Upper Winooski

Class Three and Four Road Erosion Assessment

Project funded with a grant from VT DEC ERP

Assessment managed and conducted by

Central Vermont Regional Planning Commission with assistance from

Friends of the Winooski River

and the Towns of Plainfield, Marshfield, and Cabot

March 24, 2014

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Introduction

In 2013 Central Vermont Regional Planning Commission along with the Friends of the Winooski River conducted an analysis to map, inventory, prioritize, and prepare site maps for Class 3 and 4 road erosion sites within the upper Winooski Watershed which included the following towns of Cabot, Marshfield, and Plainfield. The purpose of the project was to 1) better understand the scope of the erosion problems along the Class 3 and 4 roads. 2) To provide an inventory of erosion sites. 3) Prioritize the erosion sites for impact to water quality by sedimentation. 4) Provide a simple site map and erosion treatment techniques for the highest priority erosion sites. 5) Present the results of the study to the towns and discuss the erosion treatment techniques. The project was funded through a Grant provided by the State of Vermont Ecosystem Restoration Program (ERP).

Methodology

Geographic Information Systems (GIS) Desktop Analysis

A constraints analysis was conducted by the Central Vermont Regional Planning Commission (CVRPC) using ArcView GIS. The purpose of the constraints analysis was to use desktop GIS to identify areas of the road network that were likely susceptible to erosion and sedimentation resulting in water quality impact, in order to focus the scope of the field investigation. The constraints analysis considered a total of five parameters, which included stream crossings, width of buffers to streams, width of buffers to mapped State-regulated Class II wetlands, soil erodibility, and road slope. The road network within the five Towns was divided into 100-foot segments, and for each segment the presence or absence of the five constraints was analyzed. Then, for each road, the number of constraints was totaled. The segments of each road with the relative constraints scoring were displayed on a GIS map. In addition to the line segments a point location was also developed by CVRPC to specify locations where three, four, or five of the constraints existed at the same location. This data was then used on the field maps to help locate general and specific road areas to visit. The GIS maps are included in Attachment A. Field crews visited all point locations with 3 and greater constraints and all line segments with a total constraints score of 37 and greater. Table 1 below provides a summary of the constraint values considered in the GIS analysis.

Constraint	**Criteria**	**Data Source**
Stream Crossings	Road / Stream intersection	Vermont Hydrography Dataset (VHDCARTO, 2010)
Stream Buffer	Width 50 feet	Vermont Hydrography Dataset (VHDCARTO, 2010)
Class II Wetland	Buffer 50 feet	Vermont Significant Wetlands Inventory (VSWI, 2010)
Soil Erodibility	Kw > 0.36	Natural Resource Conservation Service (NRCS) Soil Survey (Geologic_SO, 2011)

Slope	rise/run > 15%	Vermont Hydrography Dataset DEM (ElevationDEM_VTHYDRODEM, 2005)

Table 1. GIS Analysis parameters.

Field Priority Indicators

After the completion of the GIS desktop analysis, a series of field priority indicators were developed along with a scoring matrix, which were used by field crews to rank each erosion area impact to water quality during the field mapping effort. These priority indicators included volume of runoff expected through the erosion area, the steepness of the area, the condition of the ground cover, and finally the opportunity for sediment deposition to surface waters. Individual erosion areas were scored in the field as high, medium, and low, for each of these indicators. Following the field data collection, scoring for each of the field indicators was imported into an excel spreadsheet to calculate total scores for each area. Each high, medium, and low score was assigned a value of 3, 2, or 1, respectively. In the case of the opportunity for deposition indicator, percentages of 30%, 20%, or 10% were assigned to a high, medium or low score, given that depositional areas were assumed to have a weighted importance. A summary table of the field priority indicators is provided in Table 2 below. The complete scoring matrix is provided in Attachment B.

Priority Indicators	Description	Score	Notes
Volume	small channel, headwater area	Low	Volume indicator refers to the condition at and upstream of the erosion area
	medium channel, middle of watershed	Medium	
	large channel, close to receiving water	High	
Velocity/Steepness	low slope, <5%	Low	Velocity/Steepness indicator refers to the condition at and downstream of the erosion area
	moderate slope, >5% and < 15%	Medium	
	steep slope, > 15%	High	
Soil Cover	stone	Low	Soil Cover indicator refers to the condition downstream of the erosion area
	vegetation	Medium	
	minor vegetation	Medium/High	
	bare	High	
Deposition to Stream	sheet flow over well vegetated terrain/ channel with turnouts to vegetated terrain	Low	Deposition indicator refers to the condition downstream of the erosion area
	channel flow with defined break in slope with some deposition before stream	Medium	
	channel flow with no slope	High	

	breaks, obvious in stream deposition		

Table 2. Priority indicators for water quality scoring.

Data Collection and Reduction

Field crews walked/drove each priority road segment during the 2013 field season. Field crews carried a Trimble GeoXM GPS unit capable of sub meter accuracy with post processing correction and a digital camera. The roadway surface, shoulders, and ditches where scanned for areas of erosion. Field data was entered directly into the GPS units using a data dictionary which allowed for customized drop down menus to be used to log the data. The digital camera was used to take photos of the erosion and those photos where loaded and linked directly to each site being recorded in the GPS units through a wireless network join. These two data collection techniques significantly increased data collection efficiency. The descriptor data is summarized in Table 3.

Descriptors	**Type**	**Notes**
General Erosion Category	Rill	small channel that could be graded
	Incision	medium channel that could be graded
	Gully	larger channel that could not be repaired by grading
	Slump	failure of road edge or surface
	In stream / in ditch scour	carving of stream bank / ditch side slopes
Erosion Location	Roadway	
	Roadway Shoulder	
	Ditch	
	Ditched Stream	
	Culvert Headwall	
	Culvert Endwall	
Culvert Data (Culvert Sites Only)	Diameter	inches
	Material	metal/plastic/concrete
	Condition	poor/fair/good
	Ownership	Town/Private
	Drop from outlet to stream	inches - live stream crossings only
	Bankfull width at outlet	inches - live stream crossing only

Table 3. Erosion area descriptors.

Results

A total of 119 erosion sites were mapped across the three towns. Sites having the highest priority scores in each Town were selected and a site plan with erosion treatment developed. A total of 23 sites were selected for site plan with erosion treatment development. CVRPC utilizes the Better Back Roads manual in the development of all road erosion treatments. The list of erosion sites by town follows this section of the report.

Summary of Town Erosion Results

Cabot

Erosion site 1

Location – 125 feet of road shoulder erosion where Blodgett Rd intersects with E Hill Rd in Woodbury and Cabot, VT. This is a class 4 road.

Field Collection Data –

Location of Erosion	Water Volume	Steepness of Site	Soil Cover	Deposition to Stream	Type of Erosion	Total Score
ROADWAY SHOULDER	HIGH	STEEP >15	BARE	HIGH	GULLY	13.0

Site Slope Calculation – 5%

Suggested Erosion Treatment –

- Improve road shoulder by ditching and stone lining ditch for length of erosion 125 ft
- Work with town of Woodbury to create stone line turn out at intersection of E Hill Rd.

Needed Information from Site –

- Calculate stone needed for ditch – estimate about 50 Yards
- Calculate stone needed for stone turn out – estimate about 3 Yards

Map of Site

Photo 1

Photo 2

Photo 3

Erosion site 2

Location – 129 feet of ditch erosion along Blodgett Rd 0.36 miles west of W Hill Pond Rd in Cabot, VT. This is a class 4 road.

Field Collection Data –

Location of Erosion	Water Volume	Steepness of Site	Soil Cover	Deposition to Stream	Type of Erosion	Total Score
DITCH	HIGH	MOD 5-15	BARE	HIGH	GULLY	11.7

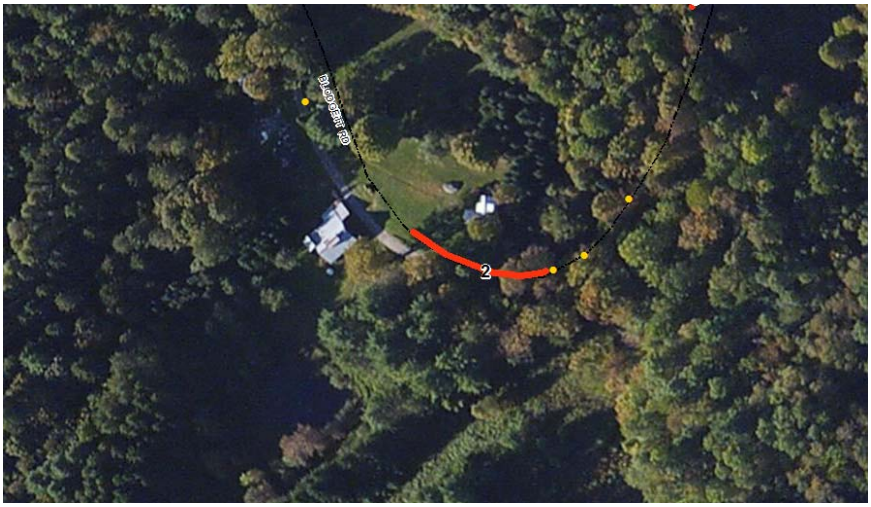
Site Slope Calculation – 15%

Suggested Erosion Treatment –

- Add stone aprons at outlets of existing culvert
- Install headers and footers on all existing culvert
- Improve ditch by stone line for length of erosion about 129 ft
- Replace existing culvert if undersized for location.

Needed Information from Site –

- Existing culvert dimensions and condition
- Existing culvert alignment
- Existing culvert header and footer information
- Calculate stone needed for ditch – estimate about 50 Yards
- Calculate stone needed for stone aprons at culvert outlets - estimate about 5 Yards
- Price of new and replacement culverts



Site Map

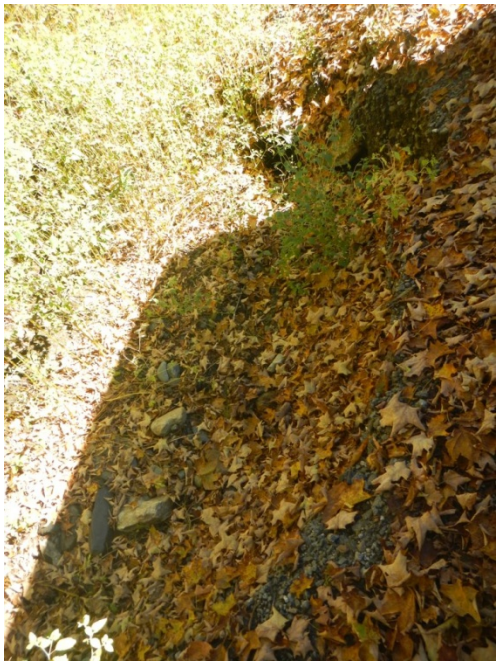


Photo 1

Photo 2

Photo 3

Photo 4

Erosion site 3

Location – 163 feet of road shoulder erosion along Blodgett Rd 0.27 miles west of W Hill Pond Rd in Cabot, VT. This is a class 4 road.

Field Collection Data –

Location of Erosion	Water Volume	Steepness of Site	Soil Cover	Deposition to Stream	Type of Erosion	Total Score
ROADWAY SHOULDER	HIGH	STEEP >15	BARE	LOW	GULLY	11.0

Site Slope Calculation – 14%

Suggested Erosion Treatment –

- Improve road shoulder by ditching and stone line for length of erosion about 163 ft

Needed Information from Site –

- Calculate stone needed for ditch – estimate about 50 Yards

Site Map

Photo 1

Photo 2

Photo 3

Photo 4

Erosion site 4

Location – 139 feet of road shoulder erosion along Blodgett Rd 0.18 miles west of W Hill Pond Rd in Cabot, VT. This is a class 4 road.

Field Collection Data –

Location of Erosion	Water Volume	Steepness of Site	Soil Cover	Deposition to Stream	Type of Erosion	Total Score
ROADWAY SHOULDER	MEDIUM	STEEP > 15	BARE	HIGH	GULLY	10.4

Site Slope Calculation – 13%

Suggested Erosion Treatment –

- Add stone lined turn out at end of erosion
- Improve road shoulder by ditching and stone line for length of erosion about 139 ft

Needed Information from Site –

- Calculate stone needed for ditch and turn out – estimate about 60 Yards

Site Map

Photo 1

Photo 2

Photo 3

Erosion site 5

Location – 432 feet of Ditch erosion along Last Rd 0.36 miles south Danville Hill Rd in Cabot, VT.

Field Collection Data –

Location of Erosion	Water Volume	Steepness of Site	Soil Cover	Deposition to Stream	Type of Erosion	Total Score
DITCH	HIGH	MOD 5-15	MINIMAL VEGITATION	HIGH	GULLY	10.4

Site Slope Calculation – 7%

Suggested Erosion Treatment –

- Add 1-2 new cross culverts along ditch
- Add stone aprons at outlets of new culverts
- Install headers and footers on all new culverts
- Improve ditch by stone lining for length of erosion about 432 ft

Needed Information from Site –

- Calculate stone needed for ditch – estimate about 100 Yards
- Calculate stone needed for stone aprons at culvert outlets - estimate about 5 Yards
- Price of new culverts

Site Map

Photo 1

Photo 2

Photo 3

Erosion site 6

Location – 258 feet of road shoulder and ditch erosion along Blodgett Rd 0.5 miles west of W Hill Pond Rd in Cabot, VT. This is a class 4 road.

Field Collection Data –

Location of Erosion	Water Volume	Steepness of Site	Soil Cover	Deposition to Stream	Type of Erosion	Total Score
DITCH	HIGH	MOD 5-15	BARE	LOW	GULLY	9.9

Site Slope Calculation – 13%

Suggested Erosion Treatment –

- Improve ditch by stone line for length of erosion about 258 ft
- Add stone lined turn out at end of erosion

Needed Information from Site –

- Calculate stone needed for ditch – estimate about 50 Yards
- Calculate stone needed for turn out - estimate about 3 Yards

Site Map

Photo 1

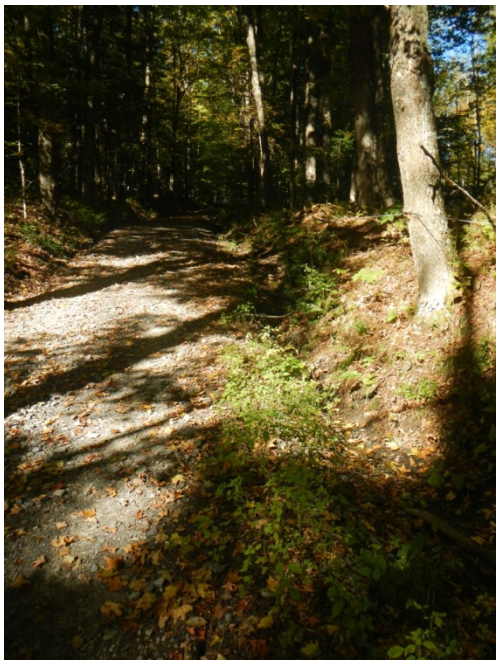


Photo 2

Photo 3

Photo 4

Photo 5

Erosion site 7

Location – 200 feet of ditch erosion along Thistle Hill Rd 1 mile west of Route 2 in Cabot, VT.

Field Collection Data –

Location of Erosion	Water Volume	Steepness of Site	Soil Cover	Deposition to Stream	Type of Erosion	Total Score
DITCH	HIGH	LOW < 5	MINIMAL VEGITATION	HIGH	GULLY	9.7

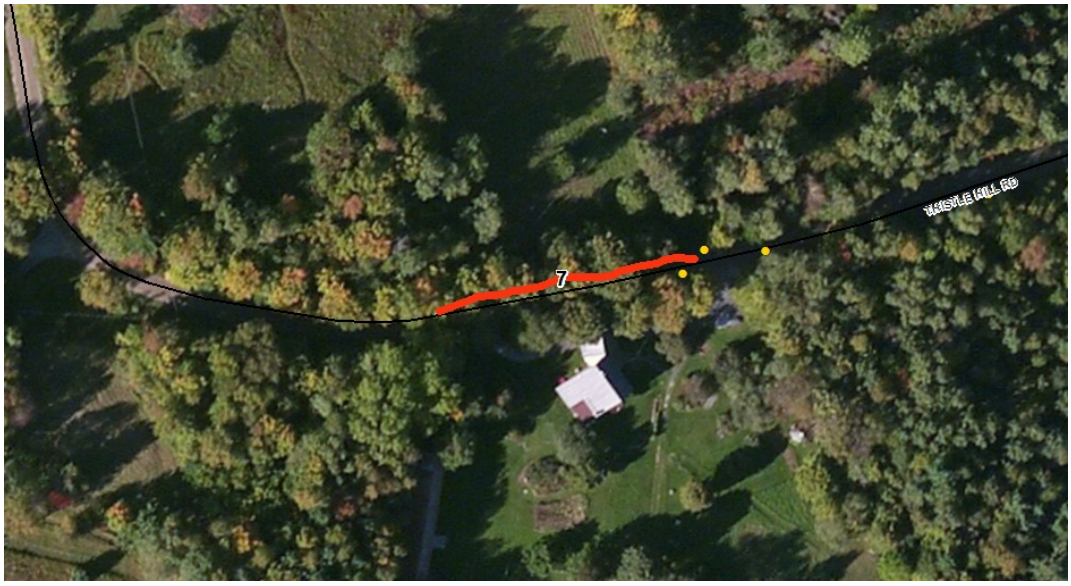
Site Slope Calculation – 6%

Suggested Erosion Treatment –

- Improve ditch by stone line for length of erosion about 200 ft
- Replace existing culvert if undersized for location.

Needed Information from Site –

- Existing culvert dimensions and condition
- Existing culvert alignment
- Existing culvert header and footer information
- Calculate stone needed for ditch – estimate about 50 Yards
- Price of new culverts



Site Map

Photo 1

Photo 2

Photo 3

Erosion site 8

Location – Slump location over outlet of culvert on Ducharme Rd 0.2 miles west of Route 2 in Cabot, VT.

Field Collection Data –

Location of Erosion	Water Volume	Steepness of Site	Soil Cover	Deposition to Stream	Type of Erosion	Total Score
CULVERT ENDWALL	MEDIUM	STEEP >15	MINIMAL VEGETATION	HIGH	SLUMP	9.1

Site Slope Calculation – Unknown

Suggested Erosion Treatment –

- Stabilize slope with rock and vegetation
- Reshape slump

Needed Information from Site –

- Existing culvert dimensions and condition
- Existing culvert alignment
- Determine bankfull width for existing culvert
- Existing culvert header and footer information
- Gather slump slope information
- Calculate stone needed for slop stabilization
- Price of replacement culvert

Site Map

Photo 1

Erosion site 9

Location – 315 feet of road shoulder and ditch erosion along Thistle Hill Rd 0.18 miles south of Wheeler Rd in Cabot, VT.

Field Collection Data –

Location of Erosion	Water Volume	Steepness of Site	Soil Cover	Deposition to Stream	Type of Erosion	Total Score
DITCH	HIGH	MOD 5-15	MINIMAL VEGITATION	LOW	GULLY	8.8

Site Slope Calculation – 6%

Suggested Erosion Treatment –

- Improve road shoulder by ditching and stone line for length of erosion about 315 ft
- Stone line turn out at end of erosion

Needed Information from Site –

- Calculate stone needed for ditch and turn out – estimate about 80 Yards

Site Map

Photo 1

Photo 2

Photo 3

TOWN	ROAD NAME	SITE NUMBER	SCORE	SITE TYPE	VOLUME	STEEPNESS	SOIL COVER	DEPOSIT TO STREAM	EROSION CATEGORY	EROSION LOCATION	PHOTO ID	PHOTO 1	PHOTO 2	PHOTO 3	PHOTO 4	PHOTO 5	COMMENT	LENGTH OF EROSION IN FEET
Cabot	Blodgett Rd	1	13.0	Line	HIGH	STEEP >15	BARE	HIGH	GULLY	DITCH	8795,8796,8797	DSCN8795.JPG	DSCN8796.JPG	DSCN8797.JPG				125
Cabot	Blodgett Rd	2	11.7	Line	HIGH	MOD 5-15	BARE	HIGH	GULLY	DITCH	8774,8775,8776,8777	DSCN8774.JPG	DSCN8775.JPG	DSCN8776.JPG	DSCN8777.JPG			129
Cabot	Blodgett Rd	3	11.0	Line	HIGH	STEEP >15	BARE	LOW	GULLY	ROADWAY SHOULDER	8770,8771,8772,8773	DSCN8770.JPG	DSCN8771.JPG	DSCN8772.JPG	DSCN8773.JPG			163
Cabot	Blodgett Rd	4	10.4	Line	MEDIUM	STEEP >15	BARE	HIGH	GULLY	ROADWAY SHOULDER	8767,8768,8769	DSCN8767.JPG	DSCN8768.JPG	DSCN8769.JPG				139
Cabot	Last Rd	5	10.4	Line	HIGH	MOD 5-15	MINIMAL VEGITATION	HIGH	GULLY	DITCH	8159,8160,8161	DSCN8159.JPG	DSCN8160.JPG	DSCN8161.JPG				433
Cabot	Blodgett Rd	6	9.9	Line	HIGH	MOD 5-15	BARE	LOW	GULLY	DITCH	8778,8779,8780,8781,8782	DSCN8778.JPG	DSCN8779.JPG	DSCN8780.JPG	DSCN8782.JPG	DSCN8781.JPG		258
Cabot	Thistle Hill Rd	7	9.7	Line	HIGH	LOW <5	MINIMAL VEGITATION	HIGH	GULLY	DITCH	8110,8111,8112	DSCN8110.JPG	DSCN8111.JPG	DSCN8112.JPG				201
Cabot	Ducharme Rd	8	9.1	Point	MEDIUM	STEEP >15	MINIMAL VEGETATION	HIGH	SLUMP	CULVERT ENDWALL	7452	DSCN7452.JPG						NA
Cabot	Thistle Hill Rd	9	8.8	Line	HIGH	MOD 5-15	MINIMAL VEGITATION	LOW	GULLY	DITCH	8098,8099,8100	DSCN8099.JPG	DSCN8100.JPG	DSCN8098.JPG				316
Cabot	Bayley-Hazen Rd	10	9.9	Line	HIGH	MOD 5-15	BARE	LOW	RILL	IN ROADWAY	8811,8812,8813	DSCN8811.JPG	DSCN8812.JPG	DSCN8813.JPG			water from driveway	156
Cabot	Bayley-Hazen Rd	11	9.9	Line	HIGH	MOD 5-15	BARE	LOW	RILL	IN ROADWAY	8814,8815,8816,8817	DSCN8814.JPG	DSCN8815.JPG	DSCN8816.JPG	DSCN8817.JPG			474
Cabot	Last Rd	12	9.6	Line	HIGH	MOD 5-15	MINIMAL VEGITATION	MEDIUM	GULLY	DITCH	8145,8146,8147	DSCN8145.JPG	DSCN8146.JPG	DSCN8147.JPG				367
Cabot	Blodgett Rd	13	8.8	Line	HIGH	LOW <5	BARE	LOW	GULLY	IN ROADWAY	8789,8790,8791	DSCN8789.JPG	DSCN8790.JPG	DSCN8791.JPG				237
Cabot	Blodgett Rd	14	8.8	Line	HIGH	LOW <5	BARE	LOW	GULLY	IN ROADWAY	8792,8793,8794	DSCN8792.JPG	DSCN8793.JPG	DSCN8794.JPG				237
Cabot	Thistle Hill Rd	15	8.8	Line	HIGH	MOD 5-15	MINIMAL VEGITATION	LOW	GULLY	DITCH	8101,8102	DSCN8101.JPG	DSCN8102.JPG					298
Cabot	Thistle Hill Rd	16	8.8	Line	HIGH	MOD 5-15	MINIMAL VEGITATION	LOW	GULLY	DITCH	8113,8114,8115	DSCN8113.JPG	DSCN8114.JPG	DSCN8115.JPG				333
Cabot	Thistle Hill Rd	17	8.8	Line	HIGH	MOD 5-15	MINIMAL VEGITATION	LOW	GULLY	DITCH	8098,8099,8100	DSCN8099.JPG	DSCN8100.JPG	DSCN8098.JPG				316
Cabot	Last Rd	18	7.8	Point	MEDIUM	LOW <5	BARE	HIGH	STREAM SCOUR	CULVERT HEADWALL	8155,8156	DSCN8155.JPG	DSCN8156.JPG					NA
Cabot	Last Rd	19	7.8	Point	LOW	STEEP >15	BARE	HIGH	SLUMP	ROADWAY SHOULDER	8157,8158	DSCN8157.JPG	DSCN8158.JPG					NA
Cabot	Blodgett Rd	20	7.7	Line	MEDIUM	MOD 5-15	BARE	LOW	GULLY	DITCH	8783,8784,8785,8786	DSCN8783.JPG	DSCN8784.JPG	DSCN8785.JPG	DSCN8786.JPG			232
Cabot	Thistle Hill Rd	21	7.7	Line	MEDIUM	MOD 5-15	BARE	LOW	GULLY	DITCH	8124,8125,8126	DSCN8124.JPG	DSCN8126.JPG	DSCN8125.JPG				196
Cabot	Last Rd	22	7.7	Line	MEDIUM	MOD 5-15	BARE	LOW	RILL	IN ROADWAY	8140,8141	DSCN8140.JPG	DSCN8141.JPG					376
Cabot	Last Rd	23	7.7	Line	HIGH	LOW <5	MINIMAL VEGITATION	LOW	GULLY	DITCH	8148,8149,8150,8151	DSCN8148.JPG	DSCN8149.JPG	DSCN8150.JPG	DSCN8151.JPG			122
Cabot	Jug Brook Rd	24	7.7	Line	MEDIUM	MOD 5-15	BARE	LOW	INCISION	IN ROADWAY	7453 7454 7455 7456	DSCN7453.JPG	DSCN7454.JPG	DSCN7455.JPG	DSCN7456.JPG			201
Cabot	Thistle Hill Rd	25	7.2	Point	MEDIUM	LOW <5	BARE	MEDIUM	GULLY	ROADWAY SHOULDER	8119	DSCN8119.JPG						NA
Cabot	Bayley-Hazen Rd	26	6.6	Line	LOW	STEEP >15	BARE	LOW	GULLY	IN ROADWAY	8807	DSCN8807.JPG						46
Cabot	Bayley-Hazen Rd	27	6.6	Line	MEDIUM	LOW <5	BARE	LOW	GULLY	IN ROADWAY	,8809,8810	DSCN8809.JPG	DSCN8810.JPG					170
Cabot	Thistle Hill Rd	28	6.6	Line	MEDIUM	MOD 5-15	MINIMAL VEGITATION	LOW	RILL	DITCH	8127,8128,8129	DSCN8127.JPG	DSCN8128.JPG	DSCN8129.JPG				307

Cabot	Last Rd	29	6.6	Line	MEDIUM	LOW <5	BARE	LOW	GULLY	DITCH	8136,8137	DSCN8136.JPG	DSCN8137.JPG					145
Cabot	Last Rd	30	6.6	Line	MEDIUM	LOW <5	BARE	LOW	RILL	IN ROADWAY	8138,8139	DSCN8139.JPG	DSCN8138.JPG					249
Cabot	Thistle Hill Rd	31	6.5	Line	LOW	LOW <5	BARE	HIGH	RILL	DITCH	8130,8131,8132	DSCN8130.JPG	DSCN8131.JPG	DSCN8132.JPG				129
Cabot	Cabot Plains Rd	32	6.5	Line	MEDIUM	LOW <5	MINIMAL VEGITATION	HIGH	GULLY	DITCH		DSCN8415.JPG	DSCN8424.JPG	DSCN8425.JPG	DSCN8426.JPG	DSCN8427.JPG	no 8415	381
Cabot	Cabot Plains Rd	33	6.5	Line	MEDIUM	LOW <5	MINIMAL VEGITATION	HIGH	GULLY	DITCH		DSCN8428.JPG	DSCN8429.JPG	DSCN8430.JPG				319
Cabot	Thistle Hill Rd	34	6.5	Point	LOW	LOW <5	BARE	HIGH	SLUMP	CULVERT HEADWALL		DSCN8120.JPG	DSCN8121.JPG	DSCN8122.JPG	DSCN8123.JPG			NA
Cabot	Last Rd	35	6.0	Line	MEDIUM	LOW <5	MINIMAL VEGITATION	MEDIUM	GULLY	DITCH	8142,8143,8144	DSCN8142.JPG	DSCN8143.JPG	DSCN8144.JPG				201
Cabot	Last Rd	36	6.0	Line	LOW	LOW <5	BARE	MEDIUM	RILL	IN ROADWAY	8152,8153,8154	DSCN8152.JPG	DSCN8153.JPG	DSCN8154.JPG				128
Cabot	Blodgett Rd	37	5.5	Line	LOW	MOD 5-15	BARE	LOW	GULLY	DITCH	8787,8788	DSCN8787.JPG	DSCN8788.JPG					119
Cabot	Thistle Hill Rd	38	5.5	Line	MEDIUM	LOW <5	MINIMAL VEGITATION	LOW	RILL	DITCH	8104,8105,8106	DSCN8106.JPG	DSCN8104.JPG	DSCN8105.JPG				258
Cabot	Thistle Hill Rd	39	5.5	Line	LOW	LOW <5	BARE	LOW	GULLY	ROADWAY SHOULDER	8107,8108,8109	DSCN8109.JPG	DSCN8108.JPG	DSCN8107.JPG				61
Cabot	Thistle Hill Rd	40	5.5	Line	LOW	LOW <5	BARE	LOW	RILL	ROADWAY SHOULDER	8116,8117,8118	DSCN8116.JPG	DSCN8117.JPG	DSCN8118.JPG				70
Cabot	Last Rd	41	5.5	Line	LOW	LOW <5	BARE	LOW	RILL	IN ROADWAY	8133,8134	DSCN8133.JPG	DSCN8134.JPG					141
Cabot	Last Rd	42	5.5	Line	LOW	LOW <5	BARE	LOW	RILL	IN ROADWAY	8162,8163,8164	DSCN8162.JPG	DSCN8163.JPG	DSCN8164.JPG				143
Cabot	Jug Brook Rd	43	5.5	Line	LOW	MOD 5-15	BARE	LOW	RILL	IN ROADWAY	7457 7458 7459	DSCN7457.JPG	DSCN7458.JPG	DSCN7459.JPG				164
Cabot	Jug Brook Rd	44	5.5	Line	LOW	MOD 5-15	BARE	LOW	INCISION	ROADWAY SHOULDER	7460 7461 7462	DSCN7460.JPG	DSCN7461.JPG	DSCN7462.JPG				160
Cabot	Jug Brook Rd	45	5.5	Line	LOW	MOD 5-15	BARE	LOW	RILL	ROADWAY SHOULDER	7463 7464	DSCN7463.JPG	DSCN7464.JPG					47
Cabot	Coits Pond Rd	46	5.5	Line	LOW	MOD 5-15	BARE	LOW	INCISION	ROADWAY SHOULDER	7465 7466 7467	DSCN7465.JPG	DSCN7466.JPG	DSCN7467.JPG				88
Cabot	Coits Pond Rd	47	5.5	Line	LOW	MOD 5-15	BARE	LOW	SHEET	ROADWAY SHOULDER	7468 7469 7470	DSCN7468.JPG	DSCN7469.JPG	DSCN7470.JPG				162
Cabot	Coits Pond Rd	48	5.5	Line	LOW	LOW <5	BARE	LOW	SHEET	ROADWAY SHOULDER	7471 7472 7473	DSCN7471.JPG	DSCN7472.JPG	DSCN7473.JPG				197
Cabot	Houston Hill Rd	49	5.5	Line	LOW	LOW <5	BARE	LOW	INCISION	ROADWAY SHOULDER	7474 7475 7476 7477	DSCN7474.JPG	DSCN7475.JPG	DSCN7476.JPG	DSCN7477.JPG			193
Cabot	W Shore Rd	50	5.5	Line	LOW	LOW <5	BARE	LOW	GULLY	ROADWAY SHOULDER	8738 8739	DSCN8739.JPG	DSCN8738.JPG					32
Cabot	W Shore Rd	51	5.5	Line	LOW	LOW <5	BARE	LOW	RILL	ROADWAY SHOULDER	8744 8745 8746	DSCN8745.JPG	DSCN8746.JPG	DSCN8744.JPG				217
Cabot	Cabot Plains Rd	52	5.5	Line	MEDIUM	LOW <5	MINIMAL VEGITATION	LOW		ROADWAY SHOULDER		DSCN8417.JPG	DSCN8418.JPG	DSCN8419.JPG	DSCN8420.JPG			765
Cabot	W Shore Rd	53	5.5	Point	LOW	LOW <5	BARE	LOW	INCISION	ROADWAY SHOULDER	8740	DSCN8740.JPG						NA
Cabot	Menard Rd	54	5.2	Point	LOW	LOW <5	MINIMAL VEGETATION	HIGH	SHEET	ROADWAY SHOULDER		DSCN8408.JPG	DSCN8409.JPG					NA
Cabot	Thistle Hill Rd	55	4.4	Line	LOW	LOW <5	MINIMAL VEGITATION	LOW	GULLY	DITCH	8097, 8095, 8096	DSCN8095.JPG	DSCN8096.JPG	DSCN8097.JPG				56
Cabot	W Shore Rd	56	4.4	Line	LOW	LOW <5	MINIMAL VEGITATION	LOW	RILL	DITCH	8741 8742 8743	DSCN8743.JPG	DSCN8742.JPG	DSCN8741.JPG				268
Cabot	Walbridge Rd	57	4.4	Line	LOW	MOD 5-15	MINIMAL VEGITATION	LOW	RILL	ROADWAY SHOULDER		DSCN8401.JPG	DSCN8402.JPG	DSCN8403.JPG				275
Cabot	Walbridge Rd	58	4.4	Line	LOW	LOW <5	MINIMAL VEGITATION	LOW	SHEET	ROADWAY SHOULDER		DSCN8404.JPG	DSCN8405.JPG	DSCN8407.JPG				126
Cabot	Cabot Plains	59	4.4	Line	LOW	MOD 5-15	MINIMAL	LOW	INCISION	ROADWAY		DSCN8436.	DSCN8437.J	DSCN8438.				158

	Rd						VEGITATION			SHOULDER		JPG	PG	JPG				
Cabot	Cabot Plains Rd	60	3.3	Line	MEDIUM	LOW <5	STONE	LOW	RILL	ROADWAY SHOULDER		DSCN8413.JPG					8413 8413 8415 8416	221
Cabot	Churchill Rd	61	2.2	Line	LOW	MOD 5-15	STONE	LOW	INCISION	ROADWAY SHOULDER		DSCN8398.JPG	DSCN8399.JPG	DSCN8400.JPG				197
Cabot	Cabot Plains Rd	62	2.2	Line	LOW	LOW <5	STONE	LOW	INCISION	ROADWAY SHOULDER		DSCN8410.JPG	DSCN8411.JPG	DSCN8412.JPG				29
Cabot	Cabot Plains Rd	63	2.2	Line	LOW	LOW <5	STONE	LOW	RILL	ROADWAY SHOULDER		DSCN8421.JPG	DSCN8422.JPG					194
Cabot	Cabot Plains Rd	64	2.2	Line	LOW	MOD 5-15	STONE	LOW	RILL	ROADWAY SHOULDER		DSCN8432.JPG	DSCN8433.JPG	DSCN8431.JPG				150
Cabot	Cabot Plains Rd	65	2.2	Line	LOW	LOW <5	STONE	LOW	RILL	ROADWAY SHOULDER		DSCN8434.JPG	DSCN8435.JPG					180
Cabot	Cabot Plains Rd	66	2.2	Line	LOW	MOD 5-15	STONE	LOW	RILL	ROADWAY SHOULDER		DSCN8439.JPG	DSCN8440.JPG	DSCN8441.JPG				46
Cabot	Cabot Plains Rd	67	2.2	Line	LOW	LOW <5	STONE	LOW	RILL	ROADWAY SHOULDER		DSCN8443.JPG	DSCN8442.JPG	DSCN8444.JPG				230

Marshfield

Erosion site 1

Location – 546 feet of road shoulder erosion along Hollister Hill Rd at the intersection of Sadie Foss Rd in Marshfield, VT.

Field Collection Data –

Location of Erosion	Water Volume	Steepness of Site	Soil Cover	Deposition to Stream	Type of Erosion	Total Score
ROADWAY SHOULDER	MEDIUM	MOD 5-15	BARE	LOW	GULLY	7.7

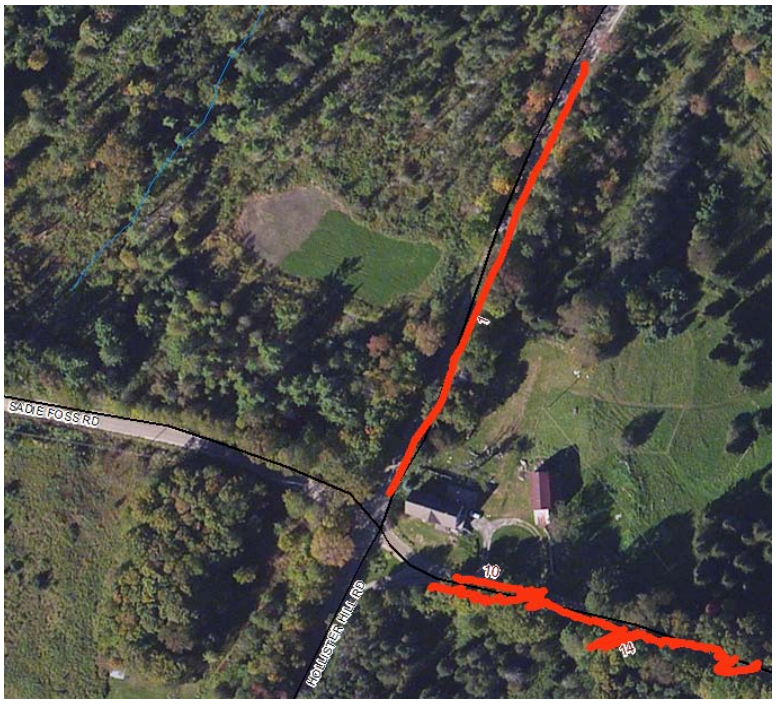
Site Slope Calculation – 8%

Suggested Erosion Treatment –

- Add 1-2 new cross culverts along erosion
- Add stone aprons at outlets of new culverts and existing culvert
- Install headers and footers on all new culverts and existing culvert
- Improve ditch by stone lining for length of erosion about 546 ft

Needed Information from Site –

- Calculate stone needed for ditch – estimate about 100 Yards
- Calculate stone needed for stone aprons at culvert outlets - estimate about 5 Yards
- Price of new culverts



Site Map

Photo 1

Photo 2

Photo 3

Erosion site 2

Location – 168 feet of road shoulder erosion along Hollister Hill Rd 0.4 miles north of Clarence George Rd in Marshfield, VT.

Field Collection Data –

Location of Erosion	Water Volume	Steepness of Site	Soil Cover	Deposition to Stream	Type of Erosion	Total Score
ROADWAY SHOULDER	MEDIUM	MOD 5-15	BARE	LOW	INCISION	7.7

Site Slope Calculation – 10%

Suggested Erosion Treatment –

- Improve road shoulder by ditching
- Stone line new ditch for length of erosion about 168 ft

Needed Information from Site –

- Calculate stone needed for ditch – estimate about 15 Yards

Site Map

Photo 1

Photo 2

Photo 3

Erosion site 3 -

Location – 340 feet of road shoulder erosion along Brook Rd 1.4 miles north of Calais Rd in Marshfield, VT.

Field Collection Data –

Location of Erosion	Water Volume	Steepness of Site	Soil Cover	Deposition to Stream	Type of Erosion	Total Score
ROADWAY SHOULDER	MEDIUM	LOW < 5	BARE	LOW	INCISION	6.6

Site Slope Calculation – 4%

Suggested Erosion Treatment –

- Improve road shoulder by grading
- Add 1-2 turn out along shoulder
- Stone line turn outs

Needed Information from Site –

- Calculate stone needed for turn outs – estimate about 6 Yards

Site Map

Photo1

Photo 2

Photo 3

Photo 4

Erosion site 4

Location – 214 feet of ditch erosion along Beaver Meadow Rd 250 feet north of Pitkin Farms Rd in Marshfield, VT.

Field Collection Data –

Location of Erosion	Water Volume	Steepness of Site	Soil Cover	Deposition to Stream	Type of Erosion	Total Score
DITCH	LOW	MOD 5-15	BARE	LOW	GULLY	5.5

Site Slope Calculation – 11%

Suggested Erosion Treatment –

- Improve ditch by stone line for length of erosion about 214 ft

Needed Information from Site –

- Calculate stone needed for ditch – estimate about 40 Yards

Site Map

Photo 1

Photo 2

Site 5 –

Location –129 feet of road shoulder erosion along Hollister Hill Rd at the intersection of Calais Rd in Marshfield, VT.

Field Collection Data –

Location of Erosion	Water Volume	Steepness of Site	Soil Cover	Deposition to Stream	Type of Erosion	Total Score
ROADWAY SHOULDER	LOW	MOD 5-15	BARE	LOW	GULLY	5.5

Site Slope Calculation – 13%

Suggested Erosion Treatment –

- Add stone aprons at outlets of existing culvert
- Install headers and footers on existing culvert
- Improve roadway shoulder by ditching
- Stone line ditch for length of erosion about 129 ft
- Replace existing culvert if undersized for location.

Needed Information from Site –

- Existing culvert dimensions and condition
- Existing culvert alignment
- Existing culvert header and footer information
- Calculate stone needed for ditch – estimate about 25 Yards
- Calculate stone needed for stone aprons at culvert outlets - estimate about 5 Yards
- Price of replacement culverts

Site Map

Photo1

Photo 2

Photo 3

Erosion site 6

Location – 215 feet of ditch erosion along Hollister Hill Rd 0.2 miles west of Calais Rd in Marshfield, VT.

Field Collection Data –

Location of Erosion	Water Volume	Steepness of Site	Soil Cover	Deposition to Stream	Type of Erosion	Total Score
DITCH	LOW	LOW < 5	BARE	LOW	GULLY	5.5

Site Slope Calculation – 4%

Suggested Erosion Treatment –

- Vegetate ditch for length of erosion about 215 ft
- Install 1- 2 turn outs along erosion.
- Stone line turn outs

Needed Information from Site –

- Calculate stone needed for turn outs – estimate about 6 Yards

Site Map

Photo 1

Photo 2

Photo 3

TOWN	ROAD NAME	SITE NUMBER	SCORE	SITE TYPE	VOLUME	STEEPNESS	SOIL COVER	DEPOSIT TO STREAM	EROSION CATEGORY	EROSION LOCATION	PHOTO ID	PHOTO 1	PHOTO 2	PHOTO 3	PHOTO 4	PHOTO 5	COMMENT	LENGTH OF EROSION IN FEET
Marshfield	Hollister Hill Rd	1	7.7	Line	MEDIUM	MOD 5-15	BARE	LOW	GULLY	ROADWAY SHOULDER	7272 7273 7274	DSCN7272.JPG	DSCN7273.JPG	DSCN7274.JPG				546
Marshfield	Hollister Hill Rd	2	7.7	Line	MEDIUM	MOD 5-15	BARE	LOW	INCISION	ROADWAY SHOULDER	7269 7270 7271	DSCN7269.JPG	DSCN7270.JPG	DSCN7271.JPG			starts at driveway	168
Marshfield	Brook Rd	3	6.6	Line	MEDIUM	LOW <5	BARE	LOW	INCISION	ROADWAY SHOULDER	7440 7441 7442 7443	DSCN7440.JPG	DSCN7441.JPG	DSCN7442.JPG	DSCN7443.JPG			340
Marshfield	Beaver Meadow Rd	4	5.5	Line	LOW	MOD 5-15	BARE	LOW	GULLY	DITCH	7290 7291	DSCN7290.JPG	DSCN7291.JPG					214
Marshfield	Hollister Hill Rd	5	5.5	Line	LOW	MOD 5-15	BARE	LOW	GULLY	ROADWAY SHOULDER	7281 7283 7284	DSCN7281.JPG	DSCN7283.JPG	DSCN7284.JPG			ditch erosion location also	129
Marshfield	Hollister Hill Rd	6	5.5	Line	LOW	LOW <5	BARE	LOW	GULLY	DITCH	7278 7279 7280	DSCN7278.JPG	DSCN7279.JPG	DSCN7280.JPG				215
Marshfield	Ennis Hill Rd	7	5.5	Line	LOW	LOW <5	BARE	LOW	INCISION	ROADWAY SHOULDER	7444 7445 7446	DSCN7444.JPG	DSCN7445.JPG	DSCN7446.JPG				109
Marshfield	Hollister Hill Rd	8	5.5	Line	MEDIUM	LOW <5	MINIMAL VEGITATION	LOW	INCISION	ROADWAY SHOULDER	7265 7266 7267 7268	DSCN7265.JPG	DSCN7266.JPG	DSCN7267.JPG	DSCN7268.JPG		there is a driveway in the middle	760
Marshfield	Hollister Hill Rd	9	5.5	Line	LOW	MOD 5-15	BARE	LOW	INCISION	ROADWAY SHOULDER	7274 7275 7277	DSCN7274.JPG	DSCN7275.JPG	DSCN7277.JPG				322
Marshfield	Beaver Meadow Rd	10	5.5	Line	LOW	LOW <5	BARE	LOW	RILL	ROADWAY SHOULDER	7288 7289	DSCN7288.JPG	DSCN7289.JPG					126
Marshfield	Beaver Meadow Rd	11	5.5	Line	LOW	LOW <5	BARE	LOW	SHEET	DITCH	7292 7293 7294	DSCN7292.JPG	DSCN7293.JPG	DSCN4292.JPG				156
Marshfield	Beaver Meadow Rd	12	5.5	Line	LOW	MOD 5-15	BARE	LOW	INCISION	ROADWAY SHOULDER	7295 7296 7297	DSCN7295.JPG	DSCN7296.JPG	DSCN7297.JPG				260
Marshfield	Hollister Hill Rd	13	4.4	Line	LOW	MOD 5-15	MINIMAL VEGITATION	LOW	GULLY	ROADWAY SHOULDER	7259 7260 7261 7262 7263	DSCN7259.JPG	DSCN7260.JPG	DSCN7261.JPG	DSCN7262.JPG	DSCN7263.JPG		391
Marshfield	Beaver Meadow Rd	14	4.4	Line	LOW	MOD 5-15	MINIMAL VEGITATION	LOW	INCISION	DITCH	7285 7286 7287	DSCN7285.JPG	DSCN7286.JPG	DSCN7287.JPG				795
Marshfield	Maple Hill Rd	15	3.6	Line	MEDIUM	LOW <5	STONE	MEDIUM	INCISION	DITCH	7256 7257 7258	DSCN7256.JPG	DSCN7257.JPG	DSCN7258.JPG				139

Plainfield

Erosion site 1

Location – 179 feet of road shoulder erosion along Gray Rd at intersection of Brook Rd in Plainfield, VT.

Field Collection Data –

Location of Erosion	Water Volume	Steepness of Site	Soil Cover	Deposition to Stream	Type of Erosion	Total Score
ROADWAY SHOULDER	MEDIUM	MOD 5-15	BARE	HIGH	GULLY	9.1

Site Slope Calculation – 20%

Suggested Erosion Treatment –

- Improve road shoulder by ditching
- Stone line ditch for length of erosion about 179 ft
- Add stone check dams within the ditch

Needed Information from Site –

- Calculate stone needed for ditch and dams – estimate about 30 Yards

Site Map

Photo 1

Photo 2

Photo 3

Erosion site 2

Location – Slump location on roadway shoulder near outlet of culvert on Country Club 0.5 miles South of US Route 2 in Plainfield, VT.

Field Collection Data –

Location of Erosion	Water Volume	Steepness of Site	Soil Cover	Deposition to Stream	Type of Erosion	Total Score
ROADWAY SHOULDER	MEDIUM	STEEP >15	MINIMAL VEGETATION	HIGH	SLUMP	9.1

Site Slope Calculation – Unknown

Suggested Erosion Treatment –

- Stabilize slope with rock and vegetation

- Reshape slump

Needed Information from Site –

- Gather slump slope information
- Calculate stone needed for slop stabilization
- Price of replacement culvert

Site Map

Photo 1

Photo 2

Erosion site 3

Location – Erosion along road edge over outlet of culvert on Harris Hill Rd 400 feet west of Batchelder Rd in Plainfield, VT.

Field Collection Data –

Location of Erosion	Water Volume	Steepness of Site	Soil Cover	Deposition to Stream	Type of Erosion	Total Score
ROADWAY SHOULDER	MEDIUM	STEEP >15	MINIMAL VEGETATION	HIGH	INCISION	9.1

Site Slope Calculation – Unknown

Suggested Erosion Treatment –

- Armor road shoulder above culvert
- Replace existing culvert if undersized for location.

Needed Information from Site –

- Existing culvert dimensions and condition
- Existing culvert alignment
- Determine stream bankful width at culvert
- Existing culvert header and footer information
- Calculate stone needed for stone apron at culvert outlet - estimate about 2 Yards
- Price of replacement culvert

Site Map

Photo 1

Erosion site 4

Location – Erosion in ditch on E Hill Rd at intersection of Fowler Rd, Bean Rd and E Hill Rd in Plainfield, VT.

Field Collection Data Site–

Location of Erosion	Water Volume	Steepness of Site	Soil Cover	Deposition to Stream	Type of Erosion	Total Score
DITCH	MEDIUM	MOD 5-15	MINIMAL VEGETATION	HIGH	INCISION	7.8

Site Slope Calculation – Unknown

Suggested Erosion Treatment –

- Improve ditch by stone lining up to erosion
- Create stone lined turn out at erosion

Needed Information from Site –

- Calculate stone needed for ditch and turn out

Site Map


Photo 1

Erosion site 5

Location – 477 feet of road shoulder erosion along E. Hill Rd 0.33 miles west of Batchelder Rd in Plainfield, VT.

Field Collection Data –

Location of Erosion	Water Volume	Steepness of Site	Soil Cover	Deposition to Stream	Type of Erosion	Total Score
ROADWAY SHOULDER	MEDIUM	MOD 5-15	BARE	LOW	INCISION	7.7

Site Slope Calculation – 11%

Suggested Erosion Treatment –

- Add 1-2 new cross culverts along erosion
- Add stone aprons at outlets of new culverts
- Install headers and footers on all new culverts
- Improve roadway shoulder by ditching
- Stone line new ditch for length of erosion about 477 ft
- Stone line turn out at end of ditch

Needed Information from Site –

- Calculate stone needed for ditch and turn out – estimate about 100 Yards
- Calculate stone needed for stone aprons at culvert outlets - estimate about 5 Yards
- Price of new culverts

Site Map

Photo 1

Photo 2

Photo 3

Erosion site 6

Location – 162 feet of road shoulder erosion along E Hill Rd 0.4 miles north of Brook Rd in Plainfield, VT.

Field Collection Data –

Location of Erosion	Water Volume	Steepness of Site	Soil Cover	Deposition to Stream	Type of Erosion	Total Score
ROADWAY SHOULDER	MEDIUM	LOW <5	BARE	LOW	INCISION	6.6

Site Slope Calculation – 6%

Suggested Erosion Treatment –

- Improve roadway shoulder by ditching
- Stone line new ditch for length of erosion about 162 ft
- Stone line turn out at end of ditch

Needed Information from Site –

- Calculate stone needed for ditch and turn out – estimate about 30 Yards

Site Map


Photo 1


Photo 2

Erosion site 7 and 8

Location – Erosion on Cerutti Rd 340 feet east of Lower Rd in Plainfield, VT.

Field Collection Data Site–

Location of Erosion	Water Volume	Steepness of Site	Soil Cover	Deposition to Stream	Type of Erosion	Total Score
DITCH	LOW	MOD 5-15	BARE	HIGH	INCISION	6.5
HEADWALL	LOW	MOD 5-15	BARE	HIGH	SLUMP	6.5

Site Slope Calculation – 5%

Suggested Erosion Treatment for Ditch Incision–

- Stone line ditch up to erosion about 25 ft
- Stone line turn out at end of ditch

Suggested Erosion Treatment for Headwall Slump–

- Stabilize slope with rock and vegetation
- Reshape slump

Needed Information from Site –

- Existing culvert dimensions and condition
- Existing culvert alignment
- Existing culvert header and footer information
- Determine bankfull width for existing culvert
- Gather slump slope information
- Calculate stone needed for slop stabilization, ditch, and turnout – estimate about 20 Yards
- Price of replacement culvert

Site Map

Photo 1

Photo 2

Photo 3

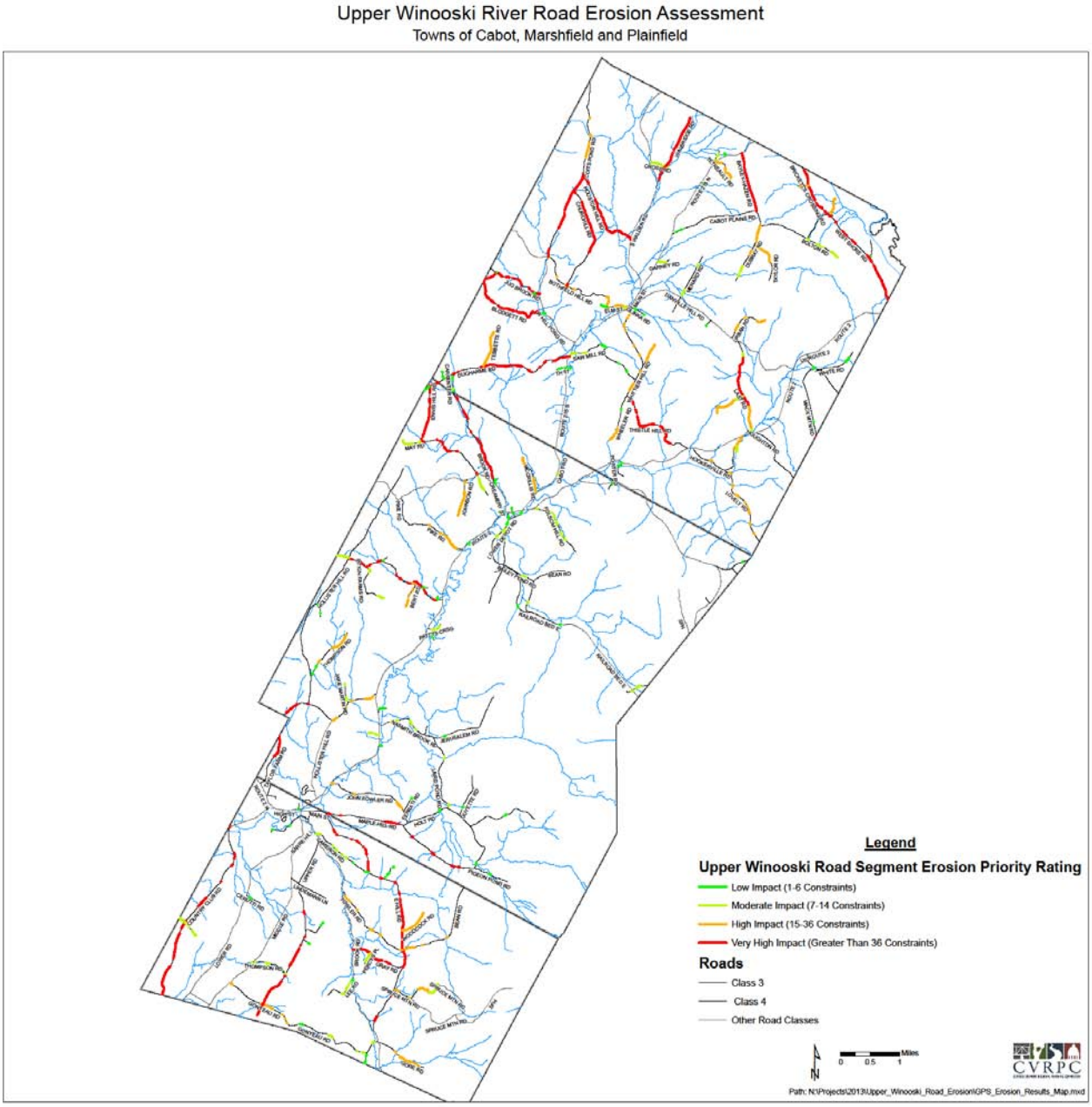
Photo 4

Photo 5

TOWN	ROAD NAME	SITE NUMBER	SCORE	SITE TYPE	VOLUME	STEEPNESS	SOIL COVER	DEPOSIT TO STREAM	EROSION CATEGORY	EROSION LOCATION	PHOTO ID	PHOTO 1	PHOTO 2	PHOTO 3	PHOTO 4	PHOTO 5	COMMENT	LENGTH OF EROSION IN FEET
Plainfield	Gray Rd	1	9.1	Line	MEDIUM	MOD 5-15	BARE	HIGH	GULLY	ROADWAY SHOULDER	6224 6225 6226	DSCN6226.JPG	DSCN6225.JPG	DSCN6224.JPG				179
Plainfield	Country Club Rd	2	9.1	Point	MEDIUM	STEEP >15	MINIMAL VEGETATION	HIGH	SLUMP	ROADWAY SHOULDER		DSCN6150.JPG	DSCN6149.JPG				town crew starting to repair	NA
Plainfield	E Hill Rd	3	9.1	Point	MEDIUM	STEEP >15	MINIMAL VEGETATION	HIGH	INCISION	CULVERT ENDWALL	6177	DSCN6177.JPG						NA
Plainfield	E Hill Rd	4	7.8	Point	MEDIUM	MOD 5-15	MINIMAL VEGETATION	HIGH	INCISION	DITCH	6193	DSCN6193.JPG						NA
Plainfield	E Hill Rd	5	7.7	Line	MEDIUM	MOD 5-15	BARE	LOW	INCISION	ROADWAY SHOULDER	6173 6174 6175 6176	DSCN6176.JPG	DSCN6175.JPG	DSCN6174.JPG	DSCN6173.JPG			478
Plainfield	E Hill Rd	6	6.6	Line	MEDIUM	LOW <5	BARE	LOW	INCISION	ROADWAY SHOULDER	6200 6201	DSCN6201.JPG	DSCN6200.JPG				ans run off area	162
Plainfield	Cerutti Rd	7	6.5	Line	LOW	MOD 5-15	BARE	HIGH	INCISION	DITCH		Cerutti Rd 1.JPG	Cerutti Rd 2.JPG	Cerutti Rd 3.JPG				25
Plainfield	Cerutti Rd	8	6.5	Point	LOW	MOD 5-15	BARE	HIGH	SLUMP	HEADWALL		Cerutti Culvert 1.JPG	Cerutti Culvert 2.JPG					NA
Plainfield	Upper Rd	9	6.0	Line	LOW	LOW <5	BARE	MEDIUM	INCISION	ROADWAY SHOULDER	6165 6166 6167 6168	DSCN6165.JPG	DSCN6166.JPG	DSCN6167.JPG	DSCN6168.JPG			373
Plainfield	E Hill Rd	10	6.0	Line	LOW	LOW <5	BARE	MEDIUM	INCISION	ROADWAY SHOULDER	6202 6203 6204 6205 6206	DSCN6204.JPG	DSCN6202.JPG	DSCN6203.JPG	DSCN6205.JPG	DSCN6206.JPG	erosion runs into hole in culvert	486
Plainfield	E Hill Rd	11	6.0	Point	LOW	STEEP >15	MINIMAL VEGETATION	MEDIUM	GULLY	DITCH	6194	DSCN6194.JPG						NA
Plainfield	Upper Rd	12	5.5	Line	LOW	LOW <5	BARE	LOW	INCISION	ROADWAY SHOULDER	6159 6160 6161	DSCN6159.JPG	DSCN6160.JPG	DSCN6161.JPG				121
Plainfield	Upper Rd	13	5.5	Line	LOW	LOW <5	BARE	LOW	INCISION	ROADWAY SHOULDER	6162 6163 6164	DSCN6163.JPG	DSCN6162.JPG	DSCN6164.JPG			and ditch	369
Plainfield	Upper Rd	14	5.5	Line	LOW	LOW <5	BARE	LOW	INCISION	ROADWAY SHOULDER	6169 6170	DSCN6169.JPG	DSCN6170.JPG					274
Plainfield	E Hill Rd	15	5.5	Line	LOW	LOW <5	BARE	LOW	INCISION	ROADWAY SHOULDER	6171 6172	DSCN6172.JPG	DSCN6171.JPG				and ditch	175
Plainfield	E Hill Rd	16	5.5	Line	LOW	MOD 5-15	BARE	LOW	GULLY	ROADWAY SHOULDER	6178 6179 6180 6181	DSCN6178.JPG	DSCN6181.JPG	DSCN6179.JPG	DSCN6180.JPG		erosion from driveway	364
Plainfield	E Hill Rd	17	5.5	Line	LOW	MOD 5-15	BARE	LOW	INCISION	ROADWAY SHOULDER	6182 6183	DSCN6183.JPG	DSCN6182.JPG					444
Plainfield	E Hill Rd	18	5.5	Line	LOW	MOD 5-15	BARE	LOW	GULLY	ROADWAY SHOULDER	6184 6185 6186	DSCN6184.JPG	DSCN6185.JPG	DSCN6186.JPG				420
Plainfield	E Hill Rd	19	5.5	Line	LOW	MOD 5-15	BARE	LOW	INCISION	ROADWAY SHOULDER	6187 6188 6189	DSCN6187.JPG	DSCN6188.JPG	DSCN6189.JPG				530
Plainfield	E Hill Rd	20	5.5	Line	LOW	MOD 5-15	BARE	LOW	INCISION	ROADWAY SHOULDER	6190 6191 6192	DSCN6190.JPG	DSCN6192.JPG					925
Plainfield	E Hill Rd	21	5.5	Line	LOW	LOW <5	BARE	LOW	INCISION	ROADWAY SHOULDER	6195 6196 6197	DSCN6195.JPG	DSCN6196.JPG	DSCN6197.JPG				217
Plainfield	E Hill Rd	22	5.5	Line	LOW	LOW <5	BARE	LOW	INCISION	ROADWAY SHOULDER	6198 6199	DSCN6198.JPG	DSCN6199.JPG					250
Plainfield	Gray Rd	23	5.5	Line	LOW	LOW <5	BARE	LOW	INCISION	ROADWAY SHOULDER	6214 6213	DSCN6213.JPG	DSCN6214.JPG					197
Plainfield	Gray Rd	24	5.5	Line	LOW	LOW <5	BARE	LOW	INCISION	ROADWAY SHOULDER	6215 6216 6217	DSCN6216.JPG	DSCN6217.JPG	DSCN6215.JPG				285
Plainfield	Gray Rd	25	5.5	Line	LOW	MOD 5-15	BARE	LOW	INCISION	ROADWAY	6218 6219	DSCN6218.J	DSCN6219.J					439

										SHOULDER		PG	PG					
Plainfield	Gray Rd	26	5.5	Line	LOW	MOD 5-15	BARE	LOW	INCISION	ROADWAY SHOULDER	6220 6221 6222	DSCN6220.JPG	DSCN6221.JPG	DSCN6222.JPG			slump ar culvert	290
Plainfield	Upper Rd	27	5.5	Point	LOW	LOW <5	BARE	LOW	INCISION	ROADWAY SHOULDER	6154 6515	DSCN6154.JPG	DSCN6155.JPG					NA
Plainfield	Maxfield Rd	28	5.5	Point	LOW	LOW <5	BARE	LOW	GULLY		6207 6208	DSCN6208.JPG	DSCN6207.JPG				top of bridge	NA
Plainfield	Gray Rd	29	5.5	Point	LOW	MOD 5-15	BARE	LOW	INCISION	ROADWAY SHOULDER	6223	DSCN6223.JPG						NA
Plainfield	Country Club Rd	30	3.6	Line	LOW	LOW <5	VEGETATION	MEDIUM	INCISION	ROADWAY SHOULDER	6151 6152 6163	DSCN6152.JPG	DSCN6153.JPG	DSCN6151.JPG				164
Plainfield	Upper Rd	31	3.3	Line	LOW	MOD 5-15	VEGETATION	LOW	INCISION	ROADWAY SHOULDER	6156 6157 6158	DSCN6156.JPG	DSCN6158.JPG	DSCN6157.JPG				252

Attachment A – Study Area Map



Attachment B – Scoring Matrix

Volume	add	Steepness ~ Velocity	add	Soil Cover	add	Deposition to Stream	add	total
L		S		K		D		
High Vol	3	Steep	3	Bare	4	Much Depo	30%	13
	3		3		4	Some Depo	20%	12
	3		3		4	Low Depo	10%	11
	3		3	Minor Veg	3	Much Depo	30%	11.7
	3		3		3	Some Depo	20%	10.8
	3		3		3	Low Depo	10%	9.9
	3		3	Veg	2	Much Depo	30%	10.4
	3		3		2	Some Depo	20%	9.6
	3		3		2	Low Depo	10%	8.8
	3		3	Stone	1	Much Depo	30%	9.1
	3		3		1	Some Depo	20%	8.4
	3		3		1	Low Depo	10%	7.7
	3	Moderate	2	Bare	4	Much Depo	30%	11.7
	3		2		4	Some Depo	20%	10.8
	3		2		4	Low Depo	10%	9.9
	3		2	Minor Veg	3	Much Depo	30%	10.4
	3		2		3	Some Depo	20%	9.6
	3		2		3	Low Depo	10%	8.8
	3		2	Veg	2	Much Depo	30%	9.1
	3		2		2	Some Depo	20%	8.4
	3		2		2	Low Depo	10%	7.7
	3		2	Stone	1	Much Depo	30%	7.8
	3		2		1	Some Depo	20%	7.2
	3		2		1	Low Depo	10%	6.6
	3	Shallow	1	Bare	4	Much Depo	30%	10.4
	3		1		4	Some Depo	20%	9.6

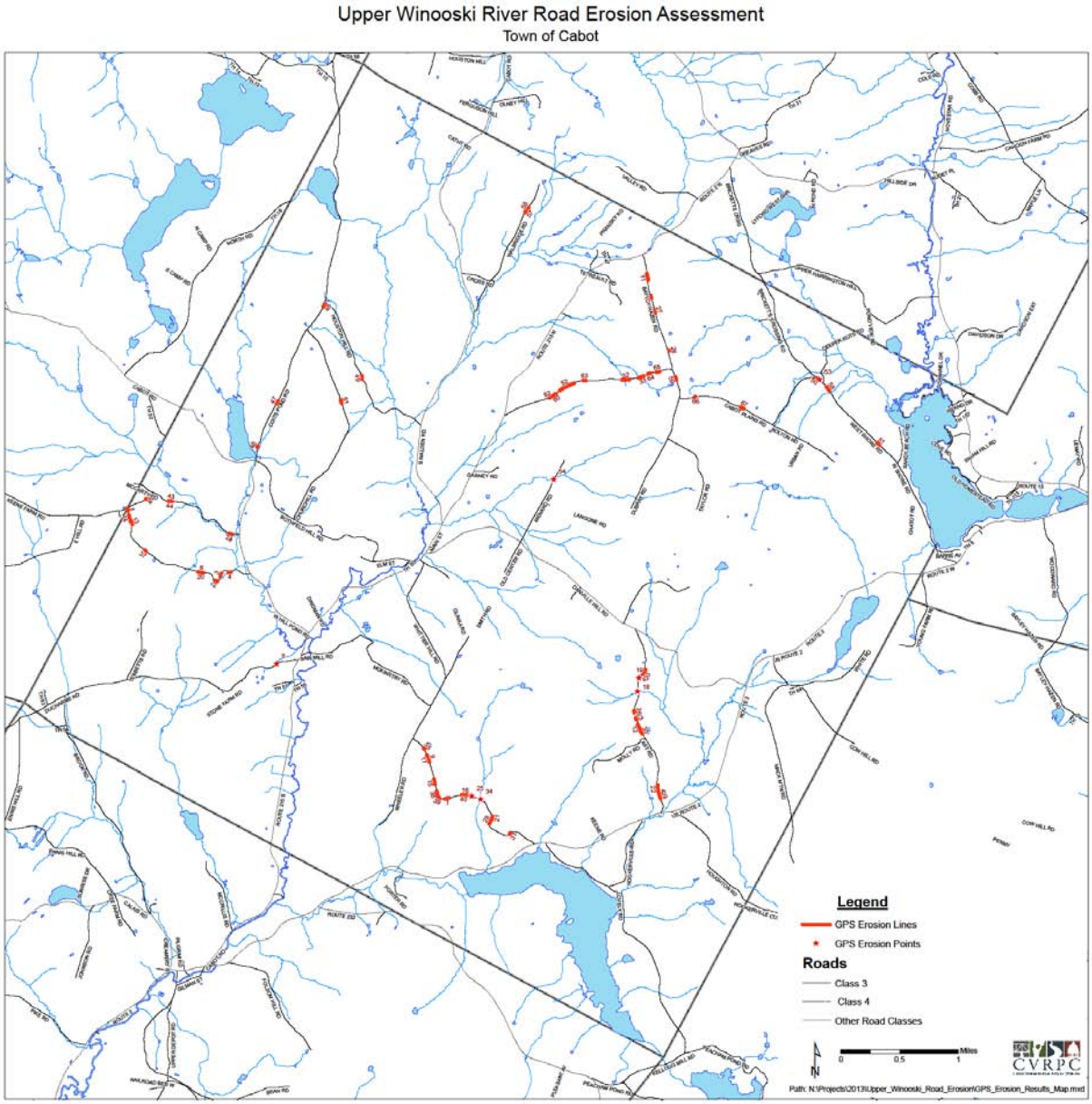
Volume	add	Steepness ~ Velocity	add	Soil Cover	add	Deposition to Stream	add	total
	3		1		4	Low Depo	10%	8.8
	3		1	Minor Veg	3	Much Depo	30%	9.1
	3		1		3	Some Depo	20%	8.4
	3		1		3	Low Depo	10%	7.7
	3		1	Veg	2	Much Depo	30%	7.8
	3		1		2	Some Depo	20%	7.2
	3		1		2	Low Depo	10%	6.6
	3		1	Stone	1	Much Depo	30%	6.5
	3		1		1	Some Depo	20%	6
	3		1		1	Low Depo	10%	5.5
Med Vol	2	Steep	2	Bare	4	Much Depo	30%	10.4
	2		2		4	Some Depo	20%	9.6
	2		2		4	Low Depo	10%	8.8
	2		2	Minor Veg	3	Much Depo	30%	9.1
	2		2		3	Some Depo	20%	8.4
	2		2		3	Low Depo	10%	7.7
	2		2	Veg	2	Much Depo	30%	7.8
	2		2		2	Some Depo	20%	7.2
	2		2		2	Low Depo	10%	6.6
	2		2	Stone	1	Much Depo	30%	6.5
	2		2		1	Some Depo	20%	6
	2		2		1	Low Depo	10%	5.5
	2	Moderate	1	Bare	4	Much Depo	30%	9.1
	2		1		4	Some Depo	20%	8.4
	2		1		4	Low Depo	10%	7.7
	2		1	Minor Veg	3	Much Depo	30%	7.8
	2		1		3	Some Depo	20%	7.2
	2		1		3	Low Depo	10%	6.6

Volume	add	Steepness ~ Velocity	add	Soil Cover	add	Deposition to Stream	add	total
	2		1	Veg	2	Much Depo	30%	6.5
	2		1		2	Some Depo	20%	6
	2		1		2	Low Depo	10%	5.5
	2		1	Stone	1	Much Depo	30%	5.2
	2		1		1	Some Depo	20%	4.8
	2		1		1	Low Depo	10%	4.4
	2	Shallow	0	Bare	4	Much Depo	30%	7.8
	2		0		4	Some Depo	20%	7.2
	2		0		4	Low Depo	10%	6.6
	2		0	Minor Veg	3	Much Depo	30%	6.5
	2		0		3	Some Depo	20%	6
	2		0		3	Low Depo	10%	5.5
	2		0	Veg	2	Much Depo	30%	5.2
	2		0		2	Some Depo	20%	4.8
	2		0		2	Low Depo	10%	4.4
	2		0	Stone	1	Much Depo	30%	3.9
	2		0		1	Some Depo	20%	3.6
	2		0		1	Low Depo	10%	3.3
Low Vol	1	Steep	1	Bare	4	Much Depo	30%	7.8
	1		1		4	Some Depo	20%	7.2
	1		1		4	Low Depo	10%	6.6
	1		1	Minor Veg	3	Much Depo	30%	6.5
	1		1		3	Some Depo	20%	6
	1		1		3	Low Depo	10%	5.5
	1		1	Veg	2	Much Depo	30%	5.2
	1		1		2	Some Depo	20%	4.8
	1		1		2	Low Depo	10%	4.4
	1		1	Stone	1	Much Depo	30%	3.9

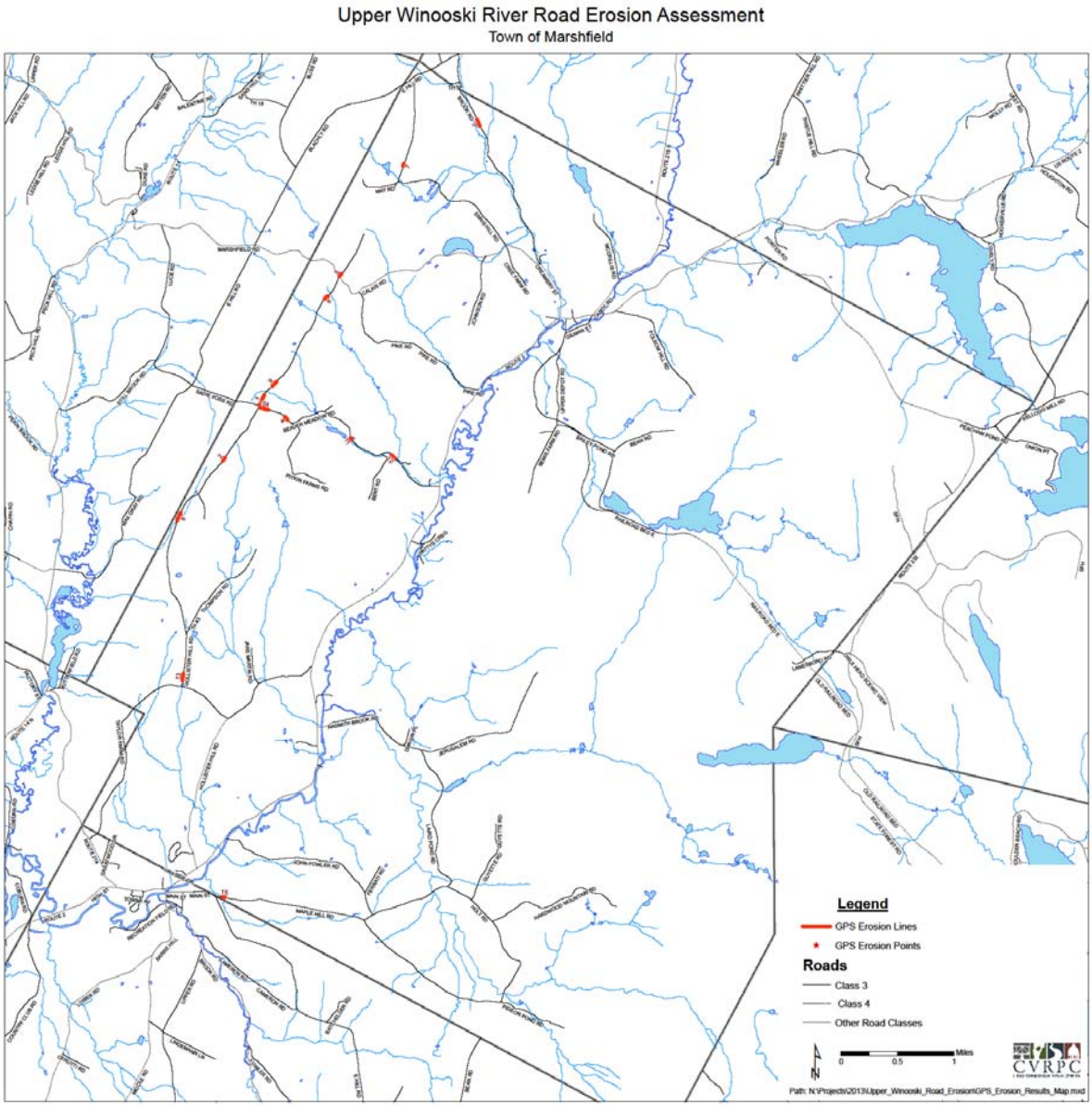
Volume	add	Steepness ~ Velocity	add	Soil Cover	add	Deposition to Stream	add	total
	1		1		1	Some Depo	20%	3.6
	1		1		1	Low Depo	10%	3.3
	1	Moderate	0	Bare	4	Much Depo	30%	6.5
	1		0		4	Some Depo	20%	6
	1		0		4	Low Depo	10%	5.5
	1		0	Minor Veg	3	Much Depo	30%	5.2
	1		0		3	Some Depo	20%	4.8
	1		0		3	Low Depo	10%	4.4
	1		0	Veg	2	Much Depo	30%	3.9
	1		0		2	Some Depo	20%	3.6
	1		0		2	Low Depo	10%	3.3
	1		0	Stone	1	Much Depo	30%	2.6
	1		0		1	Some Depo	20%	2.4
	1		0		1	Low Depo	10%	2.2
	1	Shallow	0	Bare	4	Much Depo	30%	6.5
	1		0		4	Some Depo	20%	6
	1		0		4	Low Depo	10%	5.5
	1		0	Minor Veg	3	Much Depo	30%	5.2
	1		0		3	Some Depo	20%	4.8
	1		0		3	Low Depo	10%	4.4
	1		0	Veg	2	Much Depo	30%	3.9
	1		0		2	Some Depo	20%	3.6
	1		0		2	Low Depo	10%	3.3
	1		0	Stone	1	Much Depo	30%	2.6
	1		0		1	Some Depo	20%	2.4
	1		0		1	Low Depo	10%	2.2

Attachment C – Town Erosion Site Maps

Cabot



Marshfield


Upper Winooski River Road Erosion Assessment
Town of Marshfield
Legend
GPS Erosion Lines
GPS Erosion Points
Roads
Class 3
Class 4
Other Road Classes
Miles
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0.5
1
N
CVRPC
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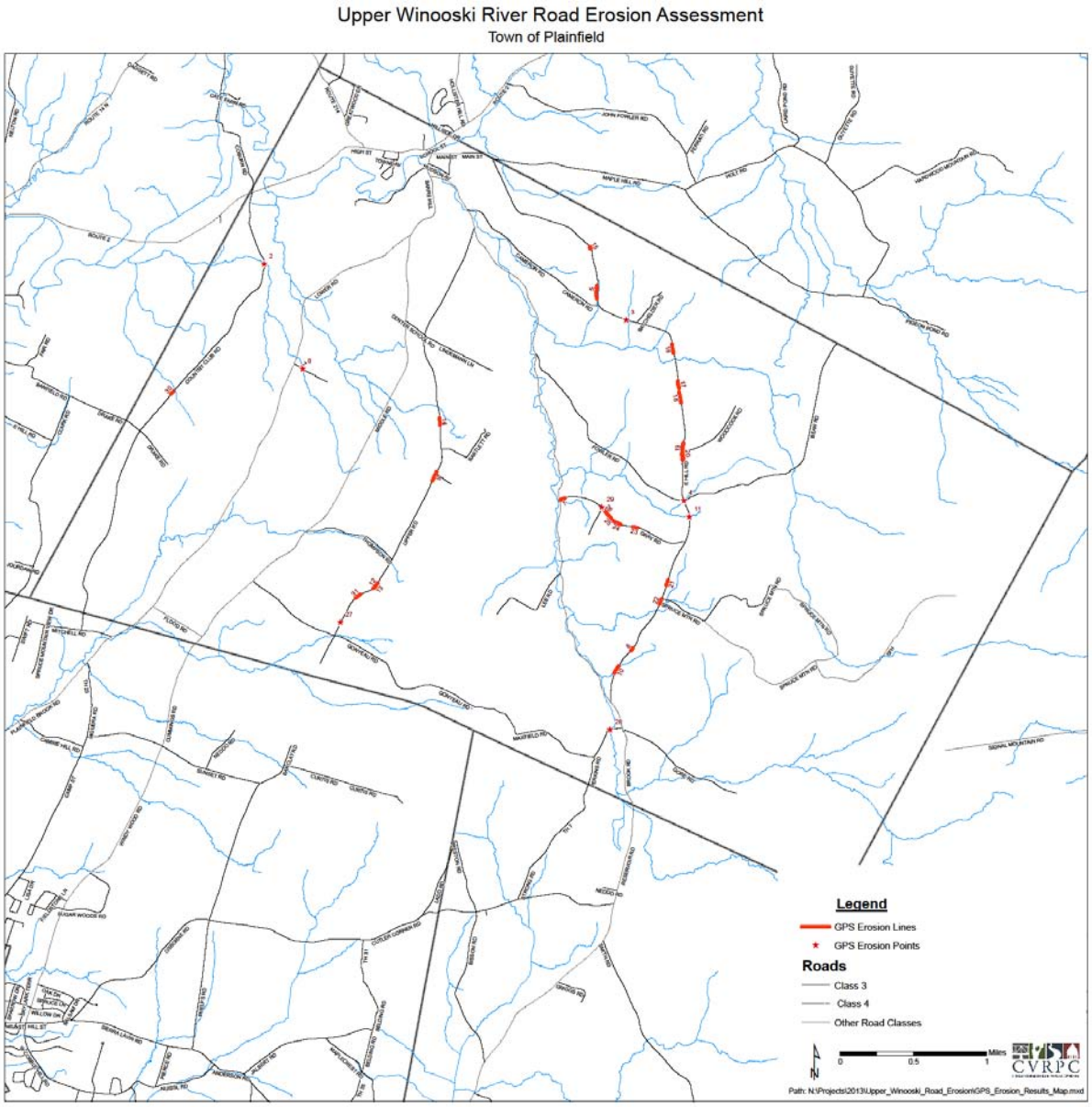
Plainfield


Upper Winooski River Road Erosion Assessment
Town of Plainfield
Legend
GPS Erosion Lines
GPS Erosion Points
Roads
Class 3
Class 4
Other Road Classes
Miles
0
0.5
1
CVRPC
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Attachment D – Town Aquatic Organism Report and Data

Town Aquatic Organism Passage (AOP), Geomorphic Compatibility, and Retrofit Potential

We are writing to share recently collected information on culverts in your town that are vulnerable to flood damage and impair the movement of fish species such as brook trout. In 2013, the Friends of the Winooski River and the Central VT Regional Planning Commission using protocols jointly developed by the Vermont River Management Program and the Vermont Department of Fish & Wildlife.[1] These protocols involve rapid screening of structures regarding:

their susceptibility to failure due to sizing or design ("fluvial geomorphic compatibility" or "Geomorphic Compatibility" for short); and

their ability to permit unrestricted movement for fish ("Aquatic Organism Passage", or AOP)

As you know, flash flooding is one of the most common and damaging natural hazards in Vermont. Increasing frequency and intensity of storms over the last several decades (Fig. 1) has amplified damage to infrastructure and required repairs that have been increasingly costly and frequently damaging to stream health.

While most towns are acutely aware that good design and adequate sizing can save money and limit damage to road infrastructure in the long run, with the added benefit of improving stream habitat for fish, this can be challenging and expensive. It is our hope that data collected in this assessments can provide addition information to help prioritize efforts and optimize expenditures in addressing these challenges, as well as provide compelling documentation for leveraging funding options when opportunities arise.

This project was conducted under funding provided by The Agency of Natural Resources Ecosystem Restoration Program. Full data sets from the assessments have been uploaded to the Vermont Agency of Natural Resources Stream Geomorphic Assessment Data Management System (DMS), where they are accessible for public viewing. [2] Summary reports on a town-wide basis are also available through the DMS. [3]

The two primary screening tools noted above (Geomorphic Compatibility Screen and Aquatic Organism Passage Screen) have been developed to quickly analyze the data and yield easy-to-read assessment reports (a brief description of the screening process is found on pages G16-G20 of the Bridge and Culvert Assessment Protocols mentioned above).[4]

Based on the results of the 2013 assessments, we are providing a list and a map of the town culverts assessed in your municipality. While it may be noticeable that some of these structures are small in size, the impacts of such structures can be large (Fig. 2) and the costs for replacement or repair may be relatively small compared to costs to address larger structures.

[1] http://www.anr.state.vt.us/dec/waterq/rivers/docs/rv_SGAB&CProtocols.pdf

[2] https://anrnode.anr.state.vt.us/SGA/datasets/structures/dataEntry.aspx?did=176

[3] https://anrnode.anr.state.vt.us/SGA/datasets/selectReport.aspx?sortType=Town&bid=07&bnm=Lamoille

[4] http://www.anr.state.vt.us/dec/waterq/rivers/docs/rv_SGAB&CProtocols.pdf

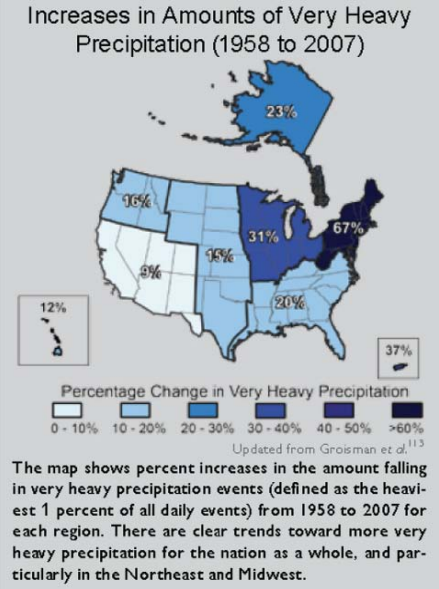

Figure 1. Increases in heavy precipitation events have been pronounced in the northeast over the past 50 years (from Betts 2011, 'Climate Change in Vermont'

Figure 2. This gully formed in a microburst storm when a small stream jumped its banks at a plugged culvert at the top of a hill in 2007. The woman at center of the photo is spanning the post-storm width of the stream with her arms. Adequately sized and well-designed culvert installs benefit both roads and streams.

We acknowledge that funding for replacing or otherwise remediating these structures is limited. Toward this end, we hope to provide some limited technical assistance and perhaps guidance towards emerging opportunities to secure funds for addressing these issues. While funding sources shift over time, recent years have seen a number of projects implemented under USFWS Partners for Fish & Wildlife funds. Although issues with FEMA funding for culvert upgrades have resurfaced, FEMA funds were actually allowed to partially fund culvert upgrades in a very limited number of post-Irene situations where culvert priorities had been clearly identified ahead of time. A contact list is provided below for further questions or requests for assistance. In addition, a wealth of information concerning these issues can be found on the 'Aquatic Organism Passage at Road/Stream Crossings' page hosted by VT Fish & Wildlife (http://www.vtfishandwildlife.com/fisheries_AOP.cfm).

Primary leads and contacts for this project include:

Ann Smith
Director
Friends of the Winooski River
ASmithinVT@Yahoo.com

Dan Currier
GIS Manager
Central VT Regional Planning
currier@cvregion.com

Additional Contact Info

Rich Kirn
Fisheries Biologist
VT Dept. of Fish & Wildlife
rich.kirn@state.vt.us
(802) 485-7566

As noted in the code explanations below, Incompatible structures (compatibility ratings coded red and orange) are most at risk for failure. Culvert retrofits for fish passage are generally only recommended for structures that are not at risk for failure due to geomorphic incompatibility.

Structures 'Missing data' for AOP screening is bridge or older structure data with missing attributes so some of the parameters used for the screening could not be scored.

Category	Aquatic Organism Passage (AOP) Geomorphic Compatibility
Fully compatible	Structure fully compatible with natural channel form and process. There is a low risk of failure. No replacement anticipated over the lifetime of the structure. A similar structure is recommended when replacement is needed.
Mostly compatible	Structure mostly compatible with current channel. No replacement anticipated over the lifetime of the structure. Minor design adjustments recommended when replacement is needed to make fully compatible.
Partially compatible	Structure compatible with either current form or process, but not both. Compatibility likely short term. There is a moderate risk of structure failure and replacement may be needed. Re-design suggested to improve geomorphic compatibility.
Mostly incompatible	Structure mostly incompatible with current form and process, with a moderate to high risk of structure failure. Re-design and replacement planning should be initiated to improve geomorphic compatibility.
Fully incompatible	Structure fully incompatible with channel and high risk of failure. Re-design and replacement should be performed as soon as possible to improve geomorphic compatibility.

AOP Coarse Screen
Green - Full AOP for all aquatic organisms
Gray -Reduced AOP for all aquatic organisms
Orange -No AOP for all aquatic organisms except adult salmonids
Red – No AOP for all aquatic organisms including adult salmonids

AOP Retrofit Potential	
H	High probability the existing culvert can be retrofitted.
M	Medium probability the existing culvert can be retrofitted
L	Low probability the existing culvert can be retrofitted
Pos 1 (left)	For strong swimmers
Pos2 (Center)	For moderate swimmers
Pos 3 (right)	For weak swimmers

Cabot

VERMONT

Stream Geomorphic Assessment

Agency of Natural Resouces

VT DEC
Vermont.gov
December, 31

Aquatic Organism Passage

Geomorphic Compatibility

Retrofit Potential

Upper Winooski-aboveBoltonDam

Explanation of codes used in table header

AOP Coarse Screen		AOP Geomorphic Compatibility		AOP Retrofit Potential	
Green	Full AOP for all aquatic organisms	Green	Structure is fully compatable geomorphically 20 < GC < 25	H	High probablity the existing culvert can be retrofited
Grey	Reduced AOP for all aquatic organisms	Light Green	Structure is mostly compatable geomorphically 15 < GC < 20	M	Medium probablity the existing culvert can be retrofited
Orange	No AOP for all aquatic organisms except adult salmonids	Yellow	Structure is partially compatable geomorphically 10 < GC < 15	L	Low probablity the existing culvert can be retrofited
Red	No AOP for all aquatic organisms including adult salmonids	Orange	Structure is mostly incompatable geomorphically 5 < GC < 10	Pos 1 (left)	For strong swimmers
		Red	Structure is fully incompatable geomorphically 0 < GC < 5	Pos2 (Center)	For moderate swimmers
				Pos 3 (right)	For weak swimmers

Explanation of data acquisition (link)

Town	Road	Stream Name	SgaID / struct_num	AOP Coarse Screen	AOP Geomorphic Compatibility	AOP Retrofit Potential	Percent Bankfull Width
Cabot	BLODGETT RD	Jug Brook	401204003812041	Reduced AOP	Mostly Compatable	MML	69 %
Cabot	BRICKETT'S CROSSING RD		400000000012041	No AOP Including Adult Salmonids	Mostly Compatable	HHH	100 %
Cabot	CABOT RD	Jug Brook	401204000412041	No AOP Including Adult Salmonids	Mostly Compatable	MML	60 %
Cabot	COITS POND RD	Trib to Winooski River	Win2006-004	Reduced AOP	Mostly Compatable	LLL	24 %
Cabot	DEEPER RUTS RD		400000000112041	Reduced AOP	Mostly Compatable	HHH	100 %
Cabot	DUCHARME RD		400051000012041	Reduced AOP	Partially Compatable	HHM	86 %
Cabot	DUCHARME RD	Trib to Winooski River	401204001512041	Reduced AOP	Partially Compatable	MLL	39 %
Cabot	HOUSTON HILL RD		600020000012041	No AOP Including Adult Salmonids	Mostly Compatable	HHM	100 %

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Stream Geomorphic Assessment

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Town	Road	Stream Name	SgaID / struct_num	AOP Coarse Screen	AOP Geomorphic Compatibility	AOP Retrofit Potential	Percent Bankfull Width
Cabot	HOUSTON HILL RD	Trib to Winooski River	401204002212041	Full AOP	Mostly Compatable	HHH	118 %
Cabot	HOUSTON HILL RD	Trib to Winooski River	401204003312041 400020036912041	No AOP Except Adult Salmonids	Partially Compatable	MLL	40 %
Cabot	JUG BROOK RD	Jug Brook	401204002712041	Reduced AOP	Partially Compatable	MML	61 %
Cabot	JUG BROOK RD	Jug Brook	401204003112041	Reduced AOP	Mostly Compatable	MML	55 %
Cabot	MENARD RD		400023000012041	Reduced AOP	Partially Compatable	LLL	61 %
Cabot	PORTER RD	Mollys Brook	401204003612041 400058069712041	No AOP Except Adult Salmonids	Mostly Compatable	MML	67 %
Cabot	S WALDEN RD	Trib to Winooski	401204003912041	Full AOP	Mostly Compatable	HHM	85 %
Cabot	S WALDEN RD	Trib to Winooski	Win2006-006	No AOP Including Adult Salmonids	Mostly Compatable	MLL	70 %
Cabot	S WALDEN RD	Trib to Winooski River	Win2006-002	Reduced AOP	Mostly Compatable	HHH	120 %
Cabot	S WALDEN RD	Trib to Winooski River	Win2006-003	Reduced AOP	Partially Compatable	MML	68 %
Cabot	TH 11		600011000012041	Reduced AOP	Partially Compatable	HHM	436 %
Cabot	THISTLE HILL RD		600056000012041	No AOP Including Adult Salmonids	Partially Compatable	MML	50 %
Cabot	US ROUTE 2	Molly's Brook	300028008612041	Reduced AOP	Mostly Compatable	MLL	49 %
Cabot	US ROUTE 2	Molly's Brook	300028008912041	No AOP Including Adult Salmonids	Mostly Compatable	MLL	255 %
Cabot	US ROUTE 2	Molly's Brook	300028009012041	Reduced AOP	Mostly Compatable	HHM	77 %
Cabot	WALBRIDGE RD	Trib of Winooski	Win2006-005	Reduced AOP	Mostly Compatable	MML	70 %

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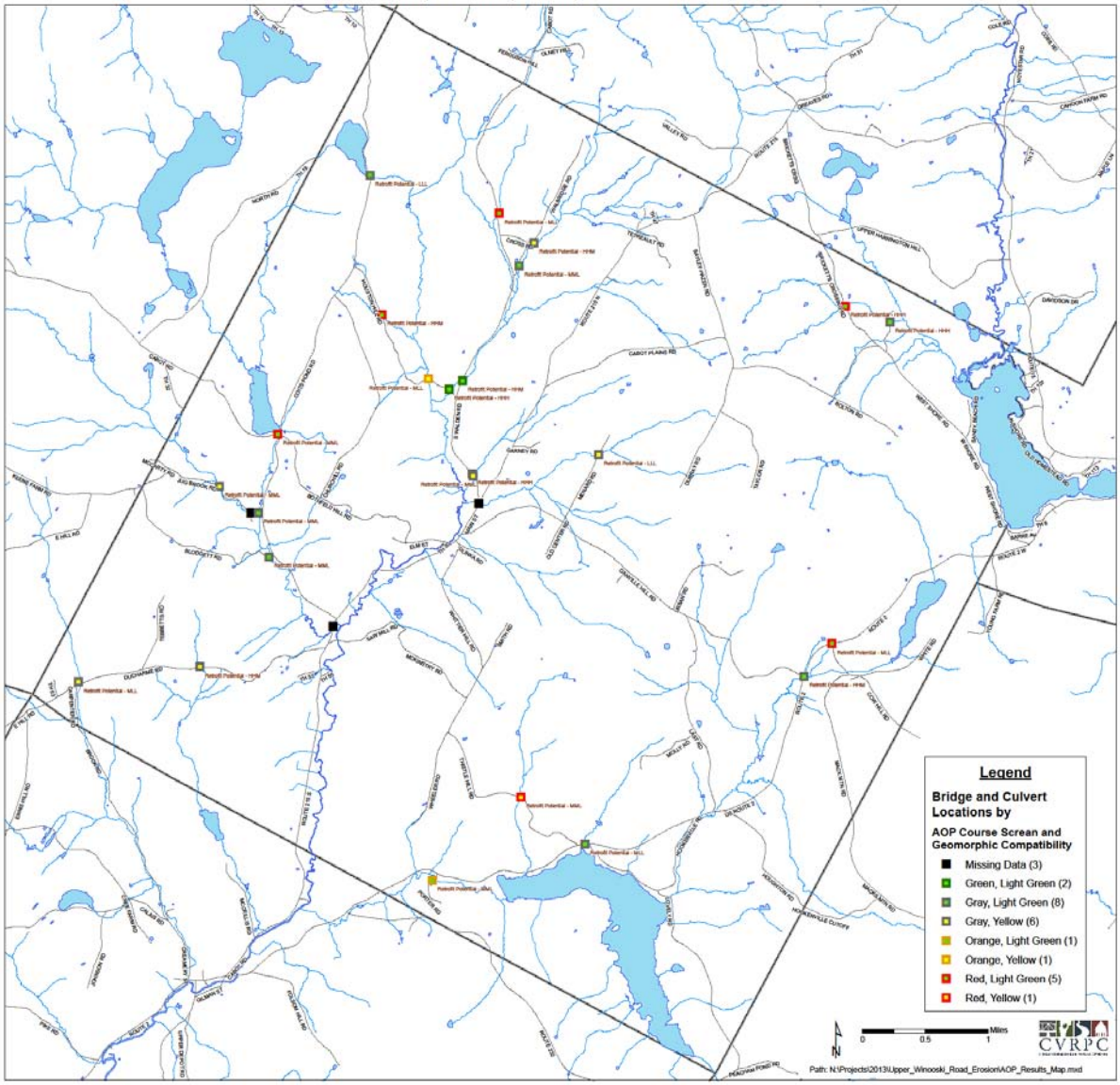
Town of Cabot - Aquatic Organism Passage (AOP)
Geomorphic Compatibility and Retrofit Potential



Marshfield

VERMONT

Stream Geomorphic Assessment

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December, 31

Aquatic Organism Passage

Geomorphic Compatibility

Retrofit Potential

Upper Winooski-aboveBoltonDam

Explanation of codes used in table header

AOP Coarse Screen	
Green	Full AOP for all aquatic organisms
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AOP Geomorphic Compatibility	
Green	Structure is fully compatable geomorphically 20 < GC < 25
Light Green	Structure is mostly compatable geomorphically 15 < GC < 20
Yellow	Structure is partially compatable geomorphically 10 < GC < 15
Orange	Structure is mostly incompatable geomorphically 5 < GC < 10
Red	Structure is fully incompatable geomorphically 0 < GC < 5

AOP Retrofit Potential	
H	High probablity the existing culvert can be retrofited
M	Medium probablity the existing culvert can be retrofited
L	Low probablity the existing culvert can be retrofited
Pos 1 (left)	For strong swimmers
Pos2 (Center)	For moderate swimmers
Pos 3 (right)	For weak swimmers

Explanation of data acquisition (link)

Town	Road	Stream Name	SgaID / struct_num	AOP Coarse Screen	AOP Geomorphic Compatibility	AOP Retrofit Potential	Percent Bankfull Width
Marshfield	ROUTE 215	Trib to Winooski River	401209000112091	Reduced AOP	Mostly Incompatable	MLL	38 %
Marshfield	BAILEY POND RD	Marshfield Brook	401209001412091	Reduced AOP	Mostly Compatable	LLL	19 %
Marshfield	BAILEY POND RD	Marshfield Brook	7003102771209x	Reduced AOP	Partially Compatable	LLL	64 %
Marshfield	BEAVER MEADOW RD	Beaver Meadow Brook	401209003912091	Reduced AOP	Mostly Compatable	MML	63 %
Marshfield	BEAVER MEADOW RD	Beaver Meadow Brook	70003300361209x 70003302291209 3	Reduced AOP	Mostly Compatable	LLL	18 %
Marshfield	BENT RD	Beaver Meadow Brook	401209004012091	No AOP Including Adult Salmonids	Mostly Compatable	MML	57 %
Marshfield	BROOK RD	Trib to Winooski River	40129000712091	No AOP Except Adult Salmonids	Mostly Compatable	MML	62 %
Marshfield	BROOK RD	Trib to Winooski River	700008014011209x	No AOP Including Adult Salmonids	Mostly Compatable	MLL	49 %

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December, 31

Town	Road	Stream Name	SgaID / struct_num	AOP Coarse Screen	AOP Geomorphic Compatibility	AOP Retrofit Potential	Percent Bankfull Width
Marshfield	CALAIS RD	Outlet Knob Hill Pond	70000201441209x	Reduced AOP	Mostly Compatable	LLL	29 %
Marshfield	CALAIS RD	Outlet of Knob Pond	70000201521209x	Reduced AOP	Mostly Compatable	LLL	43 %
Marshfield	CALAIS RD	Trib to Winooski River	401209003612091	Reduced AOP	Partially Compatable	MML	71 %
Marshfield	EATON CEMETERY RD	King/Guernsay Brook	401209003312091	Reduced AOP	Fully Compatable	MLL	33 %
Marshfield	ENNIS HILL RD	Trib to Knob Hill Pond	70001301071209x	Reduced AOP	Mostly Incompatable	LLL	48 %
Marshfield	HOLT RD	Nasmith Brook	401209002612091	No AOP Including Adult Salmonids	Fully Compatable	MLL	57 %
Marshfield	JAKE MARTIN RD	Guernsey Brook	70004700871209x	Reduced AOP	Mostly Compatable	MLL	45 %
Marshfield	JOHNSON RD	Outlet to Knob Hill Pond	70002401371209x	No AOP Including Adult Salmonids	Mostly Compatable	MLL	32 %
Marshfield	JURKIEWICZ PL	Trib to Winooski River	401209000912091	No AOP Including Adult Salmonids	Partially Compatable	LLL	29 %
Marshfield	LANESBORO RD	Marshfield Brook	401209000612091	Reduced AOP	Fully Compatable	HHM	76 %
Marshfield	MAPLE HILL RD	Potter Brook	401209002912091	Reduced AOP	Mostly Compatable	MLL	44 %
Marshfield	PECK PL	Beaver Meadow Brook	401209002012091	No AOP Including Adult Salmonids	Mostly Compatable	MML	66 %
Marshfield	PIGEON POND RD	Lanes Brook	401209003012091	Reduced AOP	Mostly Compatable	MLL	48 %
Marshfield	PIKE RD	Trib to Winooski River	4012090001612091	Reduced AOP	Mostly Compatable	MLL	59 %
Marshfield	ROUTE 2	King/Guernsay Brook	300028007712091	Reduced AOP	Mostly Compatable	MLL	37 %
Marshfield	TIBBETTS RD	Beaver Meadow Brook	401209003812091 700041025712093	No AOP Except Adult Salmonids	Partially Compatable	MML	51 %

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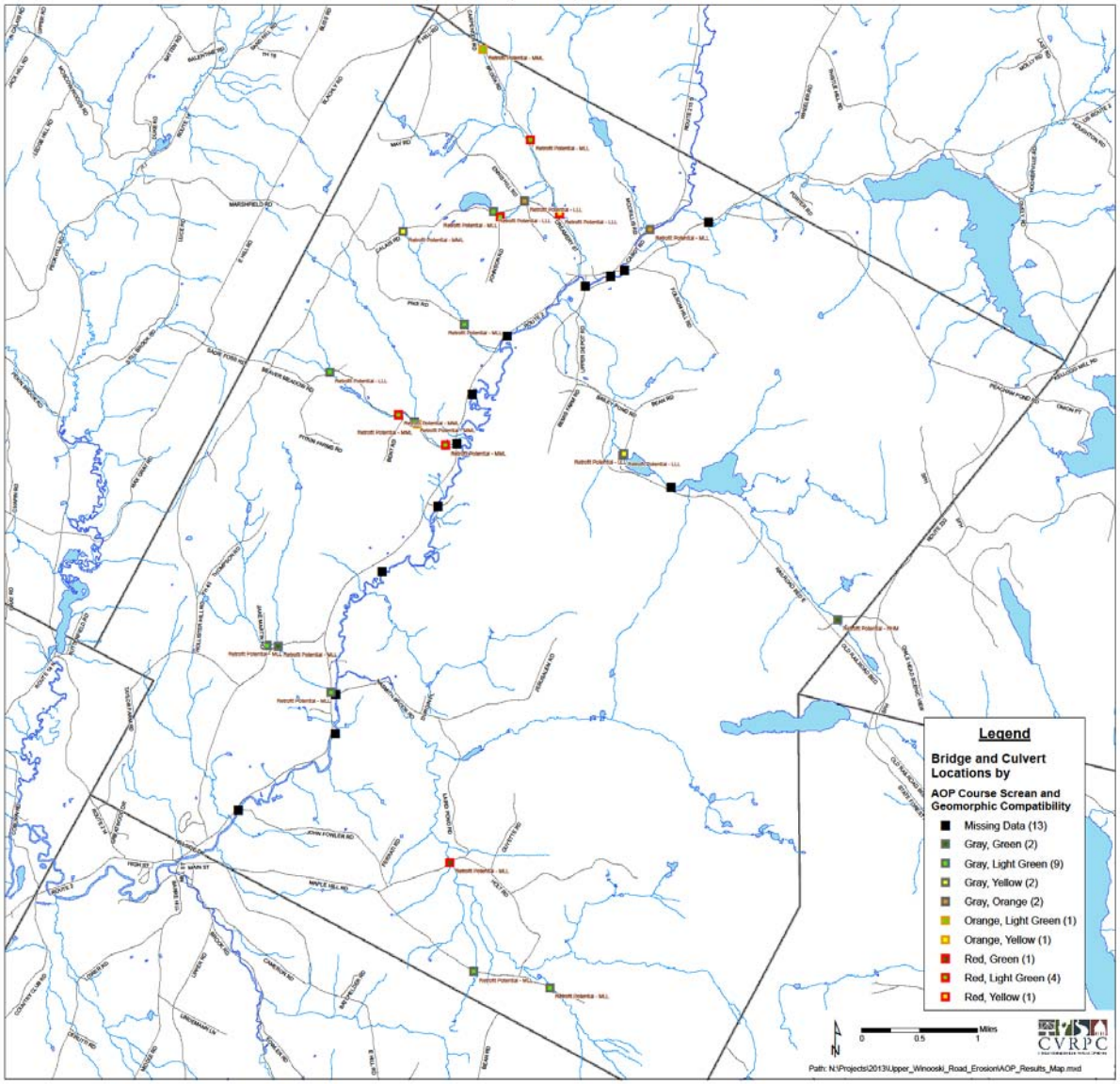
Town of Marshfield - Aquatic Organism Passage (AOP)
Geomorphic Compatibility and Retrofit Potential



Plainfield

VERMONT

Stream Geomorphic Assessment

Agency of Natural Resouces

VT DEC
Vermont.gov
December, 31

Aquatic Organism Passage

Geomorphic Compatibility

Retrofit Potential

Upper Winooski-aboveBoltonDam

Explanation of codes used in table header

AOP Coarse Screen	
Green	Full AOP for all aquatic organisms
Gray	Reduced AOP for all aquatic organisms
Orange	No AOP for all aquatic organisms except adult salmonids
Red	No AOP for all aquatic organisms including adult salmonids

AOP Geomorphic Compatibility	
Green	Structure is fully compatable geomorphically 20 < GC < 25
Light Green	Structure is mostly compatable geomorphically 15 < GC < 20
Yellow	Structure is partially compatable geomorphically 10 < GC < 15
Orange	Structure is mostly incompatable geomorphically 5 < GC < 10
Red	Structure is fully incompatable geomorphically 0 < GC < 5

AOP Retrofit Potential	
H	High probablity the existing culvert can be retrofited
M	Medium probablity the existing culvert can be retrofited
L	Low probablity the existing culvert can be retrofited
Pos 1 (left)	For strong swimmers
Pos2 (Center)	For moderate swimmers
Pos 3 (right)	For weak swimmers

Explanation of data acquisition (link)

Town	Road	Stream Name	SgaID / struct_num	AOP Coarse Screen	AOP Geomorphic Compatibility	AOP Retrofit Potential	Percent Bankfull Width
Plainfield	BEAN RD	Inlet to Bancroft Pond	401214000512141	No AOP Except Adult Salmonids	Mostly Compatable	LLL	25 %
Plainfield	BROOK RD		400000000212141	No AOP Including Adult Salmonids	Mostly Compatable	MLL	100 %
Plainfield	BROOK RD	Great Brook	101214002112141 101214002112141	Reduced AOP	Mostly Incompatable	MLL	49 %
Plainfield	BROOK RD	Great Brook	101214002512141 101214002512141	Reduced AOP	Mostly Incompatable	MML	65 %
Plainfield	BROOK RD	Great Brook	401214001312141	Reduced AOP	Fully Incompatable	MLL	41 %
Plainfield	BROOK RD	Great Brook	401214001412141	Reduced AOP	Partially Compatable	MML	51 %
Plainfield	BROOK RD	Great Brook	401214001512141 400002042212141	Reduced AOP	Partially Compatable	MML	55 %
Plainfield	BROOK RD	Great Brook	990000000112141	Full AOP	Mostly Incompatable	MLL	34 %

VERMONT

Stream Geomorphic Assessment

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Town	Road	Stream Name	SgaID / struct_num	AOP Coarse Screen	AOP Geomorphic Compatibility	AOP Retrofit Potential	Percent Bankfull Width
Plainfield	BROOK RD	Outlet to Bancroft Pond	401214000112141	Full AOP	Partially Compatable	MLL	35 %
Plainfield	BROOK RD	Trib to Great Brook	401214000212141	Reduced AOP	Mostly Compatable	MML	54 %
Plainfield	COUNTRY CLUB RD		400000000312141	Reduced AOP	Mostly Compatable	HHH	100 %
Plainfield	E HILL RD		400000000012141	Reduced AOP	Mostly Compatable	HHH	100 %
Plainfield	E HILL RD		400000000512141	No AOP Including Adult Salmonids	Mostly Compatable	HHH	100 %
Plainfield	E HILL RD	Outlet to Bancroft Pond	401214000712141	No AOP Including Adult Salmonids	Partially Compatable	LLL	63 %
Plainfield	GORE RD	Great Brook	990000000212141	No AOP Including Adult Salmonids	Partially Compatable	MLL	47 %
Plainfield	GORE RD	Trib to Great Brook	401214003012141	Reduced AOP	Partially Compatable	MML	55 %
Plainfield	LOWER RD		100000000712141	No AOP Including Adult Salmonids	Partially Compatable	LLL	100 %
Plainfield	LOWER RD		400000000112141	No AOP Including Adult Salmonids	Mostly Compatable	HHH	100 %
Plainfield	LOWER RD	Gunners Brook	70004100401214x	No AOP Including Adult Salmonids	Mostly Compatable	HHM	75 %
Plainfield	MIDDLE RD		100000000812141	No AOP Including Adult Salmonids	Partially Compatable	HHM	100 %
Plainfield	MIDDLE RD		400000000412141	Reduced AOP	Mostly Compatable	LLL	100 %

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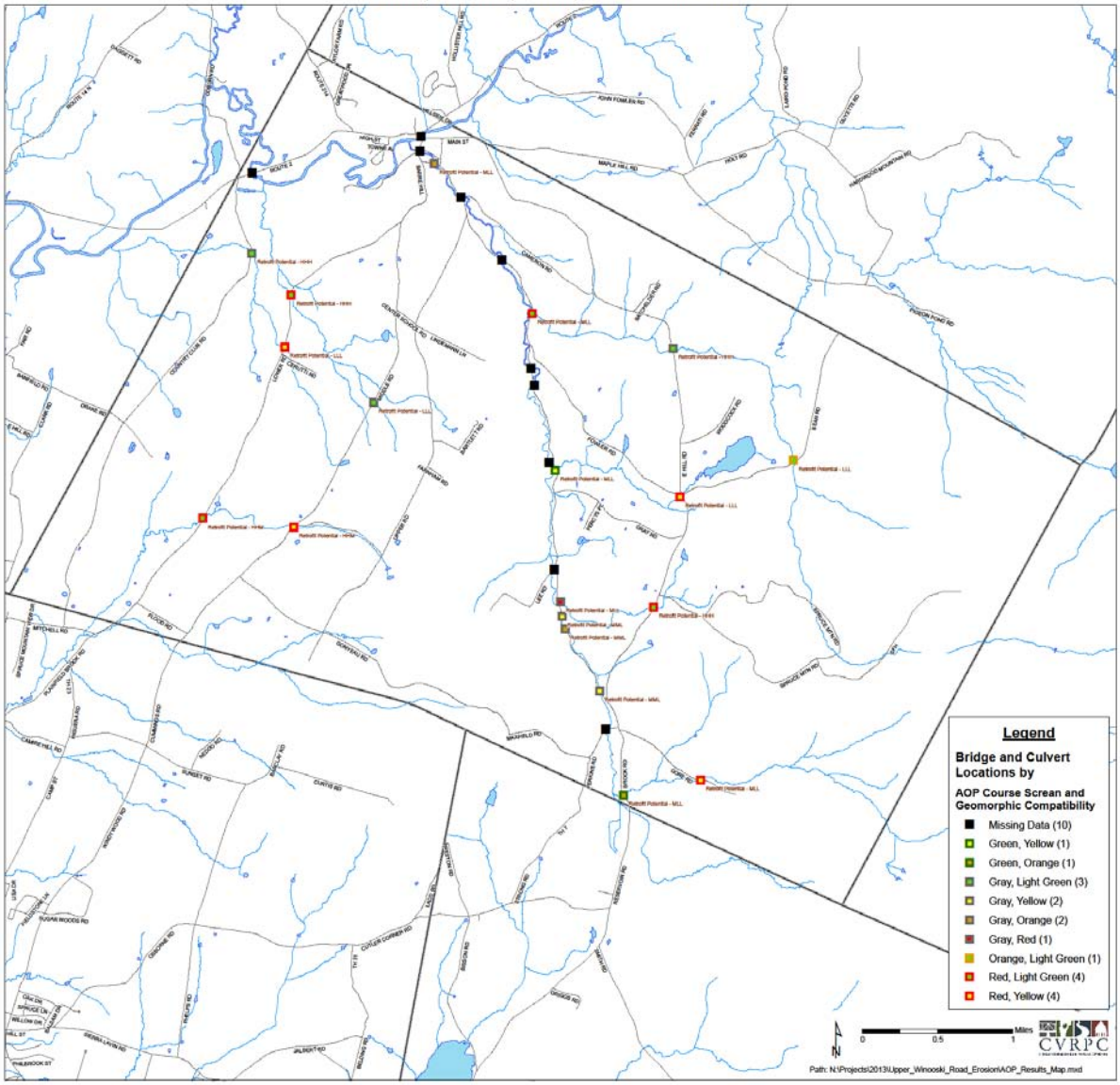
Town of Plainfield - Aquatic Organism Passage (AOP)
Geomorphic Compatibility and Retrofit Potential



Attachment E – GIS Shapefiles and Photos

GIS Shapefiles

To view the erosion line and point data collected during this project please refer to the digital folder titled Final Report and Data which contains two shapefiles titled:

1. Erosion_Lines_Roads.shp
2. Erosion_Points_Roads.shp

Photos

To view the erosion site photos taken during this project please refer to the digital folder titled Final Report and Data and then sub folder titled Pictures which contains the photos of the erosion sites.