Town of Stockbridge
Road Erosion Inventory Report

Whitcomb Hill Road. *Photo taken by TRORC staff.*

Prepared by:

Two Rivers-Ottauquechee Regional Commission

128 King Farm Road
Woodstock, VT 05091

Inventory and report funded by the Vermont Agency of Transportation 2016 Better Roads Program.

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Introduction

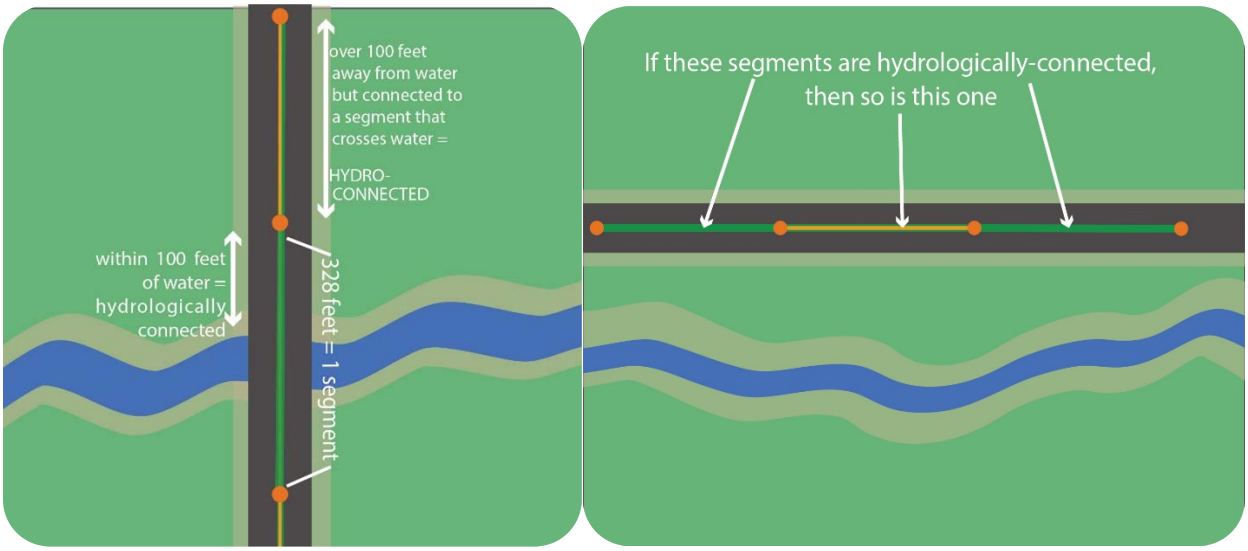
In the fall of 2017, the Two Rivers-Ottauquechee Regional Commission (TRORC) conducted a road erosion inventory (REI) to evaluate hydrologically connected segments in the town of Stockbridge. This report highlights the road sites with the most significant hydrological impact due to erosion within the municipality.

Hydrologically-connected road segments are one or more of the following:

- Within 100' or within river corridor layer to water resources (perennial and intermittent streams, wetlands, lakes and ponds)
- Road segments that bisect a water resource
- Adjacent segments to bisected connected segments if 8% or greater slope
- Road segments that bisect 24" or greater culverts
- Non-connected segments that were bordered on either side by a connected segment
- Stormwater infrastructure mapping

*There may be additional factors when assessing urban areas

The following diagrams depict the criteria for ***hydrologically-connected road segment:***



Images created by TRORC staff

Problem Definition

Many roads in Vermont traverse waterways since these are the lowest and flattest parts of the topography. Erosion, exacerbated by unpaved roads, has adverse effects on nearby bodies of water. During rain events road sediment is deposited directly into the water resources. Water resources are defined as perennial and intermittent streams, wetlands, lakes, and ponds. Road sediment in water resources causes a wide spectrum of ecological problems including increased algae blooms and decreased levels of dissolved oxygen, both of which negatively impact fish habitat and the ecosystem as a whole.

Response
Instrumental to both grant funding and permit compliance is the Road Erosion Inventory (REI) and Evaluation. The purpose of the inventory is to identify locations that result in problematic road erosion. These are the places that require continuous attention by town road crews to maintain quality or restore problems. Since sediment only reaches the watershed if the road is close to open water (rivers, streams, lakes, ponds, wetlands), only hydrologically-connected road segments were assessed.

The REI reflects the criteria set out by the Department of Environmental Conservation (DEC)'s Municipal Roads General Permit (MRGP), which is based on the Better Roads Manual provided by the Vermont Agency of Transportation (VTrans). The MRGP sets specific standards in order to reduce stormwater-related erosion from municipal roads. The DEC provides GIS data for hydrologically-connected road segments that will be assessed in each municipality's REI. This data can be accessed via the VT ANR Atlas on the DEC website.

The MRGP is required by the Vermont Clean Water Act (Act 64), and the Lake Champlain Phase I TMDL. While funding from DEC might be available through the Ecosystem Restoration grant program, towns can currently apply for funding through VTrans Better Roads grants. Better Roads is funded with state funds that could include appropriations through the Transportation Bill, the Clean Water Fund and the Capital Bill as well as federal funding VTrans receives from the Federal Highway Administration. Grants such as these will support the proper construction and maintenance of road drainages and surfaces.

Methodology

- The DEC determined all hydrologically-connected municipal roads (paved, gravel, and class 4) based on proximity to water.
- The hydrologically-connected roads were divided into approximately 300 foot segments and given an identification number.
- Each segment was assessed and given a score of Fully Meets, Partially Meets, or Does Not Meet for the crown, berm, drainage, conveyance, drainage culverts and driveway culverts in the right-of-way. An overall score was given to each segment.
    - Fully Meets (FM) indicates that all individual scores fully met.
    - Partially Meets (PM) designates one or two partially meet individual scores.
    - Does Not Meet (DNM) stipulates three or more partially meets individual scores or one or more does not meet individual score.
    - Class 4 roads are evaluated based on gully erosion. If gully erosion is present, the overall segment does not meet. If gully erosion is absent, the overall segment fully meets.

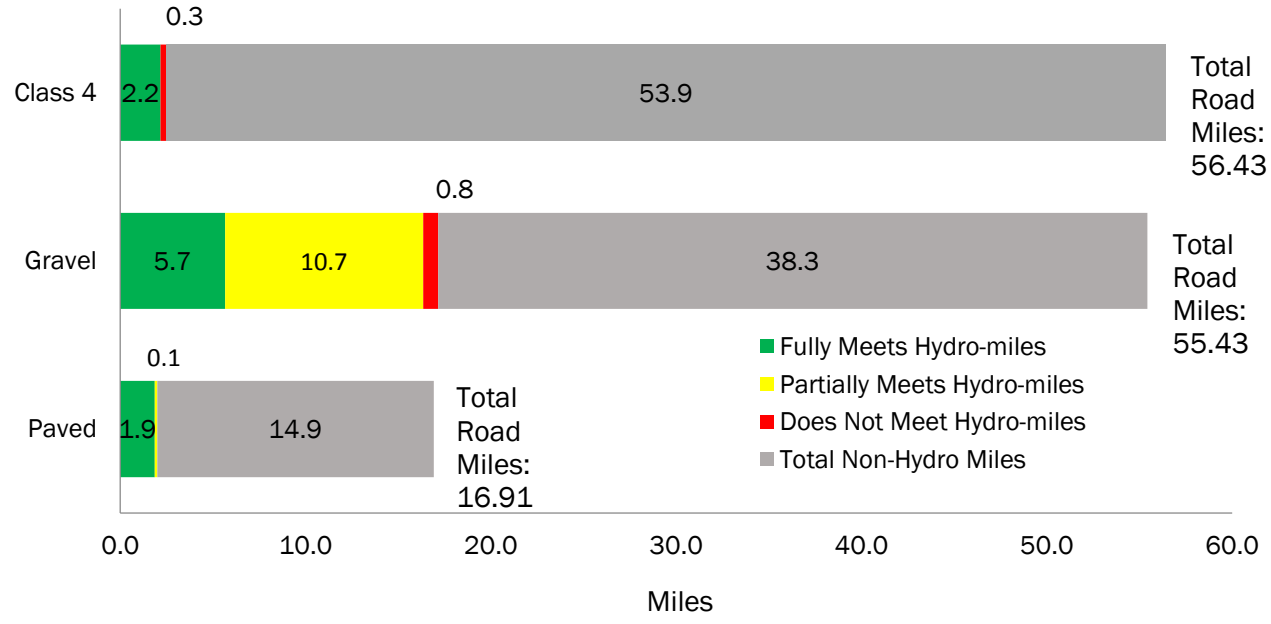
Town Report

Context

The town of Stockbridge is almost 47 square miles of mountains and rivers. A large portion of roads within the town run along rivers and are directly located near or within a floodplain. Roads in these types of locations are typically are flanked by a steep grade to one side and a river or creek on the other. These characteristics, combined with steep roads, create extra challenges and emphasize the importance of proper road drainage installation and maintenance.

Current Condition

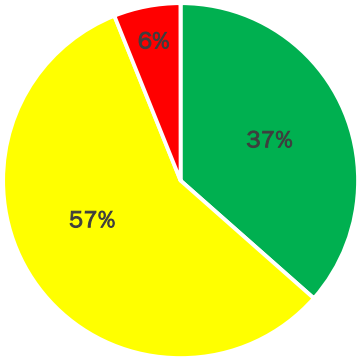
This bar chart depicts the scoring breakdown by road type for hydrologically-connected road miles within the town's total road miles.

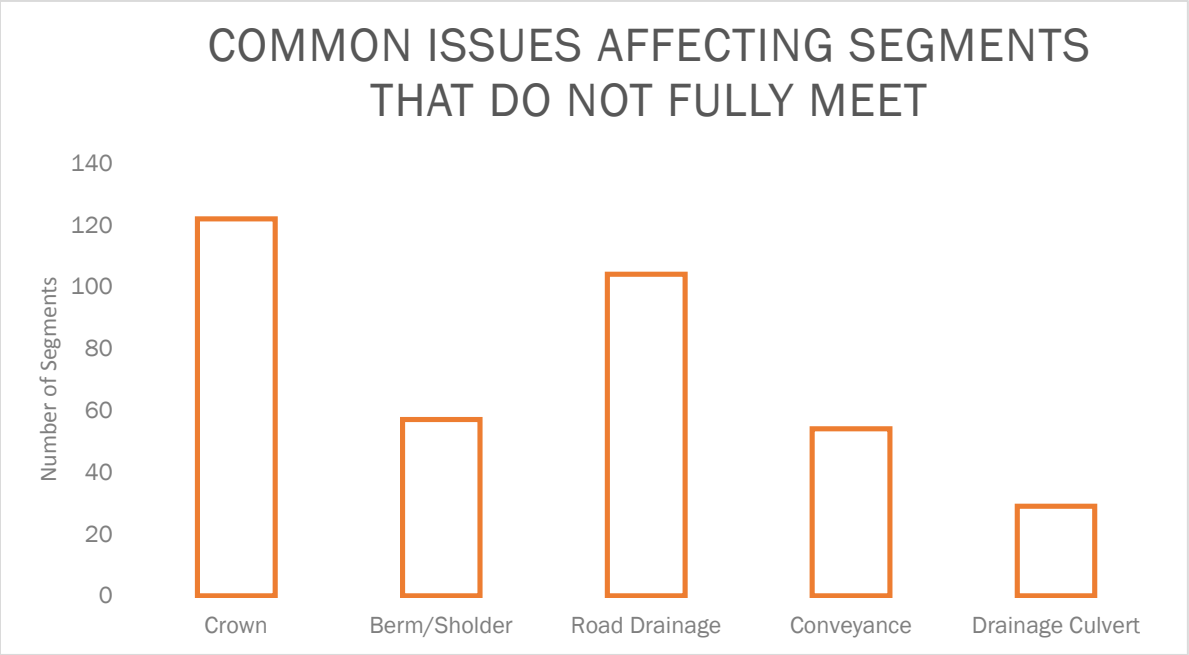


Appendix A depicts the town with detailed results of the inventory.
The following provides a brief summary:

- There are **464** hydrologically-connected road segments in Stockbridge, or 28.8 miles.
- Of these, **63% do not fully meet** standards; which equals 18.2 miles of road eroding into the streams.

Summary of Accessible Hydro-Connected Segments Status





Four (4) segments have been identified as **Very High Priority Road Segments**. Very High Priority indicates an overall score of **Does Not Meet** with a slope of **10% or greater**. These are the segments which the town will focus on addressing in future grants. They are also a good example of issues facing the road network as a whole as other segments are likely to deteriorate in similar ways.

The three main issues in the high priority segments are:

- Crown (70% Do Not Fully Meet)
- Poor Drainage (50% have erosion present)
- Conveyance (50% Do Not Fully Meet)

Very High Priority Road Segments									
Road Type	Overall Segment Score	Average Road Grade	ID Town Road	Crown	Berm/Shoulder	Berm Erosion	Road Drainage	Drainage Erosion	Conveyance
Gravel	DNM	17.31	27095_Eichenbrod_Rd_1	FM	FM	FM	DNM	Gully	All areas meet standard
Gravel	DNM	14.24	27095_Davis_Hill_Rd_6	DNM	DNM	Rill	PM	Rill	All areas meet standard
Gravel	DNM	11.45	27095_Davis_Hill_Rd_1	FM	FM	FM	DNM	Gully	All areas meet standard
Gravel	DNM	10.19	27095_Fletcher_Brook_Rd	FM	PM	Rill	DNM	Gully	All areas meet standard

It is useful to note that of all hydrologically-connected roads, the average road grade is: **7.12%.** This indicates the need for proper drainage practices, including stabilization through vegetation or stone-lining, and well-stabilized conveyance areas, as both of these are impacted by the faster flow of water that runs down steep grades.

Common causes for these issues are as follows:

- Inadequate infiltration and diversion practices
- Unstable banks separating roads from rivers
- Unstable ditches or no ditches at all where they are needed
- Lack of culvert headwalls, or culverts that are poorly placed, undersized, or in disrepair

Compliance & Implementation Guidelines

Total Number of Non-Compliant Road Segments: **219**
Number of Upgraded Segments Needed to Achieve 15% Compliance: **33**

Construction Compliance Schedule

Hydrologically Connected Segment Score: Partially Meets or Does Not Meet		
Type	**Slope or Erosion**	**Compliance Deadline**
15% of segments	Any	January 1, 2023
All segments	Any	December 31, 2036
Very High Priority Hydrologically Connected Segment Score: Does Not Meet		
Paved and gravel segments with drainage ditches	10% slope or greater	December 31, 2025
Paved segments with catch basins	Field-measured erosion values of 3 cubic yards and greater	December 31, 2025
Class 4 roads	10% slope or greater with 1' deep or greater gully erosion	December 31, 2028

Full Compliance Schedule

Compliance Deadline	Action
July 31, 2018	Notice of Intent must be filed with the Agency
April 1, 2019	Annual Report due
April 1, 2020	Annual Report due
December 31, 2020	RSWMP due: Consists of Implementation Table with REI results
April 1, 2022 (annually forward)	Annual Report due
October 1, 2022	Apply for authorization upon reissuance of the MRGP
January 1, 2023	Upgrade at least 15% of the non-compliant segments
December 31, 2025	Very High Priority Hydrologically Connected Segment Score: Does Not Meet, class 1-3 roads
December 31, 2028	Very High Priority Hydrologically Connected Segment Score: Does Not Meet, class 4 roads
December 31, 2036	Complete implementation; all hydrologically-connected municipal roads meet the standards listed in the MRGP GP

The following is an outline of the baseline standards put forth by the MRGP. For additional details, refer the full MRGP on the DEC website.

Roadway Standards:

- Crown
    - Paved roads – crowned during new construction
        - Minimum: 1%
        - Recommended: 1-2%
    - Gravel roads
        - Minimum: 2%
        - Recommended: 2-4%
- Shoulder Berms – Shall be removed to allow precipitation to flow into road drainage system (drainage ditch or filter area).

Road Drainage Standards (based on % slope):

- 0-5%: Grass-lined ditch
- 5-8%:
    - Stone-lined ditch with 6”-8” minus stone
    - Grass-lined ditch with stone check dams
    - Grass-lined ditch AND 2+ cross culverts or turnouts
- 8-10%: Stone-lined ditch with 6-8” minus stone
- >10%: Stone-lined ditch - min 6-8” minus stone, 12” minus stone recommended

Conclusion

The results of the field inventory illustrate the importance of the MRGP. While the placement of roads in proximity to water poses a threat, adequate road maintenance practices will greatly diminish the rate of unfiltered runoff reaching our valuable natural resources.

TRORC and your road foremen will coordinate site visits to identify best management practices (BMPs) for remediation. Implementation plans to bring segments to MRGP compliance standards will include measures like grass and stone-lined drainage ditches, stone check-dams, sheet flow infiltration, ditches and turnouts disconnected from surface waters, road crowning, upgrading culverts, installing outlet stabilization headwalls, and stabilizing exposed soil. A detailed financial plan will be submitted to the VTrans Better Roads program.

Appendix A

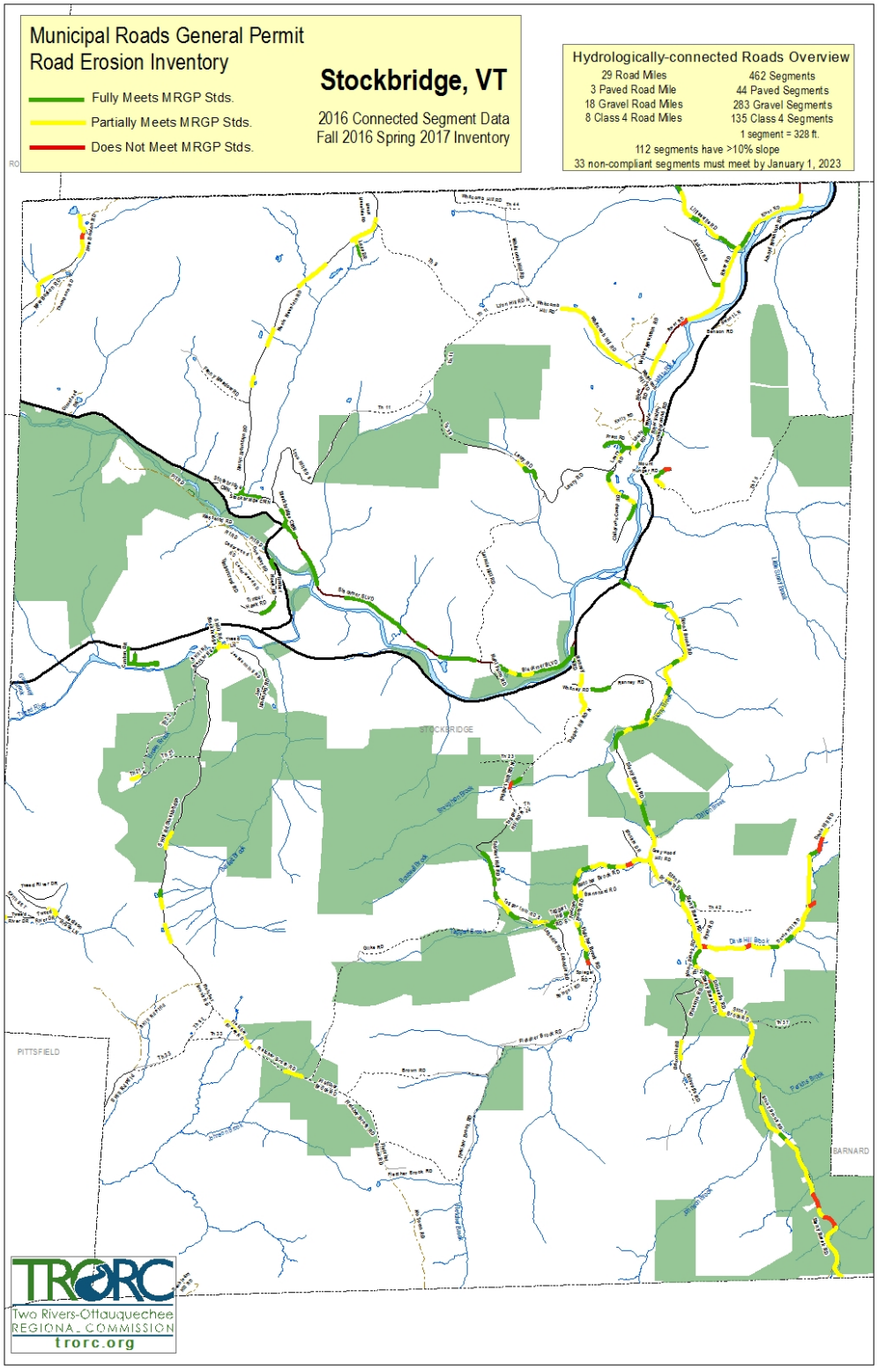


Figure 1- Depicts the Town with all hydro-connected segments and their scores, as well as the breakdown of how many segments Fully Meet, Partially Meet, and Do Not Meet.

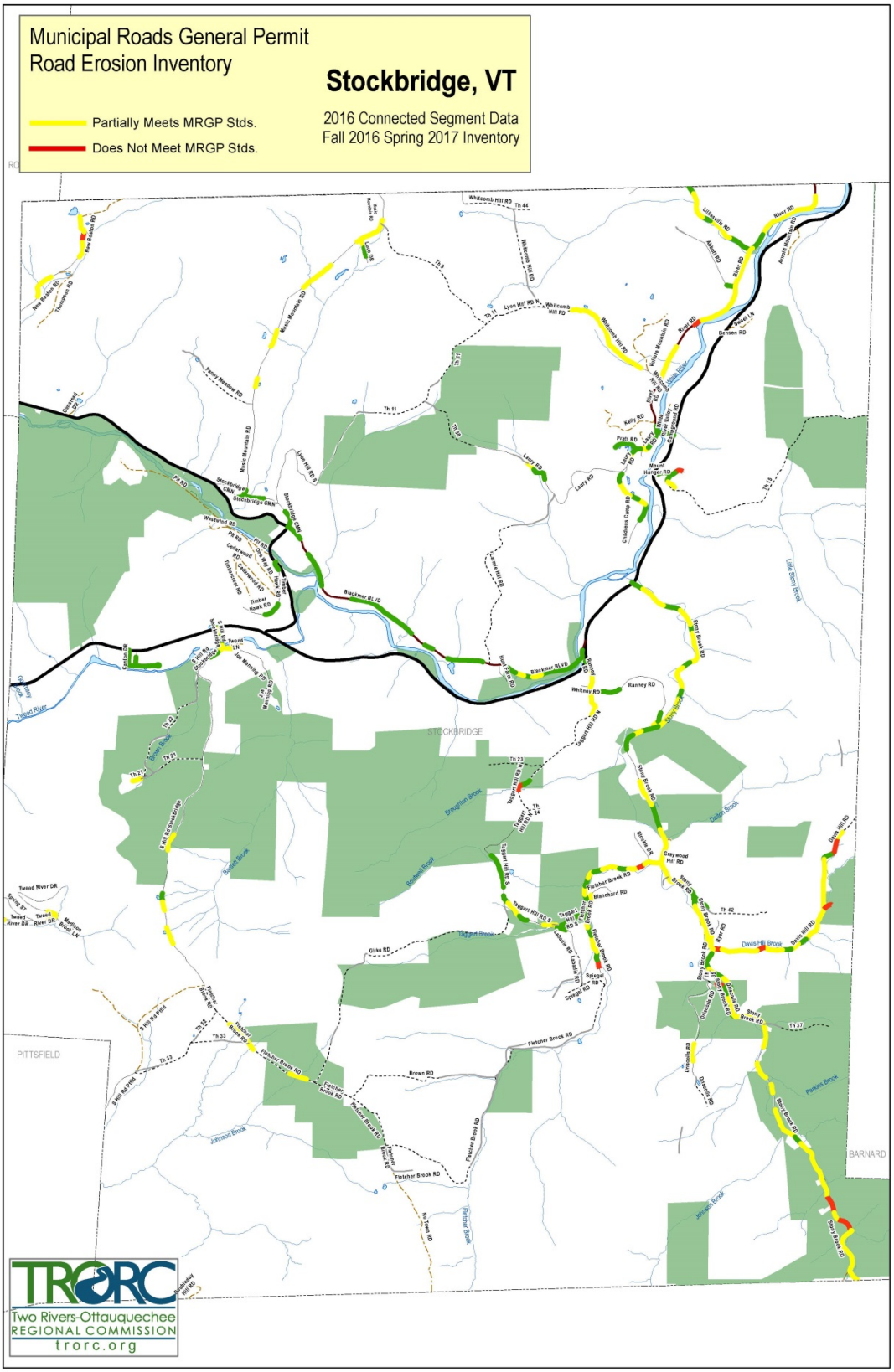


Figure 2- Displays the segments with a score of Partially Meet and Does Not Meet.

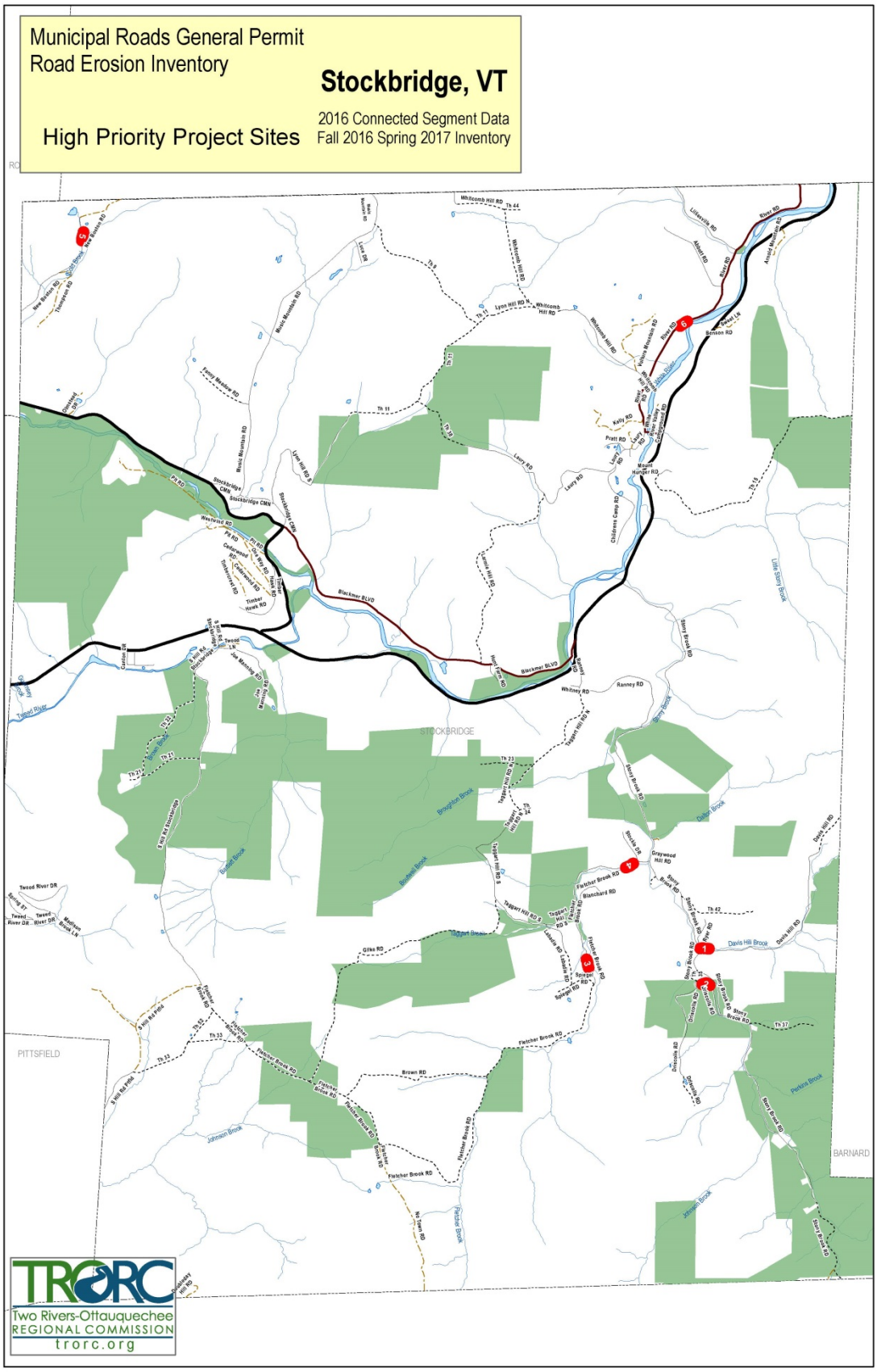
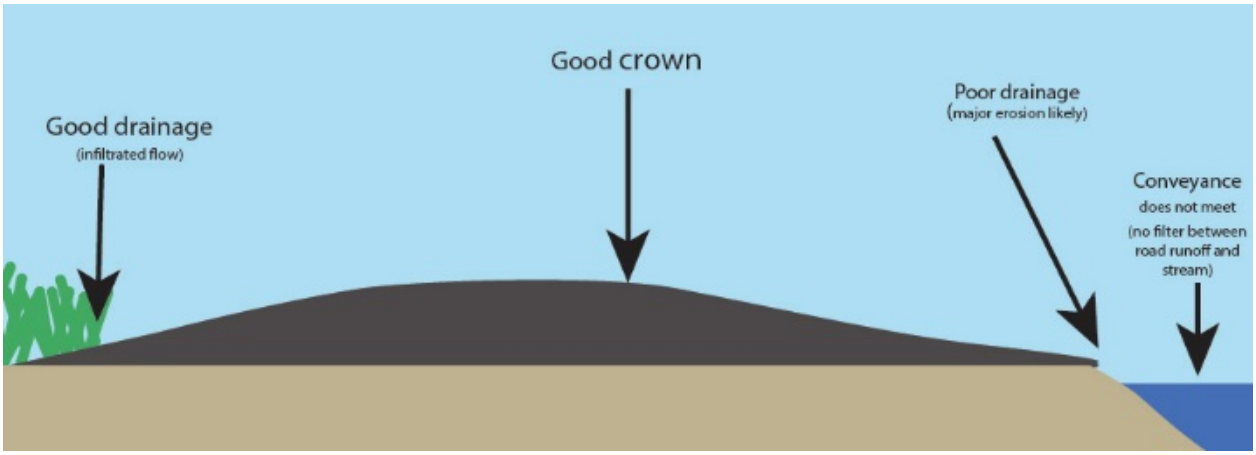
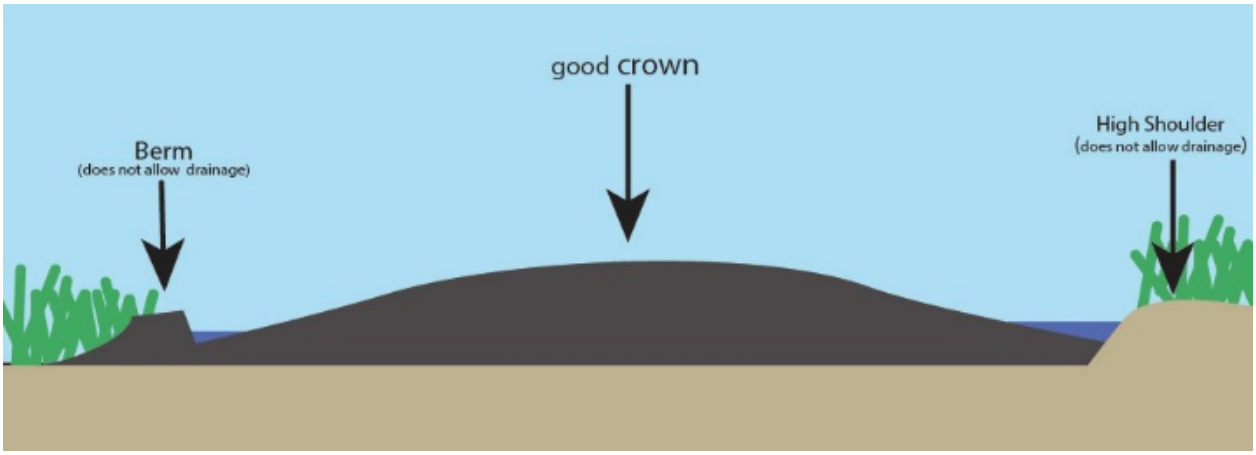


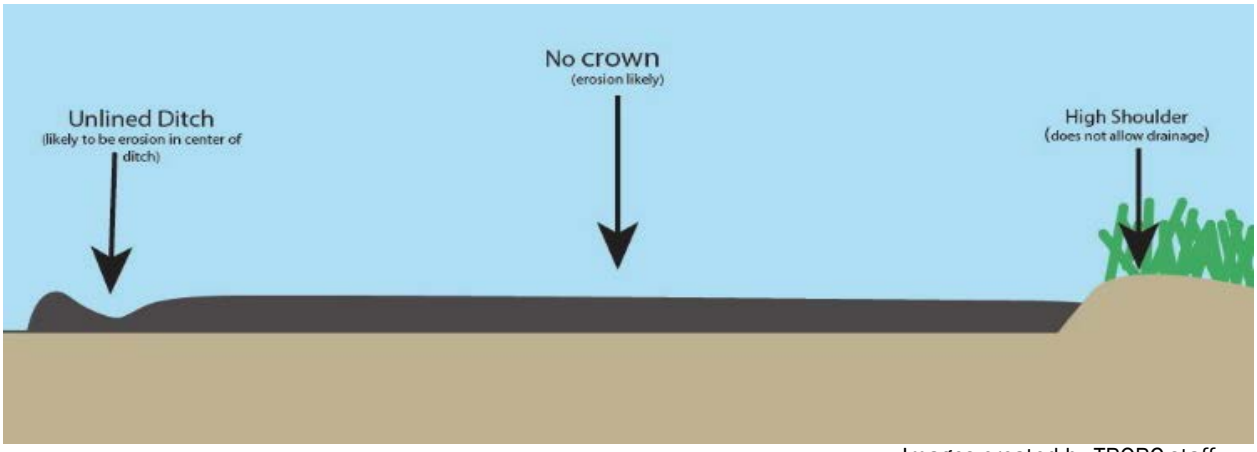
Figure 3- Displays high priority project sites within the Town.

Appendix B

Table 1 Terminology Illustrated

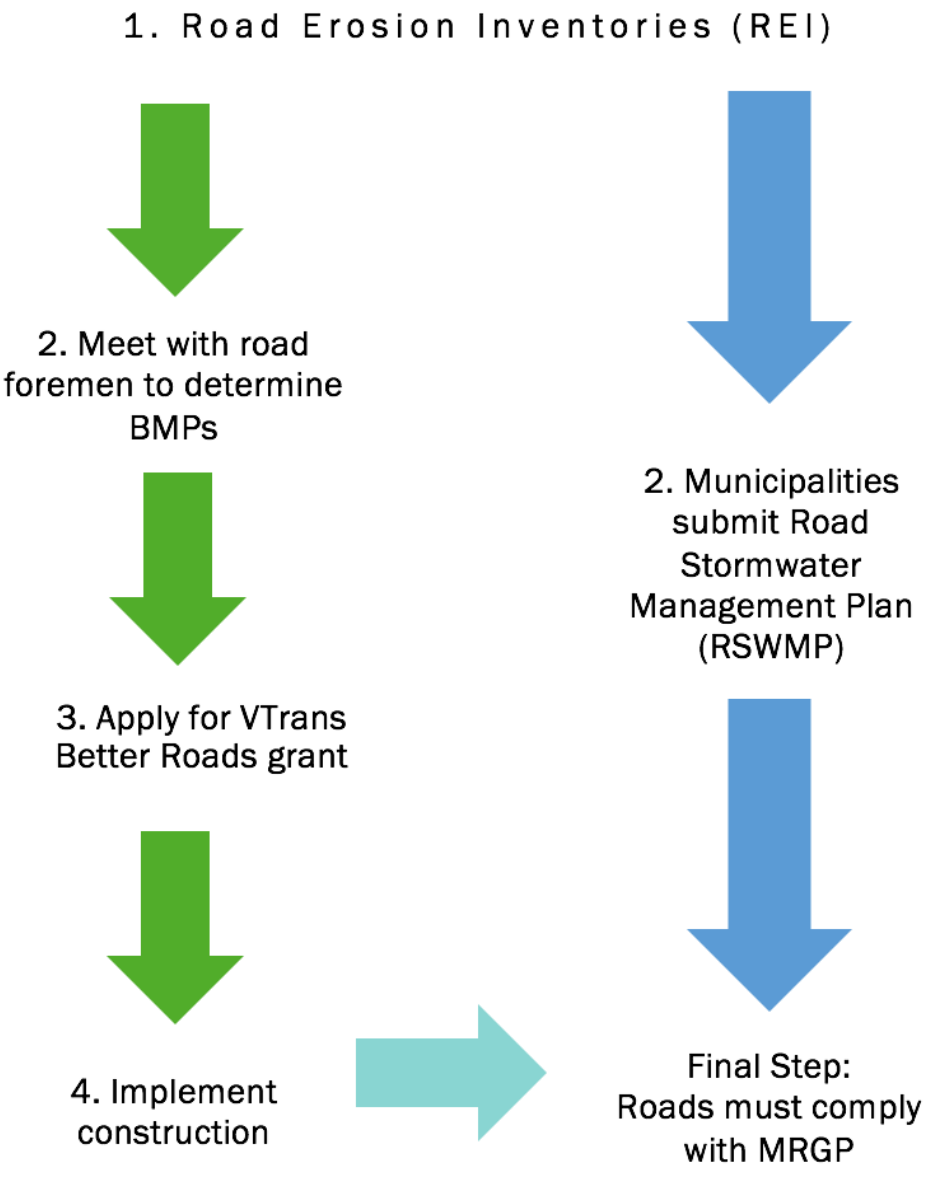






Images created by TRORC staff

Figure 1 Permit and Grant Process



Flow chart created by TRORC Staff

Appendix C

Road Inventory and Evaluation Form for High Priority Project Sites

Road Inventory and Evaluation Form for High Priority Project Sites

The following six segments were deemed high priority project sites. High priority project sites differ from very high priority segments in that very high priority segments must meet the criteria of >10% slope and a status of DNM while high priority project sites are chosen by TRORC based on inventory results as well as priorities voiced by the town itself.

Project 1 Davis Hill Road

Best Management Practices:

- Clean out and stoneline ditch on right
- Culvert replacement

Road Segment Name & Segment ID Number:	Road Type:	Average Road Grade:	Site Number:
Davis Hill Road 31315	Gravel	11.45%	1

1. ROADWAY CROWN/TRAVEL LANE:	Erosion Type:	2. GRADER BERM/WINDROW:	Erosion Type:
Fully Meets		Fully Meets	
3. ROAD DRAINAGE:	**Erosion Type:**	**4. CONVEYANCE AREA/TURNOUT:**	**Erosion Type:**
Fully Meets		One or more areas does not meet standard	Gully

5. DRIVEWAY CULVERT:	6. DRAINAGE CULVERT:
Not Identified	Fully Meets

(Left side) Clean

(Right side) Clean out

(Right side) Stone-line ditch

Culvert replacement

(Right side) Stone-line ditch

Project 2 Driscolls Road

Best Management Practices:

- Replace 15” steel culvert with 18” plastic
- Ditch inlet and stone outlet

Road Segment Name & Segment ID Number:	Road Type:	Average Road Grade:	Site Number:
Driscolls Road 34212	Gravel	5.99%	2

1. ROADWAY CROWN/TRAVEL LANE:	Erosion Type:	2. GRADER BERM/WINDROW:	Erosion Type:
Fully Meets		Fully Meets	
3. ROAD DRAINAGE:	**Erosion Type:**	**4. CONVEYANCE AREA/TURNOUT:**	**Erosion Type:**
Fully Meets		All areas meet standard	

5. DRIVEWAY CULVERT:	6. DRAINAGE CULVERT:
Not Identified	Does Not Meet

(Right side) Stone-line ditch

Left Ditch culvert inlet

Right Stone outlet

Project 3 Fletcher Brook Road
Best Management Practices:

- Stabilize bank
- Ditch

Road Segment Name & Segment ID Number:	Road Type:	Average Road Grade:	Site Number:
Fletcher Brook Road 98417	Gravel	5.63%	3

1. ROADWAY CROWN/TRAVEL LANE:	Erosion Type:	2. GRADER BERM/WINDROW:	Erosion Type:
Does Not Meet		Fully Meets	
3. ROAD DRAINAGE:	**Erosion Type:**	**4. CONVEYANCE AREA/TURNOUT:**	**Erosion Type:**
Does Not Meet		One or more areas does not meet standard	

5. DRIVEWAY CULVERT:	6. DRAINAGE CULVERT:
Not Identified	Fully Meets

Stabilize bank

Left Stabilize bank

Right Clean and seed ditch

Best Management Practices:

- Replace two culverts, 15” steel and 18” steel with 18” plastic culverts
- Clean ditch and stone outlet
- Ditch to Stockle Drive

Road Segment Name & Segment ID Number:	Road Type:	Average Road Grade:	Site Number:
Fletcher Brook Road 98434	Gravel	10.19%	4

1. ROADWAY CROWN/TRAVEL LANE:	Erosion Type:	2. GRADER BERM/WINDROW:	Erosion Type:
Fully Meets		Partially Meets	Rill
3. ROAD DRAINAGE:	**Erosion Type:**	**4. CONVEYANCE AREA/TURNOUT:**	**Erosion Type:**
Fully Meets		One or more areas does not meet standard	Gully

5. DRIVEWAY CULVERT:	6. DRAINAGE CULVERT:
Not Identified	Fully Meets

Ditch to Stockle Dr, seed and mulch

Left Replace 18” steel culvert with 18” plastic

Right Clean ditch, stone outlet

Left Upgrade 15” steel culvert with 18” plastic

Right Clean culvert

Left Clean ditch

Right Stabilize bank

Project 4 New Boston Road
Best Management Practices:

- Replace 36” steel culvert with 48” plastic
- New header
- Stone inlet and outlet

Road Segment Name & Segment ID Number:	Road Type:	Average Road Grade:	Site Number:
New Boston Road 140108	Gravel	7.80%	5

1. ROADWAY CROWN/TRAVEL LANE:	Erosion Type:	2. GRADER BERM/WINDROW:	Erosion Type:
Partially Meets		Partially Meets	
3. ROAD DRAINAGE:	**Erosion Type:**	**4. CONVEYANCE AREA/TURNOUT:**	**Erosion Type:**
Partially Meets		All areas meet standard	

5. DRIVEWAY CULVERT:	6. DRAINAGE CULVERT:
Not Identified	Not Identified

Above Replace culvert

Above New header

Left Stone inlet

Above Stone outlet

Project 5 River Road

Best Management Practices:

- Clean ditch from culvert to next one
- Seed and mulch ditch
- High shoulder removal on river side

Road Segment Name & Segment ID Number:	Road Type:	Average Road Grade:	Site Number:
River Road 158284	Gravel	0.98%	6

1. ROADWAY CROWN/TRAVEL LANE:	Erosion Type:	2. GRADER BERM/WINDROW:	Erosion Type:
Partially Meets		Does Not Meet	
3. ROAD DRAINAGE:	**Erosion Type:**	**4. CONVEYANCE AREA/TURNOUT:**	**Erosion Type:**
Fully Meets		All areas meet standard	

5. DRIVEWAY CULVERT:	6. DRAINAGE CULVERT:
Not Identified	Not Identified

Clean ditch from one culvert to next

Left Seed and mulch

Right Bank on river side, high shoulder removal