Kingsbury Branch of the Winooski River Watershed
River Corridor Plan
October 2008

Bear Creek Environmental, LLC
Friends of Winooski River
Central Vermont Regional Planning Commission

Bear Creek **Environmental**

297 East Bear Swamp Road, Middlesex, Vermont 05602
Phone: (802) 223-5140 / **Fax:** (802) 229-4410

Kingsbury Branch of the Winooski River Watershed
River Corridor Plan

October 24, 2008

Prepared by:

Bear Creek Environmental, LLC

Friends of Winooski River

and

Central Vermont Regional Planning Commission

Kingsbury Branch of the Winooski River Watershed River Corridor Plan

TABLE OF CONTENTS

Kingsbury Branch of the Winooski River Watershed River Corridor Plan

1.0 EXECUTIVE SUMMARY

In 2007, the Friends of the Winooski River (FWR), the Winooski Natural Resource Conservation District (WNRCD) and the Central Vermont Regional Planning Commission (CVRPC) completed a Phase 1 Stream Geomorphic Assessment of the Kingsbury Branch watershed following the protocol developed by the Vermont Agency of Natural Resources (VANR). These partners hired Bear Creek Environmental to conduct Phase 2 assessment work on the Kingsbury mainstem from its confluence with the Winooski River up to its outlet from Woodbury Lake. The Phase 2 assessment also included the lower six reaches of Pekin Brook. In total approximately 18 miles of river were assessed as part of the Phase 2 field work. The project was funded through the Vermont Clean and Clear Program, and the Vermont Department of Environmental Conservation, River Management program, provided technical expertise for both the Phase 1 and 2 assessments.

During Phase 1 seventy two river reaches, encompassing fifty three stream miles were assessed. River reaches that are impounded by lakes, ponds, and wetlands were not assessed. Tables summarizing the results of Phase 1 can be found later in this document. The Phase 1 results were an important component to selecting the reaches that were more fully assessed in Phase 2.

The Phase 2 stream geomorphic assessment included field observations and measurements that are used to verify the Phase 1 study, to determine the channel adjustment process, and the stream geomorphic condition, aquatic habitat condition, and quality of the riparian corridor. The collection and synthesis of this information can be used in watershed planning, for the establishment of fluvial erosion hazard zones, and for the identification of watershed improvement projects. A short summary of the Phase 2 results is as follows:

- The upper reaches of the mainstem in Calais (from East Calais Village to Woodbury Lake) are in fair to good condition. These reaches generally have good floodplain access.
- From East Calais village downstream to the confluence of Pekin Brook the Kingsbury Branch is generally moderately incised; however there is one section that has good floodplain access. The reach of the Kingsbury Branch, located immediately upstream of the Pekin Brook confluence, is heavily influenced by beavers.
- The section from Pekin Brook downstream to the Kingsbury Hydroelectric Facility is strongly influenced by North Montpelier Pond.

- The mainstem of the Kingsbury Branch in East Montpelier is much more incised. This incision may be a result of this section being sediment starved below the Kingsbury dam.
- The majority of Pekin Brook has good floodplain access. The exception is segment (T3.06-B) that includes the town hall property. This segment is highly incised but is relatively stable.

Over 20 restoration and protection projects were identified using information collected as part of the Phase 2 assessment. Four high priority projects have been identified that provide opportunities to protect the river corridor and improve the riparian buffer. Several of these landowners may be eligible for the Conservation Reserve Enhancement Program. Corridor easements will be pursued in areas that are identified as important to sediment attenuation either because of adjustment processes or because these areas are in regime and are currently providing this function. FWR and WNRCD plan to conduct outreach to target landowners in areas identified in this river corridor plan as high priority.

2.0 LOCAL PLANNING PROGRAM OVERVIEW

2.1 RIVER CORRIDOR PLANNING TEAM

The River Corridor planning Team for the Kingsbury Branch of the Winooski River is comprised of Friends of the Winooski River, Central Vermont Regional Planning Commission (CVRPC), the Vermont Department of Environmental Conservation (DEC), Bear Creek Environmental (BCE), the Winooski Natural Resource Conservation District (WNRCD), volunteers and landowners. The CVRPC, FWR , and WNRCD completed the Phase 1 Assessment of the Kingsbury Branch Wateshed. Bear Creek Environmental was retained by FWR and partners as part of a grant with the Vermont River Management Program, to conduct a Phase 2 Stream Geomorphic Assessment of the Kingsbury Branch main stem and Pekin Brook. Gretchen Alexander from the Vermont River Management Section of the Vermont Agency of Natural Resources (VANR) provided technical guidance for this project.

2.2 GOALS AND OBJECTIVES OF THE PROJECT

2.2.1 State River Management Goals and Objectives

The State of Vermont's River Management Program has set out several goals and objectives that are supportive of the local initiative in the Kingsbury Branch 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, 2007c) The objectives of the Program are to avoid damage to investments due to fluvial erosion hazards, to reduce sediment and nutrient loads, and to restore and protect aquatic and riparian habitat. Additionally, the Vermont River Management Program has set out to provide funding and technical assistance to facilitate an understanding of river instability and the establishment of well developed and appropriately scaled strategies to protect and restore river equilibrium.

2.2.2 Local Goals and Objectives

A community-based river corridor management plan provides many opportunities for enhancing and restoring the Kingsbury Branch watershed. The corridor plan addresses many of the concerns voiced by residents of the Kingsbury Branch watershed including lack of riparian buffers, fluvial erosion damage to property and its negative impact on stream health, impact of development and loss of wildlife habitat.

Specifically, recommendations in the plan can be used to:

- Improve the water quality and biological integrity of the Kingsbury Branch and Pekin Brook
- Increase the recreational resource
- Restore river corridor functions
- Reduce erosion and flood hazards
- Protect existing flood and sediment attenuation areas

3.0 BACKGROUND WATERSHED INFORMATION

3.1 Geographic Setting

The Kingbury Branch watershed has an area of 53 square miles and lies within the Winooski River Watershed, which is one of the major rivers in Vermont within the Lake Champlain Basin (Figure 1). Located in the upper part of the Winooski River Watershed, the Kingsbury Branch begins in the Town of Woodbury, flows through Calais and enters the Winooski River in East Montpelier. The portion of the watershed that was studied in 2007 using the Phase 2 protocol lies within the Towns of Calais and East Montpelier. The Kingsbury Branch watershed falls under the jurisdiction of the Central Vermont Regional Planning Commission.

The Kingsbury Branch watershed drains from approximately 2200 feet in elevation at Woodbury Mountain in a southerly direction and meets the Winooski River near Cate Farm Road in East Montpelier at approximately 690 feet above sea level. The Phase 2 study area focuses on the lower 16 reaches on the Kingsbury Branch and the lower 6 reaches of Pekin Brook. The upper-most reach within the study area on the Kingsbury Branch (M16), which begins at the outlet of Woodbury Lake (also known as Sabin Pond), is approximately 230 feet higher in elevation than the lowest reach at the confluence with the Winooski River. The upper-most reach within the study area on Pekin Brook, which begins just upstream of the intersection of Kent Hill Road and Pekin Brook Road in Calais, is approximately 80 feet higher than the lowest reach on Pekin Brook at the confluence with the Kingsbury Branch. The Kingsbury Branch flows through a very gentle gradient valley. Except for reach M12, which has a channel slope of 4.7 percent, all reaches assessed for Phase 2 in the Kingsbury Branch have a channel slope of less than 1percent. Pekin Brook also flows through a valley with a very gentle gradient. All reaches assessed on Pekin Brook have a slope less than 1 percent.

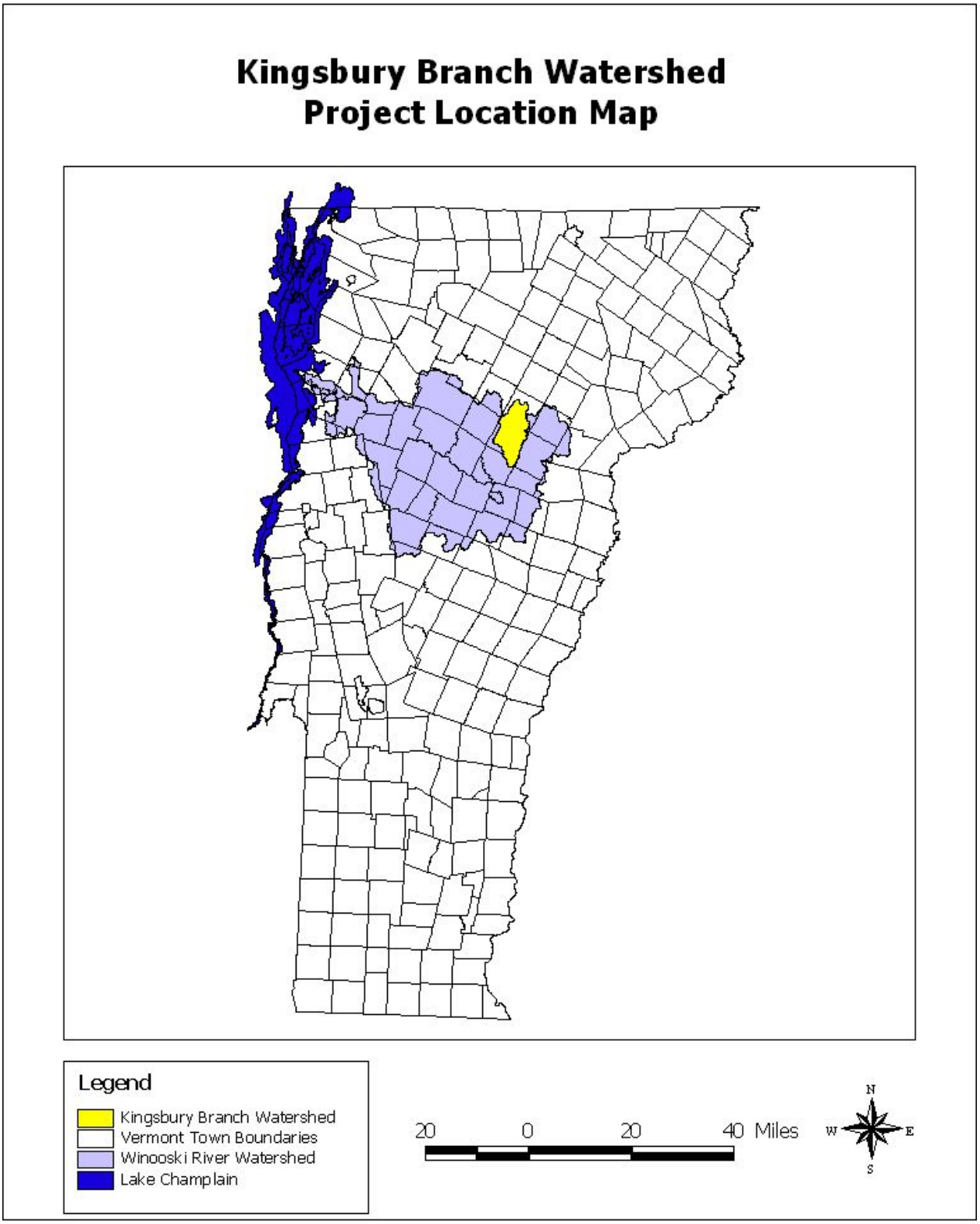


Figure 1. Project Location Map for the Kingsbury Watershed

The Kingsbury Branch watershed is dominated by forested land. However, within the Kingsbury Branch Watershed urban (residential, commercial, and industrial) land is subdominant and within the Pekin Brook Watershed cropland or urban land are sub-dominant land uses. As shown in Figure 2, seventy percent of the Kingsbury watershed is forest, eight percent is agriculture, ten percent is urban, eight percent is water, and four percent is wetland.

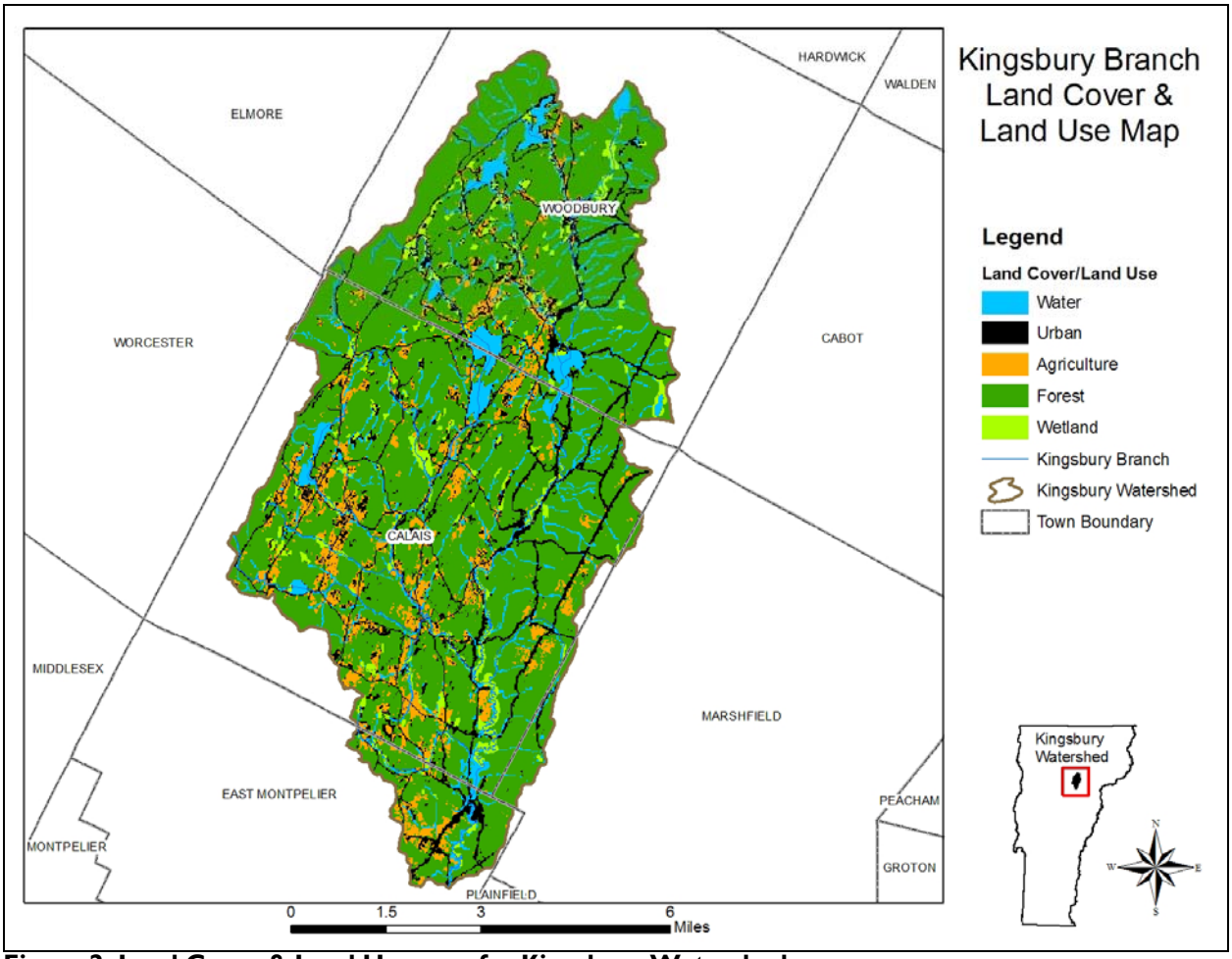


Figure 2. Land Cover & Land Use map for Kingsbury Watershed

3.2 Geologic Setting

The Kingsbury Branch Watershed is located within the Connecticut Valley Gaspe Province. This basin contains thick calcareous deposits (Doolan, 1996). This watershed was reshaped primarily by glacial activity. The last large ice sheet, the Laurentide Ice Sheet, covered all of New England and advanced up the Winooski River valley (Wright and Larsen, 2004). As the climate warmed, the glacier slowly retreated and formed glacial Lake Winooski, covering the Winooski valley and many tributaries upstream from Waterbury (Van Diver, 1987). Following the retreat of the glacier, the Winooski River and its tributaries began eroding the deposited glacial and lake sediments (Wright and Larsen, 2004).

Bedrock maps of the watershed show that the watershed is primarily comprised of the Waits River Formation: a Silurian deposit of interbedded limestone and quartzite and slate, phyllite and schist (VGS, 1961). The bedrock geology of the Kingsbury Branch Watershed consists of limy sandstone and mudstone deposited during the Acadian orogeny, which was a convergence of continental masses with the western mountains (Doolan, 1996). These deposits originated from the mountains to the west (Doolan, 1996).

The dominant surficial sediments within the Kingsbury Branch Watershed are glacial lake sediments, alluvium and ice-contact deposits. In Pekin Brook, the dominant surficial sediments are alluvium and till, while subdominant deposits are comprised of alluvium, glacial lake, ice-contact deposits and till.

3.3 Geomorphic Setting

The Kingsbury Branch Watershed was divided into 94 reaches for the Phase 1 assessment. Phase 2 Geomorphic Assessments were conducted on the Kingsbury Branch Watershed from Woodbury Lake in Calais to the confluence of the Winooski River in East Montpelier, Vermont, including Pekin Brook from the Calais town hall to the confluence with the Kingsbury Branch (Figure 3). These reaches were selected as higher priority than upstream reaches based on results from the Phase 1 assessment.

Reference stream types[1] 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. Reference stream typing was based on both the Rosgen (1996) and Montgomery and Buffington (1997) classification systems. Table 1 shows the typical characteristics used to determine reference stream types (VANR, 2007a).The reference stream types within the Kingsbury Branch watershed strongly reflect the glacial history. Fine textured and cohesive sediments (silts and clays) resulting from glacial lake deposition are prevalent along the lower reaches of the Kingsbury River and Pekin Brook. These lower reaches are classified as "E" channels and include the section of the Kingsbury Branch from the confluence of the Winooski up to approximately Peck Hill Road (9.3 river miles) and Pekin Brook from the confluence of the Kingsbury Branch to the intersection of Pekin Brook Road and Jack Hill Road (2.3 river miles).

[1] Additional information about reference stream typing can be found on the Vermont Agency of Natural Resources web page - http://www.anr.state.vt.us/dec/waterq/rivers/docs/assessmenthandbooks/rv_weblinkpgphase1.pdf

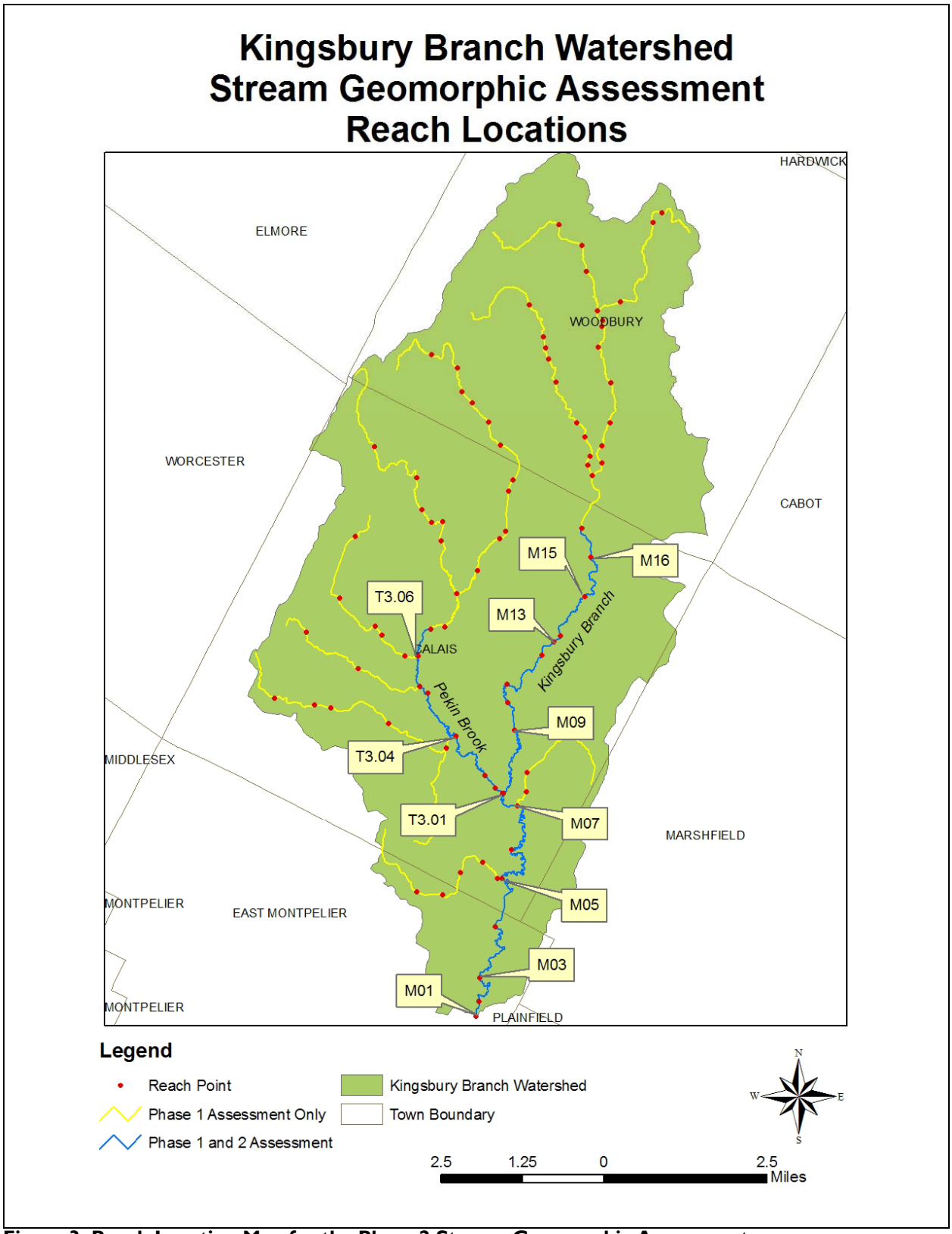


Figure 3. Reach Location Map for the Phase 2 Stream Geomorphic Assessment

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

Reference stream types for the assessed reaches are listed in Table 2. The reference stream type for reaches M01 through M10 on Kingsbury Branch and reaches T3.01 through T3.03 is type "E". These reaches have a very low slope (<1%), a low width to depth ratio, and flow through unconfined valleys. M11 has similar valley and slope conditions, but has a stream type of "C". In M12 the conditions change to a steeper gradient (~5%) and a semi-confined valley with a reference stream type of "B". The valley widens again in reach M14 with a slope less than 1% and a reference stream type of "E". Reaches 15 and 16 have unconfined valleys, slopes less than 1% and "C" reference stream types. On Pekin Brook, reaches T3.04 through T3.06, located from above the Pekin Brook Road and Jack Hill Road intersection to the Calais Town Hall are "C" channels by reference and have slightly higher slopes and larger bed material (gravel rather than sand or silt) than the lower section of Pekin Brook.

Table 2: Geomorphic Setting of Assessed Reaches

Reach ID	Reference Stream Type	Confinement	Valley Slope	Bed Form
M01	E	Narrow	0.16	Dune-Ripple
M02	E	Narrow	0.24	Dune-Ripple
M03	E	Broad	0.34	Dune-Ripple
M05	E	Broad	0.05	Dune-Ripple
M06	E	Broad	0.14	Dune-Ripple

Table 2: Geomorphic Setting of Assessed Reaches				
Reach ID	**Reference Stream Type**	**Confinement**	**Valley Slope**	**Bed Form**
M07	E	Very Broad	0.10	Dune-Ripple
M08	E	Very Broad	0.21	Riffle-Pool
M09	E	Broad	0.16	Riffle-Pool
M10	E	Narrow	0.42	Riffle-Pool
M11	C	Very Broad	0.84	Riffle-Pool
M12	B	Semi-confined	4.96	Plane Bed
M14	E	Very Broad	0.41	Riffle-Pool
M15	C	Very Broad	0.64	Riffle-Pool
M16	C	Narrow	0.45	Riffle-Pool
T3.01	E	Broad	0.39	Dune-Ripple
T3.02	E	Semi-confined	0.22	Dune-Ripple
T3.03	E	Broad	0.08	Dune-Ripple
T3.04	C	Broad	0.25	Riffle-Pool
T3.05	C	Broad	0.62	Riffle-Pool
T3.06	C	Broad	0.66	Riffle-Pool

There are no alluvial fans within the assessed reaches. There are a variety of grade controls located in the reaches included in the Phase 2 assessment. On the mainstem of the Kingsbury Branch, M03 contains two ledge grade controls and there is a dam located at the upstream end of the reach. In segment M12-B there are two waterfall grade controls. There is one small ledge grade control located near the end of T3.06-B (Pekin Brook).

3.4 Hydrology

In order to better understand the flood history of the Kingsbury Branch, long term peak discharge data from the U.S. Department of the Interior, U.S. Geological Survey (USGS) gauge on the Dog River at Northfield Falls, VT (a major tributary to the Winooski) was obtained. There is no USGS gauge in the Kingsbury watershed and the Dog River gauge is in closest proximity to the Kingsbury watershed. The Dog River gauge provides a continuous record of flow from 1935 through the present. The drainage area at the Dog River gauge is 76 square miles. The confluence of this tributary with the Winooski River is located at the terminal point of the study area.

The Dog River record shows that the 10 year discharge was exceeded in water years 1952, 1976, 1987 and 1989 and between a 25 and 50 year discharge occurred in 1938. During water year 1973, the peak discharge exceeded the projected 50 year discharge. A graph of the flood frequency analysis is provided in Figure 4.

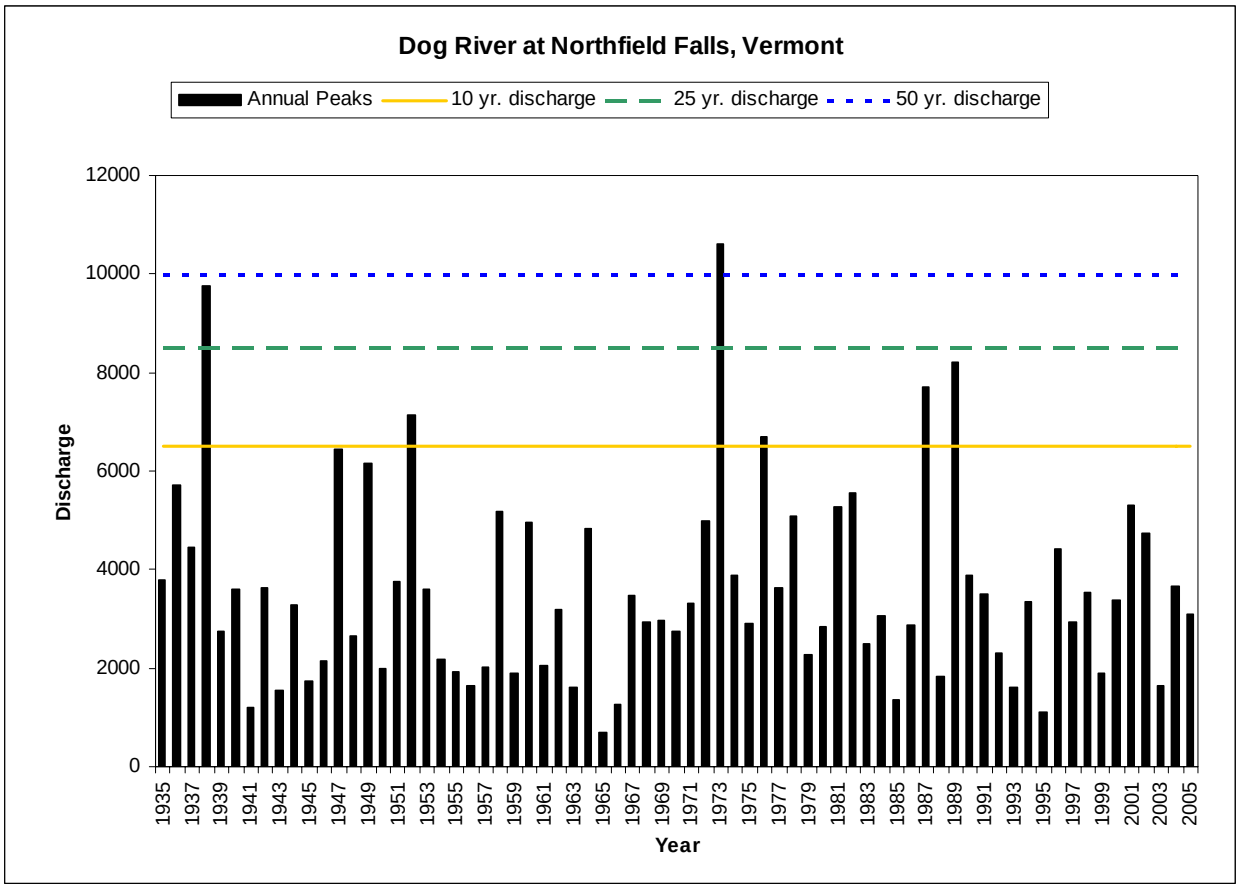


Figure 4: Flood frequency analysis for the Dog River.

Between 1995 and 1998 Vermonters suffered nearly $60,000,000 in flood damages; much of these losses were avoidable (Vermont Agency of Natural Resources, 2006). Through Vermont's history, flood waters on the Winooski River and its tributaries have destroyed property on numerous occasions.

In recent history, local flooding occurred during a heavy rainstorm in July of 2007. One location on Pekin Brook flooded across the road where a bridge crosses the stream (just upstream from the intersection of George Road and Pekin Brook Road). Flood waters left the channel just before the bridge and flowed across the road and entered Pekin Brook just downstream of a meander.

3.5 Ecological Setting

The Kingsbury Branch watershed lies within the Northern Vermont Piedmont biophysical region. The Northern Vermont Piedmont is characterized by Thompson and Sorenson (2000) as being hilly with numerous rivers. The Kingsbury Branch and Pekin Brook watersheds have abundant wetlands (Figure 2). There are numerous beaver dams on both streams, which contributed to the deep water conditions and enhanced wetland habitat.

Water flow backed up from the dam at North Montpelier Pond in East Montpelier has also contributed to the creation of wetland habitat

4.0 METHODS

4.1 Phase 1 Methodology

A Stream Geomorphic Assessment process is divided into three phases, based on VT ANR protocols. Phase 1, the remote sensing phase, involves the collection of data from topographic maps and aerial photographs, from existing studies, and from very limited field studies, called "windshield surveys." The Phase 1 remote sensing techniques allow for large watersheds (100-150 square miles) to be assessed within a few months time. The Phase 1 assessment provides an overview of the general physical nature of the watershed and helps prioritize stream reaches in need of Phase 2 assessment. As noted in the Executive Summary, 72 river reaches or 53 miles were assessed during Phase 1.

4.2 Phase 2 Methodology

The Phase 2 assessment was conducted by BCE following procedures specified in the Vermont Stream Geomorphic Assessment Handbook Phase 2 (Vermont Agency of Natural Resources 2007b), and used version 4.56 of the Stream Geomorphic Assessment Tool (SGAT) GIS extension to index impacts within each reach.

4.3 Bridge and Culvert

The Bridge and Culvert Assessment and Survey Protocols specified in Appendix G of the Vermont Stream Geomorphic Assessment Handbook (Vermont Agency of Natural Resources, 2007d) were followed. All assessment data were recorded on the Agency of Natural Resources (ANR) Bridge and Culvert Assessment – Geomorphic and Habitat Parameters data sheet, and were entered into the ANR DMS. An ArcView shapefiles of stream crossings for the State of Vermont "TRANS_TRANSTRUC_POINT" was downloaded from the Vermont Center for Geographic Information. This shapefile includes stream crossings on state and town roads.

The bankfull channel width from the Phase 2 fieldwork was used to determine the expected bankfull width in the vicinity of a particular structure. Latitude and Longitude at each of the structures was determined using a Garmin Etrex Vista GPS unit. The assessment included photo documentation of the inlet, outlet, upstream, and downstream of each of the structures.

4.4 River Corridor Plan

The Vermont Agency of Natural Resources River Corridor Planning Guide (2007c) and Draft 9 of Chapter 5 of the plan dated October 2, 2007 were followed to generate a series of stressor maps. These maps were created using indexed data from the Phase 1 and Phase 2 Stream Geomorphic Assessments along with existing data available from VCGI, including railroads, e911 roads, e911 buildings and e911 driveways. The stressor maps

were then used to identify potential project locations that have few constraints to channel adjustment.

4.5 Quality Control/Quality Assurance Procedures

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 as well as automated and manual QC checks with the DEC River Management Program.

In November 2007, BCE completed its own in-house QA review after all the Phase 2 data were entered into the DMS and the Phase 1 data were updated. The Phase 1 DMS and ArcView shapefiles were updated by Mary Nealon and Pamela DeAndrea based on the Phase 2 field assessment work during the Phase 2 QA/QC process. The DMS and the ArcView shapefiles for the Kingsbury Branch Phase 2 study were submitted to Gretchen Alexander of the ANR for a Quality Assurance review in early November 2007. Some minor revisions were made by Bear Creek Environmental to the DMS following this review.

5.0 RESULTS

5.1 Phase 1 Results[2]

The tables below summarize the Phase 1 results. The Kingsbury Branch was divided into 94 reaches. Of these, only 72 reaches received a full Phase 1 assessment (see Table 3 for details). The remanding 22 reaches were not assessed because they were impounded by lakes, ponds, and wetlands.

Table 3

Stream Name	Reach Number	Number of Reaches in Phase 1	Length of Stream (feet)
Buck Lake Brook	T5	2	6465
Dugar Brook	T3.08S1	7	30623
Kingsbury Branch	M	21	94996
Pekin Brook	T3	15	49496
Still Brook	T2	3	13686
Sub Trib 1 to Trib 1 to Pekin Brook	T3.03.S1.01s1	1	10822
Trib 1 to Kingsbury Branch	T1	6	19994
Trib 1 to Pekin Brook	T3.03S1	5	22456
Trib 2 to Pekin Brook	T3.05S1	3	15210
Trib 3 to Pekin Brook	T3.05S2	5	12476
Trib 4 to Kingsbury Branch	T4	4	10239
Grand Total		**72**	**286463**

[2] This section was prepared by Ann Smith of Friends of the Winooski River

Table 4 shows the distribution of the number of stream reaches across reference bed form.

Table 4

Stream Type	Cascade	Dune-Ripple	Plane Bed	Riffle-Pool	Step-Pool	Grand Total
Buck Lake Brook	1				1	2
Dugar Brook				6	1	7
Kingsbury Branch		6	2	13		21
Pekin Brook	1	3		9	2	15
Still Brook		1		1	1	3
Sub Trib 1 to Trib 1 to Pekin Brook				1		1
Trib 1 to Kingsbury Branch				5	1	6
Trib 1 to Pekin Brook	1			3	1	5
Trib 2 to Pekin Brook				1	2	3
Trib 3 to Pekin Brook	1			3	1	5
Trib 4 to Kingsbury Branch				4		4
Grand Total	**4**	**10**	**2**	**46**	**10**	**72**

Table 5 shows the length for each stream that has received modifications or human changes.

Table 5

Row Labels	Length of Stream that has been Armored (feet)	Length of Stream that has been Straightened (feet)	Length of Stream that has been Bermed (feet)	Length of Stream that has Corridor Development (feet)
Buck Lake Brook	630	1261	930	560
Dugar Brook	459	4108	6031	282
Kingsbury Branch	4242	24488	28661	5402
Pekin Brook	4754	18388	21286	1712
Still Brook	0	753	0	203
Sub Trib 1 to Trib 1 to Pekin Brook	95	1817	1443	324
Trib 1 to Kingsbury Branch	0	1690	719	375
Trib 1 to Pekin Brook	0	3236	3744	710
Trib 2 to Pekin Brook	0	999	0	275
Trib 3 to Pekin Brook	496	4715	1799	1385
Trib 4 to Kingsbury Branch	345	1071	942	713
Grand Total	**11022**	**62527**	**65555**	**11943**

Table 6 shows the ranges of impacts that were calculated based on the phase 1 assessment. These impacts range from 0 or no impact to 20 which is heavily impacted. These impacts helped the partners to prioritize the reaches to asses during Phase 2. As noted below, the Kingsbury Branch and Pekin Brook have the most reaches in the higher impact categories.

Table 6

	Number of Reaches in Each Category			
Impact Ranges	**0-5**	**6-10**	**11-15**	**16-20**
Buck Lake Brook	1	0	1	0
Dugar Brook	2	3	1	1
Kingsbury Branch	1	8	8	4
Pekin Brook	2	3	5	5
Still Brook	2	1	0	0
Sub Trib 1 to Trib 1 to Pekin Brook	0	1	0	0
Trib 1 to Kingsbury Branch	2	4	0	0
Trib 1 to Pekin Brook	2	2	1	0
Trib 2 to Pekin Brook	2	1	0	0
Trib 3 to Pekin Brook	1	1	2	1
Trib 4 to Kingsbury Branch	0	3	1	0

5.2 Phase 2 Results

Reports from the Phase 2 stream geomorphic assessment are provided in Appendix 1.

5.2.1 Rapid Geomorphic Assessment

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, 2007b). The reference condition for each of the Phase 2 reaches was previously identified in Table 2. Of the 23 segments where Phase 2 RGAs were conducted, 6 segments rated in the good category and 17 segments rated in the fair category. Figure 5 illustrates the geomorphic condition of the streams in relation to the watershed.

The dominant adjustment processes in the Kingsbury Branch watershed is planform adjustment. Several of the reaches studied in the Kingsbury Branch watershed are undergoing a channel evolution process in response to large scale changes in sediment, slope, and/or discharge associated with human influences on the watershed. This process is described in the following pages. Table 7 below summarizes the existing stream type, channel evolution stage, and the primary adjustment processes that are occurring for each study reach or segment.

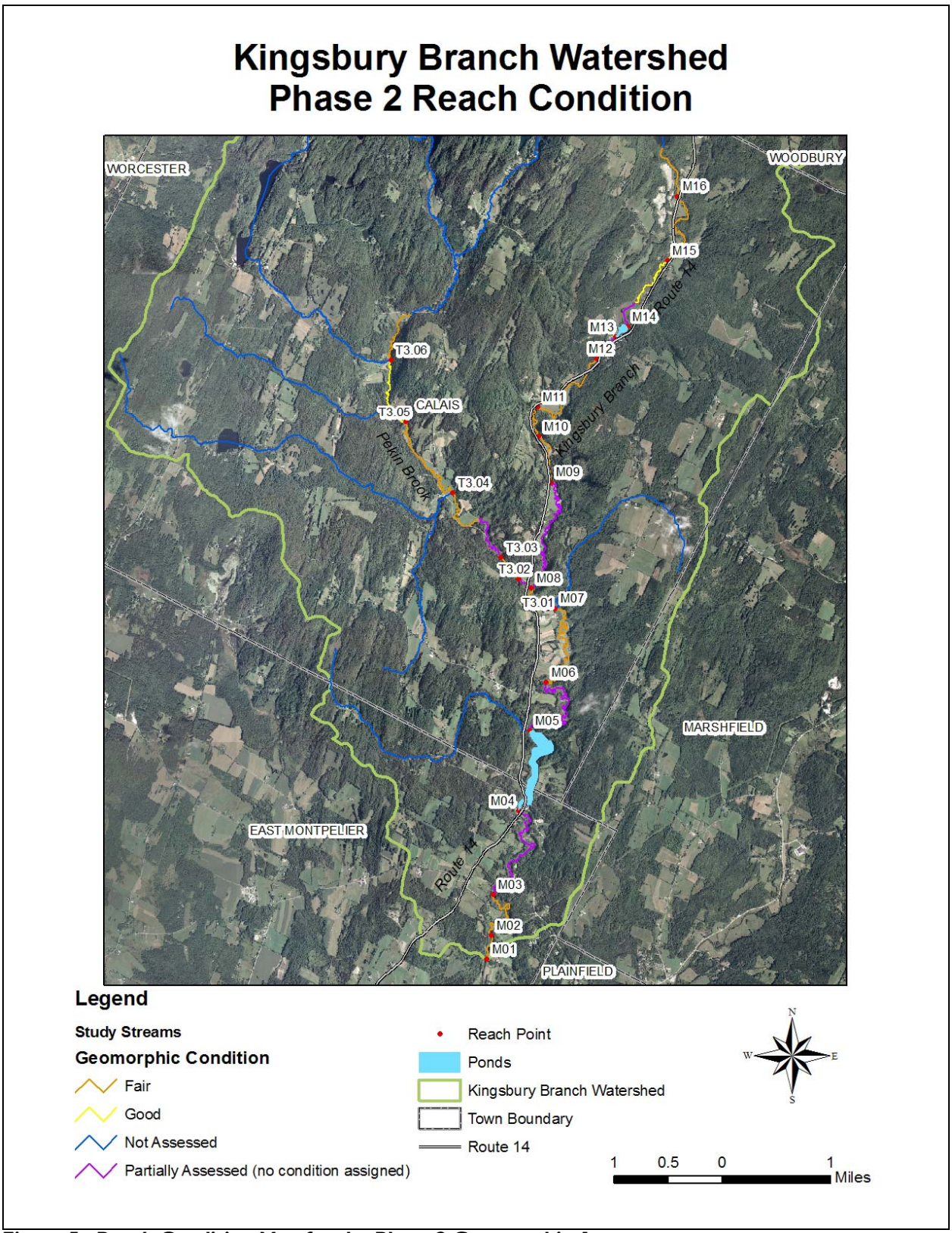


Figure 5. Reach Condition Map for the Phase 2 Geomorphic Assessment

Table 7. Stream Type and Channel Evolution Stage

Segment Number	Entrench-ment Ratio	Width to Depth Ratio	Reference Stream Type	Existing Stream Type	Channel Evolution Stage	Active Adjustment Process
M01	4.93	12.3	E5	C5	III	Planform Widening **Aggradation**
M02	6.12	16.3	E4	C4	III	**Aggradation Widening Planform**
M03	Partial Assessment – No Property Access					
M04	Not Assessed – North Montpelier Pond					
M05	Partial Assessment– Influenced by Impoundment					
M06	10.14	8.0	E5	E5	DIIc	Aggradation **Planform** Widening
M07	13.58	7.9	E5	E5	DIIc	Aggradation Widening **Planform**
M08-A	Partial Assessment – Beaver Dam Influence					
M08-B	Partial Assessment – Beaver Dam Influence					
M09	10.38	11.6	E4	E4	III	Aggradation **Planform** Widening
M10	9.69	11.4	E4	E4	III	**Aggradation Planform Widening**
M11-A	15.58	19.6	C4	C4	DIId	**Planform** Widening **Aggradation**
M11-B	1.61	23.4	C4	B4c	III	Planform Widening Aggradation
M12-A	1.62	12.6	B4	B4	III	Aggradation **Planform**
M12-B	Not Assessed – Bedrock					
M13	Not Assessed – Onstream Pond					
M14-A	Partial Assessment – Wetland					
M14-B	23.10	8.43	E5	E5	DIIc	Aggradation Planform
M14-C	13.20	21.84	C4	C4	DIIc	Aggradation **Planform** Widening
M15-A	16.13	22.77	C4	C4	DIIc	Aggradation Planform Widening

Table 7. Stream Type and Channel Evolution Stage

Segment Number	Entrench-ment Ratio	Width to Depth Ratio	Reference Stream Type	Existing Stream Type	Channel Evolution Stage	Active Adjustment Process
M15-B	5.07	20.50	C4	C4	DIId	**Planform** **Aggradation** Widening
M16	2.53	23.74	C4	C4	DIIc	Widening **Planform** **Aggradation**
T3.01	Partial Assessment – Beaver Dam Influence					
T3.02	3.71	8.07	E5	E5	DIIc	**Widening** **Planform** Aggradation
T3.03-A	Partial Assessment – Beaver Dam Influence					
T3.03-B	7.68	10.86	E5	E5	DIIc	**Planform** Widening Aggradation
T3.04-A	14.41	9.06	E5	E5	DIIc	**Planform** Aggradation Widening
T3.04-B	7.91	19.13	C5	C5	DIIc	Aggradation Widening **Planform**
T3.04-C	9.45	14.54	C5	C4	DIIc	Aggradation Widening **Planform**
T3.05-A	11.59	25.79	C4	C4	DIIc	Aggradation Widening Planform
T3.05-B	3.37	27.53	C4	C4	DIIc	Aggradation Widening **Planform**
T3.06-A	3.68	20.37	C4	C4	III	Aggradation Widening **Planform**
T3.06-B	9.33	14.88	C4	C4	II	Aggradation Widening **Planform**

Bold Red lettering - denotes extreme adjustment process
Bold Black lettering – denotes major adjustment process
Black lettering (no bold) – denotes minor adjustment process

Both the "D" stage and "F" stage channel evolution model (Appendix C, ANR 2004) are helpful for explaining the channel adjustment processes underway in the Kingsbury Branch and Pekin Brook. 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 8 include:

- A pre-disturbance period

- Incision – channel degradation
- Aggradation and channel widening
- The gradual formation of a stable channel with access to its floodplain at a lower elevation

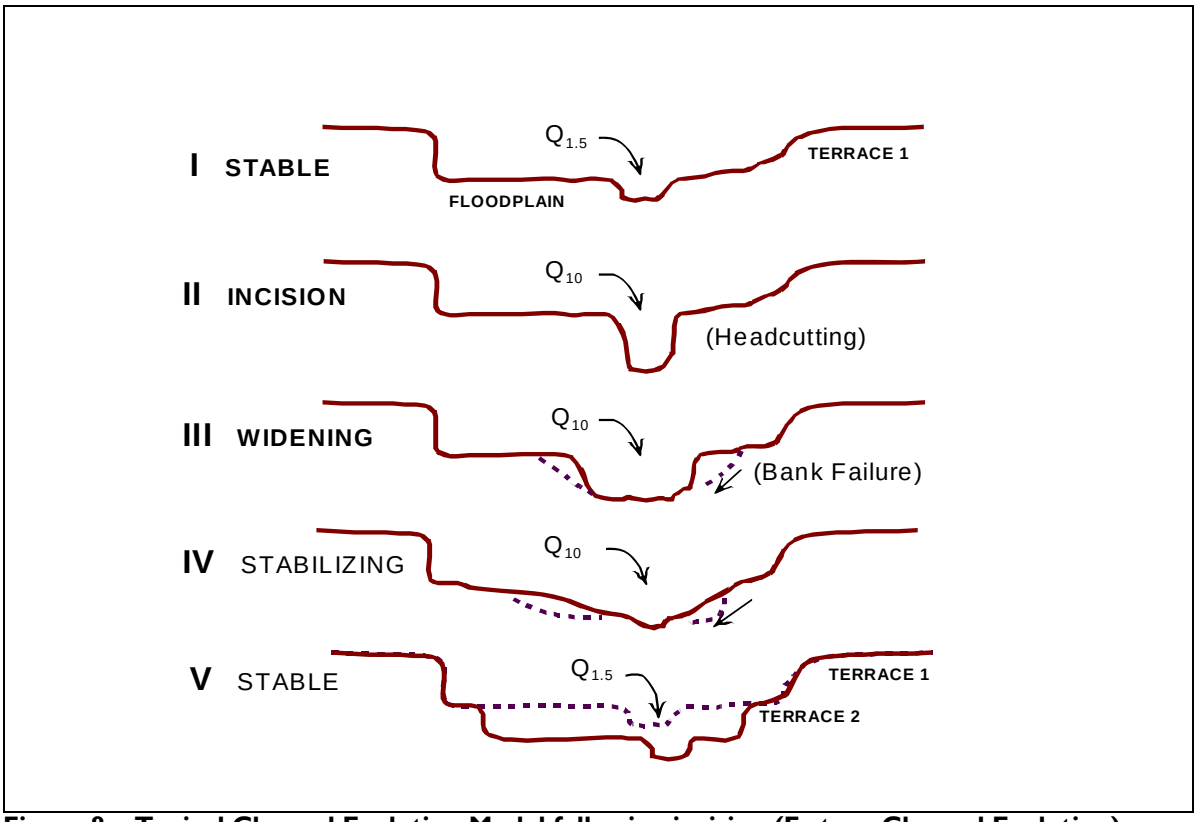


Figure 8. Typical Channel Evolution Model following incision (F-stage Channel Evolution).

Much of section of the Kingsbury Branch (reaches M12 down to M09) between Calais Village and the confluence of Pekin Brook has undergone historic incision. Channel straightening and the impact of the old mill dam likely contributed to this historic incision. In general, these reaches are in stage III of the "F" channel evolution model. This section of channel has historically incised and is going through a widening process to create a floodplain at a lower elevation. The lower three reaches of the Kingsbury Branch are also in stage III of the channel evolution model. These reaches (M03 to M01) likely incised in response to being sediment starved downstream of North Montpelier Pond. The upper reach (T3.06) on Pekin Brook have poor floodplain access; this historic incision is likely in response to the berming and channel straightening that took place in the vicinity of town hall and along Pekin Brook Road.

The bed erosion that occurs when a meandering river is straightened in its valley is a problem that translates to other sections of the stream. Localized incision will travel upstream and into tributaries eroding sediments from otherwise stable streambeds. These bed sediments will move into and clog reaches downstream leading to lateral scour and erosion of the streambanks. Channel evolution processes may take decades

to play out. Even landowners that have maintained wooded areas along their stream and riverbanks may have experienced eroding banks as stream channel slopes adjust to match the valley slopes.

It is difficult for streams to attain a new equilibrium where the placement of roads and other infrastructure has resulted in little or no valley space for the stream to access or to create a floodplain. Landowners and government agencies have repeatedly armored and bermed reaches of Vermont's rivers to contain floodwaters in channels. These efforts have proven to be temporary fixes at best, and in some cases have lead to disastrous property losses and natural resource degradation. A more effective solution is to limit encroachments within the riparian corridor and maintain a buffer of woody vegetation between the stream and adjacent land uses. Maintaining vegetated riparian corridors and offsetting development limits the conflict between property investments and the natural processes of flooding and channel migration that occurs gradually over time. Given room, a channel can adjust its shape and slope to changes in flow and sediment load. In general, the space provided by an established riparian corridor allows the river or stream system to be more resilient to watershed changes, thereby protecting the fish, wildlife, and humans that depend on Vermont's rivers and streams (Vermont Agency of Natural Resources 2005).

The majority of the channel length studied on the Kingsbury Branch and Pekin Brook during the Phase 2 assessment has adjustment processes that are best explained by the "D" stage evolution model. The more dominant adjustment process active adjustment process for the "D" stage channel evolution is aggradation, widening and planform change. Extreme deposition was noted in segments M15-B and M11-A, making these areas important attenuation reaches.

5.2.2 Rapid Habitat Assessment

The Rapid Habitat Assessment (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 results can be used to compare physical habitat condition between sites, streams, or watersheds, and also serve as a management tool in watershed planning.

Table 8 and page 64 of Appendix 1 shows a comparison of the habitat condition based on the Rapid Habitat Assessment (RHA) and the geomorphic condition based on the Rapid Geomorphic Assesment (RGA). For twelve of the segments both the RHA and RGA resulted in fair condition. The RGA was fair while the RHA was good for five of the segments. These segments were typically were undergoing a major adjustment process, but had good to excellent instream cover or riparian buffers resulting in a higher habitat score. Two of the segments (M15-A and T3.05-A) had a RGA score of good, while the habitat score was only fair. The lower habitat score for these segments was due to the lack of a high quality riparian buffer. Both the RGA and RHA score was good for four of the segments (M12-A, M14-B, M14-C, and T3.05-B).

A variety of habitat quality was often found within a reach. For example, reach 15 had fair habitat at the lower end where it lacks a high quality buffer and had been historically straightened (Figure 9). The mid section of reach 15, which is located away from roads and development, had good habitat and contained large wood debris, high quality pools, and large trees along the banks (Figure 10).

Table 8. Comparison of RHA and RGA Scores for Phase 2 Reaches

Segment Number	Score RGA	Score RHA	Rating RGA	Rating RHA
M01	0.46	0.50	Fair	Fair
M02	0.45	0.72	Fair	Good
M06	0.59	0.59	Fair	Fair
M07	0.61	0.59	Fair	Fair
M09	0.52	0.54	Fair	Fair
M10	0.45	0.64	Fair	Fair
M11-A	0.54	0.62	Fair	Fair
M11-B	0.52	0.71	Fair	Good
M12-A	0.68	0.73	Good	Good
M14-B	0.74	0.72	Good	Good
M14-C	0.65	0.70	Good	Good
M15-A	0.70	0.60	Good	Fair
M15-B	0.54	0.67	Fair	Good
M16	0.59	0.70	Fair	Good
T3.02	0.59	0.49	Fair	Fair
T3.03-B	0.62	0.55	Fair	Fair
T3.04-A	0.56	0.60	Fair	Fair
T3.04-B	0.62	0.62	Fair	Fair
T3.04-C	0.58	0.56	Fair	Fair
T3.05-A	0.68	0.64	Good	Fair
T3.05-B	0.68	0.77	Good	Good
T3.06-A	0.51	0.66	Fair	Good
T3.06-B	0.50	0.49	Fair	Fair

Figure 9. Segment M15-A rated "fair" for habitat. The segment lacked large woody debris, riparian vegetation and a diversity of pools where the channel had been historically straightened

Figure 10. This short section of M15-B had high quality habitat including excellent instream cover, deep pools, stable banks, and a high quality riparian zone.

5.2 Bridge and Culvert Assessment

Fifteen bridges/arches and four culverts were included in the assessment of stream crossings conducted during the Phase 2 field work in 2007. The geomorphic and habitat data for this bridge and culvert assessment were collected following the ANR protocol.

In order to assist local municipalities with priorities for replacement of the structures, priority lists were generated using the information and photographs taken during the assessment. The bridge span was used as a first cut in prioritizing the structures for replacement. Geomorphic stability was also considered when prioritizing bridges for replacement or retrofit. The following criteria were used to evaluate the bridges.

High Priority: Bridges with spans of approximately 50 percent of the bankfull width or less, which are significantly impeding natural sediment transport.

Moderate Priority: Bridges with spans less than 50 percent that are not causing significant geomorphic instability and structures with spans greater than 50% that are causing instability.

Low Priority: Stream crossing structures that are not included in either of the two categories above.

The Vermont Culvert Geomorphic Screening tool (2008a) and the Vermont Culvert Aquatic Organism Passage Screening Tool (2008b) developed by Milone and MacBroom, Inc. were used to identify culverts within the Kingsbury Branch watershed that are highest priority for replacement/retrofit due to geomorphic incompatibility and/or for being potential barriers to movement and migration of aquatic organisms.

Tables 9 (Kingsbury Branch Bridges) and Table 10 (Pekin Brook Bridges) and Table 11 (Pekin Brook Culverts) below provide a summary of the stream crossings assessed within the Kingsbury Branch watershed. Of the twelve bridge crossing on the Kingsbury Branch (see Table 9), three were identified as high priority for retrofit or replacement. The three high priority bridges on the Kingsbury Branch are located on Cate Farm Road, Still Brook Road, and Moscow Brook Road. All three of these bridges had narrow spans and were identified as interfering with sediment transport. One of the three bridges in the Pekin Brook watershed on Pekin Brook Road was also identified as high priority (see Table 10) due to a narrow span and poor alignment.

All four culverts within the Pekin Brook watershed were identified as high priority for replacement or refit. As shown in Table 11, the four culverts had narrow spans relative to the bankfull width. The Pekin Brook culvert met the criteria for allowing aquatic organism passage, but was identified as being mostly incompatible for geomorphic stability. The Peck Hill culvert also appeared to meet the criteria for aquatic organism passage and was identified as partially incompatible in terms of geomorphic stability. The highest priority stream crossing within the watershed is on Kent Hill Road. This structure was identified as blocking aquatic organism passage and resulting in full geomorphic incompatibility. The culvert on Singleton Road was identified as having the potential to reduce aquatic organism passage as well as being partially incompatible.

Table 9. Kingsbury Branch Bridge Crossings

Reach/ Segment No.	Structure No.	Structure Type	Road Name/ Location	% Channel Width	Blocks AOP	Problems Noted		Priority for Replacement
						Sediment Transport	Alignment	
M01	101207002112071	Bridge	Cate Farm Road	34	NA	√		High
M03	200037007112072	Bridge	Route 14 N	74	NA			Low
M05	101205002812051	Bridge	Max Gray Road	74	NA			Low
M06	700000000412053	Bridge	Farm Access	59	NA			Low
M06	700000000312053	Bridge	Farm Road	73	NA			Low
M08	400000000012051	Bridge	Still Brook Road	32	NA	√		High
M09	700000000112053	Bridge	Driveway	52	NA			Low
M11	200037007712052	Bridge	Route 14	114	NA		√	Moderate
M11	700000000212053	Bridge	Private Snowmobile Bridge	89	NA	√		Moderate
M12	401205002712051	Bridge	Moscow Woods Road	29	NA	√		High
M15	200037008212052	Bridge	Route 14	100	NA		√	Low
M15	200037008112052	Bridge	Route 14 (top of M15)	68	NA	√		Moderate

NA – not applicable

Table 10. Pekin Brook Bridge Crossings

Reach/ Segment No.	Structure No.	Structure Type	Road Name/ Location	% Channel Width	Blocks AOP	Problems Noted		Priority for Replacement
						Sediment Transport	Alignment	
T3.01	200037007412052	Bridge	Route 14	156	NA			Low
T3.04	990003001112051	Bridge	Pekin Brook Road	33	NA		√	High
T3.04	700000000012053	Bridge	Driveway off Pekin Brook Rd	27	NA			Moderate

NA – not applicable

Table 11. Pekin Brook Culvert Crossings

Reach/ Segment No.	Structure No.	Structure Type	Road Name/ Location	% Channel Width	Aquatic Organism Passage (AOP)	Geomorphic Compatibility	Priority for Replacement
T3.03	400003012412051	Culvert	Pekin Brook Road	35	Full AOP	**Mostly incompatible**	High
T3.04	400036040212051	Culvert	Peck Hill Road	42	Full AOP	**Partially incompatible**	High
T3.06	930001000512051	Culvert	Kent Hill Road	35	No AOP (except adult salmonids)	Fully incompatible	Highest
T3.06	400048055912051	Culvert	Singleton Road	27	Reduced AOP	**Partially incompatible**	High

6.0 STRESSOR, DEPARTURE AND SENSITIVITY ANALYSIS

Stressor, departure and sensitivity maps are presented here as a means of displaying the effects of all significant physical processes occurring within the Kingsbury Branch stream network that were observed during the Phase 1 and Phase 2 Stream Geomorphic Assessments. These maps also provide an indication of the degree to which the channel adjustment processes within the watershed have been altered, at both the watershed scale and the reach scale. The analysis of existing and historic departures from equilibrium conditions along a stream network allows for the prediction of future alterations within the watershed. This is helpful in developing and prioritizing potential protection and restoration projects.

6.1 Departure Analysis and Stressor Identification

6.1.1 Hydrologic Regime Stressors

The hydrologic regime is the timing, volume, and duration of flow events throughout the year and over time and is characterized by the input and manipulation of water at the watershed scale. When the hydrologic regime has been significantly changed, stream channels will respond by undergoing a series of channel adjustments. The land use within the watershed plays a role in the hydrology of the receiving waters. The percentage of urban and cropland development within the watershed are factors which change a watershed's response to precipitation. The most common effects of urban and cropland development is increasing peak discharges and runoff by reducing infiltration and travel time (United States Department of Agriculture 1986).

The dominant watershed land cover/land use within the Kingsbury Branch watershed is forest. All of the twenty reaches evaluated in the study had less than 10% watershed land cover/land use quantified as crop and/or urban. Analysis of hydric soils located where current land uses are agricultural or urban indicates some minor loss of wetlands within the Kingsbury Branch watershed. The loss of wetlands decreases the attenuation of peak flows within the watershed. Based on hydric soils in areas that are urban or agricultural, the lowermost subwatersheds of the Kingsbury Branch and Pekin Brook have likely experienced wetland loss of approximately 10 percent of the subwatershed area.

The Kingsbury Branch watershed has a modest network of roads as shown in Figure 11. Two subwatersheds within the study area have road densities greater than 7 miles per square mile (M12 and T3.01). This may contribute to localized increased flows resulting both from increased runoff and stormwater ditching. All other subwatersheds within the study area have road densities less than 5 miles per square mile. According to Foreman and Alexander (1998), increased peak flows in streams may be evident at road densities of 3.2 miles/ square mile. Subwatersheds with road densities of greater than 3.2 mile/ square mile account for approximately 17 percent of the entire Kingsbury Branch watershed.

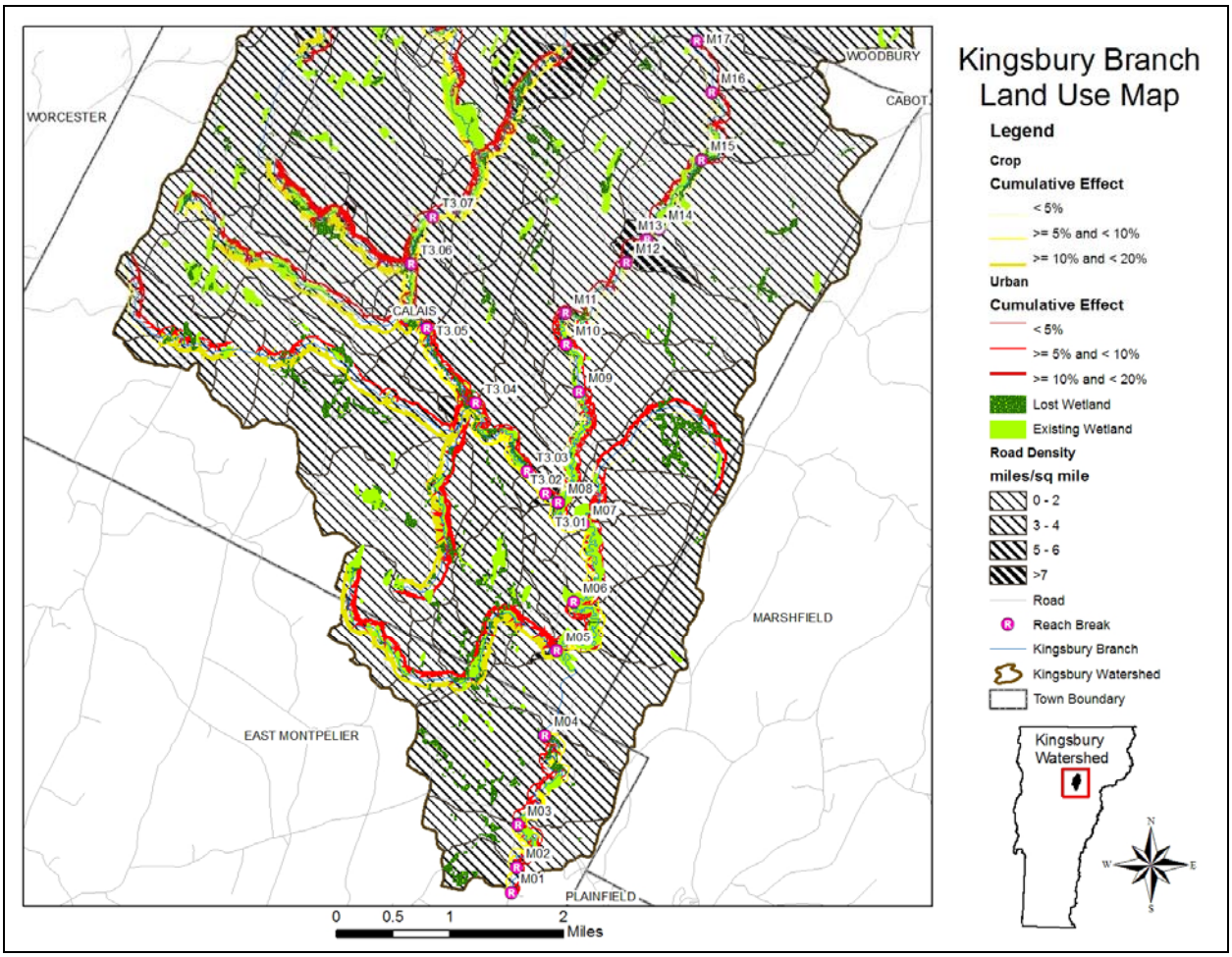


Figure 11. Land use map showing cumulative percent of urban land use, agricultural land use, road density, existing wetlands and lost wetlands

6.1.2 Sediment Regime Stressors

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 regime, and the specific morphology of the valley, floodplain, and stream. The Sediment Load Indicators Map (Page 1 and 2 of Appendix 2) show the distribution of sediment load indicators in the Kingsbury Branch watershed at the watershed scale. Bank erosion and mass failures contribute to sediment inputs along the Kingsbury Branch and Pekin Brook. Bank erosion is defined as "an area of raw and barren soil where the vegetation does not have the ability to hold the soil and/or the soil has slumped or fallen into the channel". Mass failures can occur when "a perennial stream erodes into or undercuts a high erodible landform, such as glacial lacustrine terrace". (Vermont Agency of Natural Resources, 2007b).

Mass wasting sites were common during the Stream Geomorphic Assessment and were mapped in many reaches. Thirty-one mass failures were mapped within the fourteen

Kingsbury Branch reaches. The total length of mass failures on the Kingsbury Branch is approximately 2200 linear feet (3 percent of the total channel length). Four mass failures were mapped along the six Pekin Brook reaches, amounting to 300 linear feet or one percent of the channel length. These mass failures represent a significant source of sediment within the Kingsbury Branch watershed. Localized areas of bank erosion and depositional features (steep riffles, mid channel bars, delta bars, flood chutes, and/or avulsions) are prevalent. As shown below in Table 12, the majority of the segments on the Kingsbury Branch and Pekin Brook have high bank erosion (>20% of the length) and/or depositional features (> 5 per mile).

6.1.3 Reach Scale Sediment Regime Stressors

The previously discussed alterations to flow and sediment load at the watershed scale serve as a pretext for understanding the timing and degree to which reach scale modifications are contributing to field observed channel adjustment. When the valley, floodplain, channel and channel boundary conditions are modified, a stream may change the way sediment is transported, sorted, stored and distributed. The stressors that alter these conditions either increase or decrease stream power and or increase or decrease the resistance of its boundary conditions. This is helpful for determining why a reach is under adjustment and what types of management activities will be beneficial in returning the stream to equilibrium conditions. The primary stressors in each segment of the Kingsbury Branch watershed are identified in Table 12 (Kingsbury Branch) and Table 13 (Pekin Brook).

Table 12. Kingsbury Branch Hydrologic and Sediment Load Stressors

	Watershed Input Stressors		**Reach Modification Stressors**	
River Segment	Hydrologic	Sediment load	Stream Power **Bold**=increase Plain=decrease	Boundary Resistance **Bold**=increase Plain=decrease
M01	Road Density (M) % Urban (M)	Historic Degradation Bank Erosion (H)	**Straightening (H)** **Encroachment (H)** Constriction	**Armoring (M)**
M02	% Urban (M)	Bank Erosion (H) Historic Degradation	**Straightening (M)** **Encroachment (M)**	
M03	Road Density (M) % Urban (M)		Grade Controls Constriction	Reduced riparian vegetation (M) **Grade Controls**
M04 (POND)				
M05	Road Density (M) % Urban (M)		Constriction	

Table 12. Kingsbury Branch Hydrologic and Sediment Load Stressors				
	Watershed Input Stressors		Reach Modification Stressors	
River Segment	Hydrologic	Sediment load	Stream Power **Bold**=increase Plain=decrease	Boundary Resistance **Bold**=increase Plain=decrease
M06	% Urban (M)	Bank Erosion (H)	**Straightening (H)** **Encroachment (M)** Constriction	Reduced riparian vegetation (M)
M07	% Urban (M)	Bank Erosion (H) Depositional Features (H)	**Straightening (H)** **Encroachment (H)**	Reduced riparian vegetation (M)
M08 A	% Urban (M)			Reduced riparian vegetation (M)
M08 B	% Urban (M)		Constriction	Reduced riparian vegetation (E)
M09	Stormwater Inputs (M) % Urban (M)	Bank Erosion (H) Historic Degradation Depositional Features (M)	**Straightening (H)** **Encroachment (H)** Constriction	Reduced riparian vegetation (H)
M10	Road Density (M) % Urban (M)	Bank Erosion (H) Historic Degradation Depositional Features (H)	**Straightening (H)** **Encroachment (H)**	**Armoring (M)**
M11 A	% Urban (M)	Bank Erosion (M) Depositional Features (H)	**Straightening (H)** **Encroachment (H)** Constriction	Reduced riparian vegetation (E)
M11 B	% Urban (M)	Bank Erosion (M) Historic Degradation Depositional Features (H)	**Straightening (H)** **Encroachment (H)**	Reduced riparian vegetation (M)
M12 A	Road Density (E) % Urban (M)	Historic Degradation Depositional Features (H)		
M12 B	Road Density (E) % Urban (M)		Grade Controls Constrictions	**Grade Controls**
M13 (POND)	Road Density (M)		Grade Control	
M14 A	% Urban (M)			
M14 B	Stormwater Inputs (H) %Urban (M)		**Straightening (H)** **Encroachment (M)**	Reduced riparian vegetation (M)
M14 C	% Urban (M)	Bank Erosion (M) Depositional Features (H)	**Encroachment (H)**	Reduced riparian vegetation (M)

Table 12. Kingsbury Branch Hydrologic and Sediment Load Stressors					
		Watershed Input Stressors		Reach Modification Stressors	
River Segment		Hydrologic	Sediment load	Stream Power **Bold**=increase Plain=decrease	Boundary Resistance **Bold**=increase Plain=decrease
M15	A	Road Density (M) % Urban (M)	Historic Degradation Bank Erosion (M) Depositional Features (H)	**Straightening (H)** **Encroachment (H)** Constrictions	**Armoring (M)** Reduced riparian vegetation (H)
M15	B	Road Density (M) % Urban (M)	Bank Erosion (M) Depositional Features (H)	**Straightening (H)** **Encroachment (H)**	**Armoring (M)** Reduced riparian vegetation (M)
M16		Road Density (M) % Urban (M)	Historic Degradation Bank Erosion (M)	**Straightening (H)**	Reduced riparian vegetation (H)
Moderate		Stormwater Inputs and Depositional Features 2-5 per mile; Road Density 3-4 mi/sq. mi. Straightening, Bank Armoring, Erosion, and Encroachment 5-20% Urban 5-10%; Reduced Riparian Buffer 5-20%			
High		Stormwater Inputs and Depositional Features >5 per mile; Road Density 5-6 mi/sq. mi. Straightening, Bank Armoring, Erosion, and Encroachment >20% Urban 10-20%; Reduced Riparian Buffer 20-50%			
Extreme		Road Density >7 mi/sq. mi; Reduced Riparian Buffer >50%; Urban >20%			

*Shading indicates segment was not assessed

Table 13. Pekin Brook Hydrologic and Sediment Load Stressors					
		Watershed Input Stressors		Reach Modification Stressors	
River Segment		Hydrologic	Sediment load	Stream Power **Bold**=increase Plain=decrease	Boundary Resistance **Bold**=increase Plain=decrease
T3.01		Stormwater Inputs (H) Road Density(E) % Urban (M)			Reduced riparian vegetation (H)
T3.02		Stormwater Inputs (M) Road Density (M) % Urban (M)	Bank Erosion (H)	**Straightening (H)** **Encroachment (H)**	**Armoring (M)** Reduced riparian vegetation (M)
T3.03	A	Road Density (M)		Constriction	Reduced riparian vegetation (H)

Table 13. Pekin Brook Hydrologic and Sediment Load Stressors				
	Watershed Input Stressors		Reach Modification Stressors	
River Segment	Hydrologic	Sediment load	Stream Power **Bold**=increase Plain=decrease	Boundary Resistance **Bold**=increase Plain=decrease
T3.03 B	Stormwater Inputs (H) Road Density (M) % Urban (M)	Bank Erosion (H) Depositional Features (H)	**Straightening (H)** **Encroachment (H)**	**Armoring (M)** Reduced riparian vegetation (E)
T3.04 A	Road Density (M) % Urban (M)	Bank Erosion (H)	**Straightening (H)** **Encroachment (H)** Constriction	Reduced riparian vegetation (E)
T3.04 B	Road Density (M) % Urban (M)	Bank Erosion (H) Depositional Features (H)	**Straightening (H)** **Encroachment (M)**	Reduced riparian vegetation (E)
T3.04 C	Stormwater Inputs (M) Road Density (M) % Urban (M)	Bank Erosion (H)	**Straightening (H)** **Encroachment (H)** Constriction	Reduced riparian vegetation (H)
T3.05 A	Road Density (M) % Urban (M)	Bank Erosion (M) Depositional Features (H)	**Straightening (H)**	Armoring (M)
T3.05 B	Road Density (M) % Urban (M)	Bank Erosion (M) Depositional Features (H)	**Straightening (H)**	
T3.06 A	Stormwater Inputs (M) Road Density (M) % Urban (M)	Historic Degradation Bank Erosion (M)	**Straightening (H)** **Encroachment (H)** Constriction	**Armoring (M)** Reduced riparian vegetation (H)
T3.06 B	Stormwater Inputs (H) Road Density (M) % Urban (M)	Historic Degradation Bank Erosion (M) Depositional Features (H)	**Straightening (H)** **Encroachment (H)** Constriction Grade Control	**Armoring (H)** Reduced riparian vegetation (E)
Moderate	Stormwater Inputs and Depositional Features 2-5 mile; Road Density 3-4 mi/sq. mi. Straightening, Bank Armoring, Erosion, and Encroachment 5-20% Urban 5-10%; Reduced Riparian Buffer 5-20%			
High	Stormwater Inputs and Depositional Features >5 mile; Road Density 5-6 mi/sq. mi. Straightening, Bank Armoring, Erosion, and Encroachment >20% Urban 10-20%; Reduced Riparian Buffer 20-50%			
Extreme	Road Density >7 mi/sq. mi; Reduced Riparian Buffer >50%; Urban >20%			

*Shading indicates segment was not assessed

6.1.4 Channel Slope Modifiers

Results from the Kingsbury Branch watershed indicate that primary stressors include extensive straightening of the channel along with road and development encroachments (see Channel Slope Modifiers map on page 3 and 4 of Appendix 2). Beaver dams are also common within the watershed. There are no records at the Vermont Agency of Natural Resources regarding dredging of the channel along the Kingsbury Branch or Pekin Brook. Likewise, no collected field data indicates that dredging has occurred within the area of concern in this study. However, where the channel showed that it had been straightened, it is likely that some dredging may have occurred during the straightening process.

6.1.5 Boundary Conditions and Riparian Modifiers

Riparian buffers provide many benefits. Some of these benefits are protecting and enhancing water quality, providing fish and wildlife habitat, providing streamside shading, and providing root structure to prevent bank erosion (see Boundary Conditions and Riparian Modifiers map on page 5 and 6 of Appendix 2). Three segments on Pekin Brook (T3.03-B, T3.04-A, T3.04-B) had 75 percent or more of the reach with little or no buffer on at least one bank. These stream reaches which lack a high quality riparian buffer are at a significantly higher risk of experiencing high rates of lateral erosion. Many stream banks are stabilized with rip rap or hard bank armoring where they are adjacent to human constructed infrastructure.

6.1.6 Constraints to Sediment Transport and Attenuation

Successful river corridor restoration and protection projects depend on a thorough understanding of the sources, volumes, and attenuation of flood flows and sediment loads within the stream network. If increased loads are transported through the network to a sensitive reach, where conflicts with human investments are creating a management expectation, little success can be expected unless the restoration design accommodates the increased load or finds a way to attenuate the loads upstream (Vermont Agency of Natural Resources, 2007c).

Within a reach, the principles of stream equilibrium dictate that stream power and sediment will tend to distribute evenly over time (Leopold, 1994). Changes or modifications to watershed inputs and hydraulic geometry create disequilibrium and lead to an uneven distribution of power and sediment. Large channel adjustments observed as dramatic erosion and deposition may be the result of this uneven distribution and may continue.

The sediment regime departure map (Figure 12) shows the Phase 1 reference stream sediment conditions for each reach within the stream network. These reference type streams use available floodplain access as a means to store sediment within the watershed. The majority of the stream network has a reference sediment regime of a

Coarse Equilibrium (in=out) & Fine Deposition. One bedrock dominated reach on the Kingsbury Branch (M12) is a *Transport* reach by reference.

Changes in hydrology (primarily development within the riparian corridor) and sediment storage within the watershed have altered the reference sediment regime types for some reach segments. Sediment regime departures were derived from the DMS according to the sediment regime criteria established by the Vermont Agency of Natural Resources (2007c). Some segments (M01, M02, M09, M10, M11-B, and T3.06-A) that were *Coarse Equilibrium (in=out) & Fine Deposition* type segments by reference have been converted to *Fine Source and Transport & Coarse Deposition* sediment regimes based on the Phase 2 Stream Geomorphic Assessment data. This means that most fine sediment entering the stream is either being transported through without being deposited as a result of channel incision and reduced floodplain access. M01, M02, and M11-B may have incised as a result of being sediment starved below onstream ponds. The Kingsbury Branch within reaches M09 and M10 have undergone historic straightening along Route 14 and subsequent incision. Segment T3.06-A on Pekin Brook has also been influenced by straightening along Pekin Brook Road.

Additionally coarse sediment storage is increased due to increased load along with lower transport capacity. One segment (M12-A) that was *Coarse Equilibrium (in=out) & Fine Deposition* by reference has been converted to a *Confined Source and Transport* sediment regime due to increased transport capacity derived from an incised channel below Woodbury Lake. T3.06-B that were *Coarse Equilibrium (in=out) & Fine Deposition* by reference has been converted to an *Unconfined Source and Transport* sediment regime due to increased transport capacity derived from bank armoring and channel straightening in the vicinity of the Calais Town Hall. These channel management practices have resulted in reduced attenuation of flood waters and sediment.

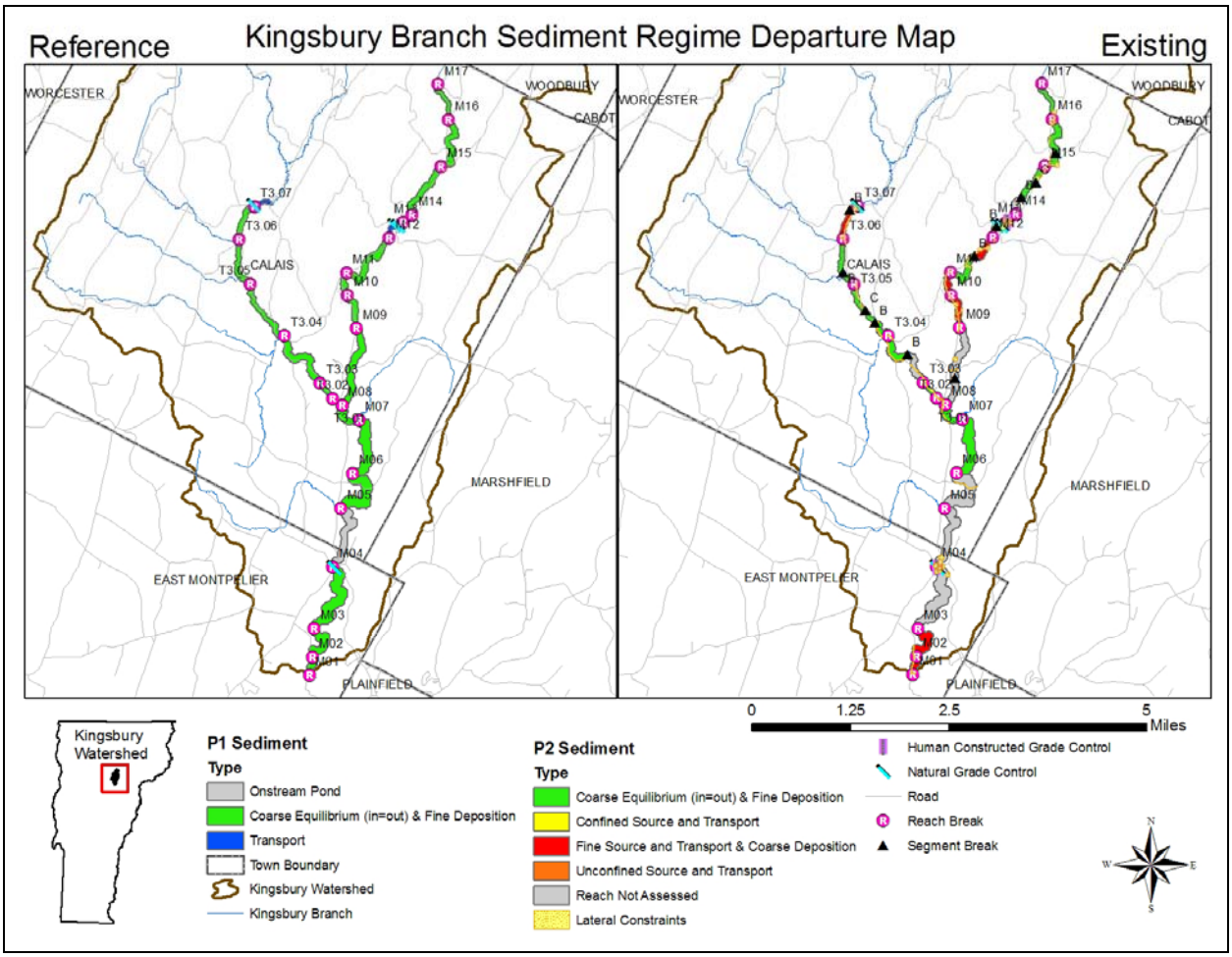


Figure 12. Sediment Regime Departure Map

The existing sediment regime for the Kingsbury Branch watershed includes reduced floodplain access, increased stream power, reduced boundary resistance, and lateral constraints at various locations throughout the stream network. Watersheds which have lost attenuation or sediment storage areas, due to human related constraints, are generally more sensitive to erosion hazards, transport greater quantities of sediment and nutrients to receiving waters, and lack the sediment storage and distribution processes that create and maintain habitat (Vermont Agency of Natural Resources, 2007c). Segments and reaches of the Kingsbury Branch watershed that can act as attenuation assets are identified below to help in designing stream corridor protection and restoration projects within the stream network. These segments include:

M05 (mostly wetland)
M06
M07
M08
M11-A
M14

M15
T3.03
T3.04-B
T3.05

6.2 Sensitivity Analysis

Stream sensitivity refers to the likelihood that a stream will respond to a watershed or local disturbance or stressor, such as; floodplain encroachment, channel straightening or armoring, changes in sediment or flow inputs, and/or disturbance of riparian vegetation (Vermont Agency of Natural Resources, 2007b). Assigning a sensitivity rating to a stream is done with the assumption that some streams, due to their setting and location within the watershed, are more likely to be in an episodic, rapid, and/or measurable state of change or adjustment. A stream's inherent sensitivity may be heightened when human activities alter the setting characteristics that influence a stream's natural adjustment rate including: boundary conditions; sediment and flow regimes; and the degree of confinement within the valley. Streams that are currently in adjustment, especially those undergoing degradation or aggradation, may become acutely sensitive (Vermont Agency of Natural Resources, 2007b).

There are many variables that are contributing to the sensitivity of the streams in the Kingsbury Branch watershed. Bank vegetation has helped to improve the boundary condition between water and land and has reduced the sensitivity of sections of the Kingsbury Branch and Pekin Brook that are well buffered. Removal of this vegetation tends to make stream segments more sensitive to channel adjustment. The location and slope of a stream also affects is morphology and sensitivity. Streams that are transporting sediment through the channel are less sensitive than streams that are storing and responding to sediment. Low gradient streams, like many in reaches in the Kingsbury Branch watershed, with high sediment supplies are very sensitive and may undergo adjustment following minor changes in channel geometry or boundary conditions.

Additionally, flow regime and floodplain constrictions may be affecting the sensitivity of Kingsbury Branch and Pekin Brook stream reaches. Changes in land use and land cover that increase impervious cover, peak discharges, and/or the frequency of high flows will heighten a stream's sensitivity to change and adjustment. Confinement becomes a significant sensitivity concern when structures such as roads, railroads, and berms significantly change the confinement ratio, reduce or restrict a stream's access to floodplain, and result in higher stream power during flood stage. Figure 13 is a map presenting the stream sensitivity, generalized according to stream type and condition, and current adjustments for each reach segment in the Kingsbury Branch watershed. Sensitivity ratings were assigned using the most current draft (September 25, 2008) of "River Corridor Protection: A Technical Guide" prepared by the Vermont River Management Program. The stream sensitivity map also documents vertical channel adjustments currently going on within a reach segment. Major aggradation adjustment processes are displayed on the corridor where they were found to be actively occurring and not evaluated as historic. This information is helpful in prioritizing the implementation of the projects identified in section

7 of this report, as certain management actions may be influenced by these active adjustment processes. Current vertical channel adjustments exist in the following reaches:

Segment ID	Current Major Adjustment Process
M01	Aggradation
M02	Aggradation
M10	Aggradation
M11-A	Aggradation
M15-B	Aggradation
M16	Aggradation

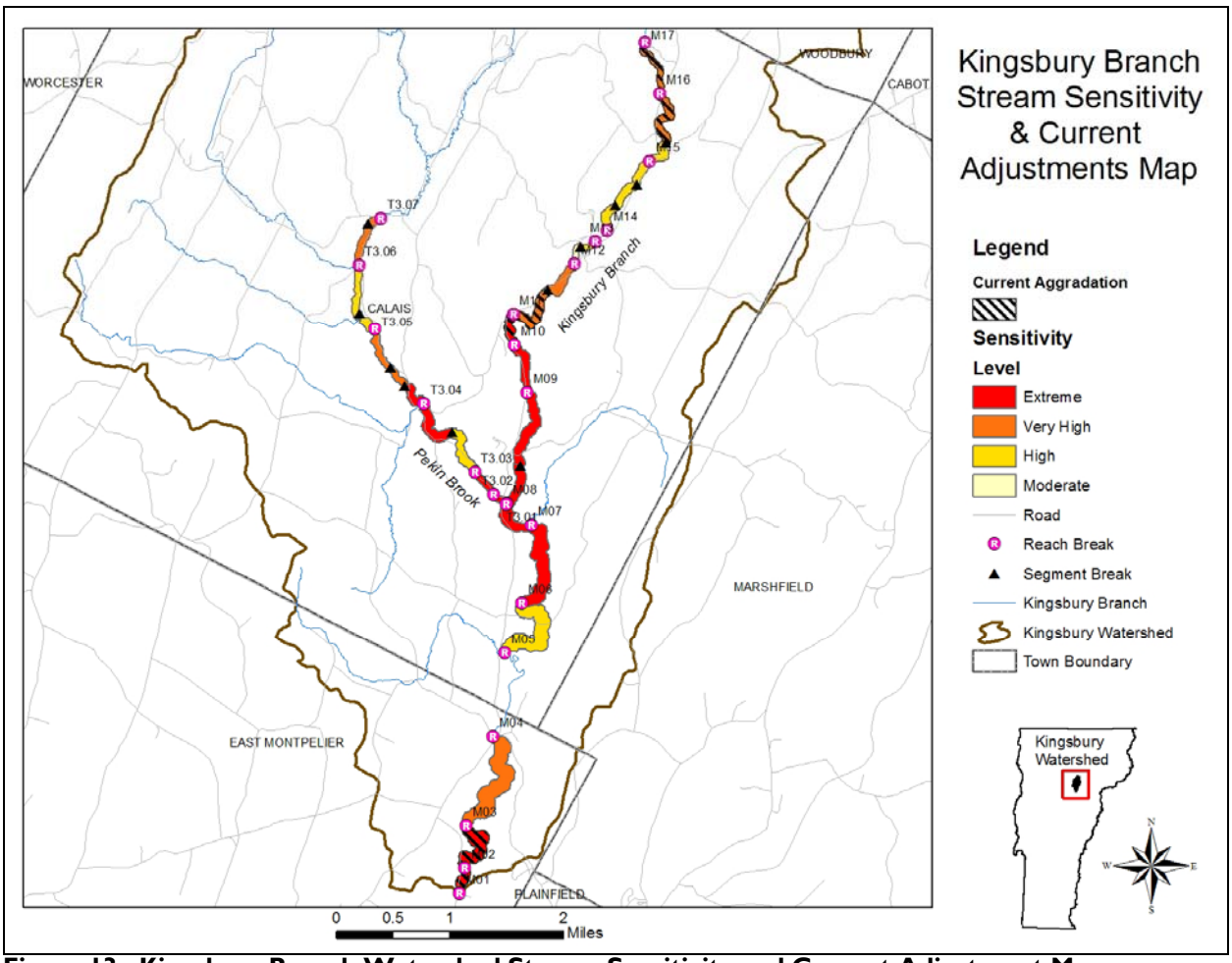


Figure 13. Kingsbury Branch Watershed Stream Sensitivity and Current Adjustment Map

7.0 PRELIMINARY PROJECT IDENTIFICATION AND PRIORITIZATION

The departure and sensitivity analyses presented in Section 6.0 of this report provide beneficial background for selecting potential projects that will effectively help the channel return to equilibrium conditions by assessing limiting factors and by identifying underlying causes of channel instability. 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, Passive Geomorphic Restoration, and Conservation.

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 the ideal results. Active riparian buffer revegetation and long-term protection of a river corridor is also essential to this alternative.

Conservation is an option to consider when stream conditions are generally good and nearing a state of dynamic equilibrium. Typically, conservation is applied to minimally disturbed stream reaches where river structure and function and vegetation associations are relatively intact.

7.1 Watershed-Level Opportunities

Fluvial Erosion Hazard Zones

Of all types of natural hazards experienced in Vermont, flash flooding represents the most frequent disaster mode and has resulted in by far the greatest magnitude of damage suffered by private property and public infrastructure. While inundation-related flood loss is a significant component of flood disasters, the predominant mode of damage is associated with the dynamic, and oftentimes catastrophic, physical adjustment of stream channel dimensions and location during storm events due to bed and bank erosion, debris and ice jams, structural failures, flow diversion, or flow modification by man-made structures. These channel adjustments and their devastating consequences have frequently been documented wherein such adjustments are related to historic channel management activities, floodplain encroachments, adjacent land use practices and/or changes to watershed hydrology associated with land use and drainage.

The purpose of defining Fluvial Erosion Hazard Zones is to prevent increases in fluvial erosion resulting from uncontrolled development in identified fluvial erosion hazard areas;

minimize property loss and damage due to fluvial erosion; prohibit land uses and development in fluvial erosion hazard areas that pose a danger to health and safety; and discourage the development of property that is unsuited for the intended purposes due to fluvial erosion hazards.

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, defined through VTANR Stream Geomorphic Assessment (2007b), 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. Additional information regarding Fluvial Erosion Hazard Zones is available on the Vermont River Management website (http://www.anr.state.vt.us/dec/waterq/rivers/htm/rv_floodhazard.htm) in the Municipal Guide to Fluvial Erosion Hazard Mitigation (Vermont Agency of Natural Resources, 2008). A model fluvial erosion hazard overlay district is provided at the end of Municipal Guide to provide local municipalities with a tool to minimize human/river conflicts and limit losses caused by fluvial erosion.

Figure 14 displays the Draft Fluvial Erosion Hazards Zones for the Kingsbury Branch watershed. The map includes a legend that provides the erosion potential from very low erosion hazard to extreme erosion hazard. As previously discussed in Section 6.2, the Sensitivity ratings are based on stream type and condition. The fluvial erosion hazard corridor widths used in draft fluvial erosion hazard zones for the Kingsbury Branch watershed are based on the recommendations presented in the draft (September 25, 2008) guidance document, "River Corridor Protection: A Vermont Technical Guide", prepared by the Vermont River Management Program. Kari Dolan of the Vermont Agency of Natural Resources River Management Program and Dan Currier of the Central Vermont Regional Planning Commission work together to develop the draft Fluvial Erosion Hazard Zones.

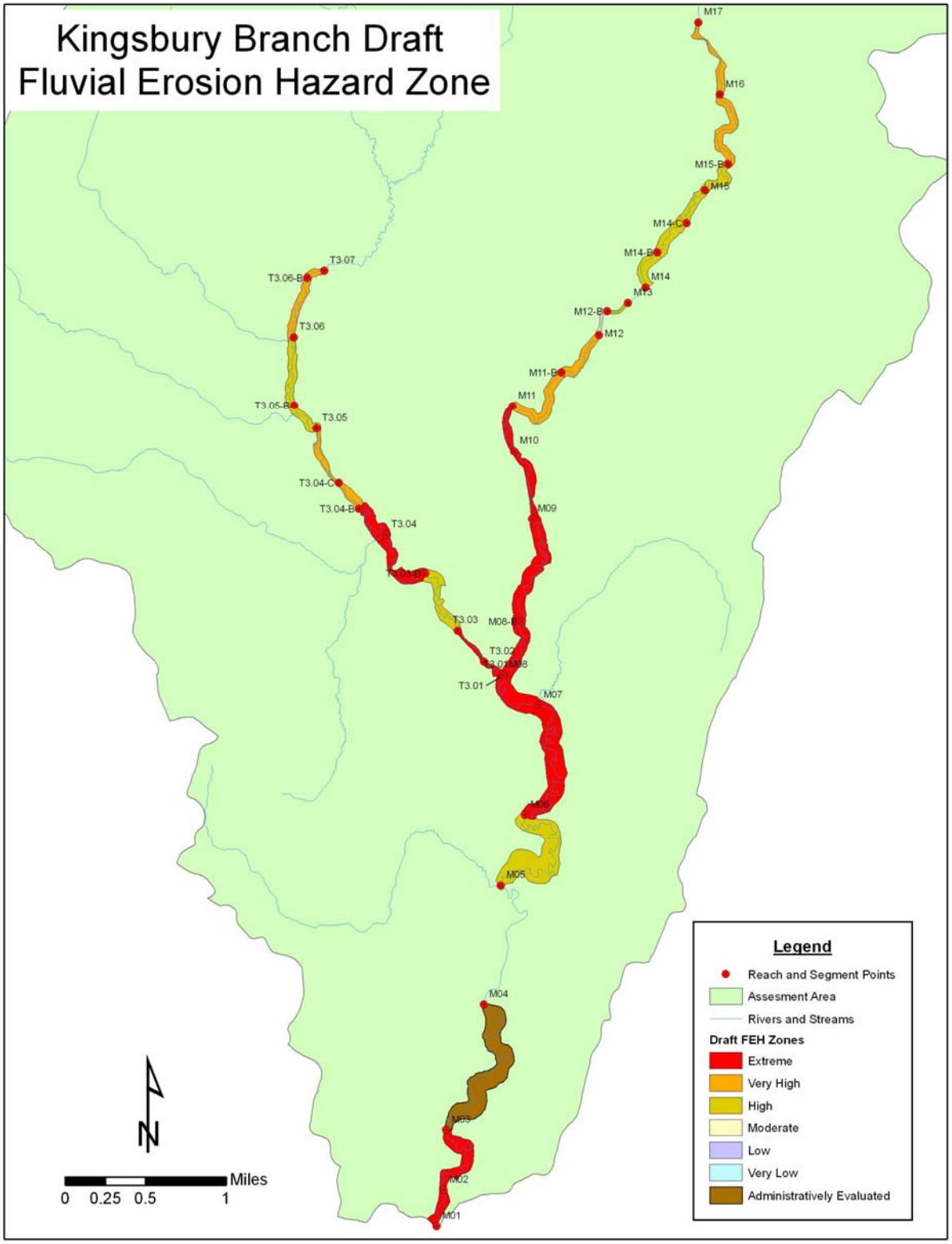


Figure 14. Draft Fluvial Erosion Hazard Zone Map for the Kingsbury Branch and Pekin Brook (prepared by Dan Currier of the Central Vermont Regional Planning Commission)

7.2 Reach-Level Opportunities

A description of each reach/segment is provided in this section along with general recommendations for restoration and protection strategies. The reaches are listed from downstream to upstream on the Kingsbury Branch and then downstream to upstream on Pekin Brook.

KINGSBURY BRANCH

Reach M01
1. Protect River Corridor

Reach M01 begins at the confluence of the Kingsbury Branch and the Winooski River. This reach has undergone a stream type departure from an "E" to a "C" channel that lacks significant bedforms and is experiencing extreme aggradation. This section of channel has been influenced by the North Montpelier Pond upstream. The reach has a healthy riparian zone with a dominant buffer width of greater than 100 feet.

Reach M02
1. Protect River Corridor

Reach M02 begins about 1200 feet upstream of the bridge at Cate Farm Road. This reach is highly sinuous and is also highly influenced by North Montpelier Pond. The lack of sediment below the pond has likely contributed to historic incision within this reach. This reach has undergone a stream type departure from an "E" to a "C" channel due to widening or planform migration and is currently undergoing a major aggradation process. M02 has an excellent riparian buffer and has abundant wetlands adjacent to the channel.

Reach M03
1. Protect River Corridor

Located directly downstream of North Montpelier Pond, Reach M03 is highly influenced by the Kingsbury Hydroelectric Project. The photos below show the river below the power house prior to and after a release on September 17, 2007. Bedrock ledge, acting as a grade control, was noted above the Route 14 bridge that is located directly below North Montpelier and upstream of the powerhouse. A partial geomorphic assessment was conducted of this reach due to limited landowner access. Although no cross section was surveyed, the reach appeared to be highly incised. This incision is likely attributed to the influence of North Montpelier Pond. The river may have incised in this area due to being sediment starved. M03 was dominated by buffer widths of greater than 100 feet of the river. There were some areas with buffers less than 25 feet

in length adjacent to commercial landuse. The reach was walked under very low flow conditions (prior to release from the hydroelectric project). Over 200 pieces of large woody debris was counted in this reach, in part due to the amount of stream bed that was exposed due to the low flow conditions.

Reach M04 – North Montpelier Pond

North Montpelier Pond is an onstream impoundment created by a concrete, gravity dam that was constructed in 1920. The dam is 15 feet high and 85 feet wide and is owned by the Kingsbury Hydroelectric Company. The facility is store and release with a maximum discharge of 1200 cubic feet per second. The impoundment is used for recreational purposes (FindLakes, 2008).

Reach M05
1. Protect River Corridor

The Kingsbury Branch within reach M05 is highly influenced by North Montpelier dam and did not receive a full phase 2 assessment for this reason. There are abundant wetlands adjacent to the channel and shrub sampling dominates the near bank, buffer and riparian corridor.

Reach M06
1. Protect Corridor
2. Evaluate Tributary 2

Reach M06 begins upstream of the impounded influence from North Montpelier Pond. Much of this reach was historically straightened for agricultural purposes and it runs through Legare Farm. The

Winooski Conservation District has been working with the farmer to plant native woody vegetation within the river corridor. This vegetation is small at this time, and will provide a high quality buffer in the future. This "E" channel is not incised but is experiencing major planform adjustment as it attempts to regain sinuosity. A tributary entering from the east at the reach break between M06 and M07 is contributing considerable sediment. A Phase 2 assessment of Tributary 2 is recommended.

Reach M07

1. Protect River Corridor

Reach M07 begins about 950 feet downstream of where Route 14 encroaches along the Kingsbury Branch, just upstream of Legare Farm. This "E" channel has been historically channelized, and major planform adjustment is evident. Overall the riparian vegetation seems to be holding the channel in place.

Reach M08

1. Improve Buffer (M08-B)

2. Protect River Corridor

The downstream end of reach M08 is at the confluence of Pekin Brook. M08 is highly influenced by beaver dams and did not receive a full Phase 2 assessment. This reach was broken into two segments due to differences in land use. The lower segment was dominated by shrub sampling in the near bank, buffer and riparian corridor and had abundant wetland adjacent to the channel. The buffer width was generally greater than 100 feet in width. The upper segment (M08-B) is hayed and is a good candidate for riparian buffer improvement.

Reach M09

1. Protect River Corridor

Reach M09 begins where the channel becomes very straight and begins to run very close to Route 14. The riffle pool bedform in this "E" channel is weak primarily due to historic straightening. Some areas are becoming more sinuous and the stream is beginning to build small benches. The channel is still widening and migrating laterally due to increased stream power. The buffer is generally good,

although some areas where the stream runs very close to Route 14 are less than 25 feet wide.

Reach M10
1. Protect River Corridor

Reach M10 begins where the Kingsbury become more sinuous along Route 14. This "E" channel is undergoing major widening with evidence of a newly created bankfull bench. This reach is also experiencing major aggradation of fine sediment and severe bank erosion on all outside beds indicating major planform adjustment. The riparian buffer is generally wider than 50 feet, although some isolated area close to Route 14, where the buffer is less than 25 feet.

Segment M11-A
1. Improve Riparian Buffer
2. Protect River Corridor

Segment M11-A begins just upstream of where Peck Hill Road meets Route 14, where the stream begins to move away from Route 14. This "C" channel has very good floodplain access and its location along the Kingsbury Branch is where the stream types change from "E" by reference to "C" by reference. This segment is extremely aggradational, having become overloaded with sediment from incision that occurred upstream in M11-B and reach 12. Also a braided channel was noted in the middle of the segment indicating major planform adjustment. The dominant buffer on both sides of this segment was substandard (<25 feet) and would be a good segment to work with landowners on river corridor protection and improving buffers.

Segment M11-B

Segment M11-B begins approximately 800 feet upstream of the snowmobile bridge in segment M11-A. This segment has historically incised resulting in a stream type departure from a "C" to a "B" channel, likely in response to being sediment starved from the onstream pond located in reach M13. This segment has an excellent riparian buffer and many downed trees creating good habitat.

Segment M12-A

1. Protect River Corridor

Segment M12-A begins about 900 feet upstream of the Route 14 bridge. This "B" channel is a transitional segment between upstream bedrock falls and "C" channels downstream. This segment has incised due to being sediment starved from onstream pond upstream in reach M13. Major planform adjustment is occurring at the base of the falls and the lower end of the segment. This segment has excellent riparian vegetation that may be preventing the channel from widening.

Segment M12-B

The upper portion of Segment M12-B contains an undersized bridge over Moscow Woods Road. Below the bridge is a 20 foot wide penstock. Both the bridge and the penstock are major channel constrictions within this segment. Below the penstock is bedrock controlled falls.

Reach M13 – Old Mill Dam

An old Mill Dam is located at the lower end of the reach, resulting in an impoundment.

Reach M14

M14 was was broken into three segments for the Phase 2 assessment. The lower segment, M14-A, did not receive a full phase 2 assessment because it is highly influenced by an old mill dam and is a wetland. A description of the other two segments is provided below.

Segment M14-B
1. Protect River Corridor

Segment M14-B begins where wetlands end just upstream of Calais recreational fields. This segment is a classic "E" channel with a broad valley and very few depositional features. This segment also has abundant wetlands adjacent to the channel.

Segment M14-C

Segment M14-C begins where channel changes from "E" ripple dune to "C" riffle pool near meander that is close to Route 14. Numerous remnant beaver dams were noted in this segment. This segment is not incised and has abundant wetlands adjacent to the channel. Major planform adjustment is occurring in this segment. This segment has excellent riparian buffers.

Segment M15-A
1. Improve Riparian Buffer

Segment M15-A begins just downstream of the Route 14 bridge near the intersection of Route 14 and Sand Hill Road. This "C" channel has little to no riparian buffers and it is not incised, making it a good candidate for buffer restoration. This segment is experiencing minor planform adjustment.

Segment M15-B
1. Protect River Corridor

Segment M15-B begins where buffer becomes more forested than downstream. This "C" channel has been historically straightened and likely pushed up against the valley wall. This has resulted in extreme planform adjustment within the segment and many mass failures are contributing abundant sediment resulting in major aggradation. The riparian buffer is generally good.

Reach M16

1. Protect River Corridor

Reach M16 begins just upstream of the Route 14 bridge that is in between the Route 14 intersections with Balentine Road and Lamberton Camp Road and continues to the outlet of Sabin Pond. The sinuosity and planform has changed due to debris jam influence on this "C" channel. This reach generally has excellent riparian buffers.

PEKIN BROOK

Reach T3.01

1. Improve Riparian Buffer

The lowest reach on Pekin Brook was heavily influenced by beavers during the Phase 2 assessment in 2007. Three beaver dams were recorded within 800 feet. Reach T3.01 is an "E" ripple-dune system. Pekin Brook Road has been responsible for a human caused change in valley width, which has also resulted in channel straightening along much of the reach. Overall, this reach appeared to be in fair geomorphic condition. The section below the Route 14 crossing and the confluence of the Kingsbury Branch had buffers less than 25 feet on both sides.

Reach T3.02

Reach T3.02 begins about 550 feet upstream of the Route 14 Bridge near Pekin Brook Road. This "E" channel has been historically straightened and has considerable bank erosion along both banks along with evidence of failed rip rap. Two remnant beaver dams were noted within the reach. Major widening and planform adjustment is occurring within this reach. Riparian buffers are generally good.

Reach T3.03

T3.03 was segmented due to beaver dam influence in the lower half of the reach. A description of the upper segment, which received a full phase 2 assessment, is provided below.

Segment T3.03-B

1. **Improve Riparian Buffer**
2. **Protect River Corridor**

Segment T3.03-B begins about 1300 feet upstream of Pekin Brook Road culvert. This "E" channel runs through an agricultural area and lacks a healthy riparian buffer along most of the segment. This segment is undergoing major planform adjustment.

Segment T3.04-A

1. **Improve Riparian Buffer**
2. **Protect River Corridor**

Segment T3.04-A begins at the culvert on Peck Hill Road near the intersection of Peck Hill Road and Pekin Brook Road. This "E" channel runs through agricultural fields that are hayed and used as cow pastures and now lacks a healthy riparian buffer. This segment was likely all straightened and is now readjusting. This segment is experiencing extreme planform adjustment and erosion is significant along this segment. The bridge at the upstream end of the segment may be causing problems in T3.04-B as flood waters have crossed the road during flood events.

Segment T3.04-B

1. **Improve Riparian Buffer**
2. **Protect River Corridor**

Segment T3.04 begins just upstream of the bridge near the intersection of Jack Hill Road and Pekin Brook Road. This "C" channel has a well developed floodplain and runs along a field on the left bank that is mowed for hay regularly leading to buffer widths <25 feet. Mass failures and erosion are present on the outside of meander bends and major planform adjustment is evident.

Segment T3.04-C

1. **Improve Riparian Buffer**

Segment T3.04-C begins at the driveway bridge off Pekin Brook Road. This "C" channel has significant erosion on the outside of meander bends, and some locations with little to no riparian buffer. This segment is experiencing major planform adjustment

in response to a corridor encroachment and historic grazing within the corridor.

Segment T3.05-A
1. Protect River Corridor

Segment T3.05-A begins about 0.5 miles upstream of the intersection of Jack Hill Road and Pekin Brook Road where valley opens up. This "C" segment has a fairly healthy and new riparian buffer, as it used to be a dairy farm but cows are no longer grazing within the corridor. No major adjustment processes are occurring within this segment.

Segment T3.05-B
1. Protect River Corridor

Segment T3.05-B begins where vegetation changes to densely forested, and thus it has a very healthy riparian buffer. This "C" segment is experiencing major planform adjustment but has good vegetation holding the banks in place.

Segment T3.06-A
1. Protect River Corridor

Segment T3.06-A begins just downstream of the intersection of Singleton Road and Pekin Brook Road where a major tributary enters Pekin Brook. This "C" segment has incised historically and is now experiencing major planform adjustment as it works to rebuild new floodplain. This segment generally has a healthy riparian buffer.

Segment T3.06-B
1. Improve Riparian buffer
2. Alternative Analysis for Berm Removal

Segment T3.06-B begins where a small tributary enters on the right bank, about 450 feet downstream of the Kent Hill Road culvert. This segment has been altered and its floodplain has been bermed to protect the town hall. This segment is experiencing major planform alteration and is lacking a healthy riparian buffer in many areas.

7.3 Site Level Opportunities

Site specific projects were identified using the criteria outlined by the ANR in Chapter 6 Preliminary Project Identification and Prioritization (Vermont Agency of Natural Resources, 2007c). This planning guide is intended to aid in the development of projects that protect and restore river equilibrium. The site level projects that were developed for the Kingsbury Branch and Pekin Brook are provided below in Tables 14 and 15. The project strategy, technical feasibility, and priority for each project are listed by project number and reach. Maps of the high priority project sites are found in Appendix 3.

7.4 Next Steps

The river corridor planning team has identified 21 potential protection and restoration projects that could successfully restore portions of the Kingsbury Branch and Pekin Brook. These projects have been identified as high, moderate or low priority based on their effectiveness and feasibility. The top ten projects have been identified for further project evaluation. Eight of the top ten projects have been rated as high priority, while two of the projects have a moderate rating. The high priority projects include buffer improvement and/or river corridor protection projects within the following reaches: M06, M07, M08, M11, M15, T3.03, T3.04 and T3.05. Two potential projects located within reach T3.06 on Pekin Brook have been given a moderate priority rating. These two projects are contingent upon an alternatives analysis for removing the berm in the vicinity of the Town Hall.

Table 14. Kingsbury Branch Site Level Opportunities for Restoration and Protection

Project #, Reach	Condition and Channel Evolution Stage	Site Description Including Stressors and Constraints	Project or Strategy Description	Technical Feasibility and Priority	Other Social Benefits	Costs	Land Use Conversion	Potential Partners
#1 M01	Fair, F-III	Influenced by North Montpelier Pond and hydroelectric facility; incised; current extreme aggradation	Protect River Corridor	Moderate priority (only one landowner)	Flood and sediment attenuation asset;	Cost of river corridor easement acquisition	No additional structures in corridor	FWR, WNRCD, ANR, VRC, CVRPC, landowners
#2 M02	Fair, F- III	Influenced by North Montpelier Pond and hydroelectric facility; incised; abundant adjacent wetlands and few lateral constraints	Protect River Corridor	Moderate priority	Flood and sediment attenuation asset	Cost of river corridor easement acquisition	No additional structures in corridor	FWR, WNRCD, ANR, VRC, CVRPC, landowners
#3 M03	Fair	Influenced by North Montpelier Pond and hydroelectric facility; incised; a few areas with buffers less than 25 feet in commercial locations; few lateral constraints	Protect River Corridor	Moderate priority	Flood and sediment attenuation asset	Cost of river corridor easement acquisition	No additional structures in corridor	FWR, WRNCD, ANR, VRC, CVRPC, landowners
#4 M05	Good	Located above North Montpelier Pond, strongly influenced by impoundment; abundant wetland	Protect River Corridor	Low priority (likely too wet for development within river corridor)	Flood and sediment attenuation asset	Cost of river corridor easement acquisition	None	FWR, WNRCD, ANR, VRC, CVRPC, landowners
#5 M06 and lower part of M07	Fair, D-IIC	Currently acting as attenuation area for sediment	Protect River Corridor	Moderate (Acquisition of a corridor easement would compliment buffer work by Winooski NRCD; downstream of straightened section along Rt 14; one landowner; wetland offers protection)	Flood and sediment attenuation asset	Cost of river corridor easements	Agricultural land to river corridor	FWR, WNRCD, ANR, VRC, CVRPC, landowners
#6 M08-B	Fair	Dominant buffer width is 0-25 feet; this segment is highly influenced by beaver	Improve Riparian Buffer	High priority	Reduce water temperature and improve bank stability	Would recommend passive revegetation due to influence of beavers	Hay to vegetated buffer	CREP, FWR, ANR,

Table 14. Kingsbury Branch Site Level Opportunities for Restoration and Protection

Project #, Reach	Condition and Channel Evolution Stage	Site Description Including Stressors and Constraints	Project or Strategy Description	Technical Feasibility and Priority	Other Social Benefits	Costs	Land Use Conversion	Potential Partners
# 7 M08-B	Fair	Currently acting as attenuation area for sediment	Protect River Corridor	High priority (few lateral constraints; Below reaches M09 and M10 that are straightened along Route 14; wetland at lower end of segment offer some protection; one landowner)	Flood and sediment attenuation asset	Cost of river corridor easement acquisition	No additional structures in corridor	FWR, WNRCD, ANR, VRC, CVRPC, landowners
#8 M09 and M10	Fair, F-III	These reaches have undergone extensive straightening due to Route 14	Protect River Corridor	Low priority (Route 14 acting as a lateral constraint, not a current attenuation asset)	There are only a few select areas that are currently offering flood and sediment attenuation	Cost of river corridor easement acquisition	No additional structures in corridor	FWR, WNRCD, ANR, VRC, CVRPC, landowners
#9 M11-A	Fair, DII-d	This segment has good floodplain access and is located in a critical flood and sediment attenuation area	Protect River Corridor	High priority (few property owners)	Flood and sediment attenuation asset	Cost of river corridor easements	No additional structures in corridor	FWR, WNRCD, ANR, VRC, CVRPC, landowners
#10 M11-A	Fair, DII-d	Dominant buffers are less than 25 feet in width	Improve Riparian Buffer	High priority (few property owners)	Reduce water temperature and improve bank stability	Cost of plants or allow the buffer to regenerate on its own	Hay to buffer	CREP, Landowners, WNRCD, FWR, CVRPC, ANR,
#11 M12-A	Fair, F-III	This segment has incised due to being sediment starved from onstream pond; The excellent riparian buffer may be preventing the river from widening.	Protect River Corridor and Existing Buffer	Moderate (few property owners)	Conservation of excellent buffer that is preventing extensive widening	Cost of river corridor easements	No additional structures in corridor	FWR, WNRCD, ANR, VRC, CVRPC, landowners
#12 M14	Good, DII-d	Abundant wetland in this reach already provides some degree of protection from development and filling within the river corridor; currently an attenuation asset	Conserve and Protect River Corridor	Low priority	Conservation	Cost of river corridor easements	No additional structures in corridor	Landowners, WRNCD, FWR, ANR, CVRPC

Table 14. Kingsbury Branch Site Level Opportunities for Restoration and Protection

Project #, Reach	Condition and Channel Evolution Stage	Site Description Including Stressors and Constraints	Project or Strategy Description	Technical Feasibility and Priority	Other Social Benefits	Costs	Land Use Conversion	Potential Partners
#13 M15-A	Good, DII-d	This segment has little to no riparian buffer and is not incised making it a good candidate for a riparian buffer improvement project.	Improve Riparian Buffer	High priority (one landowner in area with poor buffer)	Decrease water temperature, improve stability of banks	Cost of plants or allow the buffer to regenerate on its own	Hay to vegetated buffer	CREP , Landowners, FWR, ANR, WNRCD, CVRPC
#14 M15	Fair to good, DII-d	Located below reach M-16 (narrow confinement); Segment M-15 is undergoing major aggradation and planform adjustment	Protect River Corridor	High priority	Provide attenuation asset	Cost of river corridor easements	No additional structures in corridor	Landowners, FWR, WNRCD, ANR; VRC

Table 15. Pekin Brook Site Level Opportunities for Restoration and Protection

Project #, Reach	Condition and Channel Evolution Stage	Site Description Including Stressors and Constraints	Project or Strategy Description	Technical Feasibility and Priority	Other Social Benefits	Costs	Land Use Conversion	Potential Partners
#1 T3.01 to T3.03-A	Fair, D-IIC	The floodplain in the lower section of Pekin Brook has been impacted by Pekin Brook Road	Protect River Corridor	Low priority (wetland offers some degree of protection from filling and development; Pekin Brook Road acts as a lateral constraint)	Provide attenuation asset	Cost of river corridor easements	No additional structures in corridor	Property owner, ANR, FWR, WNRCD, CVRPC
#2 T3.03-B T3.04-A	Fair, D-IIC	These segments involve few landowners. The existing buffer is less than 25 feet in most locations. The river is not incised in this location making this section a good candidate for riparian buffer enhancement; beaver in lower end of watershed	Buffer improvement	High priority (few landowners)	Reduce water temperature, improve bank stability	Cost of trees and shrubs or allow vegetation to regenerate on its own	Agricultural land to buffer	CREP, Property owner, ANR, FWR, WNRCD, CVRPC
#3 T3.03-B to T3.05-A	Good to Fair, D-IIC	A portion of this segment was likely straightened and is experiencing major to extreme planform adjustment and erosion	Protect River Corridor	High priority (wetlands do not offer protection; important attenuation asset)	Allow channel to continue to adjust and provide attenuation asset	Cost of river corridor easements	No additional structures in corridor	Landowners, FWR, ANR, VRC
#4T3.05B	Good-DII-C	This segment is experiencing major planform adjustment but has good vegetation holding the banks	Protect River Corridor	Low priority (wetland offers some degree of protection from filling and development)	Provide attenuation asset	Cost of river corridor easements	No additional structures in corridor	Landowners, FWR, ANR, VRC, WNRCD

Table 15. Pekin Brook Site Level Opportunities for Restoration and Protection

Project #, Reach	Condition and Channel Evolution Stage	Site Description Including Stressors and Constraints	Project or Strategy Description	Technical Feasibility and Priority	Other Social Benefits	Costs	Land Use Conversion	Potential Partners
#5 T3.06-A	Fair, F-III	The segment has historically incised and is currently experiencing major planform adjustment as it works to rebuild new floodplain	Protect River Corridor	Low priority (good attenuation areas downstream of this segment)	Allow channel to continue to adjust	Cost of river corridor easements	No additional structures in corridor	Landowners, FWR, ANR, VRC, WNRCD
# 6 T3.06-B	Fair, F-II	This segment has been channelized and the floodplain has been bermed to protect the Calais Town Hall; it may not be possible to remove berm without causing flooding threat to town hall	Alternatives Analysis for Removing Berm near Town hall	Moderate priority (reach seems fairly stable, but is channelized straight), alternatives analysis may be expensive	Improve habitat and geomorphic stability	Cost of alternatives analysis for berm removal, excavation, and planting	Berm to floodplain	Town of Calais, FWR, ANR, WNRCD, CVRPC
#7 T3.06-B	Fair, F-II	Pekin Brook is currently incised in this reach; The dominant buffer is less than 25 feet in width; an alternatives analysis for removing the berm near the Town Hall should be done prior to planting in this area	Improve Riparian Buffer	Moderate Priority (this reach is fairly stable due to riprap on the banks and a berm)	Town property may be a perfect location for a demonstration project	Variable cost depending on size, type and quantity of plants	New buffer	Landowners, FWR, ANR, WNRCD

8.0 REFERENCES

Doolan, Barry. 1996. Geology of Vermont. In Rocks and Minerals *Vermont Issue.* Helderf Publications. 1319 Eighteenth Street, NW, Washington DC 20036-1802.

FindLakes. http://findlakes.com/north_montpelier_pond_vermont~vt00081.htm. Accessed 4/14/08.

Foreman, R.T.T. and L.E. Alexander. 1998. Roads and Their Ecological Effects: Annual. Review of Ecological Systematics. Vol. 29: 207-231.

Leopold, L.B. 1994. A View of the River. Harvard University Press. Cambridge, MA.

Milone & MacBroom, Inc. 2008a. The Vermont Culvert Geomorphic Capability Screening Tool. South Burlington, Vermont.

Milone & MacBroom, Inc. 2008b. The Vermont Culvert Aquatic Organism Passage Screening Tool, South Burlington, Vermont.

Montgomery, D., and J. Buffington. 1997. Channel-reach Morphology in Mountain Drainage Basins. Geological Society of America Bulletin; v. 109; no. 5; pp 596-611.

Rosgen, D. 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, CO.

Thompson and Sorenson. 2000. Wetland, Woodland, Wildland: A guide to the natural communities of Vermont. Capital City Press, Montpelier, Vermont.

United States Department of Agriculture. 1986. Urban Hydrology for Small Watersheds. Soil Conservation Service, Engineering Division, Technical Release 55. Washington, D.C.

Van Diver, B. 1987. Roadside Geology of Vermont and New Hampshire. Mountain Press Publishing Company. Missoula, MT.

Vermont Agency of Natural Resources, 2004. Appendix C, Channel Evolution Models, Waterbury, VT.

Vermont Agency of Natural Resources. 2005. Riparian Buffers and Corridors: Technical Papers. Waterbury, Vermont

Vermont Agency of Natural Resources. 2006. Vermont River Management Section website, Flood Hazard Management. http://www.anr.state.vt.us/dec/waterq/rivers/htm/rv_floodhazard.htm

Vermont Agency of Natural Resources. 2007a. Vermont Stream Geomorphic Assessment Phase 1 Handbook. Watershed Assessment Using Maps, Existing Data, and Windshield Surveys. Waterbury, Vermont.

Vermont Agency of Natural Resources. 2007b. Vermont Stream Geomorphic Assessment Phase 2 Handbook. Rapid Stream Assessment. Waterbury, Vermont.

Vermont Agency of Natural Resources. 2007c. Vermont Agency of Natural Resources River Corridor Planning Guide to Identify and Develop River Corridor Protection and Restoration Projects (Partially Drafted). Waterbury, Vermont.

Vermont Agency of Natural Resources. 2007d. Vermont Stream Geomorphic Assessment, Appendix G, Bridge and Culvert Assessment. Waterbury, Vermont

Vermont Agency of Natural Resources. 2008. Municipal Guide to Fluvial Erosion Hazard Mitigation. Vermont River Management Program. Waterbury, Vermont.

Vermont Geological Survey. 1961. Bedrock Map of Plainfield. http://www.anr.state.vt.us/DEC/GEO/bull16plainf/smbu16plainfield.jpg. Accessed March 2008.

Wright, S. and F. Larsen. 2004. Surficial Geology of the Barre-Montpelier Region. http://www.anr.state.vt.us/dec/geo/pdfdocs/BarreWestwright.pdf. Accessed January 2007.

APPENDIX I
STANDARD PHASE 2 DMS REPORTS

Stream: **Kingsbury Branch** Reach # **M01** Segment: **0** Completion Date: **August 10, 2007**

Organization: **Friends of the Winooski River** Observers: **MN, Frank** Why Not assessed: Rain: **Yes**

Segment Length (ft): **1,336** Segment Location: **Segment begins at confluence of Kingsbury Branch and Winooski River, just downstream of**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **None**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	1,336	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	23

1.4 Adjacent Side	Left	Right
Hillside Slope	Steep	Steep
Continuous w/	Sometimes	Sometimes
W/in 1 Bankfill	Sometimes	Sometimes
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **284**

Width Determination **Estimated**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **yes**

Step 2. Stream Channel

2.1 Bankfull Width **46**

2.2 Max Depth (ft) **4.70**

2.3 Mean Depth (ft) **3.74**

2.4 Floodprone Width (ft) **227**

Notes:

Phase 1 valley walls were mapped in the field and the phase 1 valley width was updated to result in confinement of NW rather than SC. The phase 2 channel width, rather than Phase 1 channel width, was used to determine the Phase 2 channel confinement

Step 2. (Contued)

2.5 Aband. Floodpln **7.80** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **12.30**

2.7 Entrenchment Ratio **4.93**

2.8 Incision Ratio **1.66**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Sedimented**

2.11 Riffle/Step Spacing (ft) **0**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	0%
Coarse Gravel	0%
Fine Gravel	14%
Sand	79%
Silt and smaller	7%

Silt/Clay Present? **Yes**

Detritus **8** %

Large Woody **32**

2.13 Average Largest Particle on

Bed **N/A**

Bar **N/A**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Sand**

Subclass Slope: **None**

Bed Form: **Plane Bed**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

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	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	448	239
Erosion Height (ft)	15.27	6.00
Revetmt. Type	None	Rip-Rap
Revetmt. Length (ft)	0	182
Near Bank Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin
Bank Canopy	Left	Right
Canopy %	1-25	1-25
Mid-Channel Canopy	Open	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	51-100	51-100
W less than 25	0	0
Buffer Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Deciduous	Deciduous

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Forest	Shrubs/Saplin
Sub-dominant	None	Residential
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	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 **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments **None**

Impoundmt. Location

4.6 Up/Down strm flow reg **Up Stream**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
0	0	4

Diagonal	Delta	Island
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	Yes

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **691**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: **Kingsbury Branch** Reach # **M02** Segment: **0** Completion Date: **August 9, 2007**

Organization: **Friends of the Winooski River** Observers: **MN, DS** Why Not assessed: Rain: **Yes**

Segment Length (ft): **4,436** Segment Location: **Segment begins approximately 1200 feet upstream of the bridge at Cate Farm Road.**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **None**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	748	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	0

1.4 Adjacent Side	Left	Right
Hillside Slope	Flat	Hilly
Continuous w/	Sometimes	Sometimes
W/in 1 Bankfill	Sometimes	Sometimes
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **361**

Width Determination **Estimated**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **No**

Step 2. Stream Channel

2.1 Bankfull Width **59**

2.2 Max Depth (ft) **6.30**

2.3 Mean Depth (ft) **3.60**

2.4 Floodprone Width (ft) **360**

Notes:

M02 is highly sinuous. This reach also highly influence by Montpelier Pond. The lack of sediment (sediment starved) below the pond likely contributed to incision. The incision ration was 1.44 (fair) and an incised drainage (trib) was noted within the reach.

Step 2. (Contued)

2.5 Aband. Floodpln **9.10** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **16.33**

2.7 Entrenchment Ratio **6.12**

2.8 Incision Ratio **1.44**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **High**

2.10 Riffles Type **Not Applicable**

2.11 Riffle/Step Spacing (ft) **0**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	0%
Coarse Gravel	7%
Fine Gravel	14%
Sand	79%
Silt and smaller	0%

Silt/Clay Present? **Yes**

Detritus **15** %

Large Woody **84**

2.13 Average Largest Particle on

Bed **N/A**

Bar **N/A**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Sand**

Subclass Slope: **None**

Bed Form: **Dune-Ripple**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

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	Sand	Sand
Consistency	Non-cohesive	Non-cohesive

Bank Erosion	Left	Right
Erosion Length (ft)	1,367	1,225
Erosion Height (ft)	5.42	6.17
Revetmt. Type	None	Rip-Rap
Revetmt. Length (ft)	0	79

Near Bank Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Herbaceous	Herbaceous

Bank Canopy	Left	Right
Canopy %	1-25	1-25

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	0-25	0-25
W less than 25	89	91

Buffer Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Herbaceous	Herbaceous

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	None	None
Mass Failures	172	61
Height	70	20
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **Abundant**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments

Impoundmt. Location

4.6 Up/Down strm flow reg **Up Stream**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **1**

Affected Length (ft) **150**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
1	8	7

Diagonal	Delta	Island
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
1	1	1	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	Yes

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **297**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: **Kingsbury Branch** Reach # **M03** Segment: **0** Completion Date: **September 17, 2007**

Organization: **Friends of the Winooski River** Observers: **MN, AS** Why Not assessed: **no property access** Rain: **No**

Segment Length (ft): **8,138** Segment Location: **Immediately below North Montpelier Pond, at hydroelectric project**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **None**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	**0**	**0**
height	**0**	**0**
Roads	**2,312**	**104**
height	**0**	**0**
Railroads	**0**	**0**
height	**0**	**0**
Improved Paths	**0**	**0**
height	**0**	**0**
Development	**217**	**261**

1.4 Adjacent Side	Left	Right
Hillside Slope	**Steep**	**Hilly**
Continuous w/	**Never**	**Sometimes**
W/in 1 Bankfill	**Sometimes**	**Sometimes**
Texture	**Not Evalua**	**Not Evalua**

1.5 Valley Features

Valley Width (ft) **641**

Width Determination **Estimated**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **no**

Step 2. Stream Channel

2.1 Bankfull Width **0**

2.2 Max Depth (ft) **0.00**

2.3 Mean Depth (ft) **0.00**

2.4 Floodprone Width (ft) **0**

Notes:

FWR not able to obtain landowner permisison along both banks. This reach was walked, but no cross-section was surveyed. This reach appeared to be incised and in fair geomorphic condition. The flow was very low when this reach was walked due to the store

Step 2. (Contued)

2.5 Aband. Floodpln **0.00** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **0.00**

2.7 Entrenchment Ratio **0.00**

2.8 Incision Ratio **0.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity

2.10 Riffles Type

2.11 Riffle/Step Spacing (ft) **0**

2.12 Substrate Composition

Silt/Clay Present?

Detritus **0** %

Large Woody **0**

2.13 Average Largest Particle on

Bed **0.0**

Bar **0.0**

2.14 Stream Type

Stream Type: **E**

Bed Material: **Sand**

Subclass Slope: **None**

Bed Form: **Dune-Ripple**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	**None**	**0.00**
Gullies	**None**	**0.00**

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	**Sand**	**Sand**
Consistency	**Non-cohesive**	**Non-cohesive**
Bank Erosion	Left	Right
Erosion Length (ft)	**2,610**	**1,737**
Erosion Height (ft)	**9.09**	**10.38**
Revetmt. Type	**Multiple**	**Multiple**
Revetmt. Length (ft)	**667**	**487**
Near Bank Veg. Type	Left	Right
Dominant	**Herbaceous**	**Shrubs/Saplin**
Sub-dominant	**Shrubs/Saplin**	**Herbaceous**
Bank Canopy	Left	Right
Canopy %	**1-25**	**1-25**
Mid-Channel Canopy		**Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-dominant	**0-25**	**0-25**
W less than 25	**1,227**	**547**
Buffer Veg. Type	Left	Right
Dominant	**Herbaceous**	**Shrubs/Saplin**
Sub-dominant	**Shrubs/Saplin**	**Herbaceous**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Shrubs/Saplin**	**Shrubs/Saplin**
Sub-dominant	**Commercial**	**Commercial**
Mass Failures	**321**	**120**
Height	**56**	**56**
Gullies	**0**	**0**
Height	**0**	**0**

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 **3**

4.5 Flow Regulation Type **Large Store**

Flow Regulation Use **Hydro-electric**

Impoundments

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	**0**	Road Ditch	**1**
Other	**0**	Tile Drain	**0**
Overland Flow	**0**	Urb Strm Wtr Pipe	**0**

4.9 # of Beaver Dams **2**

Affected Length (ft) **590**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
0	**0**	**0**
Diagonal	**Delta**	**Island**
0	**0**	**0**

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	**0**	**0**	**0**

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	**0**	

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **2,104**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: **Kingsbury Branch** Reach # **M05** Segment: **0** Completion Date: **August 17, 2007**

Organization: **Friends of the Winooski River** Observers: **Mary, Laura, Clay** Why Not assessed: **impounded** Rain: **No**

Segment Length (ft): **8,888** Segment Location: **Immediately above North Montpelier Pond**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **None**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	2,780	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	27

1.4 Adjacent Side	Left	Right
Hillside Slope	Very Steep	Hilly
Continuous w/	Sometimes	Never
W/in 1 Bankfill	Sometimes	Sometimes
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **633**

Width Determination **Estimated**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **yes**

Step 2. Stream Channel

2.1 Bankfull Width **0**

2.2 Max Depth (ft) **0.00**

2.3 Mean Depth (ft) **0.00**

2.4 Floodprone Width (ft) **0**

Notes:

Only a small portion of this reach was mapped. It was very deep and there were many side channels. There were also some significant debris jams. M05 is strongly influenced by the impoundment (North Montpelier Pond) and is characterized as a

Step 2. (Contued)

2.5 Aband. Floodpln **0.00** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **0.00**

2.7 Entrenchment Ratio **0.00**

2.8 Incision Ratio **0.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity

2.10 Riffles Type

2.11 Riffle/Step Spacing (ft) **0**

2.12 Substrate Composition

Silt/Clay Present?

Detritus **0** %

Large Woody **0**

2.13 Average Largest Particle on

Bed **0.0**

Bar **0.0**

2.14 Stream Type

Stream Type: **E**

Bed Material: **Sand**

Subclass Slope: **None**

Bed Form: **Dune-Ripple**

Field Measured Slope:

2.15 Reference Stream Type (if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

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	Silt	Silt
Consistency	Non-cohesive	Non-cohesive

Bank Erosion	Left	Right
Erosion Length (ft)	1,314	1,356
Erosion Height (ft)	5.00	4.02
Revetmt. Type	None	Rip-Rap
Revetmt. Length (ft)	0	19

Near Bank Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Shrubs/Saplin	Herbaceous

Bank Canopy	Left	Right
Canopy %	26-50	26-50
Mid-Channel Canopy		Open

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	51-100	51-100
W less than 25	0	0
Buffer Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Deciduous	Deciduous

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Residential	Residential
Mass Failures	106	148
Height	15	12
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Abundant**

4.2 Adjacent Wetlands **Abundant**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **2**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments

Impoundmt. Location

4.6 Up/Down strm flow reg **Down Stream**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	1	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
0	4	3
Diagonal	**Delta**	**Island**
0	1	1

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	2	1	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **383**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: **Kingsbury Branch** Reach # **M06** Segment: **0** Completion Date: **August 14, 2007**

Organization: **Friends of the Winooski River** Observers: **Mary, Laura, and Clay** Why Not assessed: Rain: **No**

Segment Length (ft): **8,589** Segment Location: **Upstream of impounded influence from North Montpelier Pond**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **None**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	1,109	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	840	33

1.4 Adjacent Side	Left	Right
Hillside Slope	Extremely	Hilly
Continuous w/	Never	Sometimes
W/in 1 Bankfill	Sometimes	Sometimes
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **577**

Width Determination **Estimated**

Confinement Type **Very Broad**

Rock Gorge? **No**

Human-caused Change? **No**

Step 2. Stream Channel

2.1 Bankfull Width **36**

2.2 Max Depth (ft) **6.70**

2.3 Mean Depth (ft) **4.43**

2.4 Floodprone Width (ft) **360**

Notes:

Much of this reach was historically straightened for agricultural purposes (see topo). Some failed riprap was observed in the field. This reach runs through the Legare Farm. The Winooski Conservation District has been working with the farmer by planting

Step 2. (Contued)

2.5 Aband. Floodpln **6.70** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **8.01**

2.7 Entrenchment Ratio **10.14**

2.8 Incision Ratio **1.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **High**

2.10 Riffles Type **Not Applicable**

2.11 Riffle/Step Spacing (ft) **0**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	0%
Coarse Gravel	0%
Fine Gravel	0%
Sand	80%
Silt and smaller	20%

Silt/Clay Present? **Yes**

Detritus **7** %

Large Woody **43**

2.13 Average Largest Particle on

Bed **N/A**

Bar **N/A**

2.14 Stream Type

Stream Type: **E**

Bed Material: **Sand**

Subclass Slope: **None**

Bed Form: **Dune-Ripple**

Field Measured Slope:

2.15 Reference Stream Type (if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

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	Clay	Clay
Consistency	Cohesive	Cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	4,105	3,446
Erosion Height (ft)	4.69	6.15
Revetmt. Type	Rip-Rap	Rip-Rap
Revetmt. Length (ft)	134	363
Near Bank Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Herbaceous	Herbaceous
Bank Canopy	Left	Right
Canopy %	1-25	1-25

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	0-25	0-25
Sub-dominant	>100	>100
W less than 25	431	198
Buffer Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Pasture	Crop
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Abundant**

4.2 Adjacent Wetlands **Abundant**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **1**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
1	14	8
Diagonal	Delta	Island
0	0	1

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	3	1	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **3,000**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: **Kingsbury Branch** Reach # **M07** Segment: **0** Completion Date: **August 14, 2007**

Organization: **Friends of the Winooski River** Observers: **Mary, Laura, Clay** Why Not assessed: Rain: **No**

Segment Length (ft): **2,817** Segment Location: **Segment begins about 950 feet downstream of where Rt 14 encroaches along the Kingsbury**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **None**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	**0**	**0**
height	**0**	**0**
Roads	**2,437**	**0**
height	**0**	**0**
Railroads	**0**	**0**
height	**0**	**0**
Improved Paths	**0**	**0**
height	**0**	**0**
Development	**0**	**0**

1.4 Adjacent Side	Left	Right
Hillside Slope	**Hilly**	**Extremely**
Continuous w/	**Never**	**Never**
W/in 1 Bankfill	**Never**	**Never**
Texture	**Not Evalua**	**Not Evalua**

1.5 Valley Features

Valley Width (ft) **732**

Width Determination **Estimated**

Confinement Type **Very Broad**

Rock Gorge? **No**

Human-caused Change? **yes**

Step 2. Stream Channel

2.1 Bankfull Width **34**

2.2 Max Depth (ft) **5.60**

2.3 Mean Depth (ft) **4.33**

2.4 Floodprone Width (ft) **465**

Notes:

Only 150 feet with riprap, but evidence of failed riprap was along a greater length of channel.

The watershed divide used to run SGAT was found to be off. A new ws shapefile was

Step 2. (Contued)

2.5 Aband. Floodpln **6.60** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **7.91**

2.7 Entrenchment Ratio **13.58**

2.8 Incision Ratio **1.18**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Moderate**

2.10 Riffles Type **Not Applicable**

2.11 Riffle/Step Spacing (ft) **0**

2.12 Substrate Composition

Bedrock	**0** %
Boulder	**0** %
Cobble	**0** %
Coarse Gravel	**0** %
Fine Gravel	**6** %
Sand	**72** %
Silt and smaller	**22** %

Silt/Clay Present? **Yes**

Detritus **2** %

Large Woody **1**

2.13 Average Largest Particle on

Bed **N/A**

Bar **N/A**

2.14 Stream Type

Stream Type: **E**

Bed Material: **Sand**

Subclass Slope: **None**

Bed Form: **Dune-Ripple**

Field Measured Slope:

2.15 Reference Stream Type (if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	**None**	**0.00**
Gullies	**None**	**0.00**

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	**Sand**	**Sand**
Consistency	**Non-cohesive**	**Non-cohesive**

Bank Erosion	Left	Right
Erosion Length (ft)	**1,453**	**1,156**
Erosion Height (ft)	**4.36**	**4.58**
Revetmt. Type	**None**	**Rip-Rap**
Revetmt. Length (ft)	**0**	**104**

Near Bank Veg. Type	Left	Right
Dominant	**Shrubs/Saplin**	**Shrubs/Saplin**
Sub-dominant	**Herbaceous**	**Herbaceous**

Bank Canopy	Left	Right
Canopy %	**1-25**	**1-25**

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-dominant	**51-100**	**26-50**
W less than 25	**0**	**0**

Buffer Veg. Type	Left	Right
Dominant	**Shrubs/Saplin**	**Herbaceous**
Sub-dominant	**Herbaceous**	**Shrubs/Saplin**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Shrubs/Saplin**	**Shrubs/Saplin**
Sub-dominant	**None**	**Residential**
Mass Failures	**0**	**0**
Height	**0**	**0**
Gullies	**0**	**0**
Height	**0**	**0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **Abundant**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	**0**	Road Ditch	**1**
Other	**0**	Tile Drain	**0**
Overland Flow	**0**	Urb Strm Wtr Pipe	**0**

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
3	**5**	**2**

Diagonal	Delta	Island
0	**1**	**0**

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	**0**	**1**	**0**

5.3 Steep Riffles and Head Cuts

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

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **1,416**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: **Kingsbury Branch** Reach # **M08** Segment: **A** Completion Date: **July 31, 2007**

Organization: **Friends of the Winooski River** Observers: **Mary and David** Why Not assessed: **beaver dam** Rain: **No**

Segment Length (ft): **3,278** Segment Location: **Segment starts about 600 feet downstream of Still Brook Road at change in landuse.**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Banks and Buffers**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	0	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	0

1.4 Adjacent Side	Left	Right
Hillside Slope	Steep	Hilly
Continuous w/	Sometimes	Never
W/in 1 Bankfill	Sometimes	Never
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **450**

Width Determination **Estimated**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **no**

Step 2. Stream Channel

2.1 Bankfull Width **0**

2.2 Max Depth (ft) **0.00**

2.3 Mean Depth (ft) **0.00**

2.4 Floodprone Width (ft) **0**

Notes:

This lower segment was not assessed due to beaver dams, wetlands, and poison ivy. No human caused change in valley width was noted in segment A. This segment is naturally narrower than the upper segment. Therefore, the phase 2 valley width for

Step 2. (Contued)

2.5 Aband. Floodpln **0.00** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **0.00**

2.7 Entrenchment Ratio **0.00**

2.8 Incision Ratio **0.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity

2.10 Riffles Type

2.11 Riffle/Step Spacing (ft) **0**

2.12 Substrate Composition

Silt/Clay Present?

Detritus **0** %

Large Woody **0**

2.13 Average Largest Particle on

Bed **0.0**

Bar **0.0**

2.14 Stream Type

Stream Type: **E**

Bed Material: **Sand**

Subclass Slope: **None**

Bed Form: **Dune-Ripple**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

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	Sand	Gravel
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	638	659
Erosion Height (ft)	4.79	5.06
Revetmt. Type	None	None
Revetmt. Length (ft)	0	0
Near Bank Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Herbaceous	Herbaceous
Bank Canopy	Left	Right
Canopy %	26-50	1-25
Mid-Channel Canopy	Open	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	None	0-25
W less than 25	0	183
Buffer Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Mixed Trees	Herbaceous

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Forest	None
Mass Failures	48	131
Height	20	24
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Abundant**

4.2 Adjacent Wetlands **Abundant**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **6**

Affected Length (ft) **2,680**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
0	8	5
Diagonal	Delta	Island
0	0	1

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	1	1	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **None**

Straightening Length: **0**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: **Kingsbury Branch** Reach # **M08** Segment: **B** Completion Date: **July 31, 2007**

Organization: **Friends of the Winooski River** Observers: **Mary and David** Why Not assessed: **beaver dam** Rain: **No**

Segment Length (ft): **6,321** Segment Location: **Segment starts at top of reach and ends approximately 600 feet below Still Brook Road**

QC Status - Staff: Provisional Cons Passed *Step 2. (Contued)*

Step 1. Valley and Floodplain

1.1 Segmentation **Banks and Buffers**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	202	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	449	32

1.4 Adjacent Side	Left	Right
Hillside Slope	Steep	Hilly
Continuous w/	Sometimes	Never
W/in 1 Bankfill	Sometimes	Never
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **620**

Width Determination **Estimated**

Confinement Type **Very Broad**

Rock Gorge? **No**

Human-caused Change? **yes**

Step 2. Stream Channel

2.1 Bankfull Width **0**

2.2 Max Depth (ft) **0.00**

2.3 Mean Depth (ft) **0.00**

2.4 Floodprone Width (ft) **0**

Notes:

Segment M08-B was also highly impacted by beaver dams. Overall, M08-B appeared to be a Rosgen "E" stream type with a riffle-pool bedform, but some of the segment was dominated by sands rather than gravel.

Step 2. (Contued)

2.5 Aband. Floodpln **0.00** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **0.00**

2.7 Entrenchment Ratio **0.00**

2.8 Incision Ratio **0.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity

2.10 Riffles Type

2.11 Riffle/Step Spacing (ft) **0**

2.12 Substrate Composition

Silt/Clay Present?

Detritus **0** %

Large Woody **0**

2.13 Average Largest Particle on

Bed **0.0**

Bar **0.0**

2.14 Stream Type

Stream Type: **E**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

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	Sand	Sand
Consistency	Non-cohesive	Non-cohesive

Bank Erosion	Left	Right
Erosion Length (ft)	995	1,118
Erosion Height (ft)	5.05	4.83
Revetmt. Type	Rip-Rap	Rip-Rap
Revetmt. Length (ft)	96	113

Near Bank Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin

Bank Canopy	Left	Right
Canopy %	1-25	1-25
Mid-Channel Canopy	Open	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	0-25	0-25
Sub-dominant	>100	>100
W less than 25	2,104	3,442

Buffer Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Hay	Hay
Sub-dominant	Forest	Shrubs/Saplin
Mass Failures	28	0
Height	20	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **Abundant**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	1	Road Ditch	1
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **9**

Affected Length (ft) **3,820**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
0	9	12
Diagonal	Delta	Island
0	0	1

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	3	1	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	Yes

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **443**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: **Kingsbury Branch** Reach # **M09** Segment: **0** Completion Date: **July 31, 2007**

Organization: **Friends of the Winooski River** Observers: **MN, Dave** Why Not assessed: Rain: **Yes**

Segment Length (ft): **2,682** Segment Location: **Segment begins where channel becomes very straight along Rt 14 and continues 2682 feet**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **None**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	**0**	**0**
height	**0**	**0**
Roads	**2,155**	**0**
height	**0**	**0**
Railroads	**0**	**0**
height	**0**	**0**
Improved Paths	**0**	**312**
height	**0**	**0**
Development	**221**	**25**

1.4 Adjacent Side	Left	Right
Hillside Slope	**Steep**	**Steep**
Continuous w/	**Sometimes**	**Never**
W/in 1 Bankfill	**Sometimes**	**Sometimes**
Texture	**Not Evalua**	**Not Evalua**

1.5 Valley Features

Valley Width (ft) **310**

Width Determination **Estimated**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **yes**

Step 2. Stream Channel

2.1 Bankfull Width **32**

2.2 Max Depth (ft) **4.00**

2.3 Mean Depth (ft) **2.72**

2.4 Floodprone Width (ft) **327**

Notes:

Weak riffle-pool bed form. Some plane bed by lower section due to historic straightening. Low w/d ratio probably due to straightening & incision. Few point bars in reach. Some areas within the reach are becoming more sinuous and the stream is beginning to build

Step 2. (Contued)

2.5 Aband. Floodpln **6.70** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **11.58**

2.7 Entrenchment Ratio **10.38**

2.8 Incision Ratio **1.67**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **380**

2.12 Substrate Composition

Bedrock	**0** %
Boulder	**0** %
Cobble	**2** %
Coarse Gravel	**14** %
Fine Gravel	**37** %
Sand	**47** %
Silt and smaller	**0** %

Silt/Clay Present? **Yes**

Detritus **5** %

Large Woody **15**

2.13 Average Largest Particle on

Bed **2.5** **inches**

Bar **1.0** **inches**

2.14 Stream Type

Stream Type: **E**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type (if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	**None**	**0.00**
Gullies	**None**	**0.00**

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	**Sand**	**Sand**
Consistency	**Non-cohesive**	**Non-cohesive**

Bank Erosion	Left	Right
Erosion Length (ft)	**931**	**372**
Erosion Height (ft)	**4.53**	**4.35**
Revetmt. Type	**None**	**Rip-Rap**
Revetmt. Length (ft)	**0**	**88**

Near Bank Veg. Type	Left	Right
Dominant	**Herbaceous**	**Herbaceous**
Sub-dominant	**Shrubs/Saplin**	**Shrubs/Saplin**

Bank Canopy	Left	Right
Canopy %	**1-25**	**1-25**

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**26-50**
Sub-dominant	**0-25**	**>100**
W less than 25	**753**	**79**

Buffer Veg. Type	Left	Right
Dominant	**Shrubs/Saplin**	**Shrubs/Saplin**
Sub-dominant	**Herbaceous**	**Herbaceous**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Shrubs/Saplin**	**Residential**
Sub-dominant	**Hay**	**Shrubs/Saplin**
Mass Failures	**107**	**0**
Height	**17**	**0**
Gullies	**0**	**0**
Height	**0**	**0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **Abundant**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	**0**	Road Ditch	**2**
Other	**0**	Tile Drain	**0**
Overland Flow	**0**	Urb Strm Wtr Pipe	**0**

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
2	**2**	**3**

Diagonal	Delta	Island
0	**0**	**1**

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	**0**	**0**	**0**

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	**0**	**Yes**

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **1,847**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: **Kingsbury Branch** Reach # **M10** Segment: **0** Completion Date: **July 27, 2007**

Organization: **Friends of the Winooski River** Observers: **MN, Dave S.** Why Not assessed: Rain: **No**

Segment Length (ft): **2,452** Segment Location: **Segment begins where stream begins to become more sinuous along Rt 14 and continues**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **None**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	2,401	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	0

1.4 Adjacent Side	Left	Right
Hillside Slope	Very Steep	Very Steep
Continuous w/	Sometimes	Never
W/in 1 Bankfill	Sometimes	Never
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **255**

Width Determination **Estimated**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **yes**

Step 2. Stream Channel

2.1 Bankfull Width **32**

2.2 Max Depth (ft) **3.70**

2.3 Mean Depth (ft) **2.79**

2.4 Floodprone Width (ft) **308**

Notes:

This reach had point bars. Most of this reach is riffle pool. In areas where straightened along Route 14, the w/d ratio is lower. No bars in these locations. Looks like channel is moving laterally - bank erosion on bends. This reach is in the early stages of buiding a

Step 2. (Contued)

2.5 Aband. Floodpln **5.60** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **11.40**

2.7 Entrenchment Ratio **9.69**

2.8 Incision Ratio **1.51**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Moderate**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **450**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	2%
Coarse Gravel	39%
Fine Gravel	35%
Sand	23%
Silt and smaller	1%

Silt/Clay Present? **No**

Detritus **5** %

Large Woody **42**

2.13 Average Largest Particle on

Bed **3.5** **inches**

Bar **1.0** **inches**

2.14 Stream Type

Stream Type: **E**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

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	Sand	Sand
Consistency	Non-cohesive	Non-cohesive

Bank Erosion	Left	Right
Erosion Length (ft)	950	824
Erosion Height (ft)	13.39	4.98
Revetmt. Type	None	Rip-Rap
Revetmt. Length (ft)	0	412

Near Bank Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin

Bank Canopy	Left	Right
Canopy %	26-50	1-25
Mid-Channel Canopy		Open

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	51-100
Sub-dominant	None	0-25
W less than 25	0	481

Buffer Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Herbaceous
Sub-dominant	Herbaceous	Shrubs/Saplin

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Forest	Residential
Sub-dominant	None	None
Mass Failures	164	0
Height	70	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **Abundant**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **1**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
4	5	4
Diagonal	**Delta**	**Island**
0	0	2

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
1	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	Yes

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **750**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Project: **Kingsbury Branch** — **Phase 2 Segment Summary** — September 22, 2008 — SGAT Version: 4.56

Stream: **Kingsbury Branch** — Reach # **M11** — Segment: **A** — Completion Date: **July 24, 2007**

Organization: **Friends of the Winooski River** — Observers: **MN, AS** — Why Not assessed: — Rain: **Yes**

Segment Length (ft): **3,199** — Segment Location: **Segment begins where stream begins to go away from Rt 14 through pasture and continues**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Channel Dimensions**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	805	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	38

1.4 Adjacent Side	Left	Right
Hillside Slope	Extremely	Hilly
Continuous w/	Sometimes	Never
W/in 1 Bankfill	Sometimes	Never
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **689**

Width Determination **Estimated**

Confinement Type **Very Broad**

Rock Gorge? **No**

Human-caused Change? **yes**

Step 2. Stream Channel

2.1 Bankfull Width **46**

2.2 Max Depth (ft) **3.65**

2.3 Mean Depth (ft) **2.32**

2.4 Floodprone Width (ft) **709**

Notes:

About 200' of straightening associated w/snowmobile bridge. No field evidence that lower section was straightened (riprap absent), but is very straight in many locations. It is possible that the stream was historically straightened (moved up against the valley

Step 2. (Contued)

2.5 Aband. Floodpln **3.65** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **19.61**

2.7 Entrenchment Ratio **15.58**

2.8 Incision Ratio **1.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Moderate**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **300**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	4%
Coarse Gravel	44%
Fine Gravel	29%
Sand	23%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **5** %

Large Woody **50**

2.13 Average Largest Particle on

Bed **6.0** **inches**

Bar **1.0** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type (if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

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	Sand	Sand
Consistency	Non-cohesive	Non-cohesive

Bank Erosion	Left	Right
Erosion Length (ft)	488	401
Erosion Height (ft)	7.44	4.84
Revetmt. Type	None	None
Revetmt. Length (ft)	0	0

Near Bank Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Herbaceous	Herbaceous

Bank Canopy	Left	Right
Canopy %	1-25	1-25

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	0-25	0-25
Sub-dominant	26-50	26-50
W less than 25	678	1,998

Buffer Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Herbaceous
Sub-dominant	Herbaceous	Shrubs/Saplin

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Pasture	Pasture
Sub-dominant	None	None
Mass Failures	159	0
Height	17	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **None**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **1**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
8	2	6
Diagonal	**Delta**	**Island**
0	0	5

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
2	0	0	1

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	No

5.4 Stream Ford or Animal **Yes**

5.5 Straightening **Straightening**

Straightening Length: **2,551**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: **Kingsbury Branch** Reach # **M11** Segment: **B** Completion Date: **July 24, 2007**

Organization: **Friends of the Winooski River** Observers: **MN, AS** Why Not assessed: Rain: **Yes**

Segment Length (ft): **2,337** Segment Location: **Segment begins approximately 800 feet upstream of snowmobile bridge in segment M11-A**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Channel Dimensions**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	1,505	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	264	81

1.4 Adjacent Side	Left	Right
Hillside Slope	Steep	Hilly
Continuous w/	Sometimes	Sometimes
W/in 1 Bankfill	Sometimes	Sometimes
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **322**

Width Determination **Estimated**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **yes**

Step 2. Stream Channel

2.1 Bankfull Width **49**

2.2 Max Depth (ft) **3.00**

2.3 Mean Depth (ft) **2.07**

2.4 Floodprone Width (ft) **78**

Notes:

200' riprap, 500' addtional possible historic straightening along field, 400' straightening along Rt 14 bridge.

Two cross sections were surveyed in this segment. The lower cross section was found

Step 2. (Contued)

2.5 Aband. Floodpln **10.00** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **23.43**

2.7 Entrenchment Ratio **1.61**

2.8 Incision Ratio **3.33**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Moderate**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **450**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	27%
Coarse Gravel	43%
Fine Gravel	21%
Sand	9%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **10** %

Large Woody **75**

2.13 Average Largest Particle on

Bed **8.0** **inches**

Bar **2.0** **inches**

2.14 Stream Type

Stream Type: **B**

Bed Material: **Gravel**

Subclass Slope: **c**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type (if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

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	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	271	247
Erosion Height (ft)	8.93	5.32
Revetmt. Type	Rip-Rap	Rip-Rap
Revetmt. Length (ft)	122	132
Near Bank Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Invasives	Invasives
Bank Canopy	Left	Right
Canopy %	51-75	51-75
Mid-Channel Canopy	Open	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	0-25	51-100
W less than 25	132	274
Buffer Veg. Type	Left	Right
Dominant	Mixed Trees	Mixed Trees
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Forest	Pasture
Sub-dominant	Residential	Forest
Mass Failures	137	53
Height	50	20
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **None**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **2**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
7	1	4
Diagonal	**Delta**	**Island**
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
3	0	Yes

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **1,181**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: **Kingsbury Branch** Reach # **M12** Segment: **A** Completion Date: **July 27, 2007**

Organization: **Friends of the Winooski River** Observers: **MN, DS** Why Not assessed: Rain: **No**

Segment Length (ft): **961** Segment Location: **Segment begins about 900 feet upstream of Route 14 bridge and continues until bedrock**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Grade Controls**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	0	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	0

1.4 Adjacent Side	Left	Right
Hillside Slope	**Very Steep**	**Steep**
Continuous w/	**Sometimes**	**Sometimes**
W/in 1 Bankfill	**Sometimes**	**Sometimes**
Texture	**Not Evalua**	**Not Evalua**

1.5 Valley Features

Valley Width (ft) **100**

Width Determination **Estimated**

Confinement Type **Semi-confined**

Rock Gorge? **No**

Human-caused Change? **no**

Step 2. Stream Channel

2.1 Bankfull Width **36**

2.2 Max Depth (ft) **3.50**

2.3 Mean Depth (ft) **2.89**

2.4 Floodprone Width (ft) **59**

Notes:

Falls, islands, step pool (very short). Plane bed. Transitional segment between falls & C channel. Most is plane bed (one long riffle). In terms of the channel evolution model, this channel may be in early stage F-III. They excellent vegetation (large trees) on the

Step 2. (Contued)

2.5 Aband. Floodpln **4.60** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **12.60**

2.7 Entrenchment Ratio **1.62**

2.8 Incision Ratio **1.31**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Not Applicable**

2.11 Riffle/Step Spacing (ft) **0**

2.12 Substrate Composition

Bedrock	0%
Boulder	10%
Cobble	40%
Coarse Gravel	38%
Fine Gravel	8%
Sand	4%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **2** %

Large Woody **2**

2.13 Average Largest Particle on

Bed **10.0** **inches**

Bar **6.0** **inches**

2.14 Stream Type

Stream Type: **B**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Plane Bed**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	**None**	**0.00**
Gullies	**None**	**0.00**

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	**Gravel**	**Gravel**
Consistency	**Non-cohesive**	**Non-cohesive**

Bank Erosion	Left	Right
Erosion Length (ft)	**43**	**0**
Erosion Height (ft)	**6.00**	**0.00**
Revetmt. Type	**None**	**None**
Revetmt. Length (ft)	**0**	**0**

Near Bank Veg. Type	Left	Right
Dominant	**Deciduous**	**Coniferous**
Sub-dominant	**Coniferous**	**Deciduous**

Bank Canopy	Left	Right
Canopy %	**76-100**	**76-100**

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-dominant	**None**	**None**
W less than 25	**0**	**0**

Buffer Veg. Type	Left	Right
Dominant	**Mixed Trees**	**Mixed Trees**
Sub-dominant	**Herbaceous**	**Herbaceous**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Forest**	**Forest**
Sub-dominant	**None**	**None**
Mass Failures	**0**	**0**
Height	**0**	**0**
Gullies	**0**	**0**
Height	**0**	**0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **None**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments

Impoundmt. Location

4.6 Up/Down strm flow reg **Up Stream**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	**0**	Road Ditch	**0**
Other	**0**	Tile Drain	**0**
Overland Flow	**0**	Urb Strm Wtr Pipe	**0**

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
2	**1**	**1**

Diagonal	Delta	Island
0	**0**	**2**

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
1	**0**	**0**	**0**

5.3 Steep Riffles and Head Cuts

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

5.4 Stream Ford or Animal **No**

5.5 Straightening **None**

Straightening Length: **0**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: **Kingsbury Branch** Reach # **M12** Segment: **B** Completion Date: **July 27, 2007**

Organization: **Friends of the Winooski River** Observers: **MN, DS** Why Not assessed: **bedrock gorge** Rain: **No**

Segment Length (ft): **797** Segment Location: **Segment begins where grade control and falls section begins and continues until about 100**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Grade Controls**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	168	307
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	245	312

1.4 Adjacent Side	Left	Right
Hillside Slope	Very Steep	Very Steep
Continuous w/	Sometimes	Sometimes
W/in 1 Bankfill	Always	Always
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **90**

Width Determination **Estimated**

Confinement Type **Narrowly**

Rock Gorge? **Yes**

Human-caused Change? **No**

Step 2. Stream Channel

2.1 Bankfull Width **0**

2.2 Max Depth (ft) **0.00**

2.3 Mean Depth (ft) **0.00**

2.4 Floodprone Width (ft) **0**

Notes:

Much of this segment consisted of a steep, bedrock falls. The upper part of the segment in the vicinity of Moscow Bridge Road was riprapped.

"Other" constriction is a penstock. It was

Step 2. (Contued)

2.5 Aband. Floodpln **0.00** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **0.00**

2.7 Entrenchment Ratio **0.00**

2.8 Incision Ratio **0.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity

2.10 Riffles Type

2.11 Riffle/Step Spacing (ft) **0**

2.12 Substrate Composition

Silt/Clay Present?

Detritus **0** %

Large Woody **0**

2.13 Average Largest Particle on

Bed **0.0**

Bar **0.0**

2.14 Stream Type

Stream Type: **A**

Bed Material: **Cobble**

Subclass Slope: **None**

Bed Form: **Cascade**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

A 3 Non Cascade

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope		
Bank Texture	Left	Right
Upper		
Material Type		
Consistency		
Lower		
Material Type		
Consistency		

Bank Erosion	Left	Right
Erosion Length (ft)	93	0
Erosion Height (ft)	20.00	0.00
Revetmt. Type	Rip-Rap	Rip-Rap
Revetmt. Length (ft)	244	270

Near Bank Veg. Type	Left	Right
Dominant		
Sub-dominant		
Bank Canopy	Left	Right
Canopy %		
Mid-Channel Canopy		

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant		
Sub-dominant		
W less than 25	0	0
Buffer Veg. Type	Left	Right
Dominant		
Sub-dominant		

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant		
Sub-dominant		
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps

4.2 Adjacent Wetlands

4.3 Flow Status

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments

Impoundmt. Location

4.6 Up/Down strm flow reg **Up Stream**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
0	0	0
Diagonal	**Delta**	**Island**
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **460**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: **Kingsbury Branch** Reach # **M14** Segment: **A** Completion Date: **July 18, 2007**

Organization: **Friends of the Winooski River** Observers: **CS, MN** Why Not assessed: **wetland** Rain: **Yes**

Segment Length (ft): **1,533** Segment Location: **Goes through wetland. Hard to walk (no access).**

QC Status - Staff: Provisional Cons

Step 1. Valley and Floodplain

1.1 Segmentation

1.2 Alluvial Fan

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	0	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	0

1.4 Adjacent Side	Left	Right
Hillside Slope		
Continuous w/		
W/in 1 Bankfill		
Texture		

1.5 Valley Features

Valley Width (ft) **0**

Width Determination

Confinement Type

Rock Gorge?

Human-caused Change?

Step 2. Stream Channel

2.1 Bankfull Width **0**

2.2 Max Depth (ft) **0.00**

2.3 Mean Depth (ft) **0.00**

2.4 Floodprone Width (ft) **0**

Notes:

KDolan RMP 5/2/08: added sensitivity rating in step 7;

Passed *Step 2. (Contued)*

2.5 Aband. Floodpln **0.00** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **0.00**

2.7 Entrenchment Ratio **0.00**

2.8 Incision Ratio **0.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity

2.10 Riffles Type

2.11 Riffle/Step Spacing (ft) **0**

2.12 Substrate Composition

Silt/Clay Present?

Detritus **0** %

Large Woody **0**

2.13 Average Largest Particle on

Bed **0.0**

Bar **0.0**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures		0.00
Gullies		0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope

Bank Texture	Left	Right
Upper		
Material Type		
Consistency		
Lower		
Material Type		
Consistency		

Bank Erosion	Left	Right
Erosion Length (ft)	0	0
Erosion Height (ft)	0.00	0.00
Revetmt. Type		
Revetmt. Length (ft)	0	0

Near Bank Veg. Type	Left	Right
Dominant		
Sub-dominant		

Bank Canopy	Left	Right
Canopy %		
Mid-Channel Canopy		

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant		
Sub-dominant		
W less than 25	0	0

Buffer Veg. Type	Left	Right
Dominant		
Sub-dominant		

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant		
Sub-dominant		
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps

4.2 Adjacent Wetlands

4.3 Flow Status

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type

Flow Regulation Use

Impoundments

Impoundmt. Location

4.6 Up/Down strm flow reg

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
0	0	0

Diagonal	Delta	Island
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	

5.4 Stream Ford or Animal

5.5 Straightening

Straightening Length: **0**

5.5 Dredging

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: **Kingsbury Branch** Reach # **M14** Segment: **B** Completion Date: **July 18, 2007**

Organization: **Friends of the Winooski River** Observers: **CS, MN** Why Not assessed: Rain: **Yes**

Segment Length (ft): **1,860** Segment Location: **Segment begins where wetland ends just upstream of Calais rec field.**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Channel Dimensions**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	381	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	80	0

1.4 Adjacent Side	Left	Right
Hillside Slope	Steep	Steep
Continuous w/	Never	Never
W/in 1 Bankfill	Never	Never
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **490**

Width Determination **Estimated**

Confinement Type **Very Broad**

Rock Gorge? **No**

Human-caused Change? **yes**

Step 2. Stream Channel

2.1 Bankfull Width **21**

2.2 Max Depth (ft) **3.30**

2.3 Mean Depth (ft) **2.49**

2.4 Floodprone Width (ft) **485**

Notes:

No pebble count (too deep) - estimated.

This segment was rated as good for both the RGA and the RHA. Segment M14-B is a classic "E" channel with a very broad valley and very few depositional features. A few

Step 2. (Contued)

2.5 Aband. Floodpln **3.30** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **8.43**

2.7 Entrenchment Ratio **23.10**

2.8 Incision Ratio **1.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Moderate**

2.10 Riffles Type **Not Applicable**

2.11 Riffle/Step Spacing (ft) **0**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	0%
Coarse Gravel	0%
Fine Gravel	25%
Sand	75%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **1** %

Large Woody **6**

2.13 Average Largest Particle on

Bed **N/A**

Bar **N/A**

2.14 Stream Type

Stream Type: **E**

Bed Material: **Sand**

Subclass Slope: **None**

Bed Form: **Dune-Ripple**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

E 5 Non Dune-Ripple

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

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	Sand	Sand
Consistency	Non-cohesive	Non-cohesive

Bank Erosion	Left	Right
Erosion Length (ft)	33	52
Erosion Height (ft)	3.00	3.00
Revetmt. Type	None	None
Revetmt. Length (ft)	0	0

Near Bank Veg. Type	Left	Right
Dominant	Herbaceous	Shrubs/Saplin
Sub-dominant	Shrubs/Saplin	Herbaceous

Bank Canopy	Left	Right
Canopy %	1-25	1-25

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	0-25	None
W less than 25	122	0

Buffer Veg. Type	Left	Right
Dominant	Herbaceous	Shrubs/Saplin
Sub-dominant	Shrubs/Saplin	Herbaceous

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Residential	None
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Abundant**

4.2 Adjacent Wetlands **Abundant**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	1	Road Ditch	1
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
0	0	5

Diagonal	Delta	Island
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	0	1	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **441**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: **Kingsbury Branch** Reach # **M14** Segment: **C** Completion Date: **July 18, 2007**

Organization: **Friends of the Winooski River** Observers: **CS, MN** Why Not assessed: Rain: **Yes**

Segment Length (ft): **1,692** Segment Location: **Segment begins where channel changes from E: ripple-dune to C: riffle pool near meander**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Channel Dimensions**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	1,692	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	68	0

1.4 Adjacent Side	Left	Right
Hillside Slope	Steep	Steep
Continuous w/	Never	Never
W/in 1 Bankfill	Never	Sometimes
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **446**

Width Determination **Estimated**

Confinement Type **Very Broad**

Rock Gorge? **No**

Human-caused Change? **yes**

Step 2. Stream Channel

2.1 Bankfull Width **42**

2.2 Max Depth (ft) **3.30**

2.3 Mean Depth (ft) **1.90**

2.4 Floodprone Width (ft) **548**

Notes:

Numerous remnant beaver dams were noted in this segment. One of the landowners in this segment mentioned that beaver had been trapped and relocated. This segment was found to be in good condition based on both the RGA and RHA. The segment is not

Step 2. (Contued)

2.5 Aband. Floodpln **3.30** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **21.84**

2.7 Entrenchment Ratio **13.20**

2.8 Incision Ratio **1.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Moderate**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **175**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	0%
Coarse Gravel	33%
Fine Gravel	44%
Sand	23%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **1** %

Large Woody **25**

2.13 Average Largest Particle on

Bed **2.0** **inches**

Bar **0.1** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type (if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

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	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	195	196
Erosion Height (ft)	3.26	5.60
Revetmt. Type	Rip-Rap	None
Revetmt. Length (ft)	33	0
Near Bank Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Herbaceous	Herbaceous
Bank Canopy	Left	Right
Canopy %	1-25	1-25
Mid-Channel Canopy		Open

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	0-25	None
W less than 25	243	0
Buffer Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Herbaceous	Herbaceous

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Residential	None
Mass Failures	0	61
Height	0	15
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Abundant**

4.2 Adjacent Wetlands **Abundant**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **1**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
3	2	3
Diagonal	**Delta**	**Island**
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
2	0	1	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
1	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **None**

Straightening Length: **0**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: **Kingsbury Branch** Reach # **M15** Segment: **A** Completion Date: **July 17, 2007**

Organization: **Friends of the Winooski River** Observers: **MN, AW** Why Not assessed: Rain: **Yes**

Segment Length (ft): **1,813** Segment Location: **Segment begins approximately 300 feet downstream of most downstream Route 14 bridge**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Banks and Buffers**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	1,108	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	86	46

1.4 Adjacent Side	Left	Right
Hillside Slope	Steep	Hilly
Continuous w/	Never	Never
W/in 1 Bankfill	Sometimes	Never
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **480**

Width Determination **Estimated**

Confinement Type **Very Broad**

Rock Gorge? **No**

Human-caused Change? **yes**

Step 2. Stream Channel

2.1 Bankfull Width **40**

2.2 Max Depth (ft) **3.10**

2.3 Mean Depth (ft) **1.77**

2.4 Floodprone Width (ft) **650**

Notes:

Straightening in this reach includes: riprap on the bend adjacent to Sand Hill Road; old bridge abutment and newer bridge. Upper part of segment appears to have been straightened at one point - no rock riprap.

Step 2. (Contued)

2.5 Aband. Floodpln **3.10** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **22.77**

2.7 Entrenchment Ratio **16.13**

2.8 Incision Ratio **1.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **190**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	1%
Coarse Gravel	70%
Fine Gravel	21%
Sand	8%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **2** %

Large Woody **10**

2.13 Average Largest Particle on

Bed **6.0** **inches**

Bar **3.0** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type (if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Moderate**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive

Bank Erosion	Left	Right
Erosion Length (ft)	172	53
Erosion Height (ft)	5.00	5.00
Revetmt. Type	Rip-Rap	None
Revetmt. Length (ft)	285	0

Near Bank Veg. Type	Left	Right
Dominant	Herbaceous	Shrubs/Saplin
Sub-dominant	Shrubs/Saplin	Herbaceous

Bank Canopy	Left	Right
Canopy %	0	1-25

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	0-25	0-25
Sub-dominant	26-50	26-50
W less than 25	841	621

Buffer Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	Coniferous	Shrubs/Saplin

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Hay	Hay
Sub-dominant	Forest	Residential
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **None**

4.3 Flow Status **High**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **1**

Affected Length (ft) **420**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
2	1	3
Diagonal	**Delta**	**Island**
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
1	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
1	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **1,192**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: **Kingsbury Branch** Reach # **M15** Segment: **B** Completion Date: **July 17, 2007**

Organization: **Friends of the Winooski River** Observers: **MN, AW** Why Not assessed: Rain: **Yes**

Segment Length (ft): **3,559** Segment Location: **Segment begins where buffer becomes more forested about 1800 feet upstream of start of**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Banks and Buffers**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	758	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	83	58

1.4 Adjacent Side	Left	Right
Hillside Slope	Steep	Hilly
Continuous w/	Sometimes	Never
W/in 1 Bankfill	Sometimes	Never
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **490**

Width Determination **Estimated**

Confinement Type **Very Broad**

Rock Gorge? **No**

Human-caused Change? **yes**

Step 2. Stream Channel

2.1 Bankfull Width **41**

2.2 Max Depth (ft) **3.20**

2.3 Mean Depth (ft) **2.00**

2.4 Floodprone Width (ft) **208**

Notes:

Straightening associated with Rt 14. Looks like this segment historically pushed up against the valley wall. Also straightened at stream crossing.

Step 2. (Contued)

2.5 Aband. Floodpln **3.20** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **20.50**

2.7 Entrenchment Ratio **5.07**

2.8 Incision Ratio **1.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Moderate**

2.10 Riffles Type **Sedimented**

2.11 Riffle/Step Spacing (ft) **235**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	25%
Coarse Gravel	58%
Fine Gravel	8%
Sand	9%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **20** %

Large Woody **128**

2.13 Average Largest Particle on

Bed **5.0** **inches**

Bar **3.0** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type (if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

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	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	373	241
Erosion Height (ft)	4.04	5.47
Revetmt. Type	None	Rip-Rap
Revetmt. Length (ft)	0	251
Near Bank Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Herbaceous	Herbaceous
Bank Canopy	Left	Right
Canopy %	1-25	1-25

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	26-50
Sub-dominant	0-25	0-25
W less than 25	143	311
Buffer Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Coniferous	Herbaceous

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Forest	Shrubs/Saplin
Sub-dominant	Shrubs/Saplin	Residential
Mass Failures	193	0
Height	52	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **Abundant**

4.3 Flow Status **High**

4.4 # of Debris Jams **3**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
7	6	12
Diagonal	**Delta**	**Island**
0	0	4

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
11	1	1	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
5	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **1,654**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: **Kingsbury Branch** Reach # **M16** Segment: **0** Completion Date: **July 19, 2007**

Organization: **Friends of the Winooski River** Observers: **PD, CM** Why Not assessed: Rain: **Yes**

Segment Length (ft): **2,841** Segment Location: **Just upstream from Rt 14 bridge until outlet of Sabin Pond.**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **None**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	151	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	311	0

1.4 Adjacent Side	Left	Right
Hillside Slope	Very Steep	Very Steep
Continuous w/	Sometimes	Sometimes
W/in 1 Bankfill	Sometimes	Sometimes
Texture	Sand	Sand

1.5 Valley Features

Valley Width (ft) **221**

Width Determination **Estimated**

Confinement Type **Narrow**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **47**

2.2 Max Depth (ft) **2.80**

2.3 Mean Depth (ft) **1.98**

2.4 Floodprone Width (ft) **119**

Notes:

Sinuosity and planform has changed quite a bit due to debris jam influence.

Poor bankfull indicators in this reach.

Since this reach is just downstream of Sabin

Step 2. (Contued)

2.5 Aband. Floodpln **3.30** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **23.74**

2.7 Entrenchment Ratio **2.53**

2.8 Incision Ratio **1.18**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Moderate**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **275**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	30%
Coarse Gravel	28%
Fine Gravel	10%
Sand	28%
Silt and smaller	4%

Silt/Clay Present? **No**

Detritus **15** %

Large Woody **70**

2.13 Average Largest Particle on

Bed **6.0** **inches**

Bar **3.0** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type (if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

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	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	490	238
Erosion Height (ft)	4.17	2.77
Revetmt. Type	Rip-Rap	None
Revetmt. Length (ft)	83	0
Near Bank Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	Coniferous	Coniferous
Bank Canopy	Left	Right
Canopy %	76-100	76-100

Mid-Channel Canopy **Closed**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	0-25	51-100
W less than 25	572	187
Buffer Veg. Type	Left	Right
Dominant	Mixed Trees	Mixed Trees
Sub-dominant	Herbaceous	Herbaceous

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Forest	Forest
Sub-dominant	Residential	Bare
Mass Failures	0	171
Height	0	20
Gullies	0	0
Height	0	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 **8**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments

Impoundmt. Location

4.6 Up/Down strm flow reg **Up Stream**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
3	5	5
Diagonal	**Delta**	**Island**
0	0	3

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
4	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	No

5.4 Stream Ford or Animal **Yes**

5.5 Straightening **Straightening**

Straightening Length: **807**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Project: **Kingsbury Branch** **Phase 2 Segment Summary** September 22, 2008 SGAT Version: 4.56

Stream: **Pekin Brook** Reach # **T3.01** Segment: **0** Completion Date: **July 5, 2007**

Organization: **Friends of the Winooski River** Observers: **MN,PD,AS** Why Not assessed: **beaver dam** Rain: **Yes**

Segment Length (ft): **814** Segment Location: **Segment begins at confluence with Kingsbury Branch and continues under Rt 14 bridge 814**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **None**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	511	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	48

1.4 Adjacent Side	Left	Right
Hillside Slope	Hilly	Very Steep
Continuous w/	Never	Sometimes
W/in 1 Bankfill	Never	Sometimes
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **200**

Width Determination **Estimated**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **yes**

Step 2. Stream Channel

2.1 Bankfull Width **0**

2.2 Max Depth (ft) **0.00**

2.3 Mean Depth (ft) **0.00**

2.4 Floodprone Width (ft) **0**

Notes:

There is some road encroachment on left side. Buffer <25' is due to mostly herbaceous species and not encroachments downstream of Rt 14.

KDolan RMP 5/2/08: Added sensitivity to

Step 2. (Contued)

2.5 Aband. Floodpln **0.00** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **0.00**

2.7 Entrenchment Ratio **0.00**

2.8 Incision Ratio **0.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity

2.10 Riffles Type

2.11 Riffle/Step Spacing (ft) **0**

2.12 Substrate Composition

Silt/Clay Present?

Detritus **0** %

Large Woody **0**

2.13 Average Largest Particle on

Bed **0.0**

Bar **0.0**

2.14 Stream Type

Stream Type: **E**

Bed Material: **Sand**

Subclass Slope: **None**

Bed Form: **Dune-Ripple**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Silt	Silt
Consistency	Cohesive	Cohesive
Lower		
Material Type	Clay	Clay
Consistency	Cohesive	Cohesive

Bank Erosion	Left	Right
Erosion Length (ft)	383	267
Erosion Height (ft)	5.25	5.39
Revetmt. Type	Multiple	Hard Bank
Revetmt. Length (ft)	115	43

Near Bank Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Herbaceous	Coniferous

Bank Canopy	Left	Right
Canopy %	1-25	26-50

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	51-100	>100
Sub-dominant	0-25	0-25
W less than 25	284	283

Buffer Veg. Type	Left	Right
Dominant	Herbaceous	Shrubs/Saplin
Sub-dominant	Shrubs/Saplin	Mixed Trees

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Residential	Forest
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Abundant**

4.2 Adjacent Wetlands **Minimal**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	2
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **3**

Affected Length (ft) **650**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
0	0	0

Diagonal	Delta	Island
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **690**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: **Pekin Brook** Reach # **T3.02** Segment: **0** Completion Date: **August 10, 2007**

Organization: **Friends of the Winooski River** Observers: **MN** Why Not assessed: Rain: **Yes**

Segment Length (ft): **1,389** Segment Location: **Reach begins about 550 feet upstream of Route 14 Bridge near Pekin Brook Rd and**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **None**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	1,389	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	0

1.4 Adjacent Side	Left	Right
Hillside Slope	Steep	Steep
Continuous w/	Never	Sometimes
W/in 1 Bankfill	Sometimes	Sometimes
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **130**

Width Determination **Measured**

Confinement Type **Narrow**

Rock Gorge? **No**

Human-caused Change? **yes**

Step 2. Stream Channel

2.1 Bankfull Width **31**

2.2 Max Depth (ft) **4.80**

2.3 Mean Depth (ft) **3.88**

2.4 Floodprone Width (ft) **116**

Notes:

Reach runs along Pekin Brook Rd. - evidence of failed riprap (historic straightening likely in 100% of reach). There was considerable bank erosion (along 73% of the banks). There was so question whether the RAF should be bankfull or the left bank; either way the

Step 2. (Contued)

2.5 Aband. Floodpln **5.50** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **8.07**

2.7 Entrenchment Ratio **3.71**

2.8 Incision Ratio **1.15**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Sedimented**

2.11 Riffle/Step Spacing (ft) **0**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	0%
Coarse Gravel	3%
Fine Gravel	21%
Sand	64%
Silt and smaller	12%

Silt/Clay Present? **Yes**

Detritus **3** %

Large Woody **7**

2.13 Average Largest Particle on

Bed **N/A**

Bar **N/A**

2.14 Stream Type

Stream Type: **E**

Bed Material: **Sand**

Subclass Slope: **None**

Bed Form: **Plane Bed**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

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	Sand	Sand
Consistency	Non-cohesive	Non-cohesive

Bank Erosion	Left	Right
Erosion Length (ft)	913	1,119
Erosion Height (ft)	5.58	4.25
Revetmt. Type	Rip-Rap	Rip-Rap
Revetmt. Length (ft)	102	119

Near Bank Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Herbaceous	Herbaceous

Bank Canopy	Left	Right
Canopy %	1-25	51-75

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	26-50	>100
Sub-dominant	0-25	None
W less than 25	146	0

Buffer Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Herbaceous	Deciduous

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Shrubs/Saplin	Forest
Sub-dominant	Residential	None
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Abundant**

4.2 Adjacent Wetlands **Abundant**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **2**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	1
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
0	0	2

Diagonal	Delta	Island
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **1,365**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Project: **Kingsbury Branch** **Phase 2 Segment Summary** September 22, 2008 SGAT Version: 4.56

Stream: **Pekin Brook** Reach # **T3.03** Segment: **A** Completion Date: **August 16, 2007**

Organization: **Friends of the Winooski River** Observers: **PD, TM** Why Not assessed: **beaver dam** Rain: **Yes**

Segment Length (ft): **3,396** Segment Location: **Segment begins near where natural valley gets wider and then continues until about 1300**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Banks and Buffers**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	2,186	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	28

1.4 Adjacent Side	Left	Right
Hillside Slope	Steep	Extremely
Continuous w/	Sometimes	Sometimes
W/in 1 Bankfill	Sometimes	Sometimes
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **245**

Width Determination **Estimated**

Confinement Type **Narrow**

Rock Gorge? **No**

Human-caused Change? **yes**

Step 2. Stream Channel

2.1 Bankfull Width **0**

2.2 Max Depth (ft) **0.00**

2.3 Mean Depth (ft) **0.00**

2.4 Floodprone Width (ft) **0**

Notes:

Reach was segmented due to changes in buffer and beaver dam influence.

KDolan RMP 5-2-08: Added sensitivity to Step 7.

Step 2. (Contued)

2.5 Aband. Floodpln **0.00** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **0.00**

2.7 Entrenchment Ratio **0.00**

2.8 Incision Ratio **0.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity

2.10 Riffles Type

2.11 Riffle/Step Spacing (ft) **0**

2.12 Substrate Composition

Silt/Clay Present?

Detritus **0** %

Large Woody **0**

2.13 Average Largest Particle on

Bed **0.0**

Bar **0.0**

2.14 Stream Type

Stream Type: **E**

Bed Material: **Sand**

Subclass Slope: **None**

Bed Form: **Dune-Ripple**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

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	Clay	Clay
Consistency	Cohesive	Cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	817	914
Erosion Height (ft)	4.08	4.06
Revetmt. Type	None	None
Revetmt. Length (ft)	0	0
Near Bank Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin
Bank Canopy	Left	Right
Canopy %	1-25	1-25
Mid-Channel Canopy	Open	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	51-100	26-50
W less than 25	0	766
Buffer Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Shrubs/Saplin	Mixed Trees

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Residential	Forest
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	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 **1**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **3**

Affected Length (ft) **2,370**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
2	6	4
Diagonal	Delta	Island
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **170**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Project: **Kingsbury Branch** | **Phase 2 Segment Summary** | September 22, 2008 SGAT Version: 4.56

Stream: **Pekin Brook** Reach # **T3.03** Segment: **B** Completion Date: **August 16, 2007**

Organization: **Friends of the Winooski River** Observers: **PD, TM** Why Not assessed: Rain: **Yes**

Segment Length (ft): **3,369** Segment Location: **Segment begins about 1300 feet upstream of Pekin Brook Rd culvert where land use on left**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Banks and Buffers**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	2,453	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	60	0

1.4 Adjacent Side	Left	Right
Hillside Slope	Steep	Extremely
Continuous w/	Sometimes	Never
W/in 1 Bankfill	Sometimes	Never
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **380**

Width Determination **Estimated**

Confinement Type **Very Broad**

Rock Gorge? **No**

Human-caused Change? **yes**

Step 2. Stream Channel

2.1 Bankfull Width **38**

2.2 Max Depth (ft) **4.50**

2.3 Mean Depth (ft) **3.50**

2.4 Floodprone Width (ft) **292**

Notes:

Most of reach is ripple dune, but there are some riffle-pool features. This reach was segmented due to changes in buffer and beaver dam influence on T3.03-A. This segment has a lot of hay/cow pasture and there is no buffer alternating on left and right

Step 2. (Contued)

2.5 Aband. Floodpln **4.50** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **10.86**

2.7 Entrenchment Ratio **7.68**

2.8 Incision Ratio **1.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Moderate**

2.10 Riffles Type **Not Applicable**

2.11 Riffle/Step Spacing (ft) **0**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	0%
Coarse Gravel	22%
Fine Gravel	28%
Sand	43%
Silt and smaller	7%

Silt/Clay Present? **Yes**

Detritus **20** %

Large Woody **75**

2.13 Average Largest Particle on

Bed **N/A**

Bar **N/A**

2.14 Stream Type

Stream Type: **E**

Bed Material: **Sand**

Subclass Slope: **None**

Bed Form: **Dune-Ripple**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

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	Silt	Silt
Consistency	Cohesive	Cohesive

Bank Erosion	Left	Right
Erosion Length (ft)	1,612	1,082
Erosion Height (ft)	5.00	5.13
Revetmt. Type	Rip-Rap	Rip-Rap
Revetmt. Length (ft)	94	469

Near Bank Veg. Type	Left	Right
Dominant	Herbaceous	Shrubs/Saplin
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin

Bank Canopy	Left	Right
Canopy %	0	0

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	0-25	0-25
Sub-dominant	>100	26-50
W less than 25	1,414	3,094

Buffer Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Hay	Residential
Sub-dominant	Forest	Hay
Mass Failures	67	0
Height	40	0
Gullies	0	0
Height	0	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 **2**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	1	Road Ditch	3
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **1**

Affected Length (ft) **100**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
8	10	5

Diagonal	Delta	Island
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	1	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **1,304**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Project: **Kingsbury Branch** | **Phase 2 Segment Summary** | September 22, 2008 | SGAT Version: 4.56

Stream: **Pekin Brook** | Reach # **T3.04** | Segment: **A** | Completion Date: **August 9, 2007**

Organization: **Friends of the Winooski River** | Observers: **PD, AW** | Why Not assessed: | Rain: **Yes**

Segment Length (ft): **2,654** | Segment Location: **Segment begins at culvert on Peck Hill Rd. near intersection of Peck Hill Rd and Pekin**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Channel Dimensions**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	1,595	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	44	70

1.4 Adjacent Side	Left	Right
Hillside Slope	Hilly	Extremely
Continuous w/	Never	Never
W/in 1 Bankfill	Never	Sometimes
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **410**

Width Determination **Estimated**

Confinement Type **Very Broad**

Rock Gorge? **No**

Human-caused Change? **yes**

Step 2. Stream Channel

2.1 Bankfull Width **29**

2.2 Max Depth (ft) **4.00**

2.3 Mean Depth (ft) **3.20**

2.4 Floodprone Width (ft) **418**

Notes:

Fields along reach are hayed and used as cow pasture. The segment is experiencing adjustment in two locations. The upstream location is where T3.04-B wants to avulse right near bridge. Flood waters during July 2007 flood crossed the road from T3-04-B

Step 2. (Contued)

2.5 Aband. Floodpln **4.00** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **9.06**

2.7 Entrenchment Ratio **14.41**

2.8 Incision Ratio **1.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **High**

2.10 Riffles Type **Not Applicable**

2.11 Riffle/Step Spacing (ft) **0**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	0%
Coarse Gravel	7%
Fine Gravel	33%
Sand	44%
Silt and smaller	16%

Silt/Clay Present? **Yes**

Detritus **20** %

Large Woody **30**

2.13 Average Largest Particle on

Bed **N/A**

Bar **N/A**

2.14 Stream Type

Stream Type: **E**

Bed Material: **Sand**

Subclass Slope: **None**

Bed Form: **Dune-Ripple**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

E 5 Non Dune-Ripple

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Undercut**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Silt	Silt
Consistency	Cohesive	Cohesive

Bank Erosion	Left	Right
Erosion Length (ft)	1,081	523
Erosion Height (ft)	2.94	2.88
Revetmt. Type	Rip-Rap	Rip-Rap
Revetmt. Length (ft)	59	155

Near Bank Veg. Type	Left	Right
Dominant	Pasture	Herbaceous
Sub-dominant	Herbaceous	Invasives

Bank Canopy	Left	Right
Canopy %	0	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	2,654	1,970

Buffer Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	Shrubs/Saplin	Invasives

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Hay	Residential
Sub-dominant	Shrubs/Saplin	Hay
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **None**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **1**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
1	4	5
Diagonal	**Delta**	**Island**
0	0	1

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	0	1	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **2,604**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: **Pekin Brook** Reach # **T3.04** Segment: **B** Completion Date: **August 9, 2007**

Organization: **Friends of the Winooski River** Observers: **PD, AW** Why Not assessed: Rain: **Yes**

Segment Length (ft): **1,327** Segment Location: **Segment begins just upstream of bridge near Jack Hill Rd intersection with Pekin Brook Rd**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Corridor Encroachment**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	93	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	0

1.4 Adjacent Side	Left	Right
Hillside Slope	Hilly	Very Steep
Continuous w/	Never	Never
W/in 1 Bankfill	Never	Sometimes
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **260**

Width Determination **Estimated**

Confinement Type **Narrow**

Rock Gorge? **No**

Human-caused Change? **no**

Step 2. Stream Channel

2.1 Bankfull Width **44**

2.2 Max Depth (ft) **3.60**

2.3 Mean Depth (ft) **2.30**

2.4 Floodprone Width (ft) **348**

Notes:

Field on left bank is mowed for hay regularly leading to buffer widths <25'. Mass failure and erosion present on outside of meander bends. At downstream end of segment (just before bridge) flood water went across road into T3.04-A during July 2007 flood. Bridge

Step 2. (Contued)

2.5 Aband. Floodpln **4.60** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **19.13**

2.7 Entrenchment Ratio **7.91**

2.8 Incision Ratio **1.28**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Moderate**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **160**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	0%
Coarse Gravel	23%
Fine Gravel	19%
Sand	35%
Silt and smaller	23%

Silt/Clay Present? **Yes**

Detritus **20** %

Large Woody **40**

2.13 Average Largest Particle on

Bed **1.5** **inches**

Bar **1.0** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Sand**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type (if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

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	Clay	Clay
Consistency	Cohesive	Cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	349	294
Erosion Height (ft)	2.89	3.27
Revetmt. Type	None	None
Revetmt. Length (ft)	0	0
Near Bank Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin
Bank Canopy	Left	Right
Canopy %	1-25	1-25
Mid-Channel Canopy		Open

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	0-25	>100
Sub-dominant	26-50	None
W less than 25	1,327	0
Buffer Veg. Type	Left	Right
Dominant	Herbaceous	Shrubs/Saplin
Sub-dominant	Shrubs/Saplin	Mixed Trees

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Hay	Forest
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin
Mass Failures	0	65
Height	0	10
Gullies	0	0
Height	0	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 **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
2	4	1
Diagonal	Delta	Island
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **448**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: **Pekin Brook** Reach # **T3.04** Segment: **C** Completion Date: **July 26, 2007**

Organization: **Friends of the Winooski River** Observers: **PD, CM** Why Not assessed: Rain: **No**

Segment Length (ft): **2,627** Segment Location: **Segment begins at driveway bridge and continues 2050 feet to T3.05.**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Corridor Encroachment**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	2,089	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	25

1.4 Adjacent Side	Left	Right
Hillside Slope	Hilly	Very Steep
Continuous w/	Never	Sometimes
W/in 1 Bankfill	Sometimes	Sometimes
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **210**

Width Determination **Estimated**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **yes**

Step 2. Stream Channel

2.1 Bankfull Width **33**

2.2 Max Depth (ft) **4.25**

2.3 Mean Depth (ft) **2.27**

2.4 Floodprone Width (ft) **312**

Notes:

Some road encroachment is present on this reach which has resulted in some locations having <25' buffer. Significant erosion on outside of meander bends.

The floodprone width at the cross section was

Step 2. (Contued)

2.5 Aband. Floodpln **4.95** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **14.54**

2.7 Entrenchment Ratio **9.45**

2.8 Incision Ratio **1.16**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Moderate**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **220**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	0%
Coarse Gravel	30%
Fine Gravel	35%
Sand	29%
Silt and smaller	6%

Silt/Clay Present? **Yes**

Detritus **10** %

Large Woody **6**

2.13 Average Largest Particle on

Bed **1.0** **inches**

Bar **1.5** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type (if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

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	Silt	Silt
Consistency	Cohesive	Cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	834	605
Erosion Height (ft)	6.84	3.62
Revetmt. Type	Rip-Rap	Rip-Rap
Revetmt. Length (ft)	128	92
Near Bank Veg. Type	Left	Right
Dominant	Herbaceous	Shrubs/Saplin
Sub-dominant	Shrubs/Saplin	Herbaceous
Bank Canopy	Left	Right
Canopy %	1-25	1-25
Mid-Channel Canopy	Open	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	26-50	>100
Sub-dominant	0-25	None
W less than 25	1,147	26
Buffer Veg. Type	Left	Right
Dominant	Herbaceous	Shrubs/Saplin
Sub-dominant	Shrubs/Saplin	Mixed Trees

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Residential	Forest
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin
Mass Failures	83	0
Height	10	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **Abundant**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **1**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	2
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
1	14	5
Diagonal	**Delta**	**Island**
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
5	1	2	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	Yes

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **1,323**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Phase 2 Segment Summary

Reach # T3.05 Observers: MN, AS, DS Segment Location: Segment begins about 0.5 miles upstream of the intersection of Jack Hill Rd and Pekin

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation: **Banks and Buffers**

1.2 Alluvial Fan: **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	0	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	0

1.4 Adjacent Side	Left	Right
Hillside Slope	Very Steep	Steep
Continuous w/	Never	Never
W/in 1 Bankfill	Sometimes	Sometimes
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft): **550**
Width Determination: **Estimated**
Confinement Type: **Very Broad**
Rock Gorge?: **No**
Human-caused Change?: **no**

Step 2. Stream Channel

2.1 Bankfull Width: **47**
2.2 Max Depth (ft): **3.30**
2.3 Mean Depth (ft): **1.83**
2.4 Floodprone Width (ft): **547**

Notes:

Reach was segmented due to changes in buffer. On the orthophoto, it looks like there is no buffer on either bank. There is regeneration of speckled alders. This used to be a dairy farm, but cows are no longer grazing along buffer.

Step 2. (Contued)

2.5 Aband. Floodpln: **3.30** ft.
Human Elev Floodpln: **0.00** ft.
2.6 Width/Depth Ratio: **25.79**
2.7 Entrenchment Ratio: **11.59**
2.8 Incision Ratio: **1.00**
Human Elevated Inc Rat: **0.00**
2.9 Sinuosity: **Moderate**
2.10 Riffles Type: **Complete**
2.11 Riffle/Step Spacing (ft): **250**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	0%
Coarse Gravel	43%
Fine Gravel	37%
Sand	20%
Silt and smaller	0%

Silt/Clay Present?: **No**
Detritus: **10** %
Large Woody: **31**

2.13 Average Largest Particle on

Bed: **5.0** inches
Bar: **2.5** inches

2.14 Stream Type

Stream Type: **C**
Bed Material: **Gravel**
Subclass Slope: **None**
Bed Form: **Riffle-Pool**
Field Measured Slope:

2.15 Reference Stream Type (if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope: **Moderate**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive

Bank Erosion	Left	Right
Erosion Length (ft)	306	298
Erosion Height (ft)	5.25	4.70
Revetmt. Type	Rip-Rap	None
Revetmt. Length (ft)	159	0

Near Bank Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin

Bank Canopy	Left	Right
Canopy %	1-25	1-25

Mid-Channel Canopy: **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	51-100	>100
Sub-dominant	None	None
W less than 25	0	0

Buffer Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Pasture	Shrubs/Saplin
Sub-dominant	Shrubs/Saplin	None
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	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: **0**
4.5 Flow Regulation Type: **None**
Flow Regulation Use
Impoundments
Impoundmt. Location
4.6 Up/Down strm flow reg: **None**
(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams: **0**
Affected Length (ft): **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
2	5	2
Diagonal	**Delta**	**Island**
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	No

5.4 Stream Ford or Animal: **Yes**
5.5 Straightening: **Straightening**
Straightening Length: **559**
5.5 Dredging: **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: **Pekin Brook** Reach # **T3.05** Segment: **B** Completion Date: **July 6, 2007**

Organization: **Friends of the Winooski River** Observers: **MN, AS, DS** Why Not assessed: Rain: **Yes**

Segment Length (ft): **2,920** Segment Location: **Segment begins where vegetation changes approximately 1400 upstream of T3.05-A.**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Banks and Buffers**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	0	87
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	0

1.4 Adjacent Side	Left	Right
Hillside Slope	Very Steep	Steep
Continuous w/	Never	Sometimes
W/in 1 Bankfill	Never	Sometimes
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **310**

Width Determination **Estimated**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **no**

Step 2. Stream Channel

2.1 Bankfull Width **49**

2.2 Max Depth (ft) **3.20**

2.3 Mean Depth (ft) **1.78**

2.4 Floodprone Width (ft) **165**

Notes:

Step 2. (Contued)

2.5 Aband. Floodpln **3.20** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **27.53**

2.7 Entrenchment Ratio **3.37**

2.8 Incision Ratio **1.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Moderate**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **200**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	0%
Coarse Gravel	38%
Fine Gravel	28%
Sand	20%
Silt and smaller	14%

Silt/Clay Present? **No**

Detritus **20** %

Large Woody **71**

2.13 Average Largest Particle on

Bed **5.0** **inches**

Bar **2.5** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type (if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Moderate**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Gravel
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive

Bank Erosion	Left	Right
Erosion Length (ft)	343	560
Erosion Height (ft)	3.96	3.83
Revetmt. Type	Rip-Rap	None
Revetmt. Length (ft)	52	0

Near Bank Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Herbaceous	Herbaceous

Bank Canopy	Left	Right
Canopy %	26-50	1-25

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	None	0-25
W less than 25	0	0

Buffer Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Mixed Trees	Herbaceous

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Forest	Forest
Mass Failures	0	81
Height	0	80
Gullies	0	0
Height	0	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 **2**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
5	12	10

Diagonal	Delta	Island
1	0	1

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
1	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **1,598**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Project: **Kingsbury Branch** **Phase 2 Segment Summary** September 22, 2008 SGAT Version: 4.56

Stream: **Pekin Brook** Reach # **T3.06** Segment: **A** Completion Date: **July 5, 2007**

Organization: **Friends of the Winooski River** Observers: **MN, PD, AS** Why Not assessed: Rain: **Yes**

Segment Length (ft): **2,826** Segment Location: **Segment begins just downstream of intersection of Singleton Rd and Pekin Brook Rd where**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Banks and Buffers**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	2,319	55
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	37

1.4 Adjacent Side	Left	Right
Hillside Slope	Very Steep	Steep
Continuous w/	Sometimes	Never
W/in 1 Bankfill	Sometimes	Never
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **307**

Width Determination **Estimated**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **44**

2.2 Max Depth (ft) **3.20**

2.3 Mean Depth (ft) **2.16**

2.4 Floodprone Width (ft) **162**

Notes:

Reach is building new floodplain.

Step 2. (Contued)

2.5 Aband. Floodpln **5.90** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **20.37**

2.7 Entrenchment Ratio **3.68**

2.8 Incision Ratio **1.84**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Moderate**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **150**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	0%
Coarse Gravel	50%
Fine Gravel	18%
Sand	32%
Silt and smaller	0%

Silt/Clay Present? **Yes**

Detritus **1** %

Large Woody **15**

2.13 Average Largest Particle on

Bed **2.6** **inches**

Bar **2.6** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type (if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Gravel
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	321	385
Erosion Height (ft)	4.18	4.24
Revetmt. Type	Rip-Rap	Rip-Rap
Revetmt. Length (ft)	213	131
Near Bank Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Herbaceous	Herbaceous
Bank Canopy	Left	Right
Canopy %	1-25	1-25
Mid-Channel Canopy	Open	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	51-100	>100
Sub-dominant	26-50	0-25
W less than 25	0	612
Buffer Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Herbaceous	Herbaceous

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Residential	Shrubs/Saplin
Sub-dominant	Shrubs/Saplin	Residential
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **None**

4.2 Adjacent Wetlands **Minimal**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	1	Road Ditch	1
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **2**

Affected Length (ft) **1,050**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
1	12	4
Diagonal	**Delta**	**Island**
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
2	0	1	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **1,331**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Project: **Kingsbury Branch** | **Phase 2 Segment Summary** | | September 22, 2008 | SGAT Version: 4.56

Stream: **Pekin Brook** | Reach # **T3.06** | Segment: **B** | Completion Date: **July 19, 2007**

Organization: **Friends of the Winooski River** | Observers: **PD, CM, AS** | Why Not assessed: | Rain: **Yes**

Segment Length (ft): **661** | Segment Location: **Segment begins where tributary enters on right bank and continues about 200 feet**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Banks and Buffers**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	253	139
height	0	0
Roads	252	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	108	217

1.4 Adjacent Side	Left	Right
Hillside Slope	Hilly	Hilly
Continuous w/	Never	Never
W/in 1 Bankfill	Never	Never
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **290**

Width Determination **Estimated**

Confinement Type **Very Broad**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **32**

2.2 Max Depth (ft) **3.80**

2.3 Mean Depth (ft) **2.15**

2.4 Floodprone Width (ft) **299**

Notes:

Segment has been altered and flood plain bermed to protect town hall. The segment appears stable and is rip-rapped on both sides of stream. Landowner on left bank mows close to stream. There are some trees on both sides, but not many.

Step 2. (Contued)

2.5 Aband. Floodpln **7.40** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **14.88**

2.7 Entrenchment Ratio **9.33**

2.8 Incision Ratio **1.95**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Not Applicable**

2.11 Riffle/Step Spacing (ft) **0**

2.12 Substrate Composition

Bedrock	0%
Boulder	1%
Cobble	36%
Coarse Gravel	40%
Fine Gravel	9%
Sand	14%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **3** %

Large Woody **2**

2.13 Average Largest Particle on

Bed	10.0	inches
Bar	4.0	inches

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Plane Bed**

Field Measured Slope:

2.15 Reference Stream Type (if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

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	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	0	70
Erosion Height (ft)	0.00	4.48
Revetmt. Type	Rip-Rap	Rip-Rap
Revetmt. Length (ft)	307	484
Near Bank Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Herbaceous	Herbaceous
Bank Canopy	Left	Right
Canopy %	1-25	1-25
Mid-Channel Canopy	Open	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	0-25	0-25
Sub-dominant	51-100	51-100
W less than 25	451	471
Buffer Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Residential	Residential
Sub-dominant	Hay	Forest
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **None**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **None**

Flow Regulation Use

Impoundments

Impoundmt. Location

4.6 Up/Down strm flow reg **None**

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	1
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
0	1	1
Diagonal	**Delta**	**Island**
1	1	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
0	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **661**

5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: **Kingsbury Branch** Reach # **M01** Segment: **0** Completion Date: **August 10, 2007**

Organization: **Friends of the Winooski River** Observers: **MN, Frank** Rain: **Yes**

Segment Length (ft): **1,336** Segment Location: **Segment begins at confluence of Kingsbury Branch and Winooski River, just**

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	25.6	Yes	Yes	Yes	Yes

Problem: Deposition Above,Scour Below

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**7**	**None**	**Yes**
7.2 Channel Aggradation	**5**	**Other**	**No**
7.3 Widening Channel	**12**		**No**
7.4 Change in Planform	**13**		**No**
Total Score	**37**		
Geomorphic Rating	**0.4625**		

Channel Evolution Model **F**

Channel Evolution Stage **III**

Geomorphic Condition **Fair**

Stream Sensitivity **Extreme**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **Low**

	Score
6.1 Epifaunal Substrate - Available Cover	6
6.2 Pool Substrate	6
6.3 Pool Variability	3
6.4 Sediment Deposition	8
6.5 Channel Flow Status	15
6.6 Channel Alteration	9
6.7 Channel Sinuosity	7
6.8 Bank Stability	Left: 6 Right: 7
6.9 Bank Vegetation Protection	Left: 8 Right: 8
6.10 Riparian Vegetation Zone Width	Left: 9 Right: 8
Total Score	100
Habitat Rating	0.5

Habitat Stream Condition **Fair**

Narrative:

Major historical degradation, extreme aggradation (upstream reaches contributing sediment), minor widening & planform adjustment.

Stream: **Kingsbury Branch** Reach # **M02** Segment: **0** Completion Date: **August 9, 2007**

Organization: **Friends of the Winooski River** Observers: **MN, DS** Rain: **Yes**

Segment Length (ft): **4,436** Segment Location: **Segment begins approximately 1200 feet upstream of the bridge at Cate Farm Road.**

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPS Taken

4.8 Channel Constrictions **None**

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**8**	**None**	**Yes**
7.2 Channel Aggradation	**9**	**None**	**No**
7.3 Widening Channel	**10**		**No**
7.4 Change in Planform	**9**		**No**
Total Score	**36**		
Geomorphic Rating	**0.45**		

Channel Evolution Model **F**

Channel Evolution Stage **III**

Geomorphic Condition **Fair**

Stream Sensitivity **Extreme**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **Low**

	Score
6.1 Epifaunal Substrate - Available Cover	12
6.2 Pool Substrate	13
6.3 Pool Variability	13
6.4 Sediment Deposition	16
6.5 Channel Flow Status	17
6.6 Channel Alteration	15
6.7 Channel Sinuosity	11
6.8 Bank Stability	Left: 5 Right: 6
6.9 Bank Vegetation Protection	Left: 9 Right: 9
6.10 Riparian Vegetation Zone Width	Left: 9 Right: 9
Total Score	144
Habitat Rating	0.72

Habitat Stream Condition **Good**

Narrative:

Major historic deg. (likely related to N. Montpelier Pond - sediment starved), major aggradation, widening and planform adjustment. Fair amount of lateral bank erosion. An avulsion and neck cutoff mapped within this reach.

Stream: **Kingsbury Branch** Reach # **M03** Segment: **0** Completion Date: **September 17,**

Organization: **Friends of the Winooski River** Observers: **MN, AS** Rain: **No**

Segment Length (ft): **8,138** Segment Location: **Immediately below North Montpelier Pond, at hydroelectric project**

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Ledge	Mid-segment	0.00	0.00	Yes	
Ledge	Mid-segment	0.00	0.00	Yes	
Dam	Mid-segment	15.00	15.00	Yes	

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	55.0	Yes	Yes	No	Yes

Problem: Scour Below

Narrative:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type

Channel Evolution Model

Channel Evolution Stage

Geomorphic Condition **Fair**

Stream Sensitivity **Extreme**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	53.0	Yes	Yes	No	Yes
Problem	Scour Above,Scour Below				

Narrative:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type

Channel Evolution Model

Channel Evolution Stage

Geomorphic Condition **Good**

Stream Sensitivity **High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Stream: **Kingsbury Branch** Reach # **M06** Segment: **0** Completion Date: **August 14, 2007**

Organization: **Friends of the Winooski River** Observers: **Mary, Laura, and Clay** Rain: **No**

Segment Length (ft): **8,589** Segment Location: **Upstream of impounded influence from North Montpelier Pond**

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	26.0	Yes	Yes	Yes	Yes
Problem	Deposition Above,Scour Above,Scour				
Bridge	21.0	Yes	Yes	Yes	Yes
Problem	Deposition Above,Deposition Below,Scour				
Bridge	25.0	Yes	No	Yes	No
Problem	Deposition Above,Scour Above,Scour				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**16**	**None**	**No**
7.2 Channel Aggradation	**12**	**None**	**No**
7.3 Widening Channel	**13**		**No**
7.4 Change in Planform	**6**		**No**

Total Score **47**

Geomorphic Rating **0.5875**

Channel Evolution Model **D**

Channel Evolution Stage **IIc**

Geomorphic Condition **Fair**

Stream Sensitivity **Extreme**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **Low**

	Score
6.1 Epifaunal Substrate - Available Cover	10
6.2 Pool Substrate	6
6.3 Pool Variability	14
6.4 Sediment Deposition	14
6.5 Channel Flow Status	20
6.6 Channel Alteration	11
6.7 Channel Sinuosity	13
6.8 Bank Stability	Left: 4 Right: 5
6.9 Bank Vegetation Protection	Left: 8 Right: 8
6.10 Riparian Vegetation Zone Width	Left: 2 Right: 2
Total Score	117
Habitat Rating	0.585

Habitat Stream Condition **Fair**

Narrative:

Not incised (incision ratio of 1.0), major planform adjustment and minor aggradation and widening. Channel has some planebed characteristics.

Stream: **Kingsbury Branch** Reach # **M07** Segment: **0** Completion Date: **August 14, 2007**

Organization: **Friends of the Winooski River** Observers: **Mary, Laura, Clay** Rain: **No**

Segment Length (ft): **2,817** Segment Location: **Segment begins about 950 feet downstream of where Rt 14 encroaches along the**

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions **None**

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**16**	**None**	**No**
7.2 Channel Aggradation	**13**	**None**	**No**
7.3 Widening Channel	**12**		**No**
7.4 Change in Planform	**8**		**No**
Total Score	**49**		
Geomorphic Rating	**0.6125**		

Channel Evolution Model **D**

Channel Evolution Stage **IIc**

Geomorphic Condition **Fair**

Stream Sensitivity **Extreme**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **Low**

	Score
6.1 Epifaunal Substrate - Available Cover	8
6.2 Pool Substrate	9
6.3 Pool Variability	13
6.4 Sediment Deposition	14
6.5 Channel Flow Status	16
6.6 Channel Alteration	8
6.7 Channel Sinuosity	9
6.8 Bank Stability	Left: 4 Right: 4
6.9 Bank Vegetation Protection	Left: 9 Right: 9
6.10 Riparian Vegetation Zone Width	Left: 9 Right: 6
Total Score	118
Habitat Rating	0.59

Habitat Stream Condition **Fair**

Narrative:

Steeper gradient imposed through channelization has likely led to increased stream power. Channel appears to be moving laterally with major planform adjustment evident. Overall the good vegetation (shrub-sapling) is holding the channel in place.

Stream: **Kingsbury Branch** Reach # **M08** Segment: **A** Completion Date: **July 31, 2007**

Organization: **Friends of the Winooski River** Observers: **Mary and David** Rain: **No**

Segment Length (ft): **3,278** Segment Location: **Segment starts about 600 feet downstream of Still Brook Road at change in landuse.**

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	29.0	Yes	Yes	Yes	No
Problem		Deposition Above,Scour Above,Scour			

Narrative:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type

Channel Evolution Model

Channel Evolution Stage

Geomorphic Condition **Fair**

Stream Sensitivity **Extreme**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPS Taken

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	16.0	Yes	Yes	Yes	Yes
Problem	Scour Above,Scour Below				

Narrative:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type

Channel Evolution Model

Channel Evolution Stage

Geomorphic Condition **Fair**

Stream Sensitivity **Extreme**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Stream: **Kingsbury Branch** Reach # **M09** Segment: **0** Completion Date: **July 31, 2007**

Organization: **Friends of the Winooski River** Observers: **MN, Dave** Rain: **Yes**

Segment Length (ft): **2,682** Segment Location: **Segment begins where channel becomes very straight along Rt 14 and continues 2682**

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	26.0	Yes	Yes	Yes	Yes
Problem		Deposition Above,Scour Above,Scour			

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**8**	**None**	**Yes**
7.2 Channel Aggradation	**12**	**None**	**No**
7.3 Widening Channel	**13**		**No**
7.4 Change in Planform	**9**		**No**
Total Score	**42**		
Geomorphic Rating	**0.525**		

Channel Evolution Model **F**

Channel Evolution Stage **III**

Geomorphic Condition **Fair**

Stream Sensitivity **Extreme**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **Low**

	Score
6.1 Epifaunal Substrate - Available Cover	10
6.2 Pool Substrate	10
6.3 Pool Variability	9
6.4 Sediment Deposition	9
6.5 Channel Flow Status	14
6.6 Channel Alteration	12
6.7 Channel Sinuosity	3
6.8 Bank Stability	Left: 6 Right: 7
6.9 Bank Vegetation Protection	Left: 7 Right: 8
6.10 Riparian Vegetation Zone Width	Left: 8 Right: 5
Total Score	108
Habitat Rating	0.54

Habitat Stream Condition **Fair**

Narrative:

Major historic degradation, minor widening, aggradation and major planform adjustment. Some areas stream is becoming more sinuous. Stream is building small bankfull benches on both sides.

Stream: **Kingsbury Branch** Reach # **M10** Segment: **0** Completion Date: **July 27, 2007**

Organization: **Friends of the Winooski River** Observers: **MN, Dave S.** Rain: **No**

Segment Length (ft): **2,452** Segment Location: **Segment begins where stream begins to become more sinuous along Rt 14 and**

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions **None**

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**8**	**None**	**Yes**
7.2 Channel Aggradation	**10**	**None**	**No**
7.3 Widening Channel	**10**		**No**
7.4 Change in Planform	**8**		**No**
Total Score	**36**		
Geomorphic Rating	**0.45**		

Channel Evolution Model **F**

Channel Evolution Stage **III**

Geomorphic Condition **Fair**

Stream Sensitivity **Extreme**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **High**

	Score
6.1 Epifaunal Substrate - Available Cover	11
6.2 Embeddedness	8
6.3 Velocity/Depth Patterns	13
6.4 Sediment Deposition	14
6.5 Channel Flow Status	15
6.6 Channel Alteration	11
6.7 Frequency of Riffles/Steps	13
6.8 Bank Stability	Left: 4 Right: 5
6.9 Bank Vegetation Protection	Left: 9 Right: 8
6.10 Riparian Vegetation Zone Width	Left: 9 Right: 7
Total Score	127
Habitat Rating	0.635

Habitat Stream Condition **Fair**

Narrative:

Major historic degradation; Major widening with evidence stream is trying to create bankfull bench; Major aggredation (upper portion of reach very soft underfoot). Bank erosion on all outside bends (major planform adjustment).

Stream: **Kingsbury Branch** Reach # **M11** Segment: **A** Completion Date: **July 24, 2007**

Organization: **Friends of the Winooski River** Observers: **MN, AS** Rain: **Yes**

Segment Length (ft): **3,199** Segment Location: **Segment begins where stream begins to go away from Rt 14 through pasture and**

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	44.0	Yes	Yes	No	Yes
Problem		Deposition Above,Deposition Below,Scour			

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**18**	**None**	**No**
7.2 Channel Aggradation	**7**	**None**	**No**
7.3 Widening Channel	**13**		**No**
7.4 Change in Planform	**5**		**No**
Total Score	**43**		
Geomorphic Rating	**0.5375**		

Channel Evolution Model **D**

Channel Evolution Stage **IId**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **High**

	Score
6.1 Epifaunal Substrate - Available Cover	14
6.2 Embeddedness	8
6.3 Velocity/Depth Patterns	15
6.4 Sediment Deposition	14
6.5 Channel Flow Status	14
6.6 Channel Alteration	11
6.7 Frequency of Riffles/Steps	16
6.8 Bank Stability	Left: 7 Right: 7
6.9 Bank Vegetation Protection	Left: 8 Right: 8
6.10 Riparian Vegetation Zone Width	Left: 1 Right: 0
Total Score	123
Habitat Rating	0.615

Habitat Stream Condition **Fair**

Narrative:

Good floodplain access, extreme planform adjustment. Braided channel, multiple islands. Channel have become overloaded with sediment from incison that occurred upstream in M11-B.

Stream: **Kingsbury Branch** Reach # **M11** Segment: **B** Completion Date: **July 24, 2007**

Organization: **Friends of the Winooski River** Observers: **MN, AS** Rain: **Yes**

Segment Length (ft): **2,337** Segment Location: **Segment begins approximately 800 feet upstream of snowmobile bridge in segment**

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPS Taken

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	34.0	Yes	Yes	Yes	Yes
Problem	Scour Above,Alignment				
Bridge	18.0	Yes	Yes	Yes	Yes
Problem	Deposition Above,Scour Above,Scour				

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	**13**	**None**	**No**
7.3 Widening Channel	**13**		**No**
7.4 Change in Planform	**13**		**No**
Total Score	**42**		
Geomorphic Rating	**0.525**		

Channel Evolution Model **F**

Channel Evolution Stage **III**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **High**

	Score
6.1 Epifaunal Substrate - Available Cover	16
6.2 Embeddedness	13
6.3 Velocity/Depth Patterns	14
6.4 Sediment Deposition	15
6.5 Channel Flow Status	15
6.6 Channel Alteration	11
6.7 Frequency of Riffles/Steps	14
6.8 Bank Stability	Left: 7 Right: 7
6.9 Bank Vegetation Protection	Left: 9 Right: 9
6.10 Riparian Vegetation Zone Width	Left: 5 Right: 7
Total Score	142
Habitat Rating	0.71

Habitat Stream Condition **Good**

Narrative:

Major historic incision, stream type departure from C to B, minor aggradation, widening & planform adjustment. Good vegetation may have helped to maintain some stream stability.

Stream: **Kingsbury Branch** Reach # **M12** Segment: **A** Completion Date: **July 27, 2007**

Organization: **Friends of the Winooski River** Observers: **MN, DS** Rain: **No**

Segment Length (ft): **961** Segment Location: **Segment begins about 900 feet upstream of Route 14 bridge and continues until**

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions **None**

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Plane Bed**

	Score	STD	Historic
7.1 Channel Degradation	**13**	**None**	**Yes**
7.2 Channel Aggradation	**14**	**None**	**No**
7.3 Widening Channel	**18**		**No**
7.4 Change in Planform	**9**		**No**
Total Score	**54**		
Geomorphic Rating	**0.675**		

Channel Evolution Model **F**

Channel Evolution Stage **III**

Geomorphic Condition **Good**

Stream Sensitivity **Moderate**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **High**

	Score
6.1 Epifaunal Substrate - Available Cover	11
6.2 Embeddedness	15
6.3 Velocity/Depth Patterns	11
6.4 Sediment Deposition	14
6.5 Channel Flow Status	16
6.6 Channel Alteration	16
6.7 Frequency of Riffles/Steps	7
6.8 Bank Stability	Left: 9 Right: 9
6.9 Bank Vegetation Protection	Left: 10 Right: 10
6.10 Riparian Vegetation Zone Width	Left: 9 Right: 9
Total Score	146
Habitat Rating	0.73

Habitat Stream Condition **Good**

Narrative:

Historic degradation (sediment starved from onstream pond - M13). Minor aggradation, no evidence of widening, major planform adjustment at base of falls & lower end of segment (islands, mid-channel bars).

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Waterfall	Mid-segment	0.00	0.00	Yes	
Waterfall	Mid-segment	0.00	0.00	Yes	

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	13.7	Yes	Yes	Yes	Yes
Problem	Scour Below				
Other	20.0	Yes	Yes	Yes	Yes
Problem					

Narrative:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type

Channel Evolution Model
Channel Evolution Stage
Geomorphic Condition **Good**
Stream Sensitivity **High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?

Narrative:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type

Channel Evolution Model
Channel Evolution Stage
Geomorphic Condition **Good**
Stream Sensitivity **High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Stream: **Kingsbury Branch** Reach # **M14** Segment: **B** Completion Date: **July 18, 2007**

Organization: **Friends of the Winooski River** Observers: **CS, MN** Rain: **Yes**

Segment Length (ft): **1,860** Segment Location: **Segment begins where wetland ends just upstream of Calais rec field.**

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions **None**

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?

Narrative:

Minor aggradation & planform adjustment.

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**16**	**None**	**No**
7.2 Channel Aggradation	**13**	**None**	**No**
7.3 Widening Channel	**18**		**No**
7.4 Change in Planform	**12**		**No**
Total Score	**59**		
Geomorphic Rating	**0.7375**		

Channel Evolution Model **D**

Channel Evolution Stage **IIc**

Geomorphic Condition **Good**

Stream Sensitivity **High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **Low**

	Score
6.1 Epifaunal Substrate - Available Cover	8
6.2 Pool Substrate	8
6.3 Pool Variability	12
6.4 Sediment Deposition	16
6.5 Channel Flow Status	19
6.6 Channel Alteration	14
6.7 Channel Sinuosity	9
6.8 Bank Stability	Left: 10 Right: 10
6.9 Bank Vegetation Protection	Left: 9 Right: 10
6.10 Riparian Vegetation Zone Width	Left: 8 Right: 10
Total Score	143
Habitat Rating	0.715

Habitat Stream Condition **Good**

Stream: **Kingsbury Branch** Reach # **M14** Segment: **C** Completion Date: **July 18, 2007**

Organization: **Friends of the Winooski River** Observers: **CS, MN** Rain: **Yes**

Segment Length (ft): **1,692** Segment Location: **Segment begins where channel changes from E: ripple-dune to C: riffle pool near**

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPS Taken

4.8 Channel Constrictions **None**

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**17**	**None**	**No**
7.2 Channel Aggradation	**13**	**None**	**No**
7.3 Widening Channel	**13**		**No**
7.4 Change in Planform	**9**		**No**
Total Score	**52**		
Geomorphic Rating	**0.65**		

Channel Evolution Model **D**

Channel Evolution Stage **IIc**

Geomorphic Condition **Good**

Stream Sensitivity **High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **Low**

	Score
6.1 Epifaunal Substrate - Available Cover	13
6.2 Pool Substrate	13
6.3 Pool Variability	13
6.4 Sediment Deposition	13
6.5 Channel Flow Status	13
6.6 Channel Alteration	16
6.7 Channel Sinuosity	11
6.8 Bank Stability	Left: 8 Right: 8
6.9 Bank Vegetation Protection	Left: 7 Right: 10
6.10 Riparian Vegetation Zone Width	Left: 6 Right: 10
Total Score	141
Habitat Rating	0.705

Habitat Stream Condition **Good**

Narrative:

Minor aggradation and widening; major planform adjustment. Three mid-channel bars, 2 flood chutes, and 1 steep riffle.

Stream: **Kingsbury Branch** Reach # **M15** Segment: **A** Completion Date: **July 17, 2007**

Organization: **Friends of the Winooski River** Observers: **MN, AW** Rain: **Yes**

Segment Length (ft): **1,813** Segment Location: **Segment begins approximately 300 feet downstream of most downstream Route 14**

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Old	35.0	Yes	No	Yes	Yes
Problem	Scour Above,Scour Below,Alignment				
Bridge	30.0	Yes	Yes	Yes	Yes
Problem	Deposition Below,Scour Below				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**16**	**None**	**Yes**
7.2 Channel Aggradation	**13**	**None**	**No**
7.3 Widening Channel	**15**		**No**
7.4 Change in Planform	**12**		**No**
Total Score	**56**		
Geomorphic Rating	**0.7**		

Channel Evolution Model **D**

Channel Evolution Stage **IIc**

Geomorphic Condition **Good**

Stream Sensitivity **High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **High**

	Score
6.1 Epifaunal Substrate - Available Cover	8
6.2 Embeddedness	11
6.3 Velocity/Depth Patterns	13
6.4 Sediment Deposition	12
6.5 Channel Flow Status	17
6.6 Channel Alteration	7
6.7 Frequency of Riffles/Steps	16
6.8 Bank Stability	Left: 8 Right: 9
6.9 Bank Vegetation Protection	Left: 6 Right: 8
6.10 Riparian Vegetation Zone Width	Left: 2 Right: 4
Total Score	121
Habitat Rating	0.605

Habitat Stream Condition **Fair**

Narrative:

Minor widening, aggradation and planform adjusment. Dominant process is planform adjustment with 2 mid-channel bars, one flood chute, a steep riffle.

Stream: **Kingsbury Branch** Reach # **M15** Segment: **B** Completion Date: **July 17, 2007**

Organization: **Friends of the Winooski River** Observers: **MN, AW** Rain: **Yes**

Segment Length (ft): **3,559** Segment Location: **Segment begins where buffer becomes more forested about 1800 feet upstream of**

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	30.0	Yes	Yes	No	Yes

Problem None

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**16**	**None**	**No**
7.2 Channel Aggradation	**8**	**None**	**No**
7.3 Widening Channel	**14**		**No**
7.4 Change in Planform	**5**		**No**
Total Score	**43**		
Geomorphic Rating	**0.5375**		

Channel Evolution Model **D**

Channel Evolution Stage **IId**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **High**

	Score
6.1 Epifaunal Substrate - Available Cover	16
6.2 Embeddedness	14
6.3 Velocity/Depth Patterns	14
6.4 Sediment Deposition	11
6.5 Channel Flow Status	15
6.6 Channel Alteration	8
6.7 Frequency of Riffles/Steps	16
6.8 Bank Stability	Left: 8 Right: 8
6.9 Bank Vegetation Protection	Left: 8 Right: 5
6.10 Riparian Vegetation Zone Width	Left: 8 Right: 3
Total Score	134
Habitat Rating	0.67

Habitat Stream Condition **Good**

Narrative:

Major aggradation, extreme planform adjustment with MCB, DJ, Islands, NC, FC. Also many steep riffles/diagonal bars. This may be brought on by historic channelization probably in most of segment. Mass failures contributing to sediment in channel.

Stream: **Kingsbury Branch** Reach # **M16** Segment: **0** Completion Date: **July 19, 2007**

Organization: **Friends of the Winooski River** Observers: **PD, CM** Rain: **Yes**

Segment Length (ft): **2,841** Segment Location: **Just upstream from Rt 14 bridge until outlet of Sabin Pond.**

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPS Taken

4.8 Channel Constrictions **None**

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**16**	**None**	**Yes**
7.2 Channel Aggradation	**10**	**None**	**No**
7.3 Widening Channel	**12**		**No**
7.4 Change in Planform	**9**		**No**
Total Score	**47**		
Geomorphic Rating	**0.5875**		

Channel Evolution Model **D**

Channel Evolution Stage **IIc**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **High**

	Score
6.1 Epifaunal Substrate - Available Cover	14
6.2 Embeddedness	12
6.3 Velocity/Depth Patterns	18
6.4 Sediment Deposition	8
6.5 Channel Flow Status	15
6.6 Channel Alteration	9
6.7 Frequency of Riffles/Steps	18
6.8 Bank Stability	Left: 7 Right: 8
6.9 Bank Vegetation Protection	Left: 9 Right: 9
6.10 Riparian Vegetation Zone Width	Left: 7 Right: 7
Total Score	141
Habitat Rating	0.705

Habitat Stream Condition **Good**

Narrative:

Major aggradation and minor widening. Stream is undergoing major planform adjustment due to the presense of many debris jams.

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPS Taken

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	39.0	Yes	Yes	No	Yes
Problem	Deposition Above,Deposition Below				

Narrative:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type

Channel Evolution Model

Channel Evolution Stage

Geomorphic Condition **Fair**

Stream Sensitivity **Extreme**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Stream: **Pekin Brook** Reach # **T3.02** Segment: **0** Completion Date: **August 10, 2007**

Organization: **Friends of the Winooski River** Observers: **MN** Rain: **Yes**

Segment Length (ft): **1,389** Segment Location: **Reach begins about 550 feet upstream of Route 14 Bridge near Pekin Brook Rd and**

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions **None**

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**17**	**None**	**No**
7.2 Channel Aggradation	**14**	**None**	**No**
7.3 Widening Channel	**8**		**No**
7.4 Change in Planform	**8**		**No**
Total Score	**47**		
Geomorphic Rating	**0.5875**		

Channel Evolution Model **D**

Channel Evolution Stage **IIc**

Geomorphic Condition **Fair**

Stream Sensitivity **Extreme**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **Low**

	Score
6.1 Epifaunal Substrate - Available Cover	4
6.2 Pool Substrate	7
6.3 Pool Variability	5
6.4 Sediment Deposition	17
6.5 Channel Flow Status	17
6.6 Channel Alteration	11
6.7 Channel Sinuosity	3
6.8 Bank Stability	Left: 3 Right: 2
6.9 Bank Vegetation Protection	Left: 6 Right: 9
6.10 Riparian Vegetation Zone Width	Left: 4 Right: 10
Total Score	98
Habitat Rating	0.49

Habitat Stream Condition **Fair**

Narrative:

Channel was likely historically straightened. Evidence of failed riprap on both sides. Bank erosion and scour along much of reach on both sides, very narrow valley. Has plane bed features. Channel trying to regain sinuosity.

Stream: **Pekin Brook** Reach # **T3.03** Segment: **A** Completion Date: **August 16, 2007**

Organization: **Friends of the Winooski River** Observers: **PD, TM** Rain: **Yes**

Segment Length (ft): **3,396** Segment Location: **Segment begins near where natural valley gets wider and then continues until about**

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Culvert	18.0	Yes	Yes	Yes	Yes
Problem	Deposition Below,Scour Above,Scour				

Narrative:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type

Channel Evolution Model

Channel Evolution Stage

Geomorphic Condition **Good**

Stream Sensitivity **High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Stream: **Pekin Brook** Reach # **T3.03** Segment: **B** Completion Date: **August 16, 2007**

Organization: **Friends of the Winooski River** Observers: **PD, TM** Rain: **Yes**

Segment Length (ft): **3,369** Segment Location: **Segment begins about 1300 feet upstream of Pekin Brook Rd culvert where land use**

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPS Taken

4.8 Channel Constrictions **None**

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?

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	**12**		**No**
7.4 Change in Planform	**8**		**No**
Total Score	**50**		
Geomorphic Rating	**0.625**		

Channel Evolution Model **D**

Channel Evolution Stage **IIc**

Geomorphic Condition **Fair**

Stream Sensitivity **Extreme**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **Low**

	Score
6.1 Epifaunal Substrate - Available Cover	13
6.2 Pool Substrate	18
6.3 Pool Variability	14
6.4 Sediment Deposition	9
6.5 Channel Flow Status	18
6.6 Channel Alteration	8
6.7 Channel Sinuosity	11
6.8 Bank Stability	Left: 4 Right: 6
6.9 Bank Vegetation Protection	Left: 4 Right: 3
6.10 Riparian Vegetation Zone Width	Left: 1 Right: 1
Total Score	110
Habitat Rating	0.55

Habitat Stream Condition **Fair**

Narrative:

Major planform adjustment due to encroachment and channel alteration and lack of buffer on both banks.

Stream: **Pekin Brook** Reach # **T3.04** Segment: **A** Completion Date: **August 9, 2007**

Organization: **Friends of the Winooski River** Observers: **PD, AW** Rain: **Yes**

Segment Length (ft): **2,654** Segment Location: **Segment begins at culvert on Peck Hill Rd. near intersection of Peck Hill Rd and Pekin**

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Culvert	12.5	Yes	Yes	Yes	Yes
Problem	Deposition Above,Deposition Below,Scour				
Bridge	15.0	Yes	Yes	Yes	Yes
Problem	Scour Above,Scour Below,Alignment				

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	**12**		**No**
7.4 Change in Planform	**3**		**No**
Total Score	**45**		
Geomorphic Rating	**0.5625**		

Channel Evolution Model **D**

Channel Evolution Stage **IIc**

Geomorphic Condition **Fair**

Stream Sensitivity **Extreme**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **Low**

	Score
6.1 Epifaunal Substrate - Available Cover	13
6.2 Pool Substrate	18
6.3 Pool Variability	19
6.4 Sediment Deposition	11
6.5 Channel Flow Status	15
6.6 Channel Alteration	7
6.7 Channel Sinuosity	12
6.8 Bank Stability	Left: 5 Right: 7
6.9 Bank Vegetation Protection	Left: 4 Right: 5
6.10 Riparian Vegetation Zone Width	Left: 1 Right: 4
Total Score	121
Habitat Rating	0.605

Habitat Stream Condition **Fair**

Narrative:

Major aggradation and widening; Extreme planform adjustment due to channelization and encroachment.

Stream: **Pekin Brook** Reach # **T3.04** Segment: **B** Completion Date: **August 9, 2007**

Organization: **Friends of the Winooski River** Observers: **PD, AW** Rain: **Yes**

Segment Length (ft): **1,327** Segment Location: **Segment begins just upstream of bridge near Jack Hill Rd intersection with Pekin**

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPS Taken

4.8 Channel Constrictions **None**

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**17**	**None**	**No**
7.2 Channel Aggradation	**12**	**None**	**No**
7.3 Widening Channel	**12**		**No**
7.4 Change in Planform	**9**		**No**
Total Score	**50**		
Geomorphic Rating	**0.625**		

Channel Evolution Model **D**

Channel Evolution Stage **IIc**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **High**

	Score
6.1 Epifaunal Substrate - Available Cover	11
6.2 Embeddedness	7
6.3 Velocity/Depth Patterns	16
6.4 Sediment Deposition	8
6.5 Channel Flow Status	15
6.6 Channel Alteration	11
6.7 Frequency of Riffles/Steps	16
6.8 Bank Stability	Left: 7 Right: 7
6.9 Bank Vegetation Protection	Left: 5 Right: 6
6.10 Riparian Vegetation Zone Width	Left: 6 Right: 10
Total Score	125
Habitat Rating	0.625

Habitat Stream Condition **Fair**

Narrative:

Major planform adjustment with moderate to high lateral bank erosion; two mid channel bars. Minor aggradation and widening. Not incised - wide floodplain.

Stream: **Pekin Brook** Reach # **T3.04** Segment: **C** Completion Date: **July 26, 2007**

Organization: **Friends of the Winooski River** Observers: **PD, CM** Rain: **No**

Segment Length (ft): **2,627** Segment Location: **Segment begins at driveway bridge and continues 2050 feet to T3.05.**

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	12.5	Yes	Yes	Yes	Yes
Problem	Deposition Below,Scour Above,Scour				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**16**	**None**	**No**
7.2 Channel Aggradation	**11**	**None**	**No**
7.3 Widening Channel	**12**		**No**
7.4 Change in Planform	**7**		**No**
Total Score	**46**		
Geomorphic Rating	**0.575**		

Channel Evolution Model **D**

Channel Evolution Stage **IIc**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **High**

	Score
6.1 Epifaunal Substrate - Available Cover	15
6.2 Embeddedness	8
6.3 Velocity/Depth Patterns	12
6.4 Sediment Deposition	7
6.5 Channel Flow Status	13
6.6 Channel Alteration	8
6.7 Frequency of Riffles/Steps	14
6.8 Bank Stability	Left: 6 Right: 7
6.9 Bank Vegetation Protection	Left: 4 Right: 6
6.10 Riparian Vegetation Zone Width	Left: 4 Right: 9
Total Score	113
Habitat Rating	0.565

Habitat Stream Condition **Fair**

Narrative:

minor widening, major planform adjustment & some aggradation. Segment is readjusting to encroachment and lack of buffer previously from grazing.

Stream: **Pekin Brook** Reach # **T3.05** Segment: **A** Completion Date: **July 6, 2007**

Organization: **Friends of the Winooski River** Observers: **MN, AS, DS** Rain: **Yes**

Segment Length (ft): **1,481** Segment Location: **Segment begins about 0.5 miles upstream of the intersection of Jack Hill Rd and Pekin**

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	0.00	No	No	Yes	Yes
Problem	Deposition Above,Deposition Below				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**16**	**None**	**No**
7.2 Channel Aggradation	**12**	**None**	**No**
7.3 Widening Channel	**13**		**No**
7.4 Change in Planform	**13**		**No**
Total Score	**54**		
Geomorphic Rating	**0.675**		

Channel Evolution Model **D**

Channel Evolution Stage **IIc**

Geomorphic Condition **Good**

Stream Sensitivity **High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **High**

	Score
6.1 Epifaunal Substrate - Available Cover	11
6.2 Embeddedness	12
6.3 Velocity/Depth Patterns	15
6.4 Sediment Deposition	11
6.5 Channel Flow Status	14
6.6 Channel Alteration	13
6.7 Frequency of Riffles/Steps	16
6.8 Bank Stability	Left: 6 Right: 6
6.9 Bank Vegetation Protection	Left: 4 Right: 4
6.10 Riparian Vegetation Zone Width	Left: 7 Right: 9
Total Score	128
Habitat Rating	0.64

Habitat Stream Condition **Fair**

Narrative:

Not incised, no major adjustment process.Vegetation starting to come in. Speckled Alder growth in buffer.

Stream: **Pekin Brook** Reach # **T3.05** Segment: **B** Completion Date: **July 6, 2007**

Organization: **Friends of the Winooski River** Observers: **MN, AS, DS** Rain: **Yes**

Segment Length (ft): **2,920** Segment Location: **Segment begins where vegetation changes approximately 1400 upstream of T3.05-A.**

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPS Taken

4.8 Channel Constrictions **None**

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?

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	**14**		**No**
7.4 Change in Planform	**10**		**No**
Total Score	**54**		
Geomorphic Rating	**0.675**		

Channel Evolution Model **D**

Channel Evolution Stage **IIc**

Geomorphic Condition **Good**

Stream Sensitivity **High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **High**

	Score
6.1 Epifaunal Substrate - Available Cover	15
6.2 Embeddedness	13
6.3 Velocity/Depth Patterns	15
6.4 Sediment Deposition	15
6.5 Channel Flow Status	14
6.6 Channel Alteration	11
6.7 Frequency of Riffles/Steps	18
6.8 Bank Stability	Left: 8 Right: 8
6.9 Bank Vegetation Protection	Left: 9 Right: 9
6.10 Riparian Vegetation Zone Width	Left: 9 Right: 9
Total Score	153
Habitat Rating	0.765

Habitat Stream Condition **Good**

Narrative:

Not incised, Some mid-channel bars and one island. Major planform adjustment. Good vegetation holding banks. Minor aggradation and widening.

Stream: **Pekin Brook** Reach # **T3.06** Segment: **A** Completion Date: **July 5, 2007**

Organization: **Friends of the Winooski River** Observers: **MN, PD, AS** Rain: **Yes**

Segment Length (ft): **2,826** Segment Location: **Segment begins just downstream of intersection of Singleton Rd and Pekin Brook Rd**

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Culvert	12.0	Yes	Yes	Yes	Yes
Problem	Deposition Above,Scour Below,Alignment				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**7**	**None**	**Yes**
7.2 Channel Aggradation	**12**	**None**	**No**
7.3 Widening Channel	**14**		**No**
7.4 Change in Planform	**8**		**No**
Total Score	**41**		
Geomorphic Rating	**0.5125**		

Channel Evolution Model **F**

Channel Evolution Stage **III**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **Low**

	Score
6.1 Epifaunal Substrate - Available Cover	15
6.2 Pool Substrate	14
6.3 Pool Variability	13
6.4 Sediment Deposition	10
6.5 Channel Flow Status	14
6.6 Channel Alteration	8
6.7 Channel Sinuosity	14
6.8 Bank Stability	Left: 7 Right: 7
6.9 Bank Vegetation Protection	Left: 7 Right: 8
6.10 Riparian Vegetation Zone Width	Left: 6 Right: 8
Total Score	131
Habitat Rating	0.655

Habitat Stream Condition **Good**

Narrative:

Some historic incision, some aggradation, minor widening, and major planform adjustment as reach builds new floodplain. The new floodplain bench is fairly narrow - probably in stage III.

Stream: **Pekin Brook** Reach # **T3.06** Segment: **B** Completion Date: **July 19, 2007**

Organization: **Friends of the Winooski River** Observers: **PD, CM, AS** Rain: **Yes**

Segment Length (ft): **661** Segment Location: **Segment begins where tributary enters on right bank and continues about 200 feet**

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Ledge	Mid-segment	2.00	1.00	No	

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Culvert	11.2	Yes	Yes	Yes	Yes
Problem	Deposition Above,Scour Below,Alignment				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**6**	**None**	**Yes**
7.2 Channel Aggradation	**12**	**None**	**No**
7.3 Widening Channel	**14**		**No**
7.4 Change in Planform	**8**		**No**

Total Score **40**

Geomorphic Rating **0.5**

Channel Evolution Model **F**

Channel Evolution Stage **II**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **High**

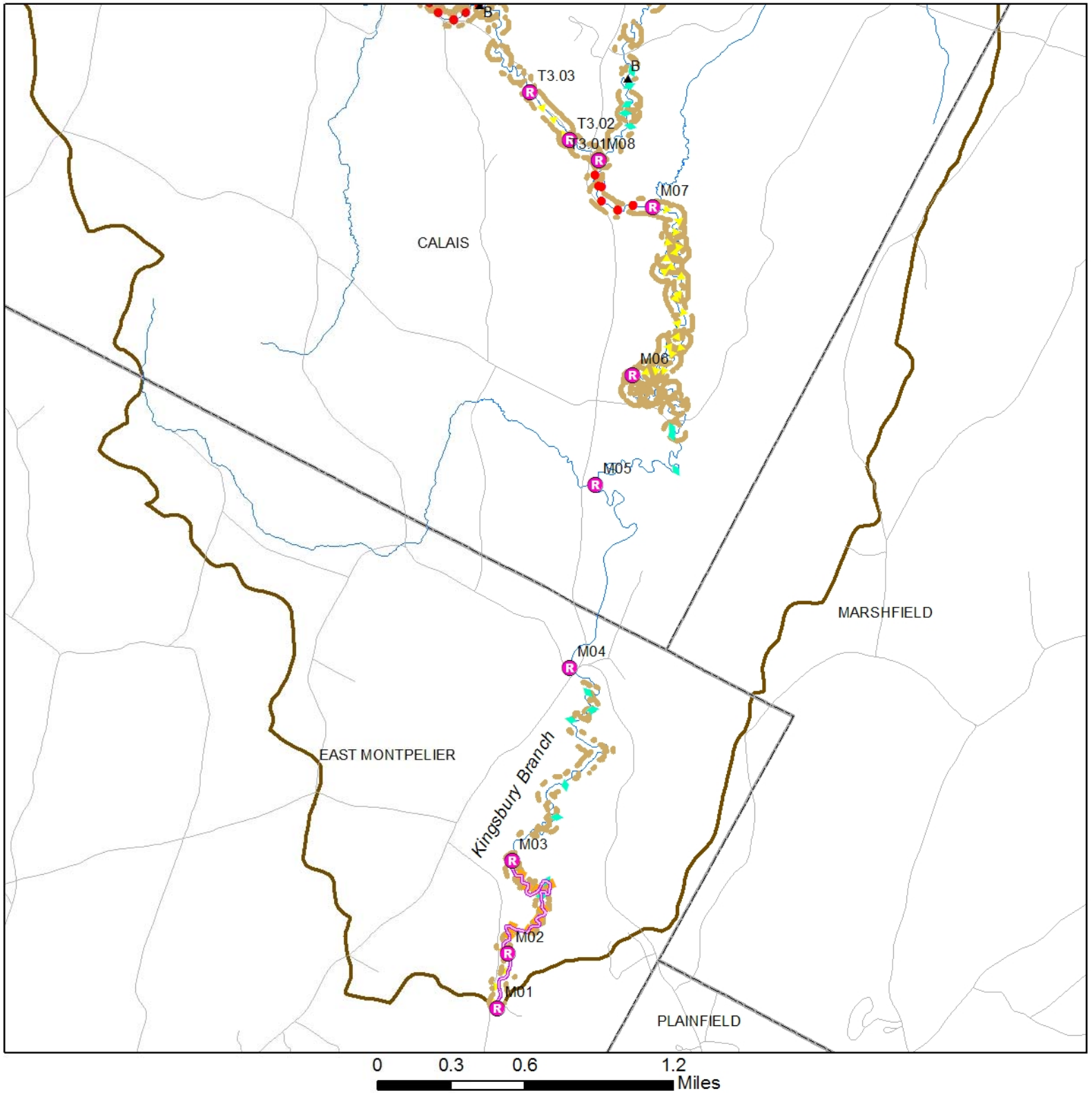
	Score
6.1 Epifaunal Substrate - Available Cover	9
6.2 Embeddedness	18
6.3 Velocity/Depth Patterns	7
6.4 Sediment Deposition	17
6.5 Channel Flow Status	19
6.6 Channel Alteration	2
6.7 Frequency of Riffles/Steps	4
6.8 Bank Stability	Left: 9 Right: 8
6.9 Bank Vegetation Protection	Left: 2 Right: 1
6.10 Riparian Vegetation Zone Width	Left: 1 Right: 1
Total Score	98
Habitat Rating	0.49

Habitat Stream Condition **Fair**

Narrative:

Major historic incision and planform change due to channel alterations. Some aggradation and widening.

APPENDIX 2
STRESSOR AND DEPARTURE MAPS



Kingsbury Branch Sediment Load Indicators Map 1

Legend

- Steep Riffle
- Tributary Rejuvenation
- Mass Failure

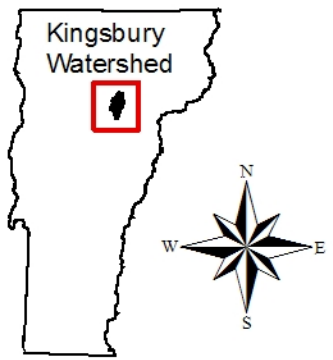
Depositional Features/mile

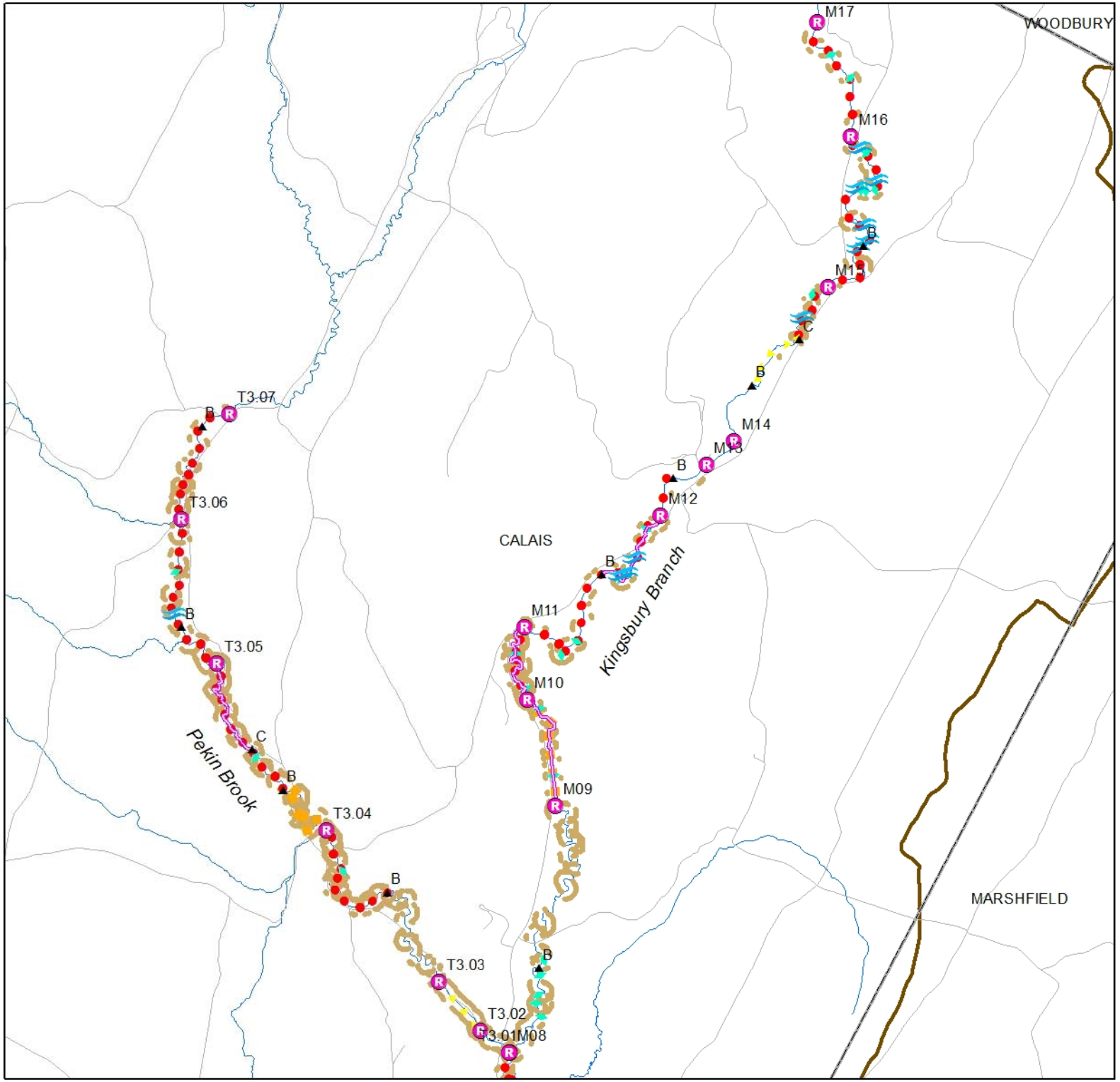
- <=2
- >2 <= 5
- > 5

Bank Erosion

LOCATION

- Left Bank
- Right Bank
- Road
- Reach Break
- Segment Break
- Kingsbury Branch
- Kingsbury Watershed
- Town Boundary





Kingsbury Branch Sediment Load Indicators Map 2

Legend

- Steep Riffle
- Tributary Rejuvenation
- Mass Failure

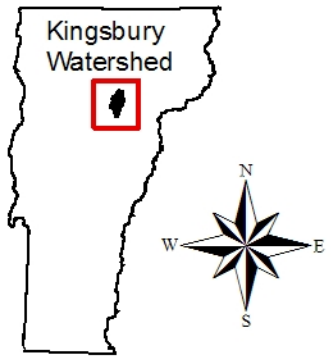
Depositional Features/mile

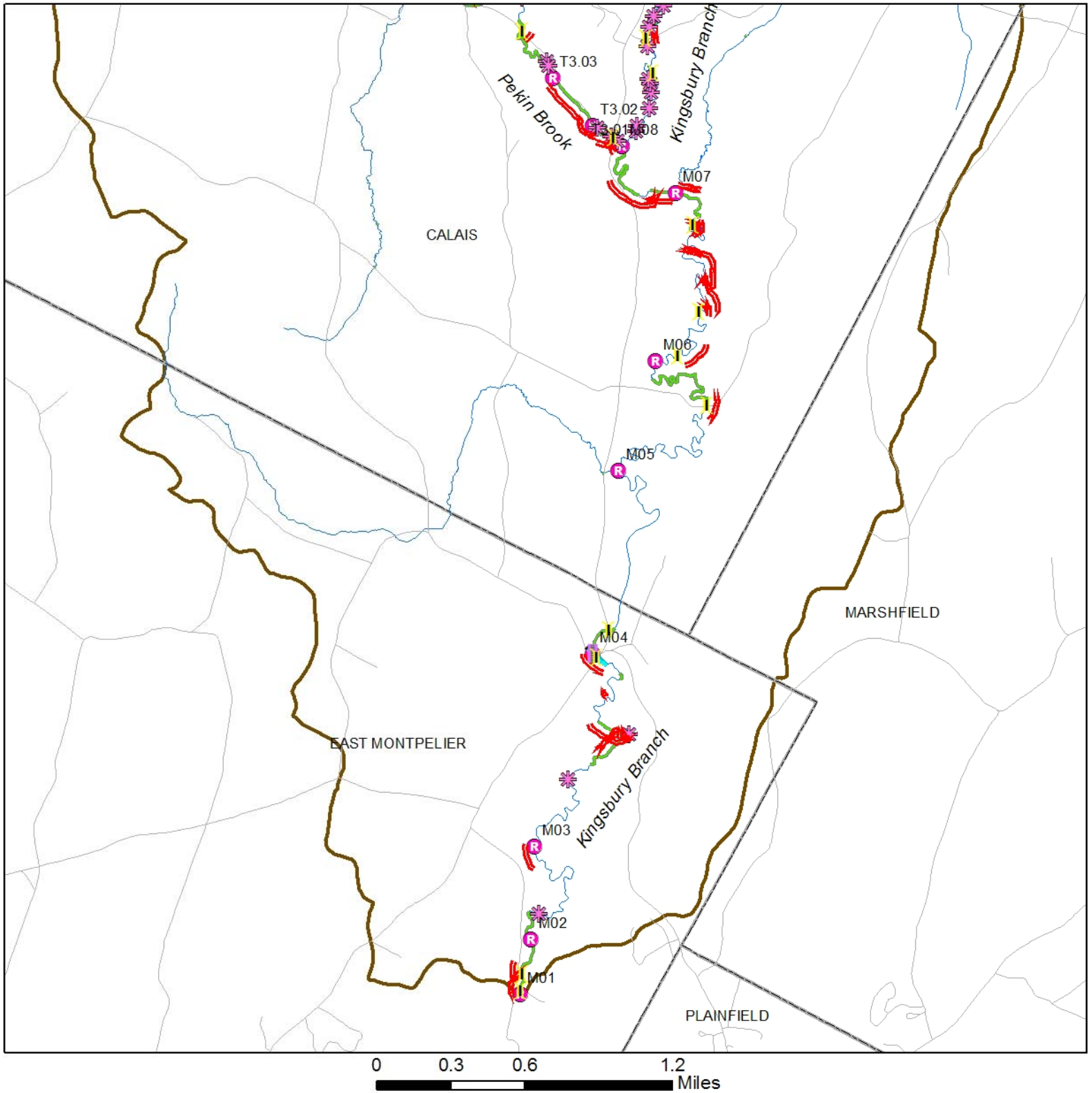
- <=2
- >2 <= 5
- > 5

Bank Erosion

LOCATION

- Left Bank
- Right Bank
- Road
- Reach Break
- Segment Break
- Kingsbury Branch
- Kingsbury Watershed
- Town Boundary





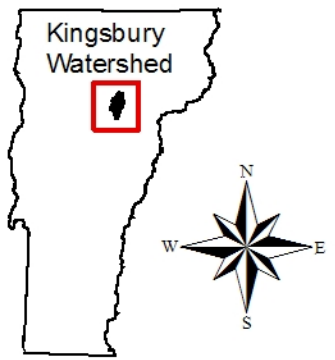
Kingsbury Branch Channel Slope Modifiers Map 1

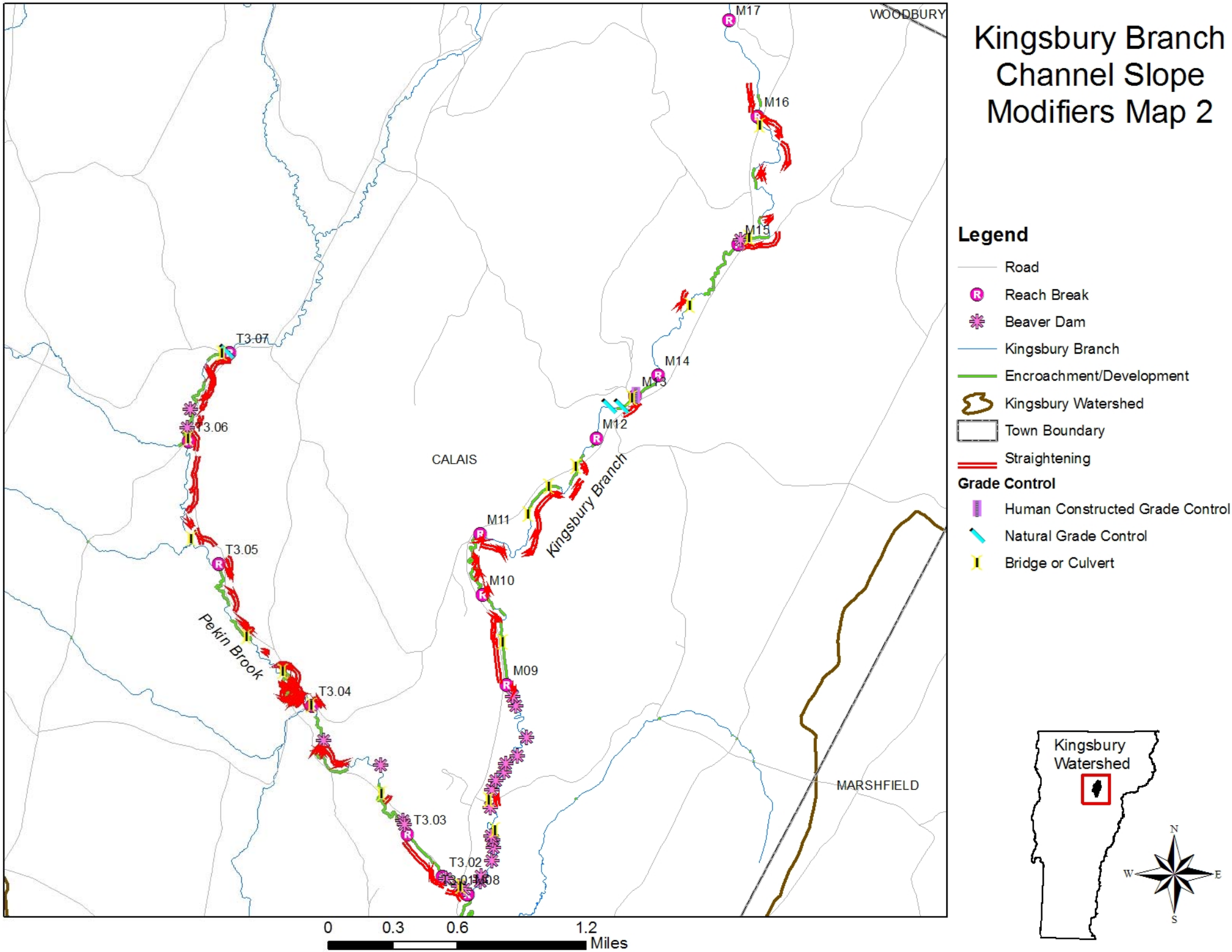
Legend

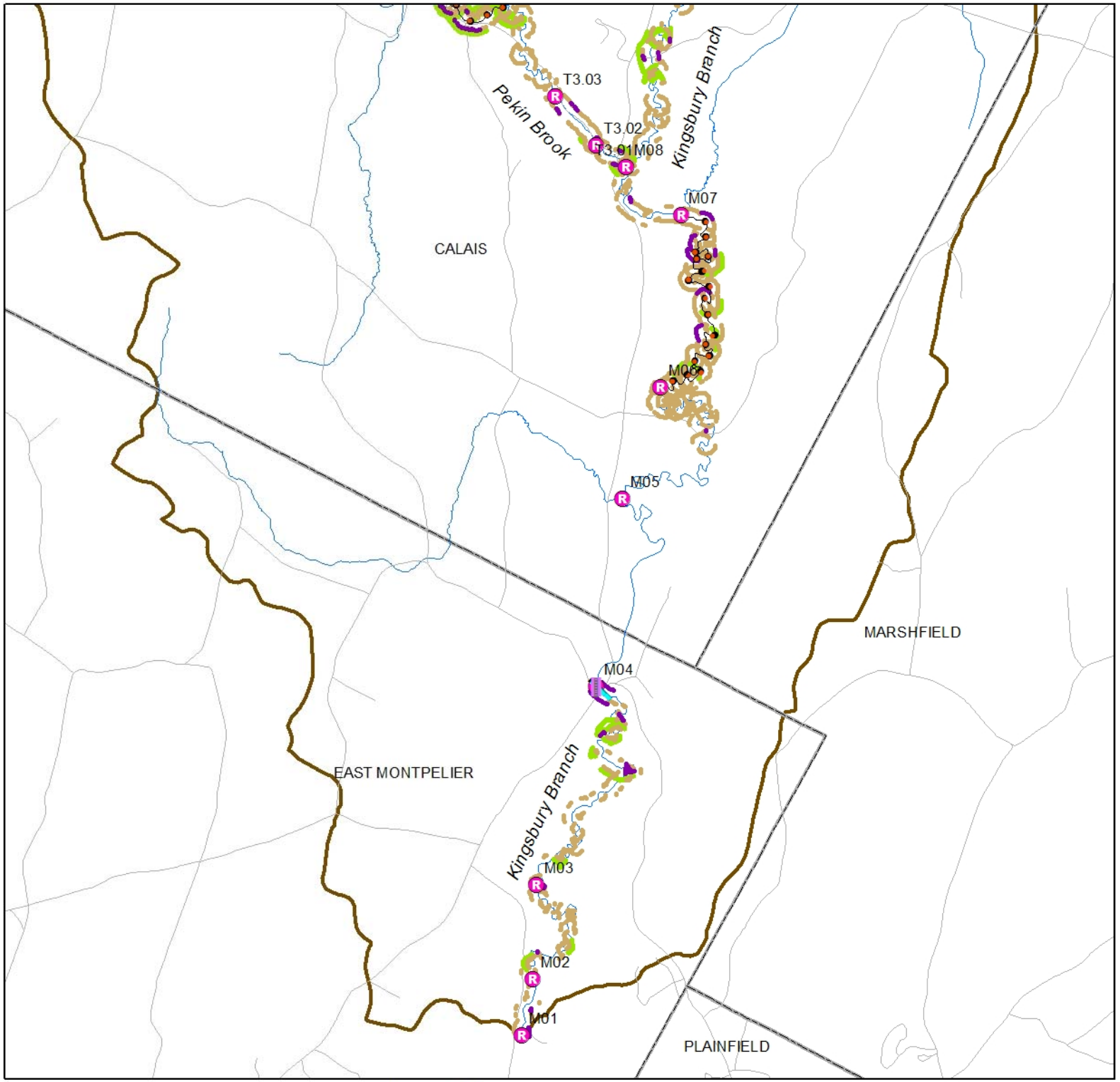
- Road
- Reach Break
- Beaver Dam
- Kingsbury Branch
- Encroachment/Development
- Kingsbury Watershed
- Town Boundary
- Straightening

Grade Control

- Human Constructed Grade Control
- Natural Grade Control
- Bridge or Culvert




Kingsbury Branch
Channel Slope
Modifiers Map 2
Legend
Road
Reach Break
Beaver Dam
Kingsbury Branch
Encroachment/Development
Kingsbury Watershed
Town Boundary
Straightening
Grade Control
Human Constructed Grade Control
Natural Grade Control
Bridge or Culvert
WOODBURY
CALAIS
MARSHFIELD
Kingsbury Branch
Pekin Brook
M17
M16
M15
M14
M13
M12
M11
M10
M09
T3.07
T3.06
T3.05
T3.04
T3.03
T3.02
T3.01
T3.08
0
0.3
0.6
1.2
Miles
Kingsbury
Watershed
N
W
E
S



Kingsbury Branch Boundary Conditions & Riparian Modifiers Map 1

Legend

- P2 Cohesive Bank
- P2 Coarse Bed

Grade Control

- Human Contructed Grade Control
- Natural Grade Control

Armoring

LOCATION

- Left Bank
- Right Bank

Bank Erosion

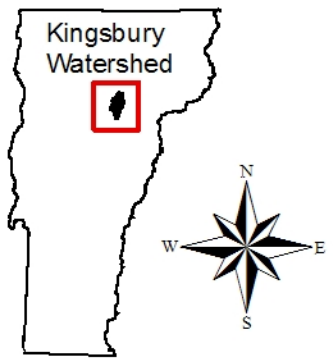
LOCATION

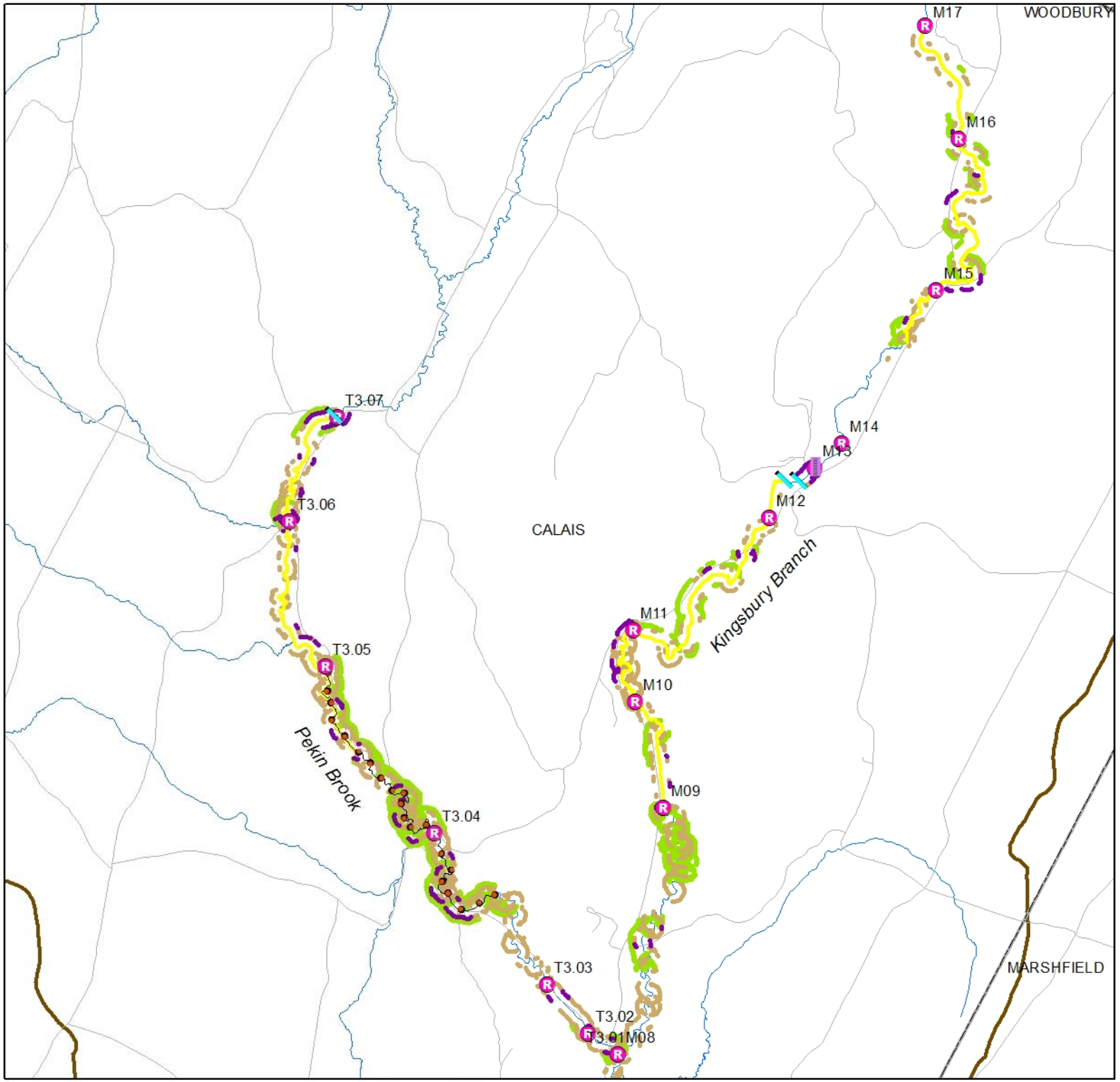
- Left Bank
- Right Bank

Buffer less 25

LOCATION

- Left Bank
- Right Bank
- Reach Break
- Road
- Kingsbury Branch
- Kingsbury Watershed
- Town Boundary





Kingsbury Branch Boundary Conditions & Riparian Modifiers Map 2

Legend

- P2 Cohesive Bank
- P2 Coarse Bed

Grade Control

- Human Contructed Grade Control
- Natural Grade Control

Armoring

LOCATION

- Left Bank
- Right Bank

Bank Erosion

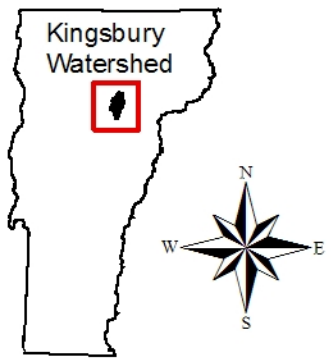
LOCATION

- Left Bank
- Right Bank

Buffer less 25

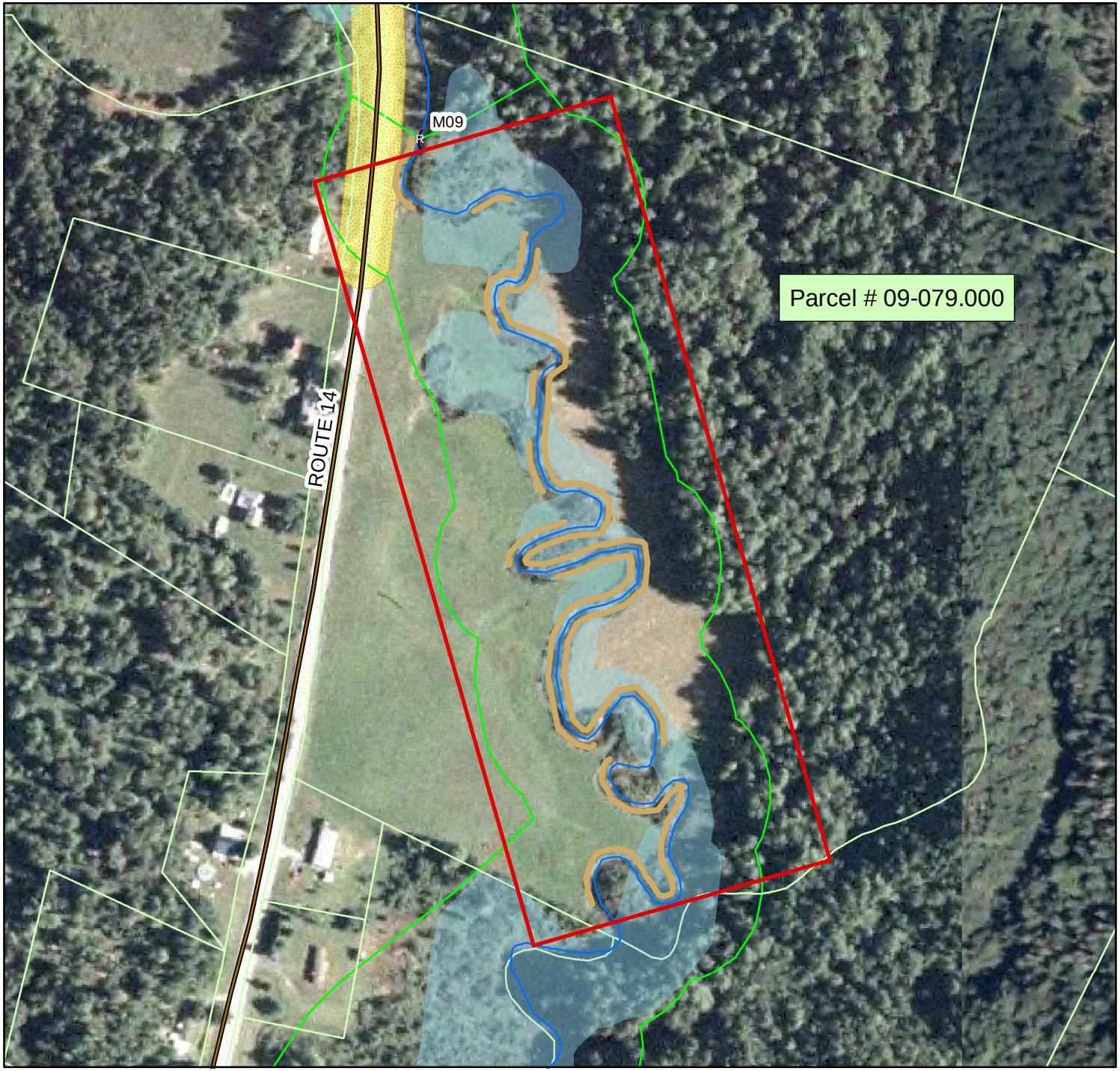
LOCATION

- Left Bank
- Right Bank
- Reach Break
- Road
- Kingsbury Branch
- Kingsbury Watershed
- Town Boundary



APPENDIX 3
MAPS OF POTENTIAL PROJECTS

M08-B Kingsbury Branch Potential Project Location



0 250 500 1,000 Feet

Legend

Buffers <25 feet

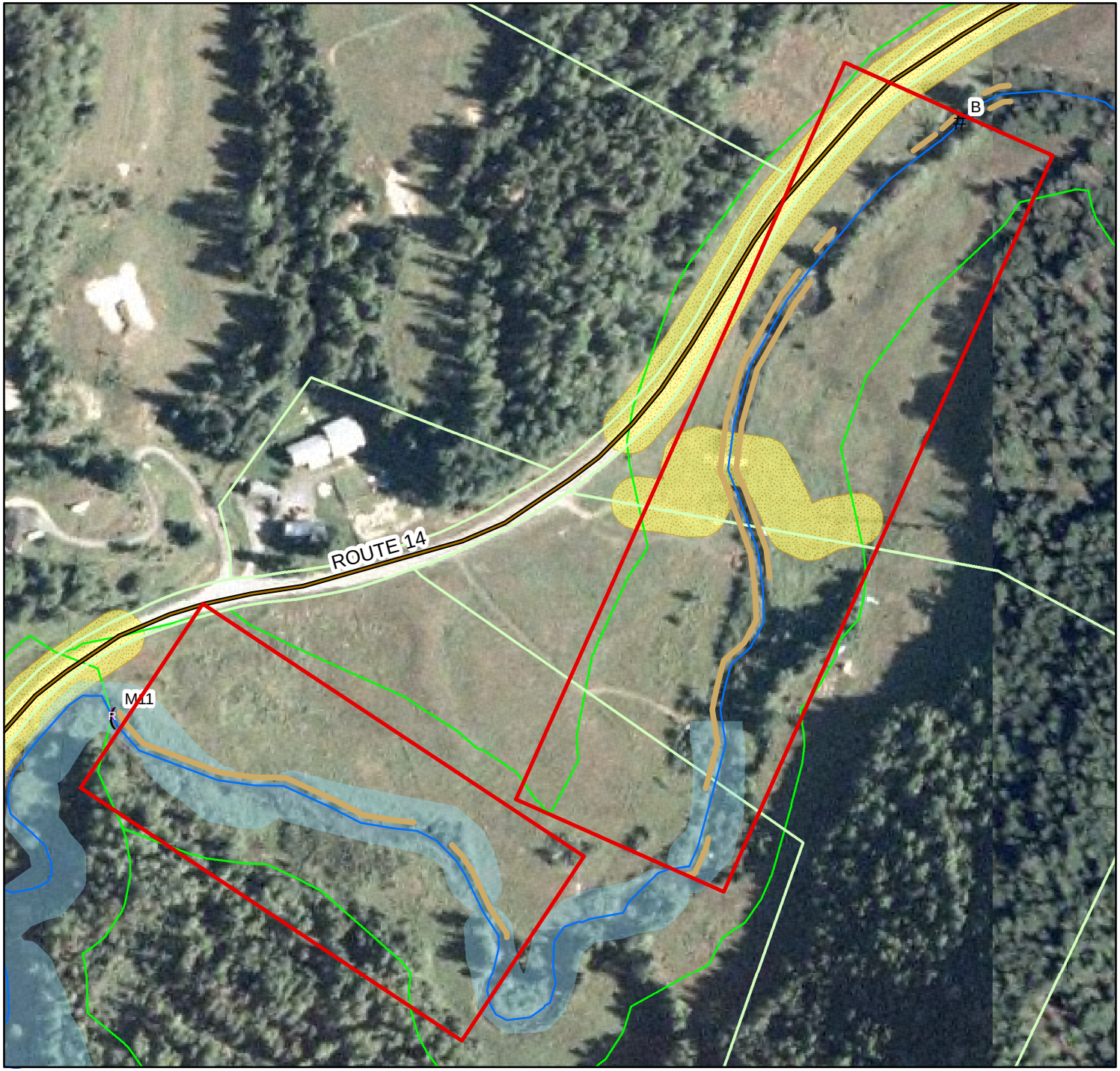
LOCATION

- Left Bank
- Right Bank
- Wetland (VSWI)
- Lateral Constraint
- Parcel
- emergency_rds_line
- River Corridor
- s05swfinaldslv
- Reach Break
- # Segment Break
- Potential Project Location

Project Description

1. Improve Riparian Buffer
2. Protect River Corridor

M11-A Kingsbury Branch Potential Project Location



Legend

Buffers <25 feet

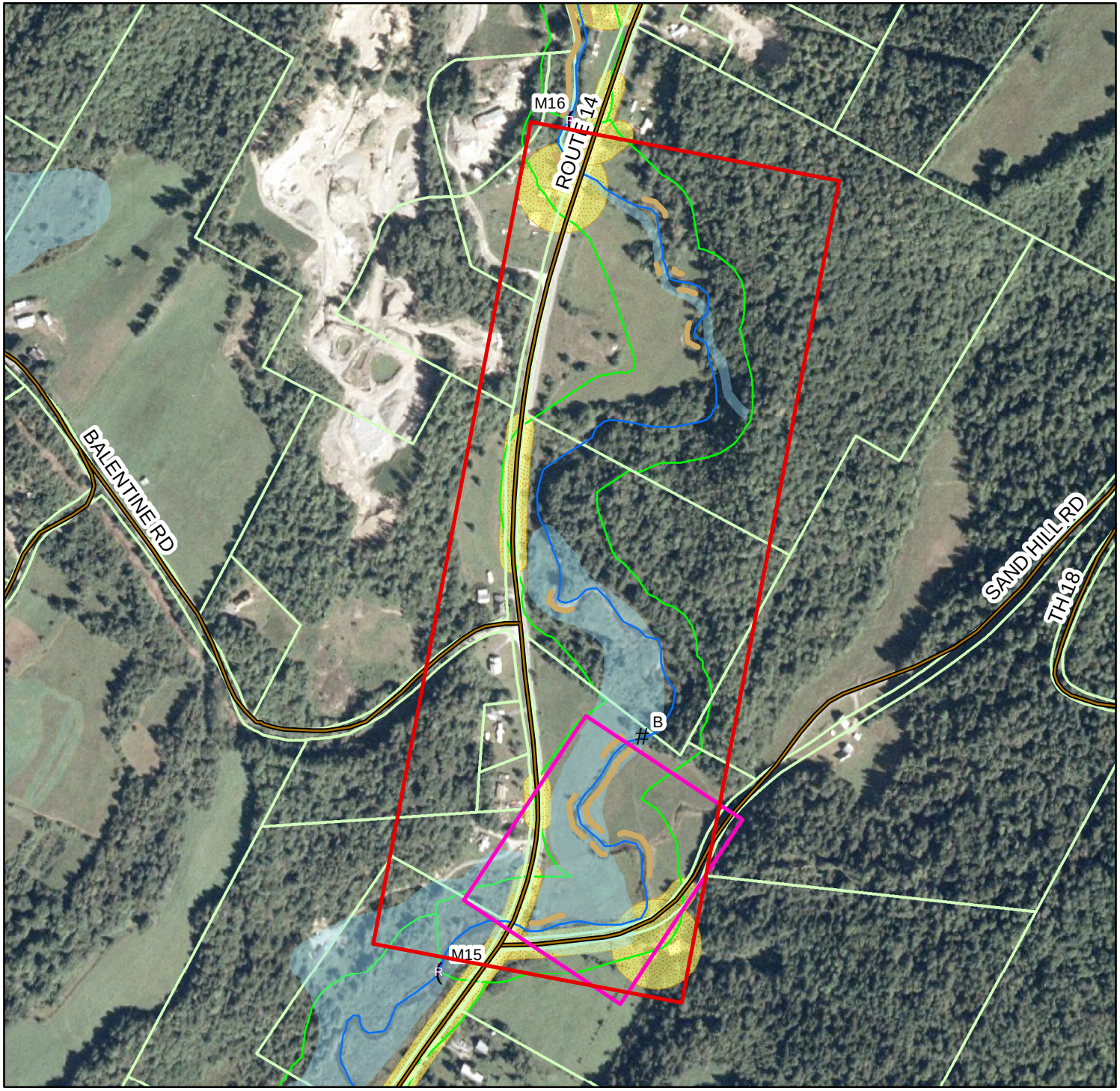
LOCATION

- Left Bank
- Right Bank
- Wetland (VSWI)
- Lateral Constraint
- Parcel
- emergency_rds_line
- River Corridor
- s05swfinaldslv
- Reach Break
- # Segment Break
- Potential Project Location

Project Description

1. Improve Riparian Buffer
2. Protect River Corridor

M15 Kingsbury Branch Potential Project Location



Legend

Buffers <25 feet

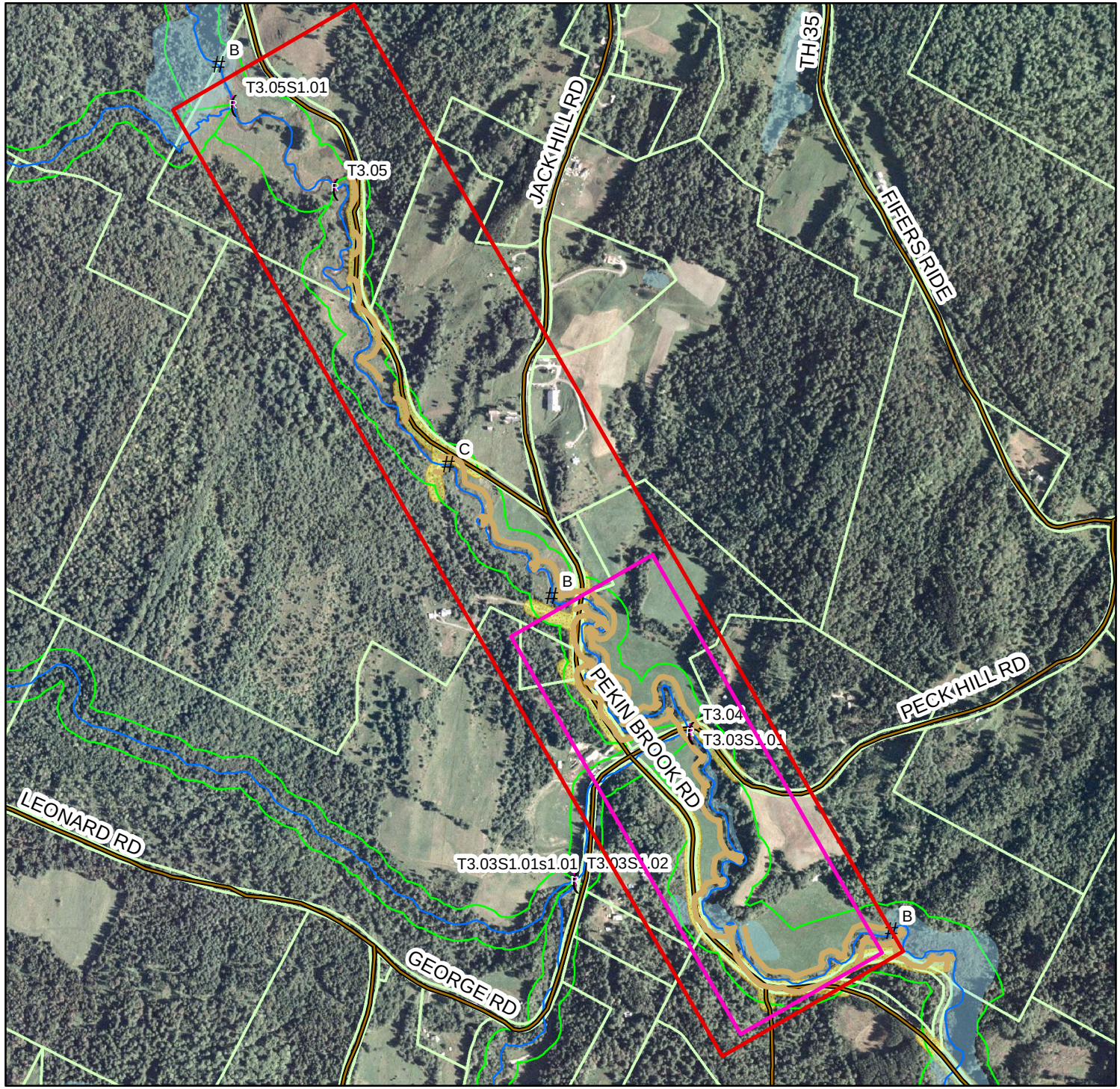
LOCATION

- Left Bank
- Right Bank
- Wetland (VSWI)
- Lateral Constraint
- Parcel
- emergency_rds_line
- River Corridor
- s05swfinaldslv
- Reach Break
- # Segment Break
- Potential Project Location 1
- Potential Project Location 2

Project Description

1. Improve Riparian Buffer
2. Protect River Corridor

T3.03-B to T3.05-A Pekin Brook Potential Project Location



0 1,000 2,000 4,000 Feet

Legend

Buffers <25 feet

LOCATION

- Left Bank
- Right Bank
- Wetland (VSWI)
- Lateral Constraint
- Parcel
- emergency_rds_line
- River Corridor
- s05swfinaldslv
- Reach Break
- # Segment Break
- Potential Project Location 1
- Potential Project Location 2

Project Description

1. Improve Riparian Buffer
2. Protect River Corridor