

Beech Hill Pond Watershed Survey 2010



February 2011



**Hancock County Soil & Water
Conservation District**

Acknowledgments

The Beech Hill Pond Watershed Survey was completed as part of a “319” grant obtained by the Hancock County Soil & Water Conservation District

The volunteers were trained through the Watershed Stewards Program through the University of Maine Cooperative Extension Water Quality Office. This program provides 20 hours of education related to lake and watershed protection in exchange for an equivalent amount of time in volunteer service to protect their lake. Beech Hill Pond residents participated in the Watershed Stewards Program in 2010.

The following people were instrumental in the success of this survey:

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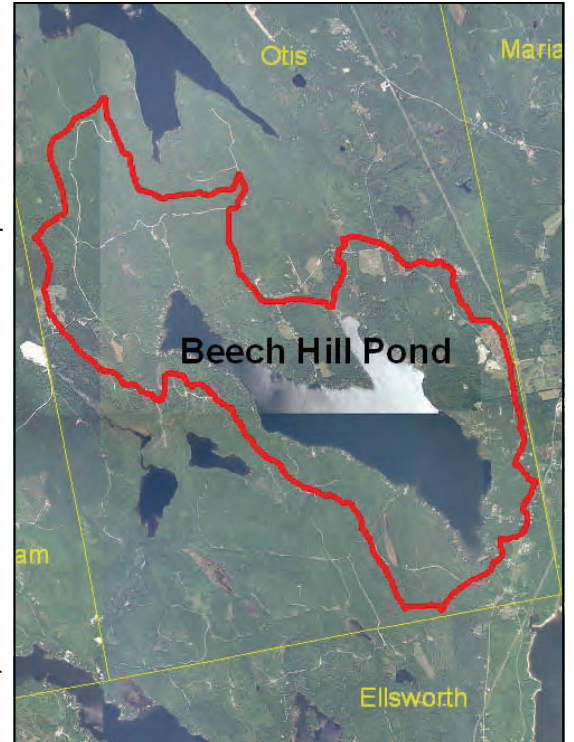
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The Hancock County Soil & Water Conservation District is an equal opportunity provider and employer.

Beech Hill Pond Watershed Information

Beech Hill Pond is a 1,422 acre lake located in Otis, Maine. The lake has a direct drainage area of 8.56 sq. mi. with a maximum depth of 104 feet, a mean depth of 44 feet, and a flushing rate of only 0.23 flushes per year (the average flushing rate for Maine lakes is 1-1.5 flushes per year). The low flushing rate of Beech Hill Pond makes the lake more sensitive to changes in its nutrient loading because it gives nutrients a chance to settle to the bottom and be recycled within the water column. The lake outlet, Beech Hill Stream, flows into Graham Lake. According to a local Registered Professional Forester, approximately 85% of the wooded watershed was severely cut around 15 years ago. Beech Hill Pond is currently listed on Maine DEP'S Nonpoint Source Priority Watersheds List most likely due to heavy development pressure in the watershed.



Beech Hill Pond is a popular recreation area with a public boat launch and beach about a mile north of the outlet on the West Shore Road. Swimming, boating, fishing, and floatplane flying are enjoyed by many residents who live on the lake and those that come to visit. The lake receives heavy fishing pressure, especially in the winter, for coldwater sport fish like lake trout and landlocked salmon. According to Maine Inland Fisheries and Wildlife, heavy ice fishing pressure was estimated at 2,300 angler-days in 1991. The Maine State Record Lake Trout, 31 pounds 8 ounces, was caught in Beech Hill Pond in 1958. The Department of Inland Fisheries and Wildlife has stocked Beech Hill Pond since 1989 with landlocked salmon, lake trout, and brook trout.

The lake is also home to several families of loons and bald eagles. According to the Maine Audubon Society Loon Count, there was an average of approximately 11 adult loons and 1 chick yearly from 1989 to 2008, with 14 reported adults in 2007 and 2008. Residents also report that there are two nesting families of bald eagles on the lake.

The lakeshore is 90% developed with a combination of summer camps and year-round residences, with an estimated 30- 40% increase from seasonal camps to year-round residences in the last 10 years. One major private road services shoreline residences on the west side of the lake and a network of private camp roads provides access to the east and north areas. The increasing development around the lake over the last 60 years has created many changes in the shoreline and access roads. As the shoreline has become more developed, the roads have experienced more traffic and erosion issues.

According to the "Summary Report of Conditions in Hancock County", prepared by the Hancock County Planning Commission, from 1970-2000 Otis' population grew by 340%. The projected population for 2015 predicts Otis' population to continue to grow by over 48%. This report also shows that by 2015, the projected number of new homes that will be constructed in Otis will increase by over 63%. With this population and development increase, there is an obvious high potential for increased stress to the water quality of Beech Hill Pond.

In 2008, watershed residents formed the Beech Hill Pond Lake Association (BHPLA). This group has 60 members, a Board of Supervisors, and recently finished putting together their by-laws. The goal of the BHPLA is "To

Watershed:
All the land that surrounds a lake that drains or sheds its water into the lake through streams, ditches, directly over the ground surface, or through ground water

Beech Hill Pond Lake Association:
"To educate and inform members how to preserve and improve Beech Hill Pond and its watershed for quality use by future generations".

educate and inform members how to preserve and improve Beech Hill Pond and its watershed for quality use by future generations.” Since 2007, watershed volunteers have been active in monitoring for invasive aquatic plants and in 2008, they participated in e-coli bacteria testing of 4 sites around the lake. In response to requests and strong support from the Beech Hill Pond Lake Association, in 2010, a Watershed Stewards Program was offered to residents of the Beech Hill Pond watershed through the University of Maine Cooperative Extension Water Quality Program.

What is Threatening Beech Hill Pond Water Quality?

The greatest threat to water quality in Beech Hill Pond, which is the same for all Maine lakes, is polluted runoff. During and after storms, soil and nutrients like phosphorus and nitrogen wash into the lake from the surrounding landscape via ditches, streams and overland flow.

In an undeveloped, forested watershed stormwater runoff is slowed and filtered by trees, shrubs and other vegetation. It then filters through the soil and soaks into the uneven forest floor. In a developed watershed, storm water velocity increases on impervious surfaces like rooftops, compacted soil, gravel camp roads and pavement, and does not always receive the filtering treatment the forest once provided.

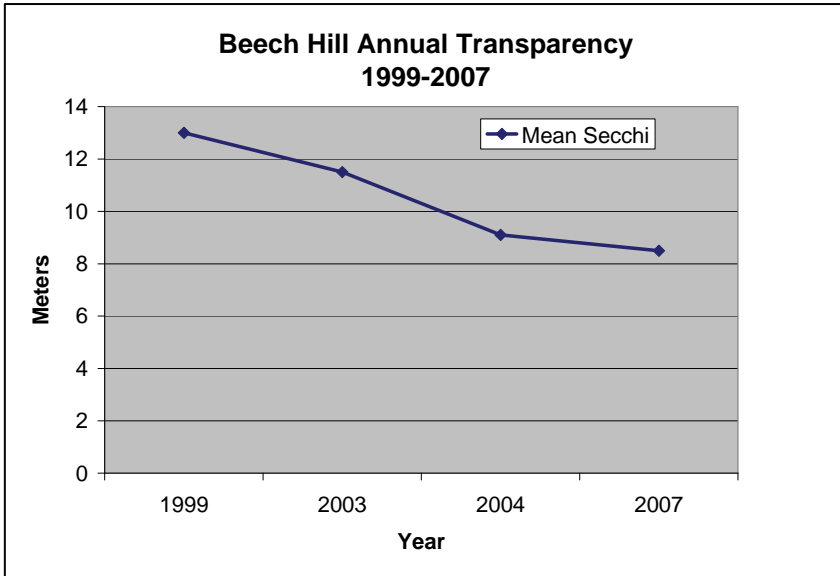


The nutrients in stormwater runoff can be bad news for lakes. Phosphorus, a nutrient that is common on land, is a primary food for all plants, including algae. In natural conditions, the scarcity of phosphorus in a lake limits algae growth. However, when a lake receives extra phosphorus from the watershed, algae growth increases dramatically.

Sometimes this growth causes choking algae blooms but more often it results in small, insidious changes in water quality that, over time, damage the ecology, aesthetics, and economy of lakes. Phosphorus is difficult to measure directly as it occurs in nonpoint source pollution. However, phosphorus is found attached to soil particles, and by documenting soil erosion in the watershed, we can gain an understanding of sources of phosphorus to the lake. Other sources of phosphorus may include agricultural runoff, fertilizers (on agricultural land and on residential lawn areas), and sewage.

The recent transformation of many summer cottages into year round residences, poorly built and inadequately maintained camp roads, increased traffic, and aging septic systems are all putting significant pressure on the water quality of Beech Hill Pond. Steep topography on the west side of lake also contributes to erosion issues. All of

these factors point towards an increasing threat of NPS pollution entering Beech Hill Pond from developed areas in the watershed. It is extremely important to document these NPS issues and work towards correcting them before the water quality of Beech Hill Pond declines substantially.



Water quality data has been collected by the Maine DEP and the Volunteer Lake Monitoring Program for Beech Hill Pond since 1974. The water quality of Beech Hill Pond is considered to be above average and the potential for nuisance algae blooms is low. However, recorded secchi readings from the last ten years show a decline in water quality.

As you can see from the graph, now is the time to identify the sources of NPS pollution so that we can start to work to correct them while they are still manageable.

Purpose of the Watershed Survey

The primary purpose of the watershed survey was to identify and prioritize existing sources of polluted runoff in the Beech Hill Pond watershed. However, of equal importance was to:

- Raise public awareness of the connection between land use and water quality
- Raise public awareness of the impact of polluted runoff
- Use the information gathered as one component of a long term lake protection strategy
- Define specific areas within the watershed that need improvement (for example, roadways that are conveying polluted runoff to the lake)
- Make general recommendations to landowners for fixing erosion problems on their properties
- Identify areas where lakefront buffers need to be installed or enhanced

Local citizen participation was essential in completing the watershed survey and will continue to be necessary for ongoing protection efforts.

Methods

The Watershed Survey is a standard method of documenting soil erosion in lake watersheds in Maine. While techniques and survey documentation may vary, volunteers:

- Walk areas of the watershed that have been impacted by humans
- Look for eroding soil
- Determine if the eroding soil can be transported to the lake, a tributary stream, or a ditch
- Document the problem
- Suggest methods to remediate the problem

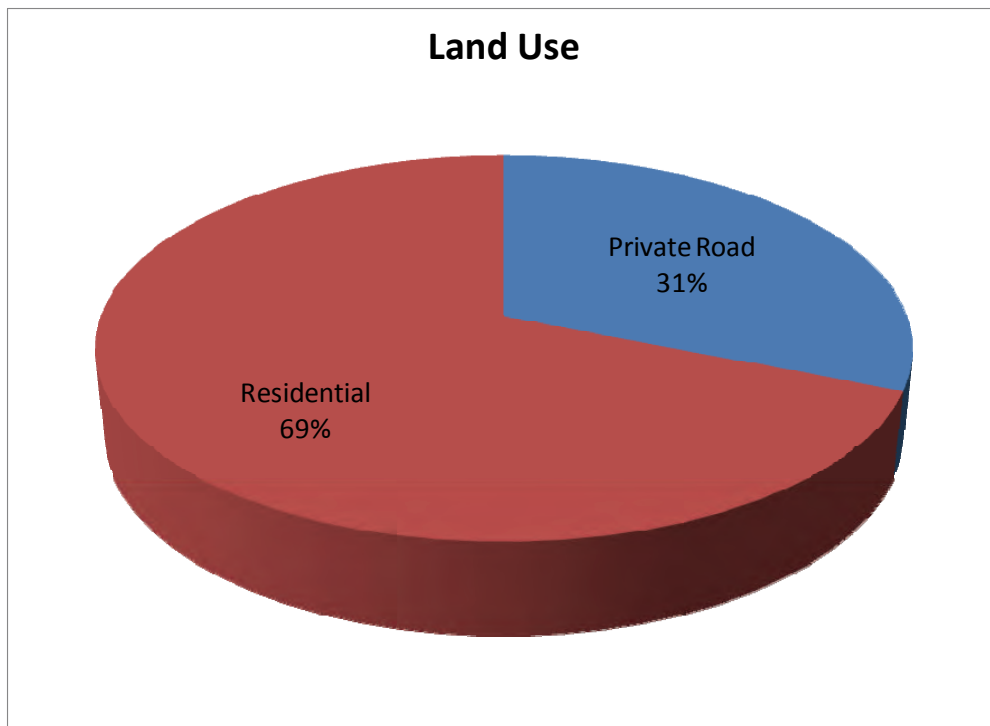


A volunteer helps to document erosion issues in the Beech Hill Pond watershed.

Water quality experts from the University of Maine Cooperative Extension and Hancock County Soil and Water Conservation District reviewed and updated all of the volunteer data.

Watershed Survey Findings

Volunteers and technical staff documented 167 sites within the Beech Hill Pond Watershed that threaten the lake (see Appendix B for the full site list). Out of these 167 sites 52 sites were Private Road issues and 115 sites were classified as Residential issues. This is a fairly large amount of sites for the size of the Beech Hill Pond Watershed.



An eroded channel going directly into Beech Hill Pond.



Dirty water during a rainstorm running over a bank into the lake.

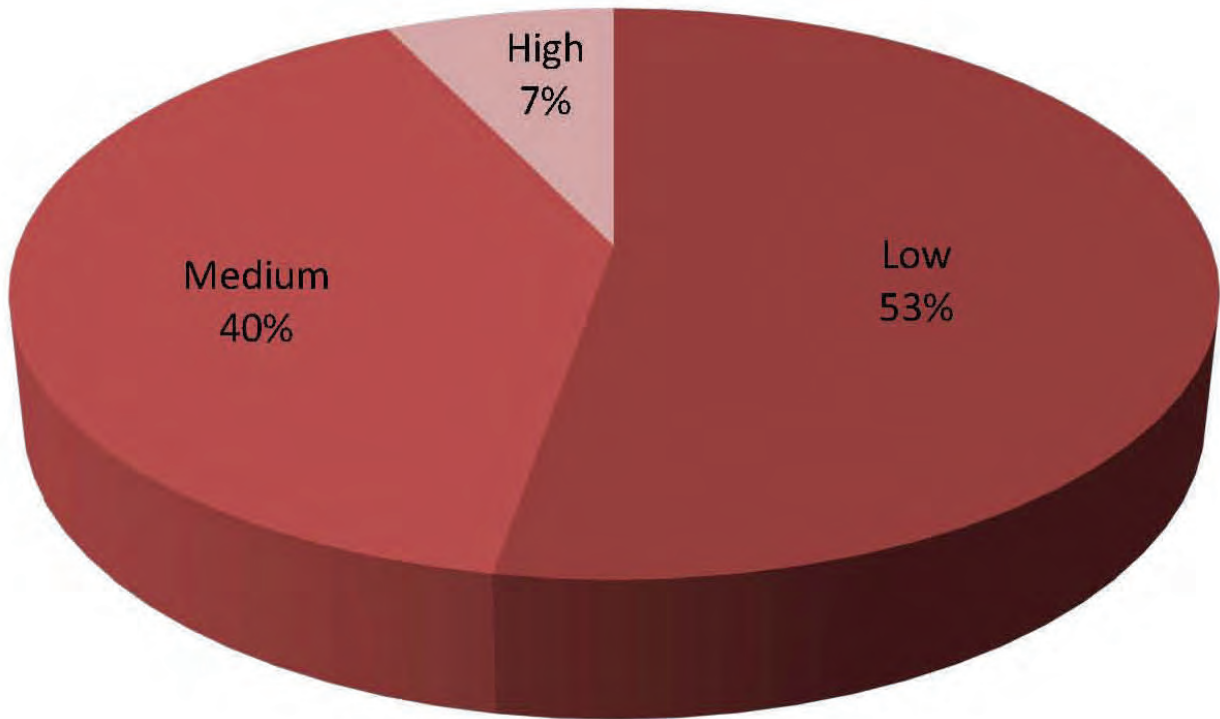
Watershed Survey Findings

Impact to the Lake

Sites are given an “Impact to the Lake” rating based on the amount of erosion, the proximity of that erosion to a ditch, stream, or the lake, and evidence that eroded soil is moving off site toward the water.

Out of the 167 total sites, 88 were rated as Low Priority, 67 as Medium Priority, and 12 were rated as High Priority in terms of Impact to the Lake.

Impact to the Lake



The findings show that most of the documented sites in the watershed are low and medium impact sites. Because of these multiple sources, many sites will need to be addressed to make a significant impact on reducing erosion issues.

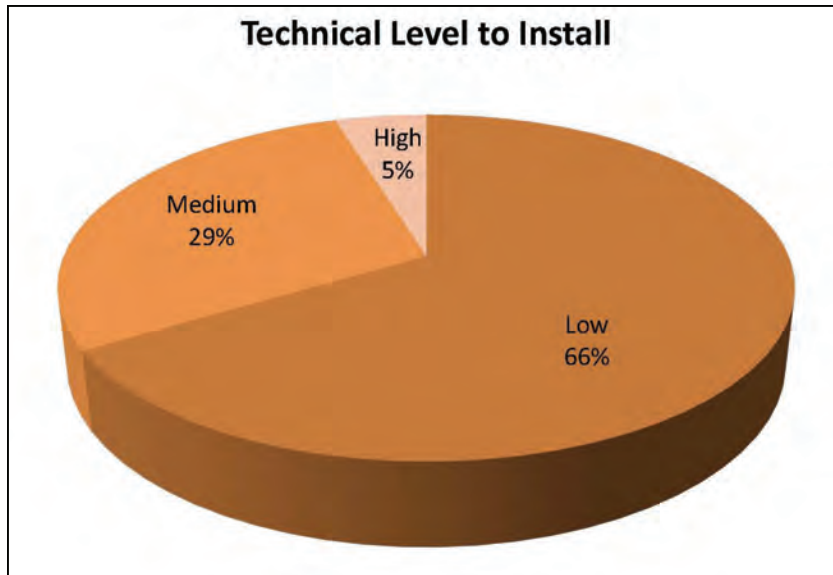


An eroding stream channel full of gravel.

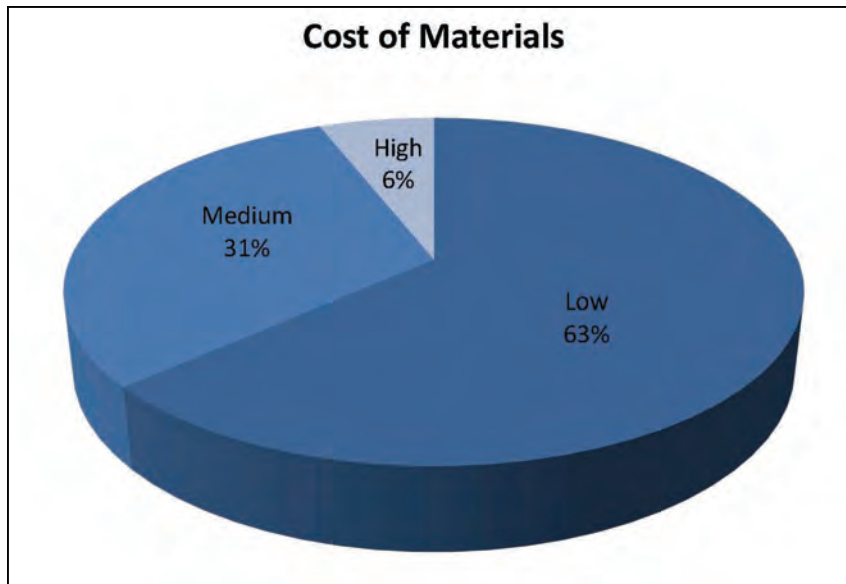
Technical Level to Install & Cost of Materials

Sites are also given ratings on the technical level required to install fixes and how much the cost for materials would be for the fixes.

Out of the total 167 sites that were documented, 111 were designated as having a low level of expertise needed (meaning a homeowner or volunteer could install the fixes with little or no assistance), 48 a medium level of expertise (meaning a person with erosion control training could supervise fixes), and 8 were high priority (meaning the site would probably require an engineered design).



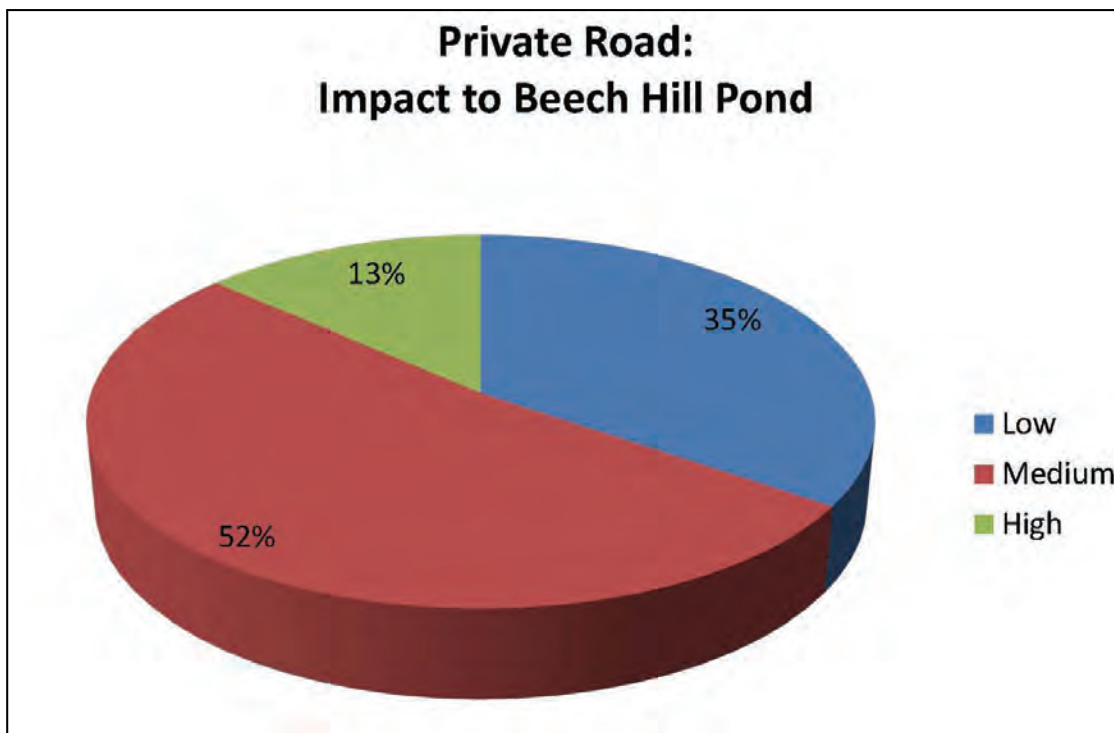
For cost of materials, a low rating is given if the project will be approximately \$500 or less, a medium rating is given to sites with an approximate cost of \$500-\$2,500, and a high rating is given for projects costing greater than \$2,500. Of the 167 total sites 106 were rated low for cost of materials, 51 sites were rated medium, and 10 were rated as high.



Looking at the information for the technical level needed to install fixes and the estimated cost, most sites can easily be fixed by homeowners, volunteers, or road associations with a relatively low cost. This is good news for trying to get a majority of sites fixed around the watershed.

Private Road Findings

52 of the 167 sites were found on Private Roads. Out of these 52 Private Road sites, 45 sites were low or medium priorities for their impacts to Beech Hill Pond.



Some of the common problems identified were:

- Unstable culverts (inadequate size, not functioning, unstable inlets and outlets)
- Ditch and shoulder erosion
- Grader berms left behind from plowing or grading that prevent water from flowing off the road
- Surface erosion



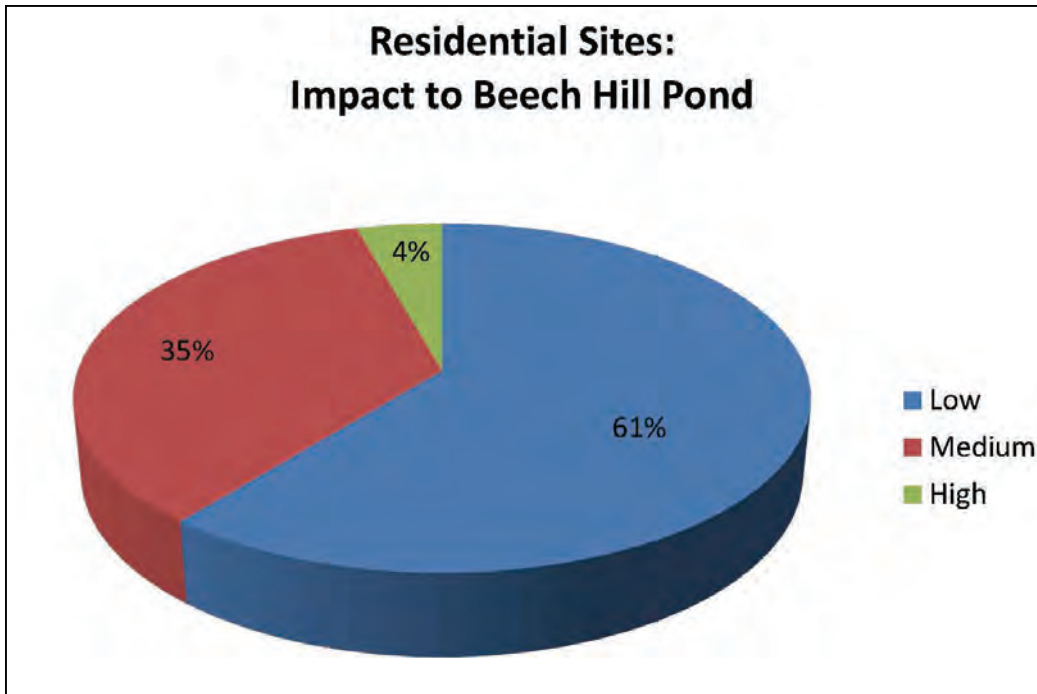
Recommended solutions:

- Install new culverts and stabilize the ends with stone
- Clean, reshape, and armour ditches with angular stone or vegetation
- Remove grader berms
- Crown and reshape roads to allow for proper drainage



Residential Findings

115 of the 167 sites were found at Residential Sites. Out of these 115 Residential sites, 110 sites were low or medium priorities for their potential impacts to Beech Hill Pond.



Some of the common problems identified were:

- Inadequate or lack of shoreline buffers (94 of the 115 residential sites)
- Surface erosion or bare/open soil areas
- Driveway erosion issues
- Uncovered soil piles

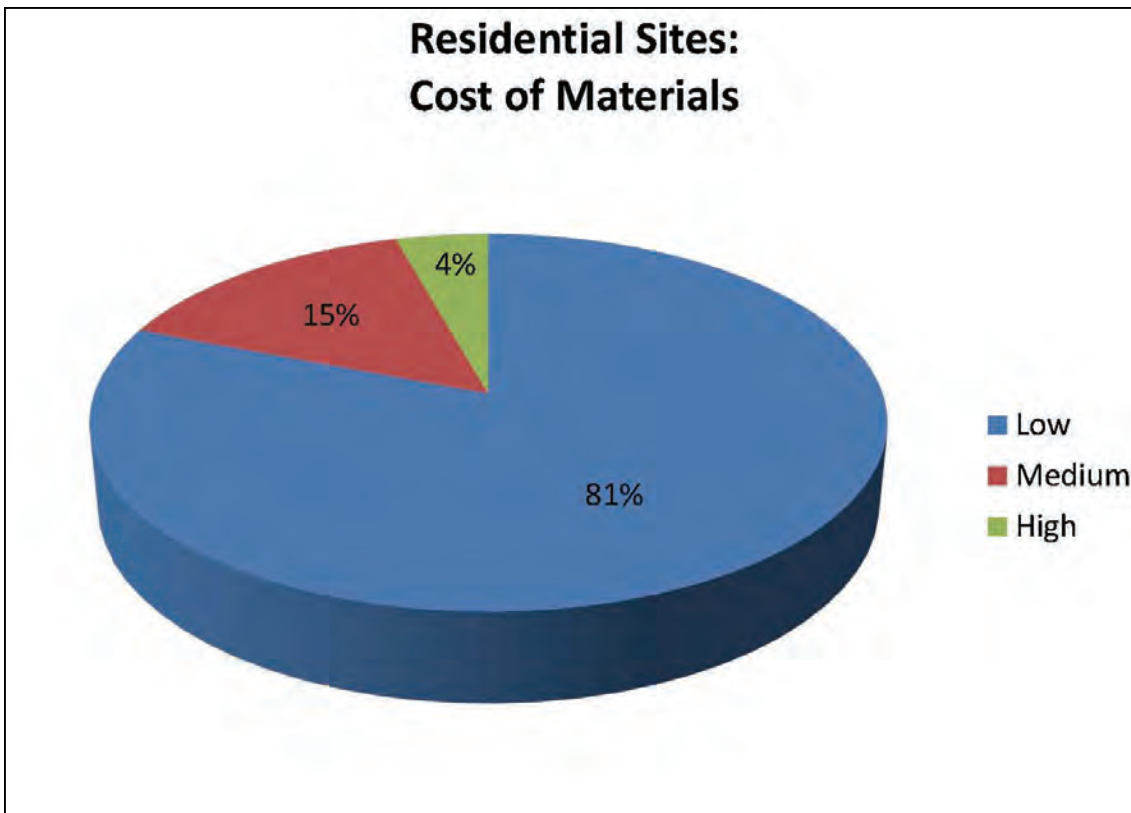
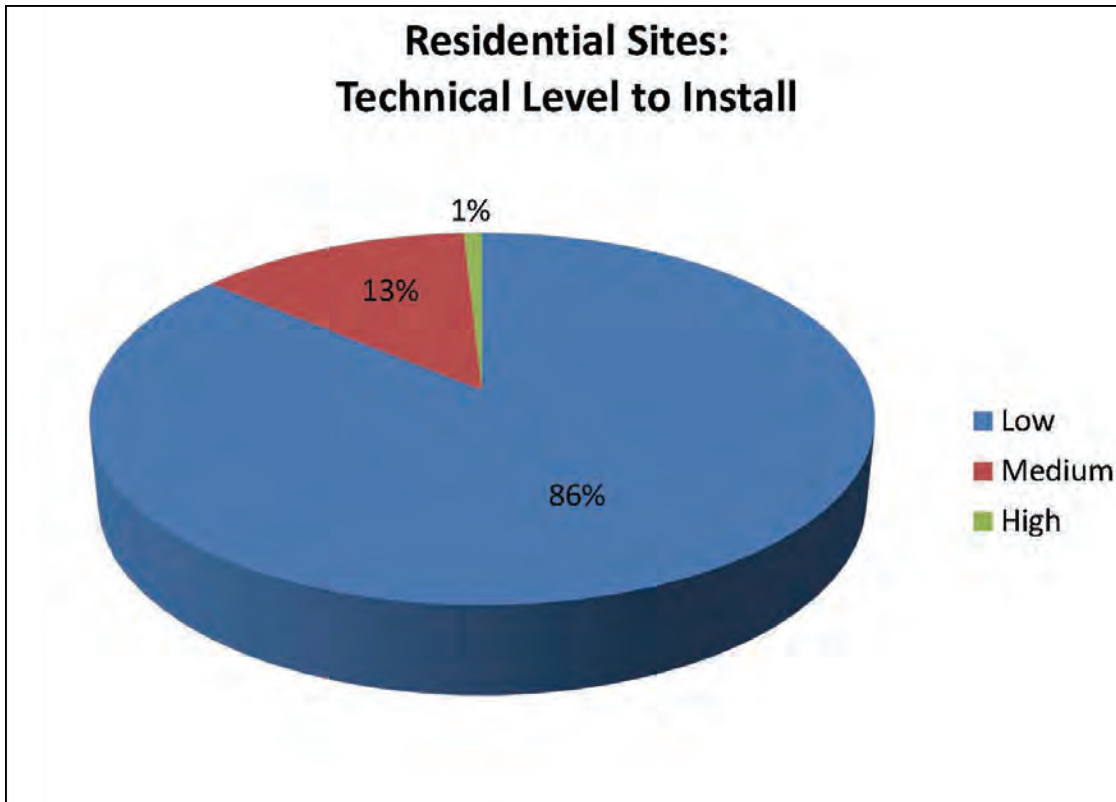
Recommended solutions:

- Install vegetated buffers
- Crown driveways
- Vegetate or mulch open areas
- Cover soil piles with tarps or remove piles



Residential Findings

114 out of 115 of the Residential Sites were found to have a low or medium level of technical knowledge needed to install the fixes and 110 of the Residential Sites had a low or medium predicted cost to fix.



Residential Findings

94 of the total 110 Residential Sites were observed to lack or have an inadequate vegetated buffer along the shoreline. The majority of these sites were documented at a medium or low impact level. However, because of the number of sites that were lacking an adequate buffer, the cumulative impacts could have a detrimental effect on Beech Hill Pond.

What Makes a Good Buffer?

Grasses are not good buffer plants. First, they are relatively impervious—that is, water will flow over the top of grasses, and not soak into the ground. Second, grasses do not fill in completely, and there is opportunity for bare soil patches to contribute sediment to runoff. Additionally, many people over-fertilize grasses, and that fertilizer that makes the grass green may do the same for your lake!

It is important to note that buffers of shrubs and trees do a much more effective job than bare ground or grass at keeping stormwater pollution from entering lakes.

The best buffer is one with five parts— trees, shrubs, understory, groundcover, and a “duff” layer of decomposing organic matter. Trees help break the erosive energy of raindrops, shrubs and an understory have extensive root systems to hold the soil, and a groundcover along with a duff layer will act as a sponge and filter the water. Deep shrub and tree roots also help hold the shoreline in place.

Buffers can be installed inexpensively. You can either stop mowing and raking to the water’s edge and let plants grow up naturally, or you can plant the area with native trees and shrubs. Before doing any planting along the shoreline, always first check with your local Code Enforcement Officer to determine if any permits are needed from the town or state.



Summary of Watershed Survey Findings

By far the largest NPS problem found in the watershed is a poor vegetative buffer along the shoreline. Planting a buffer requires minimum knowledge and relatively small cost. Educational outreach for homeowners should focus on how a shoreline buffer can benefit the lake and their properties.

The next largest issue in the watershed are private road issues including general maintenance problems (grader berms, surface erosion) and unstable culverts. Education for these issues should be given to road commissioners and road association members on how to properly maintain a road. Having a properly maintained road is not only good for the lake, but also for the people who use the road because there will be less wear and tear on their vehicles, the road will be useable year-round, and emergency personnel will be able to reach them easier. Also, the Maine Department of Environmental Protection estimates that \$1 spent on road maintenance saves \$15 worth of repairs. So, road association members will also be saving money in the future, if they work to maintain their road today.



Next Steps: Where Do We Go From Here?

Repairing the problem sites identified in this survey will require efforts by individuals, road associations, and municipal officials.

Individuals

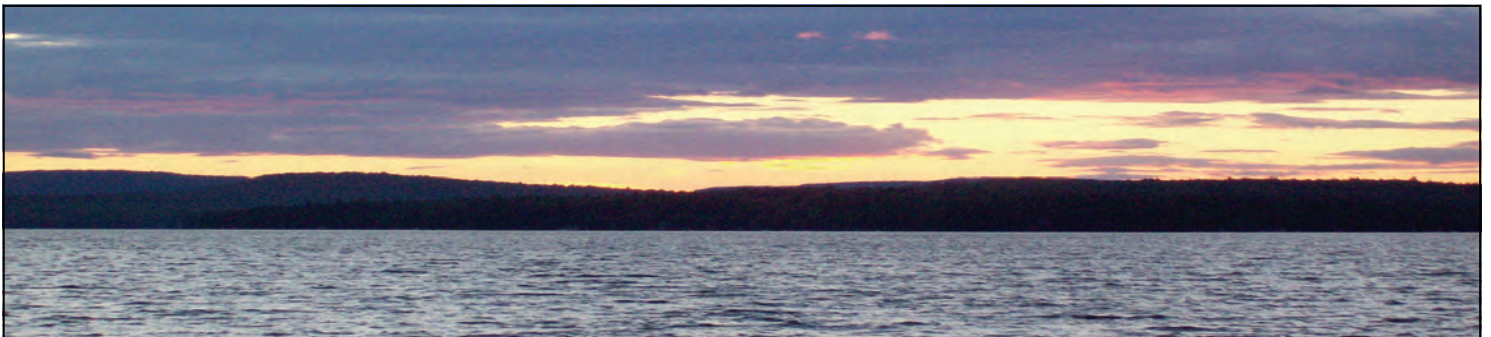
- ◆ Prevent runoff from washing sediment into the lake. Detain runoff in depressions or divert flow to vegetated areas. Call the Hancock County SWCD or DEP for assistance.
- ◆ Minimize the amount of cleared land and road surfaces on your property.
- ◆ Stop mowing and raking, and let lawn and raked areas revert back to natural plants. Deep shrub and tree roots help hold the shoreline in place and prevent erosion.
- ◆ Avoid exposing bare soil. Seed and mulch bare areas.
- ◆ Call your Code Enforcement Officer before cutting vegetation within 250 feet of the shore.
- ◆ Maintain septic systems properly. Pump septic tanks (every 2 to 3 years for year round residences; 4-5 years if seasonal) and upgrade marginal systems.

Road Associations (or private roads without associations)

- ◆ Minimize road runoff by doing regular, comprehensive maintenance. Form a road association if one does not already exist. Call the Maine DEP at 287-3901 for more information.
- ◆ Get a copy of “Camp Road Maintenance Manual – A Guide for Landowners.” This reference is a must for anyone managing a gravel road. Call the Maine DEP at 822-6300 to order a copy, or download a PDF at <http://www.state.me.us/dep/blwq/docwatershed/camproad.pdf>.
- ◆ For more extensive problems, seek free technical help. Contact the Hancock County SWCD or Maine DEP to request technical assistance.

Municipal Officials

- ◆ Enforce shoreland zoning ordinances to assure full protection of Beech Hill Pond.
- ◆ Conduct regular maintenance on town roads to control erosion issues to set a good example for the private road associations.
- ◆ Participate in and support long term watershed management projects.
- ◆ Promote training for road crews, planning boards and conservation commissions.



Where Do I Get More Information?

Contacts

Hancock County Soil and Water Conservation District

190 Bangor Road, Ellsworth, Maine 04605

(207) 667-8663

www.ellsworthme.org/soilandwater

Offers technical assistance for erosion issues, assistance with watershed planning and survey work, environmental education, assistance with road issues, seminars and training sessions, and education on the use of conservation practices.

University of Maine Cooperative Extension

Water Quality Office—495 College Ave, Orono, Maine 04473

(207) 581-2971

extension.umaine.edu/waterquality

Provides water/nonpoint source pollution-related education programs for lakefront residents statewide.

Maine Department of Environmental Protection (local office)

106 Hogan Road, Bangor, Maine 04401

Phone: (207) 941-4570

www.maine.gov/dep

Provides permit applications and assistance, numerous reference materials, technical assistance, environmental education, project funding opportunities, and stewardship activities for lakes.



Publications

Kennebec County SWCD and Maine DEP. June, 2010. *Gravel Road Maintenance Manual: A Guide for Landowners on Camp and Other Gravel Roads.* 78 pgs. Available online at <http://www.ellsworthme.org/soilandwater/Publications.htm>

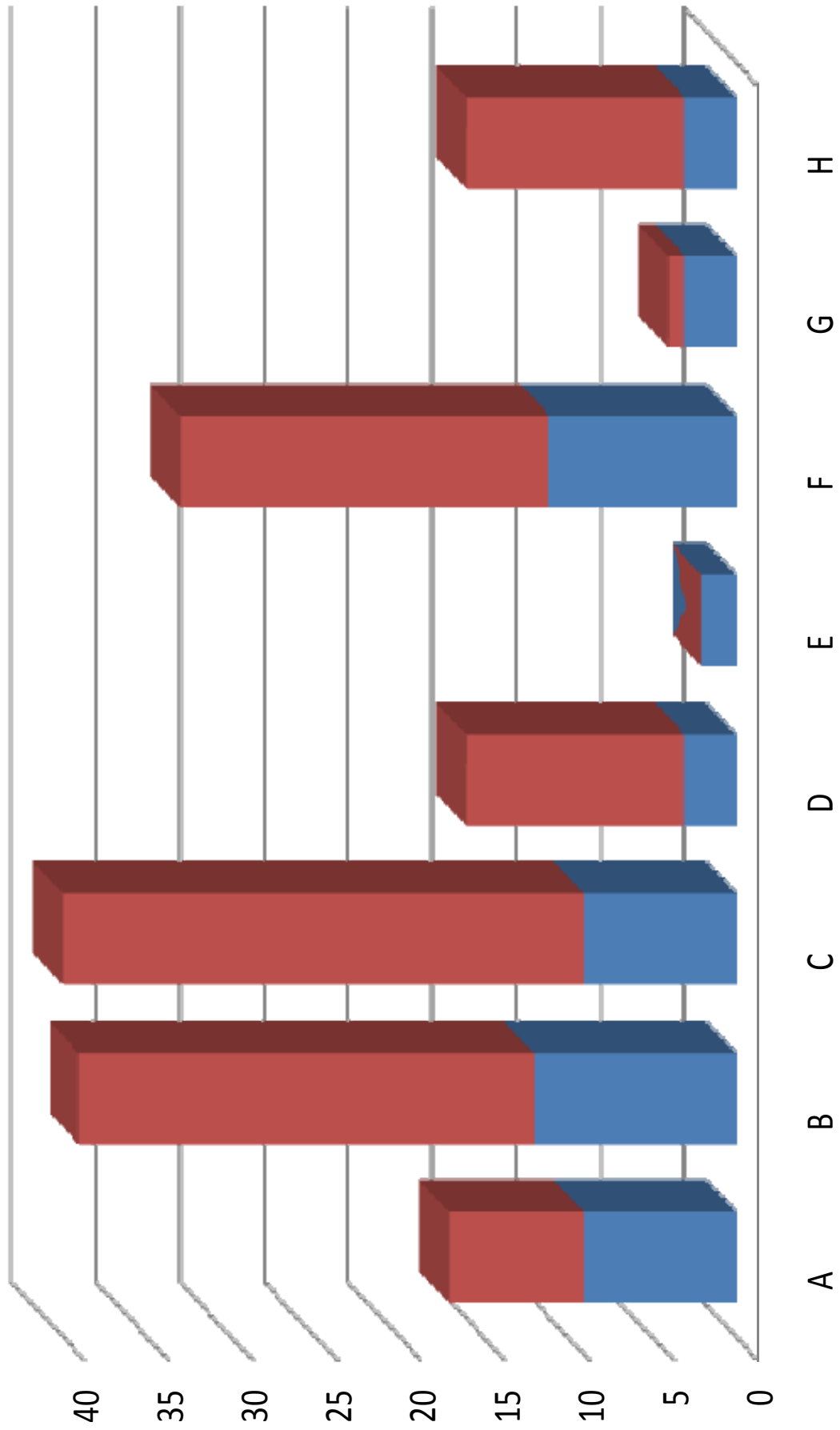
Portland Water District. 2006. Brochures and Environmental Fact Sheets. Available online at <http://www.pwd.org/news/publications.php>

University of Maine Cooperative Extension. *Gardening to Conserve Maine's Native Landscape: Plants to Use and to Avoid.* Bulletin #2500. June, 1999. Folded leaflet. <http://extension.umaine.edu/publications/2500e/>

University of Maine Cooperative Extension. *Lake*A*Syst.* Bulletin #7111. 2001. 24 pgs. Available online at <http://extension.umaine.edu/waterquality/lake-a-syst/>

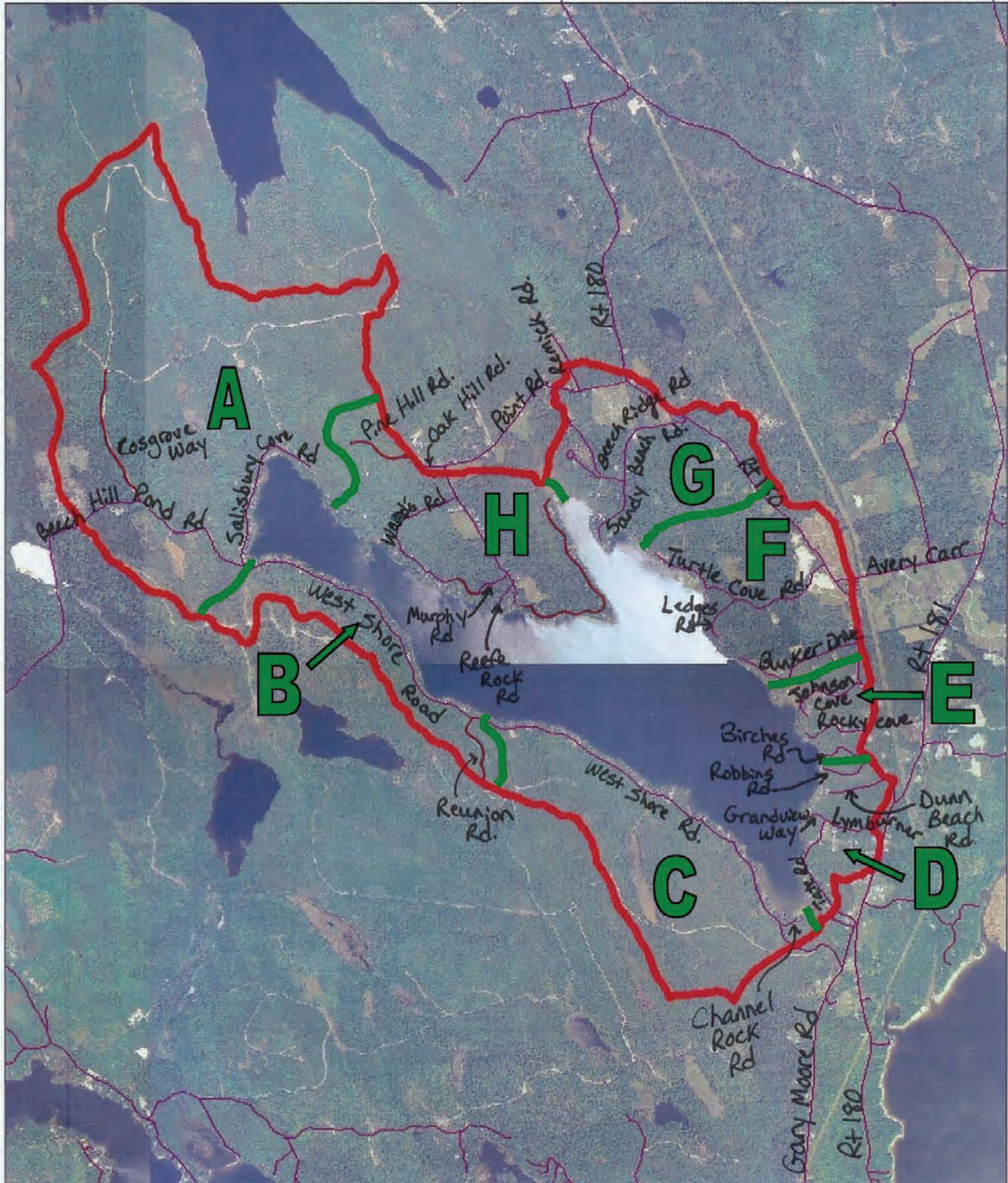
York County SWCD and Maine DEP. October, 2009. *A Guide to Forming Road Associations.* 24 pgs. Available online at <http://www.ellsworthme.org/soilandwater/Publications.htm>

Number and Type of Site by Watershed Survey Section



Appendix A:

Beech Hill Watershed Survey Sections



Appendix B: Beech Hill Pond Watershed Survey Site List

Sector & Site	Location	Land Use	Description	Recommendations	Impact	Technical level	Cost of materials
A00	Cosgrove Way	Private Road	Slight surface erosion towards bridge	Install runoff diverters before and after bridge	Med	Low	Low
A01	Cosgrove Way	Private Road	Road side berm, water channeling on side of road causing moderate surface erosion	Remove berms and crown road so water drains off side into vegetation	Low	Med	Med
A02	Cosgrove Way	Private Road	Bank failure with moderate erosion sloping down to road	Reshape embankment/ditching and vegetate	Low	Med	Med
A03	Cosgrove Way ext.	Private Road	Severe surface erosion and bare soil	Add new surface material (gravel), build up road, crown and grade, install runoff diverters on slope towards intersection	Low	High	High
A04	Cosgrove Way ext.	Residential	Severe shoulder erosion and slight surface erosion on driveway	Riprap or vegetate driveway shoulder, crown driveway	Low	Med	Med
A05	Beech Hill Pond Rd	Private Road	Slight to moderate surface erosion, road side berm	Build up & grade road, Remove berms, install runoff diverters	Low	Med	Med
A06	Salisbury Cove Rd	Residential	Slight road shoulder, surface, and ditch erosion, and berm on steep driveway	Remove berms, reshape/crown road	Med	Med	Med
A07	Salisbury Cove Rd	Private Road	Slight road shoulder and surface erosion, road side berm from grader, bare soil	Remove berms, build up road and reshape/crown, install ditching	Med	Med	Med
A08	Salisbury Cove Rd	Private Road	Unstable culvert inlet/outlet, slight ditch & road shoulder erosion, road side berm	Remove berms, build up road (new gravel) crown road, install runoff diverters, stabilize culvert inlet/outlet with stone	Med	Med	Med
A09	Beech Hill Pond Rd	Private Road	Unstable culvert inlet/outlet, moderate ditch and road shoulder erosion, slight surface erosion, road side berm from grader	Remove berms, install runoff diverters, stabilize inlet/outlet by armoring with stone, grade road	Low	Med	Med
A10	Salisbury Cove Rd	Private Road	Slight to moderate surface & ditch erosion	Build up road, add new surface material (gravel), reshape/crown road, reshape & vegetate ditch	Med	Med	Med
A11	Salisbury Cove Rd	Residential	Lack of buffer	Establish buffer	Med	Low	Low
A12	Salisbury Cove Rd	Residential	Lack of buffer	Establish buffer	Med	Low	Low

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A13	Salisbury Cove Rd	Residential	Lack of buffer	Establish buffer	Med	Low	Low
A14	Salisbury Cove Rd	Residential	Lack of buffer	Establish buffer	Med	Low	Low
A15	Salisbury Cove Rd	Residential	Lack of buffer	Establish buffer	Med	Low	Low
A16	Salisbury Cove Rd	Residential	Lack of buffer	Establish buffer	Med	Low	Low
B00	West Shore Rd	Private Road	Moderate ditch and road shoulder erosion	Add new surface material (gravel), install runoff diverters, armor ditch with stone	Med	Med	Med
B01	West Shore Rd	Residential	Lack of buffer	Establish buffer, define foot path	Low	Low	Low
B02	West Shore Rd	Residential	Unstable culvert, slight surface erosion, bare soil, inadequate buffer & shoreline erosion	Stabilize culvert inlet/outlet, enhance buffer, vegetate bare soil	Low	Low	Low
B03	West Shore Rd	Residential	Lack of buffer	Establish buffer	Low	Low	Low
B04	West Shore Rd	Residential	Lack of buffer	Establish buffer	Low	Low	Low
B05	West Shore Rd	Residential	Lack of buffer	Establish buffer	Low	Low	Low
B06	West Shore Rd	Residential	Inadequate buffer	Enhance buffer	Low	Low	Low
B07	West Shore Rd	Private Road	Slight ditch erosion and bank failure, slight road shoulder and surface erosion, bare soil	Vegetate road shoulder, reshape ditch	Med	Med	Med
B08	West Shore Rd	Residential	Lack of buffer	Establish buffer, define foot path	Low	Low	Low
B09	West Shore Rd	Private Road	Clogged culvert, slight ditch erosion, runoff from road causing moderate surface erosion on driveway	Remove clog, install plunge pool	Low	Low	Low
B10	West Shore Rd	Residential	Lack of buffer	Establish buffer	Low	Low	Low
B11	West Shore Rd	Residential	Slight shoulder and surface erosion on driveway, lack of buffer	Establish buffer, build up (& define) driveway, vegetate bare areas, & define walkway	Med	Low	Med
B12	West Shore Rd	Residential	Lack of buffer	Establish buffer	Low	Low	Low
B13	West Shore Rd	Residential	Moderate surface erosion on driveway, lack of buffer	Add new gravel on driveway, install runoff diverter, establish buffer, vegetate and define footpath	Med	Low	Med
B14	West Shore Rd	Private Road	Unstable culvert inlet/outlet, severe ditch erosion, moderate surface erosion, delta in stream	Install runoff diverters across road, install plunge pool at outlet, stabilize ditch/inlet/outlet with stone	High	Med	Med

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B15	West Shore Rd	Residential	Lack of buffer	Establish buffer	Low	Low	Low
B16	West Shore Rd	Residential	Slight surface erosion, bare soil, inadequate buffer & shoreline erosion	Enhance buffer, vegetate bare & eroding areas, install waterbar on driveway	Low	Low	Low
B17	West Shore Rd	Residential	Shoreline erosion	Riprap or vegetate shoreline	Low	Low	Low
B18	West Shore Rd	Private Road	Unstable culvert inlet/outlet, moderate ditch and surface erosion	Stabilize culvert inlet/outlet, install plunge pool	Med	Med	Med
B19	West Shore Rd	Residential	Lack of buffer	Establish buffer	Low	Low	Low
B20	West Shore Rd	Residential	Slight surface erosion, bare soil, lack of buffer, unstable access	Establish/terrace buffer, vegetate or mulch bare areas	Med	Low	Low
B21	West Shore Rd	Private Road	Ditch bank failure, moderate surface erosion	Vegetate shoulder and ditch	Med	Low	Low
B22	West Shore Rd	Residential	Inadequate buffer & undercut shoreline	Enhance buffer, riprap/vegetate shoreline	Low	Low	Med
B23	West Shore Rd	Residential	Slight driveway surface erosion	Install runoff diverter	Low	Low	Low
B24	West Shore Rd	Residential	Moderate surface erosion, bare soil, undercut & eroding shoreline	Riprap shoreline, vegetate bare and eroding areas, install runoff diverter across driveway	Low	Low	Low
B25	West Shore Rd	Residential	Unstable culvert inlet/outlet, moderate ditch erosion	Install runoff diverters, install plunge pool & armor with stone	Low	Low	Low
B26	West Shore Rd	Residential	Severe surface erosion on path and bare soil	Build steps & define pathway	Med	Med	Med
B27	West Shore Rd	Residential	Uncovered soil pile	Cover or remove pile	Low	Low	Low
B28	West Shore Rd	Private Road	Moderate road shoulder erosion, slight surface erosion	Install runoff diverter, armor ditch with stone	Low	Low	Med
B29	West Shore Rd	Residential	Bare soil (new parking lot construction?)	Vegetate bare soil, or cover with gravel for parking	Low	Low	Low
B30	West Shore Rd	Private Road	Bank failure with moderate erosion sloping down to road	Vegetate and reshape ditch (trees may need to be taken down)	Med	High	Med
B31	West Shore Rd	Residential	Inadequate buffer	Enhance buffer	Low	Low	Low
B32	West Shore Rd	Private Road	Unstable culvert inlet/outlet, moderate ditch and surface erosion	Stabilize culvert inlet/outlet, install plunge pool, vegetate or armor ditch with stone, reshape ditch	Med	Med	Med

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Sector & Site	Location	Land Use	Description	Recommendations	Impact	Technical level	Cost of materials
B33	West Shore Rd	Private Road	Inadequate ditch size, slight surface erosion	Reshape ditch	Med	Med	Med
B34	West Shore Rd	Residential	Unstable culvert outlet with severe ditch erosion along outlet stream (homeowners installed extra length of culvert to avoid erosion, but appears dysfunctional); some surface and shoreline erosion as well	Remove extra length of culvert, install plunge pool and stabilize with angular rock; vegetate ditch.	High	Med	Med
B35	West Shore Rd	Residential	Uncovered soil pile, shoreline erosion	Riprap/vegetate shoreline, cover or remove soil pile	Low	Low	Low
B36	West Shore Rd	Residential	Shoreline erosion	Enhance buffer, vegetate bare & eroding areas	Low	Low	Low
B37	West Shore Rd	Private Road	Unstable culvert outlet	Install plunge pool, armor outlet with stone	Med	Low	Low
B38	Reunion Rd	Private Road	Slight surface erosion on down hill towards lake	Grade road	Low	Med	Low
C00	West Shore Rd	Residential	Uncovered soil pile 15' from shoreline	Spread and vegetate, or cover	Low	Low	Low
C01	West Shore Rd	Residential	Slight surface erosion, lack of buffer	Establish buffer	Low	Low	Low
C02	West Shore Rd	Residential	Slight surface erosion, lack of buffer	Establish buffer, install runoff diverter on driveway	Low	Low	Low
C03	West Shore Rd	Residential	Slight surface erosion, lack of buffer	Enhance buffer, add dips for water retention, install runoff diverter, remove clog in wooden water channel	Low	Low	Low
C04	West Shore Rd	Residential	Moderate surface erosion, bare soil, lack of buffer and shoreline erosion	Establish buffer, vegetate edge of lot/bare patches	Med	Low	Low
C05	West Shore Rd	Residential	Moderate surface erosion, bare soil, lack of buffer and shoreline erosion	Establish buffer, install turnouts to divert runoff into vegetation	Med	Low	Low
C06	West Shore Rd	Residential	Unstable culvert outlet, moderate surface erosion, lack of buffer/shoreline erosion	Stabilize culvert outlet, vegetate ditch or armor with stone, install sediment pools; enhance shoreline buffer	Med	Med	Med

Appendix B: Beech Hill Pond Watershed Survey Site List

Sector & Site	Location	Land Use	Description	Recommendations	Impact	Technical level	Cost of materials
C07	West Shore Rd	Residential	Lack of buffer & shoreline erosion	Establish buffer	Low	Low	Low
C08	West Shore Rd	Residential	Lack of buffer & shoreline erosion	Establish buffer, install runoff diverter on driveway	Low	Low	Low
C09	West Shore Rd	Private Road	Crushed/broken culvert	Replace culvert	Med	Med	Med
C10	West Shore Rd	Residential	Inadequate buffer & shoreline erosion; slight surface erosion on driveway	Enhance buffer, add new gravel at top of driveway, install waterbar across driveway to divert runoff into culvert drainage	Med	Low	Low
C11	West Shore Rd	Private Road	Slight surface erosion (from road, flows down paved driveway when raining)	Install runoff diverter in road, divert to left of driveway. Possibly also install diverter across driveway.	Low	Low	Low
C12	West Shore Rd	Private Road	Slight surface erosion (from road, flows down paved driveway when raining)	Install runoff diverter in road, divert into vegetation next to driveway. Possibly also install diverter across driveway.	Low	Low	Low
C13	West Shore Rd	Residential	Slight surface erosion on driveway, inadequate buffer	Install runoff diverters across driveway, enhance shoreline buffer	Med	Low	Low
C14	West Shore Rd	Residential	Soil delta in culvert outlet	Install check dams after culvert outlet	Med	Low	Low
C15	West Shore Rd	Residential	Slight surface erosion, bare soil by staircase to lake, undercut shoreline, lack of buffer & shoreline erosion	Establish buffer, vegetate bare soil, install runoff diverter	Low	Low	Low
C16	West Shore Rd	Residential	Moderate surface erosion (driveway), bare soil, lack of buffer & shoreline erosion	Establish buffer (terrace), vegetate bare soil, install runoff diverter	Low	Low	Low
C17	West Shore Rd	Private Road	Clogged culvert, slight ditch erosion, delta in stream	Remove clog, install plunge pools, armor ditch with stone, reshape ditch, install sediment pools	Med	Med	Med
C18	West Shore Rd	Residential	Small gravel pile uncovered, bare soil, inadequate buffer	Enhance buffer, vegetate bare soil, cover pile	Low	Low	Low
C19	West Shore Rd	Private Road	Road side berm from grader	Remove berm, install ditch	Low	Med	Med

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Sector & Site	Location	Land Use	Description	Recommendations	Impact	Technical level	Cost of materials
C20	West Shore Rd	Residential	Unstable/clogged culvert across street, moderate ditch erosion. Many temporary issues relating to new construction: road side berm, moderate surface erosion, bare soil, lack of buffer, shoreline erosion & unstable access.	Remove clog & stabilize culvert outlet. Reshape & vegetate ditch. Remove berms. Establish buffer (terrace), vegetate bare soil, define footpath/install steps.	Med	Med	High
C21	West Shore Rd	Residential	Moderate ditch erosion (in channel to lake), delta in stream	Armor channel with stone, install check dams and sediment pools	High	Med	Med
C22	West Shore Rd	Residential	Inadequate buffer	Enhance buffer	Low	Low	Low
C23	West Shore Rd	Residential	Inadequate buffer	Enhance buffer	Low	Low	Low
C24	West Shore Rd	Private Road	Clogged, crushed culvert	Remove clog, install plunge pool	Med	Med	Med
C25	West Shore Rd	Residential	Moderate surface erosion (driveway), slight road shoulder erosion, inadequate shoreline buffer	Add new surface material (gravel), and install runoff diverters. Enhance buffer.	Med	Low	Low
C26	West Shore Rd	Residential	Moderate road shoulder erosion around culvert, gravel in outlet may make it to lake in high flow	Install check dams after culvert outlet, vegetate road shoulder/armor outlet with stone.	Low	Low	Low
C27	West Shore Rd	Residential	Slight surface erosion on driveway, uncovered soil pile	Add new surface material on driveway (gravel), and install waterbar; cover pile	Low	Low	Low
C28	West Shore Rd	Private Road	Inadequate ditch size, road side berm from grader	Remove berms, install ditch	Med	Med	Med
C29	West Shore Rd	Residential	Lack of buffer	Establish buffer	Low	Low	Low
C30	West Shore Rd	Residential	Severe surface erosion from driveway to walkway & lake, uncovered soil pile	Build up driveway with new gravel. Build terrace or steps down to walkway and replace silt fence at base of driveway with retaining wall or lots of vegetation	Med	Med	Med
C31	West Shore Rd	Residential	Oil drums with signs of spillage	Remove oil drums	Low	Low	Low
C32	West Shore Rd	Private Road	Bank failure, inadequate ditch size, moderate surface erosion	Reshape ditch and vegetate or armor with stone	Med	Med	Med
C33	West Shore Rd	Residential	Lack of buffer	Establish buffer	Low	Low	Low

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Sector & Site	Location	Land Use	Description	Recommendations	Impact	Technical level	Cost of materials
C34	West Shore Rd	Residential	Slight surface erosion (driveway), Lack of buffer	Install runoff diverters on driveway, establish shoreline buffer	Med	Low	Low
C35	Channel Rock Rd	Residential	Inadequate buffer	Enhance buffer	Low	Low	Low
C36	Channel Rock Rd	Residential	Inadequate buffer	Enhance buffer	Low	Low	Low
C37	Channel Rock Rd	Residential	Inadequate buffer	Enhance buffer	Low	Low	Low
C38	Channel Rock Rd	Residential	Inadequate buffer	Enhance buffer	Low	Low	Low
C39	West Shore Rd	Private Road	Moderate ditch erosion in places, moderate surface erosion	Grade road, vegetate ditch or armor with stone	Med	High	High
D00	Tate Rd	Residential	Slight surface erosion, some bare soil, inadequate buffer, slight shoreline erosion	Enhance buffer, vegetate bare soil, define footpath	Low	Low	Low
D01	Tate Rd	Residential	Inadequate buffer, slight to moderate surface erosion on driveway, severe erosion down ATV trail	Enhance buffer, add gravel and reshape driveway, install water diverters along ATV path, possibly add gravel	Med	Med	Med
D02	Tate Rd	Private Road	Slight to moderate surface erosion on road, some bare soil	Build up road with gravel, install runoff diverters to divert water into woods rather than parking area	Med	Low	Med
D03	Tate Rd	Residential	Shoreline erosion along steep bank near steps	Plant vegetation along bank	High	Low	Med
D04	Lymburner Rd	Private Road	Moderate ditch erosion, inadequate ditch size, road side berm, slight surface erosion	Build up road with new surface material and crown	Med	Med	Med
D05	Coffin Rd	Residential	Slight surface erosion, bare soil, inadequate buffer, unstable access	Enhance buffer, vegetate shoreline with low shrubs to stabilize	Low	Low	Low
D06	Coffin Rd	Residential	Slight surface erosion, shoreline erosion, unstable access	Mulch, define footpath	Med	Low	Low
D07	Grandview Way	Residential	Slight surface erosion, bare soil, lack of buffer, shoreline erosion & unstable access	Establish buffer, replace retaining wall or cutback shoreline and riprap	Med	Low	Low
D08	Grandview Way	Residential	Moderate surface erosion, bare soil, undercut shoreline, inadequate buffer, retaining wall collapsed	Rebuild retaining wall, vegetate bare areas	Med	Med	High

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Sector & Site	Location	Land Use	Description	Recommendations	Impact	Technical level	Cost of materials
D09	Grandview Way	Residential	Lack of buffer, moderate shoreline erosion, bare soil	Establish buffer, build retaining wall or riprap	Med	Med	High
D10	Grandview Way	Residential	Lack of buffer, shoreline erosion	Establish buffer, maybe plant rain garden	Low	Low	Low
D11	Grandview Way	Residential	Lack of buffer - lawn straight to lake	Establish buffer	Med	Low	Low
D12	Grandview Way So	Private Road	Severe surface erosion on steep slope	Add new surface material (new gravel or extend pavement), install runoff diverter	Low	Med	Med
D13	Grandview Way So	Residential	Severe surface erosion, bare soil, lack of buffer and shoreline erosion	Install runoff diverter across driveway, establish buffer, vegetate bare soil	High	Low	Low
D14	Dunn Beach Rd	Residential	Lack of buffer	Establish buffer	Med	Low	Low
D15	Robbins Rd	Residential	Moderate surface erosion, bare soil, lack of buffer, shoreline erosion	Establish buffer, vegetate bare soil, install runoff diverter	Med	Low	Low
E00	Johnson Cove Rd	Private Road	Moderate ditch erosion, road side berm from grader	Remove berms, reshape ditch and vegetate or armor with stone	Med	Med	Low
E01	Johnson Cove Rd	Private Road	Unstable culvert outlet -- sediment moving into stream 100 ft from lake	Install plunge pool	Med	Low	Low
F00	O'Keefe St	Residential	Unstable/broken culvert (rusting), slight surface erosion and bare soil, shoreline erosion and lack of buffer	Establish buffer, vegetate bare soil, possibly install rain garden, replace culvert	Med	Low	Med
F01	O'Keefe St	Residential	Lack of buffer, bare soil and slight surface erosion	Establish buffer, new riprap or vegetate shoreline, install runoff diverter across driveway	Med	Low	Low
F02	O'Keefe St	Residential	Severe erosion in ditch/stream directly to lake, delta in lake	Install turnouts and sediment pools	Med	High	High
F03	Macdonald Rd	Residential	Slight road shoulder erosion up to property, flowing towards lake	Install catch basin at end of camp road	Low	Med	Med
F04	Macdonald Rd	Residential	Bare soil (construction), inadequate buffer, foundation drain to lake	Enhance buffer, vegetate bare soil after construction; install catch basin for foundation drain, possibly re-route to rain garden	Med	Low	High
F05	Macdonald Rd	Residential	Slight surface/shoreline erosion	Enhance buffer - vegetate eroding area	Low	Low	Low
F06	Macdonald Rd	Private Road	Unstable culvert outlet	Stabilize outlet	Low	Low	Low

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Sector & Site	Location	Land Use	Description	Recommendations	Impact	Technical level	Cost of materials
F07	Bunker Ln	Residential	Lack of buffer	Establish buffer, good spot for rain garden	Low	Low	Low
F08	Bunker Ln	Residential	Lack of buffer, shoreline erosion	Establish buffer	Low	Low	Low
F09	Bunker Ln	Residential	Inadequate buffer, slight surface erosion	Establish buffer, vegetate bare soil, possibly install rain garden	Med	Low	Low
F10	Turtle Cove Rd	Residential	Moderate surface erosion, bare soil	Enhance buffer, vegetate bare soil	Low	Low	Low
F11	Turtle Cove Rd	Residential	Slight surface erosion	Define pathway, vegetate or terrace hill and enhance shoreline buffer	Med	Med	Med
F12	Turtle Cove Rd	Residential	Inadequate buffer	Enhance buffer	Med	Low	Low
F13	Turtle Cove Rd	Residential	Inadequate buffer	Enhance buffer	Med	Low	Low
F14	Turtle Cove Rd	Residential	Inadequate buffer, slight surface erosion	Establish buffer, riprap or vegetate eroding soil	Low	Low	Low
F15	Turtle Cove Rd	Residential	Slight surface erosion, bare soil, lack of buffer	Establish buffer, install runoff diverters	Low	Low	Low
F16	Turtle Cove Rd	Residential	Slight surface erosion, lack of buffer	establish buffer, vegetate bare soil	Low	Low	Low
F17	Turtle Cove Rd	Private Road	Road side berm from grader, severe ditch erosion	Remove berms, vegetate shoulder & ditch, install runoff diverters, install check dams or turnouts to slow water	High	High	High
F18	Turtle Cove Rd	Private Road	Unstable culvert inlet/outlet	Stabilize culvert inlet/outlet	Med	Med	Med
F19	Turtle Cove Rd	Private Road	Unstable culvert inlet/outlet, moderate ditch erosion, road side berm from grader	Remove berms, stabilize culvert inlet/outlet, vegetate ditch and slow water with turnouts or check dams	High	Med	Med
F20	Turtle Cove Rd	Private Road	Moderate ditch erosion, road side berm from grader	Remove berms, vegetate and install check dams on east side ditch	High	High	High
F21	Turtle Cove Rd	Private Road	Clogged culvert, slight ditch erosion/inadequate ditch size	Remove clog, reshape and vegetate ditch	Low	Med	Low
F22	Turtle Cove Rd	Residential	Inadequate buffer, slight ditch erosion in drainage channel	Enhance buffer, riprap or vegetate ditch, install rain garden	Low	Med	Low
F23	Turtle Cove Rd	Private Road	Unstable culvert inlet/outlet, moderate ditch and road shoulder erosion, road side berm from grader	Remove berms, vegetate shoulder & ditch, install runoff diverters, stabilize culvert inlet/outlet	High	High	Med
F24	Turtle Cove Rd	Residential	Undercut & eroding shoreline, inadequate buffer	Enhance buffer, riprap and vegetate shoreline	Low	Low	Low

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Sector & Site	Location	Land Use	Description	Recommendations	Impact	Technical level	Cost of materials
F25	Turtle Cove Rd	Residential	Slight surface erosion	Vegetate eroding area, build up and divert water into shoreline vegetation	Low	Low	Low
F26	Turtle Cove Rd	Residential	Uncovered dirt pile, lack of buffer	Establish buffer and remove or cover pile	Low	Low	Low
F27	Turtle Cove Rd	Private Road	Uncovered dirt pile	Cover pile	Low	Low	Low
F28	Sunset Ln	Private Road	Moderate surface erosion	Add new surface material (gravel), and grade road	Low	Med	Med
F29	Sunset Ln	Residential	Slight surface erosion, inadequate buffer	Establish buffer, vegetate bare soil	Low	Low	Low
F30	Ledges Rd	Residential	Moderate ditch erosion	Reduce flow through ditch by installing check dams, sediment pools, and/or turnouts	High	Med	Med
F31	Ledges Rd	Private Road	Unstable culvert outlet	Stabilize culvert outlet	Low	Low	Low
F32	Ledges Rd	Private Road	Moderate road shoulder erosion, bare soil	Vegetate shoulder, vegetate ditch & install turnouts	High	Med	Med
G00	Sandy Beach Rd	Residential	Lack of buffer and shoreline erosion	Establish buffer	Low	Low	Low
G01	Remick Rd	Private Road	Slight to moderate surface erosion, road side berm	Remove berms, build up road and reshape/crown	Low	Med	Med
G02	Sandy Beach Rd	Private Road	Severe ditch erosion and bank failure	Vegetate ditch or armor with stone, reshape ditch	Low	Med	Med
G03	Sandy Beach Rd	Private Road	Moderate ditch erosion, inadequate ditch size, moderate surface erosion	Build up road with new surface material, and crown; reshape ditch	Med	Med	Med
H01	Point Rd	Residential	Slight surface erosion on driveway, lack of buffer	Enhance buffer, install runoff diverters across driveway	Med	Low	Low
H02	Point Rd	Residential	Slight surface erosion, inadequate buffer	Enhance buffer, add new surface material to driveway (gravel) and crown	Med	Low	Med
H03	Point Rd	Residential	Slight surface erosion, bare soil, lack of buffer	Enhance buffer, install runoff diverters across driveway	Med	Low	Low
H04	Point Rd	Private Road	Lack of buffer, moderate surface erosion to lake, crushed culvert across from store	Add new surface material and crown road, install runoff diverters, enhance buffer, replace crushed culvert	High	High	High
H05	Point Rd	Residential	Inadequate Buffer	Enhance buffer	Low	Low	Low

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Sector & Site	Location	Land Use	Description	Recommendations	Impact	Technical level	Cost of materials
H06	Point Rd	Residential	Inadequate Buffer	Enhance buffer	Low	Low	Low
H07	Point Rd	Residential	Inadequate Buffer	Enhance buffer	Low	Low	Low
H08	Point Rd	Residential	Inadequate Buffer	Enhance buffer	Low	Low	Low
H09	Point Rd	Residential	Inadequate Buffer	Enhance buffer	Low	Low	Low
H10	Point Rd	Residential	Inadequate Buffer	Enhance buffer	Low	Low	Low
H11	Point Rd	Residential	Inadequate Buffer	Enhance buffer	Low	Low	Low
H12	Point Rd	Residential	Inadequate Buffer	Enhance buffer	Low	Low	Low
H13	Point Rd	Residential	Inadequate Buffer	Enhance buffer	Low	Low	Low
H14	Point Rd	Residential	Inadequate Buffer	Enhance buffer	Low	Low	Low
H15	Wards Rd	Private Road	Slight ditch erosion, slight to moderate road shoulder erosion	Vegetate ditch, vegetate shoulder, reshape (crown) road	Med	Med	Med
H16	Brooks - Dunn Rd	Private Road	Road side berm from grader, moderate surface erosion	Remove berms, build up road and reshape/crown	Med	Med	Med