**
7.4 Change in Planforml		**17**	**None**	**No**	Geomorphic Condition	**Good**
Total Score		**64**			Stream Sensitivity	**High**

Phase 2 Segment Summary Report Ompompanoosuc

Stream: Ompompanoosuc River
Reach: R12-A
Segment Length(ft): 2,204
Rain: No

SGAT Version: 4.56
Organization: Bear Creek Environmental
Observers: Mary, Emily
Completion Date: 7/6/2012
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional

Step 0 - Location: **This segment begins approximately 50 feet below the Sawnee Bean Rd. bridge and continues 2,204 feet upstream through a semi-confined valley. The segment ends as the valley widens.**

Step 5 - Notes: **There are no photos for the cross section done in this segment because the camera got wet. No bridge assessment done because bridge is not a floodprone or channel constriction and is high above the river. The old abutment in that location and bedrock on the opposite bank are creating a channel constriction. The old abutment could be removed to alleviate the channel constriction.**

Step 7 - Narrative: **Minor planform adjustment and aggradation. Numerous ledge grade controls limiting vertical adjustment.**

Step 1. Valley and Floodplain

1.1 Segmentation: Valley Width
1.2 Alluvial Fan: None
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	2,086	0	0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	1,270		0	

1.4 Adjacent Side	Left	Right
Hillside Slope:	Very Steep	Extr.Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	N.E.	N.E.

1.5 Valley Features
Valley Width (ft): 171
Width Determination: Measured
Confinement Type: SC
In Rock Gorge: No
Human Caused Change in Valley Width?: No

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	5.0	3.0	Yes	
Ledge	Mid-segment	4.0	2.0	Yes	
Ledge	Mid-segment	4.0	1.0	Yes	
Ledge	Mid-segment	4.0	2.0	Yes	
Ledge	Mid-segment	5.0	3.0	Yes	
Ledge	Mid-segment	4.0	2.0	Yes	

Stream: **Ompompanoosuc River** Reach: **R12-A**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**84.50**	2.11 Riffle/Step Spacing:	**163 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**4.00**	2.12 Substrate Composition		Bed:	**22**	**inches**
2.3 Mean Depth (tf):	**2.97**	Bedrock:	**17.0 %**	Bar:	**6.4**	**inches**
2.4 Floodprone Width (ft.):	**119.10**	Boulder:	**9.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**4.00**	Cobble:	**33.0 %**	Stream Type:	**B**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**15.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**28.45**	Fine Gravel:	**8.0 %**	Subclass Slope:	**c**	
2.7 Entrenchment Ratio:	**1.41**	Sand:	**17.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.00**	Silt and Smaller:	**1.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**0.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Complete**	# Large Woody Debris:	**35**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**42.0**	**28.7**	Dominant:	**Coniferous**	**Deciduous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**4.0**	**4.0**	Sub-dominant:	**None**	**None**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**Multiple**	Bank Canopy		
Lower			Revetment Length:	**114.4**	**230.5**	Canopy %:	**76-100**	**76-100**
Material Type:	**Mix**	**Mix**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**None**	**None**
W less than 25	**44**	**55**
Buffer Vegitation Type		
Dominant	**Coniferous**	**Coniferous**
Sub-Dominant	**Deciduous**	**Deciduous**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Forest**	Mass Failures	**22.61**	
Sub-dominant	**Residential**	**Residential**	Height	**15.0**	
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**One**	**15.0**	Gullies Length	**0**	
Gullies	**None**				

Stream: **Ompompanoosuc River** Reach: **R12-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Abundant**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	**None**	Flow Reg. Use:		Field Ditch: **0**	Road Ditch: **2**
4.3 Flow Status:	**Moderate**	Impoundments:	**None**	Other: **0**	Tile Drain: **0**
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow: **1**	Urb Strm Wtr Pipe: **0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Other	**51**	**Yes**	**Yes**	**Yes**	**Yes**	**Scour Above,Scour Below**
Old Abutment	**67**	**Yes**	**Yes**	**Yes**	**No**	**Deposition Above,Scour Below**
Bridge	**90**	**Yes**	**Yes**	**No**	**No**	**None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**1**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**1**	Delta:	**0**	Flood chutes:	**0**	Avulsion:	**0**	5.5 Straightening:		**Straightening**
Point:	**0**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):		**161**
Side:	**10**	Braiding:	**0**	Steep Riffles:	**1**	Trib Rejuv.:	**No**	5.5 Dredging:		**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Confined**	Score	STD	Historic		
7.1 Channel Degradation		**19**	**None**	**No**	Geomorphic Rating	**0.79**
7.2 Channel Aggradation		**14**	**None**	**No**	Channel Evolution Model	**D**
7.3 Widening Channel		**17**	**None**	**No**	Channel Evolution Stage	**IIc**
7.4 Change in Planforml		**13**	**None**	**No**	Geomorphic Condition	**Good**
Total Score		**63**			Stream Sensitivity	**Moderate**

Phase 2 Segment Summary Report Ompompanoosuc

Stream: **Ompompanoosuc River**
Reach: **R12-B**
Segment Length(ft): **945**
Rain: **No**

SGAT Version: **4.56**
Organization: **Bear Creek Environmental**
Observers: **Mary, Emily**
Completion Date: **7/6/2012**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **This segment begins as the valley changed from semi-confined to narrow and continues 945 feet upstream to the confluence with Barker Brook.**

Step 5 - Notes: **There are no photos from the cross section done in this segment because the camera got wet.**

Step 7 - Narrative: **This segment has multiple bedrock grade controls that are channel spanning. The DIIc channel evolution model was selected because aggradation is a major adjustment process.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Valley Width**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	61	0	0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	0		0	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Extr.Steep	Extr.Steep
Continuous w/ Bank:	Sometimes	Never
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	N.E.	N.E.

1.5 Valley Features
Valley Width (ft): **327**
Width Determination: **Measured**
Confinement Type: **NW**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **No**

1.6 Grade Controls: **None**

Stream: **Ompompanoosuc River** Reach: **R12-B**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**73.00**	2.11 Riffle/Step Spacing:	**212 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**3.80**	2.12 Substrate Composition		Bed:	**13.8**	**inches**
2.3 Mean Depth (tf):	**2.81**	Bedrock:	**0.0 %**	Bar:	**5.3**	**inches**
2.4 Floodprone Width (ft.):	**113.70**	Boulder:	**5.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**3.80**	Cobble:	**52.0 %**	Stream Type:	**B**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**21.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**25.98**	Fine Gravel:	**15.0 %**	Subclass Slope:	**c**	
2.7 Entrenchment Ratio:	**1.56**	Sand:	**7.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.00**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**0.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Complete**	# Large Woody Debris:	**12**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**32.6**	**31.1**	Dominant:	**Coniferous**	**Deciduous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**30.0**	**4.0**	Sub-dominant:	**None**	**Invasives**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**None**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**0.0**	Canopy %:	**76-100**	**51-75**
Material Type:	**Mix**	**Mix**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**26-50**
Sub-Dominant	**None**	**>100**
W less than 25	**0**	**30**
Buffer Vegitation Type		
Dominant	**Coniferous**	**Herbaceous**
Sub-Dominant	**None**	**Deciduous**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Residential**	Mass Failures	**76.53**	
Sub-dominant	**None**	**Pasture**	Height	**30.0**	
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**One**	**30.0**	Gullies Length	**0**	
Gullies	**None**				

Stream: **Ompompanoosuc River** Reach: **R12-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Abundant**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**None**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:	**None**	Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**1**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**	
Mid:	**1**	Delta:	**1**	Flood chutes:	**1**	Avulsion:	**0**	5.5 Straightening:	**None**
Point:	**0**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**0**
Side:	**7**	Braiding:	**0**	Steep Riffles:	**0**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**18**	**None**	**No**	Geomorphic Rating	**0.70**
7.2 Channel Aggradation		**10**	**None**	**No**	Channel Evolution Model	**D**
7.3 Widening Channel		**15**	**None**	**No**	Channel Evolution Stage	**IIc**
7.4 Change in Planforml		**13**	**None**	**No**	Geomorphic Condition	**Good**
Total Score		**56**			Stream Sensitivity	**Moderate**

Phase 2 Segment Summary Report Ompompanoosuc

Stream: **Ompompanoosuc River**
Reach: **R13-0**
Segment Length(ft): **3,216**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Bear Creek Environmental**
Observers: **Mary, Emily**
Completion Date: **7/3/2012**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **This reach begins at the confluence with Barker Brook and continues 3,216 feet upstream.**

Step 5 - Notes: **There are no road crossings in this segment - the road (P24) is mapped incorrectly. Many confers along banks and within buffer. Stable banks with moss and vegetation. Invasive honeysuckle present.**

Step 7 - Narrative: **Minor aggradation.**

Step 1. Valley and Floodplain

1.1 Segmentation: **None**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

	Length (ft)	One Height	Both	Height
Berm:	0		0	
Road:	1,318	0	0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	983		0	

1.4 Adjacent Side	Left	Right
Hillside Slope:	Very Steep	Extr.Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	Sand	Sand

1.5 Valley Features	
Valley Width (ft):	209
Width Determination:	Measured
Confinement Type:	SC
In Rock Gorge:	No

Human Caused Change in Valley Width?: **No**

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	4.0	2.0	Yes	
Ledge	Mid-segment	5.0	3.0	Yes	

Stream: **Ompompanoosuc River** Reach: **R13-0**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**58.80**	2.11 Riffle/Step Spacing:	**380 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**4.40**	2.12 Substrate Composition		Bed:	**13**	**inches**
2.3 Mean Depth (tf):	**3.62**	Bedrock:	**3.0 %**	Bar:	**5.2**	**inches**
2.4 Floodprone Width (ft.):	**98.20**	Boulder:	**10.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**4.40**	Cobble:	**31.0 %**	Stream Type:	**B**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**26.0 %**	Bed Material:	**Gravel**	
2.6 Width/Depth Ratio:	**16.24**	Fine Gravel:	**13.0 %**	Subclass Slope:	**c**	
2.7 Entrenchment Ratio:	**1.67**	Sand:	**15.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.00**	Silt and Smaller:	**2.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**0.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Complete**	# Large Woody Debris:	**63**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**101.7**	**197.6**	Dominant:	**Coniferous**	**Coniferous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**4.0**	**4.0**	Sub-dominant:	**None**	**None**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**None**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**0.0**	Canopy %:	**76-100**	**76-100**
Material Type:	**Gravel**	**Gravel**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**51-100**	**0-25**
W less than 25	**0**	**318**
Buffer Vegitation Type		
Dominant	**Coniferous**	**Coniferous**
Sub-Dominant	**Herbaceous**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Forest**	Mass Failures		**52**
Sub-dominant	**Residential**	**Residential**	Height		**30.0**
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**One**	**30.0**	Gullies Length	**0**	
Gullies	**None**				

Stream: **Ompompanoosuc River** Reach: **R13-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Abundant**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**None**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**1**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:	**No**		
Mid:	**1**	Delta:	**1**	Flood chutes:	**0**	Avulsion:	**0**	5.5 Straightening:	**None**
Point:	**0**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**0**
Side:	**19**	Braiding:	**0**	Steep Riffles:	**1**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Confined**	Score	STD	Historic		
7.1 Channel Degradation		**18**	**None**	**No**	Geomorphic Rating	**0.80**
7.2 Channel Aggradation		**14**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**16**	**None**	**No**	Channel Evolution Stage	**I**
7.4 Change in Planforml		**16**	**None**	**No**	Geomorphic Condition	**Good**
Total Score		**64**			Stream Sensitivity	**High**

Phase 2 Segment Summary Report Ompompanoosuc

Stream: **Ompompanoosuc River**
Reach: **R14-A**
Segment Length(ft): **4,693**
Rain: **No**

SGAT Version: **4.56**
Organization: **Bear Creek Environmental**
Observers: **Mary, Pam, Emily**
Completion Date: **7/5/2012**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **This segment begins at the reach break (R14) and continues 4,693 feet upstream through a semi-confined valley. The segment ends as the valley widens, becoming unconfined (narrow).**

Step 5 - Notes: **Segment has multiple channel spanning grade controls.**
Stable section with very steep to extremely steep valley walls. Moss or ledge along banks.

Step 7 - Narrative: **Segment is stable.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Valley Width**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	0		0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	99		0	

1.4 Adjacent Side	Left	Right
Hillside Slope:	Very Steep	Extr.Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	N.E.	N.E.

1.5 Valley Features	
Valley Width (ft):	218
Width Determination:	Measured
Confinement Type:	SC
In Rock Gorge:	No
Human Caused Change in Valley Width?:	No

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	5.0	4.0	Yes	
Ledge	Mid-segment	2.0	1.0	Yes	
Ledge	Mid-segment	0.0	0.0	Yes	
Ledge	Mid-segment	2.0	1.0	Yes	
Ledge	Mid-segment	0.0	0.0	Yes	
Ledge	Mid-segment	2.0	1.0	Yes	

Stream: **Ompompanoosuc River** Reach: **R14-A**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**74.00**	2.11 Riffle/Step Spacing:	**387 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**4.00**	2.12 Substrate Composition		Bed:	**16.1**	**inches**
2.3 Mean Depth (tf):	**3.13**	Bedrock:	**6.0 %**	Bar:	**5.9**	**inches**
2.4 Floodprone Width (ft.):	**155.00**	Boulder:	**24.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**4.00**	Cobble:	**55.0 %**	Stream Type:	**B**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**6.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**23.64**	Fine Gravel:	**5.0 %**	Subclass Slope:	**c**	
2.7 Entrenchment Ratio:	**2.09**	Sand:	**4.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.00**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**0.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Complete**	# Large Woody Debris:	**31**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**53.9**	**815.8**	Dominant:	**Coniferous**	**Coniferous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**4.0**	**4.0**	Sub-dominant:	**Herbaceous**	**Herbaceous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**None**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**0.0**	Canopy %:	**76-100**	**51-75**
Material Type:	**Mix**	**Mix**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**None**	**0-25**
W less than 25	**0**	**534**
Buffer Vegitation Type		
Dominant	**Coniferous**	**Coniferous**
Sub-Dominant	**None**	**Herbaceous**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Forest**	Mass Failures		
Sub-dominant	**None**	**Hay**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **Ompompanoosuc River** Reach: **R14-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Abundant**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**1**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:	**No**		
Mid:	**0**	Delta:	**0**	Flood chutes:	**0**	Avulsion:	**0**	5.5 Straightening:	**None**
Point:	**0**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**0**
Side:	**8**	Braiding:	**0**	Steep Riffles:	**1**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Confined**	Score	STD	Historic		
7.1 Channel Degradation		**18**	**None**	**No**	Geomorphic Rating	**0.88**
7.2 Channel Aggradation		**16**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**18**	**None**	**No**	Channel Evolution Stage	**I**
7.4 Change in Planforml		**18**	**None**	**No**	Geomorphic Condition	**Reference**
Total Score		**70**			Stream Sensitivity	**Moderate**

Phase 2 Segment Summary Report Ompompanoosuc

Stream: **Ompompanoosuc River**
Reach: **R14-B**
Segment Length(ft): **1,192**
Rain: **No**

SGAT Version: **4.56**
Organization: **Bear Creek Environmental**
Observers: **Mary, Pam, Emily**
Completion Date: **7/5/2012**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **This segment is the relatively short (compared with reach length) section of R14 that has a wider valley (narrow).**

Step 5 - Notes: **Invasive species include Japanese barberry and honeysuckle. Old junk yard in segment. Bedrock on banks and sandy substrate in runs. Although no armoring present, this segment was likely historically straightened adjacent to the field.**

Step 7 - Narrative: **Historic degradation. Reference stream type is C in this area with a broad valley. A 'C' to 'B' stream type departure exists. Minor widening and aggradation. Large diagonal bar. The bedrock grade control at the downstream end of this segment is maintaining some floodplain access in downstream areas. Localized incision has occurred in upstream areas.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Valley Width**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	0		0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	260		0	

1.4 Adjacent Side	Left	Right
Hillside Slope:	Extr.Steep	Steep
Continuous w/ Bank:	Sometimes	Never
Within 1 Bankfull W:	Sometimes	Never
Texture:	N.E.	N.E.

1.5 Valley Features	
Valley Width (ft):	540
Width Determination:	Measured
Confinement Type:	BD
In Rock Gorge:	No
Human Caused Change in Valley Width?:	No

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	0.0	0.0	Yes	

Stream: **Ompompanoosuc River** Reach: **R14-B**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**80.00**	2.11 Riffle/Step Spacing:	**1192 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**4.00**	2.12 Substrate Composition		Bed:	**13.2**	**inches**
2.3 Mean Depth (tf):	**3.27**	Bedrock:	**1.0 %**	Bar:	**N/A**	**inches**
2.4 Floodprone Width (ft.):	**152.60**	Boulder:	**7.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**6.10**	Cobble:	**36.0 %**	Stream Type:	**B**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**24.0 %**	Bed Material:	**Gravel**	
2.6 Width/Depth Ratio:	**24.46**	Fine Gravel:	**11.0 %**	Subclass Slope:	**c**	
2.7 Entrenchment Ratio:	**1.91**	Sand:	**10.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.52**	Silt and Smaller:	**3.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**0.0 %**	Reference Stream Type:	**C**	
2.10 Riffles Type:	**Not Applicable**	# Large Woody Debris:	**31**	Reference Bed Material:	**Gravel**	
				Reference Subclass Slope:	**None**	
				Reference Bedform:	**Riffle-Pool**	

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**97.3**	**262.0**	Dominant:	**Deciduous**	**Deciduous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**4.0**	**4.0**	Sub-dominant:	**None**	**None**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**None**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**0.0**	Canopy %:	**76-100**	**26-50**
Material Type:	**Mix**	**Mix**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**26-50**
Sub-Dominant	**None**	**>100**
W less than 25	**0**	**905**
Buffer Vegitation Type		
Dominant	**Mixed Trees**	**Herbaceous**
Sub-Dominant	**None**	**Mixed Trees**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Residential**	Mass Failures		
Sub-dominant	**None**	**Forest**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **Ompompanoosuc River** Reach: **R14-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**Abundant**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**1**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**0**	Delta:	**1**	Flood chutes:	**0**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**0**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**970**
Side:	**3**	Braiding:	**0**	Steep Riffles:	**0**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**10**	**C to B**	**Yes**	Geomorphic Rating	**0.61**
7.2 Channel Aggradation		**13**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**12**	**None**	**No**	Channel Evolution Stage	**III**
7.4 Change in Planforml		**14**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**49**			Stream Sensitivity	**Very High**

Phase 2 Segment Summary Report Ompompanoosuc

Stream: Ompompanoosuc River
Reach: R14-C
Segment Length(ft): 1,396
Rain: No

SGAT Version: 4.56
Organization: Bear Creek Environmental
Observers: Mary, Pam, Emily
Completion Date: 7/5/2012
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional

Step 0 - Location: **This segment begins as the valley narrows again, becoming semi-confined and continues 1,396 feet upstream to approximately 950 feet downstream of the Route 113 bridge in Post Mills.**

Step 5 - Notes: **Top part of segment has a long run and then it transitions to long run with pocket pools. There are not distinct steps; bedform appears to be planebed by reference.**

Good moss on the banks.

Step 7 - Narrative: **Some sandy pockets with aggradation. Upper segment is sandy run. Most of segment is a plane bed riffle with pocket pools. Very stable with moss on banks.**

Step 1. Valley and Floodplain

1.1 Segmentation: Valley Width
1.2 Alluvial Fan: None
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	0		0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	220		0	

1.4 Adjacent Side	Left	Right
Hillside Slope:	Very Steep	Extr.Steep
Continuous w/ Bank:	Never	Never
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	N.E.	N.E.

1.5 Valley Features
Valley Width (ft): 188
Width Determination: Measured
Confinement Type: SC
In Rock Gorge: No
Human Caused Change in Valley Width?: No

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	6.0	3.0	Yes	
Ledge	Mid-segment	1.0	1.0	Yes	
Ledge	Mid-segment	3.0	2.0	Yes	

Stream: **Ompompanoosuc River** Reach: **R14-C**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**66.70**	2.11 Riffle/Step Spacing:		2.13 Average Largest Particle on			
2.2 Max Depth (ft.):	**4.20**	2.12 Substrate Composition			Bed:	**15.7**	**inches**
2.3 Mean Depth (tf):	**3.14**	Bedrock:	**4.0 %**		Bar:	**N/A**	**inches**
2.4 Floodprone Width (ft.):	**117.50**	Boulder:	**17.0 %**	2.14 Stream Type			
2.5 Aband. Floodpn (ft.):	**4.20**	Cobble:	**31.0 %**	Stream Type:	**B**		
Human Elev FloodPln (ft.):		Coarse Gravel:	**22.0 %**	Bed Material:	**Cobble**		
2.6 Width/Depth Ratio:	**21.24**	Fine Gravel:	**13.0 %**	Subclass Slope:	**c**		
2.7 Entrenchment Ratio:	**1.76**	Sand:	**12.0 %**	Bed Form:	**Plane Bed**		
2.8 Incision Ratio:	**1.00**	Silt and Smaller:	**1.0 %**	Field Measured Slope:			
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type			
2.9 Sinuosity:	**Low**	Detritus:	**0.0 %**	Reference Stream Type:	**B**		
2.10 Riffles Type:	**Not Applicable**	# Large Woody Debris:	**33**	Reference Bed Material:	**Cobble**		
				Reference Subclass Slope:	**c**		
				Reference Bedform:	**Plane Bed**		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**319.8**	**139.4**	Dominant:	**Deciduous**	**Deciduous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**4.0**	**4.0**	Sub-dominant:	**None**	**None**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**None**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**0.0**	Canopy %:	**76-100**	**76-100**
Material Type:	**Mix**	**Mix**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**51-100**	**None**
W less than 25	**0**	**25**
Buffer Vegitation Type		
Dominant	**Coniferous**	**Coniferous**
Sub-Dominant	**None**	**None**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Forest**	Mass Failures		
Sub-dominant	**None**	**Hay**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **Ompompanoosuc River** Reach: **R14-C**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**None**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:	**None**	Other:	Tile Drain:
4.4 # of Debris Jams:	**1**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**0**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**1**	Delta:	**1**	Flood chutes:	**0**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**0**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**136**
Side:	**0**	Braiding:	**0**	Steep Riffles:	**0**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Confined**	Score	STD	Historic		
7.1 Channel Degradation		**19**	**None**	**No**	Geomorphic Rating	**0.88**
7.2 Channel Aggradation		**16**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**16**	**None**	**No**	Channel Evolution Stage	**I**
7.4 Change in Planforml		**19**	**None**	**No**	Geomorphic Condition	**Reference**
Total Score		**70**			Stream Sensitivity	**Moderate**

Phase 2 Segment Summary Report Ompompanoosuc

Stream: **Avery Brook**
Reach: **R06S1.01-A**
Segment Length(ft): **292**
Rain: **No**

SGAT Version: **4.56**
Organization: **Bear Creek Environmental**
Observers: **Mary, Emily**
Completion Date: **10/27/2012**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **This segment begins at the confluence with the Ompompanoosuc River and continues 292 feet upstream to just below the culvert on the Union Village Dam access road/continuation of Main Street.**

Step 5 - Notes: **Short section with great floodplain access as Avery Brook enters the Ompompanoosuc River.**

Step 7 - Narrative: **Minor widening and planform adjustment.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Channel Dimensions**

1.2 Alluvial Fan: **None**

1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	0		0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	0		0	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Flat	Flat
Continuous w/ Bank:	Never	Never
Within 1 Bankfull W:	Never	Never
Texture:	N.E.	N.E.

1.5 Valley Features

Valley Width (ft): **1,010**
Width Determination: **Measured**
Confinement Type: **VB**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **No**

1.6 Grade Controls: **None**

Stream: **Avery Brook** Reach: **R06S1.01-A**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**24.30**	2.11 Riffle/Step Spacing:	**27 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**2.70**	2.12 Substrate Composition		Bed:	**17**	**inches**
2.3 Mean Depth (tf):	**1.97**	Bedrock:	**0.0 %**	Bar:	**6.2**	**inches**
2.4 Floodprone Width (ft.):	**160.30**	Boulder:	**13.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**3.10**	Cobble:	**53.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**18.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**12.34**	Fine Gravel:	**10.0 %**	Subclass Slope:	**b**	
2.7 Entrenchment Ratio:	**6.60**	Sand:	**6.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.15**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**0.0 %**	Reference Stream Type:	**C**	
2.10 Riffles Type:	**Complete**	# Large Woody Debris:	**1**	Reference Bed Material:	**Cobble**	
				Reference Subclass Slope:	**b**	
				Reference Bedform:	**Riffle-Pool**	

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Moderate**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**122.3**	**45.9**	Dominant:	**Invasives**	**Invasives**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**3.0**	**3.0**	Sub-dominant:	**None**	**None**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Multiple**	**Multiple**	Bank Canopy		
Lower			Revetment Length:	**54.9**	**36.7**	Canopy %:	**51-75**	**51-75**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**51-100**	**>100**
Sub-Dominant	**None**	**26-50**
W less than 25	**0**	**31**
Buffer Vegitation Type		
Dominant	**Invasives**	**Invasives**
Sub-Dominant	**None**	**None**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Shrubs/Sapling**	**Shrubs/Sapling**
Sub-dominant	**None**	**None**
(Legacy)	Amount	Mean Hieght
Failures	**None**	
Gullies	**None**	

	Left	Right
Mass Failures		
Height		
Gullies Number	**0**	
Gullies Length	**0**	

Stream: **Avery Brook** Reach: **R06S1.01-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**Abundant**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:	**None**	Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**0**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**0**	Delta:	**0**	Flood chutes:	**0**	Avulsion:	**0**	5.5 Straightening:		**Straightening**
Point:	**0**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):		**54**
Side:	**1**	Braiding:	**0**	Steep Riffles:	**0**	Trib Rejuv.:	**No**	5.5 Dredging:		**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**19**	**None**	**No**	Geomorphic Rating	**0.81**
7.2 Channel Aggradation		**17**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**15**	**None**	**No**	Channel Evolution Stage	**I**
7.4 Change in Planforml		**14**	**None**	**No**	Geomorphic Condition	**Good**
Total Score		**65**			Stream Sensitivity	**Moderate**

Phase 2 Segment Summary Report Ompompanoosuc

Stream: **Avery Brook**
Reach: **R06S1.01-B**
Segment Length(ft): **801**
Rain: **No**

SGAT Version: **4.56**
Organization: **Bear Creek Environmental**
Observers: **Mary, Emily**
Completion Date: **10/27/2012**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **This segment begins just below the culvert crossing on the Union Village Dam access road/continuation of Main Street and continues 801 feet upstream to the downstream end of a steep grade control area.**

Step 5 - Notes: **Segment is close to a recreational area (picnic tables) near the Union Village Dam access road. This segment is where the valley transitions from narrow to very broad as is enters the Ompompanoosuc River (Segment A). Difficult to tell what the reference stream type is in this transitional area, but best judgement is B stream type.**

Step 7 - Narrative: **Didn't think channel was incised, but unsure of RAF elevation. There is a flat feature that extends to the valley wall on the left bank; however, this seemed too high to be the elevation of the floodplain for this small brook. Slightly aggradational, but mostly near constriction (old abutment). Minor widening and planform adjustment. Some straightening associated with the box culvert and old abutment.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Channel Dimensions**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

	Length (ft)	One	Height	Both	Height
Berm:		**0**		**0**	
Road:		**0**		**0**	
Railroad:		**0**		**0**	
Imp. Path:		**0**		**0**	
Dev.:		**0**		**0**	

1.4 Adjacent Side	Left	Right
Hillside Slope:	**Very Steep**	**Very Steep**
Continuous w/ Bank:	**Sometimes**	**Sometimes**
Within 1 Bankfull W:	**Sometimes**	**Sometimes**
Texture:	**N.E.**	**N.E.**

1.5 Valley Features
Valley Width (ft): **127**
Width Determination: **Measured**
Confinement Type: **NW**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **No**

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	**Mid-segment**	**4.0**	**3.0**	**Yes**	

Stream: **Avery Brook** Reach: **R06S1.01-B**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**26.10**	2.11 Riffle/Step Spacing:	**52.3 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**2.20**	2.12 Substrate Composition		Bed:	**17**	**inches**
2.3 Mean Depth (tf):	**1.53**	Bedrock:	**2.0 %**	Bar:	**3.96**	**inches**
2.4 Floodprone Width (ft.):	**44.10**	Boulder:	**17.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**2.20**	Cobble:	**45.0 %**	Stream Type:	**B**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**15.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**17.06**	Fine Gravel:	**16.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**1.69**	Sand:	**4.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.00**	Silt and Smaller:	**1.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**0.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Complete**	# Large Woody Debris:	**12**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**200.7**	**50.5**	Dominant:	**Deciduous**	**Deciduous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**2.3**	**3.8**	Sub-dominant:	**None**	**Coniferous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Multiple**	**Multiple**	Bank Canopy		
Lower			Revetment Length:	**105.7**	**152.2**	Canopy %:	**76-100**	**51-75**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**0-25**
Sub-Dominant	**0-25**	**26-50**
W less than 25	**0**	**524**
Buffer Vegitation Type		
Dominant	**Deciduous**	**Shrubs/Sapling**
Sub-Dominant	**Coniferous**	**Coniferous**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Residential**	Mass Failures		
Sub-dominant	**Residential**	**Forest**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **Avery Brook** Reach: **R06S1.01-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**None**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**None**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:	**None**	Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Old Abutment	**12.5**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Scour Above,Scour Below,Alignment**
Instream Culvert	**11**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Below,Scour Below**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**3**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**	
Mid:	**1**	Delta:	**0**	Flood chutes:	**2**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**0**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**264**
Side:	**12**	Braiding:	**0**	Steep Riffles:	**3**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**16**	**None**	**No**	Geomorphic Rating	**0.65**
7.2 Channel Aggradation		**13**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**11**	**None**	**No**	Channel Evolution Stage	**I**
7.4 Change in Planforml		**12**	**None**	**No**	Geomorphic Condition	**Good**
Total Score		**52**			Stream Sensitivity	**Moderate**

Phase 2 Segment Summary Report Ompompanoosuc

Stream: **Avery Brook**
Reach: **R06S1.02-A**
Segment Length(ft): **276**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Bear Creek Environmental**
Observers: **Pam, Emily**
Completion Date: **10/2/2012**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**
Why Not Assessed: **bedrock gorge**

Step 0 - Location: **This segment was short (276 feet) and was one long cascading grade control.**

Step 5 - Notes:

Step 7 - Narrative:

Step 1. Valley and Floodplain

1.1 Segmentation: **Grade Controls**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	**0**		**0**	
Road:	**0**		**0**	
Railroad:	**0**		**0**	
Imp. Path:	**0**		**0**	
Dev.:	**0**		**0**	

1.4 Adjacent Side	Left	Right
Hillside Slope:	**Steep**	**Extr.Steep**
Continuous w/ Bank:	**Never**	**Sometimes**
Within 1 Bankfull W:	**Never**	**Sometimes**
Texture:	**N.E.**	**N.E.**

1.5 Valley Features
Valley Width (ft): **113**
Width Determination: **Measured**
Confinement Type: **NW**
In Rock Gorge: **Yes**
Human Caused Change in Valley Width?: **No**

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	**Mid-segment**	**24.0**	**20.0**	**Yes**	

Stream: **Avery Brook** Reach: **R06S1.02-A**

Step 2. Stream Channel

2.1Bankfull Width (ft.):		2.11 Riffle/Step Spacing:		2.13 Average Largest Particle on Bed:	
2.2 Max Depth (ft.):		2.12 Substrate Composition		Bar:	
2.3 Mean Depth (tf):		Bedrock:	%	2.14 Stream Type	
2.4 Floodprone Width (ft.):		Boulder:	%	Stream Type:	**A**
2.5 Aband. Floodpn (ft.):		Cobble:	%	Bed Material:	**Bedrock**
Human Elev FloodPln (ft.):		Coarse Gravel:	%	Subclass Slope:	**None**
2.6 Width/Depth Ratio:	**0.00**	Fine Gravel:	%	Bed Form:	**Cascade**
2.7 Entrenchment Ratio:	**0.00**	Sand:	%	Field Measured Slope:	
2.8 Incision Ratio:	**0.00**	Silt and Smaller:	%	2.15 Sub-reach Stream Type	
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:		Reference Stream Type:	**A**
2.9 Sinuosity:		Detritus:	**0.0 %**	Reference Bed Material:	**Bedrock**
2.10 Riffles Type:		# Large Woody Debris:		Reference Subclass Slope:	**None**
				Reference Bedform:	**Cascade**

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**0.0**	**0.0**	Dominant:	**Deciduous**	**Coniferous**
Material Type:	**Bedrock**	**Bedrock**	Erosion Height (ft.):	**0.0**	**0.0**	Sub-dominant:	**None**	**None**
Consistency:	**Cohesive**	**Cohesive**	Revetment Type:	**None**	**None**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**0.0**	Canopy %:	**76-100**	**76-100**
Material Type:	**Bedrock**	**Bedrock**				Mid-Channel Canopy:	**Closed**	
Consistency:	**Cohesive**	**Cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**None**	**None**
W less than 25	**0**	**0**
Buffer Vegitation Type		
Dominant	**Shrubs/Sapling**	**Coniferous**
Sub-Dominant	**None**	**None**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Shrubs/Sapling**	**Forest**	Mass Failures		
Sub-dominant	**Forest**	**None**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **Avery Brook** Reach: **R06S1.02-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**None**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:	**None**	Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:	**No**
Mid:	Delta:	Flood chutes:	**0**	Avulsion:	**0**	5.5 Straightening:	**None**
Point:	Island:	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**0**
Side:	Braiding: **0**	Steep Riffles:	**0**	Trib Rejuv.:		5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradiant Type	Left	Right
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score:	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating:				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Score	STD	Historic		
7.1 Channel Degradation				Geomorphic Rating	
7.2 Channel Aggradation				Channel Evolution Model	
7.3 Widening Channel				Channel Evolution Stage	
7.4 Change in Planforml				Geomorphic Condition	**Reference**
Total Score				Stream Sensitivity	

Phase 2 Segment Summary Report Ompompanoosuc

Stream: **Avery Brook**
Reach: **R06S1.02-B**
Segment Length(ft): **990**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Bear Creek Environmental**
Observers: **Pam, Emily**
Completion Date: **10/2/2012**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **This segment begins just above the grade control area (Segment A) and continues 990 feet upstream ending about 400 feet upstream of the long box culvert that runs under Route 132.**

Step 5 - Notes: **This segment alternates between a B and C stream type. It seems to alternate between semi-confined and narrow. The left bank at our cross section may be high enough to be functioning as a valley wall.**

Step 7 - Narrative: **Aside from the altered section of the box culvert, the channel is in very good condition with minimal impact. Planform adjustment has occurred as a result of straightening for the culvert and a large flood chute has formed downstream.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Channel Dimensions**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	53	6	0	
Road:	0		0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	0		0	

1.4 Adjacent Side	Left	Right
Hillside Slope:	Very Steep	Extr.Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	N.E.	N.E.

1.5 Valley Features	
Valley Width (ft):	103
Width Determination:	Measured
Confinement Type:	SC
In Rock Gorge:	No

Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	5.0	2.0	Yes	
Ledge	Mid-segment	2.0	1.0	Yes	
Ledge	Mid-segment	8.0	7.0	Yes	
Ledge	Mid-segment	4.0	2.0	Yes	

Stream: **Avery Brook** Reach: **R06S1.02-B**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**38.03**	2.11 Riffle/Step Spacing:	**90.1 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**3.20**	2.12 Substrate Composition		Bed:	**16.4**	**inches**
2.3 Mean Depth (tf):	**2.10**	Bedrock:	**1.0 %**	Bar:	**6.3**	**inches**
2.4 Floodprone Width (ft.):	**73.00**	Boulder:	**18.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**3.20**	Cobble:	**45.0 %**	Stream Type:	**B**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**26.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**18.11**	Fine Gravel:	**2.0 %**	Subclass Slope:	**a**	
2.7 Entrenchment Ratio:	**1.92**	Sand:	**8.0 %**	Bed Form:	**Step-Pool**	
2.8 Incision Ratio:	**1.00**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Moderate**	Detritus:	**0.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Complete**	# Large Woody Debris:	**17**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**32.7**	**130.3**	Dominant:	**Coniferous**	**Coniferous**
Material Type:	**Mix**	**Mix**	Erosion Height (ft.):	**2.0**	**3.8**	Sub-dominant:	**Deciduous**	**Deciduous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Hard Bank**	**Hard Bank**	Bank Canopy		
Lower			Revetment Length:	**229.8**	**228.3**	Canopy %:	**76-100**	**76-100**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Closed**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**None**	**None**
W less than 25	**0**	**0**
Buffer Vegitation Type		
Dominant	**Coniferous**	**Coniferous**
Sub-Dominant	**Deciduous**	**Deciduous**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Forest**	**Forest**
Sub-dominant	**Residential**	**Residential**
(Legacy)	Amount	Mean Hieght
Failures	**None**	
Gullies	**None**	

	Left	Right
Mass Failures		
Height		
Gullies Number	**0**	
Gullies Length	**0**	

Stream: **Avery Brook** Reach: **R06S1.02-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Abundant**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:	**None**	Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bedrock Outcrops	**19**	**Yes**	**Yes**	**Yes**	**No**	**None**
Instream Culvert	**12.5**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Scour Below**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**1**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**2**	Delta:	**1**	Flood chutes:	**1**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**0**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**233**
Side:	**13**	Braiding:	**0**	Steep Riffles:	**1**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Confined**	Score	STD	Historic		
7.1 Channel Degradation		**17**	**None**	**No**	Geomorphic Rating	**0.70**
7.2 Channel Aggradation		**14**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**14**	**None**	**No**	Channel Evolution Stage	**I**
7.4 Change in Planforml		**11**	**None**	**No**	Geomorphic Condition	**Good**
Total Score		**56**			Stream Sensitivity	**Moderate**

Phase 2 Segment Summary Report Ompompanoosuc

Stream: Avery Brook
Reach: R06S1.02-C
Segment Length(ft): 876
Rain: Yes

SGAT Version: 4.56
Organization: Bear Creek Environmental
Observers: Pam, Emily
Completion Date: 10/2/2012
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional

Step 0 - Location: **This segment begins about 400 feet upstream of the Route 132 box culvert and continues 876 feet upstream through a narrow valley.**

Step 5 - Notes: **The VHD stream layer is not correct for the most upstream 250 feet of this reach. The VHD stream layer indicates that the upper reach break is located at the confluence of two streams; however, when in the field, we discovered that the confluence of these two streams is located about 260 feet further upstream on Avery Brook. We started our assessment at the reach break indicated on the VHD stream layer because we were not contracted or budgeted to assess more than the length of the reach. In addition to this, after review in the office and photos from the field, we decided to move the location of the left valley wall for the upstream 250 feet of the reach to a closer location in relation to the stream (not the VHD stream layer). Using our cross section from that segment, we moved the left valley wall line (in ArcView) to the most accurate location that was possible. However, since the stream layer is not correct, there may be an error of about 20 feet. Bankfull elevation on cross section was lowered in the office. The new bankfull elevation is more in line with what is going on geomorphically (higher widening score). In addition to that, the cross sectional area is more in line with downstream segments. F stream type either way.**

Step 7 - Narrative: **Channel is in stable condition. It has not incised. Bankfull elevation was lowered in the office. The cross sectional area comes out to be more in line with downstream segments. F stream type either way. This segment seems to have undergone some slight widening (w/d = 18). There is one short section where there is an island and braiding near the start of the reach, but is not representative. Planform is good except for location where the island is. Nice mossy banks throughout. There are some small spots with aggradation, but aggradation is minor overall.**

Step 1. Valley and Floodplain

1.1 Segmentation: Channel Dimensions
1.2 Alluvial Fan: None
1.3 Corridor Encroachments:

	Length (ft)	One	Height	Both	Height
Berm:		0		0	
Road:		0		0	
Railroad:		0		0	
Imp. Path:		0		0	
Dev.:		0		0	

1.4 Adjacent Side	Left	Right
Hillside Slope:	Extr.Steep	Extr.Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	Other	N.E.

1.5 Valley Features
Valley Width (ft): 73
Width Determination: Measured
Confinement Type: SC
In Rock Gorge: No
Human Caused Change in Valley Width?: No

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	6.0	4.0	Yes	
Ledge	Mid-segment	0.0	0.0	Yes	
Ledge	Mid-segment	4.0	3.0	Yes	
Ledge	Mid-segment	4.0	2.0	Yes	
Ledge	Mid-segment	4.0	4.0	Yes	
Ledge	Mid-segment	3.0	2.0	Yes	
Ledge	Mid-segment	3.0	2.0	Yes	

Stream: **Avery Brook** Reach: **R06S1.02-C**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**33.80**	2.11 Riffle/Step Spacing:	**70.2 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**2.50**	2.12 Substrate Composition		Bed:	**17.6**	**inches**
2.3 Mean Depth (tf):	**1.87**	Bedrock:	**6.0 %**	Bar:	**5.46**	**inches**
2.4 Floodprone Width (ft.):	**41.00**	Boulder:	**23.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**2.50**	Cobble:	**36.0 %**	Stream Type:	**F**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**15.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**18.07**	Fine Gravel:	**7.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**1.21**	Sand:	**13.0 %**	Bed Form:	**Step-Pool**	
2.8 Incision Ratio:	**1.00**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**0.0 %**	Reference Stream Type:	**F**	
2.10 Riffles Type:	**Complete**	# Large Woody Debris:	**22**	Reference Bed Material:	**Cobble**	
				Reference Subclass Slope:	**None**	
				Reference Bedform:	**Step-Pool**	

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**72.3**	**192.0**	Dominant:	**Coniferous**	**Coniferous**
Material Type:	**Mix**	**Mix**	Erosion Height (ft.):	**3.2**	**3.3**	Sub-dominant:	**None**	**None**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**None**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**0.0**	Canopy %:	**76-100**	**76-100**
Material Type:	**Boulder/Cobble**	**Bedrock**				Mid-Channel Canopy:	**Closed**	
Consistency:	**Non-cohesive**	**Cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**None**	**None**
W less than 25	**0**	**0**
Buffer Vegitation Type		
Dominant	**Coniferous**	**Coniferous**
Sub-Dominant	**Deciduous**	**Deciduous**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Forest**	Mass Failures		
Sub-dominant	**None**	**None**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **Avery Brook** Reach: **R06S1.02-C**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Abundant**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**None**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:	**None**	Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**3**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:	**No**		
Mid:	**2**	Delta:	**0**	Flood chutes:	**2**	Avulsion:	**0**	5.5 Straightening:	**None**
Point:	**1**	Island:	**1**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**0**
Side:	**16**	Braiding:	**1**	Steep Riffles:	**3**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Confined**	Score	STD	Historic		
7.1 Channel Degradation		**18**	**None**	**No**	Geomorphic Rating	**0.79**
7.2 Channel Aggradation		**15**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**17**	**None**	**No**	Channel Evolution Stage	**I**
7.4 Change in Planforml		**13**	**None**	**No**	Geomorphic Condition	**Good**
Total Score		**63**			Stream Sensitivity	**High**

VERMONT

Stream Geomorphic Assessment

Agency of Natural Resouces

VT DEC

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March, 22 2013

Phase 2 Segment Summary Report — West Branch Ompompanosuc

Stream: **West Branch Ompompanoosuc**
Reach: **M01-A**
Segment Length(ft): **3,904**
Rain: **No**

SGAT Version: **4.56**
Organization: **Bear Creek Environmental**
Observers: **Mary, Emily**
Completion Date: **10/26/2012**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **M01-A begins at the confluence with the Ompompanoosuc River and continues 3,900 feet upstream to where the valley becomes confined. This is at the lower end of a deep bedrock gorge (segment M01-B).**

Step 5 - Notes: **Unsure of bankfull at cross section because of erosion; we used the change in slope. The lower portion of this segment has likely been historically straightened. There seem to be some adjacent farm fields and an access road. However, currently there are only small areas of rip rap here. The river is starting to regain sinuosity here and straightening was not indexed. The agricultural fields don't seem to be in use anymore and vegetation is rejuvenating.**

Step 7 - Narrative: **Extreme historic incision resulting in a stream type departure from a C to an F. This is surprising given the grade controls at the top of the segment and the position in the watershed. You would expect the channel to be overwhelmed with sediment and not incised. Aggradation is major to extreme with multiple unvegetated mid channel and diagonal bars. Major widening with high banks and erosion along much of the segment. Planform adjustment is extreme with high lateral erosion, islands, and braiding.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Valley Width**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	0		0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	0		0	

1.4 Adjacent Side	Left	Right
Hillside Slope:	**Very Steep**	**Extr.Steep**
Continuous w/ Bank:	**Never**	**Never**
Within 1 Bankfull W:	**Sometimes**	**Never**
Texture:	**N.E.**	**N.E.**

1.5 Valley Features
Valley Width (ft): **582**
Width Determination: **Measured**
Confinement Type: **BD**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **No**

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	7.0	6.0	Yes	
Ledge	Mid-segment	8.0	3.0	Yes	
Ledge	Mid-segment	10.0	6.0	Yes	
Ledge	Mid-segment	8.0	5.0	Yes	
Weir	Mid-segment	0.0	0.0	Yes	

VERMONT

Stream Geomorphic Assessment

VT DEC

Agency of Natural Resouces

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March, 22 2013

Phase 2 Segment Summary Report — West Branch Ompompanosuc

Stream: **West Branch Ompompanoosuc** Reach: **M01-A**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**82.00**	2.11 Riffle/Step Spacing:	**191.5 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**3.60**	2.12 Substrate Composition		Bed:	**10**	**inches**
2.3 Mean Depth (tf):	**2.36**	Bedrock:	**0.0 %**	Bar:		**inches**
2.4 Floodprone Width (ft.):	**87.00**	Boulder:	**0.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.)	**10.60**	Cobble:	**27.0 %**	Stream Type:	**F**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**57.0 %**	Bed Material:	**Gravel**	
2.6 Width/Depth Ratio:	**34.75**	Fine Gravel:	**5.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**1.06**	Sand:	**11.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**2.94**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**0.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**63**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**2,024.6**	**2,616.6**	Dominant:	**Deciduous**	**Herbaceous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**6.9**	**7.0**	Sub-dominant:	**Herbaceous**	**Shrubs/Sapling**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**203.7**	Canopy %:	**1-25**	**1-25**
Material Type:	**Sand**	**Sand**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**None**	**None**
W less than 25	**0**	**0**
Buffer Vegitation Type		
Dominant	**Deciduous**	**Herbaceous**
Sub-Dominant	**Herbaceous**	**Deciduous**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Other**	Mass Failures		
Sub-dominant	**Shrubs/Sapling**	**Shrubs/Sapling**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

VERMONT

Stream Geomorphic Assessment

Agency of Natural Resouces

VT DEC

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March, 22 2013

Phase 2 Segment Summary Report — West Branch Ompompanosuc — Page3

Stream: **West Branch Ompompanoosuc** Reach: **M01-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**Abundant**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:	**None**	Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bedrock Outcrops	**40**	**Yes**	**Yes**	**Yes**	**No**	**Deposition Above,Deposition Below,Scour Below**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**7**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**10**	Delta:	**0**	Flood chutes:	**1**	Avulsion:	**0**	5.5 Straightening:	**None**
Point:	**1**	Island:	**3**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**0**
Side:	**6**	Braiding:	**4**	Steep Riffles:	**2**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type: **Unconfined**

	Score	STD	Historic		
7.1 Channel Degradation	**3**	**C to F**	**Yes**	Geomorphic Rating	**0.28**
7.2 Channel Aggradation	**7**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel	**7**	**None**	**No**	Channel Evolution Stage	**III**
7.4 Change in Planforml	**5**	**None**	**No**	Geomorphic Condition	**Poor**
Total Score	**22**			Stream Sensitivity	**Extreme**

VERMONT

Stream Geomorphic Assessment

Agency of Natural Resouces

VT DEC

Vermont.gov

March, 22 2013

Phase 2 Segment Summary Report West Branch Ompompanosuc

Stream: West Branch Ompompanoosuc
Reach: M01-B
Segment Length(ft): 883
Rain: No

SGAT Version: 4.56
Organization: Bear Creek Environmental
Observers: Mary, Emily
Completion Date: 10/26/2012
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional
Why Not Assessed: bedrock gorge

Step 0 - Location: **This segment is a deep bedrock gorge that is in the confined section of M01. It is 767 feet in length.**

Step 5 - Notes: **This segment is a deep bedrock gorge area - the channel is very narrow and contains several bedrock constrictions. The area has several large grade controls and very deep pools (scoured bed). There is an old abutment (an old mill?) in this segment on a very steep valley wall.**

Step 7 - Narrative:

Step 1. Valley and Floodplain

1.1 Segmentation: **Grade Controls**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	0		0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	0		0	

1.4 Adjacent Side	Left	Right
Hillside Slope:	Extr.Steep	Extr.Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Always	Sometimes
Texture:	Bedrock	N.E.

1.5 Valley Features
Valley Width (ft): 159
Width Determination: Measured
Confinement Type: NC
In Rock Gorge: Yes
Human Caused Change in Valley Width?: No

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	0.0	0.0	Yes	
Ledge	Mid-segment	8.0	4.0	Yes	
Ledge	Mid-segment	25.0	20.0	Yes	

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Stream Geomorphic Assessment

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Phase 2 Segment Summary Report — West Branch Ompompanosuc

Stream: **West Branch Ompompanoosuc** Reach: **M01-B**

Step 2. Stream Channel

2.1Bankfull Width (ft.):		2.11 Riffle/Step Spacing:			2.13 Average Largest Particle on		
2.2 Max Depth (ft.):		2.12 Substrate Composition			Bed:		
2.3 Mean Depth (tf):		Bedrock:	%		Bar:		
2.4 Floodprone Width (ft.):		Boulder:	%		2.14 Stream Type		
2.5 Aband. Floodpn (ft.)		Cobble:	%		Stream Type:	**F**	
Human Elev FloodPln (ft.):		Coarse Gravel:	%		Bed Material:	**Bedrock**	
2.6 Width/Depth Ratio:	**0.00**	Fine Gravel:	%		Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**0.00**	Sand:	%		Bed Form:	**Cascade**	
2.8 Incision Ratio:	**0.00**	Silt and Smaller:	%		Field Measured Slope:		
Human Elevated Inc. Rat.	**0.00**	Silt/Clay Present:			2.15 Sub-reach Stream Type		
2.9 Sinuosity:		Detritus:	**0.0 %**		Reference Stream Type:	**F**	
2.10 Riffles Type:		# Large Woody Debris:			Reference Bed Material:	**Bedrock**	
					Reference Subclass Slope:	**None**	
					Reference Bedform:	**Cascade**	

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**0.0**	**0.0**	Dominant:	**Coniferous**	**Deciduous**
Material Type:	**Bedrock**	**Bedrock**	Erosion Height (ft.):	**0.0**	**0.0**	Sub-dominant:	**Shrubs/Sapling**	**None**
Consistency:	**Cohesive**	**Cohesive**	Revetment Type:	**None**	**None**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**0.0**	Canopy %:	**76-100**	**76-100**
Material Type:	**Bedrock**	**Bedrock**				Mid-Channel Canopy:	**Open**	
Consistency:	**Cohesive**							

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**None**	**None**
W less than 25	**0**	**0**
Buffer Vegitation Type		
Dominant	**Coniferous**	**Deciduous**
Sub-Dominant	**None**	**None**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Forest**	**Forest**
Sub-dominant	**None**	**None**
(Legacy)	Amount	Mean Hieght
Failures	**None**	
Gullies	**None**	

	Left	Right
Mass Failures		
Height		
Gullies Number	**0**	
Gullies Length	**0**	

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Phase 2 Segment Summary Report

West Branch Ompompanosuc

Stream: **West Branch Ompompanoosuc** Reach: **M01-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**None**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**None**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:	**None**	Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bedrock Outcrops	**45**	**Yes**	**Yes**	**Yes**	**Yes**	**None**
Bedrock Outcrops	**37.5**	**Yes**	**Yes**	**Yes**	**No**	**Deposition Below,Scour Below**
Old Abutment	**40**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Below,Scour Above,Scour Below**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**0**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**2**	Delta:	**0**	Flood chutes:	**0**	Avulsion:	**0**	5.5 Straightening:	**None**
Point:	**0**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**0**
Side:	**4**	Braiding:	**0**	Steep Riffles:	**0**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.	6.4 Sediment Deposition:	Stream Gradiant Type	Left	Right
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score:	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating:				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Score	STD	Historic		
7.1 Channel Degradation				Geomorphic Rating	
7.2 Channel Aggradation				Channel Evolution Model	
7.3 Widening Channel				Channel Evolution Stage	
7.4 Change in Planforml				Geomorphic Condition	**Reference**
Total Score				Stream Sensitivity	

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Stream Geomorphic Assessment

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Phase 2 Segment Summary Report **West Branch Ompompanosuc**

Stream: **West Branch Ompompanoosuc**
Reach: **M01-C**
Segment Length(ft): **833**
Rain: **No**

SGAT Version: **4.56**
Organization: **Bear Creek Environmental**
Observers: **Mary, Emily**
Completion Date: **10/26/2012**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **This segment begins just above the first grade control marking the bedrock gorge segment (M01-B) and continues 955 feet upstream to through a braided section. The segment ends as the river straightens, loses floodplain access, and is not braided anymore.**

Step 5 - Notes: **In this reach, we had several "D" braided channels. We did not do a cross section in this segment, but instead used a representative "D" channel cross section that was actually measured in M01-G. The pebble count from M01-G was also used for this segment.**

Step 7 - Narrative: **Good floodplain access. Extreme aggradation with one mid channel bar and multiple diagonal bars in this short segment. Channel widening is extreme (w/d ratio 86.4). Major planform adjustment with two islands. Braiding is likely due to upstream straightened areas; braiding is commonly seen around bends in this reach.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Channel Dimensions**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	0		0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	0		0	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	**Very Steep**	**Very Steep**
Continuous w/ Bank:	**Sometimes**	**Never**
Within 1 Bankfull W:	**Sometimes**	**Never**
Texture:	**N.E.**	**N.E.**

1.5 Valley Features

Valley Width (ft):	**647**
Width Determination:	**Measured**
Confinement Type:	**BD**
In Rock Gorge:	**No**
Human Caused Change in Valley Width?:	**No**

1.6 Grade Controls: **None**

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Stream Geomorphic Assessment

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Phase 2 Segment Summary Report — West Branch Ompompanosuc

Stream: **West Branch Ompompanoosuc** Reach: **M01-C**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**150.30**	2.11 Riffle/Step Spacing:	**489 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**3.30**	2.12 Substrate Composition		Bed:	**12.4**	**inches**
2.3 Mean Depth (tf):	**1.74**	Bedrock:	**3.0 %**	Bar:	**6.5**	**inches**
2.4 Floodprone Width (ft.):	**304.00**	Boulder:	**10.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.)	**3.70**	Cobble:	**66.0 %**	Stream Type:	**D**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**9.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**86.38**	Fine Gravel:	**5.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**2.02**	Sand:	**7.0 %**	Bed Form:	**Braided**	
2.8 Incision Ratio:	**1.12**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**0.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**23**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right
Upper		
Material Type	**Sand**	**Sand**
Consistency	**Non-cohesive**	**Non-cohesive**
Lower		
Material Type	**Boulder/Cobble**	**Boulder/Cobble**
Consistency	**Non-cohesive**	**Non-cohesive**

Bank Erosion	Left	Right
Erosion Length (ft.):	**0.0**	**128.2**
Erosion Height (ft.):	**0.0**	**5.0**
Revetment Type:	**None**	**None**
Revetment Length:	**0.0**	**0.0**

Near Bank Vegetation Type	Left	Right
Dominant:	**Coniferous**	**Deciduous**
Sub-dominant:	**Shrubs/Sapling**	**None**
Bank Canopy		
Canopy %:	**76-100**	**76-100**
Mid-Channel Canopy:	**Open**	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**None**	**None**
W less than 25	**0**	**0**
Buffer Vegitation Type		
Dominant	**Deciduous**	**Deciduous**
Sub-Dominant	**Shrubs/Sapling**	**None**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Forest**	**Forest**
Sub-dominant	**Shrubs/Sapling**	**None**
(Legacy)	Amount	Mean Hieght
Failures	**None**	
Gullies	**None**	

	Left	Right
Mass Failures		
Height		
Gullies Number	**0**	
Gullies Length	**0**	

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Stream Geomorphic Assessment

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Phase 2 Segment Summary Report — West Branch Ompompanosuc

Stream: **West Branch Ompompanoosuc** Reach: **M01-C**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:	**None**	Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**2**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**	
Mid:	**1**	Delta:	**1**	Flood chutes:	**0**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**2**	Island:	**2**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**643**
Side:	**0**	Braiding:	**1**	Steep Riffles:	**1**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**17**	**None**	**No**	Geomorphic Rating	**0.43**
7.2 Channel Aggradation		**5**	**C to D**	**No**	Channel Evolution Model	**D**
7.3 Widening Channel		**5**	**None**	**No**	Channel Evolution Stage	**IIc**
7.4 Change in Planforml		**7**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**34**			Stream Sensitivity	**Extreme**

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Phase 2 Segment Summary Report **West Branch Ompompanosuc**

Stream:	**West Branch Ompompanoosuc**	SGAT Version:	**4.56**
Reach:	**M01-D**	Organization:	**Bear Creek Environmental**
Segment Length(ft):	**516**	Observers:	**Mary, Emily**
Rain:	**No**	Completion Date:	**10/26/2012**
		Qualtiy Control Status - Consultant:	**Provisional**
		Qualtiy Control Status - Staff:	**Provisional**

Step 0 - Location: **This segment is a very short segment (528 feet in length) where the river has incised and has lost floodplain access. It is the straight section of the river between two bends (M01-C and M01-E).**

Step 5 - Notes: **The eastern buffer is currently regenerating - it would be good to continue to let this happen. Great bankfull feature at cross section location.**

Step 7 - Narrative: **Extreme incision. Channel may have been historically straightened along agricultural fields, but currently there are no revetments observed. High w/d ratio of 44.2 indicates that major widening is occurring. Minor planform adjustment.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Channel Dimensions**

1.2 Alluvial Fan: **None**

1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	**0**		**0**	
Road:	**0**		**0**	
Railroad:	**0**		**0**	
Imp. Path:	**0**		**0**	
Dev.:	**0**		**0**	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	**Extr.Steep**	**Very Steep**
Continuous w/ Bank:	**Never**	**Never**
Within 1 Bankfull W:	**Never**	**Never**
Texture:	**N.E.**	**N.E.**

1.5 Valley Features

Valley Width (ft):	**1,122**
Width Determination:	**Measured**
Confinement Type:	**VB**
In Rock Gorge:	**No**
Human Caused Change in Valley Width?:	**No**

1.6 Grade Controls: **None**

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Phase 2 Segment Summary Report — West Branch Ompompanosuc

Stream: **West Branch Ompompanoosuc** Reach: **M01-D**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**96.10**	2.11 Riffle/Step Spacing:	**303 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**3.10**	2.12 Substrate Composition		Bed:	**16.5**	**inches**
2.3 Mean Depth (tf):	**2.17**	Bedrock:	**0.0 %**	Bar:	**6.7**	**inches**
2.4 Floodprone Width (ft.):	**115.60**	Boulder:	**11.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.)	**7.30**	Cobble:	**55.0 %**	Stream Type:	**F**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**15.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**44.29**	Fine Gravel:	**11.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**1.20**	Sand:	**8.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**2.35**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**0.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Complete**	# Large Woody Debris:	**1**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right
Upper		
Material Type	**Mix**	**Mix**
Consistency	**Non-cohesive**	**Non-cohesive**
Lower		
Material Type:	**Sand**	**Sand**
Consistency:	**Non-cohesive**	**Non-cohesive**

Bank Erosion	Left	Right
Erosion Length (ft.):	**102.9**	**9.3**
Erosion Height (ft.):	**5.0**	**5.0**
Revetment Type:	**None**	**None**
Revetment Length:	**0.0**	**0.0**

Near Bank Vegetation Type	Left	Right
Dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Sub-dominant:	**Deciduous**	**Herbaceous**
Bank Canopy		
Canopy %:	**26-50**	**1-25**
Mid-Channel Canopy:	**Open**	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**0-25**
Sub-Dominant	**None**	**None**
W less than 25	**26**	**516**
Buffer Vegitation Type		
Dominant	**Shrubs/Sapling**	**Herbaceous**
Sub-Dominant	**None**	**Deciduous**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Shrubs/Sapling**	**Hay**
Sub-dominant	**None**	**Forest**
(Legacy)	Amount	Mean Hieght
Failures	**None**	
Gullies	**None**	

	Left	Right
Mass Failures		
Height		
Gullies Number	**0**	
Gullies Length	**0**	

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Phase 2 Segment Summary Report — West Branch Ompompanosuc

Stream: **West Branch Ompompanoosuc** Reach: **M01-D**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**None**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**None**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:	**None**	Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**0**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:	**No**		
Mid:	**0**	Delta:	**0**	Flood chutes:	**0**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**0**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**516**
Side:	**2**	Braiding:	**0**	Steep Riffles:	**1**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**5**	**C to F**	**Yes**	Geomorphic Rating	**0.52**
7.2 Channel Aggradation		**13**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**8**	**None**	**No**	Channel Evolution Stage	**III**
7.4 Change in Planforml		**16**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**42**			Stream Sensitivity	**Very High**

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Stream Geomorphic Assessment

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Phase 2 Segment Summary Report — West Branch Ompompanosuc

Stream: **West Branch Ompompanoosuc**
Reach: **M01-E**
Segment Length(ft): **470**
Rain: **No**

SGAT Version: **4.56**
Organization: **Bear Creek Environmental**
Observers: **Mary, Emily**
Completion Date: **10/26/2012**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **Segment M01-E begins as the river becomes braided and sinuous above M01-D. A channel avulsion was observed on the orthophoto and in the field. The segment is 464 feet in length (according to the stream layer), but ... (See Step 5 Comments)**

Step 5 - Notes: **...Segment location description continued from Step 0...but has a split channel. One channel follows the VHD stream layer, while the other extends out to the northeast of the stream layer. The upstream end of the segment is where this smaller channel enters the main channel. The main channel comes straight again. In this reach, we had several "D" braided channels. We did not do a cross section in this segment, but instead used a representative "D" channel cross section that was actually measured in M01-G. The pebble count from M01-G was also used for this segment.**

Step 7 - Narrative: **A channel avulsion is evident on both the orthophoto and in the field. The channel has undergone extreme widening as a result of aggradation on bends. This has been exaggerated by straight channel upstream that is acting as a sediment transport segment. Planform adjustment is extreme with islands, active flood chutes, lateral bank erosion, as well as an avulsion. There is braiding under low flow conditions.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Channel Dimensions**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	408	0	0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	0		0	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Very Steep	Very Steep
Continuous w/ Bank:	Sometimes	Never
Within 1 Bankfull W:	Sometimes	Never
Texture:	N.E.	N.E.

1.5 Valley Features
Valley Width (ft): **1,020**
Width Determination: **Measured**
Confinement Type: **VB**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **No**

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	5.0	3.0	Yes	

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Stream Geomorphic Assessment

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Phase 2 Segment Summary Report — West Branch Ompompanosuc

Stream: **West Branch Ompompanoosuc** Reach: **M01-E**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**150.30**	2.11 Riffle/Step Spacing:	**179 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**3.30**	2.12 Substrate Composition		Bed:	**12.4**	**inches**
2.3 Mean Depth (tf):	**1.74**	Bedrock:	**3.0 %**	Bar:	**6.5**	**inches**
2.4 Floodprone Width (ft.):	**304.00**	Boulder:	**10.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.)	**3.70**	Cobble:	**66.0 %**	Stream Type:	**D**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**9.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**86.38**	Fine Gravel:	**5.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**2.02**	Sand:	**7.0 %**	Bed Form:	**Braided**	
2.8 Incision Ratio:	**1.12**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**0.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**16**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**180.9**	**238.5**	Dominant:	**Deciduous**	**Shrubs/Sapling**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**3.5**	**4.8**	Sub-dominant:	**Shrubs/Sapling**	**Herbaceous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**None**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**0.0**	Canopy %:	**76-100**	**26-50**
Material Type:	**Gravel**	**Gravel**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**51-100**
Sub-Dominant	**0-25**	**0-25**
W less than 25	**99**	**132**
Buffer Vegitation Type		
Dominant	**Deciduous**	**Shrubs/Sapling**
Sub-Dominant	**Shrubs/Sapling**	**Herbaceous**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Shrubs/Sapling**	Mass Failures		
Sub-dominant	**Hay**	**None**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

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Phase 2 Segment Summary Report — West Branch Ompompanosuc

Stream: **West Branch Ompompanoosuc** Reach: **M01-E**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**None**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:	**None**	Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**2**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**	
Mid:	**3**	Delta:	**0**	Flood chutes:	**2**	Avulsion:	**1**	5.5 Straightening:	**Straightening**
Point:	**1**	Island:	**1**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**114**
Side:	**3**	Braiding:	**1**	Steep Riffles:	**3**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**16**	**None**	**No**	Geomorphic Rating	**0.35**
7.2 Channel Aggradation		**6**	**C to D**	**No**	Channel Evolution Model	**D**
7.3 Widening Channel		**3**	**None**	**No**	Channel Evolution Stage	**IId**
7.4 Change in Planforml		**3**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**28**			Stream Sensitivity	**Extreme**

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Phase 2 Segment Summary Report — West Branch Ompompanosuc

Stream: **West Branch Ompompanoosuc**
Reach: **M01-F**
Segment Length(ft): **1,046**
Rain: **No**

SGAT Version: **4.56**
Organization: **Bear Creek Environmental**
Observers: **Mary, Emily**
Completion Date: **10/26/2012**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **This segment is a straight section between two braided segments (M01-E and M01-G). The segment is 1060 feet in length and continues upstream underneath a bridge that accesses some trails.**

Step 5 - Notes: **In this reach, we had several "C" channels. This cross section was our "representative" C channel cross section. Plane bed at top of segment; hard to see riffle heads and tails. Good floodplain access, but lose some floodplain access near bridge. Soft underfoot below bridge to riffle head.**

Step 7 - Narrative: **Channel has good floodplain access on right bank, seems to have developed a new floodplain. Distinct RAF on both sides, lower elevation is to the right of an elevated improved path. Strange that segment is so straight and in stage F-IV. Major historic degradation, aggradation, and widening. Planform adjustment is minor.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Channel Dimensions**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

	Length (ft)	One Height	Both Height
Berm:	0		0
Road:	1,046	0	0
Railroad:	0		0
Imp. Path:	996	0	0
Dev.:	0		0

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Very Steep	Very Steep
Continuous w/ Bank:	Never	Never
Within 1 Bankfull W:	Never	Never
Texture:	N.E.	N.E.

1.5 Valley Features
Valley Width (ft): **1,007**
Width Determination: **Measured**
Confinement Type: **VB**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **No**

1.6 Grade Controls: **None**

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Stream Geomorphic Assessment

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Phase 2 Segment Summary Report — West Branch Ompompanosuc

Stream: **West Branch Ompompanoosuc** Reach: **M01-F**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**105.50**	2.11 Riffle/Step Spacing:	**265 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**3.20**	2.12 Substrate Composition		Bed:	**14.6**	**inches**
2.3 Mean Depth (tf):	**2.37**	Bedrock:	**0.0 %**	Bar:	**8.3**	**inches**
2.4 Floodprone Width (ft.):	**385.00**	Boulder:	**9.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.)	**5.20**	Cobble:	**64.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**5.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**44.51**	Fine Gravel:	**9.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**3.65**	Sand:	**13.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.62**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**0.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Complete**	# Large Woody Debris:	**8**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**252.0**	**159.2**	Dominant:	**Herbaceous**	**Shrubs/Sapling**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**4.8**	**3.7**	Sub-dominant:	**Deciduous**	**Deciduous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Multiple**	**Multiple**	Bank Canopy		
Lower			Revetment Length:	**70.9**	**69.4**	Canopy %:	**1-25**	**1-25**
Material Type:	**Mix**	**Mix**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**0-25**	**>100**
Sub-Dominant	**51-100**	**51-100**
W less than 25	**539**	**68**
Buffer Vegitation Type		
Dominant	**Herbaceous**	**Shrubs/Sapling**
Sub-Dominant	**Deciduous**	**Deciduous**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Hay**	**Shrubs/Sapling**	Mass Failures		
Sub-dominant	**Forest**	**Hay**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

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Phase 2 Segment Summary Report — West Branch Ompompanosuc

Stream: **West Branch Ompompanoosuc** Reach: **M01-F**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:	**None**	Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	**48**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Scour Above,Scour Below**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**0**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**1**	Delta:	**2**	Flood chutes:	**0**	Avulsion:	**0**	5.5 Straightening:		**Straightening**
Point:	**0**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):		**982**
Side:	**2**	Braiding:	**0**	Steep Riffles:	**2**	Trib Rejuv.:	**No**	5.5 Dredging:		**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**9**	**None**	**Yes**	Geomorphic Rating	**0.44**
7.2 Channel Aggradation		**7**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**7**	**None**	**No**	Channel Evolution Stage	**IV**
7.4 Change in Planforml		**12**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**35**			Stream Sensitivity	**High**

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Phase 2 Segment Summary Report — West Branch Ompompanosuc

Stream:	West Branch Ompompanoosuc	SGAT Version:	4.56
Reach:	M01-G	Organization:	Bear Creek Environmental
Segment Length(ft):	960	Observers:	Mary, Emily, Pam, Gretchen
Rain:	No	Completion Date:	10/26/2012
		Qualtiy Control Status - Consultant:	Provisional
		Qualtiy Control Status - Staff:	Provisional

Step 0 - Location: **This segment begins approximately 500 feet upstream of a bridge (access to trails) and continues 938 feet upstream through a braided section. The segment ends at the top of a large flood chute (can be seen in the orthophoto) to the west of the main chann**

Step 5 - Notes: **In this reach, we had several "D" braided channels. This cross section was our "representative" cross section for each area that was like that.**

Step 7 - Narrative: **This segment may have undergone significant planform adjustment and widening due to past channel management practices, such as straightening. There are multiple thread channels with an island and mid channel bar creating a channel with a w/d ratio of 86. Aggradation is a major process, while widening and planform adjustment are extreme. There is good floodplain access in this segment with an incision ratio of close to 1.0.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Channel Dimensions**

1.2 Alluvial Fan: **None**

1.3 Corridor Encroachments:

	One	Height	Both	Height
Length (ft)				
Berm:	0		0	
Road:	674	0	284	0
Railroad:	0		0	
Imp. Path:	72	0	0	
Dev.:	0		0	

1.4 Adjacent Side	Left	Right
Hillside Slope:	Very Steep	Extr.Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	N.E.	N.E.

1.5 Valley Features	
Valley Width (ft):	381
Width Determination:	Measured
Confinement Type:	NW
In Rock Gorge:	No
Human Caused Change in Valley Width?:	No

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	5.0	2.0	Yes	

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Phase 2 Segment Summary Report — West Branch Ompompanosuc

Stream: **West Branch Ompompanoosuc** Reach: **M01-G**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	150.30	2.11 Riffle/Step Spacing:	157 ft.	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	3.30	2.12 Substrate Composition		Bed:	12.4	inches
2.3 Mean Depth (tf):	1.74	Bedrock:	3.0 %	Bar:	6.5	inches
2.4 Floodprone Width (ft.):	304.00	Boulder:	10.0 %	2.14 Stream Type		
2.5 Aband. Floodpn (ft.)	3.70	Cobble:	66.0 %	Stream Type:	D	
Human Elev FloodPln (ft.):		Coarse Gravel:	9.0 %	Bed Material:	Cobble	
2.6 Width/Depth Ratio:	86.38	Fine Gravel:	5.0 %	Subclass Slope:	None	
2.7 Entrenchment Ratio:	2.02	Sand:	7.0 %	Bed Form:	Riffle-Pool	
2.8 Incision Ratio:	1.12	Silt and Smaller:	0.0 %	Field Measured Slope:		
Human Elevated Inc. Rat.	0.00	Silt/Clay Present:	No	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	Low	Detritus:	0.0 %	Reference Stream Type:		
2.10 Riffles Type:	Sedimented	# Large Woody Debris:	27	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Undercut**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	27.9	188.6	Dominant:	Deciduous	Coniferous
Material Type:	Sand	Sand	Erosion Height (ft.):	3.0	2.5	Sub-dominant:	None	None
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	None	None	Bank Canopy		
Lower			Revetment Length:	0.0	0.0	Canopy %:	76-100	76-100
Material Type:	Mix	Mix				Mid-Channel Canopy:	Open	
Consistency:	Non-cohesive	Non-cohesive						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	51-100	>100
Sub-Dominant	None	None
W less than 25	0	0
Buffer Vegitation Type		
Dominant	Deciduous	Coniferous
Sub-Dominant	None	None

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Forest	Forest
Sub-dominant	None	None
(Legacy)	Amount	Mean Hieght
Failures	None	
Gullies	None	

	Left	Right
Mass Failures		
Height		
Gullies Number	0	
Gullies Length	0	

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Phase 2 Segment Summary Report

West Branch Ompompanosuc

Stream: **West Branch Ompompanoosuc** Reach: **M01-G**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**None**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**None**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:	**None**	Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bedrock Outcrops	**45**	**Yes**	**Yes**	**Yes**	**No**	**Deposition Above,Deposition Below,Scour Below**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**1**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**1**	Delta:	**0**	Flood chutes:	**3**	Avulsion:	**0**	5.5 Straightening:		**Straightening**
Point:	**0**	Island:	**1**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):		**624**
Side:	**5**	Braiding:	**2**	Steep Riffles:	**1**	Trib Rejuv.:	**No**	5.5 Dredging:		**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**18**	**None**	**No**	Geomorphic Rating	**0.47**
7.2 Channel Aggradation		**10**	**C to D**	**No**	Channel Evolution Model	**D**
7.3 Widening Channel		**5**	**None**	**No**	Channel Evolution Stage	**IId**
7.4 Change in Planforml		**5**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**38**			Stream Sensitivity	**Extreme**

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Phase 2 Segment Summary Report — West Branch Ompompanosuc

Stream: **West Branch Ompompanoosuc**
Reach: **M01-H**
Segment Length(ft): **990**
Rain: **No**

SGAT Version: **4.56**
Organization: **Bear Creek Environmental**
Observers: **Mary, Emily, Pam, Gretchen**
Completion Date: **10/27/2012**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **This segment begins at the top of a floodchute (seen on orthophoto) to the west of the main channel. It continues 661 feet upstream through an area with good floodplain access. This segment ends at the lower end of a bermed planebed section.**

Step 5 - Notes: **In this reach, we had several "C" channels. We did not do a cross section in this segment, but instead used a representative "C" channel cross section that was actually measured in M01-F. The pebble count from M01-F was also used for this segment. Upon further analysis, the elevation of the RAF in the cross section done in M01-F has been changed. That segment now has an incision ratio of 1.6. The cross section is not representative for M01-H; however, original channel dimensions (elevation of RAF) measure in M01-F remain entered for Step 2 because they are the most representative for this segment. Until another cross section is completed, this is the best way that this segment can be represented.**

Step 7 - Narrative: **Segment has good floodplain access. Two ledge grade controls (one in M01-H and one in M01-G). Channel widening likely due to aggradation. Aggradation and widening are primary adjustment processes occurring. Planform adjustment is minor.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Channel Dimensions**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

	Length (ft)	One Height	Both	Height
Berm:	432	3	0	
Road:	99	0	0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	0		0	

1.4 Adjacent Side	Left	Right
Hillside Slope:	**Extr.Steep**	**Very Steep**
Continuous w/ Bank:	**Never**	**Never**
Within 1 Bankfull W:	**Sometimes**	**Never**
Texture:	**N.E.**	**N.E.**

1.5 Valley Features
Valley Width (ft): **356**
Width Determination: **Measured**
Confinement Type: **NW**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **No**

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	**Mid-segment**	**7.0**	**3.0**	**Yes**	

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Phase 2 Segment Summary Report

West Branch Ompompanosuc

Stream: **West Branch Ompompanoosuc** Reach: **M01-H**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**105.50**	2.11 Riffle/Step Spacing:	**333 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**3.20**	2.12 Substrate Composition		Bed:	**14.6**	**inches**
2.3 Mean Depth (tf):	**2.37**	Bedrock:	**0.0 %**	Bar:	**8.3**	**inches**
2.4 Floodprone Width (ft.):	**385.00**	Boulder:	**9.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.)	**3.50**	Cobble:	**64.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**5.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**44.51**	Fine Gravel:	**9.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**3.65**	Sand:	**13.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.09**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**0.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Complete**	# Large Woody Debris:	**38**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Moderate**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**0.0**	**215.3**	Dominant:	**Deciduous**	**Deciduous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**0.0**	**3.0**	Sub-dominant:	**None**	**None**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**None**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**0.0**	Canopy %:	**76-100**	**76-100**
Material Type:	**Mix**	**Mix**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**None**	**None**
W less than 25	**0**	**0**
Buffer Vegitation Type		
Dominant	**Deciduous**	**Deciduous**
Sub-Dominant	**None**	**Coniferous**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Forest**	**Forest**
Sub-dominant	**None**	**None**
(Legacy)	Amount	Mean Hieght
Failures	**None**	
Gullies	**None**	

	Left	Right
Mass Failures		
Height		
Gullies Number	**0**	
Gullies Length	**0**	

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Stream Geomorphic Assessment

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Phase 2 Segment Summary Report — West Branch Ompompanosuc

Stream: **West Branch Ompompanoosuc** Reach: **M01-H**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**None**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:	**None**	Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**1**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**	
Mid:	**0**	Delta:	**0**	Flood chutes:	**2**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**1**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**848**
Side:	**0**	Braiding:	**0**	Steep Riffles:	**1**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**18**	**None**	**No**	Geomorphic Rating	**0.57**
7.2 Channel Aggradation		**8**	**None**	**No**	Channel Evolution Model	**D**
7.3 Widening Channel		**7**	**None**	**No**	Channel Evolution Stage	**IIc**
7.4 Change in Planforml		**13**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**46**			Stream Sensitivity	**High**

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Stream Geomorphic Assessment

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Phase 2 Segment Summary Report West Branch Ompompanosuc

Stream: West Branch Ompompanoosuc
Reach: M01-I
Segment Length(ft): 1,447
Rain: No

SGAT Version: 4.56
Organization: Bear Creek Environmental
Observers: Mary, Emily, Pam, Gretchen
Completion Date: 10/27/2012
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional

Step 0 - Location: **This segment begins as the river loses floodplain access as a result of berms on the eastern bank and a rock wall on the western bank. The segment continues 1,850 feet upstream to the Route 132 bridge.**

Step 5 - Notes: **The channel has been historically straightened (berm along left bank). There is also a rock wall on right bank that is above floodprone elevation (maybe old property line), and does not appear to be limiting floodplain access. The berm on the left bank has been outflanked in a number of places. The rock wall has not been indexed as a berm because it is not restricting floodplain access.**

Step 7 - Narrative: **Channel has been historically bermed resulting in a HEF incision ratio of 1.87. The removal of this berm would provide some additional floodplain access. The berming and subsequent channel incision has caused stream type departure from a C to an F. Widening is a major process. Loss in bedform sturcture resulting in mainly planebed form.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Channel Dimensions**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

	Length (ft)	One	Height	Both	Height
Berm:	1,419	3	0	2	
Road:	228	0	164	0	
Railroad:	0		0		
Imp. Path:	0		0		
Dev.:	0		0		

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Very Steep	Steep
Continuous w/ Bank:	Sometimes	Never
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	N.E.	N.E.

1.5 Valley Features

Valley Width (ft):	378
Width Determination:	Measured
Confinement Type:	NW
In Rock Gorge:	No
Human Caused Change in Valley Width?:	No

1.6 Grade Controls: None

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Stream Geomorphic Assessment

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Phase 2 Segment Summary Report

West Branch Ompompanosuc

Stream: **West Branch Ompompanoosuc** Reach: **M01-I**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**90.20**	2.11 Riffle/Step Spacing:	**817.5 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**3.60**	2.12 Substrate Composition		Bed:	**28.8**	**inches**
2.3 Mean Depth (tf):	**2.70**	Bedrock:	**0.0 %**	Bar:	**9.2**	**inches**
2.4 Floodprone Width (ft.):	**99.70**	Boulder:	**21.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.)	**6.00**	Cobble:	**49.0 %**	Stream Type:	**F**	
Human Elev FloodPln (ft.):	**8.60**	Coarse Gravel:	**11.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**33.41**	Fine Gravel:	**10.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**1.11**	Sand:	**9.0 %**	Bed Form:	**Plane Bed**	
2.8 Incision Ratio:	**1.67**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.	**2.39**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**0.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Complete**	# Large Woody Debris:	**1**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**41.9**	**218.5**	Dominant:	**Deciduous**	**Deciduous**
Material Type:	**Mix**	**Sand**	Erosion Height (ft.):	**4.0**	**2.8**	Sub-dominant:	**None**	**None**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**39.6**	**87.7**	Canopy %:	**76-100**	**76-100**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**None**	**None**
W less than 25	**38**	**0**
Buffer Vegitation Type		
Dominant	**Deciduous**	**Deciduous**
Sub-Dominant	**Shrubs/Sapling**	**None**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Forest**	Mass Failures		
Sub-dominant	**None**	**None**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

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Stream Geomorphic Assessment

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Phase 2 Segment Summary Report — West Branch Ompompanosuc

Stream: **West Branch Ompompanoosuc** Reach: **M01-I**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs			
4.2 Adjacent Wetlands:	**Abundant**	Flow Reg. Use:		Field Ditch:	**0**	Road Ditch:	**0**
4.3 Flow Status:	**Moderate**	Impoundments:	**None**	Other:	**0**	Tile Drain:	**0**
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	**1**	Urb Strm Wtr Pipe:	**0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:		**0**	
		(old) Upstrm Flow Reg.:		Affected Length (ft):		**0**	

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**1**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**	
Mid:	**1**	Delta:	**0**	Flood chutes:	**1**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**0**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**1,447**
Side:	**6**	Braiding:	**0**	Steep Riffles:	**1**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**3**	**C to F**	**Yes**	Geomorphic Rating	**0.45**
7.2 Channel Aggradation		**12**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**9**	**None**	**No**	Channel Evolution Stage	**III**
7.4 Change in Planforml		**12**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**36**			Stream Sensitivity	**Very High**

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Stream Geomorphic Assessment

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Phase 2 Segment Summary Report West Branch Ompompanosuc

Stream: West Branch Ompompanoosuc
Reach: M01-J
Segment Length(ft): 1,444
Rain: Yes

SGAT Version: 4.56
Organization: Bear Creek Environmental
Observers: Mary, Emily
Completion Date: 10/27/2012
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional

Step 0 - Location: **This segment begins at the Route 132 bridge and continues 1,370 feet upstream through an area with good floodplain access. The segment ends at the lower end of a large bedrock grade control (indexed in M02).**

Step 5 - Notes: **In this reach, we had several "C" channels. We did not do a cross section in this segment, but instead used a representative "C" channel cross section that was actually measured in M01-F. The pebble count from M01-I was used for this segment because it was more representative then the one done in M01-F. There is a large grade control in reach M02 that extends down into the top of M01-J (this grade control was indexed in M02). Upon further analysis, the elevation of the RAF in the cross section done in M01-F has been changed. That segment now has an incision ratio of 1.6. The cross section is not representative for M01-H; however, original channel dimensions (elevation of RAF) measure in M01-F remain entered for Step 2 because they are the most representative for this segment. Until another cross section is completed, this is the best way that this segment can be represented.**

Step 7 - Narrative: **Good floodplain access in this segment with large grade control extending from M02 into M01-J. This is contributing to its vertical stability.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Channel Dimensions**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0	3	0	
Road:	522	0	387	0
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	306		0	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Very Steep	Very Steep
Continuous w/ Bank:	Sometimes	Never
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	N.E.	N.E.

1.5 Valley Features
Valley Width (ft): 488
Width Determination: Measured
Confinement Type: BD
In Rock Gorge: No
Human Caused Change in Valley Width?: No

1.6 Grade Controls: None

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Phase 2 Segment Summary Report — West Branch Ompompanosuc

Stream: **West Branch Ompompanoosuc** Reach: **M01-J**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**105.50**	2.11 Riffle/Step Spacing:	**331 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**3.20**	2.12 Substrate Composition		Bed:	**28.8**	**inches**
2.3 Mean Depth (tf):	**2.37**	Bedrock:	**0.0 %**	Bar:	**9.2**	**inches**
2.4 Floodprone Width (ft.):	**385.00**	Boulder:	**21.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.)	**3.50**	Cobble:	**49.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**11.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**44.51**	Fine Gravel:	**10.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**3.65**	Sand:	**9.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.09**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**0.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Complete**	# Large Woody Debris:	**50**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Moderate**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**99.7**	**462.7**	Dominant:	**Deciduous**	**Deciduous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**3.0**	**5.6**	Sub-dominant:	**Shrubs/Sapling**	**None**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Multiple**	**Multiple**	Bank Canopy		
Lower			Revetment Length:	**422.9**	**106.2**	Canopy %:	**76-100**	**76-100**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**51-100**	**None**
W less than 25	**278**	**170**
Buffer Vegitation Type		
Dominant	**Deciduous**	**Deciduous**
Sub-Dominant	**None**	**None**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Forest**	**Forest**
Sub-dominant	**Residential**	**Residential**
(Legacy)	Amount	Mean Hieght
Failures	**None**	
Gullies	**None**	

	Left	Right
Mass Failures		
Height		
Gullies Number	**0**	
Gullies Length	**0**	

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Phase 2 Segment Summary Report

West Branch Ompompanosuc

Stream: **West Branch Ompompanoosuc** Reach: **M01-J**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**None**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs			
4.2 Adjacent Wetlands:	**None**	Flow Reg. Use:		Field Ditch:	**0**	Road Ditch:	**1**
4.3 Flow Status:	**Moderate**	Impoundments:	**None**	Other:	**0**	Tile Drain:	**0**
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	**0**	Urb Strm Wtr Pipe:	**0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:		**0**	
		(old) Upstrm Flow Reg.:		Affected Length (ft):		**0**	

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	**72**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Deposition Below,Scour Below,Alignment**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**1**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**2**	Delta:	**0**	Flood chutes:	**2**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**0**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**1,216**
Side:	**2**	Braiding:	**0**	Steep Riffles:	**2**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**18**	**None**	**No**	Geomorphic Rating	**0.65**
7.2 Channel Aggradation		**13**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**8**	**None**	**No**	Channel Evolution Stage	**I**
7.4 Change in Planforml		**13**	**None**	**No**	Geomorphic Condition	**Good**
Total Score		**52**			Stream Sensitivity	**Moderate**

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Stream Geomorphic Assessment

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Phase 2 Segment Summary Report — West Branch Ompompanosuc

Stream: **West Branch Ompompanoosuc**
Reach: **M02-0**
Segment Length(ft): **7,547**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Bear Creek Environmental**
Observers: **Pam, Emily, Gretchen Alexander**
Completion Date: **10/9/2012**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location:

Step 5 - Notes: **There is a 870-foot section of this reach that is semi-confined. This reach is a C3 by reference, but the Phase 2 existing stream type is C4. This reach seemed to have larger substrate overall, but the sand (16%) in interstitial spaces created a biomodal distribution and the stream type came out as C4. The substrate D50 was right on the line between cobble and gravel.**

Step 7 - Narrative: **Channel has gone through the full evolution process and is now in stage F-V. There was a higher feature (terrace) that may have been an abandoned floodplain, but not recently abandoned. Channel now has new floodplain and good access to it in most places. Abundant flood chutes, some that have been altered through flood work. Flood work was isolated to two areas.**

Step 1. Valley and Floodplain

1.1 Segmentation: **None**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	7,149	0	382	0
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	2,544		590	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Extr.Steep	Very Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	N.E.	N.E.

1.5 Valley Features
Valley Width (ft): **458**
Width Determination: **Measured**
Confinement Type: **NW**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	6.0	4.0	Yes	
Ledge	Mid-segment	3.0	2.0	Yes	
Ledge	Mid-segment	30.0	35.0	Yes	

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Stream Geomorphic Assessment

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Phase 2 Segment Summary Report — West Branch Ompompanosuc

Stream: **West Branch Ompompanoosuc** Reach: **M02-0**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**100.46**	2.11 Riffle/Step Spacing:	**290 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**4.60**	2.12 Substrate Composition		Bed:	**20.5**	**inches**
2.3 Mean Depth (tf):	**2.93**	Bedrock:	**0.0 %**	Bar:	**10.8**	**inches**
2.4 Floodprone Width (ft.):	**246.40**	Boulder:	**14.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.)	**5.50**	Cobble:	**36.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**18.0 %**	Bed Material:	**Gravel**	
2.6 Width/Depth Ratio:	**34.29**	Fine Gravel:	**17.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**2.45**	Sand:	**15.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.20**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.	**0.00**	Silt/Clay Present:	**Yes**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**0.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**98**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**2,790.8**	**2,910.2**	Dominant:	**Coniferous**	**Deciduous**
Material Type:	**Boulder/Cobble**	**Sand**	Erosion Height (ft.):	**3.1**	**3.6**	Sub-dominant:	**Herbaceous**	**None**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Multiple**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**802.6**	**820.6**	Canopy %:	**26-50**	**76-100**
Material Type:	**Sand**	**Sand**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**26-50**	**>100**
Sub-Dominant	**0-25**	**0-25**
W less than 25	**1,372**	**500**
Buffer Vegitation Type		
Dominant	**Deciduous**	**Deciduous**
Sub-Dominant	**Herbaceous**	**Herbaceous**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Residential**	**Forest**	Mass Failures		**386.92**
Sub-dominant	**None**	**Residential**	Height		**35.4**
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**Multiple**	**30.0**	Gullies Length	**0**	
Gullies	**None**				

VERMONT

Stream Geomorphic Assessment

VT DEC

Agency of Natural Resouces

Vermont.gov

March, 22 2013

Phase 2 Segment Summary Report — West Branch Ompompanosuc

Stream: **West Branch Ompompanoosuc** Reach: **M02-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Abundant**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs			
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch:	**0**	Road Ditch:	**5**
4.3 Flow Status:	**Moderate**	Impoundments:		Other:	**0**	Tile Drain:	**0**
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	**4**	Urb Strm Wtr Pipe:	**0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:		**0**	
		(old) Upstrm Flow Reg.:		Affected Length (ft):		**0**	

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**9**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:	**No**		
Mid:	**4**	Delta:	**4**	Flood chutes:	**18**	Avulsion:	**1**	5.5 Straightening:	**Straightening**
Point:	**3**	Island:	**1**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**4,601**
Side:	**25**	Braiding:	**1**	Steep Riffles:	**14**	Trib Rejuv.:	**No**	5.5 Dredging:	**Gravel Mining**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl:		6.4 Sediment Deposition:		Stream Gradiant Type	Left / Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**13**	**None**	**No**	Geomorphic Rating	**0.50**
7.2 Channel Aggradation		**7**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**12**	**None**	**No**	Channel Evolution Stage	**V**
7.4 Change in Planforml		**8**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**40**			Stream Sensitivity	**Very High**

To: Bear Creek Environmental
From: Gretchen Alexander, VT DEC River Management
Date: 2/27/13

BCE comments 3/7/13

ANR e-mail correspondence on 3/14/13 indicated no further questions/comments after BCE's 3/7/13 response.

Ompompanoosuc River Phase 2 QA

The questions raised in this Quality Assurance assessment are meant to address potential discrepancies within the data set, uncover data entry errors, or otherwise clarify and confirm those observations that might not have been expected. It is important to take into consideration how data might be viewed or interpreted by the myriad of users who are familiar with the science and protocols but may be unfamiliar with the assessed reaches. While providing notes and comments, try to anticipate the types of questions that may arise due to outliers and exceptions observed within the reach. While attempting to clarify the data for those users wishing to utilize it years after collected, it's better to err on the side of making excessive comments than it is for them to be insufficient.

After reviewing the comments below, please update this document in a second color with what steps were (or were not) taken to address the comments/questions.

General Comments:

The reaches below the Union Village Dam are all noted as having bankfull elevations lower than pre-dam construction, and you hypothesize this is likely caused by reduced flows (not incision). Did you consider whether it is possible that disruption of sediment continuity due to the dam could also have contributed to floodplain disconnection, and that some of the change in bankfull elevation could in fact be attributed to a degradation process (hungry water effect)? See below regarding specific comments about documenting floodplain disconnection and whether or not to calculate an IR off of the pre-dam RAF. The Step 7 comments for R03-B explain the lower bankfull elevation is attributed to both incision and reduction in flows. We have reevaluated the incision ratios for the other cross sections below the dam. We agree that the disconnection with the floodplain may also be due to the disruption of sediment continuity from the dam (incision). Segments below the dam now take into account this incision process. CEMs for segments below the dam were adjusted as well. We have noted that it is unclear at what point in time the incision occurred (pre or post dam construction). RGAs and RHAs have been updated. Cross sections re-uploaded to DMS.

Reach specific comments:

R03-A
Interesting upside-down mushrooms!

R03-B

No comments.

Most recent protocol says that unless road is a numbered state highway it should not be considered a Phase 2 valley wall. Phase 2 valley width has been updated to reflect this – Campbell Flats Road is not a Phase 2 valley wall. Now there is no human-caused change in confinement in this segment. RGA was updated as well.

Based on our re-evaluation of the cross sections per your comment regarding incision, we have revised the IR for R03-B to 2.27. This revised incision ratio takes into account both the degradation from incision and the lower bankfull elevation from flow reduction due to the flood control dam.

R04-A

Update Phase 1 step 6.3 from "none" to "multiple" to reflect Phase 2 data. Done. Phase 1 data was updated for the Ompompanoosuc prior to the addition of "side" as an option in 6.3, which we brought up during the Ottauquechee QA.

x.s spreadsheet: You note that the left pin is 1 foot lower than the top of the bench. Why did you not use the bench as your RAF? Your step 5 comments note incision, but this is not reflected in the cross section and step 2.8. I suspect you have it this way to show that the bankfull has changed due to flow reduction rather than bed degradation. Yes, that was the case. I can see why you would do this, but I think it is important to capture the fact that the channel now has decreased floodplain access due to the change in bankfull, regardless of the underlying cause. I would prefer that you calculate an IR off of the RAF and put it in a later CEM stage to reflect the fact that floodplain access is altered, and indicate in your notes that the IR does not reflect a degradation process in this case. Does this make sense? Do you have other suggestions on how to best capture this? This does make sense. We appreciated you taking the time to talk with us on the phone today (3/6/2013). We have revised the IR to take into account both a degradation process and the lower elevation from flow reduction. A higher RAF elevation was selected based on the change in slope (elevation where bankfull was likely prior to the channel incising). This results in an incision ratio of 2.23, which is similar to R03-B. It is difficult to know conclusively whether segment R04-A incised. Our field notes suggest R04-A is currently very stable and we observed bedrock along the banks. CEM changed from F-I to F-V to indicate that a disruption (dam construction and controlled flows) occurred here, but that the segment is stable. A note has been added to indicate that although CEM is F-V, F-III and F-IV may not have occurred.

Also, I was curious about your comment regarding Alders not growing above bankfull elevation. I have not heard of this before and am just curious if this is based on personal observation or if there is literature out there to this effect? I feel like I have seen Alders growing above bankfull before (like the Wanzer Brook restoration site with which Bear Creek was involved?). This was a typo. It should have said, "Alders do not grow below bankfull elevation." Mary learned this from Dave Rosgen at a course. However, willows and alders can grow below bankfull elevation.

R04 –B

x.s spreadsheet: I wonder why this reach does not appear to have an RAF (due to changed hydrology) similar to the downstream segment. The cross sectional area corresponds well with the other flow-affected reaches (roughly 50% of reference). Do you think the bench at distance 113 and height 8.2 is the RAF for pre-dam flows? This would be significantly higher than the downstream segment, but perhaps makes sense given that the valley is narrower in this segment. We have revised the RAF to be at distance 113 feet. This RAF makes sense in terms of the channel incising, but we are not confident in this RAF because it is in a semi-confined valley where a wide floodplain would not be expected. Our field notes suggest this is a stable segment with minimal interference. There are stable banks and high quality buffers. The river may have incised due to the sediment discontinuity of the flood control dam, but is currently a stable Bc stream type. For this reason we have revised the CE stage to F-V and added notes about this.

Based on channel dimensions, this is a borderline F or B channel. You chose B – can you justify in your comments? Would be affected if you make changes based on comment above. Justification has been added to Step 5 comments. We felt that the majority of the segment had more floodplain access than an F stream type would, so the B stream type is more representative; the location of the cross section was limited because of a very large Rank 7 pool at the downstream end of the segment. In addition, we looked back at our notes and decided to use the LBF elevation (instead of an average between LBF and RBF) due to our confidence in the feature in the field. This changed the width slightly and resulted in an entrenchment ratio of 1.40 (similar to what we used in the field to make the determination with had a "B" stream type).

R05

x.s spreadsheet: similar question as the other flood control dam affected reaches – would it make sense to calculate IR of RAF just to capture disconnection from floodplain? Do you think the channel has evolved and redeveloped a new floodplain? Maybe put it in CEM V? It seems like the channel may have incised a very long time ago from that floodplain. Campbell Flats Road (left of channel, distance -76) was built at a lower elevation than that floodplain. I would argue that this is not a "recently" abandoned floodplain. We have looked at this cross section in the office and although there is no clear RAF at a lower elevation (possibly because of road interference), an elevation of 5.5' was chosen. This results in an incision ratio of 5.5/2.9'= 1.90. This incision ratio is slightly lower than the downstream segments. The difference may be a function of R05 being closer to the grade control/dam.

Your step 5 comment indicates that Academy Road is considered the Phase 2 valley wall. Based on the current river corridor delineation protocols, unless it is a numbered state highway, roads are not considered the Phase 2 valley wall (unless they are confining). Did you think the road was confining or just that it would be considered an administrative vw for corridor delineation purposes? Phase 2 valley width has been updated to reflect that Academy Road is not a Phase 2 valley wall. Now there is no human-caused change in confinement in this segment. RGA was updated as well.

R06-A

Update Phase 1 step 6.3 from "none" to "multiple" to reflect Phase 2 data. Done.

x.s spreadsheet: similar question as the other flood control dam affected reaches – would it make sense to calculate IR off of terrace just to capture disconnection from floodplain? Is this location too altered by house/potential fill to do this? Do you think the channel has evolved and redeveloped a new floodplain at lower elevation? Or perhaps always been more stable than downstream reaches due to bedrock influence? The location is likely altered by fill from the house, although we cannot be sure. The channel is likely more stable here because of the bedrock influence and it being closer to the dam. The historic incision is not evident on this cross section. There does, however, seem to be a reduction in the bankfull elevation which may be attributed to flow reduction from the flood control dam. The revised incision ratio is 4.7/3.9 =1.22. This incision ratio is significantly lower than the IR for downstream reaches. This makes sense because the cross section was measured just downstream of the dam, which is acting as a large grade control. We have assigned a CE stage of F-V because the segment appears to be a stable B3c stream type. Comments have been added to Step 7.

Most recent protocol says that unless road is a numbered state highway it should not be considered a Phase 2 valley wall. Phase 2 valley width has been updated to reflect this – Academy Road/Main Street is not a Phase 2 valley wall. Now there is no human-caused change in confinement in this segment. RGA was updated as well.

R06-B
No comments.

R06.S1.01-A
No comments.

R06.S1.01-B
No comments.

R06.S1.02-A – not assessed
No comments.

R06.S1.02-B
Step 7 – You put it in stage 1 and noted little adjustment, but cross section does indicate some minor incision (1.2). Did you feel it was minor enough such that it would not lead to subsequent channel adjustment? Please discuss in your notes. After looking at cross section and photos from the whole segment, we have concluded that this segment is not incised. There are several bedrock grade controls in this segment that are limiting vertical adjustment. We have moved our bankfull elevation up to 3.2, which is the elevation of our RAF. Cross sectional area is now 193% of regional curve; however, on such a small stream the Vermont Hydraulic Geometry Curves likely underestimates the reference bankfull cross sectional area. All subsequent changes have been made (floodprone width, mean depth, etc.) and updated in the DMS. There is no change to stream type or channel evolution stage. Cross section has been re-uploaded to DMS.

Phase 2 valley wall shapefile has been updated in this segment to show the change in confinement due to Route 132.

R06.S1.02-C
Those are some crazy mushrooms!

R08-A – not assessed
No comments.

R08-B
Update Phase 1 step 6.3 from "mid-channel" to "multiple" to reflect Phase 2 data. Done.

Do the gabions look like they were installed to protect the road? Curious about their history. Maybe something to follow-up on in discussions with town etc. to get some history on this project. No. They were installed on both sides of the river, possibly to prevent erosion. This will be something to follow-up with and figure out the history of as we move forward.

R08-C
No comments.

R08-D – not assessed
No comments.

R09
Update Phase 1 step 6.3 from "none" to "multiple" to reflect Phase 2 data. Done.

Step 4.2: Seems odd you picked "minimal" for adjacent wetland, as there is a very large class 2 wetland mapped on river right. Did you feel it was not hydrologically connected? The banks on river right were very high (see cross section). We felt that the wetland is most likely not hydrologically connected to the channel anymore. We have added a note to Step 5.

Did you consider whether this reach might be an E stream type by reference? Looking at the photos and the cross-sectional shape of the channel, it sort of has this feel to it, but maybe it's just because the water was high at the time of assessment. Putting bankfull at top of bank would definitely increase cross-sectional area beyond reference. Just wonder your thoughts on this. Based on the fact that the reach has likely been historically straightened and sinuosity modified, it is difficult to tell whether the reference stream type is an E or C. We have kept this reach as a C by reference, but have made a note in Step 5 to indicate that it could be an E by reference. Based on field observations, it seemed more like a C by reference.

R10-A
Cross section – why did you not consider the LTOB the RAF? Your bankfull is about 1.5 feet lower than this fairly flat feature on the left bank, which would indicate historic incision, don't you think? Let me know your thoughts on this. We agree that this segment has some minor historic incision. We used the LTOB as the RAF and got an incision ratio of 1.3. We have updated the cross section to indicate this and re-uploaded to DMS. We have changed Step 2 and Step 7 in the DMS. CEM is now F-III, but still in good condition because widening is minor.

R10-B
Did you consider segmenting-out the more confined and stable (downstream) section of the segment? We did consider this in the field. However, the more pronounced change in valley confinement was at the downstream end of segment B, where it got much wider (Segment A). The valley on the upstream end of Segment B did not seem as wide in the field.

R10-C – not assessed
No comments.

R11-A
Phase 1 step 4.4 – please update springs and seeps from "abundant" to "minimal" to reflect Phase 2 data. Done.

R11-B
No comments.

R11-C
No comments.

R11-D
No comments.

R12-A
Update Phase 1 step 6.3 from "none" to "multiple" to reflect Phase 2 data. Done.

R12-B
No comments.

R13
Update Phase 1 step 6.3 from "none" to "side" to reflect Phase 2 data. Done.

x.s worksheet: what do you mean by the comment "naturally higher banks". The right bank doesn't look high on the spreadsheet – looks like a nice floodplain bench… do you just mean that the banks are often continuous with the vw and steep or confined? Yes, that is what we meant. We have changed the wording on the cross section to be clearer and re-uploaded to the DMS.

R14-A
This looks like a very nice segment of river! It was beautiful!

Update Phase 1 step 6.3 from "none" to "side" to reflect Phase 2 data. Done.

R14-B
Step 7.5 comment – fix typo for clarity: "The bedrock grade control at the downstream end of this segment is keeps some floodplain access in downstream portion." Fixed. "The bedrock

grade control at the downstream end of this segment is maintaining some floodplain access in downstream areas."

R14-C
No comments.

M01-A
Do you think the extreme incision you noted in this segment, despite the active aggradation process, might be a result of tributary rejuvenation? This segment flows into the Ompomp just upstream of the flood control dam, and although this section of Ompomp (Did you mean West Branch here?) is likely impounded at times, the stretch of river in the impoundment looks artificially straightened and may have experienced incision because of this alteration. Thoughts? Sure, tributary rejuvenation is a possibility.

West Branch Reaches – did you verify that the VW shapefile dated 6/6/06 is accurate? Didn't see an updated file in the folder you sent. West Branch reaches have updated valley wall shapefiles, but were inadvertently left out. Files are uploaded to Gretchen's FTP site.

M01-B – not assessed
No comments.

M01-C
No comments.

M01-D
No comments.

M01-E
Step 0: Your segment location description is truncated. Please edit and finish your thought elsewhere in the notes (step 5 or 7). End of description is now entered in Step 5.

M01-F
x.s worksheet: Does that path that appears in the cross section seem like it is on fill? Is this a berm? The flat features on the left and right banks (behind the path on the right bank) look like RAF's to me and make me wonder if you should calculate incision off of this. This would support the CEM stage IV thought that you had. Thoughts? The path is definitely on fill. This has now been indexed as an improved path in the FIT and re-uploaded to the DMS. This came up in our internal QA and we agree that in retrospect, we should have done an additional cross section in M01-H or M01-J. We have moved the RAF to the elevation of 6.2 in the cross section (actual elevation 5.2), which is the lower feature to the right of the path. Incision is now 1.6. CEM changed to F-IV, although it is still strange that the channel is so straight and in F-IV. Cross section re-uploaded and changes have been made in the DMS to M01-F. Step 2 channel dimensions for M01-H and M01-J will be kept as is because that is more representative of what is going on in those segments. Notes about this have been added to Step 5 comments for M01-H and M01-J. Changes can be made to those segments when a cross section(s) is completed.

A human-elevated incision ratio does not need to be calculated in this case. According to protocol (www.vtwaterquality.org/rivers/docs/rv_incisionratio.pdf), since there is still floodplain access on the left side of the channel, the path is not considered the RAF. Example C explains this. I would suggest adding some sort of human-affected entrenchment ratio calculation to the protocol. This way you could compare the natural floodplain width to the floodplain width that is restricted by the encroachment. In this case the old floodplain would have been around 615 feet wide (approximate). The actual floodplain width is 385 feet (measured on cross section). 385/615 = 0.63. So, the encroachment has reduced floodplain width by 37%. Just seems like a good way to illustrate what is going on here.

M01-G
No comments.

M01-H
x.s worksheet – if you reconsider RAF in segment F, this would have an impact on this reach too given that you used the same x.s. See comments for M01-F.

M01-I
No comments.

M01-J
x.s worksheet – if you reconsider RAF in segment F, this would have an impact on this reach too given that you used the same x.s. I know you were trying to economize fieldwork, but think it would have been nice to have a x.s for this segment given differences in bank slopes, proximity of vw, lack of path etc. See comments for M01-F.

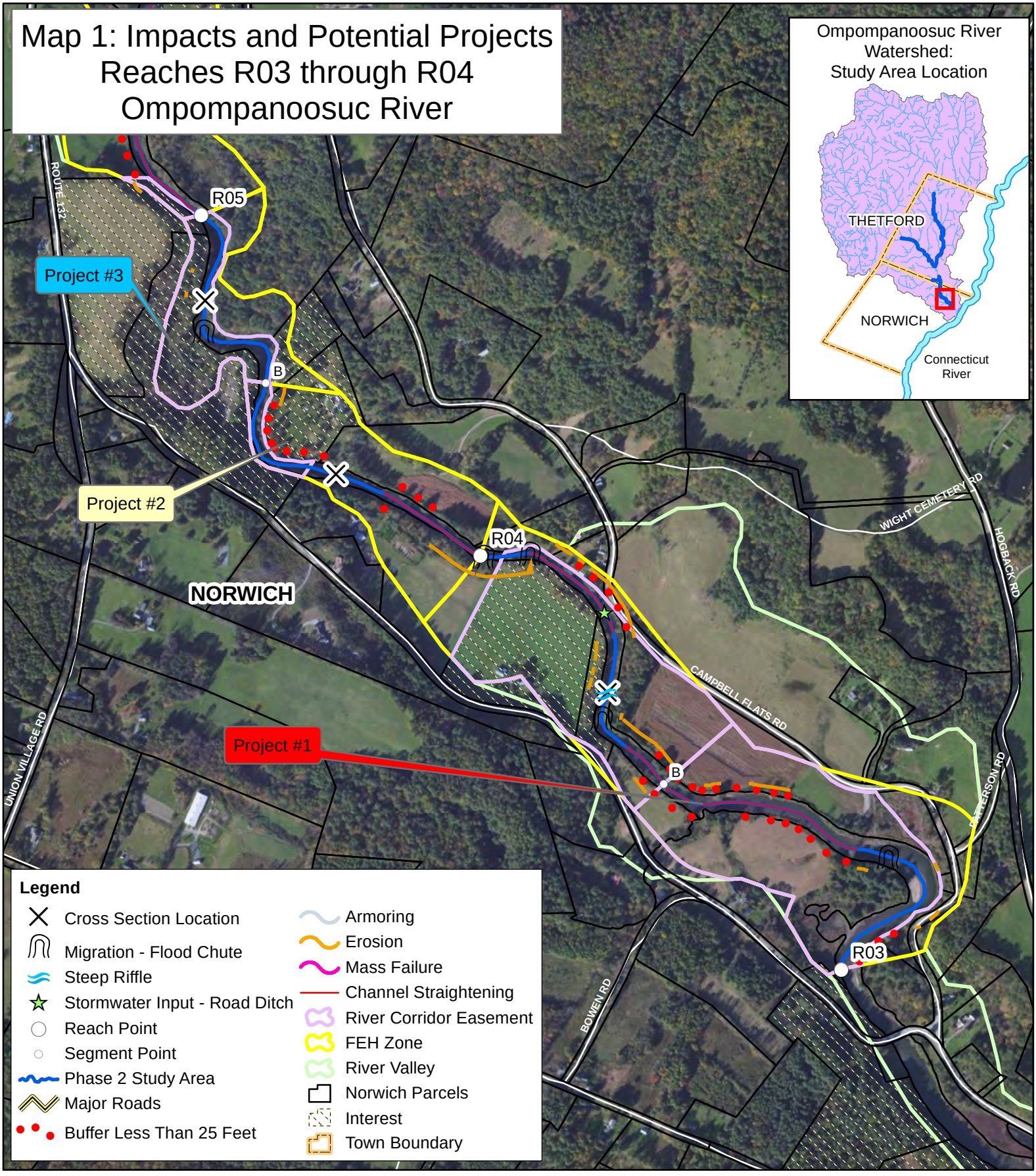
M02
No comments.

Phase 2 valley wall shapefile has been updated to show change in confinement at upper end of segment as a result of Route 132.

APPENDIX D

Potential Project Locations & Descriptions

Map 1: Impacts and Potential Projects
Reaches R03 through R04
Ompompanoosuc River



Projects:

1. Streamside Plantings and/or River Corridor Easement (RCE)
2. Buffer Improvement
3. Protect Wetland/RCE

Project Priority:

- Low
- Moderate
- High

N W E S

0 500 1,000 Feet

1 inch = 750 feet

Background is Bing Imagery

Bear Creek Environmental

Table 1. Ompompanoosuc River Main Stem Map 1: R03 through R04 Site Level Opportunities for Restoration and Protection Norwich, Vermont						
Project # Segment	**Type of Project**	**Site Description Including Stressors and Constraints**	**Project or Strategy Description**	**Technical Feasibility and Priority**	**Other Social Benefits**	**Potential Partners/ Programs**
Project #1 R03	Passive Restoration	Agricultural fields along channel lack adequate buffer along southern and northern banks; channel has poor floodplain access along agricultural fields in river corridor	**Streamside Plantings and River Corridor Easement**, segment not assessed	High Priority (interested landowner)	Improved habitat and water quality	Landowner, NCC, VANR, Town of Norwich CREP, TFS, WHIP, CRWC, RCE
Project #2 R04-A	Passive Restoration	Residential area has limited buffer vegetation	**Improve Buffer**: Stream side plantings or stop mowing and allow natural regeneration	Low Priority: Landowner extended the buffer during summer 2013 by increasing the width of the "no mow zone"	Improved habitat and water quality	Landowners, NCC, VANR, Town of Norwich TFS, CRWC
Project #3 R04-B	Passive Restoration	Wetland in western corridor; semi-confined valley is not likely to be developed	**Protect wetland**	Moderate Priority (interested landowner)	Improved habitat and water quality	Landowner, NCC, VANR, Town of Norwich WRP, RCE

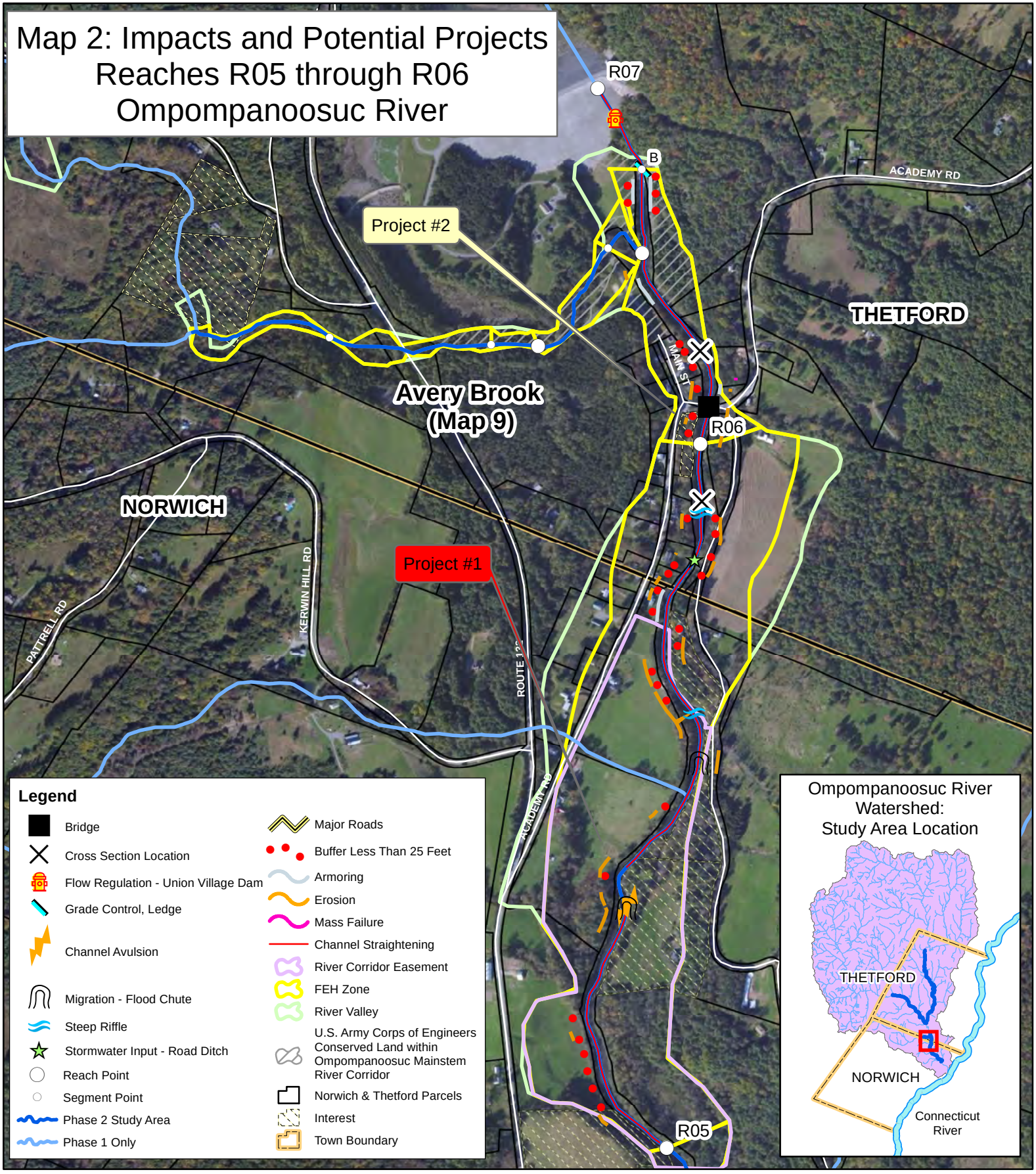
Photos of Proposed Project Locations – Map 1
Ompompanoosuc River Main Stem, R03 through R04

(No photo available for Project #3 – Protect Wetland in R04-B)

Project #1 – Streamside Plantings and River Corridor Easement, R03-A

Project #2 – Streamside Plantings, R04-A

Map 2: Impacts and Potential Projects
Reaches R05 through R06
Ompompanoosuc River



Projects:

1. River Corridor Easement
2. Streamside Plantings

Project Priority:

- Low
- Moderate
- High

N
W E
S

0 500 1,000 Feet

1 inch = 750 feet

Background is Bing Imagery

Bear Creek Environmental

Table 2. Ompompanoosuc River Main Stem Map 2: R05 through R06 Site Level Opportunities for Restoration and Protection Norwich and Thetford, Vermont						
Project # Segment	**Type of Project**	**Site Description Including Stressors and Constraints**	**Project or Strategy Description**	**Technical Feasibility and Priority**	**Other Social Benefits**	**Potential Partners/Programs**
Project #1 R05	Passive Restoration	Fields in river corridor in Norwich have good floodplain access; buffers are narrow on west side of river channel	**Streamside Plantings and River Corridor Easement**	High Priority	Improved habitat and water quality	Landowners, NCC, VANR, Town of Norwich RCE, TFS
Project #2 R05 & R06-A	Passive Restoration	Residential lawns along river have inadequately vegetated buffers in some locations.	**Streamside Plantings**	Low Priority	Improved habitat and water quality	Landowners, TCC, VANR, Town of Thetford TFS, CRWC

Photos of Proposed Project Locations – Map 2
Ompompanoosuc River Main Stem, R05 through R06

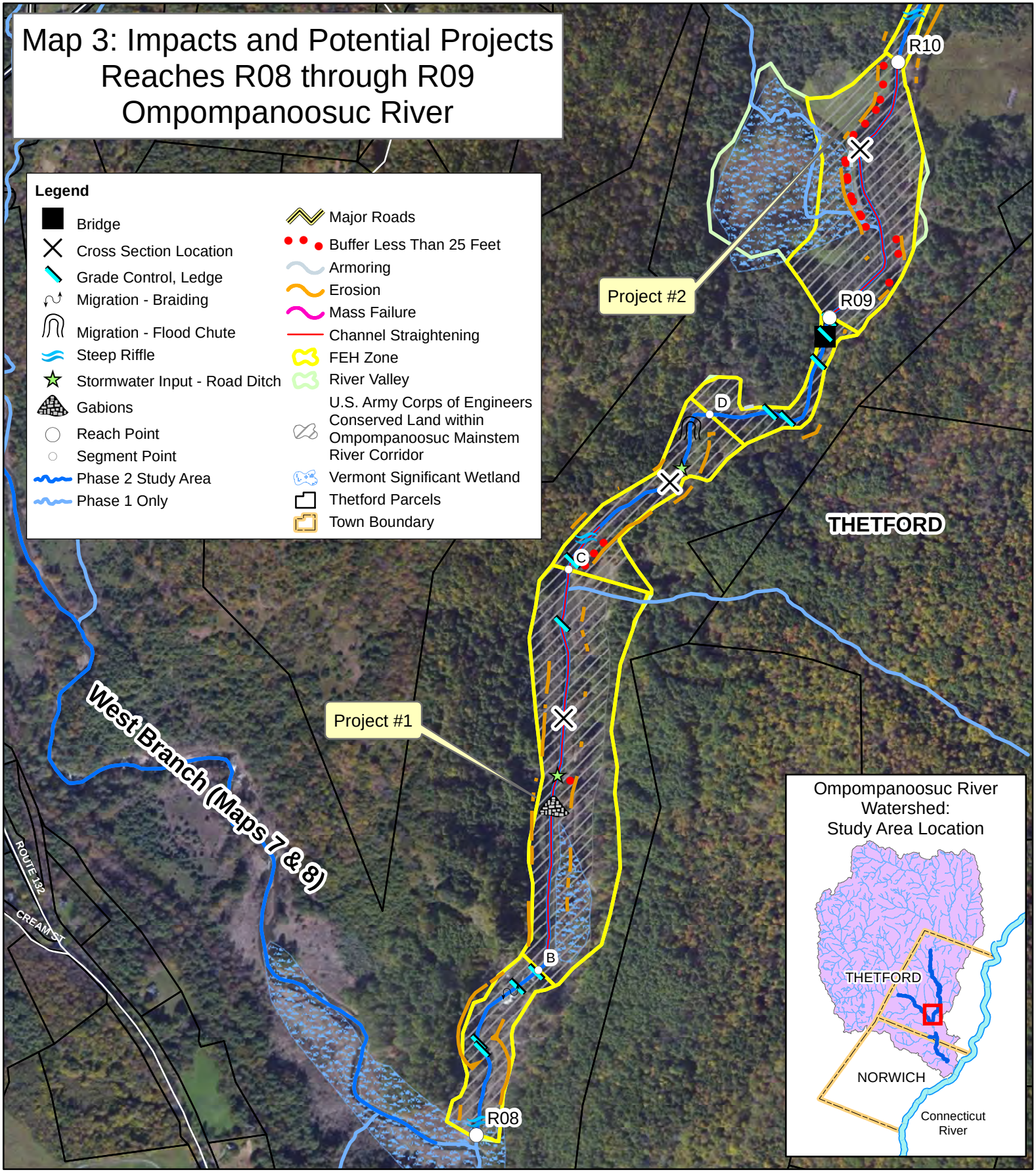
Great floodplain access in R05

Forested area near downstream end of R05

Project #1 – River Corridor Easement, R05

Project #2 – Streamside Plantings, R05 & R06-A

Map 3: Impacts and Potential Projects
Reaches R08 through R09
Ompompanoosuc River



Projects:

1. Remove Gabions
2. Natural Revegetation

Project Priority:

- Low
- Moderate
- High

N W E S

0 500 1,000 Feet

1 inches = 750 feet

Background is Bing Imagery

Bear Creek Environmental

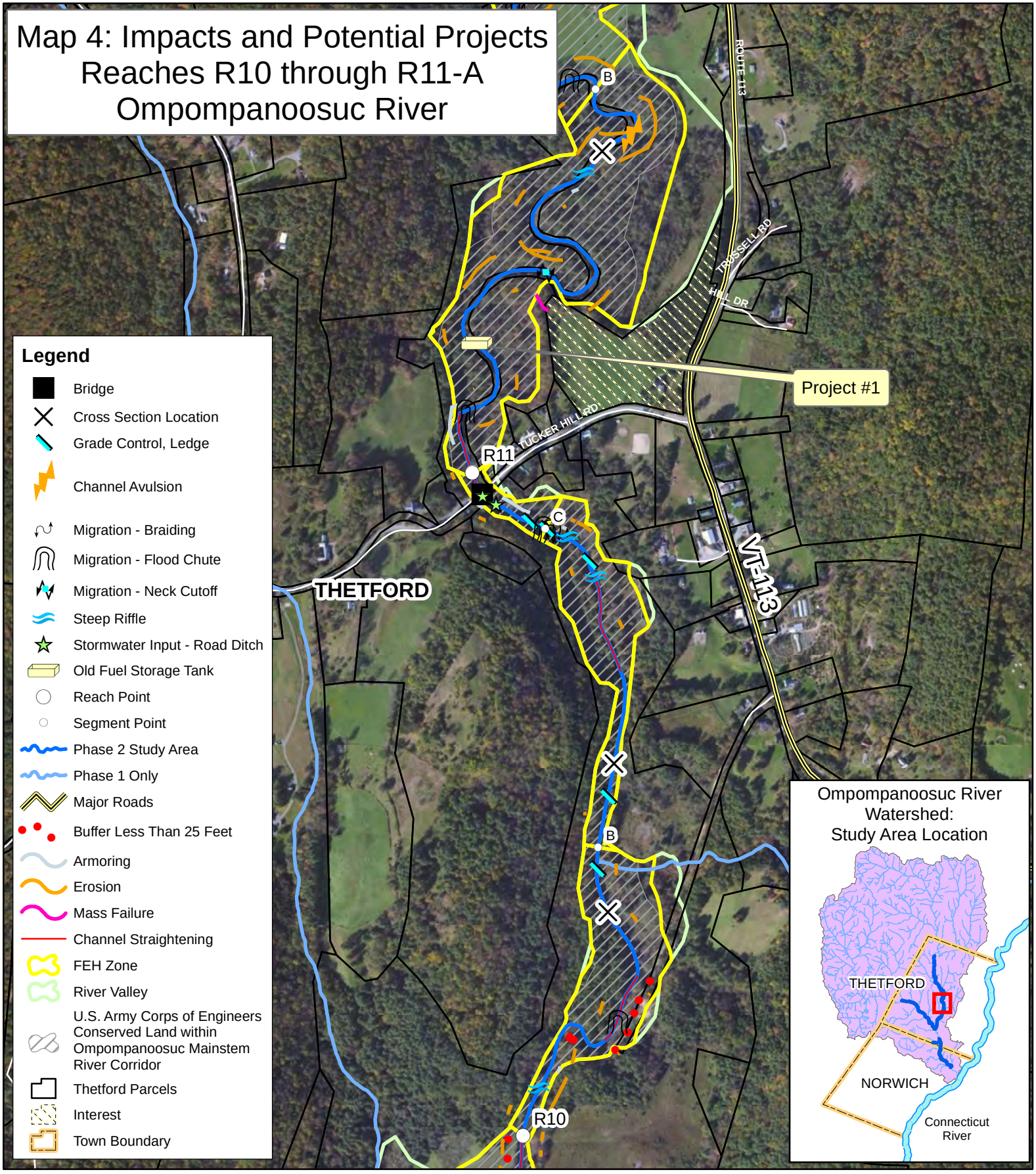
Table 3. Ompompanoosuc River Main Stem Maps 3: R08 through R11-A Site Level Opportunities for Restoration and Protection Thetford, Vermont						
Project # Segment	**Type of Project**	**Site Description Including Stressors and Constraints**	**Project or Strategy Description**	**Technical Feasibility and Priority**	**Other Social Benefits**	**Potential Partners/Programs**
Project #1 R08-B	Active Restoration	Several old gabions on both sides of the channel are causing erosion and sediment buildup. Gabions have been outflanked in some locations and in time will likely collapse on their own. They are currently providing habitat in some locations.	**Alternatives Analysis** for the removal of the gabions	Low Priority; ACOE not interested in moving forward with a project at this time	Improved habitat, water quality, and geomorphic stability	US Army Corps of Engineers, TCC, VANR, Town of Thetford ERP, CRWC
Project #2 R09	Passive Restoration	Area along western bank lacks adequate buffer width. Canopy cover is reduced. Limited access here.	**Natural Regeneration of Vegetation**	Low Priority	Improved habitat and water quality	US Army Corps of Engineers, TCC, VANR, Town of Thetford

Photos of Proposed Project Locations – Map 3
Ompompanoosuc River Main Stem, R08 through R11-A

Project #1 – Alternatives Analysis for the Removal of Gabions, R08-B

Project #2 – Natural Reestablishment of Vegetation (western bank), R09

Map 4: Impacts and Potential Projects Reaches R10 through R11-A Ompompanoosuc River



Legend

- Bridge
- Cross Section Location
- Grade Control, Ledge
- Channel Avulsion
- Migration - Braiding
- Migration - Flood Chute
- Migration - Neck Cutoff
- Steep Riffle
- Stormwater Input - Road Ditch
- Old Fuel Storage Tank
- Reach Point
- Segment Point
- Phase 2 Study Area
- Phase 1 Only
- Major Roads
- Buffer Less Than 25 Feet
- Armoring
- Erosion
- Mass Failure
- Channel Straightening
- FEH Zone
- River Valley
- U.S. Army Corps of Engineers Conserved Land within Ompompanoosuc Mainstem River Corridor
- Thetford Parcels
- Interest
- Town Boundary

Ompompanoosuc River Watershed: Study Area Location

Projects:

1. Stream Clean-Up

Project Priority:

- Low
- Moderate
- High

N W E S

0 500 1,000 Feet

1 inch = 750 feet

Background is Bing Imagery

Bear Creek Environmental

Table 4. Ompompanoosuc River Main Stem Map 4: R10 through R11-A Site Level Opportunities for Restoration and Protection Thetford, Vermont						
Project # Segment	**Type of Project**	**Site Description Including Stressors and Constraints**	**Project or Strategy Description**	**Technical Feasibility and Priority**	**Other Social Benefits**	**Potential Partners/ Programs**
Project #1 R11-A	Stream Clean-Up	Old fuel tank is in the river near the left bank. Area is difficult to access with machinery. Possibly dislodge tank by hand and float downstream to a more accessible location.	**Remove Fuel Tank**	Low Priority	Improved water quality	US Army Corps of Engineers, TCC, VANR, Town of Thetford ERP

Photos of Proposed Project Locations – Map 4
Ompompanoosuc River Main Stem, R10 through R11-A

Old fuel tank in channel

Project #1 – Stream Clean-Up, R11-A

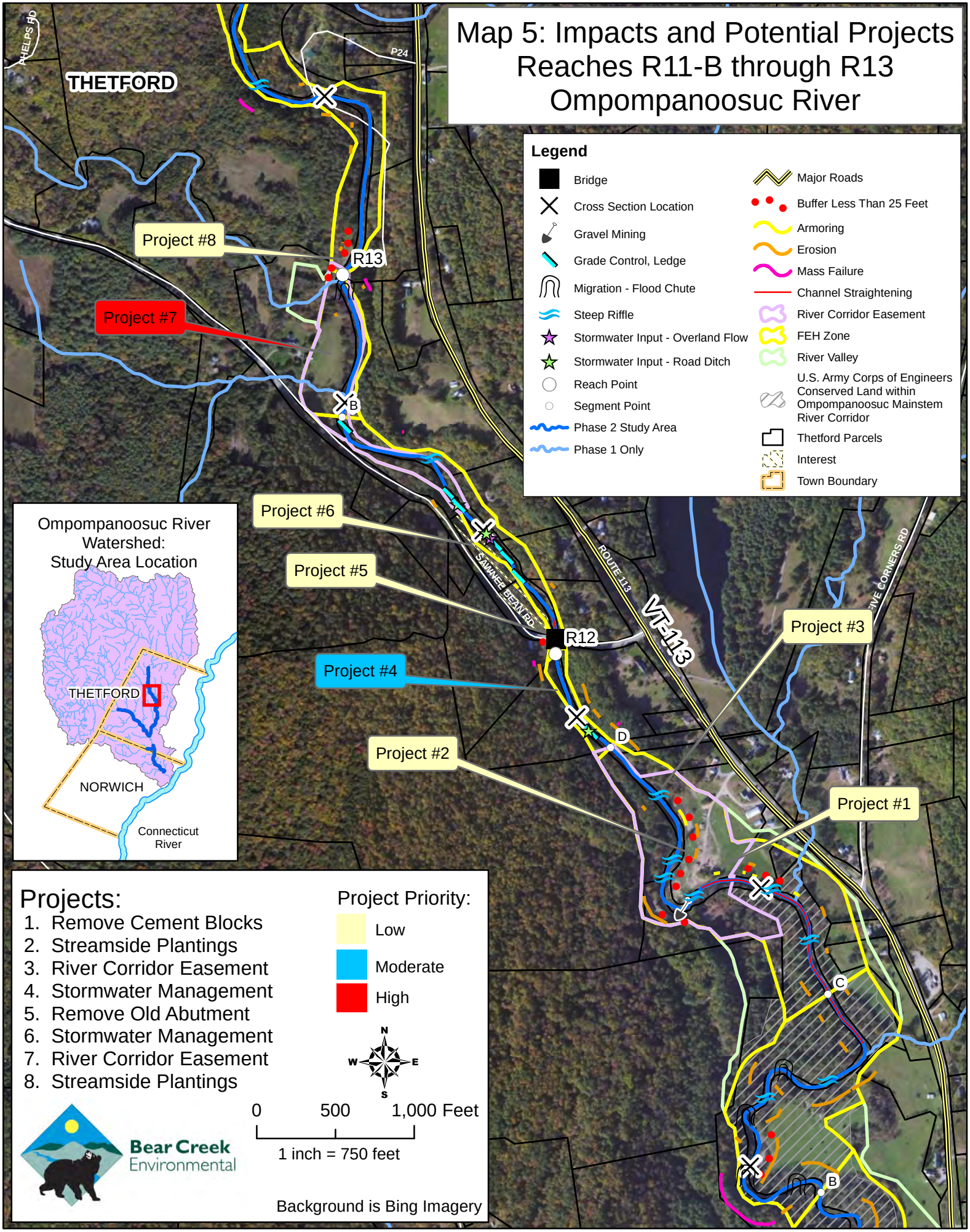

Map 5: Impacts and Potential Projects
Reaches R11-B through R13
Ompompanoosuc River
THETFORD
PHELPS RD
P24
Project #8
Project #7
Project #6
Project #5
Project #4
Project #3
Project #2
Project #1
R13
R12
B
C
D
SAWMEE BEAN RD
ROUTE 113
VT-113
FIVE CORNERS RD
Legend
Bridge
Cross Section Location
Gravel Mining
Grade Control, Ledge
Migration - Flood Chute
Steep Riffle
Stormwater Input - Overland Flow
Stormwater Input - Road Ditch
Reach Point
Segment Point
Phase 2 Study Area
Phase 1 Only
Major Roads
Buffer Less Than 25 Feet
Armoring
Erosion
Mass Failure
Channel Straightening
River Corridor Easement
FEH Zone
River Valley
U.S. Army Corps of Engineers Conserved Land within Ompompanoosuc Mainstem River Corridor
Thetford Parcels
Interest
Town Boundary
Ompompanoosuc River Watershed:
Study Area Location
THETFORD
NORWICH
Connecticut River
Projects:
1. Remove Cement Blocks
2. Streamside Plantings
3. River Corridor Easement
4. Stormwater Management
5. Remove Old Abutment
6. Stormwater Management
7. River Corridor Easement
8. Streamside Plantings
Project Priority:
Low
Moderate
High
N
W
E
S
0
500
1,000 Feet
1 inch = 750 feet
Bear Creek Environmental
Background is Bing Imagery

Table 5a. Ompompanoosuc River Main Stem Map 5: R11-B through R13 Site Level Opportunities for Restoration and Protection Thetford, Vermont						
Project # Segment	**Type of Project**	**Site Description Including Stressors and Constraints**	**Project or Strategy Description**	**Technical Feasibility and Priority**	**Other Social Benefits**	**Potential Partners/Programs**
Project #1 R11-C	Active Restoration	Short length (~35 feet) of concrete blocks limits channel's ability to widen and may add to geomorphic instability of segment. Does not appear to be protecting anything.	**Remove Cement Blocks**	Low Priority; landowner is not interested in pursuing project at this time	Improved geomorphic stability	Landowner, TCC, VANR, Town of Thetford ERP
Project #2 R11-C	Passive Restoration	Eastern bank does not have adequate buffer, good floodplain access.	**Streamside Plantings**	Low Priority; landowner is not interested in pursuing project at this time	Improved habitat and water quality	Landowner, TCC, VANR, Town of Thetford TFS, CRWC
Project #3 R11-C	Passive Restoration	Segment has good floodplain access. Unsure of land use in eastern corridor.	**Protect River corridor through Easement**	Low Priority; landowner is not interested in pursuing project at this time	Improved habitat and water quality	Landowner, TCC, VANR, Town of Thetford TFS, CRWC
Project #4 R11-D	Stormwater Management	Multiple stormwater inputs were identified in the western corridor. Runoff from private driveway is a major source of sediment.	**Evaluate stormwater Management Options**	Moderate Priority	Improved water quality	Landowner, TCC, VANR, Town of Thetford ERP

Photos of Proposed Project Locations – Map 5

Ompompanoosuc River Main Stem, R11-B through R13

(No photo available for Project #3 – Protect River Corridor, R11-C)

Project #1 – Remove Cement Blocks, R11-C

Project #2 – Streamside Plantings, R11-C

Project #4 – Stormwater Management, R11-D

Project #4 – Stormwater Management, R11-D

Table 5b. Ompompanoosuc River Main Stem Map 5: R11-B through R13 Site Level Opportunities for Restoration and Protection Thetford, Vermont						
Project # Segment	**Type of Project**	**Site Description Including Stressors and Constraints**	**Project or Strategy Description**	**Technical Feasibility and Priority**	**Other Social Benefits**	**Potential Partners/Programs**
Project #5 R12-A	Active Restoration	An old bridge abutment just upstream of the Sawnee Bean Road bridge is causing localized geomorphic instability. Access may be difficult – steep terrain.	**Alternatives Analysis for the removal of the old abutment**	Low Priority	Improved habitat, water quality, and geomorphic stability	Landowner, TCC, VANR, Town of Thetford ERP
Project #6 R12-A	Stormwater Management	Several stormwater inputs were identified along Sawnee Bean Road	**Evaluate Stormwater Management**	Low Priority	Improved water quality	Landowner, TCC, VANR, Town of Thetford ERP
Project #7 R12-A & R12-B	Passive Restoration	Valley wall close on east, western corridor has good floodplain access. Two tributaries enter main stem on this property.	**Protect River Corridor through Easement**, potential to extend easement to include tributaries	High Priority	Improved habitat and water quality	Landowners, TCC, VANR, Town of Thetford RCE
Project #8 R13	Passive Restoration	Area along western bank does not have adequate buffer.	**Streamside Plantings**	Low Priority	Improved habitat and water quality	Landowners, TCC, VANR, Town of Thetford TFS, CRWC

Photos of Proposed Project Locations – Map 5
Ompompanoosuc River Main Stem R11-B through R13

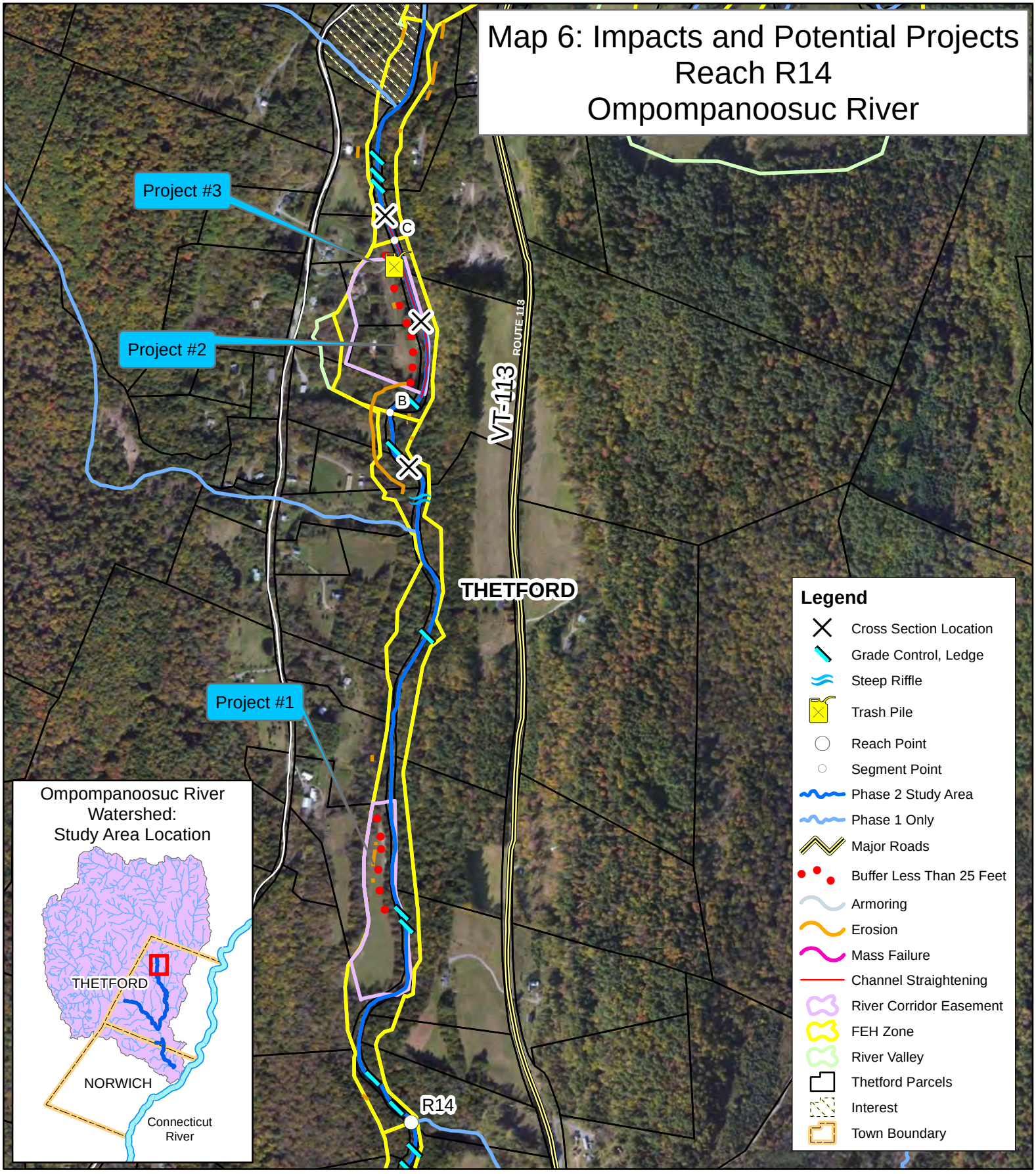
Project #5 – Remove Old Abutment, R12-A

Project #6 – Stormwater Management, R12-A

Project #7 – River Corridor Easement, R12-A & B

Project #8 – Streamside Plantings

Map 6: Impacts and Potential Projects
Reach R14
Ompompanoosuc River



Projects:

1. Streamside Plantings & River Corridor Easement
2. Streamside Plantings & River Corridor Easement
3. Stream Clean-Up

Project Priority:

- Low
- Moderate
- High

N W E S

0 500 1,000 Feet

1 inch = 750 feet

Background is Bing Imagery

Bear Creek Environmental

Table 6. Ompompanoosuc River Main Stem Map 6: R14 Site Level Opportunities for Restoration and Protection Thetford, Vermont						
Project # Segment	**Type of Project**	**Site Description Including Stressors and Constraints**	**Project or Strategy Description**	**Technical Feasibility and Priority**	**Other Social Benefits**	**Potential Partners/Programs**
Project #1 R14-A	Passive Restoration	A 500-foot section on the western stream bank does not have adequate buffer vegetation. Stable segment with good floodplain access.	**Streamside Plantings; Protect River Corridor through Easement**	Moderate Priority	Improved habitat and water quality	Landowner, TCC, VANR, Town of Thetford TFS, CRWC
Project #2 R14-B	Passive Restoration	Area on the western stream bank does not have adequate buffer vegetation. Stable segment with good floodplain access.	**Streamside Plantings; Protect River Corridor through Easement**	Moderate Priority	Improved habitat and water quality	Landowner, TCC, VANR, Town of Thetford TFS, CRWC
Project #3 R14-B	Stream Clean-Up	Old dump along west bank	**Clean up Trash**	Moderate Priority	Improved water quality	Landowners, TCC, VANR, Town of Thetford ERP, CRWC

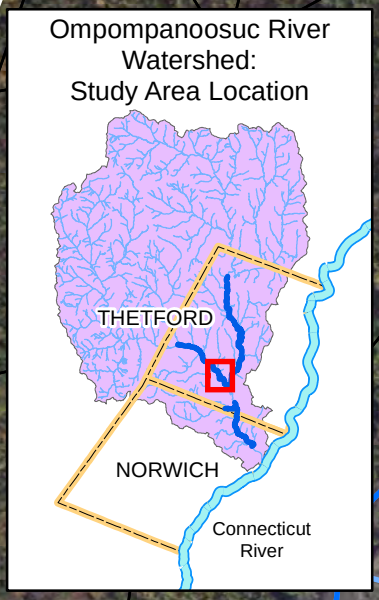
Photos of Proposed Project Locations – Map 6
Ompompanoosuc River Main Stem, R14

(No photo available for Project #1 – Streamside Plantings & River Corridor Easement, R14-A)

Project #2 – Streamside Plantings & River Corridor Easement, R14-B

Project #3 – Stream Clean Up

Map 7: Impacts and Potential Projects
Reach M01-A through M01-H
West Branch of the Ompompanoosuc River



TUCKER HILL RD

ROUTE 132

I

H

G

F

E

D

C

B

M01

Project #1

THETFORD

Ompompanoosuc River (Map 3)

Legend

- Bridge
- Cross Section Location
- Grade Control, Ledge
- Grade Control - Weir
- Channel Avulsion
- Migration - Braiding
- Migration - Flood Chute
- Steep Riffle
- Reach Point
- Segment Point
- Phase 2 Study Area
- Phase 1 Only
- Major Roads
- Buffer Less Than 25 Feet
- Armoring
- Erosion
- Mass Failure
- Channel Straightening
- FEH Zone
- River Valley
- Vermont Significant Wetland
- U.S. Army Corps of Engineers Conserved Land within West Branch River Corridor
- Thetford Parcels
- Town Boundary

Projects:

1. Streamside Plantings

Project Priority:

- Low
- Moderate
- High

N W E S

0 500 1,000 Feet

1 inch = 750 feet

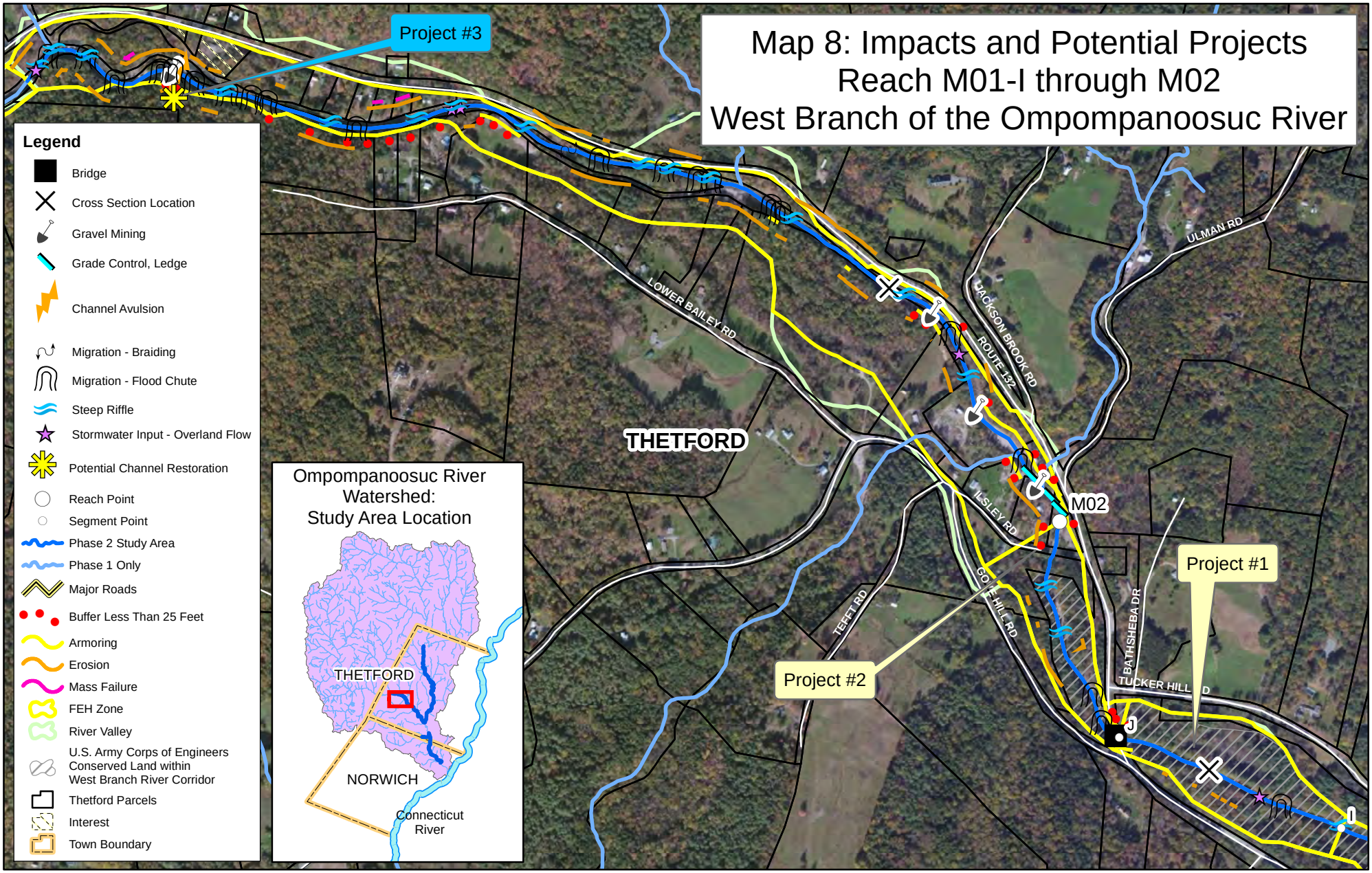
Background is Bing Imagery

Bear Creek Environmental

Table 7. Ompompanoosuc River Watershed – West Branch Map 7: M01-A through M01-H Site Level Opportunities for Restoration and Protection Thetford, Vermont						
Project # Segment	**Type of Project**	**Site Description Including Stressors and Constraints**	**Project or Strategy Description**	**Technical Feasibility and Priority**	**Other Social Benefits**	**Potential Partners/Programs**
Project #1 M01-F	Passive Restoration	Area along northern bank has inadequate buffer. Bobolinks nest in the tall grass of the field adjacent to the river.	**Buffer Improvement: Establish "no mow" zone** and let buffer naturally reestablish	High Priority; ACOE has increased buffer width to about 20 feet on east side of channel south of bridge during 2013	Improved habitat and water quality	Landowner, TCC, VANR, Town of Thetford TFS, CRWC

Photos of Proposed Project Locations – Map 7
West Branch of the Ompompanoosuc River, M01-A through M01-H

Project #1 – Streamside Plantings, M01-F



Projects:

1. Berm Removal
2. Remove Old Abutment
3. Potential Channel Restoration

Project Priority:

- Low
- Moderate
- High

N W E S

0 1,000 2,000 Feet

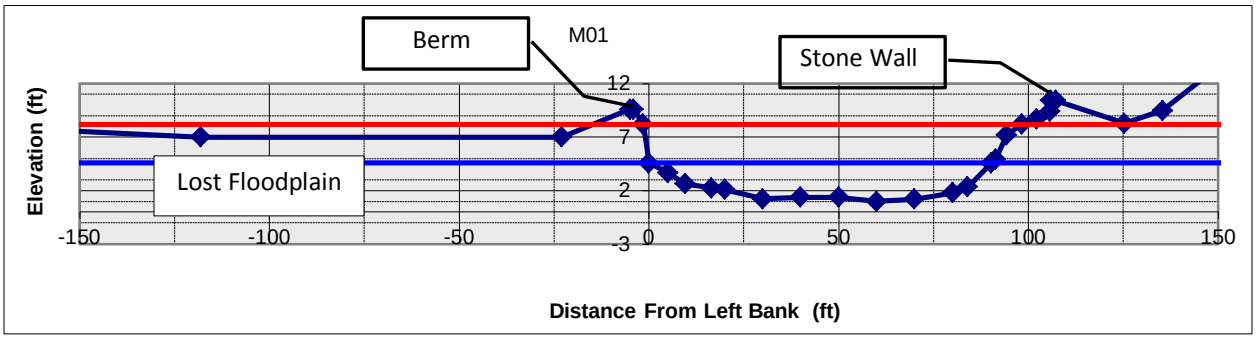
1 inch = 800 feet

Background is Bing Imagery

Bear Creek Environmental

Table 8. Ompompanoosuc River Watershed – West Branch Map 8: M01-I through M02 Site Level Opportunities for Restoration and Protection Thetford, Vermont						
Project # Segment	**Type of Project**	**Site Description Including Stressors and Constraints**	**Project or Strategy Description**	**Technical Feasibility and Priority**	**Other Social Benefits**	**Potential Partners/ Programs**
Project #1 M01-I	Active Restoration	Berm along northern bank restricts floodplain access. Removal of berm may disturb wetland to the north of the channel.	**Remove Berm**	Low Priority; the project priority was downgraded due to access issues. In addition, the wetland may be hydraulically affected if the berm were to be removed. Project partners did not want to move forward with project at this time.	Improved geomorphic stability	Landowner, TCC, VANR, Town of Thetford ERP
Project #2 M02	Active Restoration	According to landowner, during flood events water backs up behind an old abutment near end of Ilsley Road.	**Alternatives Analysis** for the removal of the old abutment	Low Priority; old abutment is impacting a private landowner and removal is not likely to improve geomorphic stability. Old Abutment may be a historic structure.	Reduced flooding on private land	Landowner, TCC, VANR, Town of Thetford ERP
Project #3 M02	Active Restoration	Material in channel was moved post TSI. Neighbor states flow was altered around an island.	**Alternatives Analysis** to determine if active restoration project is needed	Moderate Priority	Improved geomorphic stability	Landowner, TCC, VANR, Town of Thetford ERP

Photos of Proposed Project Locations – Map 8
West Branch of the Ompompanoosuc River, M01-I through M02

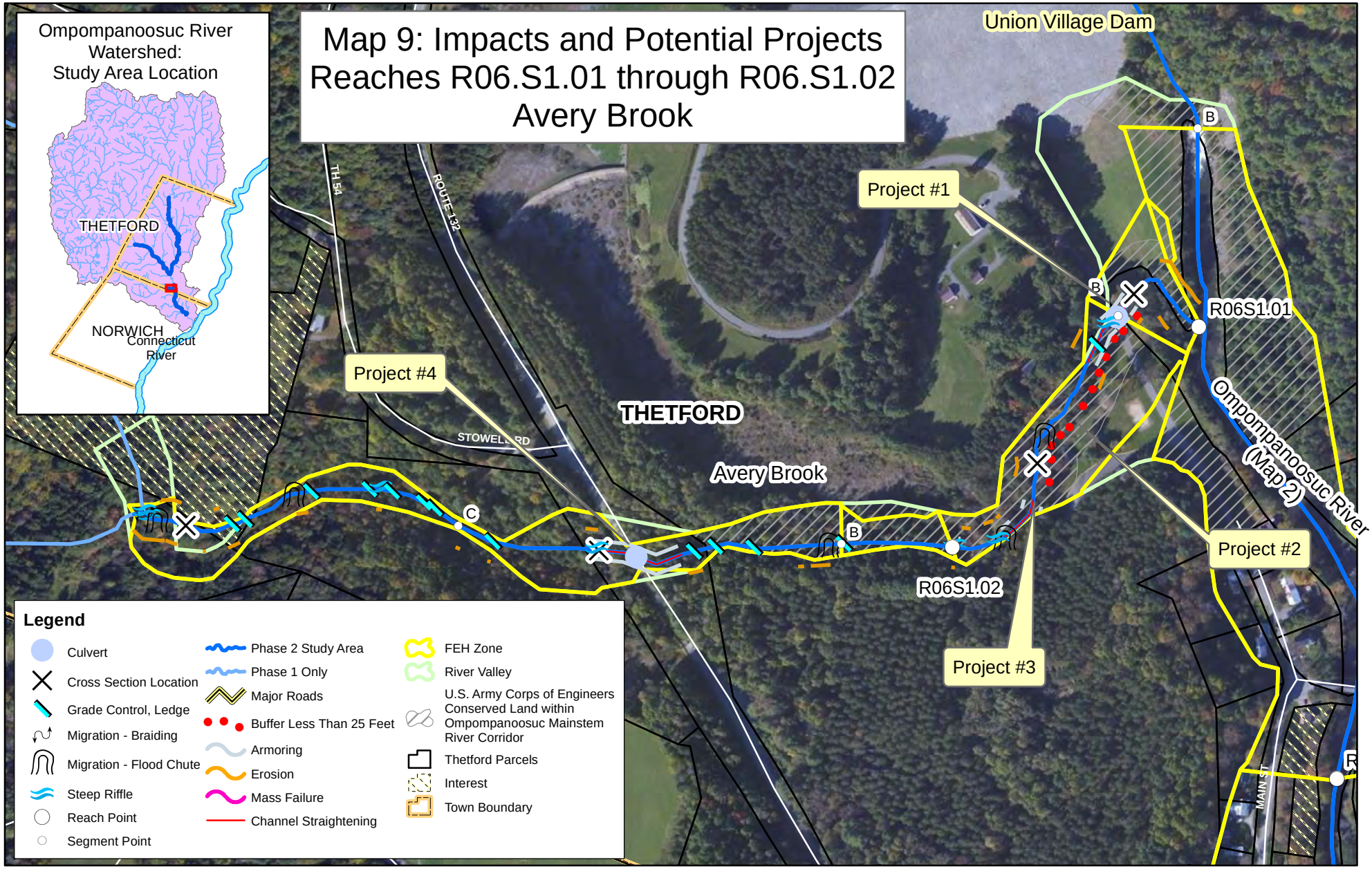


Project #1 – Berm Removal, M01-I

Project #2 – Old Abutment Removal, M02

Project #3 – Restore Natural Channel, M02

Map 9: Impacts and Potential Projects Reaches R06.S1.01 through R06.S1.02 Avery Brook



Projects:

1. Replace or Retrofit Box Culvert
2. Streamside Plantings
3. Remove Old Abutment
4. Replace or Retrofit Box Culvert

N W E S

Project Priority:

- Low
- Moderate
- High

0 500 1,000 Feet

3 inches = 1,000 feet

Background is Bing Imagery

Bear Creek Environmental

Table 9. Ompompanoosuc River Watershed – Avery Brook Map 9: R06.S1.01 through R06.S1.02 Site Level Opportunities for Restoration and Protection Thetford, Vermont						
Project # Segment	**Type of Project**	**Site Description Including Stressors and Constraints**	**Project or Strategy Description**	**Technical Feasibility and Priority**	**Other Social Benefits**	**Potential Partners/ Programs**
Project #1 R06.S1-01-B	Active Restoration	Box culvert has a geomorphic compatibility rating of "mostly incompatible" and limits all aquatic organism passage. Avery Brook is likely a summer refuge for fish who seek cooler waters.	**Replace or Retrofit Culvert** to improve AOP	Low Priority; the project priority has been downgraded due to lack of landowner interest. The priority will be reconsidered next year when additional information is available from the VFW	Improved habitat and geomorphic stability	Landowner, TCC, VANR, Town of Thetford ERP
Project #2 R06.S1.01-B	Passive Restoration	Southern bank along recreational area does not have adequate buffer width.	**Streamside Plantings**, soil may need to be aerated prior to planting.	Low Priority; the project priority was downgraded to low due to lack of landowner interest	Improved habitat and water quality	Landowner, TCC, VANR, Town of Thetford
Project #3 R06.S1.01-B	Active Restoration	Old bridge abutment is contributing to localized geomorphic instability & is a channel constriction. Bridge abutment is considered a historic site on U.S. Army Corps of Engineers property.	**Alternatives Analysis** for the removal of the abutment	Low Priority; the old bridge abutment is included as a historic structure in the ACOE's management plan and is not causing extreme geomorphic stability.	Improved geomorphic stability	Landowner, TCC, VANR, Town of Thetford ERP
Project #4 R06.S1.02-B	Active Restoration	Box culvert has a geomorphic compatibility rating of "mostly incompatible" and limits all aquatic organism passage. Difficult to access.	**Replace or Retrofit Culvert** to improve AOP	Low Priority; the project priority was downgraded to low due to poor access, culvert length & condition. The project priority will be reconsidered next year when additional information is available from VFW.	Improved habitat and geomorphic stability	Town of Thetford, TCC, VANR ERP

Photos of Proposed Project Locations – Map 9
Avery Brook, R06.S1.01 through R06.S1.02

Project #1 – Replace Box Culvert, R06.S1.01-B

Project #1 – Replace Box Culvert R06.S1.01-B

Project #2 – Streamside Plantings, R06.S1.01-B

Project #3 – Remove Old Abutment R06.S1.01-B

Project #4 –Replace Box Culvert, R06.S1.02-B