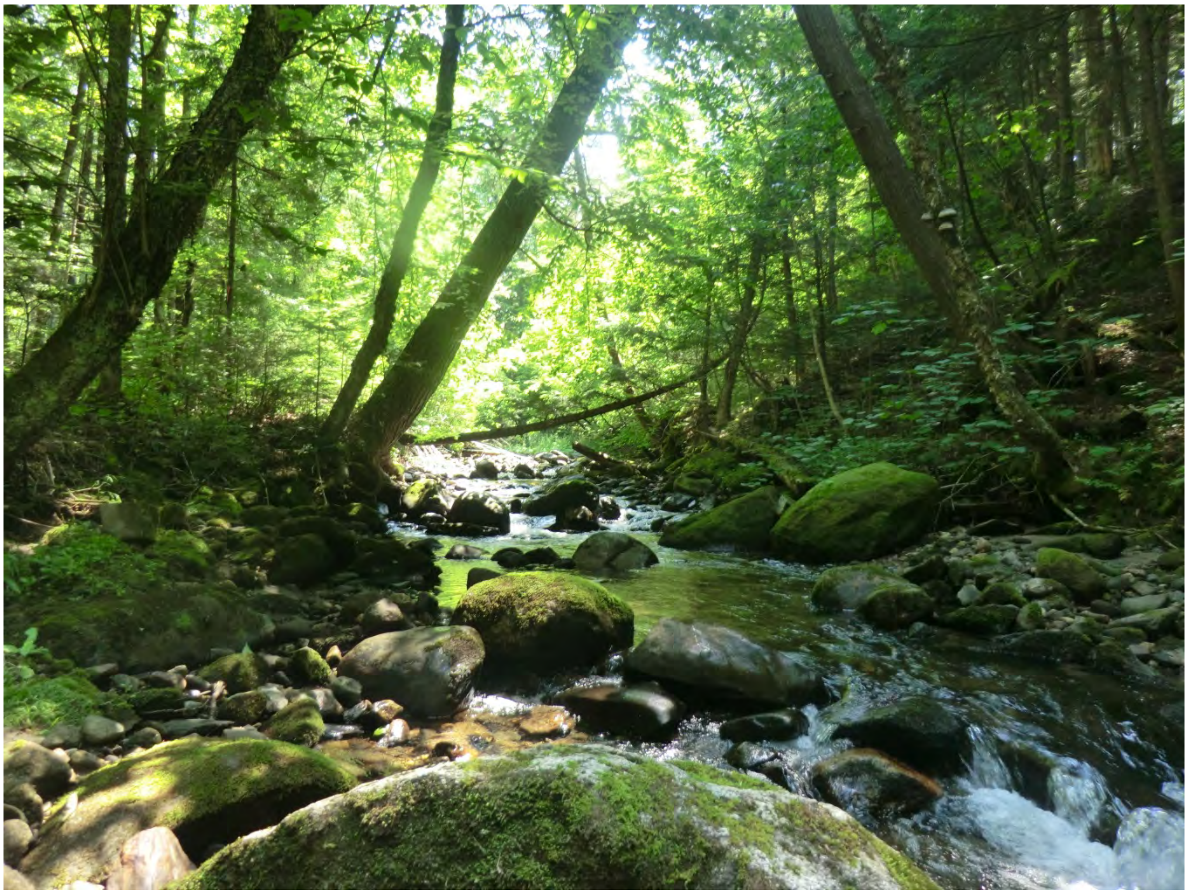
Dishmill Brook Watershed
River Corridor Plan
Burke, Vermont
February 12, 2014



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1.0 EXECUTIVE SUMMARY

A stream geomorphic assessment (study of stream dynamics and impacts to habitat and structure of streams and land adjacent to them) of Dishmill Brook and one of its tributaries was conducted by Bear Creek Environmental, LLC (BCE) in summer 2013. The study was funded by the State of Vermont Ecosystem Restoration Program and prepared under contract to the Caledonia County Natural Resources Conservation District (CCNRCD). This study is part of many efforts to understand the dynamics of the Passumpsic River watershed and to implement restoration projects at the site level following a major flood in 2002 in Lyndon and St. Johnsbury (FEA, 2010) and periodic flooding since.

A planning strategy based on *fluvial geomorphology* (flowing water and sediments in relation to land forms) 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 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 and conservation efforts.

Six reaches in the Dishmill Brook watershed were included in the 2013 assessment; five on the main stem and one on an unnamed *tributary* to Dishmill Brook (Tributary 1). The study encompassed approximately three miles of stream channel. This assessment was helpful in identifying major stressors to geomorphic stability in the Dishmill Brook watershed. One primary problem relating to geomorphic stability and habitat condition is channel straightening and corridor encroachment associated with the existence of major roads (Mountain Road) and development, particularly near the East Burke downtown area. In some cases, this encroachment has limited floodplain access and has caused moderate to extreme channel degradation (lowering of the bed). Limited floodplain access along Dishmill Brook has occurred in the downstream sections where the channel has been bermed. Channel and floodplain alteration have resulted in a reduction in habitat quality and diversity in the downtown East Burke area. Stormwater runoff along Mountain Road and from developed areas on Burke Mountain is resulting in excess sediment in Tributary 1 and Dishmill Brook. The upstream river corridor of Dishmill Brook contains well vegetated banks and buffers. However, as one heads downstream towards the Village of East Burke, impacts from road encroachments, bridges and culverts, stormwater runoff, and channel straightening and armoring have upset the natural balance of sediment causing channel adjustment in some areas.

Fluvial erosion hazards (FEH) are present within the project area due to the infrastructure within the river corridor and the associated alteration of the natural floodplain, which has caused instability in the stream channels. The Vermont Agency of Natural Resources defines fluvial erosion as erosion caused by rivers and streams that "can range from gradual bank erosion to catastrophic changes in river channel location and dimension during flood events" (Vermont Agency of Natural Resources, 2010b). A fluvial erosion hazard zone represents the land adjacent to the stream or river that is vulnerable to erosion and damage from flood waters based on the channel's need to migrate in its floodplain to achieve a balanced condition. The Town of Burke could avoid future damage and high costs through incorporating fluvial erosion hazard overlay areas in town planning and zoning strategies or ensuring landowners in the hazard areas are aware of the risks and are properly prepared.

A list of 17 potential restoration and conservation projects was developed during project identification. Types of projects include: river corridor protection through easements, improving riparian buffers, improved stormwater management, dam removals, bridge/culvert removal/replacement, gully remediation, and alternatives analyses for the removal of berms. 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 study was a follow up to the Phase 1 and 2 Geomorphic Assessment for the East Branch Passumpsic River conducted in 2009 by the Caledonia County Natural Resources Conservation District (CCNRCD). In summer 2013, Bear Creek Environmental, LLC (BCE) focused on the Dishmill Brook (tributary to the East Branch Passumpsic River) watershed in East Burke, Vermont. One unnamed *tributary* (referred to as Tributary 1 in this report) and the main stem of the Dishmill Brook were assessed using the Vermont Agency of Natural Resources Phase 2 Stream Geomorphic Assessment protocol during summer 2013 for a total of three 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

The river corridor planning team for the Dishmill Brook watershed is comprised of the Caledonia County Natural Resources Conservation District (CCNRCD) and the Vermont Agency of Natural Resources. Funding for the project is provided through the State of Vermont Ecosystem Restoration Program. Kerry O'Brien (CCNRCD) and Staci Pomeroy (Vermont River Management Program) provided guidance and oversight for the project. Staci Pomeroy also provided field work assistance and 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 CCNRCD, in collaboration with towns and other partners, has 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.

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 Dishmill Brook 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.

3.0 BACKGROUND WATERSHED INFORMATION

For specific background information regarding previous studies and the geology, hydrology and flood history, land use, and stressors of the Dishmill Brook watershed, please refer to the *East Branch Passumpsic River Corridor Plan* (CCNRCD, 2009). Dishmill Brook is a major tributary to the East Branch Passumpsic River, which drains into the Connecticut River (Figure 3.1). It drains Burke Mountain and the Burke Mountain Ski Area and flows westerly into the East Branch Passumpsic River in East Burke village just upstream from the East Burke Dam (Figure 3.2).

The CCNRCD conducted a Phase 1 Geomorphic Assessment including the Dishmill Brook watershed in 2009. The Phase 1 assessment involved breaking the watershed into 24 reaches. Each reach represents a similar section of the stream based on physical attributes such as valley confinement, slope, sinuosity, bed material, dominant *bedform*, land-use, and other hydrologic characteristics. Each point in Figure 3.2 represents the downstream end of the reach. This report summarizes the 2013 Phase 2 study of five reaches on Dishmill Brook (M101-M105) and one reach on Tributary 1 to Dishmill Brook (T1.01). These six reaches were then broken into nine *segments* for the Phase 2 study based on field observations (Figure 3.3).

A segment is distinct in one or more of the following parameters: degree of floodplain encroachment or channel alteration, *grade control* occurrence (e.g. ledge), channel dimensions, channel sinuosity and slope, *riparian buffer* and corridor conditions, and degree of flow regulation. Segments are labeled using letter notation (i.e. M101-A is the most downstream segment on Reach M101). The most downstream segment within a reach is labeled “A”, the second from the reach point is “B, etc.

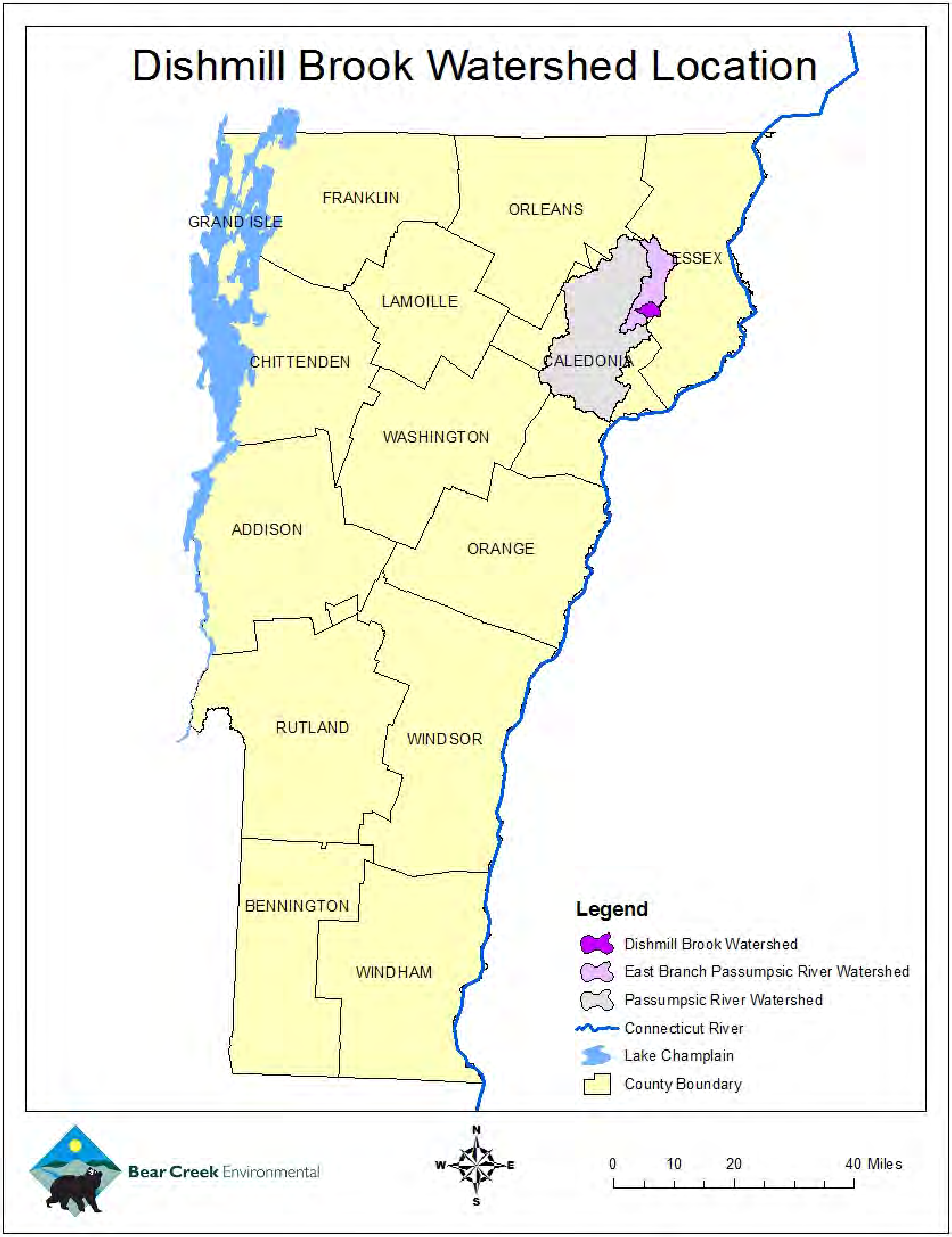

Figure 3.1. Dishmill Brook Watershed Location Map

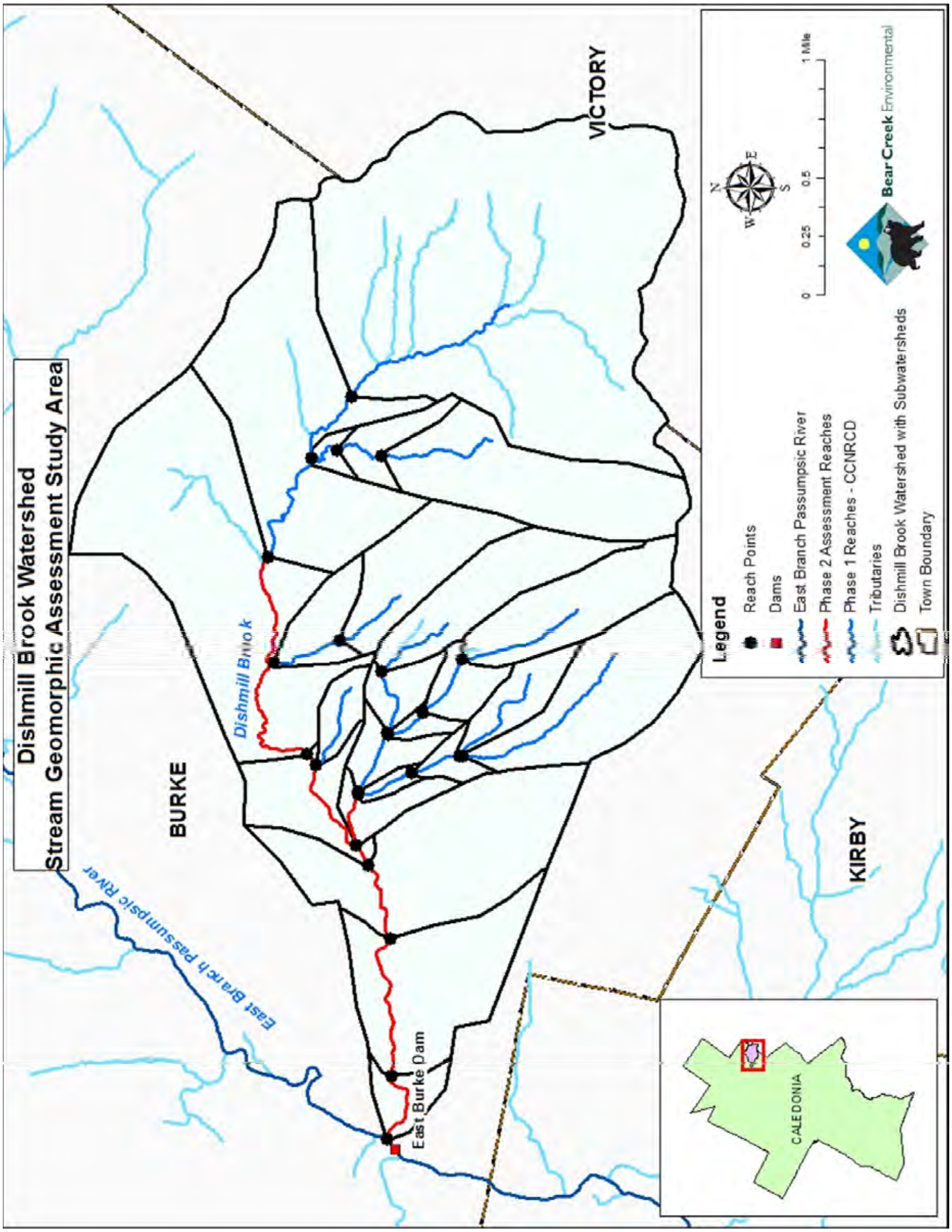

Figure 3.2. Dishmill Brook Watershed Stream Geomorphic Assessment Study Area

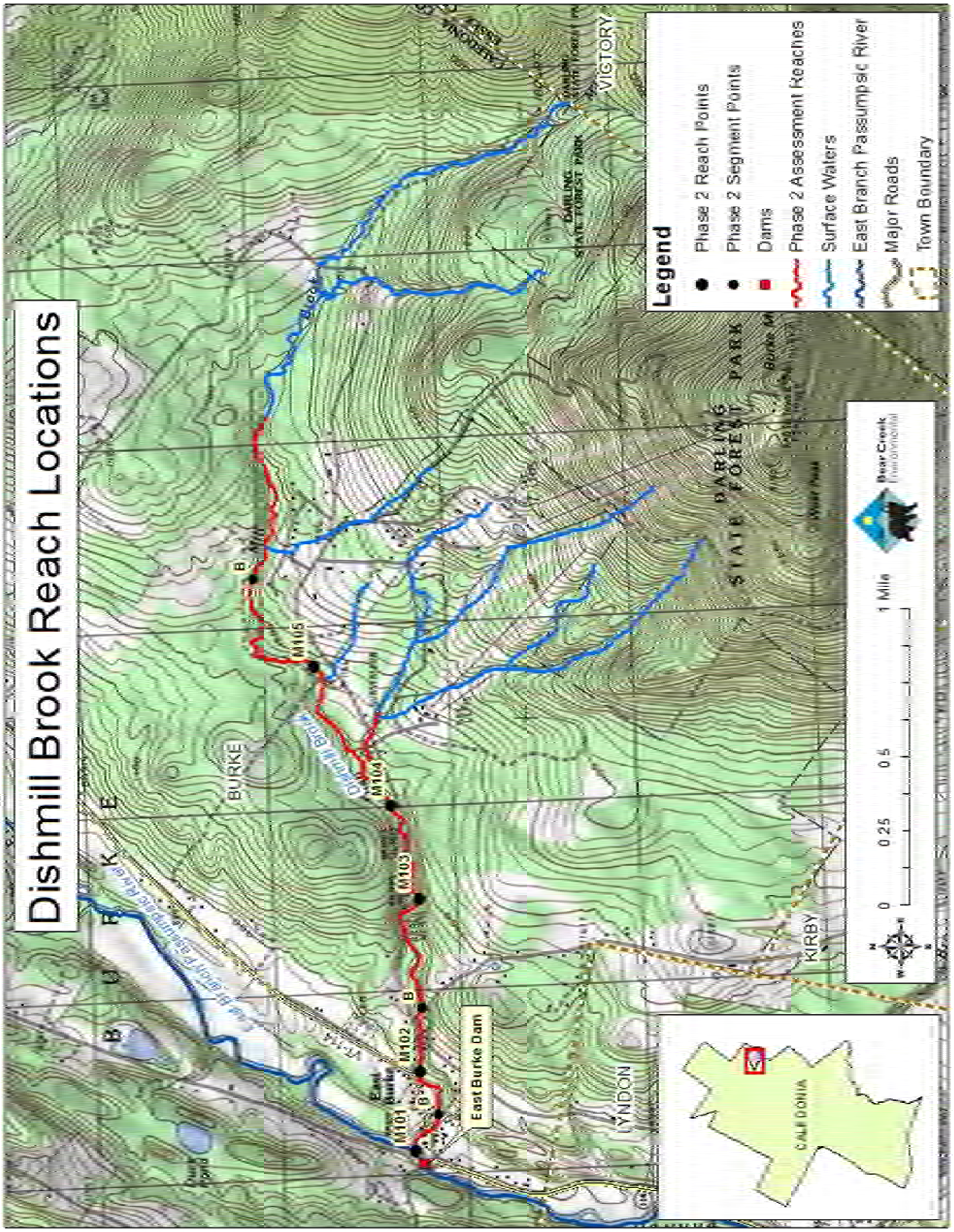

Figure 3.3. Dishmill Brook Watershed Reach Locations

4.0 METHODS

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

4.1 Phase 2 Methodology

The Phase 2 assessment of the Dishmill Brook watershed followed procedures specified in the Vermont Stream Geomorphic Assessment (SGA) Phase 2 Handbook (Vermont Agency of Natural Resources, 2009b), and used version 10.0 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).

Reaches determined during Phase 1 were broken up further into segments for the Phase 2 geomorphic assessment based on changes in channel conditions. The six Phase 2 reaches studied in 2013 were broken into nine segments based on field observations. Topographic maps and orthophotos were used as a first cut in delineating segment breaks. Attributes that were considered when determining segment breaks include: *grade controls*, changes in channel dimensions, changes in dominant bed material, slope, entrenchment or sinuosity, signs of *planform* changes, evidence of *aggradation* and *degradation,* and *riparian buffer* and corridor conditions.

The reaches were walked and features were mapped using a GPS unit in accordance with the most current version of the Phase 2 protocol. The *bankfull* width and depth were measured occasionally along the reach to track changes in bankfull dimensions. Once segment breaks were determined, the Phase 2 field forms were completed accordingly.

Valley walls delineated during Phase 1 were field-verified using a range finder and submeter GPS unit (MobileMapper 100 series). Human caused changes in valley width due to permanent high embankments that serve as artificial valley walls were also mapped on field sketches with reference to topographic maps and/or orthophotographs. The valley walls were used to evaluate Phase 2 confinement. Adjacent terraces and valley walls were evaluated in terms of their proximity to the channel. The location, total height and height above water surface were recorded for channel spanning grade controls, both natural and human constructed.

Channel dimensions and bed substrate composition were measured at one to two representative locations within each segment. The channel dimensions and substrate composition were recorded on the Cross-section Worksheet and summarized on the Rapid Stream Assessment Field Notes form under Step 2. Stream type was evaluated based on the channel dimension data, bed substrate composition results, and confirmed channel slope. Stream banks were evaluated in terms of their typical slope and dominant texture. Areas of bank erosion, mass failures, and gullies were mapped and pertinent information regarding the height and length of such features was recorded. Areas lacking adequate riparian buffers (<25 feet) were mapped and notes were made about the types of vegetation comprising existing riparian buffers. River corridor encroachments including roads, railroads, improved paths, and development were mapped according to their locations. Notes were also taken concerning river corridor land-use activities.

The locations of springs, seeps, small tributaries, adjacent wetlands, debris jams, beaver dams and channel constrictions were recorded and evaluated in terms of how they may be affecting channel flows. Locations of stormwater inputs from *urban runoff*, agricultural drainage and road ditching were noted to determine the extent of increased flow status during a storm event. Similarly, locations of flow regulations and water withdrawals were mapped to evaluate potential decreases in channel flows.

Depositional features were tallied to assess the sediment transport regime and storage capacity of the segment. Channel migration features were mapped in order to determine the amount of channel planform adjustment the segment was undergoing. Sections of the stream where the channel does not appear to be following the natural path of the river and may have been *straightened* (see *channelization*) were noted, along with locations where material has been removed from the channel in order to assess the extent to which stream power and morphology have been altered. *Steep riffles* and *headcuts* were mapped and used as indicators of active geomorphic processes.

RHA and RGA field forms were completed for the Phase 2 reaches. The appropriate RHA and RGA forms were selected based on segment characteristics and scored according to the data collected from the field assessment. A segment score and corresponding condition were determined for both the RHA and the RGA. Additionally for the RGA, major geomorphic processes were identified, the stage of channel evolution was determined, and a stream sensitivity rating was assigned.

The RHA is used to evaluate the physical components of a stream (channel bed, banks, and riparian vegetation) and how the physical condition of the stream affects aquatic life. The RHA results can be used to compare physical habitat condition between sites, streams, or watersheds, and they can also serve as a management tool in watershed planning.

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 September 2013. The Project Team conducted the assessment according to the approved Quality Assurance procedures specified in the Phase 2 handbook. Staci Pomeroy of the State of Vermont Watershed Management

Division conducted a QA/QC review of the data collected by Bear Creek Environmental (BCE) for Dishmill Brook and Tributary 1 in October 2013.

4.2 Bridge and Culvert Methodology

Bridge assessments were conducted by BCE on all public and private crossings within the selected Phase 2 reaches except for a snowmobile/foot bridge near the mouth and the Route 114 crossing in the most downstream reach (Appendix B, page 5). The Route 114 bridge is slotted for replacement so an assessment of it was not practical. 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.

The Vermont Culvert Geomorphic Compatibility Screening Tool (Milone and MacBroom, Inc. 2008) was used to determine geomorphic compatibility for each bridge. 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 and 2 in Appendix B explain how each bridge was scored using the Screening Tool. The compatibility rating is based on four criteria: structure width in relation to bankfull channel width, sediment continuity, river approach angle, and erosion & armoring and the ratings span the following range:

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

The one culvert was evaluated for Aquatic Organism Passage (AOP) using the Vermont Culvert Aquatic Organism Passage Screening Tool (Milone and MacBroom, 2009). Tables 3 through 5 in Appendix B explain 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 1 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 during the Phase 1 assessment (Table 2).

Table 1. 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 2 lists the reference stream types for assessed reaches in the Dishmill Brook watershed. Most reaches assessed for Phase 2 in the Dishmill Brook watershed are “C” channels by reference. 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 Dishmill Brook and Tributary 1 ranges from Very Broad to Semi-Confined. All reaches have a reference bedform of *riffle-pool* except for M103 and M105, which were *step-pool* by reference. The reference reach characteristics were refined during the Phase 2 Assessment.

During the Phase 2 assessment, the six assessed reaches were broken into nine segments based on detailed field observations. The existing stream type for each reach/segment is based on channel dimensions measured during the Phase 2 assessment. A map of the reference and existing stream type for each assessed reach/segment is included on page 1 of Appendix A.

Some of the segments in the 2013 assessment have the same reference and existing stream type. However, the existing stream type differs from the reference stream type in the most downstream segment (M101-A) on Dishmill Brook. This indicates that a stream type departure has taken place. 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).

Table 2: Geomorphic Setting of 2013 Assessed Reaches

Stream	Reach ID	Reference Stream Type	Reference Confinement	Channel Slope (%)	Bedform
Dishmill Brook	M101	C	Very Broad	2.11	Riffle-Pool
	M102	*C	Narrow	4.04	Riffle-Pool
	M103	B	Semi-Confined	3.13	Step-Pool
	M104	C	Broad	3.08	Riffle-Pool
	M105	C	Broad	2.71	Step-Pool
Tributary 1 to Dishmill Brook	T1.01	C	Narrow	7.98	Riffle-Pool

*This reach contained two reference stream types. It was later refined to have a sub-reach with an “F” stream type that contained bedrock falls through a confined valley, which accounted for the average confinement of Narrow and slope of 4 percent.

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

A map of the existing geomorphic condition for each segment is depicted on page 2 of Appendix A. 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.

Three segments on Dishmill Brook are in "good" geomorphic condition (M102-A, M102-B, and M105-B). These segments are all located in areas where there are minimal to no corridor encroachments and buffer conditions are good for most of their length. The rest of the assessed reaches/segments 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, increases of flow and/or sediment, and aggradation.

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 Dishmill Brook watershed include:

- Channelization and bank armoring
- Berming
- Removal of woody riparian vegetation
- Floodplain encroachments

These anthropogenic practices have altered the balance between water and sediment discharges within the Dishmill Brook 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 (Vermont Agency of Natural Resources, 2010a). Sediment can be supplied to the river through bank erosion, large flooding events, and stormwater inputs. A sediment regime map depicting the reference and existing sediment regimes can be found on page 3 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). Descriptions of each sediment regime can be found in Appendix A, page 4.

Seven of the assessed reaches/segments have a reference sediment regime of Coarse Equilibrium & Fine Deposition (*Equilibrium*). *Equilibrium* channels are unconfined on at least one side, and they transport and deposit sediment in equilibrium, wherein the stream power is balanced by the sediment load, sediment size, and boundary resistance. Two reaches/segments (M102-A and M103) have transport as their dominant reference sediment regime. *Transport* channels are typically in confined valleys, and do not supply appreciable quantities of sediment to downstream reaches. These channels have confining valley walls with limited sediment storage capacity due to both channel slope and entrenchment (Vermont Agency of Natural Resources, 2010a).

Changes in hydrology (such as stormwater input and development within the riparian corridor) and sediment storage within the watershed have altered the reference sediment regime types for many of the assessed reaches/segments. Six of the reaches/segments have undergone a transformation from a reference sediment regime of *Equilibrium* to a departure sediment regime (Appendix A, page 3). Both segments on M101 have converted to a sediment regime of *Unconfined Source and Transport*. This regime type describes incised channels that have been significantly straightened and armored and are, therefore, no longer a significant sediment supply due to the boundary resistance of the armoring (Vermont Agency of Natural Resources, 2010a). As armoring along the banks of these channels fail and the channel begins to widen, bank erosion may occur causing an increase in supply of coarse and fine sediment. Channel management practices such as straightening and encroachment have resulted in this sediment regime change.

Reach M103 departed from a reference *Transport* reach to a *Confined Source and Transport* reach. The mass failure along the confining valley wall and the encroachment of the Mountain Road in M103 have both contributed to the conversion of the sediment regime. Reaches/segments M104 and M105-A have an existing sediment regime of *Fine Source and Transport and Coarse Deposition*. The departure from the reference regime of *Equilibrium* means that most fine sediment entering the stream is transported through without being deposited. Additionally, coarse sediment storage is increased due to increased load along with lower transport capacity (Vermont Agency of Natural Resources, 2010a). The analysis of sediment regimes at the watershed level is useful for summarizing the stressors affecting geomorphic condition of river channels. Sediment regime mapping provides a context for understanding the sediment transport and channel evolution processes.

Channel morphologic responses to these anthropogenic practices and changes in sediment regimes contribute to channel adjustment that may further create unstable channels. In some reaches/segments, the placement of berms, Mountain Road and/or Route 114 has significantly changed the river's valley width, floodplain access, and its ability to meander. Specifically, the berming along the floodplain in reach M101 has resulted in major degradation of the channel and disconnection to its floodplain.

The reach condition ratings of the Dishmill Brook watershed indicate that most reaches/segments are actively or have historically undergone a process of minor or major geomorphic adjustment. Except for the most upstream assessed segment (M105-B) and a naturally confined transport segment (M102-A), many of the reaches studied in the Dishmill Brook watershed are undergoing a channel evolution process in response to the human influences on the watershed or natural conditions (drop in slope). The human influences include increased sediment input as a result of stormwater runoff from infrastructure, influence from the East Burke Dam, and impacts from development and road encroachment. Models that explain the channel evolution process are described below, and the evolution stage for each segment is provided in Section 5.4.

Both the "D" 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 Dishmill Brook 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 5.1 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.

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 (Vermont Agency of Natural Resources, 2010a). The sensitivity ratings are as follows: Very Low, Low, Moderate, High, Very High, and Extreme. Three reaches/segments (M104, M105-A, T1.01) assessed in Dishmill Brook watershed had a sensitivity of Very High. These reaches/segments are all in fair condition, have "C" stream types, and have a dominant substrate of gravel leading them to be more sensitive to channel adjustments than the other reaches/segments. Natural conditions such as changes in slope as well as impacts from human activity have led to the major aggradation and planform change that have increased the stream sensitivity. The rest of the segments are assigned a rating of Moderate or High. A map showing stream sensitivities can be found in on page 4 of Appendix A.

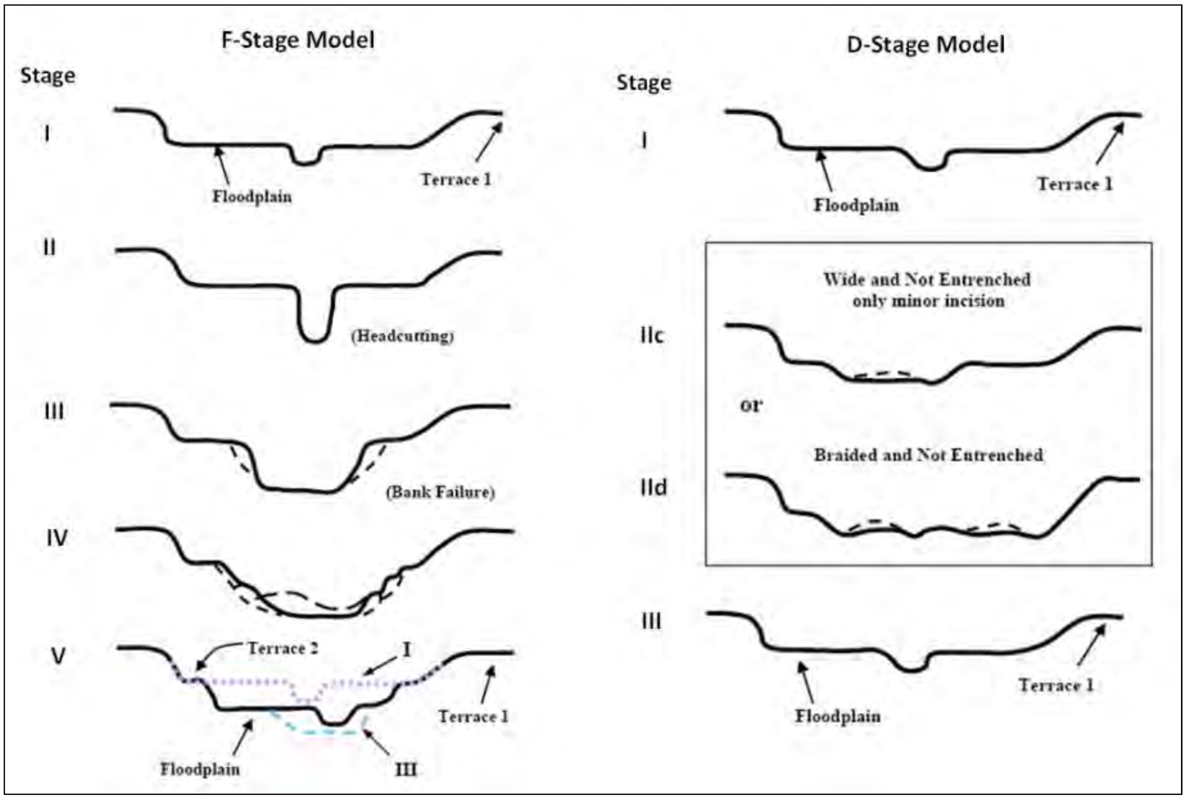

Figure 5.1 Typical channel evolution models for F-Stage and D-Stage (Vermont Agency of Natural Resources, 2009b)

5.3 Habitat Condition

The map on page 2 in Appendix A includes both the geomorphic and habitat condition maps side by side. All but four reaches/segments are in “good” habitat condition. Despite roads encroaching on the corridor and aggradation in some locations, the banks and buffers for the most part are well vegetated. There is also abundant large woody debris in the channels, many *pools*, and good canopy cover, all of which provide habitat for aquatic life. The most downstream segment, M101-A, is in “poor” habitat condition due to its extensive corridor encroachment, poor bank and buffer vegetation, invasive plants, bank revetments, lack of refuge, large woody debris and pools, increased fines in the channel, and impacted channel morphology. The remaining three reaches/segments (M101-B, M102-A, and M103) are in “fair” habitat condition. Corridor encroachments, poor bank and buffer vegetation, lack of large woody debris, invasive plants, erosion and revetments, and channel straightening have all contributed to the “fair” habitat conditions.

5.4 Reach/Segment Descriptions and Project Identification

A description of each reach/segment is provided in this section along with a list of recommendations for restoration and protection strategies. A map of the reaches/segments assessed is shown in Figure 5.2. The reaches/segments are listed from downstream to upstream. The reaches are broken into sections based on the stream they are located in: Dishmill Brook and Tributary 1 to Dishmill Brook.

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. Project maps and tables (Appendix C) have been developed for the Dishmill Brook 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 17 projects were identified by BCE to promote the restoration or protection of channel stability and aquatic habitat in the Dishmill Brook watershed. The projects are broken down by category as follows: 5 passive restoration (streamside plantings and corridor easements); 2 stormwater improvement projects; and 10 active restoration (one dam removal, one alternatives analysis for dam removal, one berm removal alternatives analysis, three gully remediation projects, one project to relocate a sand pile, and three bridge and culvert removal/replacements). Information from the Phase 2 stream geomorphic assessment and bridge and culvert assessments could be used to inform the Town of Burke of which stream crossings are contributing to localized instability.

Phase 2 Segment Summary Reports from the Agency of Natural Resources' Data Management System, which contain all the data for the Phase 2 steps, as well as associated QA/QC documents, are included in 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.

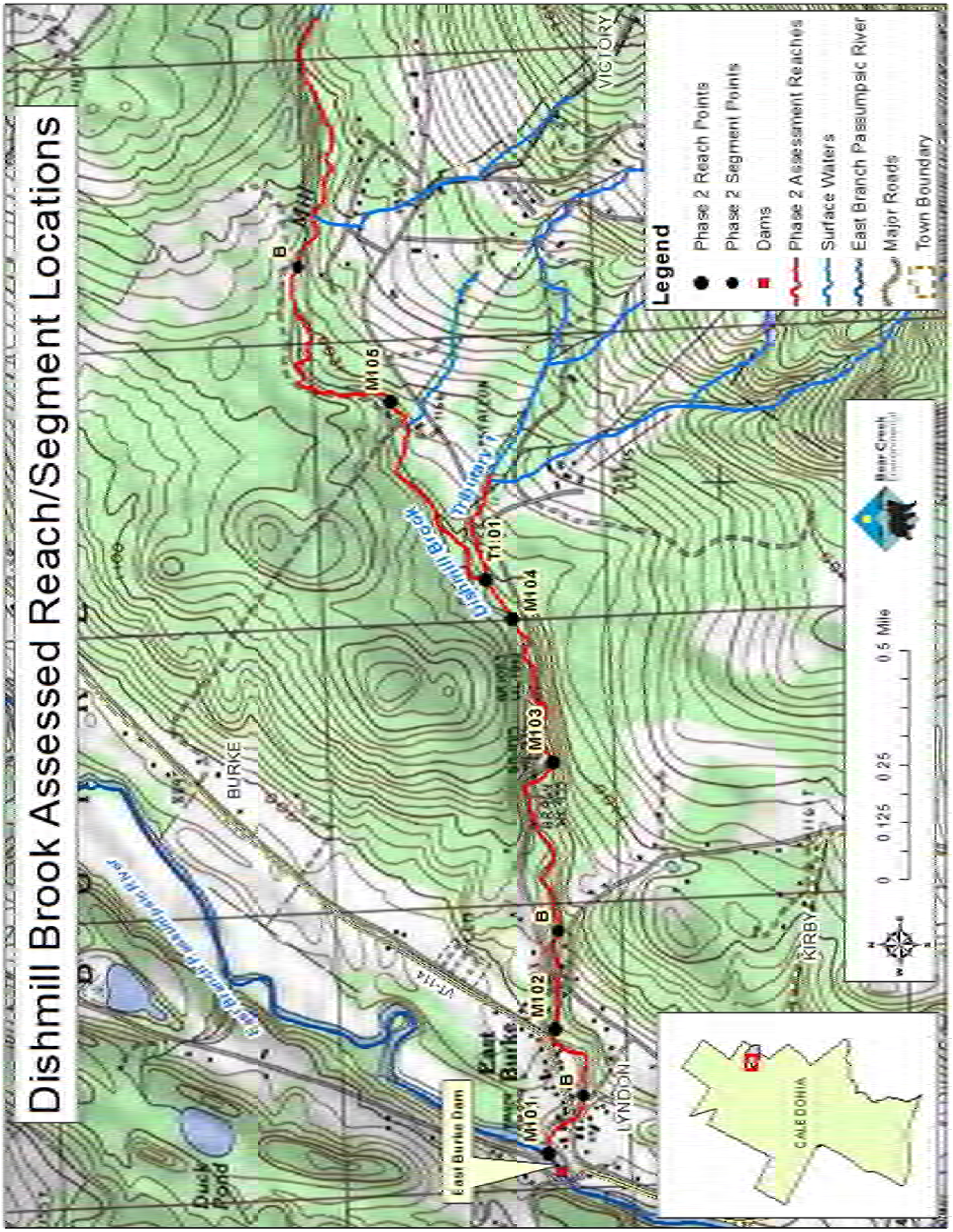

Figure 5.2. Dishmill Brook Reach and Segment Locations

Dishmill Brook

M101

The lowest Phase 2 reach of the Dishmill Brook main stem was split into two segments to account for changes in floodplain access associated with berms in the downstream section and increased development in the river corridor. The reference confinement in this reach is variable and is changed by human impacts in the downstream end of the reach.

M101-A

This segment begins at the confluence with the East Branch Passumpsic River and continues until about 330 feet upstream of the Route 114 Bridge. The reference confinement is Very Broad and the placement of infrastructure has altered the valley confinement to Broad. The channel in segment M101-A flows through a residential and commercial area and has been considerably altered through channelization. There are berms and a lack of buffers along both sides, many stormwater inputs from urban stormwater pipes and overland flow, extensive revetments and compromised riffle-pool habitat due to aggradation. Another major impact within this segment is backwater influence from the East Burke Dam. Fine sediment and streamflow is held back by the dam and disrupting the natural transport dynamics of the East Branch Passumpsic River (CCNRCD, 2009). The confluence with Dishmill Brook (Figure 5.3) is directly upstream of the dam causing the excess sediment and flow to back up into Dishmill Brook during flooding events. Complete stream geomorphic assessments are not usually conducted on those reaches that are impounded from the influence of a man-made or natural dam making the determination of channel dimensions unfeasible. The most downstream segment of Dishmill Brook was assessed since the backwater influence usually only occurs during flood conditions and the measurement of the channel dimensions was possible.

Figure 5.3. Confluence of Dishmill Brook and East Branch Passumpsic River.

M101-A is in **fair** geomorphic condition. This segment differs from the upstream segments in that it is very unstable due to loss of floodplain access through berming (Figure 5.4). The abundant infrastructure in the river corridor and the disconnection of the channel from its floodplain due to berming has led to major channel **incision** and a stream type departure from a "C" stream to a "B" stream. The channel is not widening due to the extensive armoring on the banks.

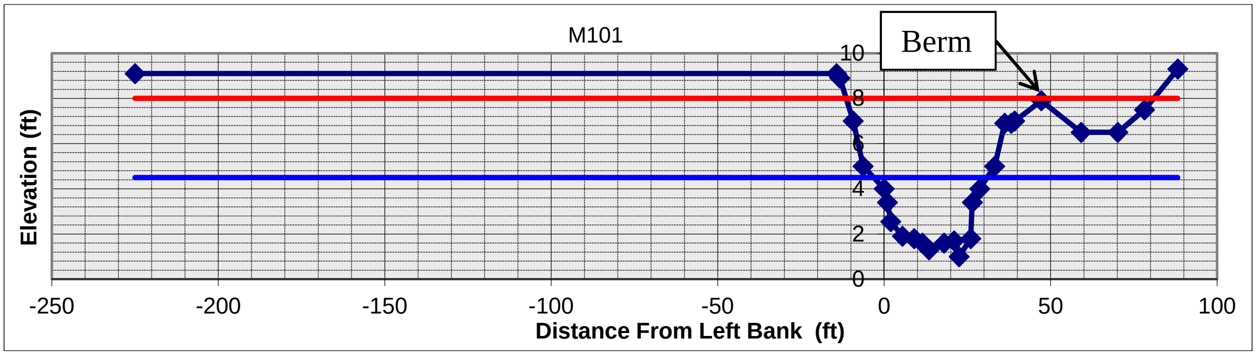

Figure 5.4. Cross section of M101-A showing berm preventing floodplain access.

M101-A is in **poor** habitat condition due to its limited pools and large woody debris, abundant fines and invasive plants (Figure 5.5), compromised channel morphology, and poor bank and buffer vegetation.

M101-A Data Summary		**Reference**	**Existing**
Length: 870 ft Evolution Stage: F-II Sensitivity: High	Confinement	Very Broad	Broad
	Stream Type	C	B
	Dominant Bed Material	Gravel	Gravel
	Dominant Bedform	Riffle-Pool	Riffle-Pool
	Entrenchment Ratio	>2.2	1.8
	Incision Ratio	< 1.2	1.6
Major Stressors:	**Poor Bank Vegetation, Poor Buffers, Encroachments, Channel Straightening, Stormwater Input, Invasives, East Burke Dam**		

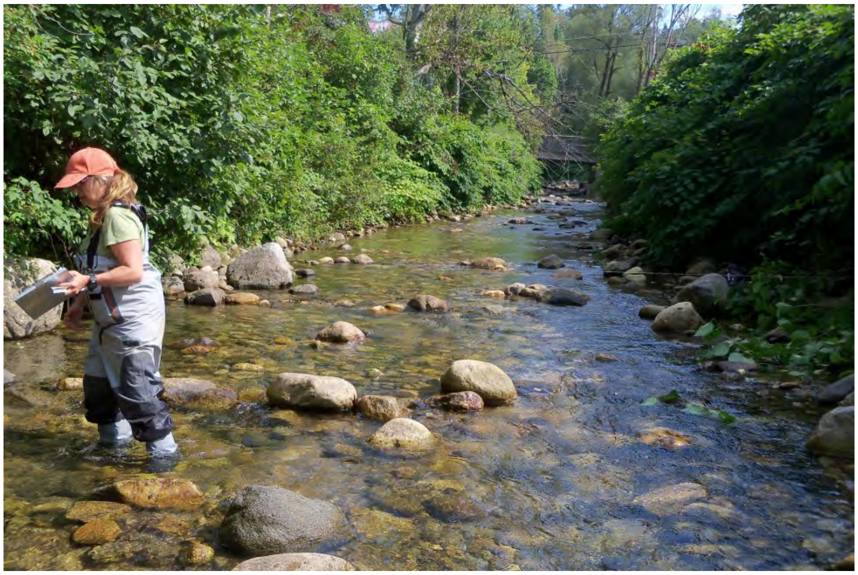

Figure 5.5 Abundant Japanese knotweed on both banks in M101-A.

M101-A Project Identification:

- **Active Restoration** by removal of the East Branch Passumpsic Dam. An alternatives analysis for dam removal has been completed by Gomez and Sullivan Engineers, P.C. for the Passumpsic Valley Land Trust. The proposed dam removal would reduce flooding impacts to the downstream portion of Dishmill Brook, restore natural sediment transport and streamflow conditions, and to improve habitat connectivity on the East Branch of the Passumpsic. Further investigation of Dishmill Brook following dam removal is recommended. More information on the alternatives analysis for dam removal may be obtained from Passumpsic Valley Land Trust. (Map 1:Project #1)
- **Active Restoration** by conducting alternatives analysis for removal of berms to open up more floodplain access, which would provide more sediment storage on the floodplain and reduce further degradation of the channel bed. (Map 1: Project #2)

M101-B

This segment begins at the top of the bermed section and continues until a change in confinement to semi-confined. The brook in M101-B flows through a developed section with limited buffer and abundant rip-rap (indicating historic channel straightening) associated with the development on the northern bank and good floodplain access on the southern bank.

M101-B is in high **fair** geomorphic condition with no major process having occurred except for **planform** change which is primarily due to channel straightening. This segment has one bedrock grade control, which is preventing channel incision (Figure 5.6) and therefore the segment is in stage F-I. Minor deposition is present with side and point bars containing material which was transported from the upstream bedrock controlled segment. The habitat condition is **fair** mainly due to its minimal large woody debris and larger pools, instream deposition, bank erosion, and inadequate vegetation on the northern bank and riparian area. Japanese knotweed is also present along both banks.

Figure 5.6. Ledge grade control in M101-B.

M101-B Data Summary		**Reference**	**Existing**
Length: 1,030 ft Evolution Stage: F-I Sensitivity: High	Confinement	Very Broad	Very Broad
	Stream Type	C	C
	Entrenchment Ratio	> 2.2	2.8
	Incision Ratio	< 1.2	1.1
	Dominant Bed Material	Cobble	Cobble
	Dominant Bedform	Riffle-Pool	Riffle-Pool
Major Stressors:	**Poor Bank Vegetation, Poor Buffer, Invasive Plants, Revetments, Channel Straightening, Development**		

M101-B Project Identification:

- **Passive Restoration** by planting trees within the riparian corridor in areas where buffers are less than 25 feet wide to reduce property loss from further bank erosion and enhance bank and buffer conditions. (Map 1: Project #3)

M102

This reach on Dishmill Brook was split into two segments to account for changes in stream type and valley conditions. The downstream segment is semi-confined bedrock controlled segment with an “F” stream type, while the upstream segment has a narrow valley and is a “C” stream type.

M102-A

This segment begins where the confinement becomes semi-confined and the stream type is an "F" and continues until the valley opens up. There is extensive bedrock throughout this segment with numerous ledge grade controls creating large pools beneficial for fish habitat (Figure 5.7). An old dam that has since fallen apart is causing a drop in the stream channel with significant scour below it. Remnant logs from the old dam are still present in the channel (Figure 5.8).

Figure 5.7. Ledge grade control just below Kirby Road in M102-A.

Figure 5.8. Old dam with logs in channel causing scour downstream in M102-A.

M102-A is in **good** geomorphic condition due to its stability through presence of abundant bedrock, lack of aggradation, widening, and recent planform change. The habitat condition in M102-A is high **fair** primarily due to the lack of woody debris cover since most of it is transported downstream of the segment. Limited refuge and bank undercuts as well as the lack of connectivity due to large grade controls and the old dam have also contributed to the fair habitat condition. Although some habitat features are limited, pools are abundant in this segment with two pools with maximum depths greater than three feet.

<table>
<tr><th>M102-A Data Summary</th><th></th><th>Reference</th><th>Existing</th></tr>
<tr><td rowspan="6">Length: 1,400 ft
Evolution Stage: F-I
Sensitivity: High</td><td>Confinement</td><td>Semi-confined</td><td>Semi-confined</td></tr>
<tr><td>Stream Type</td><td>F</td><td>F</td></tr>
<tr><td>Entrenchment Ratio</td><td>< 1.4</td><td>1.2</td></tr>
<tr><td>Incision Ratio</td><td>< 1.2</td><td>1.0</td></tr>
<tr><td>Dominant Bed Material</td><td>Cobble</td><td>Cobble</td></tr>
<tr><td>Dominant Bedform</td><td>Step-pool</td><td>Step-pool</td></tr>
<tr><td>Major Stressors:</td><td colspan="3">Old dam, Revetments</td></tr>
</table>

M102-A Project Identification:

- **Active Restoration** by conducting alternatives analysis for the removal of an old dam to provide better habitat and geomorphic compatibility. (Map 2: Project #1)

M102-B

This segment begins where the influence of bedrock grade controls ends and continues until approximately 300 feet upstream of the second Mountain Road crossing. There is good floodplain access in M102-B and adequate buffers except for in the vicinity of the two bridge crossings and along Mountain Road on the southern side of the brook.

M102-B is in **good** geomorphic condition with major **aggradation** as the main process that is a result of a decrease in slope from the upstream transport reach. The major aggradation has led to minor widening and planform change. At the upstream end of the segment, the brook has cut off its original course (*avulsion*) and is now flowing in a new channel (Figure 5.9). Gullies in this segment are contributing excess material to the channel as well causing an increase in sediment load (Figure 5.10). M102-B is in **good** habitat condition due to many factors including but not limited to good refuge habitat, abundant large woody debris and pools, good substrate cover and predominantly well vegetated banks and buffers.

Figure 5.9. Channel avulsion in M102-B with associated aggradation.

Figure 5.10. Gully on valley wall contributing sediment to channel in M102-B.

M102-B Data Summary		**Reference**	**Existing**
Length: 2,066 ft Evolution Stage: D-IIc Sensitivity: Moderate	Confinement	Narrow	Narrow
	Stream Type	C	C
	Entrenchment Ratio	> 2.2	3.3
	Incision Ratio	< 1.2	1.1
	Dominant Bed Material	Cobble	Cobble
	Dominant Bedform	Riffle-Pool	Riffle-Pool
Major Stressors:	**Gullies, Encroachments, Inadequate buffers**		

M102-B Project Identification:

- **Active restoration** by remediation of three gullies and/or reduction of stormwater runoff causing gully erosion to decrease sediment load into Dishmill Brook. (Map 2: Projects #2, #3 and #4)

M103

This reach begins approximately 300 feet upstream from the second Mountain Road crossing and continues for 1,920 feet until Mountain Road no longer encroaches upon the river corridor. The major stressors in the reach are the road encroachment from Mountain Road (Figure 5.11) and the associated stormwater inputs. Sediment load is increased in this reach and transported downstream from a mass failure (Figure 5.12), stormwater inputs (Figure 5.13), and from

Tributary 1, which enters in the upstream reach. A box culvert at the Mountain Road crossing is poorly aligned with the stream channel and causing geomorphic instability in Dishmill Brook.

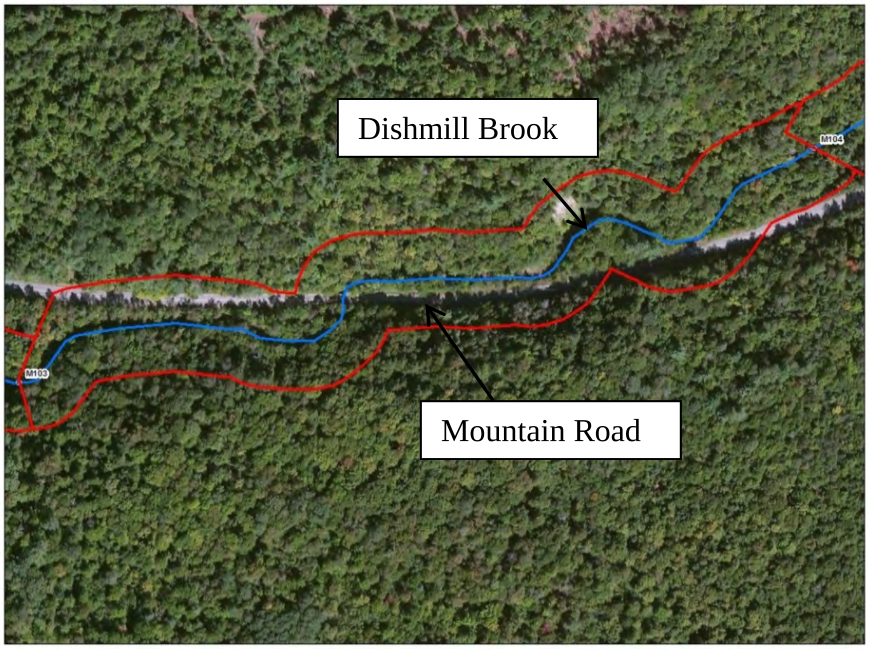

Figure 5.11. Road encroachment of Mountain Road on Reach M103.

Figure 5.12. Mass failure on the northern bank in reach M103.

Figure 5.13. Stormwater drainage pipe contributing sediment to Dishmill Brook in M103.

The stream type in this reach is predominantly a “B” but there are areas where it is an “F” stream as floodplain access is not present due to the road. The extensive road encroachment has led to major **historic incision**. The reach was also most likely extensively straightened for the placement of the road, which has caused major **planform change**. A stream geomorphic condition of **fair** was assigned based on the degree of channel alteration and degradation. The habitat condition is also **fair** due to lack of large woody debris and pools, poor bank and buffer vegetation as a result of the road encroachment, and extensive bank revetments.

M103 Data Summary		**Reference**	**Existing**
Length: 1,920 ft Evolution Stage: F-II Sensitivity: High	Confinement	Semi-confined	Semi-confined
	Stream Type	B	B
	Entrenchment Ratio	1.4 - 2.2	1.41
	Incision Ratio	< 1.2	1.8
	Dominant Bed Material	Cobble	Cobble
	Dominant Bedform	Step-Pool	Step-Pool
Major Stressors:	**Mass Failure, Encroachments, Stormwater Inputs, Revetments, Undersized bridge**		

M103 Project Identification:

- **Stormwater Management** by providing improved treatment of stormwater runoff and attenuation of stormflows from Mountain Road. (Map 3: Project #1)
- **Active Restoration** by replacing bridge at Mountain Road crossing to improve geomorphic stability and to reduce the risk of debris jams, which may cause increased flooding risks. (Map 3: Project #2)

M104

Reach M104 begins where the Mountain Road no longer encroaches upon Dishmill Brook and continues to approximately 450 feet upstream of the Dashney Road crossing. The reach is characterized by well vegetated buffers with little development or infrastructure in the river corridor. Apart from two mass failures, the banks are well vegetated. The stream type in M104 is "C", but there are areas where the valley type is narrow and the stream type is a "B".

This reach is in **fair** geomorphic condition. Channel incision is minor in reach M104, but major **aggradation** and **planform adjustment** have occurred. The build-up of sediment through aggradation has led to planform change as seen by numerous flood chutes. The aggradation may be in part due to the natural drop in slope in the upstream segment M105-A. Tributary 1 appears to have increased sediment due to stormwater runoff causing erosion around a stream crossing and cleared lots within Burke Mountain Ski Area. These sediments are likely contributing to aggradation observed in reach M104. The downstream end of the reach has higher banks indicating a greater degree of bed degradation in this section.

Dishmill Brook has experienced an increase in large woody debris from upstream sources that are causing increased sediment storage in reach M104 (Figure 5.14). Sediment storage and the presence of large woody debris in this part of the watershed are somewhat natural due to the drop in slope. The increase in large woody debris has caused significant planform adjustment, but it has allowed for sediment to be retained in this reach and not transported downstream. Protection through a river corridor easement would ensure that the reach remain a sediment attenuation reach and prevent stressors that would result in the downstream transport of more sediment.

One possible explanation of the source of the debris is the mass failures upstream as well as some minor tree cutting for the trails that are along Dishmill Brook. The increase in large trees in the channel has resulted in some debris jams in M104 (Figure 5.15). One benefit of the large woody debris is that it provides more cover for fish habitat resulting in part to the **good** habitat condition in M104. Other factors contributing to the good habitat condition are abundant pools, refuge habitat, and undercut banks (Figure 5.16).

Figure 5.14. Increased sediment storage in M104 from debris in channel.

Figure 5.15. Debris jam in M104.

Figure 5.16. Undercut bank and deep pool in M104.

M104 Data Summary		Reference	Existing
Length: 3,182 ft Evolution Stage: D-IIc Sensitivity: Very High	Confinement	Broad	Broad
	Stream Type	C	C
	Entrenchment Ratio	> 2.2	4.7
	Incision Ratio	< 1.2	1.3
	Dominant Bed Material	Gravel	Gravel
	Dominant Bedform	Riffle-Pool	Riffle-Pool
Major Stressors:	**Increased sediment and debris**		

M104 Project Identification:

- **Passive Restoration** by protecting the river corridor through easements or river corridor zoning to maintain floodplain access and sediment attenuation. (Map 4: Project #1)

M105

This reach was divided into two segments based on changes in dominant bedform, slope, process, and channel evolution stage.

M105-A

This segment begins approximately 450 feet upstream of the Dashney Road crossing and continues for about ½ mile to a private trail bridge crossing where the channel increases in slope and the dominant process is no longer aggradational. Dashney Road encroaches upon the northern river corridor for approximately 775 feet. Segment M105-A is very similar to reach M104. The banks and the buffers are well vegetated and the dominant adjustment processes are **aggradation** and **planform change**.

The geomorphic condition for M105-A is **fair** primarily due to the increased sediment load and associated planform adjustment. The aggradation is in part due to a drop in channel slope. As in reach M104, debris in the channel is causing numerous debris jams and planform adjustment (Figures 5.17 & 5.18). The stream channel is considerably wider in areas of major aggradation. There are three mass failures in segment M105-A, which are also contributing to the increase in sediment in Dishmill Brook (Figure 5.19). Despite the level of aggradation and planform adjustment in segment M105-A, it is in **good** habitat condition. The factors contributing to its good condition include, but are not limited to, the abundance of refuge, pools, undercut banks (Figure 5.20) and large woody debris providing excellent cover for fish, adequate riparian buffers, and well vegetated banks.

Figure 5.17. Large debris jam in M105-A.

Figure 5.18. Abandoned channel in M105-A from influence of debris jam.

Figure 5.19. Mass failure in M105-A contributing sediment to Dishmill Brook.

Figure 5.20. Undercut bank providing habitat in M105-A.

M105-A Data Summary		Reference	Existing
Length: 2,865 ft Evolution Stage: DIIc Sensitivity: Very High	Confinement	Broad	Broad
	Stream Type	C	C
	Entrenchment Ratio	> 2.2	3.4
	Incision Ratio	< 1.2	1.2
	Dominant Bed Material	Gravel	Gravel
	Dominant Bedform	Riffle-Pool	Riffle-Pool
Major Stressors:	**Increased debris, Road Encroachment, Mass failures**		

M105-A Project Identification:

- **Passive Restoration** by protecting the river corridor through easements or river corridor zoning to maintain floodplain access and sediment attenuation. (Map 5: Project #1)

M105-B

The most upstream segment on Dishmill Brook begins where the major processes are no longer aggradation and planform change and the channel is in a stable condition. The segment continues for approximately 3,000 feet until the next reach break and is in **good** geomorphic condition. There are some minor flood chutes and one channel avulsion (Figure 5.21) indicating minor planform change in the segment. The stream banks are predominantly mossy and stable and there is great floodplain access (Figure 5.22). Impacts include four small mass failures along the valley wall, some of which are contributing clay soils to the stream channel (Figure

5.23). Segment M105-B is also in **good** habitat condition thanks to the well forested banks and buffers, abundant large woody debris, refuge habitat, undercut banks and pools.

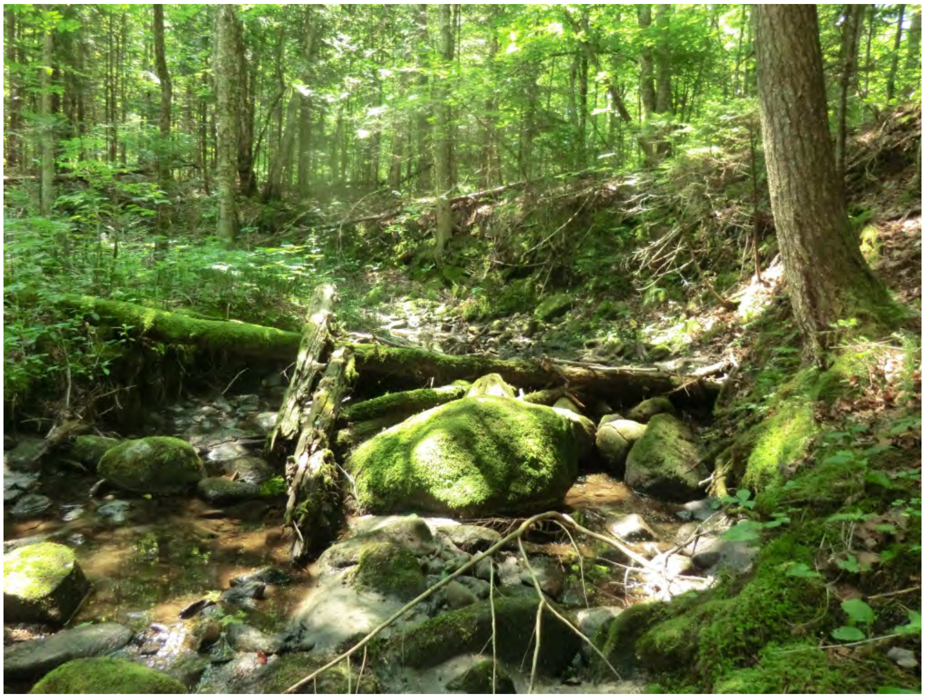

Figure 5.21. Old channel at avulsion location in M105-B.

Figure 5.22. Well vegetated banks and buffers and floodplain access in M105-B.

Figure 5.23. Mass failure with clay in lower bank and bed in M105-B.

M105-B Data Summary		**Reference**	**Existing**
Length: 3,180 ft Evolution Stage: F-I Sensitivity: Moderate	Confinement	Narrow	Narrow
	Stream Type	C	C
	Entrenchment Ratio	> 2.2	2.6
	Incision Ratio	< 1.2	1.0
	Dominant Bed Material	Cobble	Cobble
	Dominant Bedform	Step-Pool	Step-Pool
Major Stressors:	**Mass failures**		

M105-B Project Identification:

- **Passive Restoration** by protecting the river corridor through easements or river corridor zoning to maintain excellent floodplain access and natural channel and river corridor conditions. (Map 5: Project #2)

Tributary 1 to Dishmill Brook

T1.01

This reach begins at the confluence with Dishmill Brook (along reach M104) and ends just upstream of the confluence with its first major tributary. Tributary 1 is a relatively small stream (drainage area = 1.25 square miles) and flows through developed areas and across roads and trails associated with the Burke Mountain Ski Area. Two crossings in T1.01 (Mountain Road and a trail crossing) have undersized structures causing geomorphic instability. Reach T1.01, being the most downstream reach of Tributary 1, receives both runoff and sediment from receiving tributaries and nearby roads and/or trails. Sediment inputs have led this reach to have an increased amount of fines and a large percentage of exposed substrate. The increased sediment load is a result of stormwater inputs from overland flow through the river corridor (Figure 5.24). Another area of sediment input from stormwater runoff includes overland flow from around the culvert at a trail crossing just upstream of the end of the reach (Figure 5.25). Sediment piles (Figure 5.26) at the southern end of the trail are most likely contributing to sediment in the channel during rainstorms as water flows from the piles, down the trail and into the stream.

Figure 5.24. Sediment laden overland flow from the southern side of reach T1.01.

Figure 5.25. Stormwater input from trail just upstream of reach T1.01.

Figure 5.26. Sand piles at southern end of trail which crosses Tributary 1 just upstream of reach T1.01.

Reach T1.01 is in **fair** geomorphic condition with **aggradation** as a major process where there are debris jams or the valley walls open up. Debris jams have resulted in adjustments to the channel **planform** (Figure 5.27). Floodplain access is good in this reach indicating that the channel has not incised (Figure 5.28). Although the geomorphic condition is compromised by increased sediment load and planform adjustment, the habitat condition is **good**. Abundant large woody debris, nice pools, and some undercut banks have contributed to the good condition.

Figure 5.27. Debris jam and channel *bifurcation* in T1.01.

Figure 5.28. Nice floodplain access on southern bank in reach T1.01.

T1.01 Data Summary		**Reference**	**Existing**
Length: 940 ft Evolution Stage: F-I Sensitivity: Very High	Confinement	Narrow	Narrow
	Stream Type	C	C
	Entrenchment Ratio	> 2.2	2.7
	Incision Ratio	< 1.2	1.1
	Dominant Bed Material	Gravel	Gravel
	Dominant Bedform	Riffle-Pool	Riffle-Pool
Major Stressors:	**Stormwater inputs, Undersized crossings, Debris jams**		

T1.01 Project Identification:

- **Passive Restoration** by protecting the river corridor through easements or river corridor zoning to maintain floodplain access and sediment attenuation. (Map 3: Project #3)
- **Active Restoration** by removing bridge at trail crossing to reduce the erosive effects of failed structure and to improve geomorphic stability. (Map 3: Project #4)
- **Active Restoration** by replacing culvert at Mountain Road crossing to improve connectivity for fish species and improve geomorphic compatibility. (Map 3: Project #5)
- **Stormwater Management** by improving erosion and sediment control in vicinity of trail crossing and areas of overland flow. (Map 3: Project #6)
- **Active Restoration** by relocation of sand pile to reduce the likelihood of sediment transport to the stream channel during rainstorms. (Map 3:Project #7)

5.5 Stream Crossings

Table 6 on page 4 of Appendix B summarizes the data collected and compatibility for the assessed structures within the Phase 2 study area. A total of 8 stream crossings (one culvert and seven bridges) were evaluated by BCE in 2013 (Appendix B, page 5). Of the seven bridges assessed, two were "fully compatible", two were "mostly compatible", one was "partially compatible", and two were "mostly incompatible." This information can be used by municipalities and the Vermont Agency of Transportation to prioritize bridge replacements. The Route 114 Bridge in M101 is being replaced and was therefore not assessed. Stream crossings (both on Mountain Road) that have been recommended for replacement are in reaches T1.01 and M103. The Mountain Road crossing in M103 contains a structure whose bottom is deteriorating and the structure is poorly aligned with the stream channel (Figure 5.29). A significantly undersized culvert at the Mountain Road crossing in T1.01 is falling apart and is causing a potential fish passage issue due to the drop at the outlet (Figure 5.30). One crossing on reach T1.01 is recommended for removal due to its constrictive nature and failure on the northern bank that is causing significant bank erosion (Figures 5.31 and 5.32). More details of recommendations on replacing the structures are included in the tables and maps in Appendix C.

Figure 5.29. Undersized structure at Mountain Road crossing causing geomorphic instability in M103.

Figure 5.30. Undersized culvert causing potential fish passage issue with culvert apron falling off in T1.01.

Figure 5.31. Channel constriction at trail crossing in reach T1.01.

Figure 5.32. Bridge failure at trail crossing in T1.01.

6.0 WATERSHED AND SITE LEVEL PLANNING STRATEGIES

6.1 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 County Conservation Districts and US Fish and Wildlife Service or through State 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.

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.

6.2 Watershed-Level Opportunities

There are a number of watershed-level opportunities available to improve the geomorphic stability and water quality of the Dishmill Brook 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. 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.

6.3 Next Steps

There are many opportunities available to work towards restoring Dishmill Brook and Tributary 1 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 include: protection of the river corridor through easements or river corridor zoning, streamside plantings, berm removal, dam removal, bridge/culvert removal/replacement, and improving stormwater runoff. On the watershed level, the development and implementation of fluvial erosion hazard zones is recommended to avoid conflicts regarding land-use and to save money spent on flood damage and river maintenance. The Town of Burke could pursue the opportunity to work with the Caledonia County Natural Resources Conservation District and the Vermont Agency of Natural Resources to develop and incorporate into zoning bylaws Fluvial Erosion Hazard Zones for the land surrounding Dishmill Brook and its tributaries. 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. CCNRCD in collaboration with the Vermont Agency of Natural Resources will develop Fluvial Erosion Hazard Zones for the existing Phase 2 data on Dishmill Brook and Tributary One.
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 (refer to Appendix C).
5. Obtain funding and perform Phase 2 assessment of more tributaries to Dishmill Brook.
6. Obtain funding to identify stormwater runoff from roads or other developed areas in the upper part of the watershed that may be causing excess sediment input to tributaries of Dishmill Brook.

For additional information about river restoration and protection opportunities within the Dishmill Brook watershed please contact:

Kerry O'Brien, District Manager
(802) 748-3885 x110
kerry.obrien@vt.nacdnet.net

Caledonia County NRCD
481 Summer Street
St. Johnsbury, VT 05819

7.0 LIST OF ACRONYMS AND GLOSSARY OF TERMS

List of Acronyms

BCE – Bear Creek Environmental, LLC
CCNRCD – Caledonia County Natural Resources Conservation District
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
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
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 nickpoint 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.

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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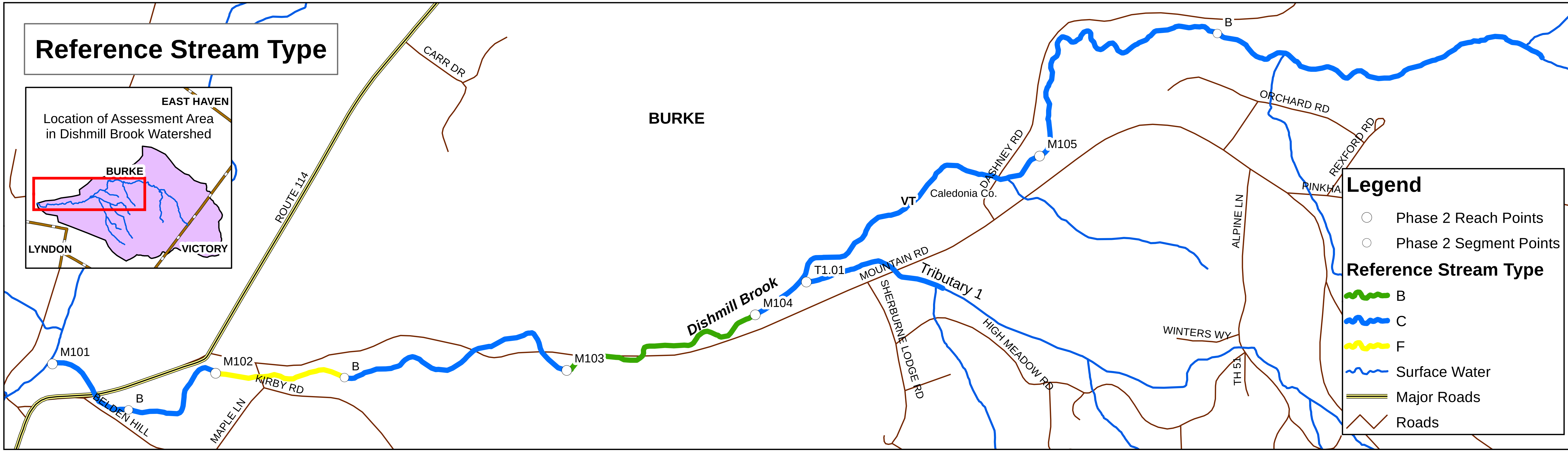
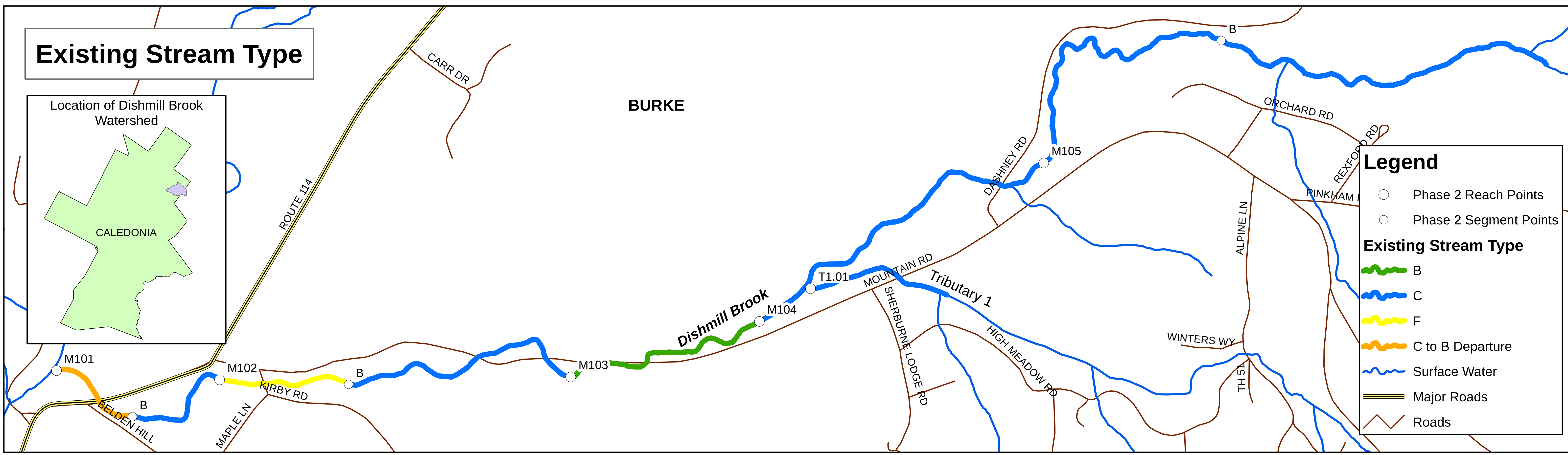
APPENDIX A

Maps



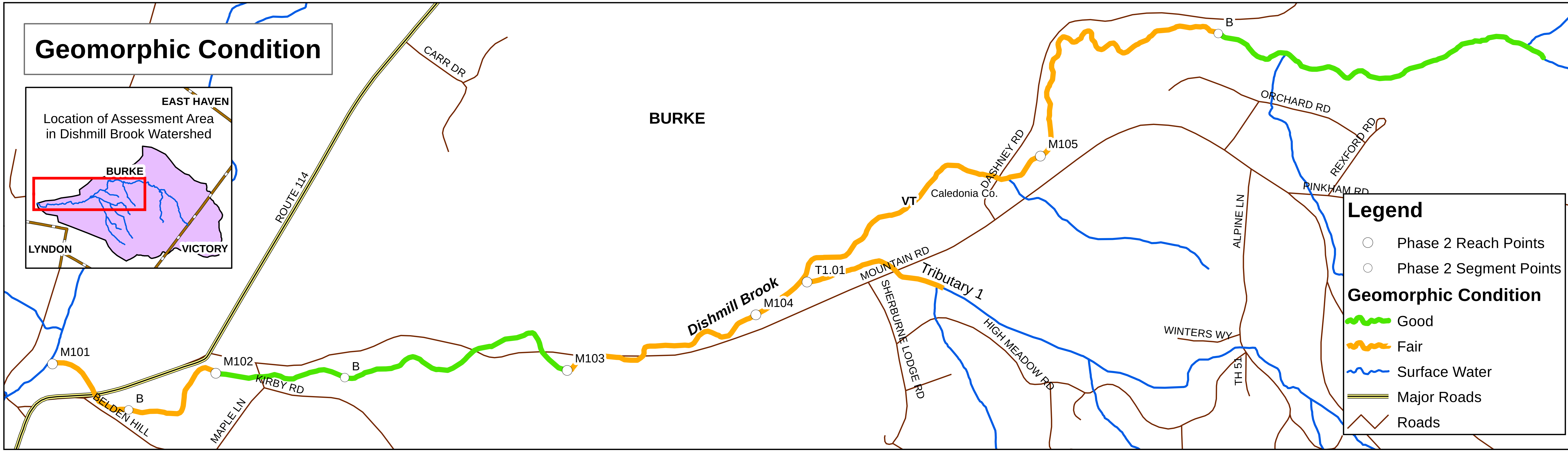


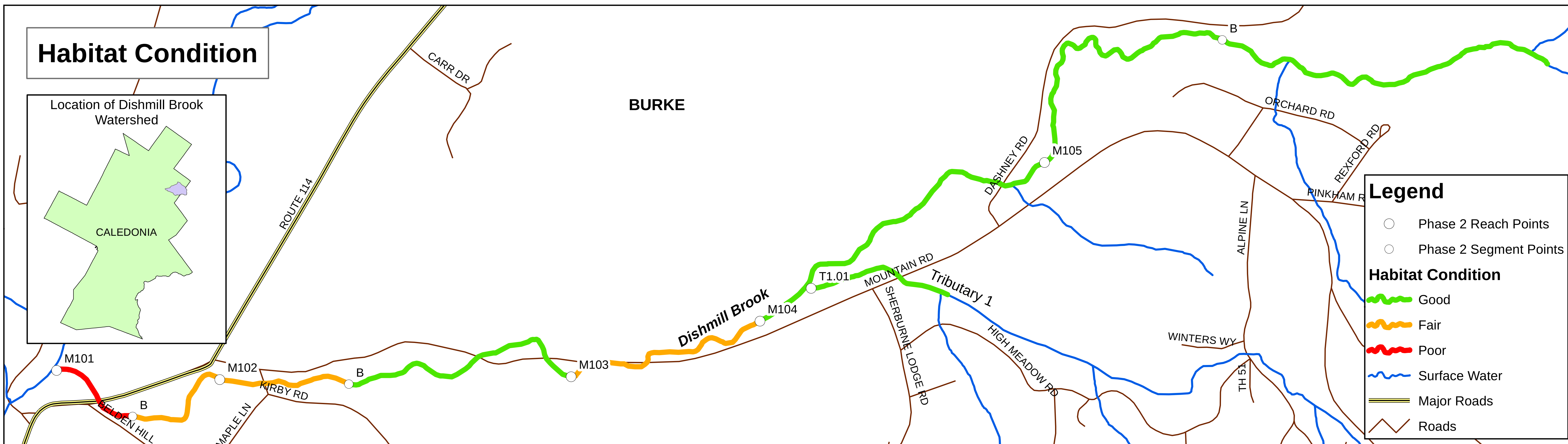
Dishmill Brook & Tributary 1
Stream Type - Burke, Vermont

N
W E
S

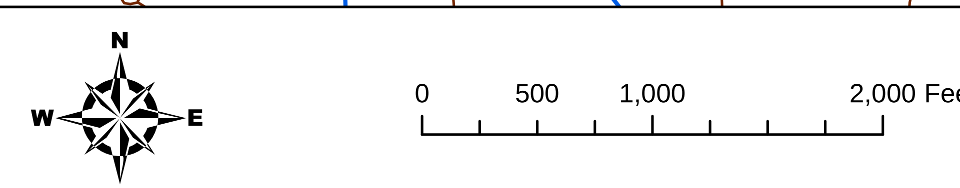
0 500 1,000 2,000 Feet

Bear Creek Environmental

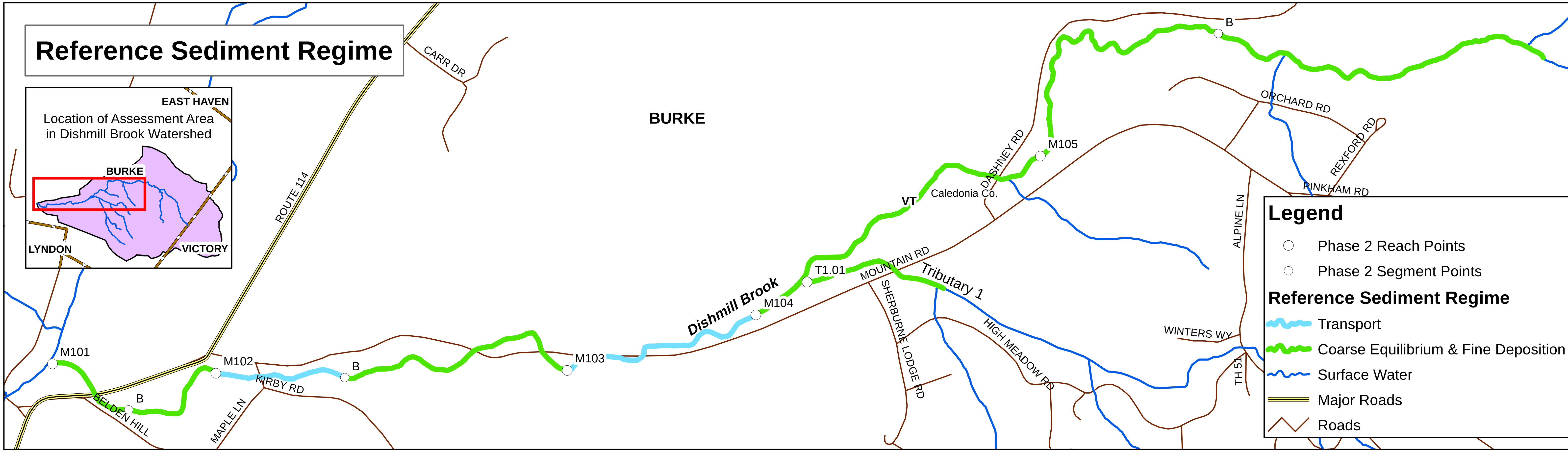


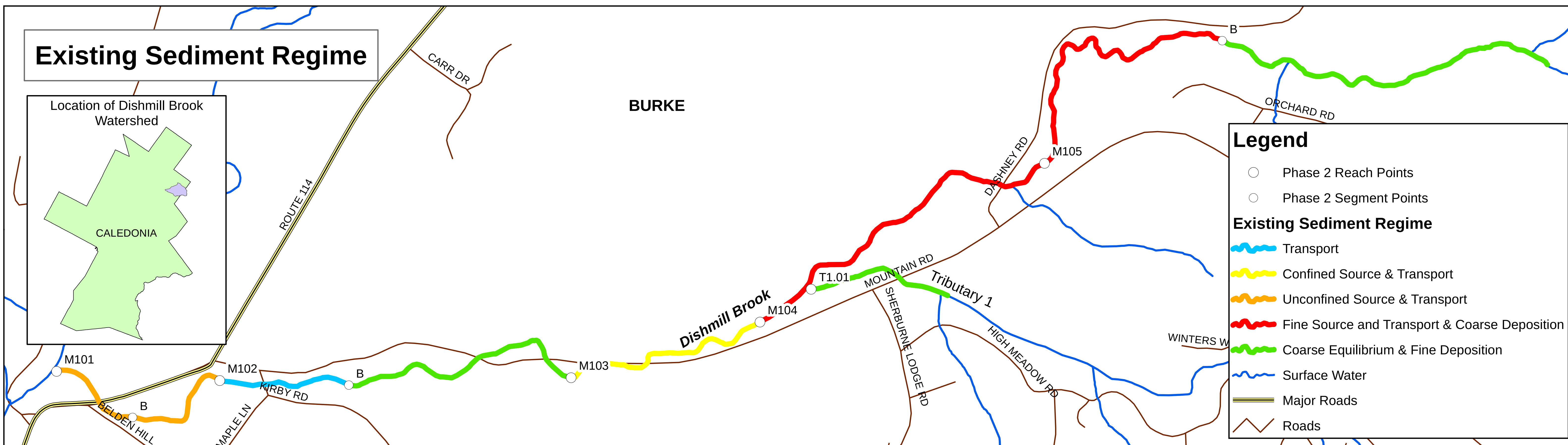


Dishmill Brook & Tributary 1
Stream Condition - Burke, Vermont



Bear Creek Environmental





Dishmill Brook & Tributary 1
Sediment Regimes - Burke, Vermont

N W E S

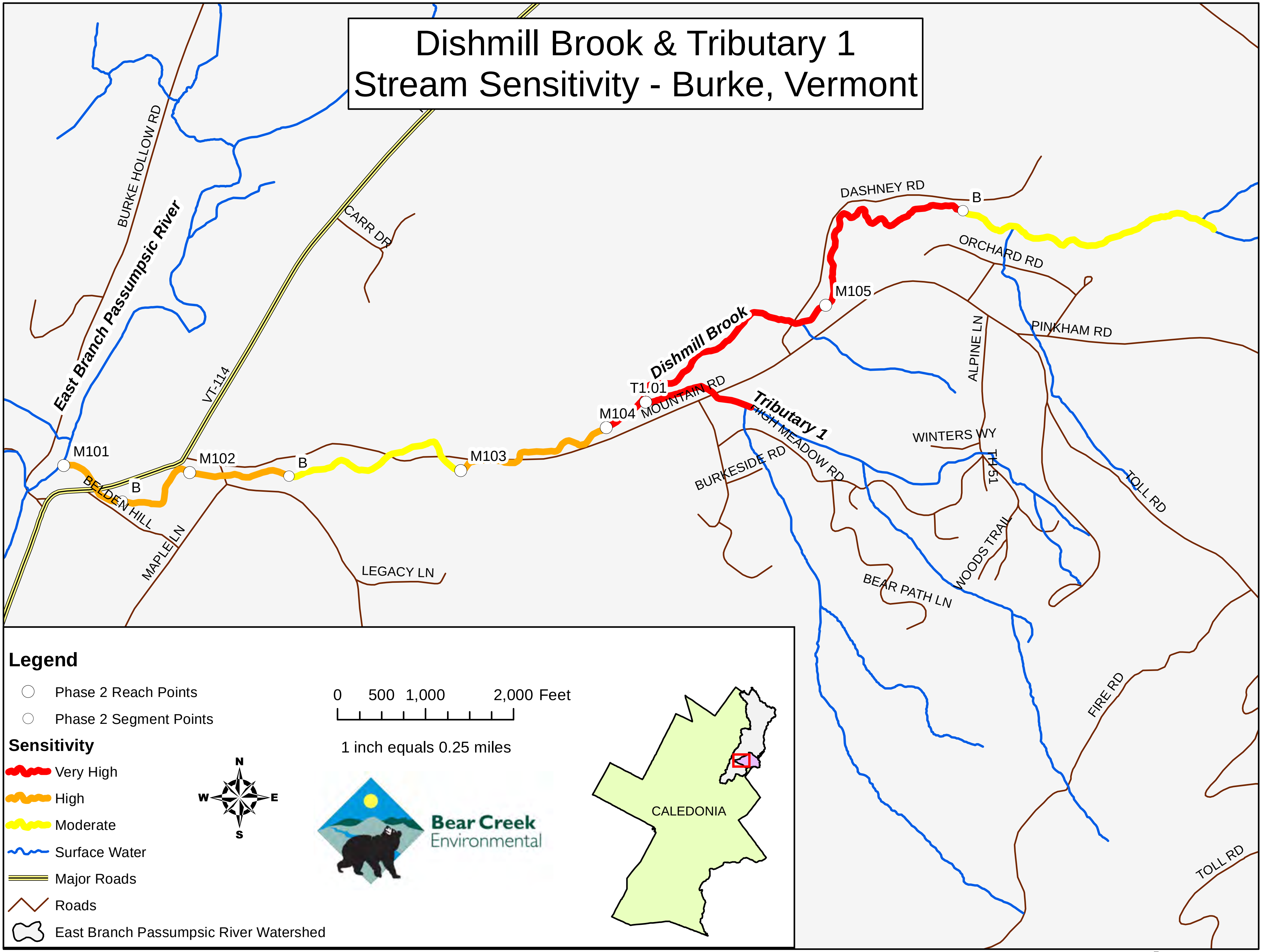
0 500 1,000 2,000 Feet

Bear Creek Environmental

Table 1 Sediment regime types - color coding and descriptions

Sediment Regime	Narrative Description
Transport	Steeper bedrock and boulder/cobble cascade and step-pool stream types; typically in more confined valleys, do not supply appreciable quantities of sediments to downstream reaches on an annual basis; little or no mass wasting; storage of fine sediment is negligible due to high transport capacity derived from both the high gradient and/or natural entrenchment of the channel.
Confined Source and Transport	Cobble step pool and steep plane bed streams; confining valley walls, comprised of erodible tills, glacial lacustrine, glacial fluvial, or alluvial materials; mass wasting and landslides common and may be triggered by valley rejuvenation processes; storage of coarse or fine sediment is limited due to high transport capacity derived from both the gradient and entrenchment of the channel. Look for streams in narrow valleys where dams, culverts, encroachment (roads, houses, etc.), and subsequent channel management may trigger incision, rejuvenation, and mass wasting processes.
Unconfined Source and Transport	Sand, gravel, or cobble plane bed streams; at least one side of the channel is unconfined by valley walls; may represent a stream type departure due to entrenchment or incision and associated bed form changes; these streams are not a significant sediment supply due to boundary resistance such as bank armoring, but may begin to experience erosion and supply both coarse and fine sediment when bank failure leads to channel widening; storage of coarse or fine sediment is negligible due to high transport capacity derived from the deep incision and little or no floodplain access. Look for straightened, incised or entrenched streams in unconfined valleys, which may have been bermed and extensively armored and are in Stage II or early Stage III of channel evolution.
Fine Source and Transport & Coarse Deposition	Sand, gravel, or cobble streams with variable bed forms; at least one side of the channel is unconfined by valley walls; may represent a stream type departure due to vertical profile and associated bed form changes; these streams supply both coarse and fine sediments due to little or no boundary resistance; storage of fine sediment is lost or severely limited as a result of channel incision and little or no floodplain access; an increase in coarse sediment storage occurs due to a high coarse sediment load coupled with the lower transport capacity that results from a lower gradient and/or channel depth. Look for historically straightened, incised, or entrenched streams in unconfined valleys, having little or no boundary resistance, increased bank erosion, and large unvegetated bars. These streams are typically in late Stage III and Stage IV of channel evolution.
Coarse Equilibrium (in = out) & Fine Deposition	Sand, gravel, or cobble streams with equilibrium bed forms; at least one side of the channel is unconfined by valley walls; these streams transport and deposit coarse sediment in equilibrium (stream power—produce as a result of channel gradient and hydraulic radius—is balanced by the sediment load, sediment size, and channel boundary resistance); and store a relatively large volume of fine sediment due to the access of high frequency (annual) floods to the floodplain. Look for unconfined streams, which are not incised or entrenched, have boundary resistance (woody buffers), minimal bank erosion, and vegetated bars. These streams are Stage I, late Stage IV, and Stage V.
Deposition	Silt, Sand, gravel, or cobble streams with variable and braided bed forms; at least one side of the channel is unconfined by valley walls; may represent a stream type departure due to changes in slope and/or depth resulting in the predominance of transient depositional features; storage of fine and coarse sediment frequently exceeds transport**. Floodplains are accessed during high frequency (annual) floods. Look for unconfined streams, which are not incised or entrenched, have become significantly over-widened, and if high rates of bank erosion are present, it is offset by the vertical growth of unvegetated bars. These regimes may be located at zones of naturally high deposition (e.g., active alluvial fans, deltas, or upstream of bedrock controls), or may exist due to impoundment and other backwater conditions above weirs, dams and other constrictions.

** Use of the "Deposition" regime characterization may be rare, but valuable as a planning tool, where the reach is storing far more than it is transporting during some defined planning period. The extreme example would be that of an impounded reach where all of the course and a great percentage of the fine sediments are being deposited, rather than transported downstream. This man-made condition may change, thereby changing the sediment regime, but is not likely over the period at which the corridor plan will be used.


Dishmill Brook & Tributary 1
Stream Sensitivity - Burke, Vermont
BURKE HOLLOW RD
East Branch Passumpsic River
VT-114
CARR DR
DASHNEY RD
B
ORCHARD RD
M105
PINKHAM RD
Dishmill Brook
ALPINE LN
T1.01
MOUNTAIN RD
M104
Tributary 1
HIGH MEADOW RD
WINTERS WY
TH51
BURKESIDE RD
TOLL RD
M101
M102
M103
B
B
BELDEN HILL
MAPLE LN
LEGACY LN
WOODS TRAIL
BEAR PATH LN
FIRE RD
TOLL RD
Legend
Phase 2 Reach Points
Phase 2 Segment Points
Sensitivity
Very High
High
Moderate
Surface Water
Major Roads
Roads
East Branch Passumpsic River Watershed
N
W
E
S
0 500 1,000 2,000 Feet
1 inch equals 0.25 miles
Bear Creek Environmental
CALEDONIA

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.

Milone & MacBroom, Inc., 2008

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 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				

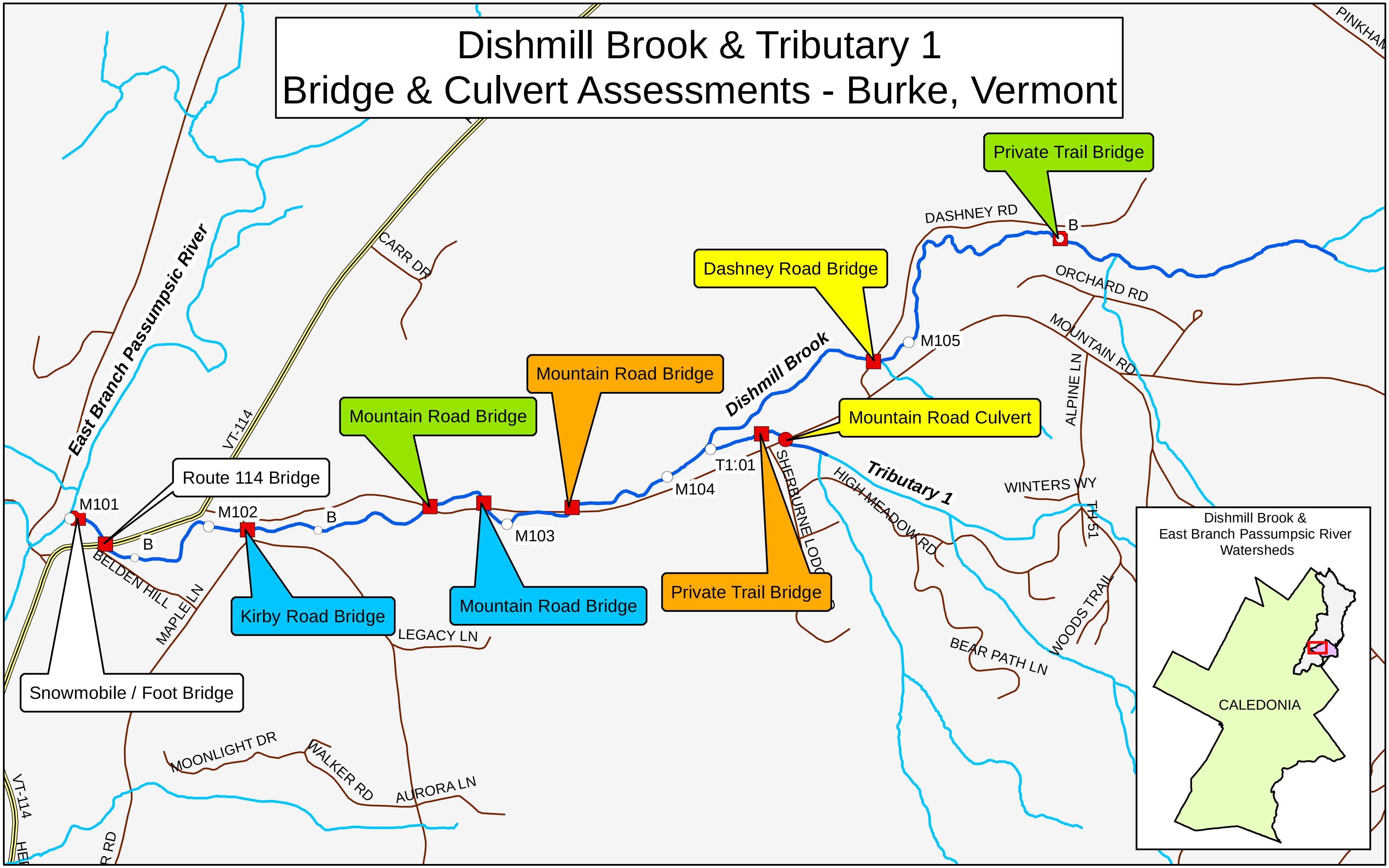
Notes:
Assessment completed during low flows
Outlet drop = invert of structure to water surface
Pool present variable is used alone if pool depths are not measured
n/m = not measured
n/a = not applicable

Table 6. Dishmill Brook Watershed Bridge & Culvert Assessment (2013)

Reach/ Segment Number	Town	Road Name	Structure Type and ID[1]	Percent Bankfull Channel Width[2]	Phase 2 Notes	Scoring							
						% Bankfull Width	Sediment Continuity	Slope	Approach Angle	Erosion & Armoring	Total Score	Geomorphic Compatibility	Aquatic Organism Passage (AOP)
Dishmill Brook													
M102-A	Burke	Kirby Road	Bridge 100302001303021	80	On top of bedrock. Stable structure although constricting channel.	3	5	n/a	5 Naturally Straight	4	**17**	Fully Compatible	n/a
M102-B	Burke	Mountain Road	Bridge 20268001603022	150[3]	Rip-rap constricting more than structure span, but still not a channel constriction.	5	5	n/a	2 Channelized Straight	4	**16**	Mostly Compatible	n/a
M102-B	Burke	Mountain Road	Bridge 20268001703022	80	Constructed in 2008 and in good condition.	3	5	n/a	5 Naturally Straight	4	**17**	Fully Compatible	n/a
M103	Burke	Mountain Road	Bridge n/a	67	Deposition above and below. Scour below and poor alignment. Bottom deteriorated.	2	2	n/a	0 Sharp Bend	3	**7**	Mostly Incompatible	n/a
M104	Burke	Dashney Road	Bridge 990050001103021	63	Scour below and poor alignment.	2	4	n/a	0 Sharp Bend	3	**9**	Partially Compatible	n/a
M105-B	Burke	Kingdom Trail Bridge	Bridge n/a	118	Small trail bridge that poses no threat to stream channel. Sediment deposits in vicinity of bridge are not due to the structure.	4	5	n/a	3 Mild Bend	4	**16**	Mostly Compatible	n/a
Tributary 1 to Dishmill Brook													
T1.01	Burke	Private Trail	Bridge n/a	38	Deposition above and below. Scour below and poor alignment. Floodprone constriction with very little natural floodplain. Deteriorated structure causing significant bank erosion.	1	2	n/a	3 Mild Bend	0	**6**	Mostly Incompatible	n/a
T1.01	Burke	Mountain Road	Culvert 700007015703023	41	150-foot long culvert. Deposition above and scour below. Perched culvert on downstream end. Culvert apron at outlet is falling off.	1	2	5	3 Mild Bend	0	**11**	Partially Compatible	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. The constriction percentage is calculated by dividing the present constriction width by the reference channel width.
[3] Rip-rap armoring is constricting channel more than structure span. Used width of armoring constriction for percent bankfull channel width calculation.

Dishmill Brook & Tributary 1
Bridge & Culvert Assessments - Burke, Vermont



Legend

- Bridge
- Culvert
- Phase 2 Reach Points
- Phase 2 Segment Points
- Phase 2 Assessment Reaches
- Surface Water
- Major Roads
- Roads
- East Branch Passumpsic River Watershed

Geomorphic Compatibility Rating:

- Fully Compatible
- Mostly Compatible
- Partially Compatible
- Mostly Incompatible
- Fully Incompatible
- Not Assessed

0 500 1,000 2,000 Feet

1 inch equals 0.25 miles

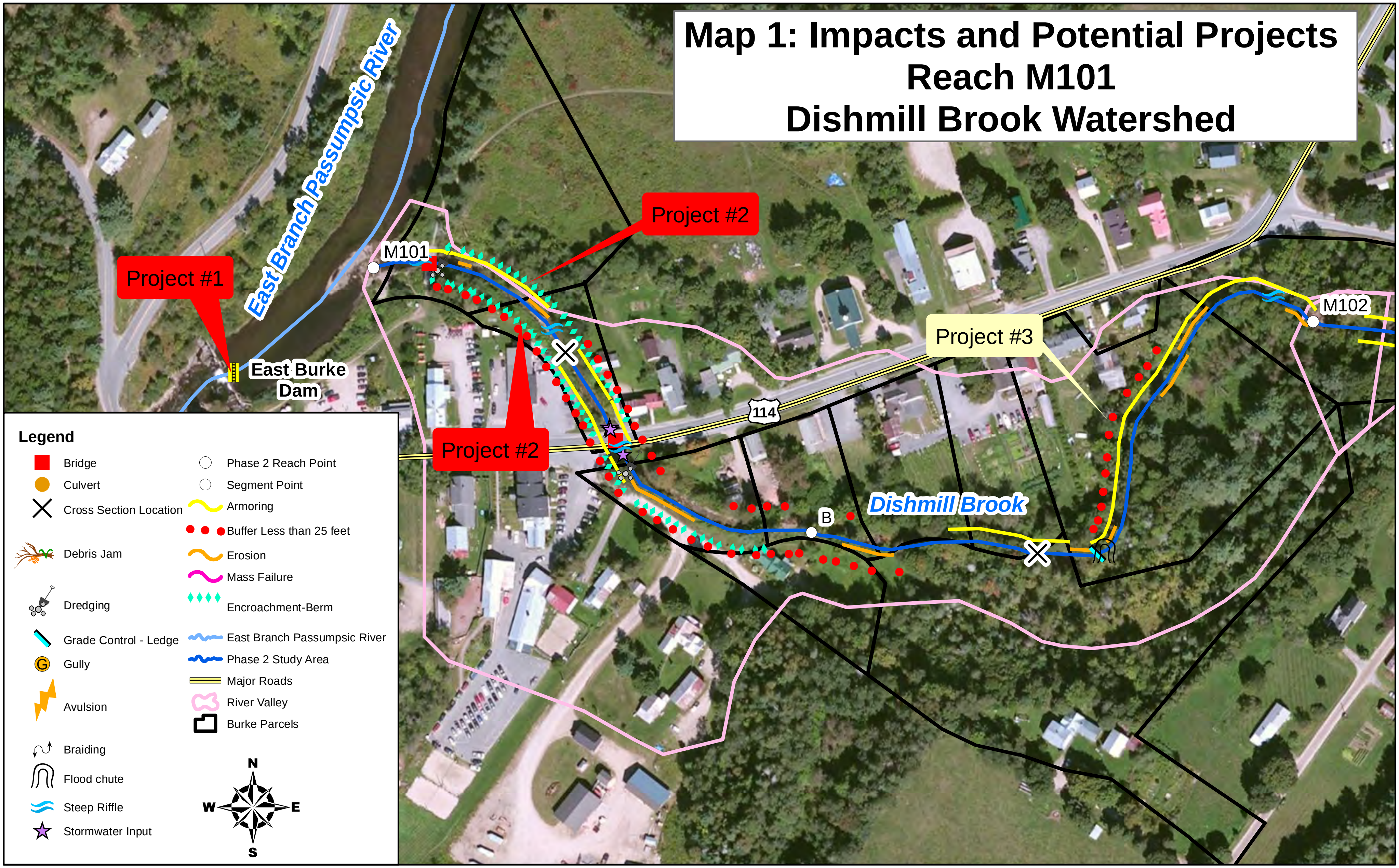
N W E S

Bear Creek Environmental

APPENDIX C

Potential Project Locations and Descriptions

Map 1: Impacts and Potential Projects Reach M101 Dishmill Brook Watershed



Background is World Imagery

Projects:

1. Dam Removal
2. Alternatives Analysis for Removal of Berms
3. Streamside Plantings

Project Priority:

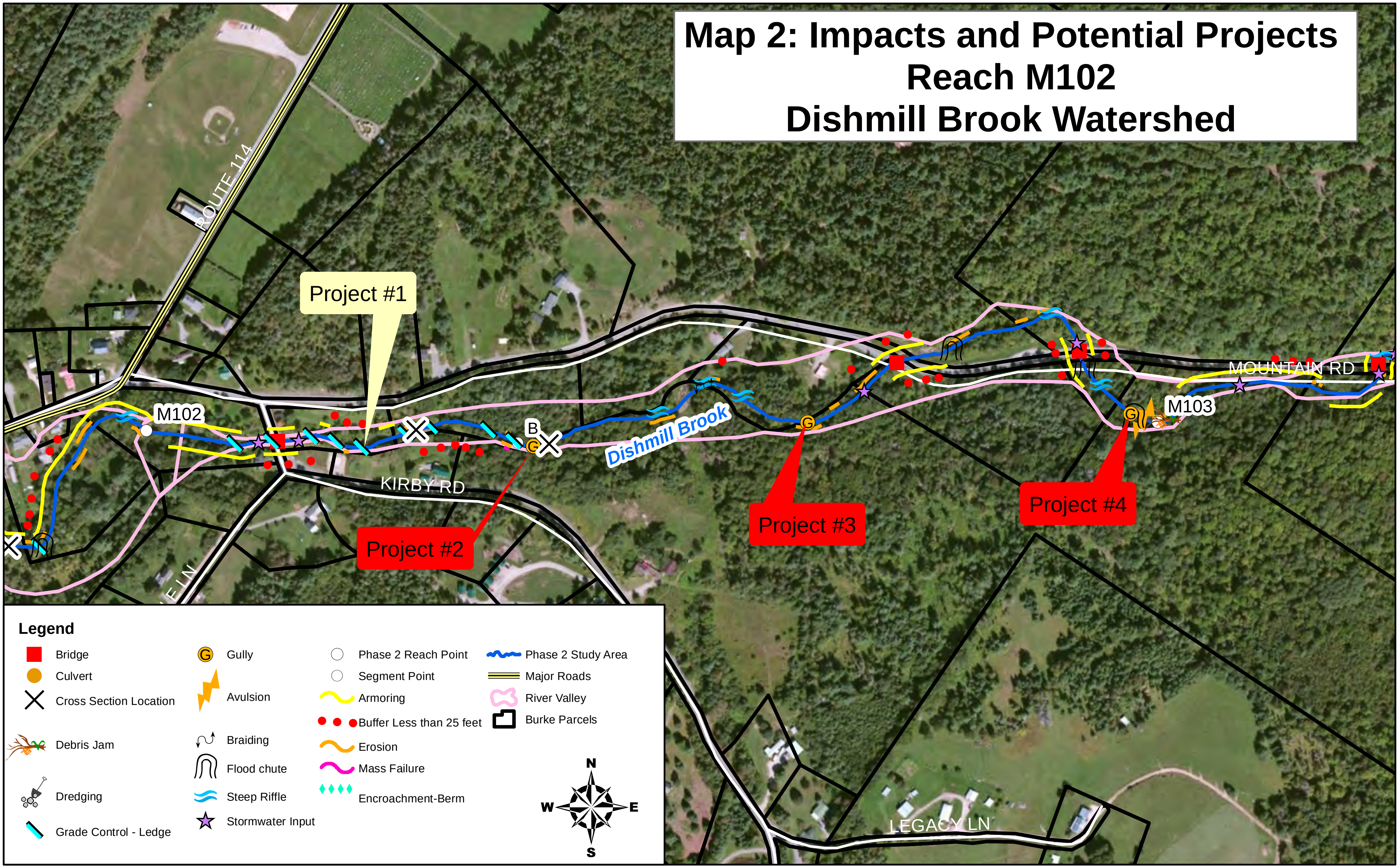
- Low
- Moderate
- High

0 50 100 200 Feet

1 inch = 200 feet

Bear Creek Environmental

Map 2: Impacts and Potential Projects
Reach M102
Dishmill Brook Watershed



Background is World Imagery

Projects:

1. Old Dam Removal
2. Gully Remediation
3. Gully Remediation
4. Gully Remediation

Project Priority:

- Low
- Moderate
- High

0 200 400 Feet

1 inch = 400 feet

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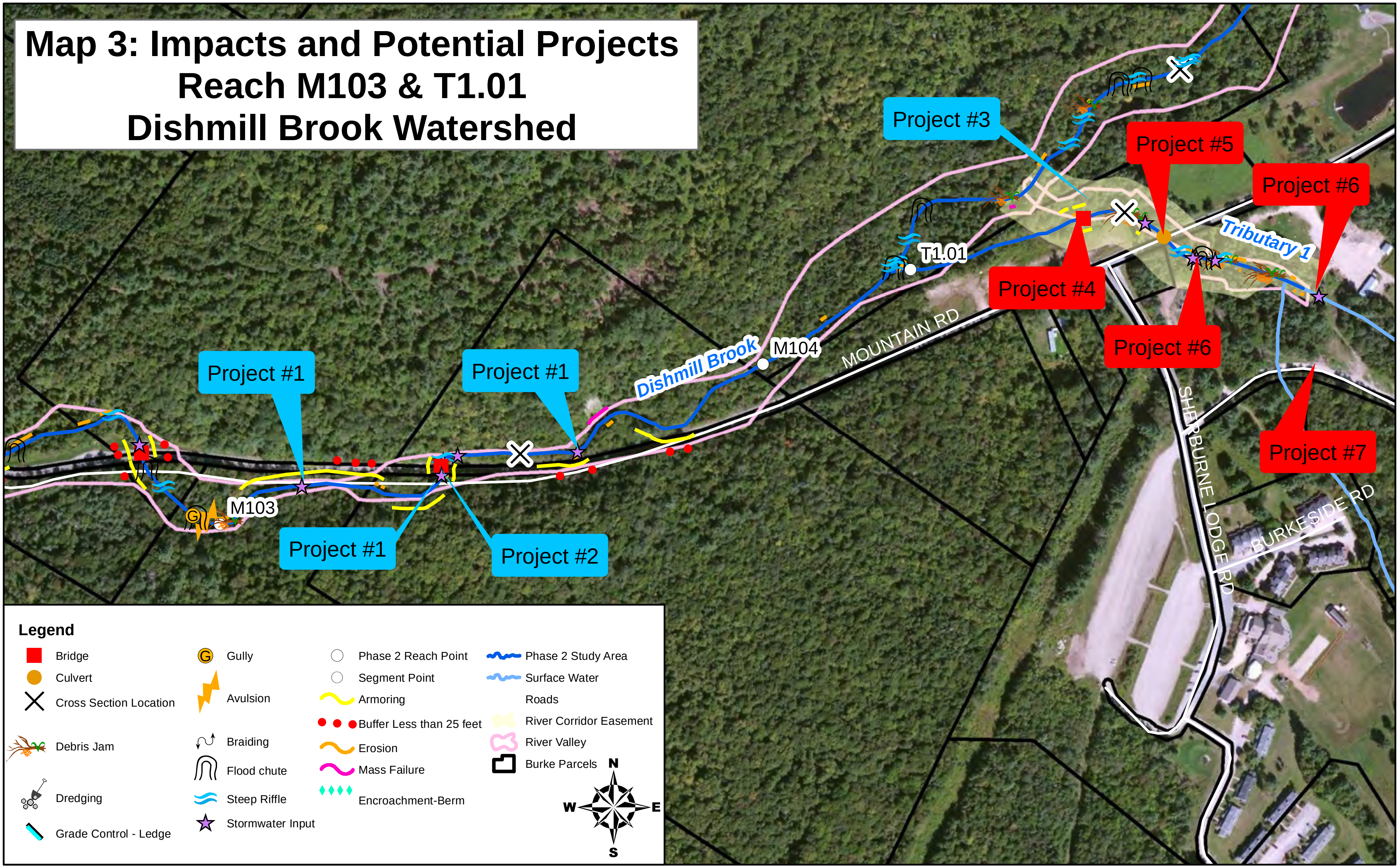
Map 3: Impacts and Potential Projects
Reach M103 & T1.01
Dishmill Brook Watershed



Projects:

1. Stormwater Management
2. Bridge Replacement
3. River Corridor Easement*
4. Bridge Removal
5. Culvert Replacement
6. Stormwater Management
7. Relocation of Sand Pile

Project Priority:

- Low
- Moderate
- High

0 200 400 Feet

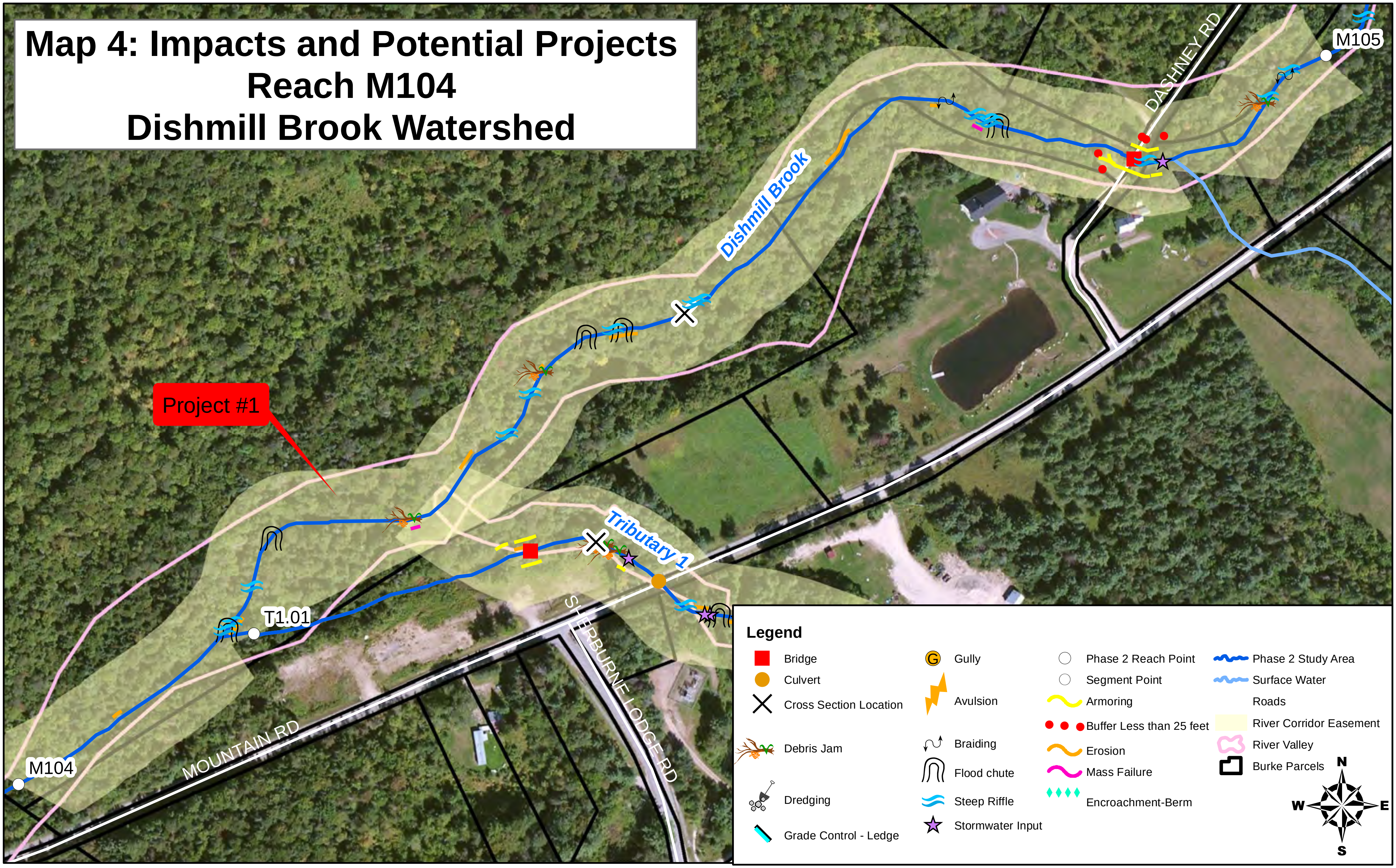
1 inch = 400 feet

Background is Bing Imagery

Bear Creek Environmental

*: Location of stream line in GIS data (VHD) is not actual location; easement area suggested for river corridor of stream line location observed in the field.

Map 4: Impacts and Potential Projects
Reach M104
Dishmill Brook Watershed



Projects:

1. River Corridor Easement

Project Priority:

- Low
- Moderate
- High

0 125 250 Feet

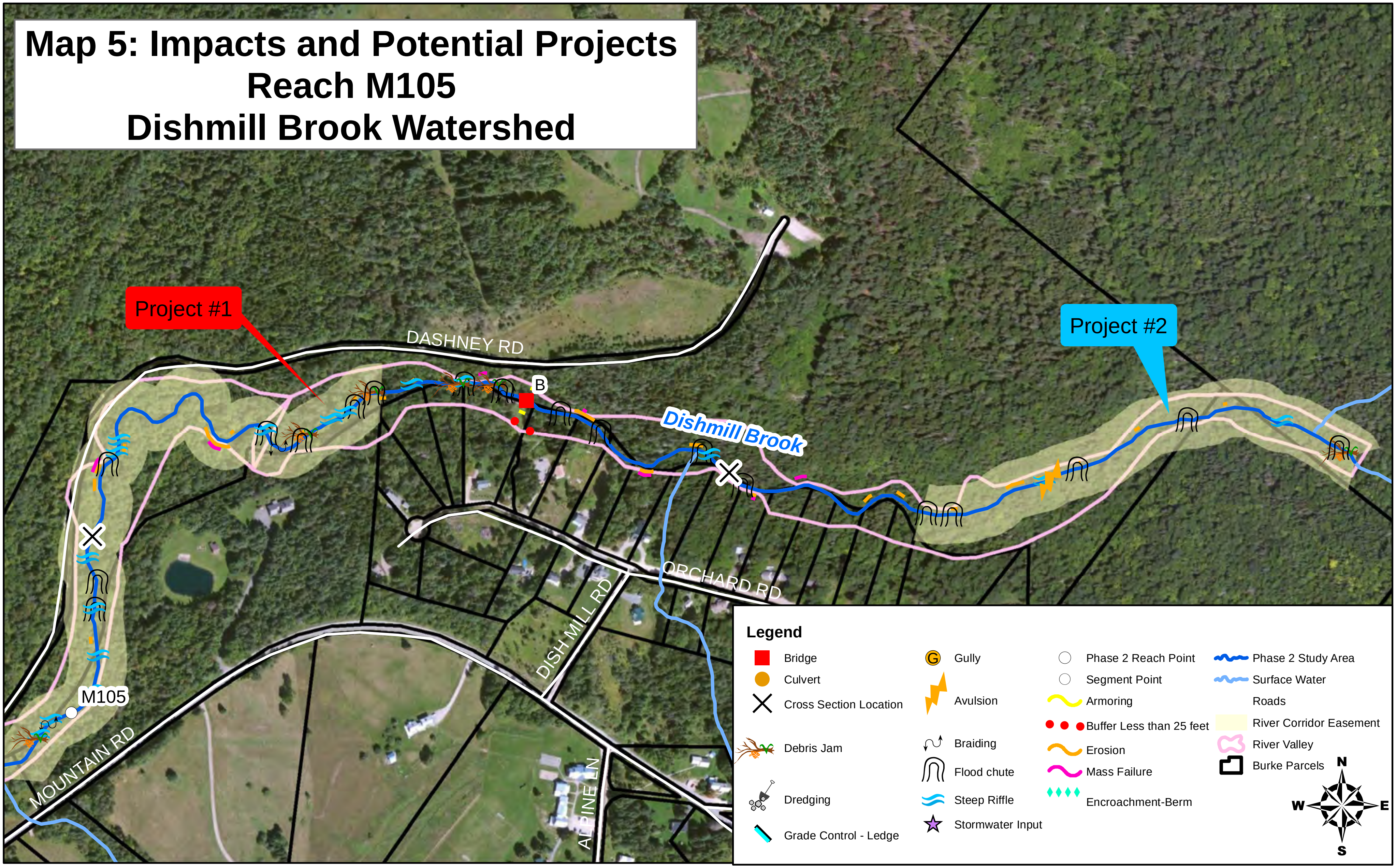
1 inch = 250 feet

Background is World Imagery

Bear Creek Environmental

Location of stream line in GIS data (VHD) in reach T1.01 is not actual location; easement area suggested for river corridor of stream line location observed in the field.

Map 5: Impacts and Potential Projects
Reach M105
Dishmill Brook Watershed



Background is World Imagery

Projects:

1. River Corridor Easement
2. River Corridor Easement

Project Priority:
- Low
- Moderate
- High

0 225 450 Feet

1 inch = 450 feet

Bear Creek Environmental

Table 1. Dishmill Brook Map 1: M101 Site Level Opportunities for Restoration and Protection Burke, Vermont						
Project # Segment	**Type of Project**	**Site Description Including Stressors and Constraints**	**Project or Strategy Description**	**Priority**	**Benefits**	**Potential Partners/Programs**
Project #1 East Branch Passumpsic	Active Restoration	Flows and sediment from East Branch Passumpsic back up into Dishmill Brook exacerbating flood conditions and aggradation	Alternatives Analysis for Removal of the East Burke Dam is completed. Dam removal is in the permitting stage. Further investigation of Dishmill Brook following dam removal.	High Priority	Reduce flood risks to downstream end of Dishmill Brook; improve geomorphic stability and habitat	Passumpsic Valley Land Trust, CCNRCD, VANR, Town of Burke ERP, CRWC, UCRMEF
Project #2 M101-A	Active Restoration	Berms along both sides of stream below Route 114 bridge and on southern side above the bridge preventing floodplain access	Alternatives analysis for the removal of the berms	High Priority	Improved geomorphic stability and flood and sediment attenuation	Landowners, CCNRCD, VANR, Town of Burke ERP, CRWC, UCRMEF
Project #3 M101-B	Passive Restoration	Residential area where buffer is not adequate	Streamside plantings	Low Priority	Improved habitat and water quality	Landowners, CCNRCD, VANR, Town of Burke TFS, WHIP, CRWC, UCRMEF
TFS=Trees for Streams, WHIP=Wildlife Habitat Incentives Program, CRWC=Connecticut River Watershed Council, ERP=Ecosystem Restoration Program, UCRMEF = Upper Connecticut River Mitigation and Enhancement Fund						

Table 2. Dishmill Brook Map 2: M102 Site Level Opportunities for Restoration and Protection Burke, Vermont						
Project # Segment	**Type of Project**	**Site Description Including Stressors and Constraints**	**Project or Strategy Description**	**Priority**	**Benefits**	**Potential Partners/Programs**
Project #1 M102-A	Active Restoration	Old fallen apart dam creating potential fish passage issue	Alternatives analysis for dam removal	Low Priority	Improved habitat and geomorphic stability; provide improved connectivity for fish species	Landowners, CCNRCD, VANR, Town of Burke ERP, CRWC, UCRMEF
Project #2 M102-B	Active Restoration	Overland runoff potentially from developed areas causing gullies which are sediment sources to the brook	Remediate gully and/or reduce stormwater runoff causing gully erosion	High Priority	Improved habitat and water quality	Landowners, CCNRCD, VANR, Town of Burke ERP, CRWC
Project #3 M102-B	Active Restoration	Overland runoff potentially from developed areas causing gullies which are sediment sources to the brook	Remediate gully and/or reduce stormwater runoff causing gully erosion	High Priority	Improved habitat and water quality	Landowners, CCNRCD, VANR, Town of Burke ERP, CRWC
Project #4 M102-B	Active Restoration	Overland runoff potentially from developed areas causing gullies which are sediment sources to the brook	Remediate gully and/or reduce stormwater runoff causing gully erosion	High Priority	Improved habitat and water quality	Landowners, CCNRCD, VANR, Town of Burke ERP, CRWC
FS=Trees for Streams, WHIP=Wildlife Habitat Incentives Program, CRWC=Connecticut River Watershed Council, ERP=Ecosystem Restoration Program, UCRMEF = Upper Connecticut River Mitigation and Enhancement Fund						

Table 3. Dishmill Brook and Tributary 1 to Dishmill Brook Map 3: M103 and T1.01 Site Level Opportunities for Restoration and Protection Burke, Vermont						
Project # Segment	**Type of Project**	**Site Description Including Stressors and Constraints**	**Project or Strategy Description**	**Priority**	**Benefits**	**Potential Partners/Programs**
Project #1 M103	Stormwater Management	Runoff from Mountain Road is causing excess stormwater in stream channel.	Evaluate stormwater inputs	Moderate Priority	Improved water quality	Landowner, CCNRCD, VANR, Town of Burke ERP
Project #2 M103	Active Restoration	Mountain Road Bridge is constrictive and poorly aligned with the stream channel.	Replace bridge	Moderate Priority	Improved habitat and geomorphic stability; reduce risk of flooding from debris jams	Landowners, CCNRCD, VTrans, Town of Burke VTrans, CRWC
Project #3 T1.01	Passive Restoration	Mostly forested river corridor with good floodplain access.	Protect river corridor through easement	Moderate Priority	Improved habitat and water quality	Landowners, CCNRCD, VANR, Town of Burke RCE
Project #4 T1.01	Active Restoration	Trail Bridge is significantly undersized and falling apart causing excessive streambank erosion.	Remove bridge	High Priority	Improved habitat and geomorphic stability; reduce erosion from failed structure	Landowners, CCNRCD, Town of Burke CRWC
Project #5 T1.01	Active Restoration	Mountain Road crossing has a culvert which is significantly undersized. The apron is falling off and causing a potential fish passage issue.	Replace culvert	High Priority	Improved habitat and geomorphic stability; improve connectivity for fish species; reduce risk of flooding from debris jams	Landowners, CCNRCD, VTrans, Town of Burke VTrans, CRWC

Table 3. Dishmill Brook and Tributary 1 to Dishmill Brook Map 3: M103 and T1.01 Site Level Opportunities for Restoration and Protection Burke, Vermont						
Project # Segment	**Type of Project**	**Site Description Including Stressors and Constraints**	**Project or Strategy Description**	**Priority**	**Benefits**	**Potential Partners/Programs**
Project #6 T1.01	Stormwater Management	Runoff from Burke Mountain Ski Area roads to development and trails is causing excess stormwater and sediment in stream channel.	Evaluate stormwater inputs	High Priority	Improved water quality	Landowner, CCNRCD, VANR, Town of Burke ERP, CRWC
Project #7 T1.01	Active Restoration	Sand pile near trail that crosses the stream is most likely a sediment source during storm events	Relocate sand pile to a less vulnerable area	High Priority	Improved water quality	Burke Mountain Ski Area, CCNRCD, VANR, Town of Burke ERP, CRWC
TFS=Trees for Streams, WHIP=Wildlife Habitat Incentives Program, CRWC=Connecticut River Watershed Council, ERP=Ecosystem Restoration Program, RCE=River Corridor Easement, VTrans = Vermont Agency of Transportation						

Table 4. Dishmill Brook Maps 4 and 5: M104 and M105 Site Level Opportunities for Restoration and Protection Burke, Vermont						
Project # Segment	**Type of Project**	**Site Description Including Stressors and Constraints**	**Project or Strategy Description**	**Priority**	**Benefits**	**Potential Partners/Programs**
Map 4 Project #1 M104	Passive Restoration	Mostly forested river corridor.	Protect river corridor through easement	High Priority	Improved habitat and water quality	Landowners, CCNRCD, VANR, Town of Burke RCE
Map 5 Project #1 M105	Passive Restoration	Forested river corridor with good floodplain access.	Protect river corridor through easement	High Priority	Improved habitat and water quality	Landowners, CCNRCD, VANR, Town of Burke RCE
Map 5 Project #2 M105	Passive Restoration	Forested river corridor with good floodplain access.	Protect river corridor through easement	Moderate Priority	Improved habitat and water quality	Landowners, CCNRCD, VANR, Town of Burke RCE
TFS=Trees for Streams, WHIP=Wildlife Habitat Incentives Program, CRWC=Connecticut River Watershed Council, ERP=Ecosystem Restoration Program, RCE=River Corridor Easement						

APPENDIX D

Phase 2 Geomorphic Assessment Data

Phase 2 Segment Summary Report **Dishmill Brook**

Stream:	**Dishmill Brook**	SGAT Version:	**4.56**
Reach:	**M101-A**	Organization:	**Bear Creek Environmental**
Segment Length(ft):	**870**	Observers:	**Pam DeAndrea, Staci Pomeroy**
Rain:	**Yes**	Completion Date:	**8/20/2013**
		Qualtiy Control Status - Consultant:	**Passed**
		Qualtiy Control Status - Staff:	**Provisional**

Step 0 - Location: **Mouth to upstream of Rte 114 bridge in East Burke**

Step 5 - Notes: **Bermed on both sides of channel preventing floodplain access.**

Step 7 - Narrative: **Segment has been extensively armored, bermed and straightened. Abundant infrastructure and berming has led to extreme channel incision. Berms have prevented floodplain access and caused the channel to degrade its bed. Most bars in segment are small but there are abundant fines in the channel between larger substrates as well as steep riffles and diagonal bars indicating current aggradation. Planform change is major due to straightening.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Corridor Encroachment**

1.2 Alluvial Fan: **None**

1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	**268**	**6**	**382**	**4**
Road:	**0**		**0**	
Railroad:	**0**		**0**	
Imp. Path:	**0**		**0**	
Dev.:	**206**		**504**	

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

1.5 Valley Features	
Valley Width (ft):	**220**
Width Determination:	**Measured**
Confinement Type:	**BD**
In Rock Gorge:	**No**
Human Caused Change in Valley Width?:	**Yes**

1.6 Grade Controls: **None**

Stream: **Dishmill Brook** Reach: **M101-A**

Step 2. Stream Channel

2.1Bankfull Width (ft.)	**34.10**	2.11 Riffle/Step Spacing:	**99 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.)	**3.50**	2.12 Substrate Composition		Bed:	**12.7**	**inches**
2.3 Mean Depth (tf):	**2.19**	Bedrock:	**0.0 %**	Bar:	**6.6**	**inches**
2.4 Floodprone Width (ft.):	**60.50**	Boulder:	**7.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**5.50**	Cobble:	**33.0 %**	Stream Type:	**B**	
Human Elev FloodPln (ft.):	**6.90**	Coarse Gravel:	**27.0 %**	Bed Material:	**Gravel**	
2.6 Width/Depth Ratio:	**15.57**	Fine Gravel	**21.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**1.77**	Sand:	**12.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.57**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**1.97**	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	**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:	**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.):	**112.3**	**64.4**
Erosion Height (ft.):	**5.0**	**3.0**
Revetment Type:	**Multiple**	**Multiple**
Revetment Length:	**204.7**	**371.6**

Near Bank Vegetation Type	Left	Right
Dominant:	**Invasives**	**Invasives**
Sub-dominant:	**Herbaceous**	**Herbaceous**
Bank Canopy		
Canopy %:	**1-25**	**1-25**
Mid-Channel Canopy:	**Open**	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**0-25**	**0-25**
Sub-Dominant	**None**	**26-50**
W less than 25	**780**	**365**
Buffer Vegitation Type		
Dominant	**Invasives**	**Invasives**
Sub-Dominant	**Deciduous**	**Deciduous**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Commercial**	**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: **Dishmill Brook** Reach: **M101-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps: **None**

4.2 Adjacent Wetlands: **None**

4.3 Flow Status: **Low**

4.4 # of Debris Jams: **0**

4.5 Flow Regulation Type **None**

Flow Reg. Use:

Impoundments: **None**

Impoundment Loc.:

4.6 Up/Down Strm flow reg.: **None**

(old) Upstrm Flow Reg.: **None**

4.7 Stormwater Inputs

Field Ditch: **0** Road Ditch: **0**

Other: **0** Tile Drain: **0**

Overland Flow: **2** Urb Strm Wtr Pipe: **2**

4.9 # of Beaver Dams: **0**

Affected Length (ft): **0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	**22**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Alignment**
Bridge	**0**	**Yes**	**Yes**	**No**	**No**	**None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid: **0** Point: **0** Side: **3**

Diagonal: **1** Delta: **0** Island: **0** Braiding: **0**

5.2 Other Features

Flood chutes: **0**

Neck Cutoff: **0** Avulsion: **0**

5.3 Steep Riffles and Head Cuts

Steep Riffles: **3** Head Cuts: **0** Trib Rejuv.: **No**

5.4 Stream Ford or Animal Crossing: **No**

5.5 Straightening: **With Windrowing**

Straightening Length (ft.): **775**

5.5 Dredging: **Dredging**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.: **18**

6.2 Pool Substrate: **10**

6.3 Pool Variability: **10**

Total Score: **96**

Habitat Rating: **0.48**

Habitat Stream Condition: **Fair**

6.4 Sediment Deposition: **11**

6.5 Channel Flow Status: **16**

6.6 Channel Alteration: **7**

6.7 Channel Sinuosity: **5**

Stream Gradiant Type	Left	Right
6.8 Bank Stability:	**7**	**8**
6.9 Bank Vegetation Protection	**1**	**1**
6.10 Riparian Veg. Zone Width:	**0**	**2**

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**	Score	STD	Historic
7.1 Channel Degradation	**3**	**C to B**	**Yes**
7.2 Channel Aggradation	**10**	**None**	**No**
7.3 Widening Channel	**13**	**None**	**No**
7.4 Change in Planforml	**9**	**None**	**No**
Total Score	**35**		

Geomorphic Rating **0.44**

Channel Evolution Model **F**

Channel Evolution Stage **II**

Geomorphic Condition **Fair**

Stream Sensitivity **High**

Phase 2 Segment Summary Report **Dishmill Brook**

Stream: **Dishmill Brook**
Reach: **M101-B**
Segment Length(ft): **1,030**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Bear Creek Environmental**
Observers: **Pam DeAndrea, Staci Pomeroy**
Completion Date: **8/20/2013**
Qualtiy Control Status - Consultant: **Passed**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **Segment begins upstream of where bermed area begins and continues to reach break for M102**

Step 5 - Notes: **Spoke with landowner at Inn who said her place did not flood in 2008, but she indicated places that were flooded.**

Step 7 - Narrative: **Abundant armoring on right bank, but channel has widened somewhat. Some large point bars resulting in a larger exposed substrate but limited mid-channel accumulation. Since armoring is abundant channel was probably straightened. Still good floodplain access at least on one side. Planform change is due to straightening.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Corridor Encroachment**

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.:	724		25	

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

1.5 Valley Features	
Valley Width (ft):	388
Width Determination:	Measured
Confinement Type:	VB
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	2.0	1.1	Yes	

Stream: **Dishmill Brook** Reach: **M101-B**

Step 2. Stream Channel

2.1Bankfull Width (ft.)	**44.50**	2.11 Riffle/Step Spacing:	**92 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.)	**2.80**	2.12 Substrate Composition		Bed:	**15.1**	**inches**
2.3 Mean Depth (tf):	**1.89**	Bedrock:	**2.0 %**	Bar:	**7.2**	**inches**
2.4 Floodprone Width (ft.):	**123.50**	Boulder:	**14.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**3.20**	Cobble:	**41.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**25.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**23.54**	Fine Gravel:	**10.0 %**	Subclass Slope:	**b**	
2.7 Entrenchment Ratio:	**2.78**	Sand:	**8.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.14**	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:	**9**	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.):	**197.1**	**144.8**	Dominant:	**Deciduous**	**Herbaceous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**3.2**	**3.5**	Sub-dominant:	**Herbaceous**	**Deciduous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**790.4**	Canopy %:	**51-75**	**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**	**0-25**
Sub-Dominant	**0-25**	**51-100**
W less than 25	**132**	**348**
Buffer Vegitation Type		
Dominant	**Mixed Trees**	**Herbaceous**
Sub-Dominant	**Shrubs/Sapling**	**Mixed Trees**

3.3 Riparian Corridor

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

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

Stream: **Dishmill Brook** Reach: **M101-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:		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:	**1**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**1**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**869**
Side:	**3**	Braiding:	**0**	Steep Riffles:	**1**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	**16**	6.4 Sediment Deposition:	**15**	Stream Gradiant Type	Left	Right
6.2 Pool Substrate:	**16**	6.5 Channel Flow Status:	**17**	6.8 Bank Stability:	**9**	**9**
6.3 Pool Variability:	**15**	6.6 Channel Alteration:	**19**	6.9 Bank Vegetation Protection	**9**	**9**
Total Score:	**167**	6.7 Channel Sinuosity:	**19**	6.10 Riparian Veg. Zone Width:	**9**	**5**
Habitat Rating:	**0.83**					
Habitat Stream Condition:	**Good**					

Step 7. Rapid Geomorphic Assessment Data

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

Phase 2 Segment Summary Report **Dishmill Brook**

Stream: **Dishmill Brook**
Reach: **M102-A**
Segment Length(ft): **1,400**
Rain: **No**

SGAT Version: **4.56**
Organization: **Bear Creek Environmental**
Observers: **Pam DeAndrea, Staci Pomeroy**
Completion Date: **7/31/2013**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **Segment begins about 400 feet downstream of Kirby Road and continues upstream until bedrock grade controls are no longer prevalent.**

Step 5 - Notes: **Stable bedrock grade control segment. Multiple revetments refer to hard bank and riprap.**

Step 7 - Narrative: **Segment contains numerous bedrock grade controls and has cascade bedform downstream of Kirby Road crossing. Much of segment is a natural "F" channel, but upstream of Kirby Road there are some areas that are a "B" and the downstream part of the segment is a "C" channel. Segment is stable and has not incised due to bedrock.**

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:	0		0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	99		144	

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

1.5 Valley Features

Valley Width (ft): **114**
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	4.8	3.7	Yes	
Ledge	Mid-segment	0.0	0.0	Yes	
Ledge	Mid-segment	3.0	2.0	Yes	
Ledge	Mid-segment	2.9	1.9	Yes	
Ledge	Mid-segment	7.5	2.9	Yes	
Ledge	Mid-segment	3.4	2.4	Yes	
Ledge	Mid-segment	5.4	3.6	Yes	
Ledge	Mid-segment	20.0	25.0	Yes	
Ledge	Mid-segment	6.7	5.4	Yes	

Stream: **Dishmill Brook** Reach: **M102-A**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**37.00**	2.11 Riffle/Step Spacing:		2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	**3.20**	2.12 Substrate Composition		Bed:	**11** inches
2.3 Mean Depth (tf):	**2.18**	Bedrock:	**17.0 %**	Bar:	**7.7** inches
2.4 Floodprone Width (ft.):	**45.00**	Boulder:	**17.0 %**	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	**3.20**	Cobble:	**32.0 %**	Stream Type:	**F**
Human Elev FloodPln (ft.):		Coarse Gravel:	**11.0 %**	Bed Material:	**Cobble**
2.6 Width/Depth Ratio:	**16.97**	Fine Gravel:	**12.0 %**	Subclass Slope:	**None**
2.7 Entrenchment Ratio:	**1.22**	Sand:	**11.0 %**	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:	**24**	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.):	**49.6**	**39.1**	Dominant:	**Deciduous**	**Deciduous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**5.3**	**4.0**	Sub-dominant:	**Herbaceous**	**Herbaceous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Multiple**	**Multiple**	Bank Canopy		
Lower			Revetment Length:	**360.1**	**401.8**	Canopy %:	**51-75**	**51-75**
Material Type:	**Bedrock**	**Boulder/Cobble**				Mid-Channel Canopy:	**Open**	
Consistency:	**Cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**26-50**	**>100**
Sub-Dominant	**>100**	**26-50**
W less than 25	**349**	**151**
Buffer Vegitation Type		
Dominant	**Herbaceous**	**Mixed Trees**
Sub-Dominant	**Deciduous**	**Herbaceous**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Residential**	**Forest**	Mass Failures	**17.41981**	
Sub-dominant	**Forest**	**Residential**	Height	**8.0**	
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**One**	**8.0**	Gullies Length	**0**	
Gullies	**None**				

Stream: **Dishmill Brook** Reach: **M102-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps: **Minimal**
4.2 Adjacent Wetlands: **None**
4.3 Flow Status: **Low**
4.4 # of Debris Jams: **0**

4.5 Flow Regulation Type **None**
Flow Reg. Use:
Impoundments:
Impoundment Loc.:
4.6 Up/Down Strm flow reg.: **None**
(old) Upstrm Flow Reg.:

4.7 Stormwater Inputs
Field Ditch: **0** Road Ditch: **0**
Other: **0** Tile Drain: **0**
Overland Flow: **0** Urb Strm Wtr Pipe: **2**
4.9 # of Beaver Dams: **0**
Affected Length (ft): **0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	**24**	**Yes**	**Yes**	**Yes**	**No**	**None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types Diagonal: **0**
Mid: **0** Delta: **0**
Point: **0** Island: **0**
Side: **1** Braiding: **0**

5.2 Other Features Neck Cutoff: **0**
Flood chutes: **0** Avulsion: **0**
5.3 Steep Riffles and Head Cuts Head Cuts: **0**
Steep Riffles: **0** Trib Rejuv.: **No**

5.4 Stream Ford or Animal Crossing: **No**
5.5 Straightening: **None**
Straightening Length (ft.): **0**
5.5 Dredging: **None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl
6.2 Pool Substrate:
6.3 Pool Variability:
Total Score: **0**
Habitat Rating: **0.00**
Habitat Stream Condition

6.4 Sediment Deposition:
6.5 Channel Flow Status:
6.6 Channel Alteration:
6.7 Channel Sinuosity:

Stream Gradiant Type Left Right
6.8 Bank Stability:
6.9 Bank Vegetation Protection
6.10 Riparian Veg. Zone Width:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Confined** Score	STD	Historic
7.1 Channel Degradation	**17**	**None**	**No**
7.2 Channel Aggradation	**18**	**None**	**No**
7.3 Widening Channel	**15**	**None**	**No**
7.4 Change in Planforml	**15**	**None**	**No**
Total Score	**65**		

Geomorphic Rating **0.81**
Channel Evolution Model **F**
Channel Evolution Stage **I**
Geomorphic Condition **Good**
Stream Sensitivity **High**

Phase 2 Segment Summary Report **Dishmill Brook**

Stream:	**Dishmill Brook**	SGAT Version:	**4.56**
Reach:	**M102-B**	Organization:	**Bear Creek Environmental**
Segment Length(ft):	**2,066**	Observers:	**Pam DeAndrea & Staci Pomeroy**
Rain:	**No**	Completion Date:	**8/20/2013**
		Qualtiy Control Status - Consultant:	**Provisional**
		Qualtiy Control Status - Staff:	**Provisional**

Step 0 - Location: **Segment begins where bedrock grade controls end and continues upstream until about 275 feet upstream of second Mountain Road crossing.**

Step 5 - Notes: **Good floodplain access.**

Step 7 - Narrative: **A decrease in slope from upstream transport reach has resulted in aggradation in this segment as seen by large bars and mid-channel accumulation. Channel has good floodplain access, but has slightly widened most likely due to aggradation.**

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:	**492**	**0**	**0**	
Railroad:	**0**		**0**	
Imp. Path:	**0**		**0**	
Dev.:	**51**		**0**	

1.4 Adjacent Side

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

1.5 Valley Features

Valley Width (ft):	**145**
Width Determination:	**Measured**
Confinement Type:	**NW**
In Rock Gorge:	**No**

Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls: **None**

Stream: **Dishmill Brook**   Reach: **M102-B**

Step 2. Stream Channel

2.1Bankfull Width (ft.)	**44.40**	2.11 Riffle/Step Spacing:	**180 ft.**	2.13 Average Largest Particle on	
2.2 Max Depth (ft.)	**2.95**	2.12 Substrate Composition		Bed:	**13.6 inches**
2.3 Mean Depth (tf):	**1.86**	Bedrock:	**0.0 %**	Bar:	**4.8 inches**
2.4 Floodprone Width (ft.):	**146.00**	Boulder:	**20.0 %**	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	**3.35**	Cobble:	**40.0 %**	Stream Type:	**C**
Human Elev FloodPln (ft.):		Coarse Gravel:	**18.0 %**	Bed Material:	**Cobble**
2.6 Width/Depth Ratio:	**23.87**	Fine Gravel:	**11.0 %**	Subclass Slope:	**b**
2.7 Entrenchment Ratio:	**3.29**	Sand:	**11.0 %**	Bed Form:	**Riffle-Pool**
2.8 Incision Ratio:	**1.14**	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:	**72**	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.):	**194.2**	**328.9**	Dominant:	**Coniferous**	**Coniferous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**3.4**	**3.9**	Sub-dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Multiple**	**Multiple**	Bank Canopy		
Lower			Revetment Length:	**343.3**	**277.5**	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	**26-50**	**26-50**
W less than 25	**278**	**249**
Buffer Vegitation Type		
Dominant	**Mixed Trees**	**Mixed Trees**
Sub-Dominant	**Shrubs/Sapling**	**Shrubs/Sapling**

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	**3**	
Failures	**None**		Gullies Length	**23**	
Gullies	**Multiple**	**36.7**			

Stream: **Dishmill Brook**   Reach: **M102-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps: **Minimal**
4.2 Adjacent Wetlands: **Minimal**
4.3 Flow Status: **Low**
4.4 # of Debris Jams: **0**

4.5 Flow Regulation Type **None**
Flow Reg. Use:
Impoundments:
Impoundment Loc.:
4.6 Up/Down Strm flow reg.: **None**
(old) Upstrm Flow Reg.:

4.7 Stormwater Inputs
Field Ditch: **0** Road Ditch: **1**
Other: **0** Tile Drain: **0**
Overland Flow: **0** Urb Strm Wtr Pipe: **1**
4.9 # of Beaver Dams: **0**
Affected Length (ft): **0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	**24**	**Yes**	**Yes**	**Yes**	**Yes**	**None**
Bridge	**45**	**Yes**	**Yes**	**No**	**Yes**	**None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types
Mid: **3** Point: **2** Side: **6**
Diagonal: **1** Delta: **0** Island: **1** Braiding: **1**

5.2 Other Features
Flood chutes: **3**
Neck Cutoff: **0**
Avulsion: **1**
5.3 Steep Riffles and Head Cuts
Head Cuts: **0**
Steep Riffles: **5**
Trib Rejuv.: **No**

5.4 Stream Ford or Animal Crossing: **No**
5.5 Straightening: **Straightening**
Straightening Length (ft.): **504**
5.5 Dredging: **None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:
6.2 Pool Substrate:
6.3 Pool Variability:
Total Score: **0**
Habitat Rating: **0.00**
Habitat Stream Condition:

6.4 Sediment Deposition:
6.5 Channel Flow Status:
6.6 Channel Alteration:
6.7 Channel Sinuosity:

Stream Gradiant Type   Left   Right
6.8 Bank Stability:
6.9 Bank Vegetation Protection
6.10 Riparian Veg. Zone Width:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**16**	**None**	**No**
7.2 Channel Aggradation	**10**	**None**	**No**
7.3 Widening Channel	**12**	**None**	**No**
7.4 Change in Planforml	**14**	**None**	**No**
Total Score	**52**		

Geomorphic Rating	**0.65**
Channel Evolution Model	**D**
Channel Evolution Stage	**IIc**
Geomorphic Condition	**Good**
Stream Sensitivity	**Moderate**

Phase 2 Segment Summary Report Dishmill Brook

Stream:	Dishmill Brook	SGAT Version:	4.56
Reach:	M103-0	Organization:	Bear Creek Environmental
Segment Length(ft):	1,920	Observers:	Pam DeAndrea & Emilly Ebert
Rain:	Yes	Completion Date:	7/31/2013
		Qualtiy Control Status - Consultant:	Provisional
		Qualtiy Control Status - Staff:	Provisional

Step 0 - Location: **Reach begins approximately 325 feet upstream of third Mountain Road Crossing heading upstream. Reach continues for 1,920 feet until Mountain Road no longer encroaches upon the river corridor.**

Step 5 - Notes: **Section fluctuates between an F and B stream type as floodplain is not present throughout and entrenchment becomes < 1.4 by the road. Incision ratio at cross section is less than most of the reach. Additional incision captured just downstream of cross section similar to other areas and shows a higher incision ratio of 1.8.**

Step 7 - Narrative: **Extensive road encroachment and change in entrenchment has resulted in major degradation. Cross section was done in short section with some floodplain access to show variability in reach and representative encroachment. Overall incision was much greater (1.8) than cross section (1.3) and captured just downstream of cross section. The cross section with an IR of 1.3 helps capture the minor areas of floodplain connection, but the modified cross section with an incision ratio of 1.8 is the dominant condition for this segment.**

Planform change is major due to extensive straightening in reach. Not as aggradational as upstream and is acting more as a transport reach. In some areas, the stream type is an "F" and the downstream end is a "C" stream type, but "B" is dominant.

Fair scores for sediment load increase is due to slope drop upstream and sediment inputs into trib T1 which enters upstream reach M104.

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:	1,657	0	0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	0		0	

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

1.5 Valley Features

Valley Width (ft):	91
Width Determination:	Measured
Confinement Type:	SC
In Rock Gorge:	No
Human Caused Change in Valley Width?:	Yes

1.6 Grade Controls: **None**

Stream: **Dishmill Brook** Reach: **M103-0**

Step 2. Stream Channel

2.1Bankfull Width (ft.)	**36.40**	2.11 Riffle/Step Spacing:	**67 ft.**	2.13 Average Largest Particle on	
2.2 Max Depth (ft.)	**2.90**	2.12 Substrate Composition		Bed:	**11.3 inches**
2.3 Mean Depth (tf):	**1.93**	Bedrock:	**0.0 %**	Bar:	**5.5 inches**
2.4 Floodprone Width (ft.):	**51.50**	Boulder:	**20.0 %**	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	**5.10**	Cobble:	**38.0 %**	Stream Type:	**B**
Human Elev FloodPln (ft.):		Coarse Gravel:	**15.0 %**	Bed Material:	**Cobble**
2.6 Width/Depth Ratio:	**18.86**	Fine Gravel:	**14.0 %**	Subclass Slope:	**None**
2.7 Entrenchment Ratio:	**1.41**	Sand:	**13.0 %**	Bed Form:	**Step-Pool**
2.8 Incision Ratio:	**1.76**	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:	**19**	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.):	**48.1**	**55.7**
Erosion Height (ft.):	**3.8**	**2.5**
Revetment Type:	**Multiple**	**Multiple**
Revetment Length:	**488.7**	**448.7**

Near Bank Vegetation Type	Left	Right
Dominant:	**Coniferous**	**Coniferous**
Sub-dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Bank Canopy		
Canopy %:	**51-75**	**51-75**
Mid-Channel Canopy:	**Open**	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**26-50**	**>100**
Sub-Dominant	**>100**	**26-50**
W less than 25	**177**	**127**
Buffer Vegitation Type		
Dominant	**Mixed Trees**	**Mixed Trees**
Sub-Dominant	**Shrubs/Sapling**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Residential**	**Forest**
Sub-dominant	**Forest**	**Residential**
(Legacy)	Amount	Mean Hieght
Failures	**One**	**60.0**
Gullies	**None**	

	Left	Right
Mass Failures		**63.15601**
Height		**60.0**
Gullies Number	**0**	
Gullies Length		

Stream: **Dishmill Brook** Reach: **M103-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps: **Abundant**
4.2 Adjacent Wetlands: **Minimal**
4.3 Flow Status: **Low**
4.4 # of Debris Jams: **1**

4.5 Flow Regulation Type **None**
Flow Reg. Use:
Impoundments:
Impoundment Loc.:
4.6 Up/Down Strm flow reg.: **None**
(old) Upstrm Flow Reg.:

4.7 Stormwater Inputs
Field Ditch: **0** Road Ditch: **1**
Other: **0** Tile Drain: **0**
Overland Flow: **4** Urb Strm Wtr Pipe: **0**
4.9 # of Beaver Dams: **0**
Affected Length (ft): **0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	**19.5**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Deposition Below,Scour Below,Alignment**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types
Mid: **0** Point: **0** Side: **4**
Diagonal: **1** Delta: **0** Island: **0** Braiding: **0**

5.2 Other Features
Flood chutes: **0**
Neck Cutoff: **0**
Avulsion: **0**
5.3 Steep Riffles and Head Cuts
Steep Riffles: **1**
Head Cuts: **0**
Trib Rejuv.: **No**

5.4 Stream Ford or Animal Crossing: **No**
5.5 Straightening: **Straightening**
Straightening Length (ft.): **396**
5.5 Dredging: **None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:
6.2 Pool Substrate:
6.3 Pool Variability:
Total Score: **0**
Habitat Rating: **0.00**
Habitat Stream Condition:

6.4 Sediment Deposition:
6.5 Channel Flow Status:
6.6 Channel Alteration:
6.7 Channel Sinuosity:

Stream Gradiant Type Left Right
6.8 Bank Stability:
6.9 Bank Vegetation Protection
6.10 Riparian Veg. Zone Width:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Confined**	Score	STD	Historic
7.1 Channel Degradation	**8**	**None**	**Yes**
7.2 Channel Aggradation	**14**	**None**	**No**
7.3 Widening Channel	**14**	**None**	**No**
7.4 Change in Planforml	**9**	**None**	**No**
Total Score	**45**		

Geomorphic Rating	**0.56**
Channel Evolution Model	**F**
Channel Evolution Stage	**II**
Geomorphic Condition	**Fair**
Stream Sensitivity	**High**

Phase 2 Segment Summary Report Dishmill Brook

Stream:	**Dishmill Brook**	SGAT Version:	**4.56**
Reach:	**M104-0**	Organization:	**Bear Creek Environmental**
Segment Length(ft):	**3,182**	Observers:	**Pam DeAndrea, Emily Ebert**
Rain:	**Yes**	Completion Date:	**7/25/2013**
		Qualtiy Control Status - Consultant:	**Provisional**
		Qualtiy Control Status - Staff:	**Provisional**

Step 0 - Location: **Reach begins where Mountain Road no longer encroaches upon Dishmill Brook approximately 1,000 feet downstream of unnamed tributary T1 and continues for 3,182 feet upstream until approximately 445 feet upstream of Dashney Road crossing.**

Step 5 - Notes: **Reach fluctuates between B and C stream type. Two cross sections were done to represent both stream types. C is more dominant. Localized areas of lower banks. Abundant large woody debris in channel contributing to sediment storage and planform change in reach. Debris is most likely transported from upstream sources including a power line cut in reach M105.**

Step 7 - Narrative: **Minor incision. Process is mostly aggradational with many steep riffles and diagonal bars. Planform change is major due to stream adjusting to sediment load in reach and developing many flood chutes. Channel evolution stage is DIIc due to aggradation being the major process. Access to floodplain in reach is predominant although downstream end of reach has lost floodplain access with high banks on both sides. Confinement is variable in the reach where sometimes it is Narrow and sometimes Broad. Broad is dominant. High terraces in places causing greater localized confinement.BCE did 2 cross sections. One cross section shows a B stream type while the other is a C stream type. The dominant stream type is C.**

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:	0		0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	72		0	

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

1.5 Valley Features	
Valley Width (ft):	**180**
Width Determination:	**Measured**
Confinement Type:	**BD**
In Rock Gorge:	**No**
Human Caused Change in Valley Width?:	**No**

1.6 Grade Controls: **None**

Stream: Dishmill Brook   **Reach:** M104-0

Step 2. Stream Channel

2.1Bankfull Width (ft.)	**39.00**	2.11 Riffle/Step Spacing:	**83 ft.**	2.13 Average Largest Particle on	
2.2 Max Depth (ft.)	**2.50**	2.12 Substrate Composition		Bed:	**12.4 inches**
2.3 Mean Depth (tf):	**1.72**	Bedrock:	**0.0 %**	Bar:	**4.4 inches**
2.4 Floodprone Width (ft.):	**184.00**	Boulder:	**5.0 %**	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	**3.30**	Cobble:	**38.0 %**	Stream Type:	**C**
Human Elev FloodPln (ft.):		Coarse Gravel:	**34.0 %**	Bed Material:	**Gravel**
2.6 Width/Depth Ratio:	**22.67**	Fine Gravel:	**10.0 %**	Subclass Slope:	**b**
2.7 Entrenchment Ratio:	**4.72**	Sand:	**13.0 %**	Bed Form:	**Riffle-Pool**
2.8 Incision Ratio:	**1.32**	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:	**102**	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.):	**114.6**	**146.8**	Dominant:	**Deciduous**	**Deciduous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**3.0**	**2.9**	Sub-dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Multiple**	**Hard Bank**	Bank Canopy		
Lower			Revetment Length:	**120.5**	**69.2**	Canopy %:	**76-100**	**76-100**
Material Type:	**Mix**	**Mix**				Mid-Channel Canopy:	**Closed**	
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	**47**	**86**
Buffer Vegitation Type		
Dominant	**Mixed Trees**	**Mixed Trees**
Sub-Dominant	**Shrubs/Sapling**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Forest**	Mass Failures	**40.589 84**	
Sub-dominant	**Residential**	**Residential**	Height	**8.6**	
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**Multiple**	**8.5**	Gullies Length	**0**	
Gullies	**None**				

Stream: **Dishmill Brook** Reach: **M104-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps: **Abundant**
4.2 Adjacent Wetlands: **Abundant**
4.3 Flow Status: **Low**
4.4 # of Debris Jams: **3**

4.5 Flow Regulation Type **None**
Flow Reg. Use:
Impoundments:
Impoundment Loc.:
4.6 Up/Down Strm flow reg.: **None**
(old) Upstrm Flow Reg.:

4.7 Stormwater Inputs
Field Ditch: **0** Road Ditch: **0**
Other: **0** Tile Drain: **0**
Overland Flow: **1** Urb Strm Wtr Pipe: **0**
4.9 # of Beaver Dams: **0**
Affected Length (ft): **0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	**17.5**	**Yes**	**Yes**	**Yes**	**Yes**	**Scour Below,Alignment**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types Diagonal: **6**
Mid: **7** Delta: **1**
Point: **3** Island: **1**
Side: **5** Braiding: **2**

5.2 Other Features
Flood chutes: **5**
5.3 Steep Riffles and Head Cuts
Steep Riffles: **14**

Neck Cutoff: **0**
Avulsion: **0**
Head Cuts: **0**
Trib Rejuv.: **No**

5.4 Stream Ford or Animal Crossing: **No**
5.5 Straightening: **None**
Straightening Length (ft.): **0**
5.5 Dredging: **None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl
6.2 Pool Substrate:
6.3 Pool Variability:
Total Score: **0**
Habitat Rating: **0.00**
Habitat Stream Condition

6.4 Sediment Deposition:
6.5 Channel Flow Status:
6.6 Channel Alteration:
6.7 Channel Sinuosity:

Stream Gradiant Type Left Right
6.8 Bank Stability:
6.9 Bank Vegetation Protection
6.10 Riparian Veg. Zone Width:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**13**	**None**	**Yes**
7.2 Channel Aggradation	**8**	**None**	**No**
7.3 Widening Channel	**11**	**None**	**No**
7.4 Change in Planforml	**8**	**None**	**No**
Total Score	**40**		

Geomorphic Rating	**0.50**
Channel Evolution Model	**D**
Channel Evolution Stage	**IIc**
Geomorphic Condition	**Fair**
Stream Sensitivity	**Very High**

Phase 2 Segment Summary Report Dishmill Brook

Stream:	Trib 1 to Dishmill Brook	SGAT Version:	4.56
Reach:	T1.01-0	Organization:	Bear Creek Environmental
Segment Length(ft):	940	Observers:	Mary Nealon, Emily Ebert, Pam DeAndrea
Rain:	Yes	Completion Date:	7/14/2013
		Qualtiy Control Status - Consultant:	Provisional
		Qualtiy Control Status - Staff:	Provisional

Step 0 - Location: **Segment begins at confluence with Dishmill Brook and continues until confluence with Tributary**

Step 5 - Notes: **Reach needs better stormwater control to prevent sediment input.**

Step 7 - Narrative: **Channel is not incised and has good FP access. Aggradation is a major process with deposition at several locations where valley walls open up or there are LWD jams. For the most part W/D ratio is low with the exception of some localized deposited areas.
Debris jams in channel have caused planform adjustments. Quite a bit of fine sediment.
Fair amount of sand in channel margins. Some Stormwater Input form Mt. Road.**

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:	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	Sometimes
Texture:	Sand	Sand

1.5 Valley Features	
Valley Width (ft):	73
Width Determination:	Measured
Confinement Type:	NW
In Rock Gorge:	No
Human Caused Change in Valley Width?:	No

1.6 Grade Controls: **None**

Stream: **Trib 1 to Dishmill Brook** Reach: **T1.01-0**

Step 2. Stream Channel

2.1Bankfull Width (ft.)	**17.30**	2.11 Riffle/Step Spacing:	**69 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.)	**2.45**	2.12 Substrate Composition		Bed:	**11.2**	**inches**
2.3 Mean Depth (tf):	**1.40**	Bedrock:	**0.0 %**	Bar:	**3.1**	**inches**
2.4 Floodprone Width (ft.):	**47.30**	Boulder:	**20.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**2.65**	Cobble:	**30.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**25.0 %**	Bed Material:	**Gravel**	
2.6 Width/Depth Ratio:	**12.36**	Fine Gravel:	**12.0 %**	Subclass Slope:	**a**	
2.7 Entrenchment Ratio:	**2.73**	Sand:	**13.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.08**	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:	**60**	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.):	**65.7**	**116.0**	Dominant:	**Coniferous**	**Deciduous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**1.0**	**1.9**	Sub-dominant:	**Deciduous**	**Coniferous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Multiple**	**Multiple**	Bank Canopy		
Lower			Revetment Length:	**63.7**	**90.9**	Canopy %:	**76-100**	**76-100**
Material Type:	**Mix**	**Mix**				Mid-Channel Canopy:	**Closed**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**51-100**	**51-100**
Sub-Dominant	**26-50**	**>100**
W less than 25	**0**	**0**
Buffer Vegitation Type		
Dominant	**Coniferous**	**Deciduous**
Sub-Dominant	**Deciduous**	**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		

Stream: **Trib 1 to Dishmill Brook** Reach: **T1.01-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps: **Minimal**

4.2 Adjacent Wetlands: **Minimal**

4.3 Flow Status: **Moderate**

4.4 # of Debris Jams: **5**

4.5 Flow Regulation Type **None**

Flow Reg. Use:

Impoundments:

Impoundment Loc.:

4.6 Up/Down Strm flow reg.: **None**

(old) Upstrm Flow Reg.:

4.7 Stormwater Inputs

Field Ditch: **0** Road Ditch: **0**

Other: **0** Tile Drain: **0**

Overland Flow: **4** Urb Strm Wtr Pipe: **0**

4.9 # of Beaver Dams: **0**

Affected Length (ft): **0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Instream Culvert	**6**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Scour Below**
Bridge	**5.5**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Deposition Below,Scour Below,Alignment**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types Diagonal: **3**

Mid: **3** Delta: **2**

Point: **0** Island: **1**

Side: **14** Braiding: **0**

5.2 Other Features

Flood chutes: **1**

5.3 Steep Riffles and Head Cuts

Steep Riffles: **2**

Neck Cutoff: **0**

Avulsion: **0**

Head Cuts: **0**

Trib Rejuv.: **No**

5.4 Stream Ford or Animal Crossing: **No**

5.5 Straightening: **Straightening**

Straightening Length (ft.): **236**

5.5 Dredging: **None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:

6.2 Pool Substrate:

6.3 Pool Variability:

Total Score: **0**

Habitat Rating: **0.00**

Habitat Stream Condition:

6.4 Sediment Deposition:

6.5 Channel Flow Status:

6.6 Channel Alteration:

6.7 Channel Sinuosity:

Stream Gradiant Type | Left | Right

6.8 Bank Stability:

6.9 Bank Vegetation Protection

6.10 Riparian Veg. Zone Width:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**	Score	STD	Historic
7.1 Channel Degradation	**15**	**None**	**No**
7.2 Channel Aggradation	**10**	**None**	**No**
7.3 Widening Channel	**14**	**None**	**No**
7.4 Change in Planforml	**10**	**None**	**No**
Total Score	**49**		

Geomorphic Rating	**0.61**
Channel Evolution Model	**F**
Channel Evolution Stage	**I**
Geomorphic Condition	**Fair**
Stream Sensitivity	**Very High**

Phase 2 Segment Summary Report Dishmill Brook

Stream: **Dishmill Brook**
Reach: **M105-A**
Segment Length(ft): **2,865**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Bear Creek Environmental**
Observers: **Pam DeAndrea, Emily Ebert**
Completion Date: **7/25/2013**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **Segment begins approximately 460 feet upstream of the Dashney Road crossing and continues for 2,865 feet until the trail crossing for the Kingdom Trails where stream channel becomes narrower and processes are less aggradational.**

Step 5 - Notes: **Depositional segment. Many depositional features and much wider, especially in upstream end where large bars and debris have caused channel to widen and planform change. At segment break there is a steep power line crossing which may have been the source of the abundant debris in the channel just downstream of it. Some tree cutting as well along the left side for a trail.**

Step 7 - Narrative: **Change in slope and debris in channel in this segment has led to major aggradation as seen through large bars and steep riffles as well as many flood chutes. Abundant debris in upstream end of segment causing numerous debris jams which are holding back sediment and causing planform change. Degradation is minor and channel is widened mostly where major aggradation has occurred. Localized areas that are more confined due to high terraces. Cross section done in area with less aggradation and a lower width to depth ratio.**

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:	776	0	0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	0		0	

1.6 Grade Controls: **None**

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

1.5 Valley Features

Valley Width (ft): **186**
Width Determination: **Measured**
Confinement Type: **BD**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **No**

Stream: **Dishmill Brook** Reach: **M105-A**

Step 2. Stream Channel

2.1Bankfull Width (ft.)	**33.80**	2.11 Riffle/Step Spacing:	**108.9 ft.**	2.13 Average Largest Particle on	
2.2 Max Depth (ft.)	**2.80**	2.12 Substrate Composition		Bed:	**8.6 inches**
2.3 Mean Depth (tf):	**1.93**	Bedrock:	**0.0 %**	Bar:	**4.9 inches**
2.4 Floodprone Width (ft.):	**114.50**	Boulder:	**14.0 %**	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	**3.30**	Cobble:	**32.0 %**	Stream Type:	**C**
Human Elev FloodPln (ft.):		Coarse Gravel:	**22.0 %**	Bed Material:	**Gravel**
2.6 Width/Depth Ratio:	**17.51**	Fine Gravel:	**21.0 %**	Subclass Slope:	**None**
2.7 Entrenchment Ratio:	**3.39**	Sand:	**11.0 %**	Bed Form:	**Riffle-Pool**
2.8 Incision Ratio:	**1.18**	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:	**Moderate**	Detritus:	**0.0 %**	Reference Stream Type:	**C**
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**102**	Reference Bed Material:	**Gravel**
				Reference Subclass Slope:	**None**
				Reference Bedform:	**Riffle-Pool**

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.):	**140.0**	**176.2**	Dominant:	**Deciduous**	**Deciduous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**3.0**	**4.1**	Sub-dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**None**	Bank Canopy		
Lower			Revetment Length:	**4.6**	**0.0**	Canopy %:	**76-100**	**76-100**
Material Type:	**Mix**	**Mix**				Mid-Channel Canopy:	**Closed**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**None**	**51-100**
W less than 25	**15**	**0**
Buffer Vegitation Type		
Dominant	**Mixed Trees**	**Mixed Trees**
Sub-Dominant	**Shrubs/Sapling**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Forest**	Mass Failures	**31.98973**	**65.44691**
Sub-dominant	**None**	**Residential**	Height	**15.0**	**22.3**
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**Multiple**	**21.0**	Gullies Length	**0**	
Gullies	**None**				

Stream: **Dishmill Brook** Reach: **M105-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:	**Low**	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	**4**	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:	**7**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:	**No**
Mid:	**5**	Delta:	**0**	Flood chutes:	**9**	Avulsion:	**0**	5.5 Straightening:	**None**
Point:	**4**	Island:	**2**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**0**
Side:	**12**	Braiding:	**2**	Steep Riffles:	**11**	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	**7**	**None**	**No**	Channel Evolution Model	**D**
7.3 Widening Channel	**12**	**None**	**No**	Channel Evolution Stage	**IIc**
7.4 Change in Planforml	**9**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score	**46**			Stream Sensitivity	**Very High**

Phase 2 Segment Summary Report   Dishmill Brook

Stream:	Dishmill Brook	SGAT Version:	4.56
Reach:	M105-B	Organization:	Bear Creek Environmental
Segment Length(ft):	3,180	Observers:	Pam DeAndrea, Emily Ebert
Rain:	Yes	Completion Date:	7/17/2013
		Qualtiy Control Status - Consultant:	Provisional
		Qualtiy Control Status - Staff:	Provisional

Step 0 - Location: **Segment begins at the bridge at the Kingdom Trails crossing and continues through well forested land for 3,180 feet.**

Step 5 - Notes: **Nice mossy banks, good habitat and good floodplain access. Localized areas of higher terraces with greater confinement.**

Step 7 - Narrative: **Nice reference segment but there are some larger side bars. Minor aggradation. Channel has good floodplain access and is mostly a "C" stream type. Some areas it may be a "B" stream type. Predominantly a step-pool system, but some areas of riffle-pool where slope decreases. Minor planform change due to channel avulsion in segment where LWD blocked left side of channel and channel changed its route to the right side of channel. Old channel is now a large flood chute. Actual width is a bit wider than reference width in curve data.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Planform and Scope**

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	Very Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	Silt/Clay	Silt/Clay

1.5 Valley Features	
Valley Width (ft):	136
Width Determination:	Measured
Confinement Type:	NW
In Rock Gorge:	No
Human Caused Change in Valley Width?:	No

1.6 Grade Controls: **None**

Stream: **Dishmill Brook** Reach: **M105-B**

Step 2. Stream Channel

2.1Bankfull Width (ft.)	**31.20**	2.11 Riffle/Step Spacing:	**76 ft.**	2.13 Average Largest Particle on	
2.2 Max Depth (ft.)	**3.00**	2.12 Substrate Composition		Bed:	**9.6 inches**
2.3 Mean Depth (tf):	**1.84**	Bedrock:	**0.0 %**	Bar:	**5.2 inches**
2.4 Floodprone Width (ft.):	**79.70**	Boulder:	**16.0 %**	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	**3.00**	Cobble:	**41.0 %**	Stream Type:	**C**
Human Elev FloodPln (ft.):		Coarse Gravel:	**20.0 %**	Bed Material:	**Cobble**
2.6 Width/Depth Ratio:	**16.96**	Fine Gravel	**10.0 %**	Subclass Slope:	**b**
2.7 Entrenchment Ratio:	**2.55**	Sand:	**11.0 %**	Bed Form:	**Step-Pool**
2.8 Incision Ratio:	**1.00**	Silt and Smaller:	**2.0 %**	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:	**Complete**	# Large Woody Debris	**63**	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.):	**47.3**	**365.8**	Dominant:	**Deciduous**	**Deciduous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**16.4**	**4.4**	Sub-dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**26.4**	**8.9**	Canopy %:	**76-100**	**76-100**
Material Type:	**Mix**	**Mix**				Mid-Channel Canopy:	**Closed**	
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	**60**	**0**
Buffer Vegitation Type		
Dominant	**Mixed Trees**	**Mixed Trees**
Sub-Dominant	**Herbaceous**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Forest**	Mass Failures	**47.107 36**	**47.681 35**
Sub-dominant	**Pasture**	**None**	Height	**16.5**	**28.9**
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**Multiple**	**19.5**	Gullies Length		
Gullies	**None**				

Stream: **Dishmill Brook** Reach: **M105-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps: **Abundant**
4.2 Adjacent Wetlands: **Abundant**
4.3 Flow Status: **Low**
4.4 # of Debris Jams: **1**

4.5 Flow Regulation Type **Small Bypass**
Flow Reg. Use: **Recreation**
Impoundments:
Impoundment Loc.:
4.6 Up/Down Strm flow reg.: **None**
(old) Upstrm Flow Reg.:

4.7 Stormwater Inputs **None**
Field Ditch: Road Ditch:
Other: Tile Drain:
Overland Flow: Urb Strm Wtr Pipe:
4.9 # of Beaver Dams: **0**
Affected Length (ft): **0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	**29**	**Yes**	**Yes**	**No**	**No**	**None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types Diagonal: **5** Mid: **5** Delta: **0** Point: **2** Island: **1** Side: **38** Braiding: **0**

5.2 Other Features Neck Cutoff: **0** Flood chutes: **9** Avulsion: **1**
5.3 Steep Riffles and Head Cuts Head Cuts: **0** Steep Riffles: **3** Trib Rejuv.: **No**

5.4 Stream Ford or Animal Crossing: **No**
5.5 Straightening: **None**
Straightening Length (ft.): **0**
5.5 Dredging: **None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl
6.2 Pool Substrate:
6.3 Pool Variability:
Total Score: **0**
Habitat Rating: **0.00**
Habitat Stream Condition

6.4 Sediment Deposition:
6.5 Channel Flow Status:
6.6 Channel Alteration:
6.7 Channel Sinuosity:

Stream Gradiant Type Left Right
6.8 Bank Stability:
6.9 Bank Vegetation Protection
6.10 Riparian Veg. Zone Width:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**18**	**None**	**No**
7.2 Channel Aggradation	**12**	**None**	**No**
7.3 Widening Channel	**17**	**None**	**No**
7.4 Change in Planforml	**11**	**None**	**No**
Total Score	**58**		

Geomorphic Rating **0.73**
Channel Evolution Model **F**
Channel Evolution Stage **I**
Geomorphic Condition **Good**
Stream Sensitivity **Moderate**

October 11, 2013

QA Notes For: **West Branch Passumpsic and Dishmill Brook**

Ph2 Assessment by Bear Creek Environmental

Data checked by Staci Pomeroy

QA response prepared by Pam DeAndrea of Bear Creek Environmental

Date: 10/22/13 Review by Staci – 10/29/13

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 or segment. 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 information noted, the consultant should update this document (preferably in a second color) with what steps, if any, were taken to address the comments/questions.

General Comments:

- The notes and narratives for all reaches were well done and provide additional data to help with interpretation of the data and understanding of why certain segments/reaches were done the way they were. It is greatly appreciated that this level of effort was taken to help provide this data.
- For all reaches that have segments, please provide a comment in Phase 1 step 7.4 to indicate that the reach has been segmented and brief information about the segment. This will help folks using Phase 1 data know the reach has multiple parts and/or has sub-reaches (please note if sub-reach) of a different natural stream type. Example – M101A – 870’,C4-riff/pool ; M101B- 1,030’, Cb-4-riff/pool.
    - **Reaches** : **Dishmill - M101,M102,M105 ; West Branch –T3.12; T3.S301**

Entered in comments in Phase 1 step 7.4 regarding segmentation of reaches. – Thank you

- Phase 2 - Step 3.1 – revetment type. When it is noted as “multiple”. Please note the type in the comments filed if other than rip-rap. This will help understand what type of bank stabilization methods are in play along the reach.
    - **Reaches: Dishmill – M102A, M102B, M103, M104;T1.01; West Branch – T3.12A; T3.S301A; T3.S301C**

Multiple revetments simply refers to hard bank and riprap present in the segment, which was often the case if there was a bridge crossing in the segment. Comments were added in DMS to reflect that multiple refers to hard bank and rip rap. If this is important to know in the future, perhaps the DMS should indicate the different types of revetments when the FIT is uploaded. - ok

Dishmill Reach Comments:

M101-A

- Step 4.8 – no bridge width entered for the second bridge. A width had been done in an early assessment, please confirm with Kerry the width and update.
- Step 7.1 – Noted as a “STD from C to B” The is no current STD. See the note indicates it is possible, but at this stage not there yet.
  Thanks for catching this Staci! The cross sectional area in the field came out much lower than what was observed in all the reaches upstream. The bankfull height was increased by 0.5 feet in the cross section

worksheet to be closer to the other cross sectional areas. When the bankfull height was increased, this changed the entrenchment to 1.8 and therefore a "B" channel and not a "C". There is therefore a STD from a "C" to a "B". I neglected to update this in the DMS in steps 2 and 5. Updated step 2 and comments in step 5. - ok

- Row 2 – noted in poor , the incision ratio at this point is not >2 and entrenchment is >2, so would be in "fair" between 1.4 and 2 with entrenchment >2.

Incision ratio for the human elevated floodplain (berm) is 2.0, therefore the RGA should be scored in poor according to the protocol (see page 28). When the RAF is on the other side of the berm, the protocol indicates to use the IRHef for the RGA. Entrenchment is actually less than 2.0 (1.8), there was a data entry error in Step 2. - ok

- Row 6 – in poor - "major existing flow alteration, greater flows and/or reduction in sediment load". - - What are you considering the major existing flow/greater flows or reduction of sediment. There are minimum stormwater inputs, no flow modifiers; or indication that sediment is being reduced, so it is not clear as to what the modifier is; please help provide additional comments to support this as "poor".

  I chose poor under this because Kerry had mentioned to us that the Dam on the East Branch causes significant backwater into this segment. Stormwater input was present of course, but I did not select poor alone for that reason. Sediment was not reduced, just more water and sediment from the East Branch. If you don't think I should select that since it does not relate to the degradation, let me know. I can add to the comments to reflect why poor was selected for this parameter if you like. Adding a comment will clarify the potential influence from the East Branch reach on this segment and how it is contributing to the impacts noted. It is not easily picked out in the data, so having it in the comments will help folks see why the score was in poor.

  - This gets a little confusing with the Aggradation choices (see next comment), so that is why I'm looking to clarify this a bit more.

- Step 7.2
  - Row 5 – in poor "major existing alterations, extreme reduction in flow and/or increase in sediment load." - See note above for Degradation. Help explain what the major existing flow reduction is and/or increase in sediment load. As both the degradation and aggradation categories indication "existing" situations, they seem to contradict each other, so clarification is needed.

    Again I chose poor here because of backwater into M101-A from the dam on the East Branch. Let me know if we should change this. Same as above, the comment to help capture the influence of the dam on the segment will help clarify what why this was captured in poor.

M101B-

- Step 7.1 – Row 4 – in fair "significant human caused change in confinement. Enough to change valley type". There has been minimum valley width change (394 in P1, 388' in P2) and no change in valley type (VB – P1, VB-P2). Looks like this could be in "good", please review and update as needed.
  This was a data entry error. It has been changed to "good". There was a minor change in valley width and no change in valley type. -ok

M102

- Phase 1 – step 6.3 channel bars – is noted as "not evaluated". Please update based on Phase 2 info and update the impact score.
  This step in Phase 1 was previously not updating correctly in the DMS. Now phase 1 is updated to show depositional features observed during Phase 2. -ok

M102A:

- Step 1.1 – segmentation – Please change this to "sub-reach". While grade controls were certainly the contributor, the "sub-reach" category will help flag that is a natural change in the stream type.

The sub-reach stream type is listed as "F" in step 2. The reason we segmented was because of the numerous grade controls and different stream type. Changed segmentation reason to sub-reach and put grade controls in the comment. – thank you

M102B:

- No comments

M103:

Phase 1 – step 6.3 channel bars – is noted as "not evaluated". Please update based on Phase 2 info and update the impact score.
This step in Phase 1 was previously not updating correctly in the DMS. Now phase 1 is updated to show depositional features observed during Phase 2. - ok

- Step 2.10 – With the level of incision were you surprised to see "complete" riffles?
  It is a step-pool system and determining whether the riffles are eroded or not was difficult. They did appear complete in the field. No head cuts were present. - ok
- Step 7 narrative – The incision ratio of 1.8 is indicated in the cross-section data in step 2, and in the cross-section worksheet. The note of the incision ratio of 1.3 in the cross-section is a little confusing. To help show both conditions, please update the cross-section worksheet to have an un-modified cross-section, where your incision is the 1.3 indicated. Add a note that this is the cross-section that helps capture the minor areas of floodplain connection; but that the other incision ratio/ modified cross-section is the one used to represent dominant condition. The note you currently have in the worksheet for that cross-section is fine.
  Updated cross section worksheet to show both conditions; one with an IR of 1.3 and one with an IR of 1.8. Added the following comment in Step 7: "This cross section helps capture the minor areas of floodplain connection, but the other incision ratio of 1.8 is the dominant condition for this segment." - ok

M104:

- Phase 1 – step 6.3 channel bars – is noted as "not evaluated". Please update based on Phase 2 info and update the impact score.
  This step in Phase 1 was previously not updating correctly in the DMS. Now phase 1 is updated to show depositional features observed during Phase 2. - ok
- Step 2 – LWD – Wow 102 pieces! Does the wood seem to be playing a large role in the storage of sediment and/or planform change? Does it seem like it is coming from upstream and/or in the reach? See the same , 102, number of LWD in M105A. Seems like this is a good source of material in the system, but not much making its way to downstream reaches. Thoughts?
  There is a power line cut at the upstream end of M105A where some of the trees may have come from. Just downstream of the power line cut, there are abundant trees in the stream holding back sediment and creating planform change. For the kingdom trails some trees have also been cut down that may be contributing to the debris in the channel. We didn't see much of this material in M105-B so it may just be from the power line and trail cutting. However, there is so much debris that it may have been transported from sources upstream of M105. Added a comment in Step 5. - ok

M105

- Phase 1 – step 6.3 channel bars – is noted as "not evaluated". Please update based on Phase 2 info and update the impact score.
  This step in Phase 1 was previously not updating correctly in the DMS. Now phase 1 is updated to show depositional features observed during Phase 2. - ok

M105A:

- Step 1.1 – segmentation – Please change this to "sub-reach". While depositional features were certainly the contributor, the "sub-reach" category will help flag that is a natural change in the stream type.

The only difference in the stream type is the substrate. I really segmented because the process was so different with all the aggradation. Would you not have captured it as a different reference stream type without the aggradation? I did change it to subreach in the DMS, but it seems that the depositional features indicate why I segmented more than the subreach category. Do we select sub-reach no matter what when indicating reasons for segmentation? If it is a different reference stream type, then it should always be segmented, regardless of the adjustment process happening compared to the other segments; thus becoming a "sub-reach". If the deposition was causing it to be in a different adjustment process then the overall reach, but the reference stream type was the same, then I'd capture that as the reason for the segmentation. Flagging it as a sub-reach we can more easily see where we may have potentially different management strategies/needs given the reference stream type is different than the overall reach. It is more difficult to pick that out by sorting through the Step 2 data or notes.

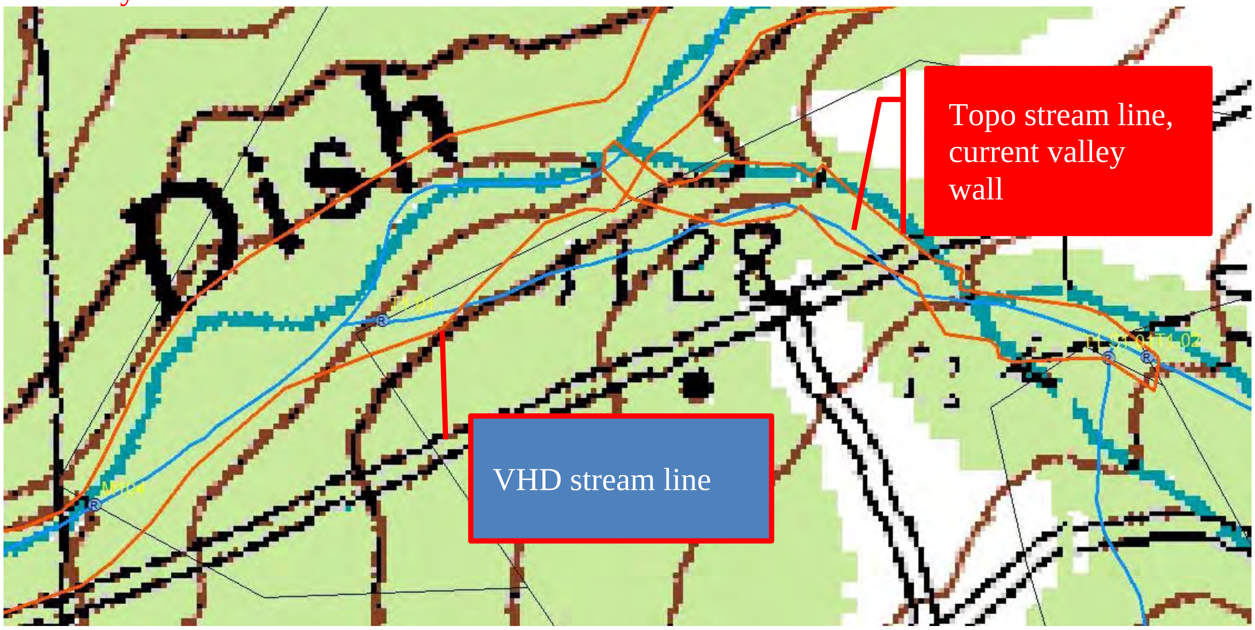
- Step 2.14 – subclass slope noted as "b". In the step 7 narrative, it notes "change in slope in the segment has led to ……" Both segments have a "b" slope indicated. What change in slope do you feel is contributing to the aggradation? Do you think this is still a "b" slope in this segment, or does it have a lower slope than upstream segment causing the sediment deposition?
  I think the change in slope is a factor in the deposition in addition to the debris storing sediment here. If you look at the contours, you can see the slight change in slope. I did not take an instream slope measurement in segment A, but most of the segment from the contours has a slope of about 2%. The slope for M105-B using the contours is about 3% so there is a change in slope. I changed the slope designation for M105-A from "b" to none. - ok
- Step 5 notes - noted that the power line may have been a source of the abundant debris just downstream of it. Is there evidence of recent clearing, or that there was erosion of the power line area that would send debris into the stream? Looking to see if there are issues at the power line and/or possible issues with how the lines are cleared that would send abundant debris into the stream. Something we'd want to work with the power company on if this is a source of debris.
  The area of the power line is very steep. Not sure when the cut was done and I did not see evidence of recent clearing or significant erosion, but the debris jams started right after the cut so it is suspect. – ok. Perhaps that is something CCNRCD can look at to determine potential clearing dates to get an idea of how this area may influence debris in the stream.
- Step 7 narrative – notes cross-section in area with less aggradation lower width/depth. Do you think the other areas of major aggradation would bump the channel into a different stream type or just show how much widening is happening?
  No I think it would still be a "C" throughout most of the reach, but it would be wider. Unfortunately, due to time, I did not get another cross section in. - ok
- Step 7.1 – degradation – score of 13 seems low, as has 5 of the categories in reference and 1 in good. Thoughts as to what score of 13 helps indicate? (*this is also looking at that T1.01had a score of 18 with 3 reference and 3 good; just trying to get a feel for how scores are assigned)
  Good catch. I had adjusted bankfull in the cross section worksheet which resulted in no incision, but neglected to change the degradation score. Thanks. The DMS has been updated with a score of 18. - ok

M105B:

- Step 1.1 – segmentation reason – noted as planform and slope. As noted above, checking on the slope in the segments to see if that is different between segments and part of the reason why we may see the differences in the segments.
  Not sure what your comment is here. Change in slope using topos is from 3 to 2 percent. Upstream is also more step-pool while the other is mostly riffle-pool. - ok
- Step 7.2 (Row 2) Step 7.3 (Row 4). Both in Good "single to multiple mid- channel side bars….". Seems like this could be in "fair" as there are multiple bars and flood chutes. Thoughts?
  M105-A was much more aggradational than this segment despite the number of bars. The good category is appropriate for this segment when compared to the upstream one. There were mostly larger side bars as shown in this photo and a few small mid-channel bars, but I think it was more natural for this segment. - ok

T1.01 –

- Discussion note – question on the Phase 2 valley wall. It does note line up with the current VHD stream line; it looks like it lines up with the topo stream line, which enters further upstream. Is the stream located as the VHD has it or as the topo has it?
  The VHD is off. I can provide you with the GPS points we took in the field for line and point impacts and valley walls to show where the stream should be.

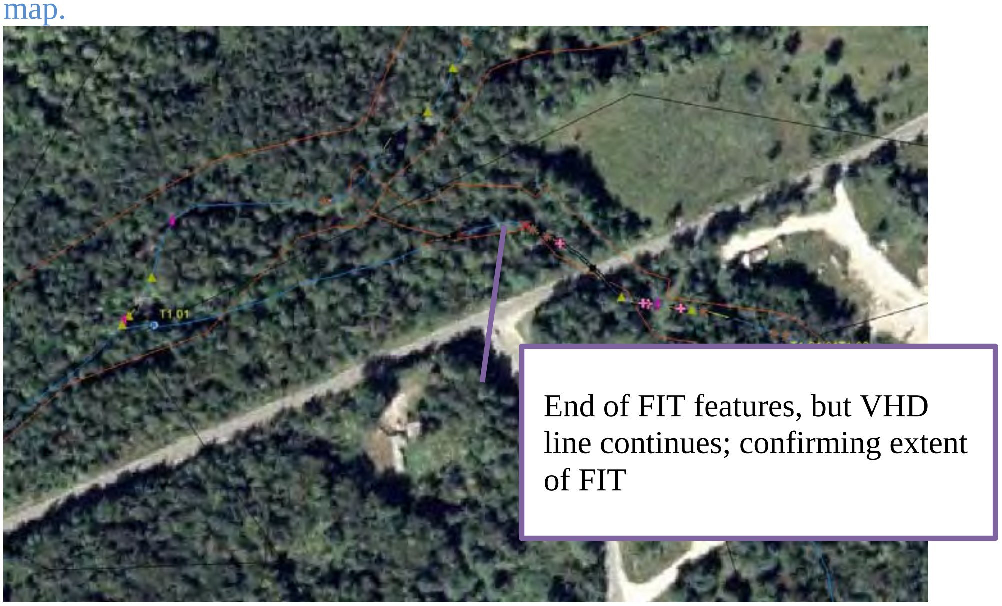


This could represent a difference in stream and valley length –changes in slope as well. As we are tied to the VHD at the moment and SGAT has been run with this configuration; this will need to be documented in the Phase 1 notes if the VHD stream line is not correct. Corrections in stream and valley length may be able to manually corrected in the DMS or updated in the notes for correct length/slopes.

There is a change in stream length as a result. The stream length should be about 940 feet and the valley length about 920 feet. I added a note in the phase 1 data and I updated the stream and valley lengths in the Phase 1 and 2 DMS. – ok, thank you

How is the FIT features in relation to the VHD; are the FIT at the end of the reach or is there additional stream length that didn't have anything going on so that is reason for no FIT in lower ~635'. Trying to make

sure if FIT location indicates end of reach and/or information not in correct location spatially due to VHD off we can track it.
I used the current line to index the impacts so it would generate the lengths, but luckily I did not have any impacts in the downstream end. Again I can send you our points from the field so you can see where the impacts ended. – ok, just good to know that current features are in correct location and ended as noted on the map.



- Phase 1 – step 6.3 channel bars – is noted as "not evaluated". Please update based on Phase 2 info and update the impact score.
  This step in Phase 1 was previously not updating correctly in the DMS. Now phase 1 is updated to show depositional features observed during Phase 2. - ok
- Step 2.10 – riffle type. Were you surprised to see the riffles were complete with the level of sediment noted? Does it seem to be transported well through the reach such that the riffles are not being impacted?
  There were some diagonal bars present in the riffles. Changed to sedimented and updated the RGA. - ok
- Step 2.14 stream type – I was surprised to see a "Ca – riffle pool" stream type. I went back to check slope and seems okay, but as this is not typical wanted to confirm that the entire reach has this type of slope, or if there is a change of slope downstream of the road crossing, or in a valley type change. Does the slope seem correct in the field, given what can be estimated from the topo?
  I estimated the slope as 7% from the topo, which is an "a" slope. The slope was variable through the reach with steep sections and some not as steep. It is true that a Ca is rare, but despite the steep slope, the channel still had floodplain access and was a "C" overall. A comment was added to the DMS. – ok, just trying to make sure we help capture notes about those outliers, as it will likely get flagged if someone just sorting through data. Thanks for adding notes.
    - It is not in the usual categories of stream type, so please provide a comment in Phase1/Phase 2 how this reach is naturally a "Ca". This will help reduce it getting flagged as an error and help highlight where we may have stream types that are not typical.
- Step 4.8 – Bridge is noted as channel constriction. Width is 26 ft. Channel width is 17. What other indicators are there a that the bridge is a channel constrictor with a width wider than bankfull?
  Below is a photo of the bridge crossing. The channel is wider both upstream and downstream of the crossing and this is a major channel constriction. The road width was inadvertently entered as the structure width and vice-versa. This has been corrected in the DMS. – ok. Yikes that is a tight squeeze☺

- Step 5 notes – noted "aggradation major process". Do you think it is a natural process for the location or an increase in what you might expect?
  I think it is increased from what we might expect in this small stream. There was quite a lot of stormwater runoff at the top of the reach coming in from a trail as well as other stormwater issues along the road that may be getting into the stream. It is at the bottom of the watershed, which would naturally receive sediment, but there are stormwater inputs entering the stream. - ok
- Step 6 – The tally sheet for LWD, pools, etc. is blank in the DMS. Please update.
  Tally sheet has been entered into the DMS. - ok
- Step 7 narrative – notes "quite a bit of fine sediment…..some stormwater input from Mt. Rd" The stormwater types noted are overland. Are there any direct ditch connections or is the sediment enough that it is making its way through the buffer (51-100') and into the stream…or are there just some localized spots near the road/crossing that are a high input of sediment? Trying to get a feel for extent and option for possible project needs.
  As mentioned above in the explanation for aggradation being a major process, sediment is definitely entering the stream via stormwater runoff as observed at the crossing just upstream of the top reach break. There is a trail crossing here and stormwater runoff around the culvert is causing sediment to enter (see photo below).

Stormwater runoff off of trail crossing by culvert in T1.02

We did not see any direct ditch connections. We observed overland stormwater runoff that is making its way into the stream (see photo below). – ok, these type of sediment inputs often get missed with such a wide buffer, and no direct type of input seen; so this help demonstrate the issue ; thanks for the photos and will be helpful to highlight in the report.

Overland stormwater runoff in T1.01

Overland stormwater runoff making its way to stream

- Step 7.1 – Degradation score of 18 seems high given several in good category.
  We usually weight the top two categories most heavily when scoring for step 7.1. Given that the incision was 1.08 is why we chose to score in reference. We see your point about there being some rows in the good category and have lowered the score to 15. – ok, I don't want to have folks change scores just to change scores; just providing a second set of eyes and checking in to see if scores still seem reasonable.

West Branch Reach Notes:

T3.11 –

- Phase 1 – step 6.3 channel bars – is noted as "not evaluated". Please update based on Phase 2 info and update the impact score.
  This step in Phase 1 was previously not updating correctly in the DMS. Now phase 1 is updated to show depositional features observed during Phase 2. - ok
- Phase 1 – step 2. 8 – channel width – noted as "30" and in meta data is noted as "field survey". This is significantly different than the RHGC estimate of 53' for a watershed of 24 sq. miles. It is also much narrower than the upstream reach or what was measured in the Phase 2 cross-section. What would be reasons for the significant difference in estimated channel width in the RHGC and that entered for the reference width? Would the narrower width have occurred due to the straightening? It would explain much if the channel were made narrower when straightened and now trying to widen to a more stable width. Or are we way over widened and now it will look to have channel narrowed up? Please provide comments as to why the narrower width would be considered the reference width/where measured.
  The reference widths were off for the reaches we assessed in this stream. What factors do you consider were reasons for the widths to be off? It is helpful to have some ideas as to why the stream is an outlier for the curves and/or expected widths. Reference was 53 feet and we observed a channel width in our cross section of about 40 feet. The cross sections we did in the upstream reach had channel widths that ranged from about 23 to 32. We spoke with the landowner right near our cross section that informed us

that the channel has widened. The tree in the following photograph used to be on the bank according to him. I changed the reference width to 30 feet to reflect this information considering that the channel is now about 40 feet wide. The channel was not straightened in the upstream reach and the channel width was also narrower than reference, so I don't think straightening had to do with the narrower actual channel width. While the curves do not always predict exact measures; a difference of ~23' in expected width raises questions. Given that this is a C stream type the width would be expected to be reasonably close to the expected curve estimate. Were there soils, slopes, valley constraints, etc. that would have caused the widths to be that much narrower than expected? What clues did you see that led you to 30'f or a reference width, was it only based on the landowner's comments?

Both T3.11 (613' out of 939') and T3.12A (1,013' out of 1,400') were identified as straightened segments. Perhaps when it was straightened it may have been narrowed? There were dams noted in the T3.12 reach, perhaps this has also influenced the widths in these reaches? It is likely the landowner is seeing the channel become wider if given the watershed size and other factors; the expected width would be wider. Given all factors, would we expect to be trying to manage this channel back to a width of 30ft?

- Step 1.5 valley type – noted as NW. Phase 1 is noted as Broad. There is no human change in the valley type noted. It looks like the channel width is significantly wider than that of Phase 1. If the channel with is due to adjustment and Phase 1 is more accurate of what it should be; then Phase 1 channel width should be used to determine valley type. Please review and update as needed.
  Valley type is Broad for Phase 1 and Phase 2. This was updated for Phase 2. Adjusted Phase 1 channel width (30 feet) was used to calculate confinement. Given that the upstream reach reference width is 40 ft, ; 30' may be too narrow for the actual reference width. It may not be 53' as the curves suggest given it's watershed size; but 30'does not seem accurate for this size watershed. It may be more accurate to use the Phase 2 width for your valley confinement given the question of what is the actual reference width.
- Step 2.10 – riffle type noted as "sedimented". There are not many sediment features noted, and aggradation noted as minor in the notes. Were there fines or other features that were impacting the riffles to be more sedimented. There is only one steep riffle noted, is the sedimented riffle? With such an extent of straightening would "eroded" be a reason limited riffles seen?
  Note that this is a very short reach (939 feet). There was one steep riffle in there and it was a very long riffle from what I remember. Aggradation is not major since there were not abundant depositional features. We had four riffles in the reach, so I don't think riffles are limited. Sedimented describes the riffles better than eroded even though there is only one steep riffle. If I called the riffles eroded, it would not make sense if there was a steep riffle present. Ok – looking to see if the other areas where riffles may have been expected were more eroded than the one riffle noted; but if there were no other riffles seen and only the steep riffle that is fine.

- Step 2.14 – subclass noted as “b”; there is no subclass noted in Phase 1. Slightly greater than 2% slope, is this reflected in what was seen in the field? Please review and update as needed.
  Updated reference slope to be “b”. - ok
- Step 5.5 – straightening – with high straightening and minimal erosion on left bank or rip-rap, what do you think is allowing this to maintain the straighter condition? The riparian veg? Would it start to unravel if veg. removed? Looking at a couple ortho dates, looks like there was veg. removed in the upper portion but not in area where erosion is noted. Thoughts?
  As mentioned above the channel is widening and the left side has lost floodplain. The channel will probably try to obtain a more sinuous pattern in the future, but perhaps it has not happened yet. There is some riprap on the left, but you are right, it is minimal. The right side is well vegetated and has a steeper bank so there is not much room for it to migrate on that side. The landowner here is interested in a planting project so perhaps this could be investigated more during that phase. ok

T3.12A –

- Phase 1 – Step 6.3 – channel bars – only “point” is noted, several types noted in Phase 2, please review and update.
  This step in Phase 1 was previously not updating correctly in the DMS. Now phase 1 is updated to show depositional features observed during Phase 2. ok
- Step 1.5 / Step 2.4- valley type is noted as “narrow”. Phase 1 valley type is broad. Looking at the floodprone area of 206 in step 2.4 seems like there is areas of wider valley type. What is more representative for this segement. The wider floodprone area at the cross-section would seem to be a broad valley.
  The confinement at the cross section is Broad, but the average Phase 2 confinement for the segment is narrow (145/26=5.5). The Phase 1 valley type is Broad because the Phase 1 valley width is wider in the upstream end of the segment. The Phase 2 confinement is probably about half narrow and half broad, but the average comes out to be narrow.
- Step 2.1 bankfull width – noted as 26. This is much narrower than RHGC estimate in Phase 1 of 40. Do you think this occurred when the channel was straightened? Do you think it will move towards a wider width?
  I think the reference width was just lower for this watershed. we are not sure why this would be the case. Please note the bankfull cross sectional areas that we measured in the field for West Branch and the Sutton River were approximately 70% of the regional curve.
- Step 7 CEM noted as stage 1. An incision ratio of 1.3 is moderate, and given the level of channel straightening do you think it is still in a stable form?
  True the channel has incised somewhat, but given the grade controls in this segment, further incision is unlikely. ok
- Step 7.4 – Planform in the notes is indicated as historic for the low score, but the “historic” in step 7 is indicated as “no”. Do you feel there is still planform happening?
  No planform change is due to the historic channel straightening. Historic in step 7 was changed to “yes”. ok

T3.12B:

- Step 1.1 – segmentation – Please change this to “sub-reach”. While grade controls were certainly the contributor, the “sub-reach” category will help flag that is a natural change in the stream type.
  We entered sub-reach as the reason for segmentation. ok
- Step 1.5 – Rock Gorge is noted as “no”. The “why not assessed” is noted as “bedrock gorge”. Is this a gorge or not? Provide notes in the comments if this reach does not meet the criteria of a gorge, but is used for the “why not assessed”.
  Changed reason for not assessing to other and provided explanation in comments that it is not a true bedrock gorge, but due to the extensive bedrock, it did not need a full Phase 2 Assessment. ok

- Step 1.5 – human caused change – noted as "yes". I see the road encroachment, and that P1 valley type is broad. Would you have expected a naturally broad valley for this segment, given its bedrock/gorge stream type; or has there been such an encroachment that it has shifted this to a semi-confined valley? If it has changed from broad to semi confined due to encroachment, seems like it could have shifted the stream type; do you think there has been a stream type departure due to a shift in the valley type?
  The road encroachment most likely caused a change in stream type from a "C" to a "B", but now the channel is very stable due to the extensive bedrock. Since the stream will not migrate back to a "C" and it is in stable condition, a modified reference stream type of "B" was assigned. Comment was added to the DMS. ok
- Step 2.14/2.15 – The sub-class is noted as "none" in step 2.14 and as "c" in step 2.15. Does the reference stream type for this segment have a "c" slope" or is a steeper "b" slope? Please review and update to be consistent and/or provide comments if subclass slopes remain different.
  Changed Phase 2 subslope to "c". ok
- Step 7 – geomorphic condition noted as "good". Please provide a note as to why you feel the reach is in "good" condition. This will help with knowing what you were looking at in making that decision and potential needs/opportunities down the road.
  The segment is in "Good" condition due to its stability and lack of aggradation, recent planform change, and widening. Comment was added to the DMS. ok

T3.12C:

- Step 2.10 – Riffle type – noted as "eroded"; In RGA for degradation (row 3) and aggradation (row1) riffles are noted as complete and/or mostly complete. Are features starting to reestablish themselves?
  Changed row 1 aggradation to mostly complete. Riffles incomplete due to erosion not aggradation. Not dominated by plane bed, therefore, "fair" category was not chosen for degradation (row 3) in RGA. ok
- Step 7 notes – "old mill dams….may have caused historic channel incision…." I see lots of ledge in the reach. Do you think this has incised down to bedrock? Is the current dam on the downstream side capturing sediment /flow upstream of it? Do you think the mill ponds were perhaps bigger and this has incised through old mill pond sediments?
  Yes channel has incised to bedrock. Comment added to DMS step 7. The dam on the downstream end is a run-of-river dam. Some sediment is being held back, but flow is not. It's possible that the channel has incised through old mill pond sediments, but more information would need to be collected of the historic nature of the dams and the ponds to answer this question. ok
- Step 7.3 – widening – the score of 18 seemed high with a couple categories in the "fair" range.
  We usually weight the first two categories more when scoring for widening, but we see your point with two categories in "fair" that this should be scored lower. Score changed to 15. ok

T3.12D:

- Step 1.4 – valley width - Please look to get valley width off the map.
  Average valley width estimated as 560 feet and entered into DMS. ok
- Step 2.14 – Stream type noted as C4-riff/pool. Would this be a sub-reach with a different ref. stream type given the channel material is gravel vs the cobble ; or is this an impact that has shifted the channel material to be smaller than expected?
  Given that we did not assess this part of the reach due to landowner permission, it is difficult to say whether there is an impact causing a change in substrate. We observed gravel as dominant looking upstream into this segment. Changed this to a sub-reach given the difference in substrate. ok
- Step 7 – geomorphic condition noted as "good". Please provide a note as to why you feel the reach is in "good" condition. This will help with knowing what you were looking at in making that decision and potential needs/opportunities down the road.
  Segment did not appear incised looking upstream into segment since there was good floodplain access on left side, which is why we originally assigned the "good" condition. In looking at the orthophotos again, it looks like the channel was probably straightened upstream for agriculture and may be in a "fair"

condition as a result. There appears to be some limited buffer as well upstream due to farm fields. Condition changed to “fair” in DMS and comment was added. ok

T3.S301A –

- Step 7 - please add the “none” / “no” for the step 7.2 – 7.3 STD and Historic.
  Updated step 7 in Phase 2 DMS. ok

T3.S301B:

- Step 1.1 – Please add segmentation reason “property access”. Done. ok
- Step 1.5 – valley information – please capture off a map. An average valley width of 410 feet was estimated from map and entered into the DMS. ok
- Step 3.2 – buffer information – please capture off an ortho.
  We updated this in the DMS. ok
- Step 3.3 – corridor land use – please capture off an ortho.
  We updated this in the DMS. ok
- Step 7 – geomorphic condition noted as “good”. Please provide a note as to why you feel the reach is in “good” condition. This will help with knowing what you were looking at in making that decision and potential needs/opportunities down the road.
  The channel was similar to upstream, which was in “good’ condition and aside from the one house in the corridor and associated impacts, the rest of the segment had few observable impacts. Comment was added to DMS. ok

T3.S301C:

- Phase 1 – Step 6.3 – channel bars – noted as “no data”; please update and impact score with Phase 2 data.
  This step in Phase 1 was previously not updating correctly in the DMS. Now phase 1 is updated to show depositional features observed during Phase 2. ok
- Step 1.6 – grade controls – photo taken noted as “no” – I believe we took photos of the ledge along the way. Confirm.
  Staci, unfortunately the photos you took that day were not retrievable from the camera. Apparently the SD card was corrupt. Perhaps that was why you were having trouble in the beginning getting the camera to be on photo mode. It seemed to be working though when you looked back at the photos. Ok - ahh…equipment ☺
- Step 7 narrative – please add “abundant fines seems to be a natural condition of this reach”.
  Comment was added to step 5 in the DMS. ok