FINAL REPORT

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IDENTIFYING AND FIXING EROSION ISSUES ON PRIVATE AND PARK ROADS IN THE LAKE CARMI WATERSHED

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1. EXECUTIVE SUMMARY

The Northwest Regional Planning Commission (NRPC) has completed a road erosion inventory (REI) on all hydrologically-connected segments on private roads, park roads, and driveways within the Lake Carmi Watershed. NRPC prioritized roads segments for phosphorus best management practices implementation projects based on the potential for reducing phosphorus loading using Vermont Department of Environmental Conservation's (VTDEC) default methodology. In partnership with the Friends of Northern Lake Champlain (FNLC), NRPC further prioritized road segments for project implementation based on landowner willingness, likelihood of long-term success, and cost effectiveness. Two projects were selected for construction. Outreach to property owners and camp owners included workshops and 1-on-1 coordination. Other partners involved in the project besides FNLC include Franklin County Natural Resources Conservation District (FCNRCD) and Franklin Watershed Committee (FWC).

The project was pursued in response to several events, including: (a) Lake Carmi's history of cyanobacteria blooms as a result of high nutrient concentrations, (b) a Total Maximum Daily Load (TMDL) analysis that aims to reduce phosphorus loading to the lake, (c) the designation of Lake Carmi as a "Lake in Crisis" under Act 168, and (d) the Vermont Department of Environmental Conservations (DEC's) Crisis Response Plan, which identifies the importance of managing stormwater from developed areas and private roads.

The chief objectives were related to building on past work, adapting processes previously used to address water quality-related need on public roads to a new setting, completing demonstration projects that reduce sedimentation and phosphorus, and serving as a catalyst for future action. They included creation of a prioritized plan for improving roads and driveways in the watershed and establishment of project delivery process that might be employed to complete projects on into the future.

Work occurred over more than three years, including years coinciding with the COVID pandemic. The project was initiated in 2019 and 2020 with the execution of various contracts. A road erosion inventory, separate prioritization, and initial project selection were completed in 2021. Project designs were developed in 2021 and 2022. Projects were implemented in 2022 and 2023. Post construction road inventories were completed in 2023.

Accomplishments included completion of an approved Quality Assurance Project Plan (QAPP), development of a baseline road erosion inventory consistent with the QAPP, and improved knowledge among summer residents as a result of public outreach and workshops. They also included three project designs, two actual projects, the road improvements and changes in P- generation potential resulting from the projects. Less tangible but no less valid are the experience developed by staff, the relationships with camp owners, vendor contacts, and increased understanding of the appropriateness of using MRGP standards in private road settings.

Regarding lessons learned, one stands out. NRPC found through this pilot effort that applying standards associated with the Vermont Municipal Roads General Permit to private roads is not as simple as it might seem. Private roads—including those along lakes in Vermont—are not constructed or managed like public roads are, ordinarily. Some adaptation

of the standards is likely necessary. Other lessons learned varied widely in scope. They included managing public processes during a global pandemic at one end and appreciating the importance of landowner commitment in the form of a letter of intent prior to investing significant time or effort in design at the other end. Regarding the latter point, maintaining communications with landowners throughout the design process is also essential for success.

2. CONTENTS

3. PROJECT SYNOPSIS

Lake Carmi is a relatively shallow lake in northwest Vermont and suffers from cyanobacteria blooms because of high nutrient concentrations. A Total Maximum Daily Load (TMDL) document for phosphorus was issued in 2009 with the aim of reducing phosphorus loading to the lake. The TMDL Action Plan details the importance of, among other things, road erosion inventories and of ongoing road maintenance.[1]

In May 2018, the Vermont State Legislature passed Act 168, which designated Lake Carmi as a Lake in Crisis. In response to Act 168, Vermont's Department of Environmental Conservation (DEC) created and issued a Crisis Response Plan, and private road assessments were added to the list of objectives for the Lake Carmi watershed.

According to the Franklin Watershed Committee (FWC), some 3,700 feet of roadway lie within 50 meters of the Lake Carmi shoreline, the majority of which are private.[2] The proximity of these roads to surface waters has significant implications for water quality, particularly if the roads are not appropriately maintained.

The process of inventorying private road conditions in the Lake Carmi watershed began in 2013 and has continued every two to three years since. Inventory methods have varied, but in general the investigations have identified common issues related to inadequate ditching, undersized culverts, lack of crowning and other maintenance, and lack of implementation.

FWC's 2019 inventory synthesized prior work, incorporated a private road assessment, and included recommendations for possible treatments on 30 roads in four primary neighbourhoods. It stressed the need for thoughtful project planning and the importance of maintenance once projects are implemented. The report concluded with a simple list of priority areas consisting of five road names. It described possible solutions and, in some cases, recommended treatments but did not include designs.

The current project builds on the work of prior inventories by carrying out a more sophisticated REI using a methodology based on the one used to assess and prioritize improvements on public roads subject to the Municipal Roads General Permit (MRGP). Indeed, the project is essentially a Pilot study addressing the question: Are MRGP standards appropriate ones to use when attempting to address water quality concerns on private roads?

The project focuses on private roads but owing to potential water quality significance also includes an assessment of the roads in the Lake Carmi State Park, which are not assessed under the MRGP. It systematically prioritizes road segments based on the potential to reduce phosphorus along with factors such as landowner willingness, likelihood of success, and cost effectiveness. And, perhaps most important, the project includes the funding to implement actual improvements and conduct post construction inventories allowing a comparison of conditions "before" and "after."

The approach taken to complete the project was straightforward and conventional. It proposed to address four goals identified in *Opportunities for Action*—namely Clean Water, Healthy

[1] For example, Action Item #14 points to the need for a "Town Road Erosion Inventory (Priority: High)."
[2] LAKE CARMI PRIVATE ROADS EROSION INVENTORY REPORT 2019, Franklin Watershed Committee. The combined use of metric and imperial units is found in the original.

Ecosystems, Thriving Communities, and Informed and Involved Public—by following a series of steps. The steps included public involvement and awareness, inventory, identification of problem areas, prioritization of problem areas, development of designs, and implementation of designs. The work plan for the project called for the identification and prioritization of road erosion projects and the implementation of two to five construction projects that reduce the amount of phosphorus and sediment being carried into the lake. NRPC posited that a reduction in nutrients resulting from construction of priority projects proposed in the work plan would contribute to a healthier aquatic ecosystem and improve the habitat in Lake Carmi.

Similarly, NRPC anticipated that road BMPs and water quality improvements in Lake Carmi would increase the appreciation residents and visitors have of the natural and cultural resources and attract more people to this unique area of the state—which might translate into the development of programs to better address road BMPs. Finally, residents were engaged through the workshops and outreach efforts of the project and become empowered with the knowledge and awareness of the need to take stewardship actions.

Results Summary:

- 246 distinct segments were assessed.
- 84 segments were found to fully meet MRGP standards.
- 61 segments partially meet standards.
- 63 segments do not meet standards.
- 26 segments were determined to be not connected.
- 12 segments had incomplete data.
- Lack of crown and poor surface conditions (i.e., potholes) were frequently observed throughout.
- Unstabilized drainage ditches and high shoulders preventing sheetflow were encountered frequently.
- There were 8 very high priority segments, 17 high priority segments, 34 moderate priority segments, and 51 low priority segments.
- Projects were identified from among very high, high, and moderate priority segments.

As a result of its inventory, analysis, and prioritization, NRPC identified opportunities for projects in the following locations: Sandy Bay & Black Woods Roads, Mullen Shore Road, Patton Shore Road, and Westcott Shore Road. These roads serve multiple camps and have different slopes and segment scores. The analysis also identified potential for projects at two locations at Lake Carmi State Park, namely Bass Lane and at the Boat launch site.

Projects were designed for sites on Sandy Bay & Black Woods Roads, Mullen Shore Road, Patton Shore Road. BMPs were ultimately implemented on Sandy Bay & Black Woods Roads and Patton Shore Road.

Work on the project occurred over more than three years, including years coinciding with the COVID pandemic. The project was initiated in 2019 and 2020 with the execution of various contracts. A road erosion inventory, separate prioritization, and initial project selection were

completed in 2021. Project designs were developed in 2021 and 2022. Projects were implemented in 2022 and 2023. Post construction road inventories were completed in 2023.

NRPC's efforts were enhanced by the support of partner organizations Friends of Northern Lake Champlain (FNLC), the Franklin County Natural Resources and Conservation District (FCNRCD), and Franklin Watershed Committee (FWC). These partners assisted by participating in kickoff and advisory committee meetings; publicizing, promoting and participating in Best Management Practices workshops; and coordinating outreach and 1-on-1 meetings with property owners in high priority areas.

4. TASKS COMPLETED

In carrying out the project, NRPC has systematically examined all private and park roads in the Lake Carmi watershed and completed a road erosion inventory of those roads using the VTDEC application and default prioritization methodology. Unlike previous efforts in the watershed, the inventory explicitly identified segments as hydrologically connected. Products created include a comprehensive Geographic Information System (GIS) layer of private and park roads and driveways; an additional GIS layer of those roads broken down into 100 meter segments, and assessment data identifying segments that do not meet the expected condition, prioritized by potential contribution of phosphorus to surface waters.

NRPC and its partner organizations also provided education and outreach to property and camp owners through targeted workshops aimed at informing them about Best Management Practices for road maintenance. Using the prioritized inventory, NRPC then executed a pilot program to identify willing property owners and work with them to plan and construct road BMPs in prioritized segments. Three project designs were created with the assistance of a well known regional water quality firm, and, following execution of agreements with landowners and organizations taking responsibility for maintenance, two projects were ultimately constructed. With the completion of the BMP improvements, NRPC anticipates beneficial changes in P- generation potential.

The project was initiated in 2019 and 2020 with the execution of various contracts. A road erosion inventory, separate prioritization, and initial project selection were completed in 2021, while project designs were developed in 2021 and 2022. Projects were implemented in 2022 and 2023, and post construction road inventories were completed in 2023. With respect to a detailed accounting of completed tasks, NRPC has addressed the following:

Task 1: Quality Assurance Project Plan (QAPP)

NRPC prepared and received approval from NEIWPCC, LCBP, and EPA for its QAPP for data collection.

Task 2: Road Erosion Inventory

NRPC completed a Road Erosion Inventory (REI) as described in greater detail in the Methodology section below. As part of the REI, NRPC also identified hydrologically connected road segments and applied a system for prioritization of project sites. These are also described in more detail in the **Methodology section below.** As part of the REI,

- 246 distinct segments were assessed.

• 84 segments were found to fully meet MRGP standards.
• 61 segments partially meet standards.
• 63 segments do not meet standards.
• 26 segments were determined to be not connected.
• 12 segments had incomplete data.
• Lack of crown and poor surface conditions (i.e., potholes) were frequently observed throughout.
• Unstabilized drainage ditches and high shoulders preventing sheetflow were encountered frequently.
• There were 8 very high priority segments, 17 high priority segments, 34 moderate priority segments, and 51 low priority segments.
• Projects were identified from among very high, high, and moderate priority segments.

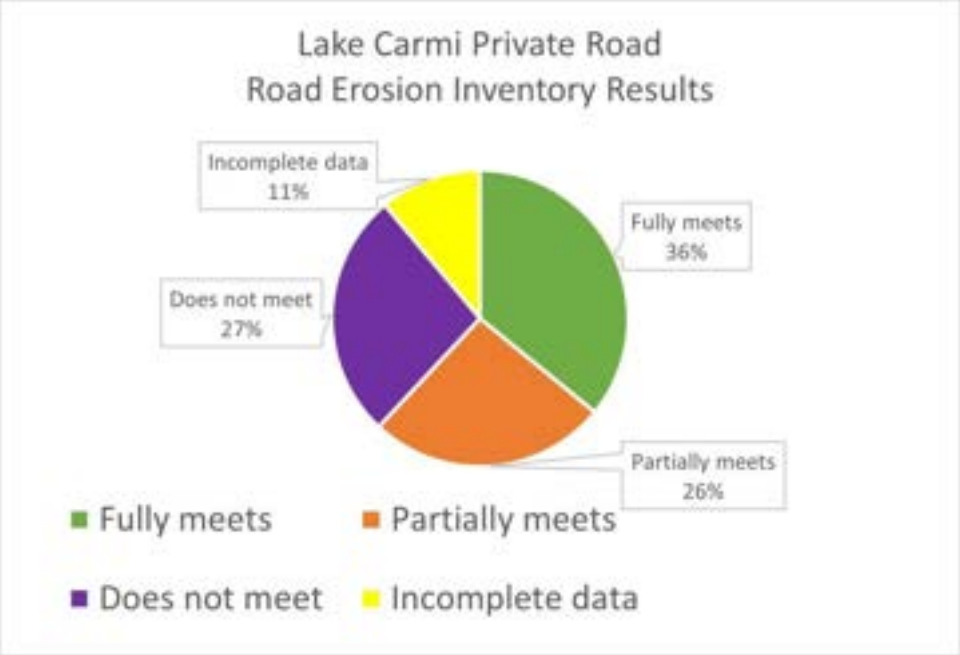

Figure 1. Results of the lake Carmi Road Erosion Inventory.

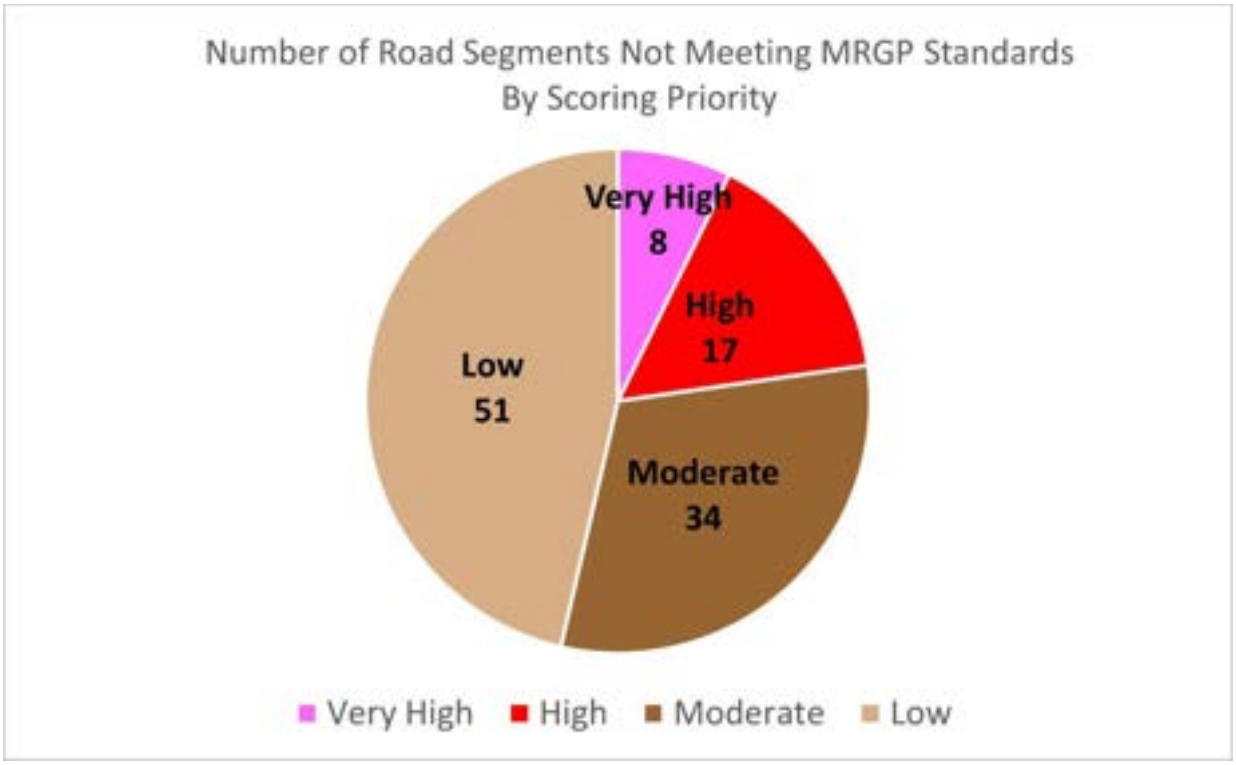

Figure 2. Road erosion inventory results by scoring priority.

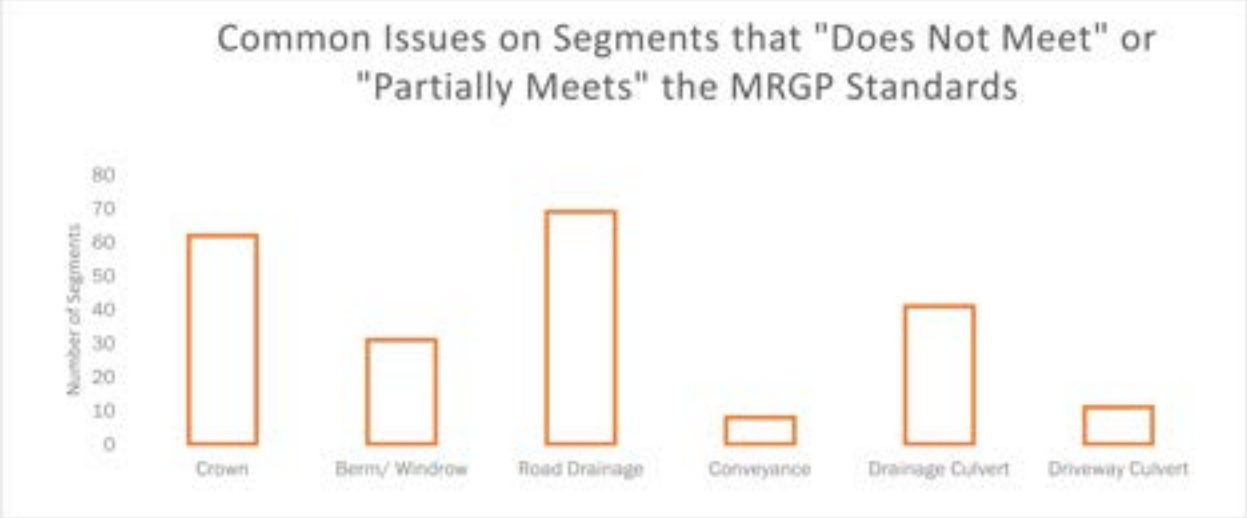

Figure 3. Common issues that cause segments to be scored as "Does Not Meet" or Partially Meets" MRGP standards.

Task 3: Outreach and Workshops

With assistance from a consultant, NRPC staff developed content and curriculum to target and educate homeowners and private road residents on road Best Management Practices for water quality and encourage action. Construction contractors were encouraged to attend. NRPC selected the consultant from a pre-qualified list of firms with technical expertise in road erosion and water quality issues. Workshop materials are attached as Appendix H.

Staff of the project partners FNLC and FCNRCD coordinated outreach and marketing to publicize and promote the workshops. The consultant along with key NRPC staff aimed to conduct multiple workshops to inform the public but owing to the COVID 19 pandemic ultimately, NRPC and partner organization staff coordinated outreach and marketing to publicize and promote the workshop, which was conducted online during the summer of 2021.

In the buildup to the workshop, the project team conducted a mailing to all property and camp owners within the watershed. The letter (a copy of which is included as Appendix A) advertised workshops, explained the road erosion inventory, and introduce the private road implementation grant program. The letter also explained how property owners can "opt-out" of having their private property included in the road erosion inventory.

As segments were prioritized through the REI, partner organizations coordinated 1-on-1 meetings with property owners in certain high priority areas to talk about the construction grant funding and gauge interest in participating.

Tasks 4 and 5: Construction planning, coordination and implementation

The project team established prioritization and selection criteria for choosing construction projects, with the assistance of a project advisory committee. As a starting point, the team used the default REI prioritization methodology which incorporates potential to reduce phosphorus loading. It then extended the methodology to identify clusters of projects, projects that address two or more segments, landowner support, and cost effectiveness. BMPs were selected from those identified in the Vermont Better Roads Manual, the Vermont Guide to Stormwater Management for Homeowners and Small Businesses.

Summary of NRPC Initial Project Screening

- Clusters of segments that are very high, high, and moderate priority
- Roads over driveways
- Areas with project advocates or where we perceived landowner willingness would be positive

As a result of its inventory, analysis, and prioritization, NRPC identified opportunities for projects in the following locations: Sandy Bay & Black Woods Roads, Mullen Shore Road, Patton Shore Road, and Westcott Shore Road. These roads serve multiple camps and have different slopes and segment scores. The analysis also identified potential for projects at two locations at Lake Carmi State Park, namely Bass Lane and at the Boat launch site.

Figure 4. Black Woods Road before work was completed.

Figure 5. Existing conditions of the intersection of Patton Shore and Ledge Drive.

Projects were designed for sites at the intersection of Sandy Bay & Black Woods Roads, on Mullen Shore Road, and along Patton Shore Road. Design level of detail was consistent with the level of detail provided for projects funded through the Better Roads and/or Municipal Roads Grant-In-Aid programs. BMPs were implemented at the intersection of Sandy Bay & Black Woods Roads and along Patton Shore Road (including intersections of Scottish Lane and Ledge Road).

NRPC competitively procured contractors, who constructed BMPs according to designs meant to meet the standards of the MRGP. Work on Mullen Shore Road did not advance as a result of landowner concerns.

Concurrent with the design process, the project team developed a project agreement template (Memorandum of Understanding (MOU)) that participating property owners were asked to sign to receive construction funding. The agreement outlines roles and responsibilities before and during construction, property owner financial/labor contribution, and a commitment to long-term maintenance of the installed BMPs.

NRPC completed a "post" road erosion inventory on road segments included in the construction projects. Staff captured photos. Once Vermont DEC finalizes its ArcGIS online portal for private roads REIs, NRPC will upload the data to the portal.

Figure 6. Black Woods Road recently after construction was completed.

Figure 7. Post construction conditions of the Patton Shore Ledge Drive intersection. To note these photos are after a recent rain storm. Sedimentation basin does not have consistent pooling water.

Task 6: Quarterly and Final Reporting, Advisory Committee meetings

NRPC created and coordinated the advisory committee helping to guide the project. NRPC also completed all required reporting, and when necessitated by the impacts of the COVID 19 pandemic amended the contract with an extended timeline.

5. METHODOLOGY

The project's purpose was to collect, maintain, analyze, display, and document data to accurately map the condition and location of all private and park roads and driveways in the Lake Carmi watershed, as well as to complete technical designs for priority projects and to move at least some of those projects forward to construction. Steps taken to complete three technical tasks in particular—the REI Process, Identification of Hydrologically Connected Segments on Private and Other Roads; and Prioritization—are described in more detail below.

REI Process

NRPC reviewed Vermont E911 road centerline and Vermont E911 driveway GIS data to identify gaps for private roads including park roads, driveways and non-farm access roads. NRPC also digitized missing private roads and driveways based on recent orthophotography or when a road

was not visible due to tree cover collected centerline data in the field using ArcCollector on an iPad.

Next, NRPC created a master private/park road GIS layer for the Lake Carmi watershed comprised of private and park roads from the E911 road centerline layer, the E911 driveway data and additional centerline data collected by NRPC. NRPC then segmented the private/park road GIS layer into 100-meter sections. With guidance from VT DEC, NRPC assigned a unique ID number to each segment.[3]

NRPC used LiDAR data to calculate slope for each segment. This calculated slope was used for the proximity analysis. Actual road slope was also collected in the field as required by the REI protocols.

NRPC then used the "VT DEC and Agency of Digital Services methodology for determining GIS-derived municipal roads hydrologic connectivity proximity analysis" to identify hydrologically-connected road segments, **as detailed below**. NRPC then submitted the private/park road GIS layer to ANR for integration into the VT ANR REI mobile application.[4]

After data were loaded into the application, NRPC completed a road erosion inventory for each hydrologically-connect private/park road segment in the watershed, including driveways and non-farm access roads. Results of the REI set the stage for the **Prioritization process described below**.

Identification of Hydrologically Connected Segments on Private and Other Roads

Per Vermont's Municipal Roads General Permit (MRGP), all hydrologically connected municipal road segments are to be assessed for compliance with road standards. Those road segments are classified as "hydrologically connected" or "not connected" using field surveys and proximity analyses. A hydrologically connected road segment in the MRGP context meets one of the following criteria:

1. Municipal road segment within 100' of a perennial or intermittent stream, lake,
2. Municipal road segment that drains directly into a perennial or intermittent stream, lake,
3. Municipal road segment that drains directly into a wetland [2].

DEC's hydrologically connected road layer does not include private roads, however. For the current project, NRPC applied the criteria above to a set of non-municipal roads in the Lake Carmi watershed. The non municipal roads subject to evaluation consisted largely of private roads and drives. However, they also included roads within Lake Carmi State Park, because such roads are also not part of the MRGP.

[3] Traditionally, municipalities have used a DEC-approved road layer to identify hydrologically connected road segments. Municipalities apply the data layer using an app during the Road Erosion Inventory (REI) process and identify each segment as Fully Meets, Partially Meets, or Does Not Meet the standards outlined in the General Permit.

[4] Application is currently not available. See https://dec.vermont.gov/watershed/stormwater/permit-information-applications-fees/municipal-roads-program .

After completing this process, an additional desktop GIS proximity analysis was performed to identify private and park roads and driveways that are within 250 feet of Lake Carmi and those were added as hydrologically connected segments. This adjustment to the criteria was made in response to a request from DEC staff. The change was requested to achieve consistency with Vermont's Shoreland Protection Act (SPA), which has jurisdiction within 250 of lake shorelines.

Prioritization Process

The prioritization process used to identify best management practices and implementation projects as part of Task 4 built on the one used as part of the MRGP process. First, NRPC determined default segment prioritization using the MRGP model, and selected those segments categorized as very high priority, high priority, or moderate priority. NRPC then identified potential projects and selected those projects with the potential to improve two or more priority segments for further consideration.

For 'Moderate Priority', 'High Priority' and 'Very High Priority' segments, NRPC also identified missing BMPs that prevent the segment from meeting the MRGP standards and referenced previous Lake Carmi road erosion reports to help identify potential BMPs that should be installed.

NRPC and partner staff then made initial contacts with landowner(s) corresponding to potential projects that had been identified and selected those where the landowner was positive or the project had resident advocates. NRPC selected from the priority projects with supportive landowners projects that were previously identified in inventories. NRPC further prioritized road segments for project implementation based on landowner willingness, likelihood of long-term success, and cost effectiveness. As noted above, a total of three projects were selected for design, and two were implemented. Post-construction road inventories followed implementation.

6. QUALITY ASSURANCE TASKS COMPLETED

Overview of QAPP tasks

The REI-related tasks identified in the QAPP may be summarized as follows:

- Review Vermont E911 road and driveway GIS data to spot private road gaps.
- Digitize missing roads and driveways from recent orthophotography; collect obscured data in-field using ArcCollector.
- Establish a master private/park road GIS layer for Lake Carmi watershed using E911 and collected data.
- Segment the GIS layer into 100-meter sections and assign unique IDs with VT DEC guidance.
- Utilize LiDAR data to calculate segment slopes; gather in-field slope data as needed.
- Employ "VT DEC and Agency of Digital Services methodology" to determine hydrologically-connected road segments.
- Identify and add to GIS layer those roads and driveways within 250 feet of Lake Carmi.
- Forward the GIS layer to ANR for integration in the VT ANR REI mobile app.
- Complete road erosion inventory for hydrologically-connected segments in Lake Carmi watershed.

- Use VT ANR REI mobile app to collect data, adhering to MRGP REI standards, and forward data to ANR.
- Plan to conduct REI on 354 road segments, adjusting based on in-field hydrologic connectivity verification.
- Retrieve collected REI data from ANR web portal.
- Examine default REI road segment prioritization. This can be found in Appendix L.
- Identify missing BMPs for segments not meeting MRGP standards and discern potential BMPs from past Lake Carmi erosion reports.

Execution of QAPP

Prior to acceptance, data collected as part of the REI passed through a quality assurance process overseen by the project QA Officer.

As data was compiled, the QA Officer and NRPC Project Manager reviewed data quality to determine if it falls within acceptable limits and for logical consistency and coding errors. The QA Officer provided review and approval of the data before closure of the project.

NRPC provided training to all individuals collecting preconstruction data. This preconstruction training included instructions on how to apply the ANR DEC road erosion inventory methodology to each segment being assessed in the field as well as the use of the ANR Road Erosion Inventory app. The NRPC staff member responsible for post construction assessments (a new hire) received similar training at an event hosted by CCRPC and the state of Vermont.

NRPC has maintained a log of all source GIS data used during the assessment. The data is stored in an ArcGIS geodatabase on the NRPC server, which is backed up to a remote location automatically. During the field collection phase of the project, newly collected data were uploaded to a geodatabase hosted on NRPC's ArcGIS online account. Field data stored online were downloaded and saved on NRPC's server and included in regular backups.

Known Limitations

The only known limitations of the data relate to the documentation of the post construction inspection for BMPs installed before October of 2022. Work was inspected and documented, however compilation of condition data consistent with REI protocols was delayed. Collection and compilation of condition data did occur after follow up visits in July of 2023.

7. DELIVERABLES COMPLETED

With the support of its partners and consultant, NRPC completed the following deliverables, as called for in the project workplan. The workplan is attached in Appendix B. Generally speaking, the timeframe for the completion of deliverables was consistently longer than initially anticipated. The factors most responsible for the longer-than-expected completion of deliverables included the COVID 19 pandemic and changes in staffing.

Task 1: Quality Assurance Project Plan (QAPP)

•QAPP. NRCP worked with grant managers to create draft, final, and amended versions of the QAPP in the initial months of the project. This can be viewed in Appendix C.

Task 2: Road Erosion Inventory

•REI assessment data. NRPC staff (and interns) used the newly created and uploaded data to conduct the REI assessment, which resulted in the creation of a wide array of geolocated data on road conditions.

•List of priority segments. Using a prioritization approach adapted from the standard REI method, NRPC's team developed a prioritized list of segments. The prioritization reflected categories for Very high priority, high priority, and moderate priority. In some cases, segments required field verification of modelled slope. Detailed descriptions of each of the segments assessed can be found in Appendix D: REI Data.

•Estimates of BMP construction costs. Detailed cost estimates of BMPs were developed by the consultant for the two project areas at the time following the creation of 30% designs. Detailed cost estimates can be viewed in Appendix E.

Task 3: Outreach and Workshops

•Letters to all property/camp owners. A mailing to property/camp owners was issued on September 28, 2020. This letter documented the three phases of the project including the road erosion inventory, workshops and construction. A second letter was sent March 8, 2021 reiterating the three phases of work to be completed. These can be found in Appendix A.

•Press release to papers. Press releases were distributed to local media following completion of projects as part of Task 4 and Task 5. These can be found in Appendix F.

NRPC also advertised the work completed in two newsletter articles that are posted to NRPC's website and distributed to the NRPC's regional distribution list. A Lake Carmi Camper's Association newsletter article was also released to let campers know about the work proposed. This went out in the June 2021 newsletter. These newsletters can be viewed in Appendix G.

•Front Porch Forum (FPF) posts. FPF posts were planned but not created owing to the relatively infrequent publication schedule of the Forum serving Lake Carmi. As an alternative, a Workshop flyer was circulated and a social media post was made on the Friends of Northern Lake Champlain's Facebook page advertising the event. These flyers can be seen in the Outreach Appendix H.

•Written summaries from workshops held – Due to COVID only one held- after delays- on July 14 2021. The plan had been to post the recordings to the website. Unfortunately, the recordings were not created. A copy of the PowerPoint can be viewed in Appendix H.

Tasks 4 and 5: Construction planning, coordination and implementation

•Listing of selected projects:

- Mullen Shore Road and;
- Sandy Bay-Black Woods Roads

•Summary of private roads implementation grant program. This can be found in Appendix I.

•RFP for contractors: Two issued, first in Summer 2022 and second in Spring 2023. These RFPs can be found in Appendix J.

•MOUs and maintenance plan with property owners, Summer 2022 and second in Spring 2023. These can be found in the Appendix K for each project location.

•Before, during and after construction photos; Full size photos are available at https://drive.google.com/drive/folders/1ysTqhFgybQTyKUWP3o7Bb3KcFxHZZGn4?usp=sharing

Task 6: Quarterly and Final Reporting, Advisory Committee meetings

•Approved quarterly reports and final report; quarterly reports previously filed

•NRPC Coordination of advisory committee meetings; agendas and minutes

•List of persons who received training in REI

Linda Blasch, NRPC

Luke Briccetti, NRPC

Maddie Yandow, NRPC

Adrian Pierce, NRPC (intern)

Jacob Goodwin, NRPC (intern)

8. CONCLUSIONS

Project Accomplishments

Tangible accomplishments achieved by this project include completion of an approved Quality Assurance Project Plan (QAPP), development of a baseline road erosion inventory consistent with the QAPP, improved knowledge among summer residents as a result of public outreach and workshops. They also included three project designs, two actual projects, the road improvements and changes in P- generation potential resulting from the projects. Less tangible but no less valid are the experience developed by staff, the relationships with camp owners, vendor contacts, and increased understanding of the appropriateness of using MRGP standards in private road settings.

Lessons Learned

As for lessons learned, some stand out. First and foremost, NRPC found through this pilot effort that applying standards associated with the Vermont Municipal Roads General Permit to private roads is not as simple as it might seem. Private roads—including those along lakes in Vermont—are not constructed or managed like public roads are, ordinarily. The practical reality is that some adaptation of the standards is likely necessary going forward, as additional "private roads work" is attempted. Other lessons learned varied widely in scope. They included managing public processes during a global pandemic at one end and appreciating the importance of landowner commitment prior to investing significant time or effort in design at the other end. Regarding the latter point, maintaining communications with landowners throughout the design process is also essential for success but is easier in the abstract than in practice.

We have also learned that the context for private roads is not the same as public roads. Doing work on gravel roads owned by a municipality is mandated by the MRGP where certain number of segments have to be upgraded a year for P reduction is different from managing private roads. A municipality is required by permitting to do work. There may be less motivation for private landowners or road associations to do work on their roads, as they are not required to by the state. Their motivation could be due more to aesthetics, dust suppression, and addressing pot holes or ponding issues that create difficulties in travelling the road. An assumption is made by most users that road work on private roads is not done to achieve P targets for roads, but for ease of travel and mitigating nuisances. Another key factor in municipalities completing work to achieve their MRGP requirements is that there is funding available for improvements and road crews with the experience to do most of the work themselves.

This is unlike the case for private property owners needing to contract for everything or where spot improvements not addressing an entire segment might be favored. Contrary to working with municipal road crews who work on road projects day in and day out, may have materials available, a private landowner or group of people with a common right of way will have to hire out all the work done. Also, the funds used for these types of projects are coming out of the landowner's pockets especially when there is not a homeowner's association or road association already formed to have the network of landowners established to do the work collaboratively. When there is no association, one landowner may be unwilling to contribute funds or have work done on or

near their property, adding to the difficulty to get work done. Doing work on private roads is more difficult due to expenses, lack of experience, and the need to contract work.

Another difference between working on public roads and private roads is that when contracting work is to be done, more oversight will be necessary to ensure the work is being completed as designed—especially if designs are cursory. (Cursory designs may be the case as a result of application of the Vermont Better Roads manual or because low-effort—and thus low cost—designs are promoted by some DEC staff.) This could involve increased time for a construction inspector to be working on-site during the construction period, reviewing the design with the contractor, verifying elevations and slope as the contractor is working. This can culminate in red-lined final design plans to document the condition of the road after construction, where extensive documentation is warranted.

NRPC's work on this project suggests that MRGP standards are a good lens to look through to *begin* the process. But, MRGP standards should not be used to evaluate the ultimate success of road-based practices of private roads, where there needs to be further consideration of context. Barriers to implementation that would impede standards implementation also need to be considered. These include physical constraints such as width of the Right of Way (ROW), historic stone walls or large trees, buried utilities, wetlands, lakeshore vegetation, excessive ledge or public safety considerations. Such barriers can prevent standard practices from being feasible on a particular road. These barriers to implementation have been added to the 2023 MRGP segment scoring. Private roads such as these around Lake Carmi may have been just small camp access trails that have been more formalized over time. In many cases, these roads were not installed with specific specifications or requirements in mind as does with the construction of a public road. Therefore, the standards for public roads are not always adequate for use on private roads.

The Best Management Practice (BMP) that is most absent from the hydrologically connected roads is crowning. Crowning ensures that stormwater runoff on the roadways can flow in a distributed manner and sheet flow off the sides of the roads. Proper crowning can ensure that flow runs into roadside ditches. This is required whether or not there has been erosion present on the road. Many private roads in the Lake Carmi watershed and elsewhere lack crowns. A lack of crowns can cause substantial problems. Stormwater flow can become channelized, forming gullies or eroded channels like ruts, rather than sheet flowing off the side of the roads. Channelized flow can travel long distances picking up speed on steeper slopes, becoming more erosive, and damaging to the road surface. It is important to maintain the crown of a gravel road, even on private roads. It is one of the baseline standards for gravel and paved roads with ditches under the Municipal Roads General Permit. Regrading and crowning may need to occur on a gravel road multiple times a year to ensure the proper drainage. This regular maintenance is necessary. However, crowning is not an eligible project type within the Clean Water Initiative Program (CWIP). Grants authorized by CWIP, such as Water Quality Restoration Formula Grants, cannot be used to cover the cost of routine maintenance of this practice type, per the CWIP Funding Policy. A "disconnect" exists between what is required by the MRGP standards on gravel roads and the ability to have funding assistance to implement these practices and maintain them. The most recent question and answer document released on the CWIP State Fiscal Year 2023 Funding Policy notes, "road projects should work to meet the MRGP standard, and this requirement sets a high bar which presumably narrows eligible projects to larger private road/driveway networks." This is a barrier to successful implementation of private roads projects

and has been realized through this project and will need to be addressed so that future work can continue on private roads in the Lake Carmi watershed.

Also, work on private roads won't happen without some incentive or change—especially when there is no road association. There also needs to be an increased understanding among landowners and road associations that work completed on a gravel road is not a one-time occurrence. As mentioned previously, regrading and ensuring the crown remains can involve work multiple times a year. This understanding can be outlined in more specific maintenance agreements that have specific details of the amount and type of work that needs to be done and a typical timeline or schedule.

The most obvious potential solution to this problem statewide is for DEC to expand eligibility under its CWIP funding policy. If the State of Vermont cannot be proactive and create incentives for this important work, it may be left with few non-regulatory options to meet its goals to improve water quality, whether in Lake Carmi or, more broadly, as a result of its Lake Champlain TMDL obligations.

Possible Future Work

Potential future work relating to the Lake Carmi private roads and park roads assessment conducted by NRPC can be assigned to two categories. The first would involve using the REI data for high priority segments on private roads and reevaluating certain criteria used to help identify areas that are most suitable for BMPs. This will build upon the accomplishments of this project and take into consideration many of the lessons learned so that future work can be more successful, cost-effective, and supported by landowners. Work with private landowners stands in contrast to work on public roads where the landowner is the municipality and is subject to MRGP i.e., regulatory requirements. In the private road setting, increased weighting for landowner support should help identify truly viable projects earlier than otherwise would occur. This will help to reach the goals of reducing phosphorus and sedimentation into Lake Carmi to help achieve the TMDL targets and reduce the number of cyanobacteria blooms due to high nutrient concentrations.

The second category of possible future work rests on questions concerning the appropriateness of using the MRGP standards in the private road setting, as noted above. The work would test approaches that are simpler than REI (for the identification of needs) and MRGP (for the calculation of the benefits of road improvement). At least one option would be to leverage the fact that very high priority segments tend to coincide with steep slopes, erodible soils, and proximity to water features. By applying detailed topographic data along with data for erodible soils and hydrologic connectivity, it may be possible to create a "quick response" methodology that identifies many of the same priority road segments but with less effort.

9. REFERENCES

- Vermont Better Roads Manual
- "VT DEC and Agency of Digital Services methodology

10. APPENDICES

Appended Documents:

Appendix A- Outreach Materials List

Appendix B- Work Plan

Appendix C- QAPP

Appendix D- REI Data

Appendix E- Cost Estimates

Appendix E- Press Releases

Appendix G- Newsletters

Appendix H- Workshop Materials

Appendix I- Summary of REI

Appendix J- RFP for Contractors

Appendix K- MOUs

Appendix L- MRGP REI Supplement

Photos:

Photos supplied with this report may be credited to NRPC and may be used by NEIWPCC, LCBP, and/or EPA in their discretion in any future publications.

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Electronic Data:

Electronic datasets generated through this project may be reached by the Project Officer and others using links included in the document text above.