PRIORITIZING AND IMPLEMENTING CLEAN WATER PROJECTS ON STATE LANDS

Dave Wilcox
Watershed Forester
Watershed Forestry Program

- Bridge Cost Share Program
- Bridge Rental Program
- Education and Outreach
Watershed Forestry Program

- AMP Technical Assistance
- Logger/Forester Education
- Agency Land Tech Assistance
ANR Lands

• 360,000 acres
• 8% of VT land base

Including

39 State Forests
55 State Parks
80 WMAs
Also, DEC Dam sites, FW Pond sites and Fishing Accesses

Approximately 600 miles of roads and 1,500 miles of trails
While forestland protects water quality more than any other land use, it is still important to monitor and implement good water quality practices when managing forests for the multitude of uses and benefits they provide.

- Forest land is estimated to contribute approximately 16% of total phosphorus load to Lake Champlain, primarily coming from the runoff from roads and trails.
Previously, FPR applied for ERP (Ecosystem Restoration Program) funds to address erosion issues and sedimentation on State Lands.

- This was a project-by-project basis.
- Applications were time consuming and needed lots of details to meet program requirements and standards.
- In March of 2020, FPR met to begin discussions to create a comprehensive method for assessing roads, determining need, and prioritizing projects.
- We decided to model our system after the Municipal Road General Permit (MRGP) process.
  - For forest management roads, the Acceptable Management Practices (AMPs) are used as the standards for the assessment.
MRGP Requirements: Road Erosion Inventory

Road Erosion Inventory (REI) was developed for municipalities to fulfill requirements of the Vermont Department of Environmental Conservation’s Municipal Roads General Permit (MRGP). The form is based on practice standards that have developed as part of the MRGP. Vermont municipalities will have to adhere to the MRGP requirements starting in 2018. These requirements include conducting road erosion inventories of all hydrologically-connected roads.

This general permit is intended to achieve significant reductions in stormwater-related erosion from Vermont’s municipal roads, both paved and unpaved. Municipalities will implement a customized, multi-year plan to stabilize their road drainage system. The plan will include bringing road drainage systems up to basic maintenance standards, and additional corrective measures to reduce erosion as necessary to meet a TMDL or other water quality restoration effort. The permit is required under 33CFR, the Vermont Clean Water Act, and the Lake Champlain Phases I & II.

For more information on the OEC Municipal Roads program and the development of the Municipal Roads General Permit, contact Jim Ryan by email or at (802) 864-4140.
Hydrologically-Connected Road Segments
What are the AMPs?

26 practices to:

- Protect Water Quality
- Prevent Soil Erosion
- Minimize Stream Impacts

To be applied on:

- Truck Roads
- Skid Trails
- Stream Crossings
- Riparian Areas (Buffers)
- Log Landings

To be applied prior to, during and immediately after harvesting
Clean Water Principles

• Disconnect road
  Stormwater whenever possible, perpendicular flow

• Infiltrate stormwater
  • Slow it down
  • Spread it out

• Stabilize conveyances and turn out ditches or add ditch relief culverts
  • Spread water back out

• Properly size stream crossings
Different Road Types on ANR Lands

- **Type 1 Roads** - a road that provides recreational and management access to Vermont State Parks, developed Alpine Ski Areas and F+W fishing access areas.
  - Uses MRGP standards

- **Type 2 Roads** - gravel surface roads, wide enough and have a suitable gravel surface for a motor grader to grade. The travel lane is greater than 12 feet wide, may be crowned and sloped so water sheds off the surface into ditches or in a distributed manner, or may have a combination of practices to shed water including crowning, broad based dips, or waterbars. Type 2 roads have ditching with ditch relief culverts and permanent stream crossings to manage water outside of the roadway.

- **Type 3 Roads** - gravel surface but is not easily graded or accessed by a motor grader. The travel lane is typically 12 feet or less in width and has a combination of practices to shed water including crowning, out-slope, in-slope, broad based dips and waterbars. Type 3 roads typically have ditches with cross-drain culverts and permanent stream crossings and can range from being heavily covered in grass to grass-free.

- **Type 4 Roads** - surface consists of native material and generally utilized during frozen conditions as a winter harvest road and/or designated VAST (Vermont Association of Snow Travelers) trail. The travel lane is not graded by a motor grader and has broad based dips and waterbars to shed water from the roadway. Type 4 roads sometimes have permanent stream crossings removed, but when designated as a VAST trail, permanent crossings occur with more frequency and also has occasional ford crossings.
  - Type 2, 3 and 4 roads use AMP standards
Hydrologically-Connected Road Segments

Segment length = 100 Meters

Connected Criteria:
- Within 100’ of a water resource
- Bisects (crosses) and drains to a water resource
- The forest road segment is uphill from, and drains to, a segment that bisects a water of the state
- Connectivity status can be changed during the inventories

Water Resources:
- Perennial streams
- Intermittent streams/Defined channel (even if dry)
- Wetlands
- Lakes and Ponds
ANR
Road Erosion Inventory (REI)

Utilizes Field Maps and Survey 123 to manage the segments and collect segment data.
Survey and Segment Information

Use the Road Erosion Inventory Supplement and the Acceptable Management Practices (AMPs) Manual to complete the assessment.

Name(s) *
Dave Wilcox

Organization *
FPR

Date of Assessment *
Tuesday, April 26, 2022

ANR Unit *
L.R. Jones State Forest

Forestry District *
District 4 Central

Assess reason *
- Initial assessment
- Reassessment
- Work completed
- Storm damage

Segment ID *
56743

Segment length (m) *
100

Road name
South Road

Hydro-connected *
Yes

Forest road type *
- Type I Road
- Type II Road
- Type III Road
- Type IV Road

Modeled slope

Field determined percent slope *
(rise / run) x 100
4

Complete the assessment.
Type II-IV Forest Roads

Travel Lane/Crown:

A-1: Is 90% of the segment downsloped, out-sloped or properly crowned (≥2% crown slope)?
- Yes
- No
- Not applicable

A-2: Are functioning broad-based dips or waterbars spaced at intervals less than:

300 feet (2-5% field determined slope)?
- Answer
- Yes
- No
- Not applicable

A-3: What type of erosion is within the travel lane?
- Document: rill erosion ≥1'; gully erosion ≥1' long
  - Gully erosion (6' + depth)
  - Rill erosion (between 1' and 6')
  - Sheet flow (1' or less) or none

Notes on segment’s drainage

Road shoulder/ditch area

B-1: Is 90% of the roadway runoff flowing in a distributed manner and shedding into a vegetated area or drainage ditch that is; stabilized with vegetation and/or stone (<5% field determined slope)?
- Answer
- Yes
- No

B-2: What type of erosion is within the road shoulder or ditch area?
- Document: rill erosion ≥1'; gully erosion ≥1' long
  - Gully erosion (6' + depth)
  - Rill erosion (between 1' and 6')
  - Sheet flow (1' or less) or none

Notes on segment’s drainage

Drainage Culverts

Inventory cross drainage culverts, culverts used for landings, intersections, side roads and driveways. Not culverts associated with stream crossings.

C-1: Are functioning cross-drainage culverts spaced at intervals less than:

200 feet (5-10% field determined slope)?
- Answer
- Yes
- No
- Not applicable

C-2: Are all drainage culverts ≥15" in diameter?
- Yes
- No

C-3: What type of erosion is associated with the segment’s drainage culverts?
- Gully erosion (6' + depth)
- Rill erosion (between 1' and 6')
- Sheet flow (1' or less) or none

Notes on segment’s culverts
**Stream Crossing and Disconnection**

D-1: Are perennial or intermittent stream crossings present in road segment? *

- Yes
- No

Inventory each perennial and intermittent stream crossing within the segment

**Stream Crossings Repeat**

D-2: Crossing Type *

- Intermittent stream
- Culvert

D-3: Is the intermittent stream crossings sized to active channel width? *

- Yes
- No

D-4: Are disconnection practices a minimum of 25' away from top of bank? *

- Yes
- No

D-5: Is the stream crossing failing or ≥75% obstructed? *

**Forest Buffers**

E-1: Is there recent disturbance in the forest buffer area? Use AMP Table 4 below to determine minimum forest buffer widths. *

<table>
<thead>
<tr>
<th>TABLE 4: Minimum Forest Buffer Widths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance from Stream</td>
</tr>
<tr>
<td>-----------------------</td>
</tr>
<tr>
<td>0-10</td>
</tr>
<tr>
<td>11-20</td>
</tr>
<tr>
<td>21-30</td>
</tr>
<tr>
<td>31-40*</td>
</tr>
</tbody>
</table>

*Not 20 feet for each additional 10 percent slope

**Deviations from Table 4**

- If one side of the stream is 10% slope, the buffer distance on that side is 50 feet. If the other side is 20% slope, the buffer distance on that side is 70 feet. The total forest buffer width at location on the stream is 120 feet.

E-2: Are exposed soils seeded and mulched? *

- Yes
- No

E-3: What type of erosion is within the segment’s forest buffer area? *
Segment Maintenance and Recommendations

Does the road segment need maintenance or a practice installed? *

- Yes
- No

Recommended roadway maintenance and practices

select all that apply
- Crown road
- Resurface gravel
- Install sub-surface drainage
- Armor shoulder
- Grading
- Install waterbar/broad-based dip
- Lower road shoulder
- Other

Recommended ditch maintenance and practices

select all that apply
- Install cross-drainage culvert
- Add new driveway culvert
- Install inlet culvert header
- Install outlet culvert header
- Line ditch with stone
- Line ditch with vegetation
- Establish ditching
- Ditch cleaning and maintenance
- Add new ditch turnout
- Add culvert outlet treatment (stone apron)
- Establish conveyance zone
- Install stone check dams
- Add cross drainage/ditch relief waterbar
- Other

Recommended crossing maintenance and practices

select all that apply
- Replace perennial stream culvert
- Replace intermittent stream culvert
- New perennial stream culvert
- New intermittent stream culvert
- Install perennial stream ford
- Install perennial stream open crossing
- Install inlet culvert header
- Install sediment control
- Other
- Replace perennial stream bridge
- Replace intermittent stream bridge
- New perennial stream bridge
- New intermittent stream bridge
- Install intermittent stream ford
- Install intermittent stream open crossing
- Install outlet culvert header
- Install seed and mulch

Non-water quality observations

select all that apply
- Hazard trees
- Roadside mowing
- Invasive species
- Illegal dumping
Segment Scoring

Travel lane:
- Crown is installed on 90% or greater of segment or Water bars/dips in place and none to rill erosion, fully meets, if gully erosion partially meets.
- Crown not installed on 90% or greater of segment or Water bars/dips not in place and no erosion, Practice fully meets
- Crown not installed on 90% or greater of segment or Water bars/dips not in place and rill erosion in place, Practice Partially Meets
- Crown not installed on 90% or greater of segment or water bars/dips not in place and gully erosion in place. Practice Does Not Meet

Shoulder/ditching scoring:
- Distributed flow or proper ditching based on slope in place present on 90% or more and none to rill erosion present- Practice Fully Meets, if gully erosion partially meets.
- Distributed flow or ditching practices absent on more than 10% of segment and no erosion present, Practice fully Meets
- Distributed flow or ditching practices absent on more than 10% of segment and rill erosion present, Practice Partially Meets
- Distributed flow or ditching practices absent on more than 10% of segment and gully erosion present, Practice Does Not Meet
Drainage culverts scoring:

- Drainage culverts properly sized and spaced properly, and none to rill erosion, Fully Meets, if gully erosion is present, Partially meets.
- Drainage culverts missing and/or undersized and no erosion present, Fully meets.
- Drainage culverts missing and/or undersized and rill erosion present, Partially Meets.
- Drainage culverts missing and/or undersized and gully erosion present, Does Not Meet.

Stream Crossings Scoring:

- Crossings properly sized and none to rill erosion present- Fully meets, if presence of inlet sediment deposition and/or outlet scour, or presence of streambed scour at the inlet causing structural undermining - partially meets.
- Crossings undersized and no erosion- Fully Meets.
- Crossings undersized and inlet sediment deposition or inlet scour causing structural undermining - Does not meet.
- Crossings undersized and outlet streambed scour, channel widening, or perching - Does Not Meet.
- One or more required disconnection culvert missing- Does Not Meet.
- Stream crossing failing or more than 75% obstructed - Does not Meet.

Forest Buffer Scoring:

- Seed and mulch in place and no erosion or rill erosion present on 90% or greater of exposed soil = Fully Meets, if gully erosion present partially meets.
- Seed and mulch not installed for greater than 10% of exposed soil and no erosion = Fully meets.
- Seed and mulch not installed for greater than 10% of exposed soil and rill erosion in place = Partially Meets.
- Seed and mulch not installed for greater than 10% of exposed soil and gully erosion in place = Does Not Meet.
Overall Segment Scoring

- Fully Meets = all Fully Meets scores
- Partially Meets = 1 or 2 individual Partially Meets scores
- Does Not Meet = any Does Not Meet score or 3 or more Partially Meets scores

Water quality Prioritization for Hydrologically Connected Segments

<table>
<thead>
<tr>
<th>Segment slope</th>
<th>Fully Meets</th>
<th>Partially Meets</th>
<th>Does Not Meet</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-&lt;5%</td>
<td>N/A</td>
<td>Low priority</td>
<td>moderate priority</td>
</tr>
<tr>
<td>5-&lt;10%</td>
<td>N/A</td>
<td>Low priority</td>
<td>High priority</td>
</tr>
<tr>
<td>10-&lt;20%</td>
<td>N/A</td>
<td>Moderate Priority</td>
<td>Very high priority</td>
</tr>
<tr>
<td>&gt;20%</td>
<td>N/A</td>
<td>High Priority</td>
<td>Highest priority</td>
</tr>
</tbody>
</table>
Phosphorus Accounting

- P-baseload by segment that does not meet standards = 0% reduction
- Change from Does Not Meet to Partially Meets = 40% load reduction
- Change from Does Not Meet to Fully Meets = 80% load reduction
Over the summer of 2020, worked with Jim Ryan and Ryan Knox to develop the REI methodology.

During the winter of 2020-2021, FPR started creating center line data and classifying the roads on Agency Lands.

In the spring of 2021, the REI was used to assess several projects that had obvious erosion identified by the District Stewardship Teams.

This was a great way to “ground truth” the system, and FPR identified and laid out several projects.

Over the course of the 2021 field season, FPR completed 7 projects totaling over $488,000.
Project Location

Capital Funding/ Clean Water Project
Road Re-Surfacing and Culvert Replacement

New Culvert Installation 16 ea.
Lineal Ft. of Crushed Ledge Resurfacing: 15,700'
Lineal Ft. of Roadway in Need of Broad Based Dips: 1,900'

Legend
- Culvert Replacement
- Broad Based Dips
- Gravel
- State Forest Highway
- Cotton Brook

Drawn By: [signature]
[Date]
REI Results

- The road erosion inventory found that many hydrologically connected segment needed some improvement to meet the VT AMP Standards for truck roads.
Corrective Practices Installed

- **Common items included:**
  - Ditch relief culverts
  - Ditch disconnection culverts
  - Armoring culvert outlets
  - Correctly sizing structures
  - Re-crowning & grading the road surface & shoulders
  - Installing new road surface material
Ditch Relief & Disconnection

- Ditch relief culverts were installed according to AMP spacing based on road slope.
Disconnection culverts were installed to disconnect ditch drainage from directly discharging into waterways.
Ditches were shortened, turned out and armored.
Structure Sizing

- Undersized structures were removed.
- Replaced with structures sized according to drainage area.
Road Surface & Shoulder Improvements

- Improvements were made to roadway to control surface drainage & resiliency.
The travel lane was properly shimmed and graded to re-establish crown or cross drainage.
Shoulders were re-graded to establish positive drainage.
A new wear surface was installed to make the road more resilient and lower maintenance cost.
# Project Summary

## REI Accomplishments

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
</tr>
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<tbody>
<tr>
<td>Feet of road resurfaced</td>
<td>4950</td>
</tr>
<tr>
<td>Feet of road crowned/out sloped</td>
<td>4950</td>
</tr>
<tr>
<td>Number of waterbars/broad based dips installed</td>
<td>3</td>
</tr>
<tr>
<td>Number of turnouts constructed</td>
<td>5</td>
</tr>
<tr>
<td>Number of cross drain culverts installed</td>
<td>33</td>
</tr>
<tr>
<td>Culvert end treatments completed</td>
<td>33</td>
</tr>
<tr>
<td>Feet of ditching completed</td>
<td>100</td>
</tr>
<tr>
<td>Feet of ditch stone lined</td>
<td>80</td>
</tr>
<tr>
<td>Number of stone check dams installed</td>
<td>0</td>
</tr>
<tr>
<td>Feet of sub-surface drainage installed</td>
<td>0</td>
</tr>
<tr>
<td>Stream crossings improved</td>
<td>10</td>
</tr>
<tr>
<td>Stream crossings permanently removed</td>
<td>0</td>
</tr>
<tr>
<td>Feet of existing road brought up to AMP standards</td>
<td>4950</td>
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<tr>
<td>Feet of road “put to bed”</td>
<td>0</td>
</tr>
<tr>
<td>Feet of road constructed (to AMP standards)</td>
<td>0</td>
</tr>
<tr>
<td>Feet of existing trail brought up to AMP standards</td>
<td>0</td>
</tr>
<tr>
<td>Feet of trail “put to bed”</td>
<td>0</td>
</tr>
<tr>
<td>Feet of trail constructed (to AMP standards)</td>
<td>0</td>
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<tr>
<td>Other - please describe</td>
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## Project Cost

<table>
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<tr>
<th>Category</th>
<th>Cost</th>
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<tr>
<td>Equipment</td>
<td>$65,682.50</td>
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<tr>
<td>Road Material</td>
<td>$90,772.75</td>
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<tr>
<td>Labor</td>
<td>$15,215.00</td>
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<tr>
<td>Misc. Cost</td>
<td>$1,817.28</td>
</tr>
<tr>
<td>Culverts</td>
<td>$13,686.56</td>
</tr>
<tr>
<td>Total</td>
<td>$187,174.09</td>
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</table>
Next Steps

- A contractor is slated to start the inventory process of approximately 1/3 of the forest road miles on Agency Land.

- Road centerline mapping and segmentation is taking place on the remaining miles of forest roads. An RFP will be put out for another inventory contract this spring/Summer.

- Another 13 projects have been identified by the District Stewardship Teams to be implemented during this field season.

- Once the first phase of inventory is completed, the next round of implementation projects will come from the REI process.
Special Thanks to:

- Jim Ryan - DEC Stormwater Program
- Ryan Knox - ANR IT
- Pat Ross - River Management Engineer
- FPR state lands foresters