Great East Lake Watershed-Based Protection Plan

2022-2032

Acton Wakefield Watersheds Alliance

Great East Lake Improvement Association

March 2022

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1. Background Information

a) Purpose & Scope

The purpose of the Great East Lake Watershed Based Plan, herein after referred to as the "plan", is to lay out a strategy and schedule for NPS mitigation and water quality protection efforts for the Great East Lake watershed over the next ten years (2022 to 2032). Acton Wakefield Watersheds Alliance prepared the plan with assistance and input from Maine Department of Environmental Protection (ME DEP), Great East Lake Improvement Association, and United States Environmental Protection Agency (EPA).

The plan was developed to satisfy national watershed planning guidelines provided by the EPA. EPA requires nine-element plans for impaired watersheds, but allows alternative plans in several cases including for protection of high quality or unimpaired waters. ME DEP accepts alternative plans for unimpaired lakes that have completed a recent watershed survey provided that the plans follow EPA and ME DEP guidance and include minimum planning elements. Great East Lake meets these eligibility criteria, and the plan was written to include the EPA and ME DEP required planning elements.

Note: Information collected during the 2021 Great East Lake watershed survey forms the basis for much of the plan. As such, the Great East Lake Watershed Survey Report is attached to the plan in Appendix A.

b) Watershed Background

The area of Great East Lake is 1,707 acres (2.67 square miles) while the area of the entire watershed is approximately 9,990 acres (15.53 square miles). The maximum water depth is 102 feet, with an average depth of 35 feet. The lake is located in the towns of Wakefield, NH (71%) and Acton, ME (29%) (Figure 1). The shoreline of Great East Lake is highly developed and almost entirely residential with only about 7% of the shoreline undeveloped. There are 671 parcels located on the Maine side of the watershed and 1,093 parcels in New Hampshire. The major outlet is at the southeast end of the lake. This outlet is dam controlled and the outflow travels through a canal and enters Horn Pond. A public boat launch is located immediately adjacent to the dam. Great East Lake is part of a larger watershed along with Lovell Lake, Horn Pond, Lake Ivanhoe, and Wilson Lake as the headwaters of the Salmon Falls River, which serves as the border between New Hampshire and Maine. The Salmon Falls River converges with the Cocheco River to become the Piscataqua River and eventually empties into the Gulf of Maine.

The convenient location draws weekend visitors and makes it a popular site for powerboat activities such as water skiing, wakeboarding, and tubing. Likewise, the lake is ideal for sailing, canoeing, and kayaking. Fishing is also popular here due to an abundance of fish species including bass, trout, brown bullhead, landlocked alewife, banded killifish, pickerel, smelt, and perch. In addition to the numerous fish species, bald eagles and other large birds of prey utilize the lake

habitat for hunting, nesting, and breeding. Loons are a frequent sight and have become a symbol of the region. The upper watershed is primarily (~85%) forested with wetland areas. Other land uses include residential, quarry/gravel mining, beaches, and active agricultural land. Agriculture on the watershed consists of ~30 acres of cropland and ~540 acres of hay/pasture.

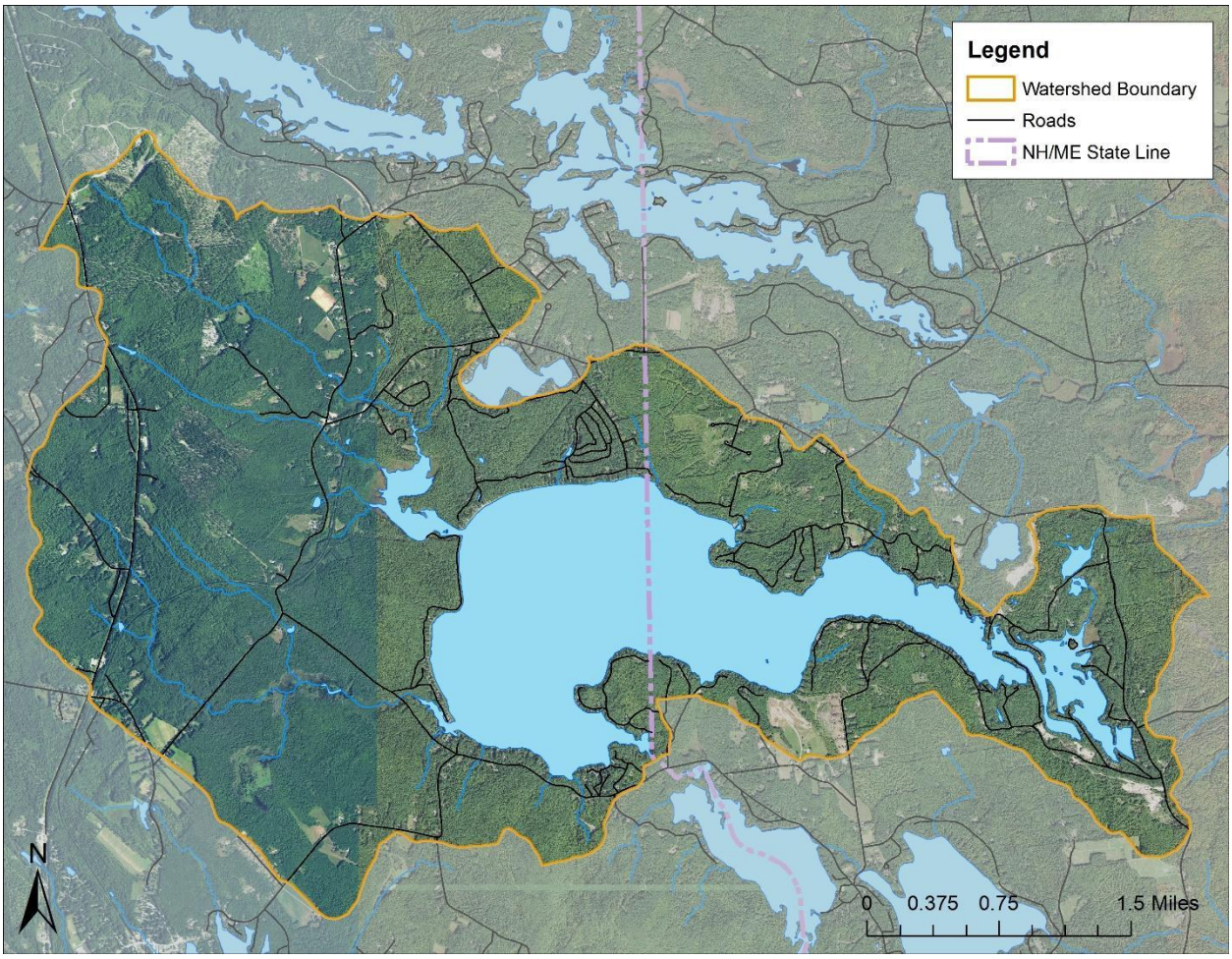

Figure 1. Great East Lake Watershed

c) Summary of Prior Watershed Work

GELIA was established in 1932 and has been conducting water quality monitoring with the University of New Hampshire Lay Lakes Monitoring Program (UNH LLMP) for over 30 years. They also operate a courtesy boat inspection program on the Maine side of the lake, and the equivalent LakeHost Program on the New Hampshire side to prevent the colonization of aquatic invasive species. In 2009 and 2010, GELIA collaborated with ME DEP, NHDES, and AWWA to conduct a watershed survey and develop a 9 element watershed-based management plan with funding from EPA under CWA s.319 (the subaward projects were administered by the NHDES NPS Program). The plan (FB Environmental, 2010), known as the Salmon Falls Headwater Lakes Watershed Management Plan, encompassed five headwater lakes of the Salmon Falls River. In the 10 years that followed, GELIA received multiple USEPA section 319 grants administered by NHDES and ME DEP to address identified NPS, including 3 phases of grants in Maine between 2012 and 2018. A new watershed survey was completed in 2021 and forms the basis for this plan (see survey report in Appendix A).

A total of 10 road improvement projects on private camp roads surrounding GEL were completed as part of past Maine-administered Section 319 grant projects. BMPs such as road grading and crowning, culvert and ditch enhancements, level spreaders, plunge pools, sediment basins, and paving were installed. In total, the three phases of projects reduced pollutant loading to the lake by 108 tons of sediment and 92 pounds of phosphorus per year. A septic survey was also completed as part of the Phase II grant, which surveyed Great East Lake residents and found that approximately 27% of the 154 respondents had septic systems that were more than 25 years old, and about 23% had systems within 75 feet of the lake.

Additionally, AWWA's Youth Conservation Corps has completed stormwater landscaping projects for 78 properties on the lake since 2006 (39 of which were on the Maine side) resulting in 400 individual BMPs being installed to address stormwater. Approximately 25% of these projects were funded by Section 319 grants. Following the 2009 watershed survey, all homeowners with identified erosion were notified via mail and provided with recommendations for remediating erosion on their property.

2. Identification of Causes or Sources of the NPS Threat

a) Water Quality Summary

Volunteers have been testing the water quality of Great East Lake since 1974. The Maine DEP, Lake Stewards of Maine (formerly Maine Volunteer Lake Monitoring Program (VLMP)), the UNH LLMP, and NHDES have collaborated with GELIA in order to evaluate water quality, track algae blooms, and determine water quality trends. This includes 40 years of Secchi disk transparencies, 34 years of total phosphorus (TP) data, 31 years of chlorophyll-a, (Chl-a) data, 31 years of color data, and 18 years of dissolved oxygen (DO) profiles.

Great East Lake is on the cusp of an "outstanding" and "good" classification in Maine and qualifies as a high-quality waterbody in New Hampshire. Outstanding lakes exhibit average Secchi disk transparency (SDT) greater than 9.1 meters (30 feet), Chl-a levels of <2 ppb, and TP concentrations of 2 to 5 ppb. Great East Lake has an average SDT of 35 feet (10.6 meters), average TP of 4.2 ppb, and average Chl-a of 1.3 ppb. A detailed analysis has shown that TP has been slowly decreasing over the last 30 years.

Great East Lake is classified as an oligotrophic lake. It has historically exhibited minimal dissolved oxygen depletion in the deepest parts of the lake, which is good news, both for cold-water fish and also for limiting internal phosphorus loading. The lake has a low flushing rate of 0.3 times per year, meaning that it takes 3.3 years on average for water to pass through the lake. GELIA has been effective in recruiting volunteers to monitor the health and vitality of the lake. In addition to water quality monitors, weed watchers and lake hosts have been actively engaged to prevent an infestation of aquatic invasive plants.

b) Threatened Status

Great East Lake currently meets Maine state water quality standards. However, it is listed as threatened on Maine DEP's Nonpoint Source Priority Watersheds List due to its outstanding water quality and threats from development. Despite this, it is not listed in Maine Stormwater Law Chapter 502 as a "Lake Most at Risk from New Development" but it is susceptible to significant erosion coming from existing development.

c) Watershed NPS Threats

The largest threat to Great East Lake is polluted runoff or nonpoint source (NPS) pollution. In such a developed watershed, stormwater does not have the opportunity to infiltrate and does not receive the filtration provided by the forest floor. Stormwater picks up speed as it flows across impervious surfaces like rooftops, compacted soil, gravel camp roads, and pavement, and becomes a formidable, erosive force, carrying sediment and nutrients such as phosphorus with it into the lake. High levels of phosphorus can cause dense algae blooms, which can also create a biological and chemical reaction that depletes the oxygen from the bottom of the lake and results in the loss of cold-water fisheries.

Although much of Great East Lake's watershed is still forested, most of the shoreline is developed with seasonal and year-round residences as well as an extensive network of town and camp roads. Residences and roads convey most of the runoff to the lake. Camp roads in particular are subject to frequent wash-outs during periods of heavy precipitation and spring thaws. Wash-outs can transport significant quantities of sediment into the lake increasing the nutrient levels and reducing clarity. Additionally, a number of the camps that surround the lake are many decades old and some may have ineffective septic systems. Leaching of these systems can release excess nutrients and potentially dangerous bacteria into the lake.

GELIA self-funded a watershed survey in 2021, recruiting the assistance of ME DEP, NHDES and AWWA. The GEL community provided ~30 volunteers and identified 221 erosion sites: 147 in

Maine, 73 in New Hampshire. Of these 221 sites, 101 were low impact/ low priority erosion issues, 97 were medium impact, and 23 were deemed a high impact/high priority (Figure 2, Tables 1, 2 and 3). The most common land use associated with NPS sites was residential use (141), followed by private roads (37) and driveways (17). This report is included in its entirety in Appendix A of this plan and includes documentation for each identified site, including recommendations, maps, and estimated phosphorus load reductions. The following graph summarizes the findings of the survey:

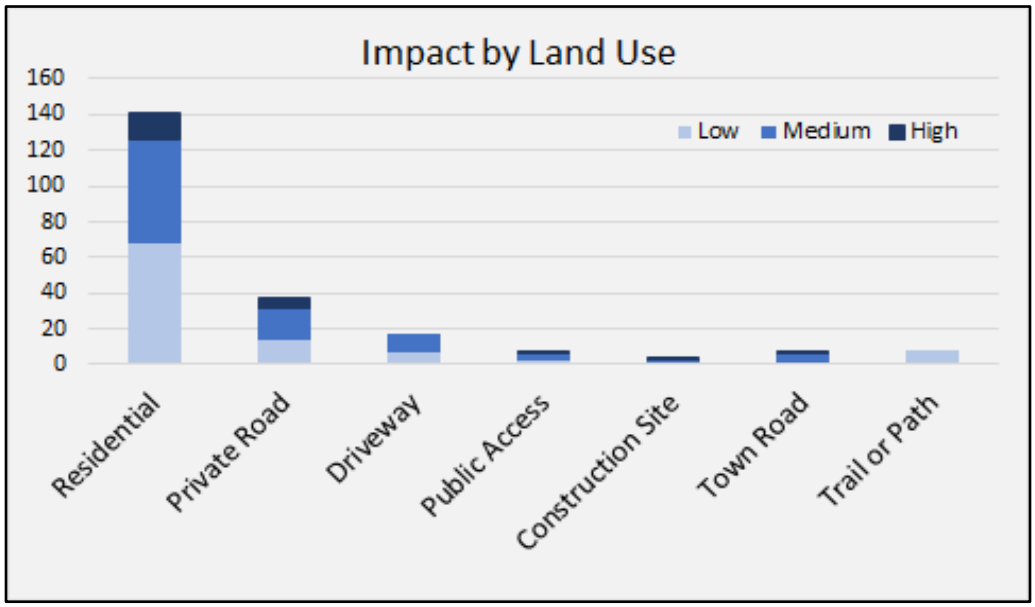

Figure 2. Erosion sites on Great East Lake: Identified by Land-use type and further broken down by water quality impact level.

NH & Maine

Land Use	Low	Medium	High	Total (#)	Total (%)
Residential	68	58	15	141	64%
Private Road	14	18	5	37	17%
Driveway	7	10	0	17	8%
Public Access	2	4	1	7	3%
Construction Site	1	2	1	4	2%
Town Road	1	4	1	7	2.5%
State Road	0	1	0	1	0.5%
Trail or Path	8	0	0	8	3%
Total	101	97	23	221	100%

Maine Sites Only

Land Use	Low	Medium	High	Total (#)	Total (%)
Residential	52	32	5	89	55%
Private Road	14	18	4	36	22%
Driveway	7	9	0	16	10%
Public Access	2	4	1	7	4%

Table 1. Land-use type broken down by water quality threat.

Construction Site	1	2	1	4	2%
Town Road	1	1	1	3	2%
Trail or Path	8	0	0	8	5%
Total	85	66	12	163	100%

Table 2. Land-use type broken down by water quality threat on Maine sites.

New Hampshire Sites Only

Land Use	Low	Medium	High	Total (#)	Total (%)
Residential	16	26	10	52	90%
Private Road	0	0	1	1	2%
Driveway	0	1	0	1	2%
State Road	0	1	0	1	2%
Construction Site	0	0	0	0	0%
Town Road	0	3	0	3	5%
Trail or Path	0	0	0	0	0%
Total	16	31	11	58	100%

Table 3. Land-use type broken down by water quality threat on NH sites.

3. Watershed Plan Goals and Objectives

The goal of this plan and of the GEL community is to maintain or improve the Class GPA water quality standards in Great East Lake. This will be accomplished by reducing the amount of phosphorus and sediment that enters the lake annually over the course of the next 10 years (2022 - 2032) using the following management objectives:

1. **Reduce existing sources of phosphorus** loading by fixing all erosion sites identified in the watershed survey. This will be achieved by providing targeted outreach, technical assistance, and cost-sharing assistance to install conservation practices at NPS sites identified in the watershed survey. It is expected that sites will be addressed through a combination of YCC, grant cost sharing, and independent landowner initiative.
2. **Prevent new sources of Phosphorus** by facilitating improved land use practices and ongoing maintenance activities. This objective will be met by conducting outreach and providing technical assistance to residents, road associations, youth camps and municipal officials.
3. **Strengthen and maintain local capacity for watershed stewardship** by providing outreach, holding workshops, building GELIA and AWWA membership, and raising funds for mitigation work.
4. **Conduct ongoing assessment of lake and watershed condition** by monitoring lake water quality and setting up and maintaining the NPS Site Tracker.

4. Schedule and Milestones to Guide Project Implementation

a) Action Plan and Schedule

Specific action items necessary to complete the goals outlined in this plan are identified in this section. These items include approximate timeframes and milestones that would be associated with the successful completion of identified actions. These action items were determined based on recommendations from the GEL Watershed Survey and based on past projects in the watershed that have been successful in reducing NPS pollution and raising community awareness. The plan is designed to be implemented over a ten year period, and an estimated schedule is provided for each action (Table 1). Potential funding sources and key partners were also identified for each action (Table 2). The plan will be carried out, in large part, with local funding and resources. However, state and federal funding will also be sought to help implement some actions in the plan.

Table 1 - Implementation Schedule

2022-2023	● Mail notifications to all landowners in the watershed with the status of erosion on their property and suggested recommendations. ● Apply for EPA Clean Water Act section 319 Grants in ME to address major identified erosion issues ● Promote AWWA's YCC program to homeowners with erosion and encourage DIY BMP installation where possible. ● Set up NPS Site Tracker.
2023-2026	● Implement CWA s. 319 project (pending approval of the grant) ● Monitor and document projects. Track Pollutant Load reductions ● Continue to implement YCC projects
2022 - 2032	● Distribute outreach regarding BMPs and lake-friendly living ● Engage with Road Associations to offer Road BMP recommendations ● Apply for additional USEPA Section 319 grants in ME to address major NPS pollution in three phases. ● Assist Road Associations in Acton with applying for Article 43 assistance (town funds for private road projects) ● Continue use of NPS Site Tracker.

Table 2 - Action Items & Milestones

Action Items	Schedule	Responsible Party	Cost	Potential Funding Sources
Reduce existing sources of P loading by addressing NPS pollution				
Notify landowners with identified erosion - 221 sites	2022	GELIA	$500	GELIA
Residential BMPs (Homeowners) - 91 Sites (27 NH/ 64 ME)	2022-32	Landowners	$82K	Private
Residential BMPs (YCC/landscape design) - 50 Sites (25 NH/25 ME)	2022-32	Landowners, AWWA	$150K	Private, AWWA, EPA 319
BMP Trail/Path Restoration projects to reduce erosion from lake side foot traffic - 8 Sites (0 NH/8 Maine)	2022-32	Landowners, AWWA	$8K	AWWA, Landowners
Private Road BMPs - 37 sites (1 NH/ 36 ME)	2023-32	Road Association, GELIA, AWWA	$140K	Road Association, EPA 319
Address issues identified on State/Town Roads and public access points identified by the survey - 14 sites (3 NH/11 ME)	2023-32	Town of Acton	$280K	Town of Acton
Assist Road Associations with applying for Article 43 funding in Maine - 30 sites (All in Maine)	2022-32	AWWA, Road Association, Town of Acton, MEDEP	$200K	Town of Acton, Road Associations
Driveway BMPs - 17 sites (1 NH/16 ME)	2023 -32	Homeowners, AWWA	$8,500K	Homeowners, EPA 319
Prevent new sources of phosphorus				
Provide site visits for BMP recommendations and develop sites specific BMP designs - 100 site visits	2022-32	AWWA	$25K	AWWA, EPA 319
Septic System Maintenance Outreach with pumping and maintenance schedules in digital and print newsletters. Advertise Maine Small Community Grant Program for cost-share opportunities.	Annual 2023-32	AWWA, GELIA	$1.5K	GELIA
Distribute BMPs and NPS pollution outreach via annual meetings, newsletters, and website links.	Annual 2022-32	AWWA, GELIA	$1.5K	AWWA, GELIA
Continue to promote the YCC program as a tool for	Annual	AWWA, GELIA	$5k	AWWA, GELIA

homeowners to prevent erosion on lake properties.	2022-32			
Strengthen and maintain local capacity				
Apply for section 319 watershed grants.	‘22, ‘25, ‘28	AWWA, GELIA	$6K	AWWA
Bolster GELIA membership by keeping the community apprised of implementation projects.	2022-32	GELIA	$10K	GELIA
Support local watershed groups with consistent outreach, education opportunities, and technical assistance.	2022-32	AWWA, GELIA	$60K	AWWA
Encourage volunteerism for continued water quality monitoring & weed watcher program	2022-32	GELIA, AWWA	$10K	GELIA
GELIA to continue holding annual meetings. AWWA will speak at meetings to provide updates to grants and water quality issues.	2022-32	GELIA	$10K	GELIA
Review existing shoreland protection laws and provide resources for more robust enforcement.	2023	Town of Acton	N/A	Town of Acton
Conduct ongoing assessment of lake and watershed condition				
Continue Water Quality monitoring with UNH	Ongoing	GELIA	$3K/yr	GELIA
Conduct one & five-year BMP installation 2023-32 assessments to determine long-term effectiveness	Ongoing	AWWA	$1K/yr	AWWA
Contact Road associations to encourage annual BMP maintenance conduct assessments.	Ongoing	GELIA, AWWA	$300	GELIA
Continue CBI inspection program and NH LAKES Lake Host program to control invasive species.	Ongoing	GELIA	$200K	GELIA. Town of Acton
Create and Maintain NPS site tracker	Ongoing	AWWA	$10K	AWWA

b) Plan Oversight and Partner Roles

The Acton Wakefield Watershed Alliance (AWWA) will be the primary owner of this plan. AWWA is a nonprofit organization that assists 9+ lakes in Wakefield, NH and Acton Maine with watershed management efforts. AWWA has a robust and long-running technical assistance and Youth Conservation Corps program to assist homeowners with installing BMPs has managed several USEPA Section 319 grants in Maine and New Hampshire and played a critical role in the completion of the recent watershed survey. As such the organization is well equipped with the capacity to oversee the implementation of this plan. In this effort, AWWA will work very closely with the following organizations and stakeholders:

- **Great East Lake Improvement Association (GELIA)** will provide in-kind and/or cash match to any CWA s. 319 subawards and outreach to encourage BMP implementation and education. They will also support AWWA and promote the YCC and technical assistance programs to the GEL community.
- **The Town of Acton** will continue to approve Article 43 funding requests and provide funding to AWWA and GELIA's watershed programs. They will also address town road sites identified in the watershed survey with guidance from AWWA and survey recommendations.
- **Maine Department of Environmental Protection (ME DEP)** will conduct water quality monitoring and technical assistance and provide the opportunity for financial assistance through the NPS Grants Program.
- Watershed **Road Associations** will offer support and match (in-kind and/or cash) for USEPA Section 319 grant projects that involve BMP construction on private roads.
- **EPA** will provide guidance on grant programs, particularly Clean Water Act section 319, workplan guidance, and selected project funding, pending acceptability of grant proposals, final workplans and availability of federal funds.

c) Plan Outputs and Milestones

Organizational Outputs

- Acton Wakefield Watersheds Alliance applies for USEPA 319 grant for Phase I project
- NPS Tracker created and program coordinator at AWWA trained in use
- Contact made with all property owners and road associations with identified erosion.

NPS Mitigation Outcomes

- 91 NPS sites fixed by voluntary landowner initiative
- 50 YCC projects completed on NPS sites
- 80 NPS sites addressed independently or with cost-sharing assistance
- 100 technical assistance visits
- Estimated pollutant load reductions achieved by installed BMPs

Water Quality Outcomes

- Meets lake GPA standards in ME DEP's biennial 303d reports
- Stable or improved trend for in-lake Total Phosphorus and chlorophyll-a

5. Proposed Management Measures

The GEL Watershed Survey Report (Appendix A) lists specific management measures recommended for each of the NPS erosion sites identified during the survey. The most common management measures recommended in the survey are described in the following section. Recommendations follow guidelines found in ME DEP publications including the Gravel Road Maintenance Manual, Conservation Practices for Homeowners fact sheet series, and Erosion and Sediment Control Manual. The recommended BMPs accomplish this plan's goal of reducing phosphorus and sediment loading to the lake by stabilizing bare soil and erosion and diverting, infiltrating, or filtering polluted runoff before it reaches the lake.

In addition to structural BMPs recommended for each problem, public education and outreach efforts will also be needed to promote responsible stewardship and ongoing maintenance activities. The NPS Site Tracker will be created and used by AWWA with support from ME DEP on an ongoing basis to identify new problems and to prompt maintenance on sites fixed through the plan.

a) Residential Shoreline Erosion

The watershed survey identified 141 residential erosion sites, 15 of which were deemed high impact, 58 medium impact, and 68 were low impact. Common problems included sheet erosion on bare soil, gully erosion on steep walking paths, Steep driveways with gully erosion. Based on the survey results, the most common BMPs will include:

- Infiltration Trenches
- Infiltration Pathways
- Erosion Control Mulch
- Native Vegetation/Vegetated Buffers

Of the 141 residential sites, 75 were estimated to be low-cost (<$1K), and 50 were estimated to have medium-cost ($1-3K) remediations. Given this, we expect that over half of these erosion sites will be remediated by homeowners themselves, or with minimal help from a professional landscaper. The majority of the other half will either need to hire a professional landscaper or a low-cost alternative such as AWWA's Youth Conservation Corps to install the recommended BMPs. Grants will likely be sought to address the more expensive remediations.

In addition to these structural BMPs, GEL residents will also have access to free Technical Assistance from AWWA to develop site-specific BMP implementation plans. AWWA creates these plans with grant funding and individual funding from local lake communities. GELIA also provides outreach via a printed newsletter with references to BMP manuals and proper septic system maintenance and fertilizer application, other key sources of NPS pollution.

b) Driveways

There were 17 documented erosion sites in driveways. All were either low or medium impact to the lake, and only one of them was considered to be cost-prohibitive to the homeowner. As such, we expect that the vast majority of these sites can be handled by homeowners or a Youth Conservation Corps crew. The most common BMPs for addressing driveway erosion are:

- Rubber Razors
- Drywells
- Infiltration Trenches
- Firehose Diverters (paved driveways)
- Drywells

Driveways on residential properties also fall into the category of sites that can receive technical assistance designs from AWWA.

c) Private & Public Roads

37 private road sites were also identified in the survey in addition to seven town road sites, seven sites on public access ways, and one site on a state road. Impact ratings tend to be disproportionately higher for these sites compared to other sites in the watershed. Since remediations are similar for these, they are discussed as one category in this section. In these combined categories, seven sites were high impact, 27 were medium impact, and 17 were low impact. Common problems included lack of grading, lack of proper ditching on the roadway edge, and undersized culverts. The most common BMPs recommended in the survey included:

- Crowning and grading the road surface
- Removing berms that trap runoff on the road surface
- Installing rubber razors or open-top culverts to divert water off the road
- Clean, enlarge, stabilize, or create roadside ditches with vegetation and check dams
- Armoring culvert inlets and outlets
- Enhancing shoreline buffers for roads close to the water/parallel with the shore

There were only two private road sites and one town road site that were rated as high impact *and* high cost. Grant funding, and matching funds from either the road association or the town, will be sought to address these three sites. On town-owned roads, speaking with the road commissioner will be the first step in addressing the problem. The town's willingness and capacity to address the issue will dictate how the project gets funded and addressed. The private road sites will require cooperation from the road association and grant funding will likely be sought to address problems not caused by lack of regular maintenance. Less expensive or serious road sites can be addressed by local road associations.

Road maintenance (e.g., grading, removing accumulated sediment from sediment basins, and turnouts) will be critical to the long-term performance of these BMPs and the prevention of new NPS problems. As a result, the plan calls for periodic inspections of implemented BMPs by

AWWA and by the road associations that install them. Follow-up contact will be made by AWWA or GELIA to ensure maintenance schedules are being followed.

6. Pollutant Load Reductions

Estimated pollutant load reductions (PLR) were calculated for all NPS sites identified in the watershed survey. These estimates showed a total phosphorous reduction of 665 lbs/yr and a sediment load reduction of 782 tons/yr if all sites are remediated. PLRs will be calculated for every project reported in the watershed and summed up to be reported to ME DEP. Tracking NPS sites in this way demonstrates the value of BMPs to reduce the amount of sediment and phosphorus entering the lake.

AWWA will document all stormwater best management projects that are completed on the lake, either resulting from a CWA section 319-funded project or a YCC project and calculate phosphorus and sediment pollutant load reductions. This is done using the EPA Region 5 Model developed for bank and gully erosion. Homeowners might complete projects without informing AWWA or GELIA, but if they do report their projects, AWWA will document these load reductions as well.

7. Water Quality Monitoring

Maine water quality criteria require that lakes and ponds have a stable or improving trophic state and be free of culturally-induced algal blooms. GELIA conducts water quality monitoring and sampling bi-weekly from May through October every year. Volunteers will continue to take samples and conduct monitoring and sampling efforts to measure water clarity, Total Phosphorus, chlorophyll-a, dissolved oxygen, color, conductivity, pH, and alkalinity. GELIA sends all water samples and monitoring data to the UNH LLMP to be analyzed and compiled into an annual report.

ME DEP conducts Secchi disk trend analysis every two years as part of their Integrated Water Quality Monitoring and Assessment report. Trend reporting (positive, negative, or stable) will assist in determining whether the plan meets its goal of having stable or improving water quality over time.

Appendix A.

See Attached Great East Lake Watershed Survey Report.

Great East Lake Watershed Survey Report

2021

Acton Wakefield Watersheds Alliance

Great East Lake Improvement Association

Maine Department of Environmental Protection

Acknowledgments

The following people and organizations were instrumental in the Great East Lake Watershed Survey Project and deserve special recognition for their efforts:

Watershed Survey Volunteers

Adam Fennelly	Effie Jaramillo	Donna Towne
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Jay Ward	Steve Towne	Dorothy Crespi

Supporting Organizations

Acton Wakefield Watersheds Alliance (AWWA)

Great East Lake Improvement Association (GELIA)

Maine Department of Environmental Protection (ME DEP)

New Hampshire Department of Environmental Services (NHDES)

Wilson Lake Association (WLA)

NH LAKES

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Introduction

This report serves to compile, summarize, and analyze the data collected during the Great East Lake watershed survey conducted in the spring of 2021 and is intended for residents, landowners, and town officials within the Great East Lake watershed.

Watershed surveys provide a snapshot of the condition of the watershed at the time the survey is conducted and document all evidence of sediment erosion. The information gathered during the Great East Lake survey will be used by the Great East Lake Improvement Association (GELIA), the Acton Wakefield Watersheds Alliance (AWWA), the Town of Acton, and the Town of Wakefield to guide future efforts to preserve the lake's pristine quality for future generations to enjoy.

Great East Lake Watershed

The area of Great East Lake is 1,707 acres (2.67 square miles) while the area of the entire watershed is approximately 9,990 acres (15.53 square miles). The maximum water depth is 102 feet, with an average depth of 35 feet. The lake is located in the towns of Wakefield, NH and Acton, ME. The shoreline of Great East Lake is highly developed with only about 7% of the shoreline undeveloped. All precipitation that falls in the watershed drains directly into the lake through a network of streams, ditches, and overland flow.

The major outlet is at the southeast end of the lake. This outlet is dam controlled and the outflow travels through a canal and enters Horn Pond. A public boat launch is located immediately adjacent to the dam. Great East Lake is part of a larger watershed along with Lovell Lake, Horn Pond, Lake Ivanhoe, and Wilson Lake as the headwaters of the Salmon Falls River, which serves as the border between New Hampshire and Maine. The Salmon Falls River converges with the Cocheco River to become the Piscataqua River and eventually empties into the Gulf of Maine.

What is a Watershed?

A watershed is defined as all of the land that drains or "sheds" into a given water body. A large watershed is made up of many smaller watersheds. For example, the watershed of Great East Lake is part of the watershed of the Salmon Falls River and the watershed of the Salmon Falls River is part of the watershed of the Gulf of Maine.

Activity in any part of the watershed can affect the quality of the water body as a result of the flow from rivers, streams, surface runoff, and groundwater, roads, ditches, pathways, and beaches. This is why protection of Great East Lake must be addressed on a watershed level rather than simply focusing on shoreline activity.

Water Quality

Volunteers have been testing the water quality of Great East Lake since 1974. The Maine DEP, Lake Stewards of Maine (formerly Maine Volunteer Lake Monitoring Program (VLMP)), the UNH Lay Lakes Monitoring Program (LLMP), and NHDES have collaborated with GELIA in order to evaluate water quality, track algae blooms, and determine water quality trends. This includes 40 years of Secchi disk transparencies, 34 years of total phosphorus (TP) data, 31 years of chlorophyll-a, (Chl-a) data, 31 years of color data, and 18 years of dissolved oxygen (DO) profiles.

> ***Phosphorus*** **-**
> *A nutrient needed for plant growth. It is generally present in small amounts, and limits plant growth in lakes. As the amount of phosphorus increases in the lake, this allows algae and bacteria populations to expand.*

Great East Lake is on the cusp of an "outstanding" and "good" classification in Maine and qualifies as a high-quality waterbody in New Hampshire. Outstanding lakes exhibit average Secchi disk transparency (SDT) greater than 9.1 meters (30 feet), Chl-a levels of <2 ppb, and TP concentrations of 2 to 5 ppb. These lakes are rare and unique resources, which are particularly sensitive to small increases in phosphorus concentrations. Great East Lake has an average SDT of 35 feet (10.6 meters), average TP of 4.2 ppb, and average Chl-a of 1.3 ppb. A detailed analysis has shown that TP has been slowly decreasing over the last 30 years.

Great East Lake is classified as an oligotrophic lake. Oligotrophic lakes are nutrient-poor. They tend to have rocky substrates and shorelines, deeper water, limited algae and aquatic plant growth, and an abundance of dissolved oxygen. Great East Lake has historically exhibited minimal dissolved oxygen depletion in the deepest parts of the lake, which is good news, both for cold-water fish and also for limiting internal phosphorus loading, which is important for the prevention of algae blooms. Internal loading occurs in lakes with low DO; phosphorus is released from the lakebed sediments and enters the water column, where it becomes available to algae, promoting algae growth and the potential for algae blooms.

GELIA has been effective in recruiting volunteers to monitor the health and vitality of the lake. A dedicated water quality monitoring group has participated with the UNH Lakes Lay Monitoring program and Lake Stewards of Maine since 1974. Weed Watchers and Lake Hosts have been actively engaged to prevent an infestation of aquatic invasive plants which can enter the lake and disrupt the fragile aquatic ecosystem.

GELIA and the Towns of Acton and Wakefield have also supported the efforts of AWWA and its Youth Conservation Corps (YCC). AWWA provides technical assistance to landowners with erosion issues and advises the use of best management practices (BMPs) to address stormwater runoff. Landowners participating in the program supply the necessary landscaping materials and the YCC's labor is provided free of charge.

Threats to Great East Lake

The largest threat to Maine and New Hampshire lakes, including Great East Lake, is polluted runoff or nonpoint source (NPS) pollution. Stormwater runoff from rain and snowmelt picks up soil, nutrients, and other pollutants as it flows across the land, and flushes into the lake.

In an undeveloped, forested watershed, stormwater runoff moves more slowly due to uneven terrain, tree and shrub roots, ground cover plants, leaves, and other natural debris on the forest floor. These features give runoff time to infiltrate into the ground, soaking into the uneven forest floor and filtering through the soil. The soil and mineral substrate below ground is the most effective form of filtration for stormwater runoff.

In a developed watershed, stormwater does not have the opportunity to infiltrate and does not receive the filtration provided by the forest floor. Rainwater picks up speed as it flows across impervious surfaces like rooftops, compacted soil, gravel camp roads and pavement, and becomes a formidable, erosive force.

Although much of Great East Lake's watershed is still forested, most of the shoreline is developed with seasonal and year-round residences as well as an extensive network of town and camp roads. While these residences and roads convey most of the runoff to the lake, public access points such as beaches and boat launches were found to contribute as well. Camp roads are subject to frequent wash-outs during periods of heavy precipitation and spring thaws. Wash-outs can transport significant quantities of sediment and gravel into the lake increasing the nutrient levels and reducing clarity.

A number of the camps that surround the lake are many decades old and some may have ineffective septic systems. Leaching of these systems can release excess nutrients and potentially dangerous bacteria into the lake.

Why is Storm Water Runoff a Problem?

The problem is not typically the water itself that is running into the lake, but the pollutants that it carries with it. The sediment and nutrients in the runoff can be bad news for freshwater lakes.

The nutrient known as phosphorus is food for algae and other plants and is found in soil, septic waste, pet waste and fertilizers. Algae in the lake react to the addition of phosphorus in the same way that plants in the home and garden react when nutrients like phosphorus, commonly in fertilizers, are fed to the plant—they grow. In natural conditions, the scarcity of phosphorus in a lake limits algae growth. Consequently, when a lake receives extra phosphorus, algae growth increases dramatically. Sometimes this growth causes choking blooms, but more often it results in small changes in water quality that, over time, damage the ecology, aesthetics, and economy of lakes.

Soil/Sediment is the biggest source of phosphorus to Maine and New Hampshire lakes. As every gardener knows, phosphorus and other nutrients are naturally present in the soil. So, runoff is essentially "fertilizing" Great East Lake with the soil that erodes from our driveways, roads, ditches, pathways, and beaches.

Reasons to Reduce Runoff

Great East Lake's pristine conditions make it a valuable asset to the community for multiple reasons; economic, recreational, ecological, and cultural.

- Once a lake has declined, it is difficult or impossible to restore. Prevention is the key.

- Economic studies show that declines in water quality are directly correlated with waterfront property value. A large portion of both Wakefield's and Acton's revenue is derived from waterfront property taxes, which are based upon property value. Therefore, maintaining a clean, clear lake is crucial to the town's financial viability as well as protecting the investments of property owners.

- The lake attracts anglers and boaters from across the region. The convenient location draws weekend visitors who flock to the area to pursue leisurely activities. The large size of the lake makes it a popular site for powerboat activities, especially waterskiing, wakeboarding, and tubing. Likewise, the lake is ideal for sailing, canoeing, and kayaking. Easy access to the lake makes boating the primary use of the lake.

- Fishing is a popular activity thanks to the abundance of fish species including smallmouth bass, landlocked alewife, American eel, banded killifish, brook trout, brown bullhead, brown trout, chain pickerel, lake trout, largemouth bass, rainbow smelt, rainbow trout, white perch, and yellow perch.

- In addition to the numerous fish species, bald eagles and other large birds of prey utilize the lake habitat for hunting, nesting, and breeding. Loons are a frequent sight and have become a symbol of the region. Declining water quality could force these majestic birds to find healthier waterbodies to call home.

- A clean lake with clear water is perceived as being a community asset. Healthy lakes are regarded as being more valuable and desirable. The lake becomes a source of community pride to its users and fosters a sense of stewardship.

- Sediment deposited into the lake from erosion creates the ideal environment for invasive aquatic plants, algae, and cyanobacteria to thrive.




Purpose of the Great East Lake Watershed Survey

The purpose of this survey was to gain an in-depth understanding of the current conditions of the watershed in terms of surface sediment erosion through direct observation.

The watershed survey is used for the following purposes:

- Identify and prioritize existing sources of polluted runoff, particularly soil erosion sites in the Great East Lake watershed.

- To renew the watershed survey that was done in 2009 as part of the Salmon Falls Headwater Lakes Watershed Management Plan.

- To raise public awareness about the connection between land use and water quality and the impact of soil erosion on Great East Lake, and to inspire people to become active watershed stewards.

- Provide the basis to obtain grant funding to assist in fixing identified erosion sites.

- Make general recommendations to landowners for fixing erosion problems on their properties.

- Identify sites for future Youth Conservation Corps/grant projects

- To use the information gathered as one component of a long-term lake protection strategy. Every parcel of property was physically inspected and all sediment erosion that reaches the lake was documented. The resulting lake protection plan thus has a real-world perspective with hard data collected from first-hand observations.

Note: The purpose of the survey is *NOT* to blame landowners with erosion or seek enforcement action against landowners not in compliance with ordinances. This is an education, outreach, and science-based tool intended to help the Great East Lake community work together with landowners and community partners to solve erosion problems on their property through technical assistance, Youth Conservation Corp projects, and grants.

Local citizen participation was essential in completing the watershed survey and will be even more important in years to come. With the leadership of GELIA and AWWA and others concerned with lake water quality, the opportunities for stewardship are limitless.

Survey Method

The survey was conducted by GELIA volunteers with the help of trained technical staff from Maine DEP, New Hampshire DES, NH LAKES, WLA, and AWWA. 24 volunteers were trained in survey techniques during a two-hour virtual training session on April 8th, 2021. On Saturday, April 10th, the volunteers met up at two locations in Wakefield and Acton, organized into groups, and spent the day documenting erosion on the roads, properties, driveways, and shorelines in their assigned sectors using a tailored digital data collection app called Survey123. The volunteers completed the majority of the survey in a single day; smaller groups reconvened on subsequent days and weeks to complete the survey. Each survey group had one technical leader and 2-3 volunteers. The Technical Leader was responsible for entering data into the app and providing quality control for each entry. Volunteers were responsible for navigating their sector, numbering site photos, and interacting with homeowners. The entire group was responsible for seeking and identifying erosion sources.

When erosion was identified on a site, it was categorized in several ways:

- Degree of impact on lake water quality
- Estimated remediation cost
- Technical level required to fix the erosion issue

Impact on Lake Water Quality: Each site was rated for its potential impact on lake water quality. The impact was based on slope, amount of soil loss, proximity to water, and the presence and size of a vegetated buffer.

- "Low" impact sites were those with limited soil transport off-site and little or no visible gullies.

- "Medium" impact sites had some sediment transport off-site with noticeable rills in the ground.

- "High" impact sites exhibited a large amount of sediment transported off-site with significant gullies eroded into the ground.

Estimated Remediation Cost: Recommendations were made for fixing erosion at each site and the associated cost of labor and materials was estimated for the homeowner.

- "Low" cost sites were estimated to cost less than $1,000

- "Medium" cost sites were estimated to cost between $1,000 and $3,000

- "High" cost sites were estimated to cost in excess of $3,000

Technical Requirements: In addition to cost, surveyors also determined what level of technical expertise would be required in order to correct an erosion issue. This often correlates with cost, but not always.

- "Low" tech recommendations can easily be installed by homeowners using hand tools and do not require landscape design knowledge or engineering.

- "Medium" tech recommendations require a site-specific landscape design using specific stormwater best management practices and could be completed by a landscape design company or by AWWA's Youth Conservation Corps Program.

- "High" tech recommendations will require large, complex installations and will likely require an engineered design.

Photos and additional site information were gathered for each site to get a full picture of the erosion. All site information was then submitted through the Survey123 App and downloaded into an excel spreadsheet for analysis. Island sites and additional sites were surveyed by boat.

Technical staff conducted follow-up examinations of some sites in subsequent months to verify data accuracy and estimate soil loss from the sites characterized as having a medium or high impact on Great East Lake. Estimates of soil loss to the lake and the associated phosphorus loading estimates were made using the Region 5 Model. This model is the standard used by most organizations to estimate soil loss, including Maine DEP, NHDES, and the US EPA.

All information collected during the initial survey and subsequent soil loss estimations were entered into an excel database managed by AWWA. This data was standardized, validated, and organized to allow relationships and rankings to be determined. The sites that were identified by volunteers were prioritized for remediation based on rankings of their impact on the lake, required technical expertise, and estimated cost of remediation. The documented erosion sites were then marked on the Great East Lake watershed map.

A description of sites and associated rankings are discussed in the next section of this report. Maps of the erosion sites are located in Appendix A, and a spreadsheet with data from the documented sites is located in Appendix B. Contact GELIA or AWWA for additional site information.

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Note: This Survey was conducted using the Maine DEP Lake Watershed Survey Protocol. View at: https://www.maine.gov/dep/land/watershed/materials/lakewsurveyguide.pdf

Summary of Watershed Survey Findings

Volunteers identified 220 erosion sites that were directly impacting Great East Lake. Of these 220 sites, 101 were low impact/ low priority erosion issues, 97 were medium impact, and 23 were deemed a high impact/high priority. All three of these categories had a range of costs and technical complexity associated with fixing erosion. Figure 1 demonstrates this breakdown.

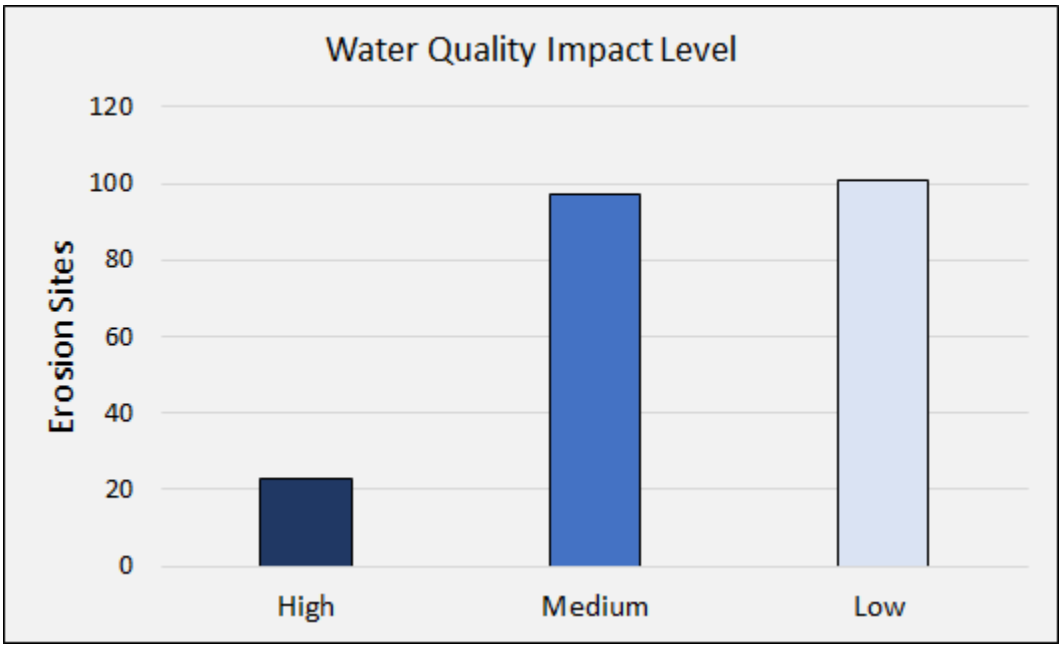


Figure 1. Identified Erosion sites based on estimated water quality impact.

In addition to being categorized by water quality impact, erosion sites were also identified by land use type. The majority of erosion sites were identified on residential properties, followed by driveways and roads, both public and private. Figure 2 depicts the various land-use types and their water quality impact on the lake. This is further outlined in Table 1.

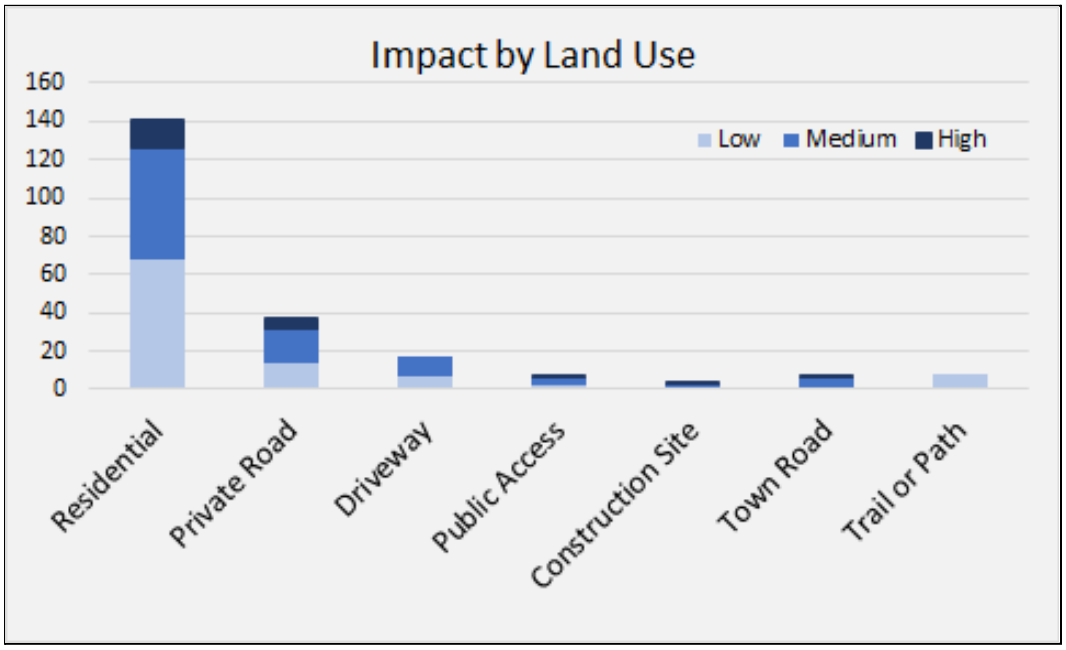


Figure 2. Land Use type at erosion sites, separated by water quality impact.

After assessing water quality impact, volunteers also assessed the estimated cost to fix an erosion site and the technical requirements needed to fix it. These are important considerations when prioritizing erosion control efforts given that inexpensive, simple projects can be completed in greater abundance and less time which could significantly benefit water quality. Figures 3 and 4 compare the water quality impact of a site to both cost and technical requirements. *Notice that the graphs are nearly identical.* There were only a handful of sites where cost estimates and technical level to repair differed.

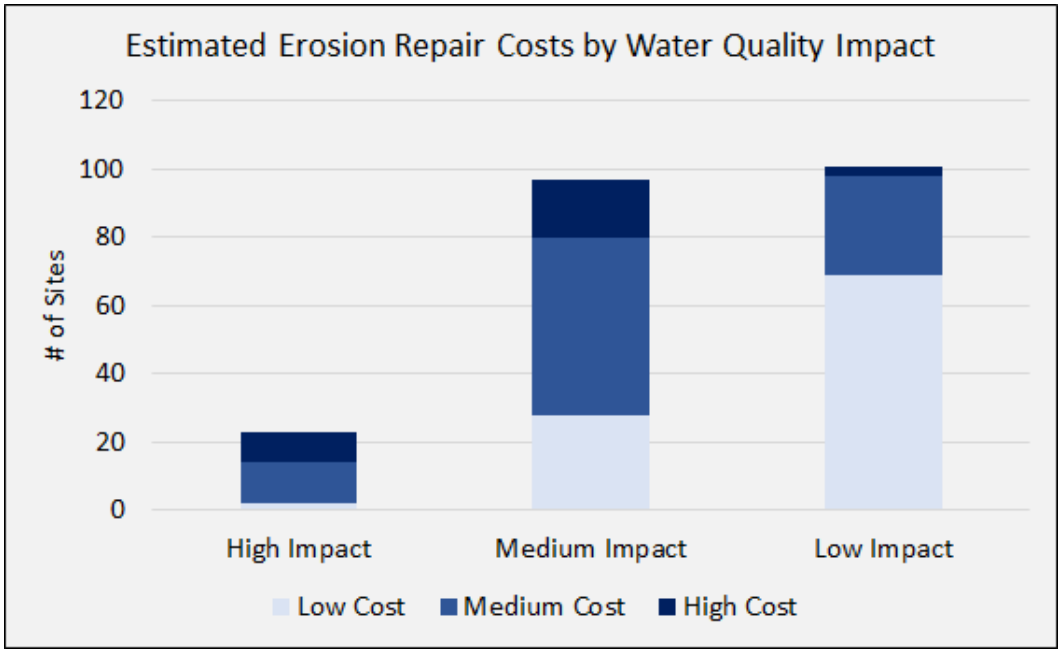


Figure 3. Water quality impact of erosion broken down by repair cost.

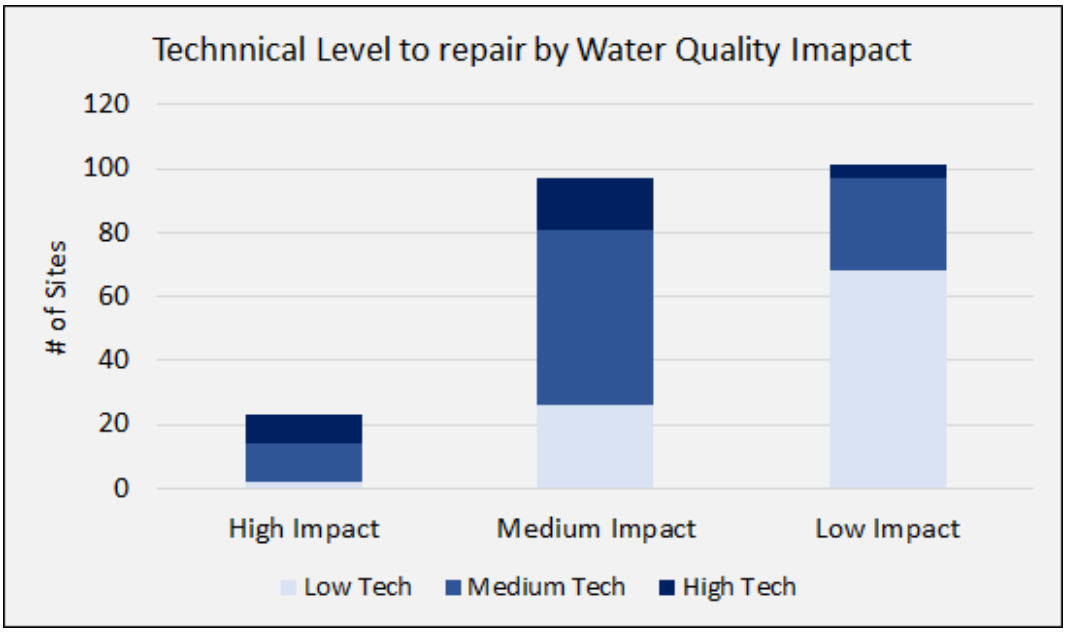


Figure 4. Water quality impact of erosion broken down by complexity of repair.

Discussion

As seen in these figures, the majority of erosion sites that were identified by volunteers do not have a high impact on water quality. It is important to remember that polluted runoff is a nonpoint source pollution problem, meaning that *no single source is having a major impact on water quality*. When added together, however, these small impacts have a significant effect on water quality. These ratings (high, medium, and low), are relative and are primarily used as a way to prioritize which sites should be addressed by the community, but any erosion that can be addressed should be. For example, one high impact site may represent 5% of the overall erosion in the lake and should be addressed right away. A site that represents only 1% of the lake's erosion is a lower priority to repair, however, if 10 of these low priority sites are fixed, the effect will be 10% of erosion eliminated, twice as much as repairing the previously mentioned high priority site. Every erosion source that is eliminated adds up to reduce overall water pollution.

By prioritizing sites by impact, cost, and technical level, we can focus our collective efforts on the small amount of high-priority, complex fixes, while encouraging homeowners to address the much larger category of inexpensive, low-impact sites. In Appendix B, the entire list of erosion sites is broken down by priority. The highest priority sites are those that have a high impact on the lake but are inexpensive and easy to fix. The lowest priority is low-impact sites that would be expensive and complicated. This prioritization ensures that we spend our limited financial resources efficiently while having the greatest impact on the lake. *If your own property is ranked higher on the priority list, this does not mean you have more responsibility to protect water quality than others.* Everyone is responsible for doing whatever they reasonably can to minimize their property's effect on water quality. This data will be a resource to the Great East Lake community for accomplishing that goal.

Tables

Land Use	Low	Medium	High
Residential	68	58	15
Private Road	14	18	5
Driveway	7	10	0
Public Access	2	4	1
Construction Site	1	2	1
Town Road	1	5	1
Trail or Path	8	0	0

Table 1. Water Quality Impact by Land Use

Impact	Low Tech	Medium Tech	High Tech
High Impact	2	12	9
Medium Impact	26	55	16
Low Impact	68	29	4

Table 2. Water Quality Impact comparison to repair cost.

Impact	Low Cost	Medium Cost	High Cost
High Impact	2	12	9
Medium Impact	28	52	17
Low Impact	69	29	3

Table 3. Water Quality Impact comparison to Technical Level.

Next Steps

Remediating the erosion issues identified in this survey will require efforts by GELIA, AWWA, community members, road associations, and municipal officials.

GELIA & AWWA

- Contact property owners, road associations, and towns with identified erosion problems to offer technical assistance and encourage them to make improvements.
- Provide copies of the survey report to property owners, road associations, and towns.
- Partner with NHDES, MEDEP, and towns to seek grant funding and implement projects to protect lake water quality. Develop a Lake Protection Plan to qualify for Maine 319 grants.
- Continue to promote the Lake Host, Weed Watch, and water quality monitoring programs and encourage lake stewardship.
- Increase awareness; provide educational materials and guidance to members of the Great East Lake watershed community.
- Organize workshops and volunteers to start fixing identified erosion problems and teach citizens how to fix similar problems on their own properties.
- Educate municipal officials about lake issues and work cooperatively to find solutions.

Individual Landowners

- Repair areas of your property where erosion is occurring if possible. Contact AWWA for technical assistance and educational materials about best management practices.
- Contact GELIA to get involved with current water quality monitoring programs.
- Encourage native vegetation on your property; stop mowing and raking where possible and avoid exposing soil. Seed and mulch bare soil areas.
- Call your local Code Enforcement Officer (CEO) before doing any tree cutting or soil disturbance projects.
- Maintain septic systems properly. Pump your tank every 2 to 3 years.

Municipal Officials

- Enforce shoreland zoning and other ordinances to ensure protection of Great East Lake.
- Conduct regular maintenance on town roads in the watershed, and address town road issues identified in this survey where feasible.

Forming a Road Association

Proper maintenance of camp roads is crucial to the long-term protection of Great East Lake.

What is a road association?

- A road association is a way for landowners on a private camp road to share responsibility, make decisions, and split costs for road maintenance and repairs.

- There are three types of road associations: Informal, Statutory, and Nonprofit Corporations. Each type varies in the formation time, complexity, and legal standing.

- While small roads can make do with informal associations, it is becoming more common to establish road associations as 501(c)3 non-profit organizations. These associations are run through a straightforward, democratic process and have the ability to collect dues, receive legal protections, and may qualify for grant funding to fix erosion issues.

Why form a road association on Great East Lake?

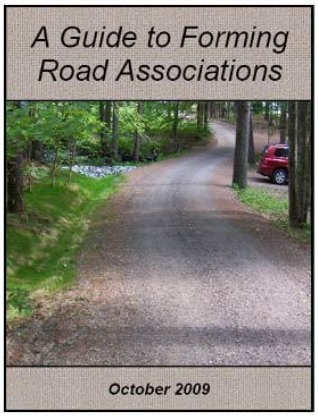
- 37 impact sites identified during the watershed survey are on private roads. Maintaining these roads helps protect Great East Lake from the impacts of soil erosion.

- A road association provides an avenue for private camp road users to formally manage roads in a fair, organized, and cost-effective manner.

- Regular maintenance can reduce road expenses over time. The Camp Road Maintenance Manual estimates that $1 spent on routine maintenance saves $15 in repairs.

- Acton's "Article 43" allocates funding to private roads to assist in the construction of road BMPs that lead to the protection or restoration of a "great pond." As a result, private roads in Acton, Maine surrounding Great East Lake are eligible if they have a formal road association (statutory and nonprofit corporations).

More information on road associations:



- Maine DEP's 'Guide to Forming a Road Association - www.maine.gov/dep/land/watershed/roadassociation.html.

- Maine Laws on camp roads and road associations - www.maine.gov/dep/land/watershed/camp/road/index.html

- New Hampshire Road Association Laws - RSA 231:81-A

- NH Private Road Tax Payers Alliance - nhpvrta.com

- How to form a Non-Profit - learning.candid.org/resources/knowledge-base/starting-a-nonprofit
    - NH Charitable Trusts Unit - doj.nh.gov/charitable-trusts

Common Erosion Issues and Best Management Practices for Homeowners

Below are common examples of erosion and the Best Management Practices (BMPs) that are recommended to prevent it. Erosion takes many forms and can occur naturally, but in all cases, the end result is that running water (stormwater runoff) picks up soil and transports it into the lake. These practices are designed to trap stormwater and allow it to infiltrate into the ground before it reaches the lake, while also operating as functional and aesthetic landscaping features on a property. Some BMPs are useful for residential properties and some are specifically for use on private and town-owned roads. Residential BMPs are relatively simple to install and can be done by homeowners and landscapers. Road BMPs often require heavy machinery and in some cases require engineering (i.e. culvert installation).

For additional information on Stormwater Runoff and Erosion BMPs, please use the following resources:

- BMP Manuals (Maine DEP) - https://www.maine.gov/dep/land/watershed/materials.html
- Gravel Road Manual: www.maine.gov/dep/land/watershed/camp/road/gravel_road_manual.pdf
- NH Homeowner's Guide to Stormwater Management: https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/2020-01/homeowner-guide-stormwater.pdf
- Conservation Practices for Homeowners - awwatersheds.org/conservation-practices-for-homeowners

Common Erosion Issues

Gully Erosion - forms when fast moving water forms a channel on bare soil and begins to pick up and transport sediment downhill to the lake. Most visually obvious form of erosion. Smaller gullies are referred to as rills.

Shoreline Erosion - Shoreline can erode both from stormwater runoff and intense wind and wave action. The root systems of plants on the shoreline work to stabilize soil on the slope and protect it from eroding. In the absence of permanent, woody vegetation, the bank soils have no structure and can easily erode into the lake.

Sheet Erosion - Less apparent than a gully. Occurs when soil erodes in equal amounts across the landscape and the soil level lowers. Exposed roots are evidence of this. Roots naturally grow underground, so the amount of soil loss equals at least the height of the exposed roots. Sheet erosion often goes unnoticed and can lead to significant soil loss.

Best Management Practices: *Infiltration*

Infiltration Path - a trench filled with crushed stone that traps stormwater. Can replace dirt paths susceptible to runoff.

Dripline Trench - Traps roof runoff and directs it into the ground. An alternative to gutters.

Infiltration Steps - Crushed stone steps that trap stormwater instead of allowing it to flow downhill.

Best Management Practices: *Diversion*

Rubber Razor - strips of hard rubber are partially buried in the driveway, placed on an angle to divert stormwater into an adjacent trench or natural area.

Water Bars - 6"x 6" lumber is installed on a slope with crushed stone on the uphill side to trap and divert stormwater. Water bars are left slightly raised to slow water down an can be used as seen above, or placed in a pathway in shorter lengths to function as steps.

Firehose Diverter - In paved driveways, burying rubber and wood are not an option. Old firehose, or other durable material, can be filled with sand or stone and placed on an angle to divert stormwater. These have the added benefit of being movable.

Best Management Practices - *Retention*

Rain Garden - pervious detention basin designed to store stormwater during a rain event and allow it to infiltrate. Typically a trench directs water into the rain garden. Water tolerant plants are put in to uptake additional water and absorb excess nutrients.

Vegetated Buffer - The shoreline is the last line of defense from stormwater. Dense, woody vegetation slows down stormwater and the root system binds sediment together and keeps it from eroding.

Erosion Control Mulch - This chunky mulch is made of tree and stump grindings of various sizes, this allows it to bind together and trap stormwater without washing away. This is the simplest way to protect bare soil and will last for many years before breaking down.

Best Management Practices - *Roads*

Hard Pack - This is an aggregate stone material that does not wash away as easily as sand and gravel. The lack of fine materials means less sediment erosion.

Crowning - A dirt road must be slightly pitched so water will run off of it instead of forming potholes and gullies. The high point can be in the middle to direct water in both directions, or on a far side to direct all water in one direction.

Ditching - Once water is directed off the road, it should flow into a pervious ditch to allow it to infiltrate. There are various methods such as vegetation and check dams which can be used to slow stormwater down in a ditch.

Permitting & Regulations - Maine

Protection of Maine's watersheds is ensured through the goodwill of lake residents and through laws and ordinances created and enforced by the State of Maine and local municipalities. The following laws and ordinances require permits for activities adjacent to wetlands and water bodies.

Shoreland Zoning Law—Construction, clearing of vegetation, and soil movement within 250 feet of lakes, ponds, and many wetlands, and within 75 feet of most streams, falls under the Shoreland Zoning Act, which is administered by the Town through the Code Enforcement Officer and the Planning Board.

Natural Resources Protection Act (NRPA) - Soil disturbance & other activities within 75 feet of the lakeshore or stream also fall under the NRPA, which is administered by Maine DEP.

Contact the DEP and Town Code Enforcement Officer if you have any plans to construct, expand or relocate a structure, clear vegetation, create a new path or driveway, stabilize a shoreline, or otherwise disturb the soil on your property. Even if projects are planned with the intent of enhancing the environment, contact the DEP and town to be sure.

How to apply for a Permit by Rule with DEP:

To ensure that permits for small projects are processed swiftly, the DEP has established a streamlined permit process called **Permit by Rule**. These one-page forms are simple to fill out and allow the DEP to quickly review the project.

- Fill out a notification form before starting any work. Forms are available from your town code enforcement officer, the Maine DEP office in Portland, or online at www.maine.gov/dep/land/nrpa/nrpa-pbr-notification.pdf

- A permit-by-rule will be reviewed by the DEP within 14 days. If you do not hear from DEP in 14 days, you can assume your permit is approved and you can proceed with work on the project. *With a standard application for larger projects, you must wait for approval.*

- Follow all standards required for the specifically permitted activities to keep soil erosion to a minimum. It is important that you obtain a copy of the standards so you will be familiar with the law's requirements.

For an in-depth description of shoreland laws in Maine visit the Maine DEP website at these links:

- Natural Resource Protection Act - https://www.maine.gov/dep/land/nrpa/
- Mandatory Shoreland Zoning - https://www.maine.gov/dep/land/slz/index.html

Permitting and Regulations - New Hampshire

The Shoreland Water Quality Protection Act (SWQPA) establishes buffers known as "protected shoreland", located along public waters. Certain homeowner activities are regulated within the protected shoreland, which includes all lands within 250' of pubic waters:

- Lakes & ponds greater than 10 acres;
- Year-round flowing waters (streams and rivers) of fourth-order or higher;
- Coastal waters.

Waterfront Buffer Requirements

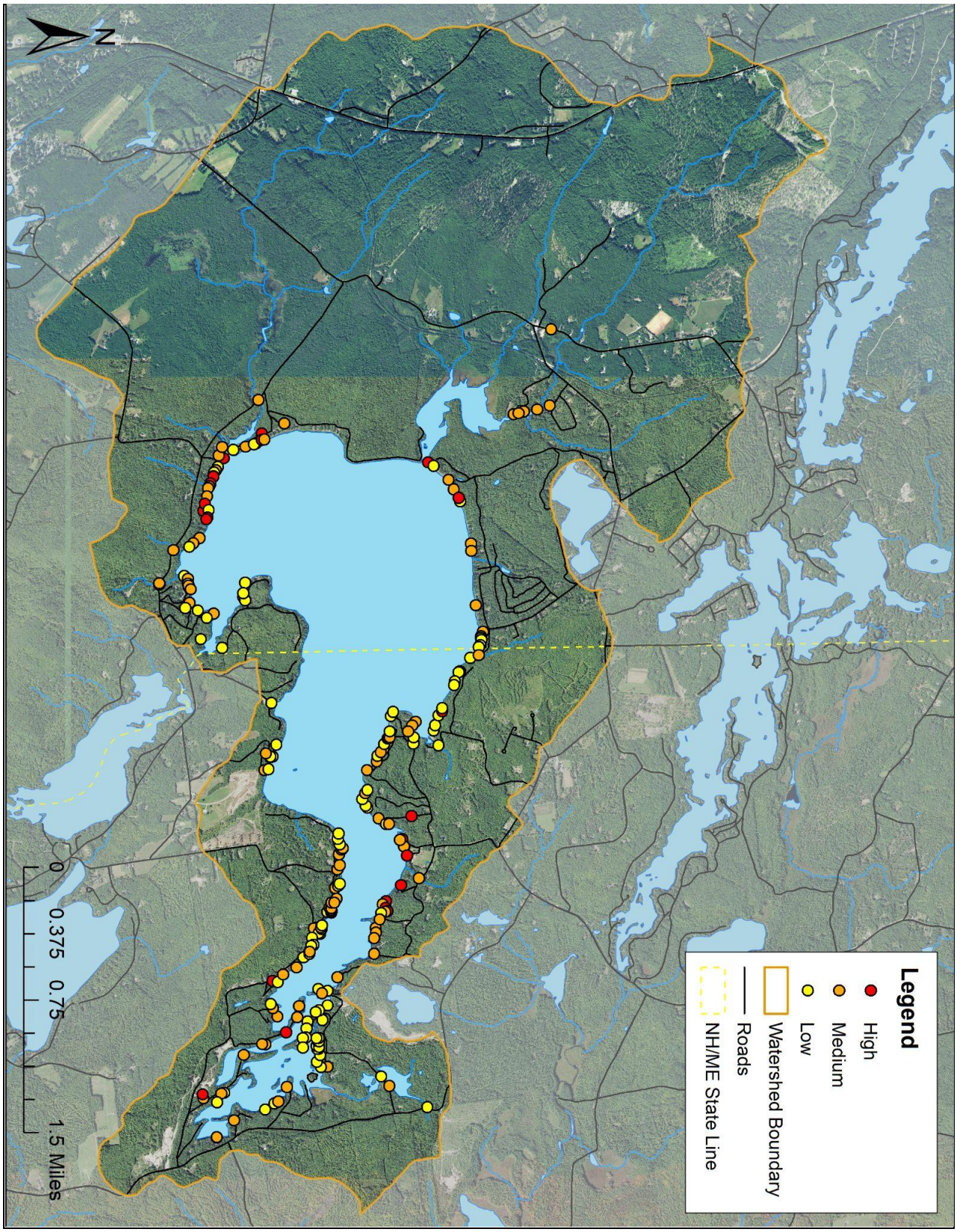
Within 50' of the reference line, ground cover and shrubs may not be removed and replaced with landscaping or lawn. They may only be removed to provide a 6' wide footpath to the water or to structures in the waterfront buffer (a shoreland permit may be required). Ground cover and shrubs may only be trimmed to a height of no less than 3'. Trees may also be pruned as long as the health of the tree is not endangered. Pruning only the bottom 1/3 of a tree is recommended to maintain property aesthetics and tree health. Pruning trees increases views while providing wildlife habitat, privacy, and retaining shade. No pesticides can be applied within 25' of the reference line, and no chemicals of any kind can be applied within 50' other than by an NH licensed professional.

Permitting Requirements

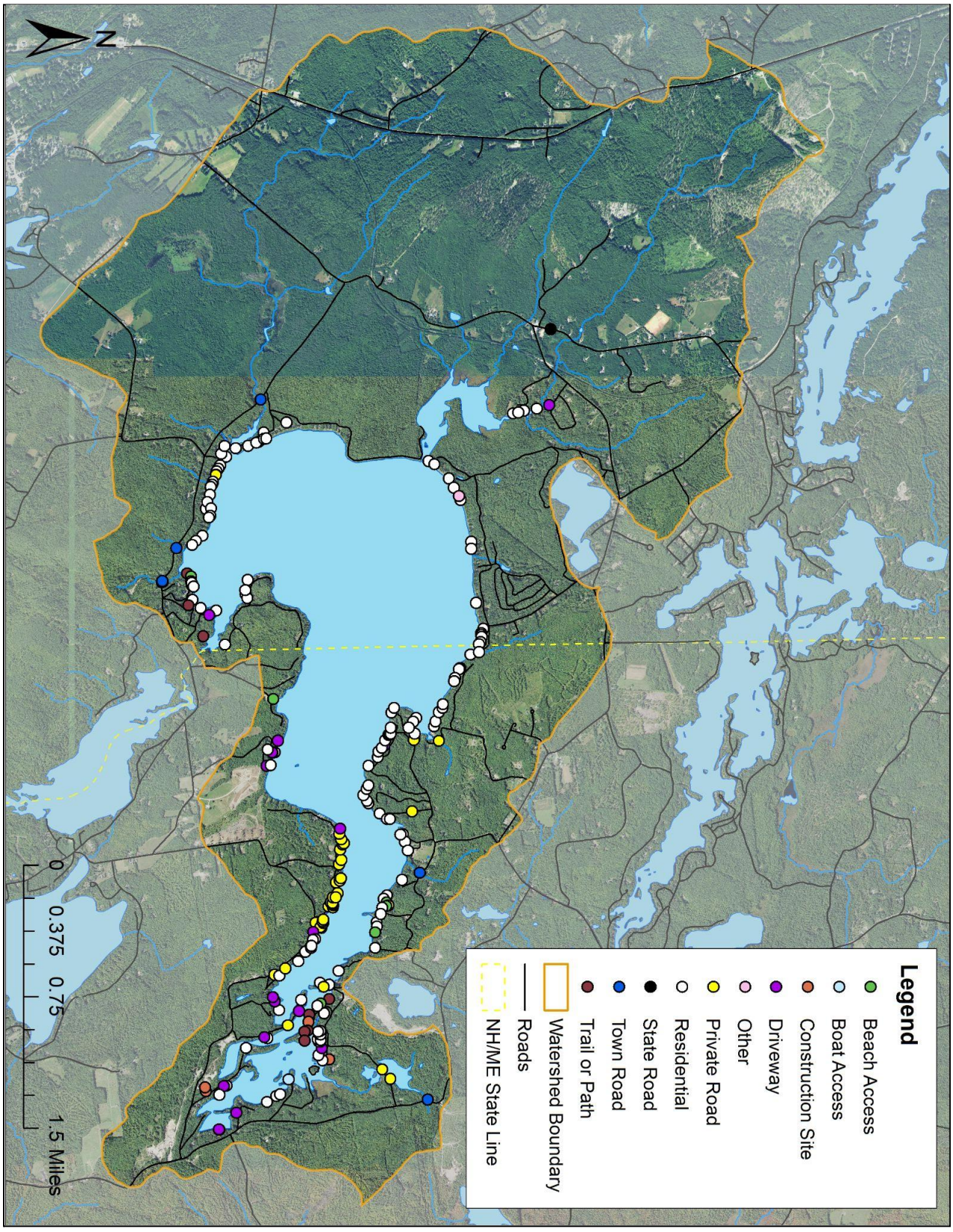
- A shoreland permit is not required for vegetation management provided it occurs in accordance with the SWQPA.
- Any dead, diseased or hazardous tree may be cut to ground level at any time without a shoreland permit.
- An NHDES shoreland permit is required for excavation, fill, or construction within 250' of the reference line. Examples include, but are not limited to removing stumps, constructing most walkways, patios, other structures, or grading. Any earthwork or construction on the bank, in the water, or on the bed of a waterbody is regulated by the NHDES Wetlands Bureau and is subject to the NHDES Wetlands Permitting Process.
- Areas cleared of ground cover, shrubs, or trees prior to July 1, 2008 may be maintained but not enlarged.
- Before removing trees, always check local ordinances as well. Many municipalities have standards that are stricter than the NH Shoreland Water Quality Protection Act.

To apply for a Shoreland Permit, visit the NHDES Shoreland webpage at this link: https://www.des.nh.gov/land/waterfront-development/protected-shoreland.
Many low-impact activities that propose no greater than 1,500 SQFT of impact may qualify for a shoreland permit by notification, which is a simplified permit with a faster turnaround.

Appendix A: Watershed Survey Map - Impact



Appendix A: Watershed Survey Maps - Land Use Type



Appendix B: Site Descriptions

Site	Impact	Cost	Technical Level	Land use	Issue	Recommendations	P Loading lb/yr	Sediment Loss tons/yr
1-15	High	Low	Low	Residential	Soil Delta, Bare Soil	Define Foot Path, Stabilize Foot Path, Infiltration Steps, Install waterbar Install waterbar	0.51	0.60
7-10	High	Low	Medium	Residential	Bare Soil	Stabilize Foot Path, Install waterbar, Erosion Control Mulch Dripline Trench	2.13	2.50
1-17	High	Medium	Low	Residential	Bare Soil	Silt Fence, ECM Berms	2.55	3.00
1-08	High	Medium	Medium	Private Road	Shoreline Erosion	Install Plunge Pool, cut culvert outlet back and outlet it into vegetated swale culvert	2.55	3.00
1-16	High	Medium	Medium	Residential	Bare Soil	Infiltration Steps, Stabilize Foot Path, Define Foot Path, Install waterbar	0.64	0.75
7-12	High	Medium	Medium	Beach Access	Bare Soil	Stabilize Foot Path Establish Buffer Install waterbar	19.13	22.50
7-07	High	Medium	Medium	Residential	Bare Soil, Soil Delta	Establish Buffer Install waterbar	47.81	56.25
7-08	High	Medium	Medium	Residential	Bare Soil, Lack of Shoreline Vegetation	Define Foot Path Stabilize Foot Path Install waterbar Erosion Control Mulch, Establish Buffer Infiltration Trench	12.75	15.00
4-09	High	Medium	Medium	Private Road	Ditch Erosion Gully, existing stormwater BMPs inadequate, channel through yard down to lake.	Remove debris & sediment, Install Sediment detention pools, Native Vegetation	1.15	1.35
4-03	High	Medium	Medium	Private Road	Shoulder Erosion, Bare Soil	Build Up, Add gravel, Reshape/Crown, Vegetate Shoulder Erosion Control Mulch	3.57	4.20
1-11	High	Medium	Medium	Residential	Bare Soil	Stabilize Foot Path, Install waterbar	0.51	0.60
1-25	High	Medium	Medium	Residential	Shoreline Undercut, Erosion	native vegetation, repair retaining wall.	0.13	0.15
5-07	High	Medium	Medium	Construction	Uncovered Soil	Silt Fence, ECM Berms, Spread Hay		

Site	Impact	Cost	Technical Level	Land use	Issue	Recommendations	P Loading lb/yr	Sediment Loss tons/yr
7-05	High	Medium	Medium	Residential	Bare Soil	Install waterbar, Erosion Control Mulch, Water Retention Swales, stabilize parking area	3.40	4.00
7-01	High	High	High	Private Road	Shoulder Erosion, Bare Soil Berm	Armor Inlet/Outlet, Enlarge Reshape Ditch Remove Berms, Reshape/Crown, Add gravel	3.19	3.75
1-14	High	High	High	Residential	Shoreline Erosion	perched beach with infiltration trenches around it and vegetated buffer	1.91	2.25
1-02	High	High	High	Residential	Shoreline Unstable Access, Undercut, Inadequate Vegetation, Erosion	Establish Buffer Rip Rap	2.13	2.50
7-13	High	High	High	Private Road	erosion in road	Add gravel, Reshape/Crown	12.75	15.00
9-04	High	High	High	Residential	Soil Delta, Lack of Shoreline Vegetation, Erosion, Inadequate Vegetation		0.43	0.50
2-02	High	High	High	Town Road	Culvert Unstable, Undersized Shoulder Erosion, Bare Soil	Install Plunge Pool, Enlarge, Armor Inlet/Outlet Vegetate Vegetate Shoulder	21.25	25.00
1-27	High	High	High	Residential	Shoreline Undercut		0.32	0.38
8-31	High	High	High	Residential	Bare Soil Shoreline Undercut, Erosion, Unstable Access		9.56	11.25
9-05	High	High	High	Residential	Bare Soil Shoreline Undercut, Inadequate Vegetation, Erosion, Unstable Access	Define Foot Path, Stabilize Foot Path Add to Buffer	3.19	3.75
1-04	Medium	Low	Low	Residential	Bare Soil, Shoreline Erosion	Install waterbar	0.09	0.10
1-19	Medium	Low	Low	Residential	Shoreline Erosion	Infiltration Steps, Stabilize Foot Path, Install waterbar	0.21	0.25
1-28	Medium	Low	Low	Residential	Bare soil on dripline	Dripline Trench	0.64	0.75
7-20	Medium	Low	Low	Residential	Bare Soil	Install waterbar, Erosion Control Mulch	10.63	12.50

Site	Impact	Cost	Technical Level	Land use	Issue	Recommendations	P Loading lb/yr	Sediment Loss tons/yr
8-12	Medium	Low	Low	Residential	Bare Soil, Shoreline Inadequate Vegetation	Define Foot Path, Erosion Control Mulch Add to Buffer	3.40	4.00
3-02	Medium	Low	Low	Private Road	Ditch Erosion Sheet Shoulder Erosion Sheet Lack of Shoreline Vegetation, Shoreline Erosion	Dripline Trench Establish Buffer Erosion Control Mulch	0.11	0.13
9-07	Medium	Low	Low	Residential	Ditch Erosion, Bare Soil Shoreline Undercut, Lack of Shoreline Vegetation, Erosion, Unstable Access	Define Foot Path Establish Buffer, Add to Buffer, Reseed	0.51	0.60
6-01	Medium	Low	Low	Private Road	Shoulder Erosion Sheet Winter Sand Berm	Remove Berms, Reshape/Crown	5.31	6.25
1-06	Medium	Low	Low	Residential	Shoreline Undercut	Rain Garden	0.00	0.00
1-01	Medium	Low	Low	Residential	Shoreline Erosion, Shoreline Undercut	Infiltration Steps Install waterbar	0.31	0.36
1-12	Medium	Low	Low	Residential		Infiltration Steps	0.03	0.04
1-18	Medium	Low	Low	Residential	Shoreline Erosion		0.07	0.08
1-22	Medium	Low	Low	Residential	Shoreline Undercut, Shoreline Erosion	Install waterbar	0.85	1.00
1-25	Medium	Low	Low	Residential	Shoreline Erosion		0.01	0.01
10-2	Medium	Low	Low	Residential	Bare Soil	Install waterbar	0.10	0.12
10-3	Medium	Low	Low	Residential	Bare Soil	Erosion Control Mulch Establish Buffer	0.43	0.50
10-4	Medium	Low	Low	Residential	Bare Soil, Shoreline Erosion	Establish Buffer Install waterbar	3.19	3.75
7-11	Medium	Low	Low	Residential	Bare Soil	Erosion Control Mulch	2.98	3.50
7-17	Medium	Low	Low	Residential	Bare Soil		15.94	18.75
8-04	Medium	Low	Low	Residential	Bare Soil Shoreline Erosion, Lack of Shoreline Vegetation	Define Foot Path Erosion Control Mulch	0.64	0.75
8-22	Medium	Low	Low	Residential	Bare Soil	Stabilize Foot Path Add to Buffer Erosion Control Mulch	2.13	2.50

Site	Impact	Cost	Technical Level	Land use	Issue	Recommendations	P Loading lb/yr	Sediment Loss tons/yr
7-06	Medium	Low	Medium	Residential	Shoreline Erosion, Roof Runoff Erosion	Dripline Trench Erosion Control Mulch, Infiltration Trench	2.55	3.00
10-6	Medium	Low	Medium	Town Road	roadside erosion	Erosion Control Mulch, Rip Rap	0.26	0.30
10-7	Medium	Low	Medium	Town Road	roadside erosion	Erosion Control Mulch, Rip Rap	0.26	0.30
2-20	Medium	Low	Medium	Residential	Lack of Shoreline Vegetation, Shoreline Erosion	Establish Buffer, Reseed	6.38	7.50
3-23	Medium	Low	Medium	Private Road	Shoreline Inadequate Vegetation, Shoreline Erosion	Install Waterbar Install waterbar, Erosion Control Mulch	0.26	0.30
3-22	Medium	Low	Medium	Private Road	roadside erosion	Erosion Control Mulch, Install waterbar	0.85	1.00
6-31	Medium	Low	Medium	Boat Access	erosion	Add gravel Erosion Control Mulch	0.32	0.38
1-13	Medium	Medium	Low	Residential	Lack of Shoreline Vegetation, Erosion, Inadequate Vegetation	Establish Buffer Infiltration Trench	0.57	0.68
4-12	Medium	Medium	Low	Residential	Bare Soil, Shoreline Inadequate Vegetation, Roof Runoff Erosion	Define Foot Path, Erosion Control Mulch Dripline Trench Add to Buffer, Stop Raking, Reseed Erosion Control Mulch	15.94	18.75
4-02	Medium	Medium	Low	Driveway	driveway directs water down and around edge of stairs	Build Up, Add gravel, Reshape/Crown Infiltration Steps	2.55	3.00
5-06	Medium	Medium	Low	Construction	Bare Soil	Silt Fence, ECM Berms, Hay	1.28	1.50
8-07	Medium	Medium	Low	Residential	Bare Soil, Shoreline Undercut, Shoreline Erosion	Erosion Control Mulch, Rain Garden	3.19	3.75
10-1	Medium	Medium	Medium	Driveway	Ditch Erosion, Gully, Bare Soil	Armor with Stone	2.13	2.50
3-06	Medium	Medium	Medium	Private Road	Ditch Erosion, Gully, Bare Soil	Mulch Infiltration Trench, Rip Rap	0.89	1.05
4-07	Medium	Medium	Medium	Driveway	Ditch Bank Failure	Reshape/Crown, Add gravel, Build Up Erosion Control Mulch	1.70	2.00
5-01	Medium	Medium	Medium	Residential	Ditch Bank Failure	Reshape Ditch, Armor with Stone	3.40	4.00

Site	Impact	Cost	Technical Level	Land use	Issue	Recommendations	P Loading lb/yr	Sediment Loss tons/yr
10-8	Medium	Medium	Medium	Town Road	Shoulder Erosion Sheet	Rip Rap	3.83	4.50
3-13	Medium	Medium	Medium	Private Road	Shoulder Erosion Sheet	Add gravel, Install Rubber Razor, Waterbars Mulch Erosion Control Mulch, Install waterbar Establish Buffer, Reseed	3.19	3.75
8-15	Medium	Medium	Medium	Residential	Shoulder Erosion Sheet Bare Soil	Define Foot Path, Install waterbar, Erosion Control Mulch Establish Buffer Install waterbar, Erosion Control Mulch, Infiltration Trench, Rain Garden	12.75	15.00
5-04	Medium	Medium	Medium	Driveway	Shoulder Erosion Gully	Rip Rap	6.38	7.50
5-10	Medium	Medium	Medium	Driveway	Shoulder Erosion Gully	Rip Rap	3.19	3.75
4-34	Medium	Medium	Medium	Residential	Roof Runoff Erosion	Dripline Trench, Drywell, Rain Barrel Add to Buffer Rain Garden, Infiltration Trench	0.17	0.20
6-07	Medium	Medium	Medium	Residential	Shoreline Inadequate Vegetation, Shoreline Erosion	Add gravel, Reshape/Crown, Install Waterbar Stabilize Foot Path, Infiltration Steps, Install waterbar, Define Foot Path Establish Buffer	0.43	0.50
1-14	Medium	Medium	Medium	Residential	Shoreline Erosion		NA	NA
2-14	Medium	Medium	Medium	Driveway		Install Plunge Pool Install Check Dams, Remove debris/sediment	0.05	0.06
4-06	Medium	Medium	Medium	Residential	Bare Soil, Lack of Shoreline Vegetation, Shoreline Erosion	Establish Buffer Erosion Control Mulch	5.10	6.00
5-09	Medium	Medium	Medium	Driveway	erosion	Add gravel, Install Rubber Razor, Install Waterbar, Reshape/Crown	1.49	1.75
7-14	Medium	Medium	Medium	Beach Access	Bare Soil	Stabilize Foot Path Install waterbar	12.75	15.00
7-19	Medium	Medium	Medium	Residential		Install waterbar	3.83	4.50
7a-5	Medium	Medium	Medium	Residential	Bare Soil, Shoreline Erosion	Stabilize Foot Path Establish Buffer Install waterbar	3.19	3.75

Site	Impact	Cost	Technical Level	Land use	Issue	Recommendations	P Loading lb/yr	Sediment Loss tons/yr
8-11	Medium	Medium	Medium	Driveway	Bare Soil, Lack of Shoreline Vegetation	Install Rubber Razor Define Foot Path, Stabilize Foot Path, Erosion Control Mulch, Install waterbar Establish Buffer Install waterbar, Erosion Control Mulch	0.43	0.50
8-23	Medium	Medium	Medium	Residential	Bare Soil, Shoreline Inadequate Vegetation	Add to Buffer Erosion Control Mulch, Infiltration Trench	0.26	0.30
9-02	Medium	Medium	Medium	Residential	Bare Soil, Lack of Shoreline Vegetation	Define Foot Path, Infiltration Steps, Erosion Control Mulch Establish Buffer, Reseed	8.93	10.50
10-9	Medium	Medium	Medium	State Road	Ditch Erosion, Shoulder Erosion, Bare Soil	Armor Inlet/Outlet Erosion Control Mulch, Rip Rap	0.80	0.94
3-16	Medium	Medium	Medium	Private Road	Ditch Erosion Gully	Install Catch Basin, Install Detention Basin, Install Broad-based Dip Install waterbar, Erosion Control Mulch	0.34	0.40
6-27	Medium	Medium	Medium	Private Road	Shoulder Erosion Gully	Vegetate Shoulder, Reshape/Crown, Install Catch Basin	0.32	0.38
7-02	Medium	Medium	Medium	Residential	Bare Soil, Roof Runoff Erosion	Dripline Trench Establish Buffer Erosion Control Mulch, Install waterbar	2.55	3.00
7-15	Medium	Medium	Medium	Residential	Lack of Shoreline Vegetation Roof Runoff Erosion	Infiltration Trench, Erosion Control Mulch, Install waterbar	15.94	18.75
8-16	Medium	Medium	Medium	Residential	Bare Soil, Lack of Shoreline Vegetation Roof Runoff Erosion	Stabilize Foot Path, Erosion Control Mulch, Install waterbar Drywell Add to Buffer Erosion Control Mulch	1.91	2.25
8-21	Medium	Medium	Medium	Residential	Bare Soil, Roof Runoff Erosion	Stabilize Foot Path, Install waterbar, Erosion Control Mulch Dripline Trench, Drywell Add to Buffer Install waterbar, Erosion Control Mulch	1.59	1.88
4-04	Medium	Medium	Medium	Driveway	Bare Soil, loose gravel parking on slope; no barrier.	Add gravel, Vegetate Shoulder Silt Fence, ECM Berms	7.65	9.00

Site	Impact	Cost	Technical Level	Land use	Issue	Recommendations	P Loading lb/yr	Sediment Loss tons/yr
4-05	Medium	Medium	Medium	Residential	Shoreline Inadequate Vegetation, Shoreline Undercut on slope near shore	Add to Buffer Rip Rap, Erosion Control Mulch	0.43	0.50
6-30	Medium	Medium	Medium	Residential	Shoreline Undercut, Shoreline Unstable Access	Rip Rap	0.02	0.03
1-28	Medium	Medium	Medium	Residential	Shoreline Erosion	Install waterbar	NA	NA
10-5	Medium	Medium	Medium	Residential	Bare Soil, Shoreline Erosion	Establish Buffer	2.13	2.50
2-12	Medium	Medium	Medium	Residential	Bare Soil, Shoreline Inadequate Vegetation, Erosion & Undercut	Install Broad-based Dip Establish Buffer, Add to Buffer Erosion Control Mulch	0.77	0.90
2-4	Medium	Medium	Medium	Beach Access	Bare Soil, Lack of Shoreline Vegetation, Shoreline Undercut & Erosion	Define Foot Path Establish Buffer, Reseed	21.25	25.00
2-6	Medium	Medium	Medium	Residential	Shoreline Inadequate Vegetation	Add to Buffer Install waterbar, Erosion Control Mulch	6.80	8.00
2-7	Medium	Medium	Medium	Residential	Bare Soil, Shoreline Undercut, Lack of Shoreline Vegetation, Shoreline Erosion, Unstable Access	Establish Buffer Install waterbar	3.83	4.50
3-09	Medium	Medium	Medium	Private Road	Bare Soil	Establish Buffer, Add to Buffer, Reseed Install waterbar, Erosion Control Mulch	0.48	0.56
3-14	Medium	Medium	Medium	Private Road	Bare Soil	Install waterbar, Erosion Control Mulch	0.64	0.75
4-01	Medium	Medium	Medium	Residential	Bare Soil	Define Foot Path Add to Buffer, Stop Raking Erosion Control Mulch	8.93	10.50
6-03	Medium	Medium	Medium	Construction	Bare Soil	Silt Fence/ECM Berms, Erosion Control Mulch	21.25	25.00
7-18	Medium	Medium	Medium	Beach Access	Bare Soil	Erosion Control Mulch, Establish Buffer	8.50	10.00

Site	Impact	Cost	Technical Level	Land use	Issue	Recommendations	P Loading lb/yr	Sediment Loss tons/yr
8-09	Medium	Medium	Medium	Residential	Bare Soil, Lack of Shoreline Vegetation	Stabilize Foot Path, Install waterbar, Erosion Control Mulch Add to Buffer Install waterbar, Erosion Control Mulch	0.51	0.60
9-10	Medium	Medium	Medium	Residential	Bare Soil, Shoreline Inadequate Vegetation	Define Foot Path, Stabilize Foot Path, Infiltration Steps, Install waterbar, Erosion Control Mulch Add to Buffer	0.34	0.40
3-21	Medium	Medium	High	Private Road	Shoulder Erosion,, Bare Soil	Reshape/Crown, Install Rubber Razor, Install Waterbar Mulch	0.10	0.11
3-20	Medium	Medium	High	Private Road	erosion	Install Open Top Culvert, Install Rubber Razor, Install Waterbar, Install Detention Basin Erosion Control Mulch	0.21	0.25
9-09	Medium	Medium	High	Residential	bank erosion	Establish Buffer, Reseed	3.83	4.50
2-8	Medium	High	Medium	Residential	culvert from driveway into lake		NA	NA
9-01	Medium	High	Medium	Residential	Lack of Shoreline Vegetation, Shoreline Erosion potentially unpermitted sand	Erosion Control Mulch Establish Buffer Erosion Control Mulch	11.48	13.50
1-09	Medium	High	Medium	Residential	Shoreline Erosion	Armor Inlet/Outlet	NA	NA
3-15	Medium	High	Medium	Private Road	Culvert Crushed, Undersized, Clogged	Remove Clog, Replace, Enlarge	0.19	0.23
4-11	Medium	High	High	Private Road	Ditch Undersized	Install Plunge Pool Reshape Ditch, Remove debris/sediment	12.75	15.00
3-15	Medium	High	High	Private Road	Ditch Erosion Gully Bare Soil, Shoreline Erosion		6.38	7.50
3-12	Medium	High	High	Private Road	Ditch Bank Failure Bare Soil	Vegetate Install Detention Basin Erosion Control Mulch Establish Buffer Erosion Control Mulch	2.13	2.50
3-10	Medium	High	High	Private Road	Shoreline Erosion Roof Runoff Erosion	Install Ditch, Install Sediment Pools, Stabilize Foot Path Establish Buffer	2.55	3.00
9-08	Medium	High	High	Residential	Pipe draining into lake. no odor		NA	NA

Site	Impact	Cost	Technical Level	Land use	Issue	Recommendations	P Loading lb/yr	Sediment Loss tons/yr
1-23	Medium	High	High	Residential	Shoreline Undercut, Lack of Shoreline Vegetation, Erosion	Establish Buffer, Add to Buffer, Stop Raking	0.13	0.15
1-24	Medium	High	High	Residential	Shoreline Undercut, Erosion, Unstable Access		0.16	0.19
3-19	Medium	High	High	Private Road	Bare Soil	Install waterbar, Erosion Control Mulch	0.11	0.13
7-21	Medium	High	High	Residential	Bare Soil	Build Up, Add gravel, Reshape/Crown, Install Detention Basin	11.48	13.50
7-10	Medium	High	High	Town Road	Culvert undersized, Ditch Erosion, Shoulder Erosion Bare Soil, Winter Sand Berm, Roof Runoff Erosion	Armor Inlet/Outlet Reshape Ditch Vegetate Shoulder	NA	NA
2-1	Medium	High	High	Driveway	Culvert Undersized Ditch Erosion,, Undersized Shoulder Erosion, Roof Runoff Erosion	Armor Inlet/Outlet, Reshape/Crown	2.55	3.00
9-16	Medium	High	High	Residential	Shoulder Erosion, Shoreline Undercut, Lack of Shoreline Vegetation, Erosion, Unstable Access	Vegetate Shoulder Add to Buffer	0.21	0.25
7-04	Medium	High	High	Residential	Bare Soil		7.65	9.00
6-10	Low	Low	Low	Residential	Roof Runoff Erosion	Drywell, Dripline Trench, Rain Barrel	0.04	0.05
6-13	Low	Low	Low	Residential	Roof Runoff Erosion	Dripline Trench, Rain Barrel, Drywell	0.04	0.05
7-16	Low	Low	Low	Residential	Bare Soil, Roof Runoff Erosion	Stabilize Foot Path, Define Foot Path Add to Buffer Erosion Control Mulch	20.40	24.00

Site	Impact	Cost	Technical Level	Land use	Issue	Recommendations	P Loading lb/yr	Sediment Loss tons/yr
6-18	Low	Low	Low	Residential	Lack of Shoreline Vegetation, Shoreline Erosion, Sinkhole between Stabilizing rocks	Stabilize Foot Path Add to Buffer, Stop Raking, Erosion Control Mulch	0.16	0.19
2-99	Low	Low	Low	Residential	Shoreline Lack of Vegetation, Unstable Access	Add gravel, Establish Buffer	0.64	0.75
1-05	Low	Low	Low	Residential	Bare Soil, septic	Establish Buffer	0.04	0.05
6-08	Low	Low	Low	Residential	Bare Soil, Soil Delta, Lack of Shoreline Vegetation	Define Foot Path Establish Buffer, Reseed Rain Garden, Erosion Control Mulch	1.28	1.50
6-15	Low	Low	Low	Residential	Lack of Shoreline Vegetation, Shoreline Erosion, Unstable Access	Add gravel Stabilize Foot Path, Install waterbar Establish Buffer Install waterbar	1.28	1.50
6-16	Low	Low	Low	Trail or Path	Shoreline Inadequate Vegetation, Unstable Access	Stabilize Foot Path, Erosion Control Mulch Establish Buffer, Add to Buffer	0.11	0.13
6-23	Low	Low	Low	Trail or Path	Bare Soil	Stabilize Foot Path, Infiltration Steps, Install waterbar, Erosion Control Mulch Stop Raking	0.77	0.90
6-24	Low	Low	Low	Trail or Path	trail erosion	Stabilize Foot Path	0.21	0.25
1-15	Low	Low	Low	Residential	Bare Soil, Shoreline Erosion		0.00	0.00
1-21	Low	Low	Low	Residential	Shoreline Erosion	Stabilize Foot Path, Infiltration Steps, Install waterbar, Define Foot Path	0.27	0.32
1-23	Low	Low	Low	Residential	Bare Soil, Shoreline Erosion	Install waterbar	0.11	0.13
1-25	Low	Low	Low	Residential		Install waterbar	0.04	0.05
2-17	Low	Low	Low	Residential	Lack of Shoreline Vegetation	Establish Buffer, Reseed	0.85	1.00
2-97	Low	Low	Low	Residential	Bare Soil, Lack of Shoreline Vegetation	Establish Buffer	1.28	1.50
2-98	Low	Low	Low	Residential		Define Foot Path Establish Buffer	1.28	1.50

Site	Impact	Cost	Technical Level	Land use	Issue	Recommendations	P Loading lb/yr	Sediment Loss tons/yr
3-96	Low	Low	Low	Residential	Lack of Shoreline Vegetation	Establish Buffer, Add to Buffer, Reseed Erosion Control Mulch	1.28	1.50
4-10	Low	Low	Low	Residential	Bare Soil, Lack of Shoreline Vegetation	Define Foot Path Establish Buffer, Stop Raking, Reseed Erosion Control Mulch	1.91	2.25
4-14	Low	Low	Low	Residential	Bare Soil	Define Foot Path, Stabilize Foot Path, Erosion Control Mulch, Install waterbar Add to Buffer, Reseed Install waterbar, Erosion Control Mulch	1.06	1.25
4-32	Low	Low	Low	Residential	Bare Soil	Define Foot Path, Erosion Control Mulch	0.06	0.08
5-03	Low	Low	Low	Residential	Uncovered Soil, Bare Soil	Stabilize Foot Path, Define Foot Path, Add to Buffer	0.19	0.23
6-09	Low	Low	Low	Residential	Bare Soil, Lack of Shoreline Vegetation, Shoreline Erosion	Establish Buffer, Reseed, Stop Raking Rain Garden, Erosion Control Mulch	7.97	9.38
6-14	Low	Low	Low	Residential	Lack of Shoreline Vegetation, Shoreline Erosion, Unstable Access	Erosion Control Mulch Establish Buffer, Reseed Install waterbar	1.28	1.50
6-29	Low	Low	Low	Residential	Bare Soil	Infiltration Steps, Define Foot Path, Erosion Control Mulch	0.19	0.23
8-13	Low	Low	Low	Residential	Bare Soil, Lack of Shoreline Vegetation	Establish Buffer Install waterbar, Erosion Control Mulch	0.21	0.25
8-33	Low	Low	Low	Residential	Bare Soil	Stabilize Foot Path, Erosion Control Mulch Add to Buffer Erosion Control Mulch, Install waterbar	0.13	0.15
9-11	Low	Low	Low	Residential	Shoreline Inadequate Vegetation	Add to Buffer	0.96	1.13
9-13	Low	Low	Low	Residential	Bare Soil, Lack of Shoreline Vegetation	Define Foot Path Establish Buffer, Reseed	0.64	0.75
6-02	Low	Low	Low	Private Road	Culvert Clogged, Shoulder Erosion, Winter Sand, Shoreline Undercut & Erosion Berm	Remove Clog, Armor Inlet/Outlet Remove Berms	0.27	0.31

Site	Impact	Cost	Technical Level	Land use	Issue	Recommendations	P Loading lb/yr	Sediment Loss tons/yr
6-17	Low	Low	Low	Beach Access	Shoulder Erosion, Shoreline Erosion, Unstable Access, Inadequate Vegetation	Add to Buffer, Reseed Erosion Control Mulch	0.11	0.13
8-29	Low	Low	Low	Residential	Shoulder Erosion Sheet Bare Soil	Add to Buffer	0.06	0.08
6-12	Low	Low	Low	Residential	Roof Runoff Erosion	Drywell, Dripline Trench, Rain Barrel	0.03	0.04
4-13	Low	Low	Low	Residential	Roof Runoff Erosion	Dripline Trench Reseed	0.06	0.08
8-20	Low	Low	Low	Residential	Bare Soil, Shoreline Inadequate Vegetation, Shoreline Erosion, Roof Runoff Erosion	Dripline Trench Add to Buffer Erosion Control Mulch	0.85	1.00
6-20	Low	Low	Low	Trail or Path	Bare Soil, Shoreline Erosion, Steps eroding, no gravel, chipmunk holes	Stabilize Foot Path, Infiltration Steps	0.13	0.15
6-05	Low	Low	Low	Residential	Bare Soil, Lack of Shoreline Vegetation, Shoreline Erosion	Define Foot Path Establish Buffer, Stop Raking, Reseed Erosion Control Mulch, Rain Garden	0.43	0.50
6-11	Low	Low	Low	Residential	Shoreline Erosion, Unstable Access	Add gravel, Install Waterbar	0.11	0.13
6-21	Low	Low	Low	Construction	Shoreline Erosion	Silt_Fence/EC_Berms, Mulch, Seed/Hay	0.43	0.50
6-22	Low	Low	Low	Trail or Path	erosion in path	Stabilize Foot Path, Infiltration Steps	0.17	0.20
6-25	Low	Low	Low	Residential	Bare Soil, Shoreline Erosion, Inadequate Vegetation	Stabilize Foot Path, Infiltration Steps	0.04	0.05
2-95	Low	Low	Low	Residential	Bare Soil Shoreline Inadequate Vegetation, Shoreline Erosion	Add to Buffer	1.02	1.20
4-33	Low	Low	Low	Residential	Bare Soil		0.03	0.03
5-05	Low	Low	Low	Residential	Bare Soil	Stabilize Foot Path, Define Foot Path Erosion Control Mulch	0.26	0.30

Site	Impact	Cost	Technical Level	Land use	Issue	Recommendations	P Loading lb/yr	Sediment Loss tons/yr
6-04	Low	Low	Low	Residential	Bare Soil Shoreline Erosion	Infiltration Steps, Install waterbar, Erosion Control Mulch, Define Foot Path Add to Buffer Erosion Control Mulch, Infiltration Trench, Install waterbar, Water Retention Swales	1.70	2.00
6-26	Low	Low	Low	Residential	Shoreline Inadequate Vegetation	Infiltration Steps, Install waterbar Add to Buffer Water Retention Swales	0.43	0.50
8-01	Low	Low	Low	Residential	Lack of Shoreline Vegetation, Erosion	Establish Buffer	0.32	0.38
8-32	Low	Low	Low	Residential	Bare Soil, Shoreline Inadequate Vegetation	Add to Buffer Install waterbar, Erosion Control Mulch	0.13	0.15
8-34	Low	Low	Low	Residential	Bare Soil, Shoreline Erosion	Stabilize Foot Path, Erosion Control Mulch Add to Buffer Erosion Control Mulch	0.43	0.50
8-35	Low	Low	Low	Residential	Bare Soil	Stabilize Foot Path Establish Buffer Erosion Control Mulch	0.21	0.25
9-12	Low	Low	Low	Residential	Shoreline Inadequate Vegetation	Add to Buffer, Reseed	0.64	0.75
9-14	Low	Low	Low	Residential	Lack of Shoreline Vegetation	Mulch Establish Buffer, Add to Buffer	3.83	4.50
9-15	Low	Low	Low	Residential	Bare Soil, Shoreline Inadequate Vegetation	Add to Buffer, Stop Raking, Reseed Erosion Control Mulch	0.11	0.13
8-02	Low	Low	Low	Residential	Bare Soil, Shoreline Erosion, Roof Runoff Erosion	Dripline Trench Establish Buffer, Reseed Erosion Control Mulch	0.21	0.25
1-03	Low	Low	Low	Residential	Bare Soil	Rain Garden	0.10	0.12
2-11	Low	Low	Low	Residential	lack of vegetation	Add to Buffer	0.21	0.25
3-26	Low	Low	Low	Driveway	erosion		0.53	0.63
8-14	Low	Low	Low	Residential	Bare Soil, Shoreline Erosion	Define Foot Path, Stabilize Foot Path, Erosion Control Mulch Add to Buffer	0.21	0.25
8-27	Low	Low	Low	Residential	Bare Soil	Stabilize Foot Path, Erosion Control Mulch Add to Buffer	0.11	0.13

Site	Impact	Cost	Technical Level	Land use	Issue	Recommendations	P Loading lb/yr	Sediment Loss tons/yr
6-28	Low	Low	Medium	Town Road	Culvert Clogged, Undersized, Unstable	Armor Inlet/Outlet, Remove Clog, Enlarge	0.10	0.12
3-18	Low	Low	Medium	Private Road	Shoulder Erosion	Install Waterbar, Install Rubber Razor	0.68	0.80
3-05	Low	Low	Medium	Private Road	Bare Soil	Erosion Control Mulch Dripline Trench Infiltration Trench	0.17	0.20
3-08	Low	Low	Medium	Private Road	Bare soil	Define Foot Path, Stabilize Foot Path, Install waterbar, Erosion Control Mulch	0.19	0.23
3-11	Low	Low	Medium	Private Road	Bare Soil, Winter Sand Shoreline Erosion	Erosion Control Mulch, Stabilize Foot Path Install waterbar, Erosion Control Mulch	0.02	0.02
7-03	Low	Low	Medium	Residential	Bare Soil, Shoreline Lack of Vegetation, Unstable Access, Erosion	Establish Buffer Install waterbar, Erosion Control Mulch	2.55	3.00
3-17	Low	Low	Medium	Private Road	Roof Runoff Erosion	Dripline Trench	0.04	0.05
3-24	Low	Low	Medium	Private Road	bare soil	Install Waterbar Install waterbar, Erosion Control Mulch Dripline Trench	0.16	0.19
3-25	Low	Low	Medium	Private Road	erosion	Install waterbar, Erosion Control Mulch	0.21	0.25
2-16	Low	Medium	Low	Residential	Bare Soil	Define Foot Path, Install waterbar, Erosion Control Mulch Establish Buffer Erosion Control Mulch	8.50	10.00
5-08	Low	Medium	Low	Residential	Bare Soil	Install Sediment Pools	0.03	0.04
8-05	Low	Medium	Low	Residential	Bare Soil	Install Waterbar Define Foot Path, Erosion Control Mulch Add to Buffer Erosion Control Mulch, Install waterbar	1.33	1.56
8-39	Low	Medium	Low	Residential	Bare Soil, Shoreline Inadequate Vegetation	Stabilize Foot Path Establish Buffer Erosion Control Mulch	1.91	2.25
6-32	Low	Medium	Low	Residential	erosion	Stabilize Foot Path, Infiltration Steps Stop Raking	0.19	0.23

Site	Impact	Cost	Technical Level	Land use	Issue	Recommendations	P Loading lb/yr	Sediment Loss tons/yr
8-10	Low	Medium	Low	Residential	Bare Soil	Define Foot Path, Stabilize Foot Path, Erosion Control Mulch Add to Buffer Erosion Control Mulch	1.28	1.50
8-36	Low	Medium	Low	Residential	Bare Soil	Erosion Control Mulch Add to Buffer Erosion Control Mulch	0.85	1.00
8-17	Low	Medium	Low	Residential	Bare Soil, Lack of Shoreline Vegetation	Define Foot Path Install waterbar, Erosion Control Mulch	1.70	2.00
9-03	Low	Medium	Medium	Residential	Culvert Crushed, Culvert Undersized, Soil Delta, Shoreline Inadequate Vegetation	Define Foot Path, Infiltration Steps Drywell Add to Buffer, Stop Raking Erosion Control Mulch	2.98	3.50
3-03	Low	Medium	Medium	Private Road	Ditch Erosion, Soil Delta	Establish Buffer Install waterbar, Erosion Control Mulch	10.63	12.50
4-08	Low	Medium	Medium	Driveway	Ditch Erosion, existing waterbars out letting to unstable slope	Install Waterbar, Install Detention Basin, Vegetate Shoulder Erosion Control Mulch	2.30	2.70
6-06	Low	Medium	Medium	Driveway	Shoulder Erosion, Shoreline Unstable Access	Add gravel, Build Up, Reshape/Crown, Install Waterbar	0.13	0.15
2-13	Low	Medium	Medium	Driveway	Shoulder Erosion	Vegetate Shoulder, Install Detention Basin	1.06	1.25
3-01	Low	Medium	Medium	Private Road	Shoulder Erosion, Bare Soil Shoreline Inadequate Vegetation, Shoreline Erosion	Add gravel Mulch	0.32	0.38
2-10	Low	Medium	Medium	Trail or Path	Bare Soil	Define Foot Path, Infiltration Steps, Install waterbar	19.13	22.50
2-15	Low	Medium	Medium	Residential	Bare Soil	Define Foot Path Establish Buffer, Add to Buffer Erosion Control Mulch	21.25	25.00
2-22	Low	Medium	Medium	Beach Access	Lack of Shoreline Vegetation	Reshape Ditch, Install Turnouts Reshape/Crown, Vegetate Shoulder	5.74	6.75
2-3	Low	Medium	Medium	Trail or Path	Bare Soil, Lack of Shoreline Vegetation	Define Foot Path, Install waterbar Establish Buffer, Stop Raking	21.25	25.00

Site	Impact	Cost	Technical Level	Land use	Issue	Recommendations	P Loading lb/yr	Sediment Loss tons/yr
2-5	Low	Medium	Medium	Residential	Bare Soil, Lack of Shoreline Vegetation	Define Foot Path Establish Buffer, Stop Raking, Reseed	10.63	12.50
3-04	Low	Medium	Medium	Private Road	erosion	Erosion Control ulch, Install waterbar M	1.02	1.20
3-07	Low	Medium	Medium	Private Road	Bare Soil	Install waterbar, Erosion Control Mulch	0.38	0.45
4-31	Low	Medium	Medium	Driveway	erosion	Install Check Dams, Install_Ditch Install Open Top Culvert, Install Waterbar, Install Rubber Razor	0.13	0.15
8-08	Low	Medium	Medium	Residential	Bare Soil, Soil Delta	Remove Invasive Plants	1.28	1.50
8-30	Low	Medium	Medium	Residential	Bare Soil	Add to Buffer	2.55	3.00
9-06	Low	Medium	Medium	Residential	Shoreline Lack of Vegetation, Unstable Access	Define Foot Path, Stabilize Foot Path Drywell Establish Buffer, Reseed	1.28	1.50
2-14	Low	Medium	Medium	Trail or Path	erosion	Stabilize Foot Path, Infiltration Steps	4.25	5.00
2-18	Low	Medium	Medium	Driveway	erosion	Install Rubber Razor	1.91	2.25
8-03	Low	Medium	Medium	Residential	Bare Soil	Infiltration Steps, Install waterbar, Erosion Control Mulch Dripline Trench Reseed Erosion Control Mulch	1.06	1.25
2-21	Low	Medium	High	Driveway	Culvert Clogged	Remove Clog Establish Buffer	0.85	1.00
8-06	Low	High	High	Private Road	Culvert Unstable, Undersized Shoulder Erosion Sheet	Armor Inlet/Outlet, Replace, Enlarge, Lengthen Add gravel	0.17	0.20
8-25	Low	High	High	Private Road	Culvert Undersized, Culvert Unstable	Armor Inlet/Outlet, Replace, Enlarge, Lengthen	0.06	0.08
8-19	Low	High	High	Residential	Bare Soil, Lack of Shoreline Vegetation	Establish Buffer Erosion Control Mulch	0.85	1.00

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Publications

A citizen's guide to Volunteer Lake Watershed Surveys. Maine DEP. 2011. 53 pgs. https://www.maine.gov/dep/land/watershed/materials/lakewsurveyguide.pdf

A Guide to Forming Road Associations. Maine DEP. 2020. 21 pgs. https://www.maine.gov/dep/land/watershed/road_assoc_guide_2020_edit.pdf

Gravel Road Maintenance Manual: A Guide for Landowners. Kennebec County SWCD and Maine DEP. 2016. 98 pgs. https://www.maine.gov/dep/land/watershed/camp/road/gravel_road_manual.pdf

Conservation Practices for Homeowners. Maine DEP and Portland Water District. 2006. 20 fact sheets. https://www.maine.gov/dep/land/watershed/materials.html

NH Homeowner's Guide to Stormwater Management. NHDES. 2019. 63 pgs. https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/2020-01/homeowner-guide-stormwater.pdf

NHDES - Vegetation Management for Water Quality. NHDES. 2020. 5 pgs. https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/2020-01/sp-5.pdf