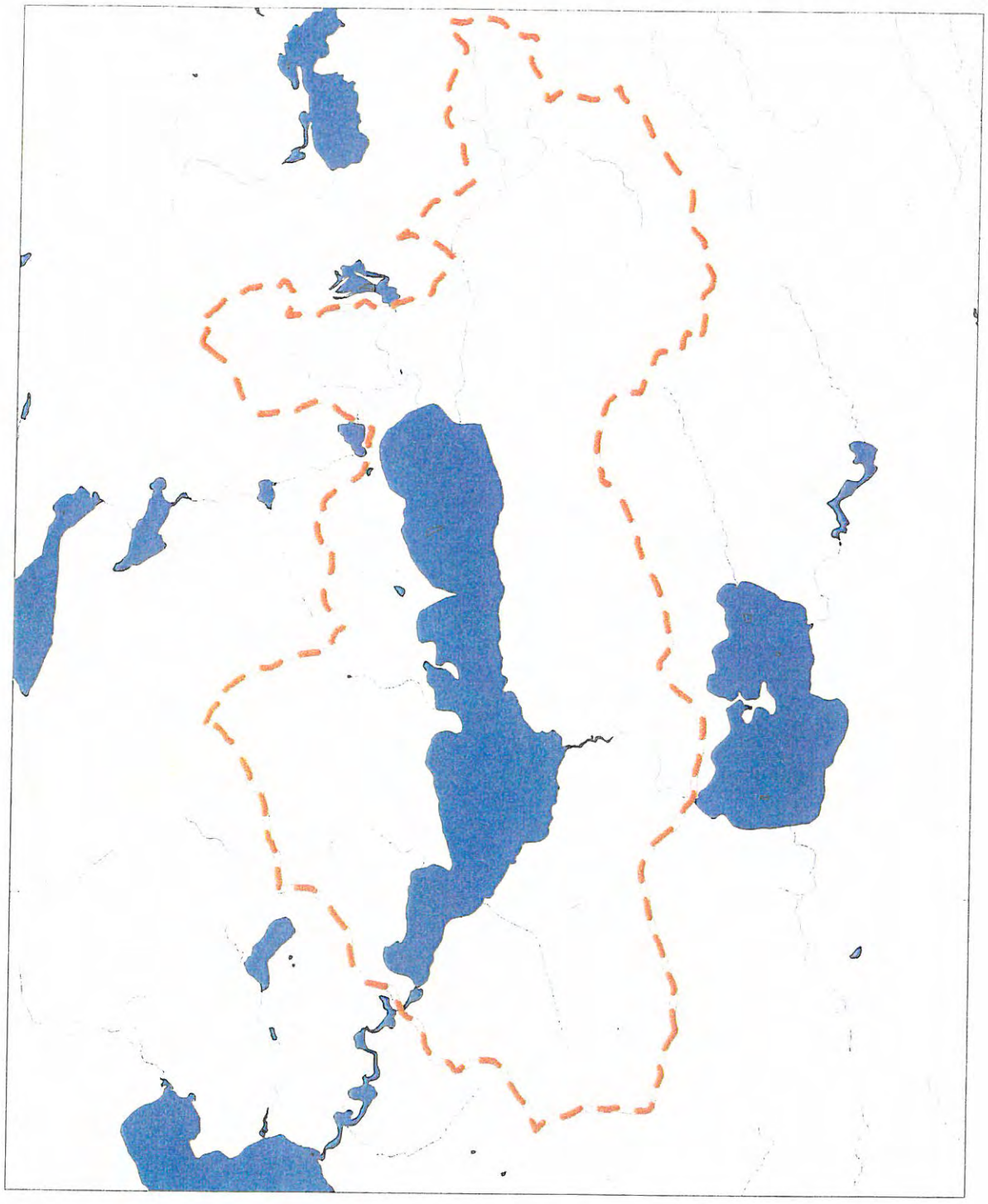
Crescent Lake Watershed Survey



Prepared by:
Crescent Lake Watershed Steering Committee
Raymond Conservation Commission
April 2000

Appendix A

Acknowledgments

We are grateful to the following Crescent Lake Watershed Survey participants, most of whom were involved in this study on a volunteer basis:

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In March, 1999, the Maine Department of Environmental Protection (MDEP) awarded approximately $7,200 from their Maine Nonpoint Source Grants Program to the Raymond Conservation Commission and the Town of Raymond to conduct a watershed survey on Crescent Lake.

While this project was funded by a grant from the Maine Department of Environmental Protection, the contents of this document do not necessarily reflect the view and policies of the MDEP, nor does the mention of trade names or commercial products constitute endorsement or recommendation for use.

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Appendix A

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Introduction

Is there a water quality problem with Crescent Lake?

According to the Maine Department of Environmental Protection's (MDEP's) *State of Maine 1996 Water Quality Assessment*, Crescent Lake does not meet state water quality standards. MDEP's characterization is based on data provided by the Raymond Waterways Protective Association that show very low concentrations of ***dissolved oxygen*** (DO) in the bottom waters of the lake in late summer (See Appendix A). The lake's cold water fishery cannot tolerate these low dissolved oxygen levels and the low DO also presents a risk for the development of more serious water quality problems.

MDEP has also listed all Raymond lakes and ponds, including Crescent, on their list of *Lakes Most at Risk from Development*. This ranking forecasts a future decline in lake water quality related to the increased shoreline and ***watershed*** development we are seeing in Raymond today. This prediction is based on studies and experience on lakes in Maine (e.g., China Lake) and in other states where water quality degradation has correlated with watershed development.

WATERSHED:

All land that surrounds a lake that drains, or sheds, water into the lake through streams, ditches, directly over the ground surface, or through groundwater. The Crescent Lake watershed is shown in **Figure 1**.

What's causing the problems in the lake?

The biggest culprit causing water quality decline in Maine's lakes is ***polluted runoff*** from rain and snowmelt. Runoff occurs during and after storm events when soil, nutrients (such as phosphorus and nitrogen), and debris are washed into the lake from the surrounding landscape via streams and overland flow.

In an undeveloped watershed, the forest canopy (trees, shrubs, and other vegetation) and duff layer (leaf litter on the ground) prevent rain drops from disturbing and carrying away soil particles. Also, the forest floor, with its uneven surface and leafy debris, slows and filters runoff.

In developed areas, many trees have been removed and the forest floor has been leveled and stripped of its filtering duff layer. These alterations, along with the added impervious surfaces (e.g., roofs, compacted soil, gravel camp roads and pavement) result in increased volumes and velocities of stormwater runoff.

The nutrients attached to soil particles and dissolved in stormwater runoff are bad news for lakes. ***Phosphorus*** and nitrogen are the primary food for all plants, including algae. When a lake receives extra nutrients from the watershed, algae growth increases dramatically. Sometimes this growth causes choking ***algal blooms***, but more often it results in small insidious changes in water quality that, over time, damage lake ecology and aesthetics, as well as the economy of the lake watershed community.

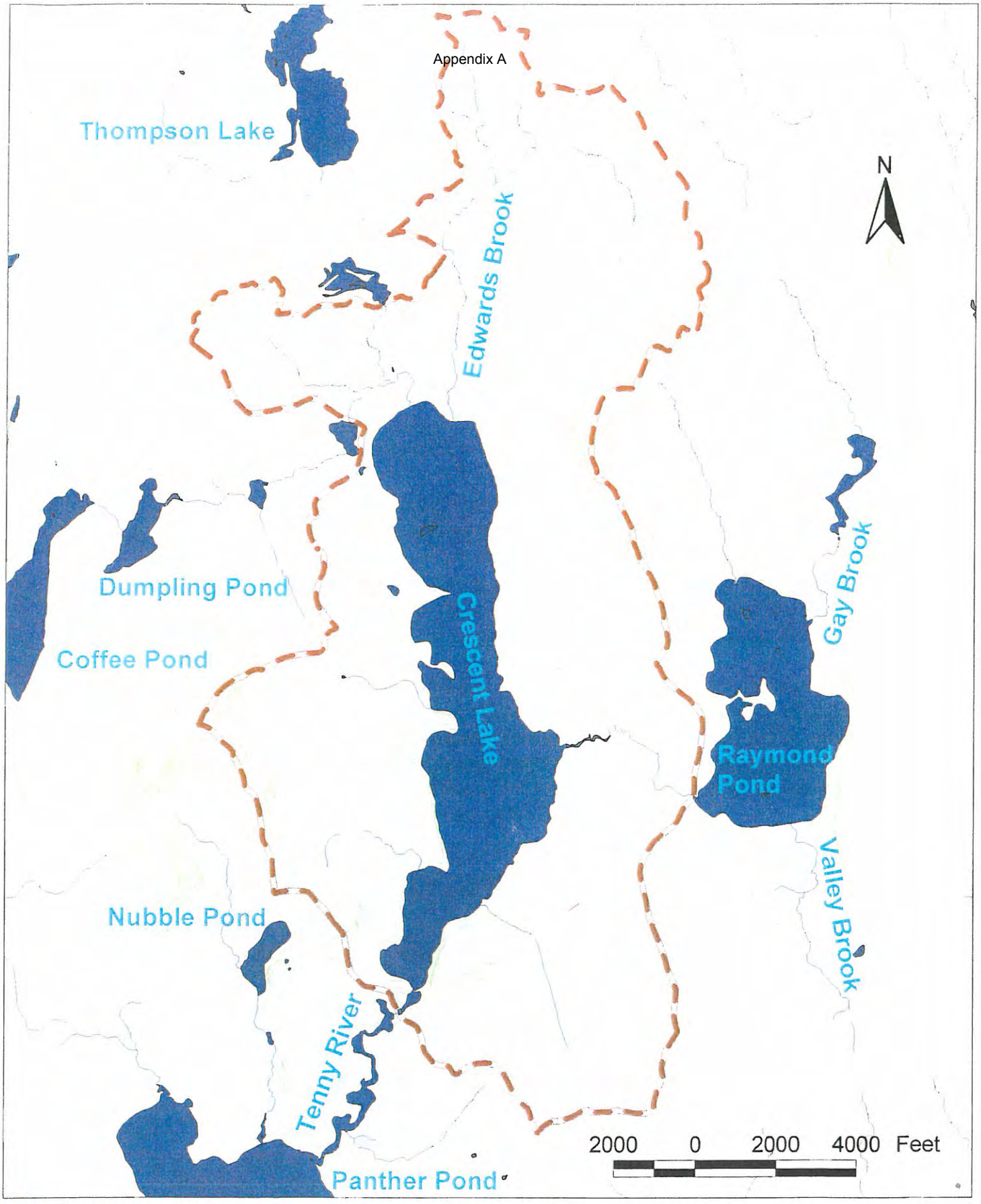


Figure 1
Crescent Lake Watershed

Why is it important to protect Crescent Lake from polluted runoff?

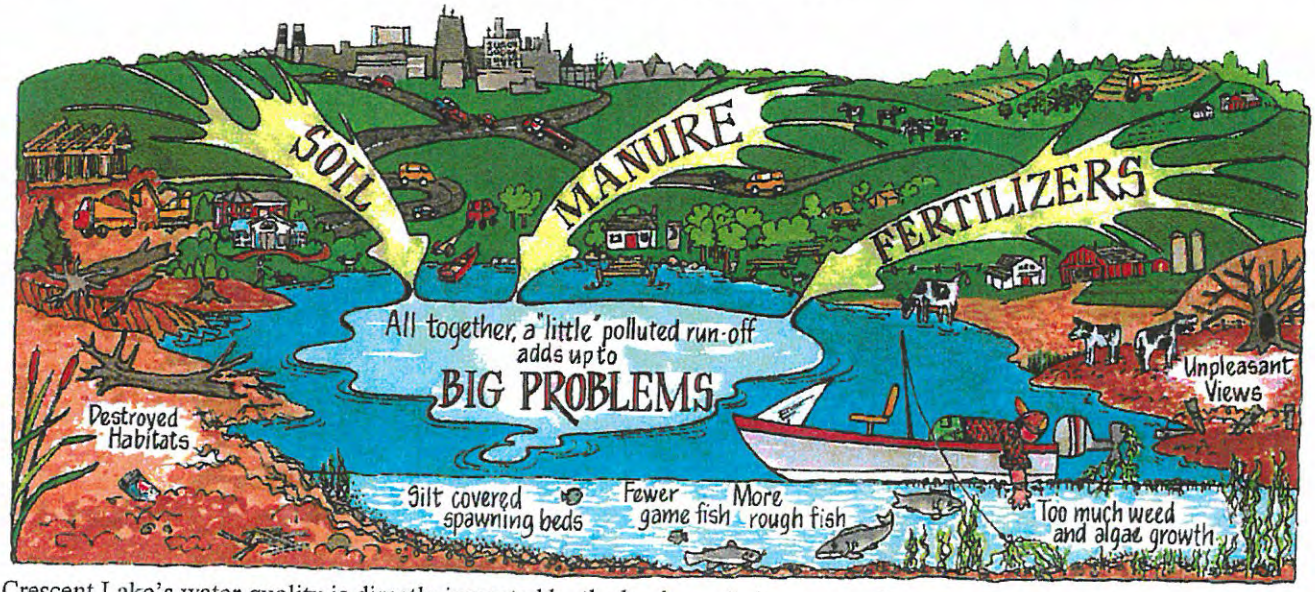
As with other lakes in Raymond, Crescent Lake is a valuable ecological and economic resource. Protecting this lake makes good sense for our community:

- The lake provides recreational opportunities to Raymond residents and visitors alike.
- Crescent Lake contains valuable habitat for fish, birds and other wildlife.
- A 1996 University of Maine study demonstrated that lake water quality affects property values! For every meter of diminished lake water clarity, shorefront property values dropped by 10-20%. Depreciated property values affect individual landowners as well as the economy of communities that depend on lakes for recreation.
- Once lake water quality has declined, it can be difficult, if not impossible to restore.

What is being done to protect Crescent Lake?

The Raymond Pond Waterways Protective Association volunteers and MDEP have been collecting water quality data for Crescent Lake since 1974. This monitoring, which has provided valuable scientific information, has also served as the primary environmental stewardship activity on the Lake.

The Raymond Conservation Commission has also strived to protect and improve water quality in Raymond's lakes and streams. Because the *watershed survey* has lately become an effective tool in protecting lake water quality on other Maine lakes, the Commission conducted a pilot survey on Raymond Pond in 1998 to determine if Raymond residents were ready for such watershed stewardship efforts. The healthy response on Raymond Pond inspired us to further develop watershed protection in Raymond with an EPA grant-funded survey on Crescent Lake.



Crescent Lake's water quality is directly impacted by the land uses in its surrounding watershed. The most effective way to manage lake water quality is by managing land uses within the watershed.

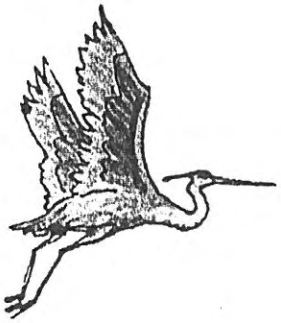
Purpose of the Watershed Survey

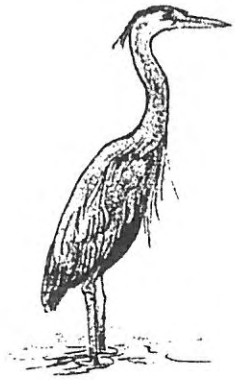
The primary purpose of this survey was to inventory and rank existing sources of polluted runoff, particularly soil erosion sites, in the Crescent Lake Watershed. The following secondary goals of this study are of equal importance, in that they foster long-term lake protection:

- Raise public awareness of watershed protection issues;
- Make general recommendations to landowners for fixing erosion problems;
- Inspire people to become active stewards of land and water resources;
- Identify demonstration project sites for grant-funded erosion control fixes; and,
- Promote and support long-term watershed management and planning in Raymond.

The beauty of these surveys is that local citizen participation is essential and results in local people being trained in, and promoters of, watershed care-taking practices.

We hope this survey, as well as the 1998 Raymond Pond survey, will inspire citizens, Town officials and Boards, as well as the various concerned groups (e.g., lake and road associations, Raymond Conservation Commission, Raymond Waterways Protective Association) to promote education, planning and remediation efforts that address the current problems and to support long-term watershed stewardship.

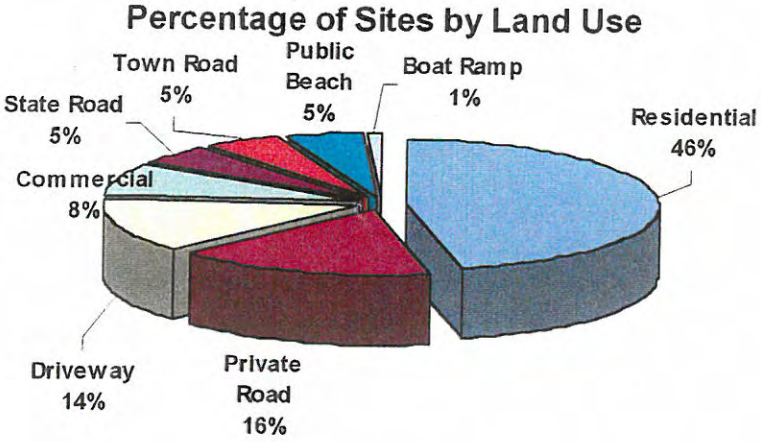




great blue heron

Summary of Watershed Survey Findings

Volunteers and technical staff identified **139 erosion sites** within the Crescent Lake watershed. Surveyors recorded detailed information (size, slope, soil type, vegetative cover, stormwater flow paths) for each eroded area. In addition, they provided design recommendations for fixing the erosion and runoff problems at each site. Sites were ranked for *impact* on lake water quality, *technical skill level* needed to install the recommended solution and likely *cost* of the recommended fix. The results are presented in Figure 2 and Appendix C.



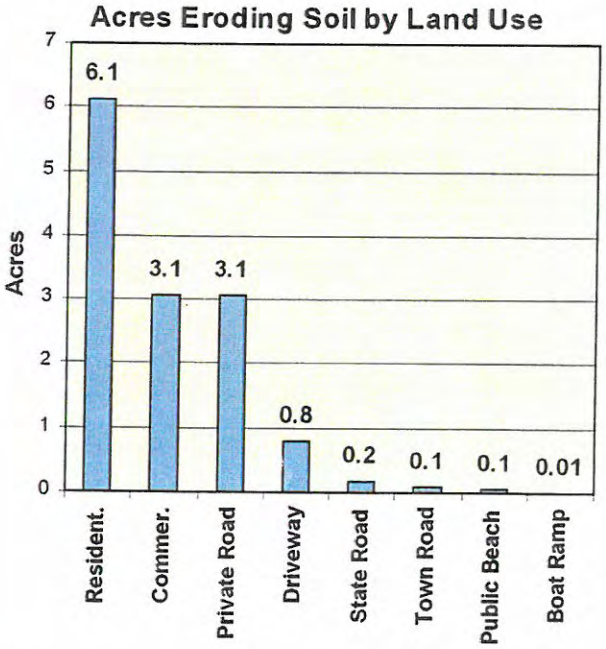
Clearly, residents and landowners have the greatest opportunity, and responsibility, to improve lake water quality. However, as a community that depends on this lake for aesthetic, recreational, and economic well-being, we **ALL** must contribute, as a team, to the protection of this valuable resource.

Studies show that one ton of soil, which contains about a pound of phosphorous, can erode each year from each acre of unstable land.

For our survey, this means that 13½ tons **(a full dump truck)** of soil may be eroding in the Crescent Lake watershed each year, and thus 13 pounds of "extra" phosphorus is being transported toward and potentially deposited in the lake each year.

Because the lake is sensitive to very low concentrations of phosphorus (part per billion levels), **13 pounds** of "extra" phosphorus is a **BIG PROBLEM!**

The majority (84%) of the identified sites in the survey were on private property and commercial camps. In fact, private land (residential lots, driveways and private roads) and commercial campgrounds account for 97% of the eroding surface area in the Crescent Lake watershed.



Most sites identified in this survey can be treated with relatively low cost and straightforward methods. The following pages present summaries of the most prevalent problems and suggested solutions. The *Next Steps* section provides more guidance on how to proceed with watershed stewardship activities.

It's going to take honest EFFORT, DESIRE, and COMMUNITY SUPPORT to address the problems identified in this survey.

RESIDENTIAL SITES

Of the 65 residential sites identified in the survey, 45 were considered to have a low impact, 16 a medium impact, and only two sites were judged to have a high impact on the lake's water quality. **The total eroding surface area of all of the residential sites combined is six acres.** Fifty three (82%) of the solutions are easy fixes with low repair costs.

Common Problems Identified:

- Surface erosion
- Bare and/or sparsely vegetated soil
- Lack of ***vegetated buffer***
- Shoreline erosion
- Direct flow of runoff into lake/tributary

Possible Solutions:

- Seed and ***mulch***
- Stop raking the ***buffer***, manage foot traffic
- Establish/enhance buffer with plantings
- Limit/manage foot traffic, stabilize
- Slow/divert runoff into wooded or buffered areas

Example Residential Site

Problems:

- Soil in foot path is bare and compacted; runoff velocity increased
- Path is straight, resulting in greater runoff velocity with direct flow to lake
- Trees (protective canopy) have been removed

Solutions:

- Limit foot traffic damage with bark mulch or pea stone on path
- Create meanders in foot path, to slow and interrupt runoff
- Terrace and/or install timbers across path to divert runoff into buffer
- Establish ground cover adjacent to path to slow down and soak up precipitation (a diverse mix of trees, shrubs and ground cover plants will stabilize this property better than will grass)

Even though most residential sites were judged *low impact*, there are a lot of them. Together, they comprise a significant threat to water quality. Fortunately, most of these sites have easy, low cost fixes.

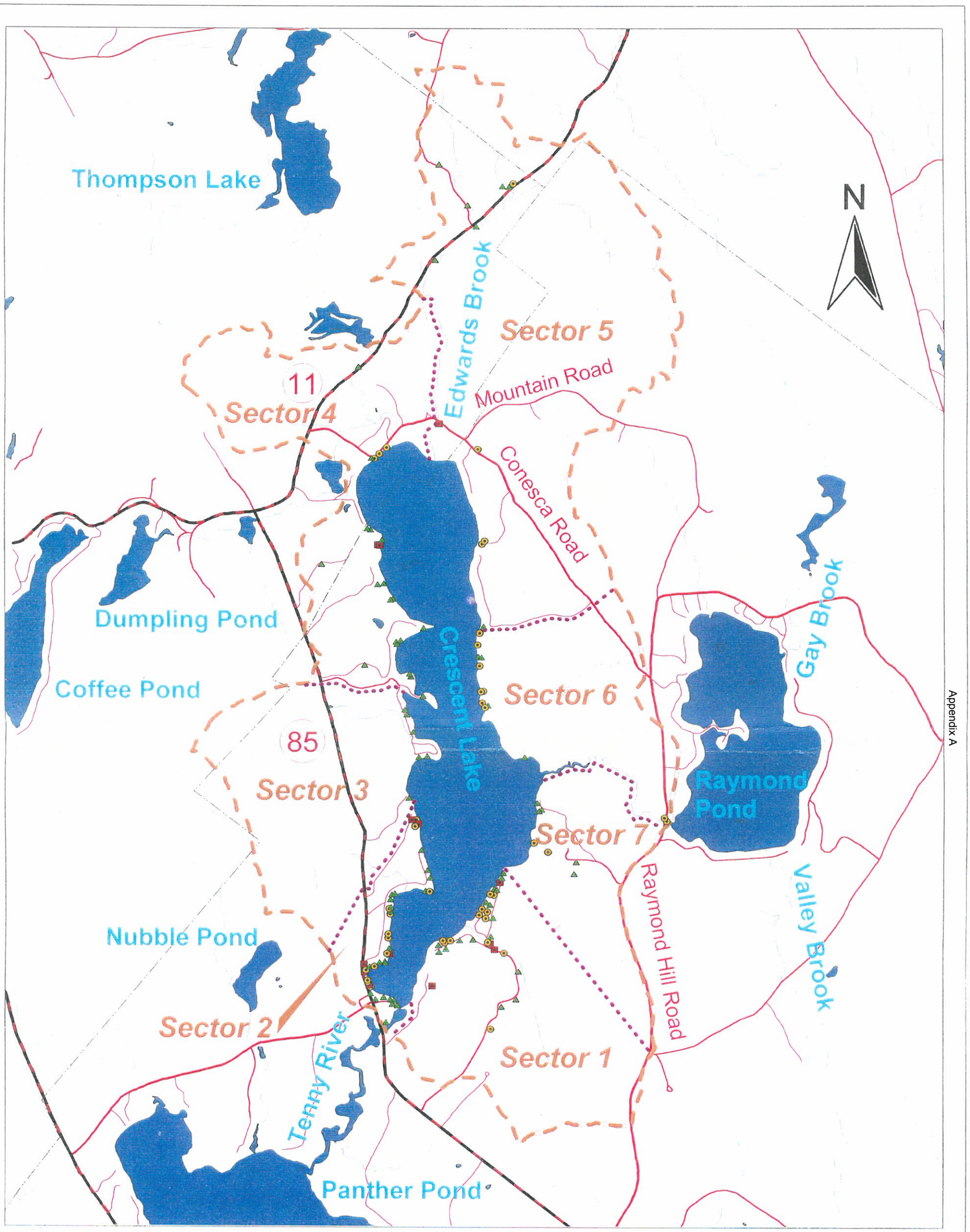


Figure 2
Crescent Lake Erosion Sites

Appendix A

RESIDENTIAL / SHORE ACCESS SITES

Two of the most common problems encountered at the surveyed shorefront properties were lack of adequate vegetated buffer and eroding footpaths to the lake. The sites shown below look relatively benign, but are typical of conditions at many of the residential sites identified in this survey. The remedies are simple, and if applied at all of the sites around the lake, would diminish the transport of phosphorous to the lake.

Example Shore Access Site

Problems:

- Bare soil eroding to lake
- Lack of vegetated buffer

Solutions:

- Establish a buffer (shrubs and groundcover) along shore front
- Plant and mulch bare soil areas
- Install steps to direct foot traffic over bank and protect bank from further erosion

Example Footpath Site

Problems:

- Soil in footpath is bare and easily eroded;
- Path is too steep, straight and long. Storm water gains volume and velocity and 'blows out' trail bed.

Solutions:

- Terrace and meander trail to break up slope
- Resurface trail with consolidated (e.g., peastone) material or mulch path surface
- Install timbers (*waterbars*) across path to divert runoff to buffer

DRIVEWAY SITES

Nineteen driveway sites were found and, together, comprise almost an acre of eroding surface. Thirteen of these sites have a low impact and six a medium impact on the lake. Thirteen driveways could be repaired easily for a few hundred dollars. Five driveways need somewhat more complex and expensive fixes, and one driveway in Sector 2 will require expensive installations to eliminate significant runoff to the lake.

Common Problems Identified:	**Possible Solutions:**
• Surface erosion	• Install waterbars or ***open-top culverts***.
• Poor shaping	• ***Crown*** driveway so that water flows to buffer or stable ditch
• Inadequate surface material	• Re-grade and add appropriate surface material

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Example Driveway Site

Problems:

- Poor driveway shaping causes water to concentrate and erode the surface
- Loose surface material erodes easily

Solutions:

- Determine where water flow to driveway is coming from and manage/divert those sources
- Reshape (crown) driveway so water moves quickly from the surface (allow for ½" of crown for each foot of road width).
- Install waterbars or open-top culverts across driveway to divert runoff to buffer
- Resurface with gravel that will compact, not erode.

Preserve water quality and save time, money, and wear and tear on your vehicle:

- **Have a properly crowned driveway with adequate surface material;**
- **Add *diversions* to reduce water velocity; and,**
- **Direct runoff into vegetated buffers.**

Its great for driveways and its great for the lake!

PRIVATE ROAD SITES

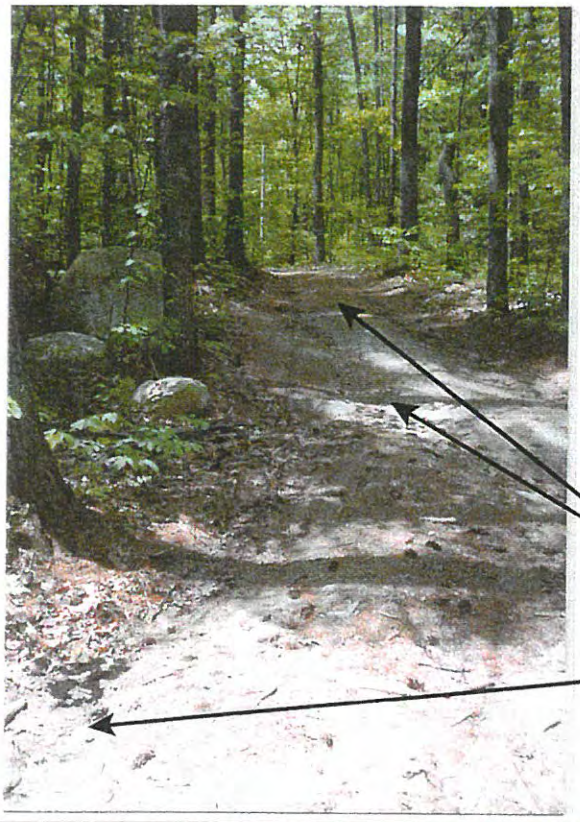
Twenty three sites, comprising three acres of eroding private roadway and ditches, were identified in the survey as impacting the water quality of Crescent Lake. While 13 sites were of low impact, ten of them were ranked as contributing significant runoff loads to the lake. Seventeen private road problems could be addressed cheaply and easily. Four road sites need more complex fixes and two sites will require significant engineering (e.g., installation of culvert, sediment traps, and crown) to adequately curtail runoff to the lake.

Common Problems Identified:

- Road surface erosion
- Poor shaping
- Ditch and shoulder erosion
- Direct discharge to streams
- Unstable and plugged culvert inlets and outlets

Possible Solutions:

- Apply less-erodible material, reshape
- Crown/reshape road surface and maintain it
- Reshape ditch to remove steep banks, vegetate ditch, install ***ditch turnouts*** to lessen volume and velocity
- Install sediment traps, turnouts and ***level lip spreaders***
- Rip rap inlets and outlets, ensure adequate side-slopes by using long enough culverts



Example Private Road Site

Problems:

- Poor surface material
- Poor drainage from road
- Poor shaping causes water to concentrate and erode the surface

Solutions:

- Reshape road, build crown (allow for ½" of crown for each foot of road width)
- Surface road with materials that compact
- Install waterbars or open-top culverts with turnouts to buffer
- Install sediment trap with level-lip spreader at base of hill

Unpaved roads deliver large volumes of material to the lake. While a one-time fix may cost more up front, it will reduce pollutant loads to the lake and reduce maintenance costs on the road, the ditches and vehicles.

STATE AND TOWN ROAD SITES

Fourteen erosion problems were identified on town or state roads. While these sites comprised a small percentage (10%) of the total identified in the survey, they ranked higher in severity than most others. Three problems were rated as high impact and five were rated as having a medium impact on lake water quality.

Common Problems Identified:

- Ditch and shoulder erosion
- Direct discharge of ditches to streams
- Unstable/plugged culvert inlets and outlets
- Winter sand buildup

Possible Solutions:

- Shape ditches; line with erosion control matting or vegetate, install turnouts to relieve ditches of runoff volume and velocity
- Install sediment traps, turnouts to buffers
- Rip rap culvert inlets and outlets, ensure adequate side-slopes by using long enough culverts
- Remove winter sand

Problems:

- Winter sand build-up
- Lack of ditch, road runoff carries sand to beach and phosphorous to lake

Solutions:

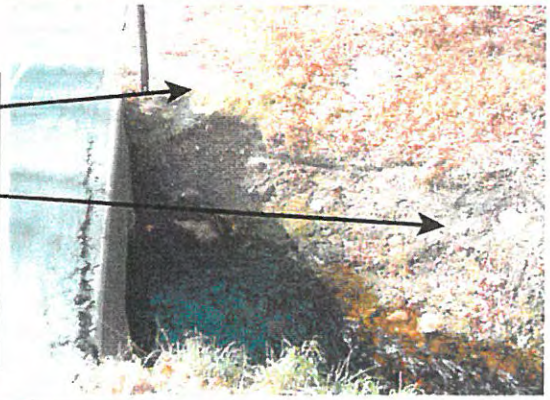
- Install plunge pools and sediment traps to break the flow of water and retain material
- Surface shoulders with less-erodible materials
- Vegetate bank
- Remove winter sand earlier in the spring

Problems:

- Road runoff discharges directly to stream
- Bank eroding into stream

Solutions:

- Armor (rip rap) stream bank
- Install curb and turnouts to keep runoff out of stream



Installing and maintaining erosion control practices at town and state road sites will save money, improve water quality, and support and inspire a local watershed protection ethic.

PUBLIC BEACH SITES

Seven distinct erosion problems were identified on Raymond's and Casco's town beaches. Both beaches are used heavily and suffer from soil compaction and serious slope and shoreline erosion. The high visibility and use of these beaches make them excellent candidates for demonstrating repair and maintenance practices. Problems and solutions noted for these beaches also apply to private beaches and shorefronts.

Common Problems Identified:

- Bare, compacted soil, sparse vegetation on 'sunbathing' areas
- Surface, slope erosion leading to water
- Undercut and eroding banks, lack of buffer plants on banks
- Unstable beach access (over banks)

Possible Solutions:

- Re-seed, mulch, or sod high-use sunbathing areas, grassy terraces
- Divert road runoff away from beach to buffers
- Stabilize banks with rip rap or buffer vegetation to prevent further erosion of shore and banks
- Establish pathways to control beach access and reduce soil compaction

Crescent Beach in Raymond

Public Beach in Casco

Fixing a public beach affords an opportunity for inspiring volunteers and educating the larger community

Cost Analysis of using Best Management Practices (BMP's)[1]

The following is an example of how a one-time expenditure directed at controlling gravel road erosion resulted in protecting a lake AND saving on long-term road maintenance costs.

Problem:
During periods of heavy rain, the long, steep road leading to a lakefront club washed out and caused siltation of the local swimming area.

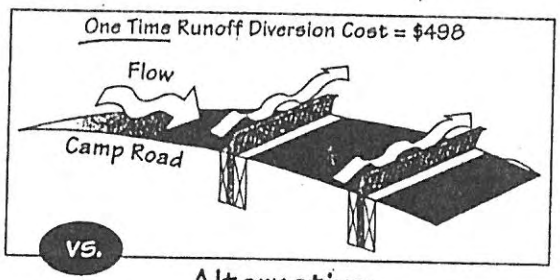
Solutions:

- Stabilized existing eroded shoulders with hardy grass seed mix (inexpensive and creates a natural look).
- Installed a diversion dip (e.g., a concave speed bump) along the midsection of the roadway to intercept stormwater and discharge it to buffer at side of road.
- Constructed *rubber razor blades* that also diverted stormwater to roadside buffers.

(A rubber razor blade is a strip of rubber sandwiched between lumber. The lumber is installed flush with the road surface, while the rubber blade extends about 1" above the road surface. This device allows for less disruption of traffic and plowing than does a true waterbar).

Cost Analysis:

BMP:



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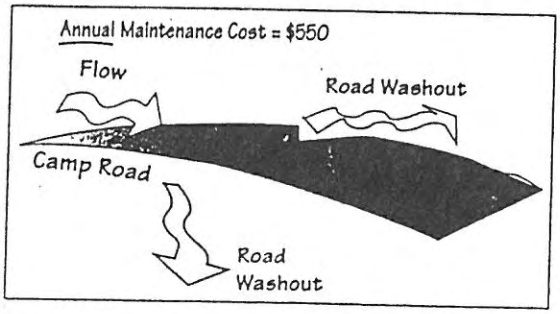


Cost-effectiveness:

The total cost to install the BMPs was $498 including labor and materials, including "rubber razor blades", and stabilizing eroded areas. If no BMPs were installed, the estimated annual maintenance cost for the 350 foot road is $550, including regrading the entire road and replacing 10% of the road surface

[1] BMPs: Cost-Effective Solutions to protect Maine's Water Quality, Casco Bay Estuary Project, July, 1995

Next Steps/Where Do We Go From Here?

Our intention in conducting this watershed survey was that it be a *first step* in a comprehensive, long-term effort to protect water quality in the Raymond lakes. The Raymond Conservation Commission is committed to continuing our involvement, but solving the polluted runoff problems in these watersheds can and should occur at many levels (citizens, organizations, businesses, government and schools) and within varied time frames. While individuals can correct many small, uncomplicated sources of polluted runoff with little guidance or expense, more complex sites will require technical expertise, long-term planning and fundraising.

It is vital to the success of watershed management that we assemble a dedicated team, form a realistic plan and build a strong network of public support.

WATERSHED PLANNING:

Local, planned management of land-use and development in watersheds has been accomplished in other towns through the following steps:

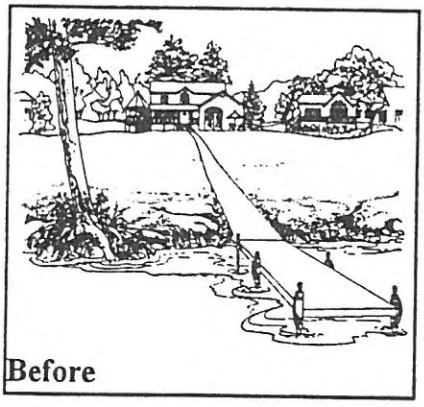
1. **Define water quality problems** (monitoring and inventories);
2. **Set goals** (i.e., clean lake water, protected habitats, educated landowners, valued resource);
3. **Identify solutions** (i.e., watershed planning, better site design, watershed stewardship programs, land conservation) and technical and funding assistance sources;
4. **Implement controls** (i.e., BMPs, aquatic buffers); and
5. **Measure success** and make adjustments to the watershed management plan.

WATERSHED TEAM:

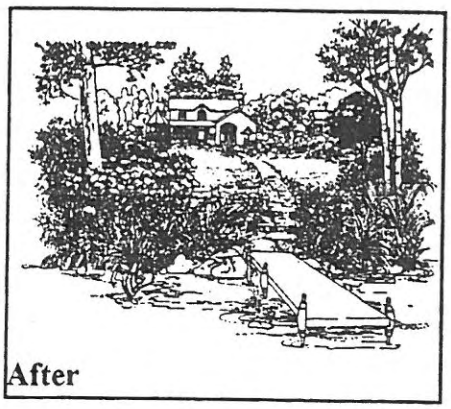
Individuals:

Local citizen participation was essential in completing the watershed survey and will be just as important in upcoming years as we remedy the problems and build a stronger watershed stewardship ethic in Raymond. Individuals can install easy and inexpensive conservation practices:

- Prevent stormwater from running directly into streams and the lake with waterbars, open top culverts, detention pools and diversions to vegetated buffers;
- Direct runoff from roof tops into vegetated areas;
- Reduce the amount of cleared land and road surfaces, avoid removal of natural vegetation (trees, shrubs and ground cover), and let portions of lawn revert back to natural plants;
- Seed and mulch areas of bare soil;



Before



After

Individuals (cont.)

- Don't alter the shoreline. Leave existing rocks and vegetation in place;
- Obtain permits and technical assistance before rebuilding beaches;
- Know local shoreland zoning ordinances. Consult with the town Code Enforcement Officer before cutting trees or other vegetation in this zone;
- Check sludge levels in septic tank every year, pump it out when it is HALF full (every 2 to 3 years for full-time residences; 4-5 years if seasonal) and upgrade marginal systems;
- Support watershed efforts at town meetings; and,
- Get the various road associations together to form a Crescent Lake Watershed Association.

Road Associations (and private roads without associations):

Road associations or individuals on private roads can work together by getting educated about proper road construction and maintenance:

- Attend a camp road workshop - one will be held in Cumberland County in the spring;
- Develop a budget and regular, comprehensive schedule for road maintenance - and adhere to it;
- Use conservation practices on the road (address areas such as road shaping, stabilizing ditches and road shoulders, cleaning ditch turnouts, and using proper surface material);
- Get a copy of *Camp Road Maintenance Manual - A Guide for Landowners*. This reference is a must for anyone managing a dirt road. (Copies can be purchased ($4.50) from Kennebec County SWCD - 9 Green St., Rm 307, Augusta, ME 04330).
- For extensive problems, seek a professional engineer's help. Contact the Cumberland County Soil and Water Conservation District to request technical assistance.

Municipal Officials:

Municipal officials (e.g., Planning Board and Selectboard, Town Manager, Road Commissioner, Comprehensive Planning and Ordinance Committees) play a vital role in the future of these projects and in long-term watershed management:

- Review public policy and ordinances to assure full protection of lake water quality.
- Encourage revision of the comprehensive plan.
- Support long term watershed management projects with money, materials, and participation.
- Promote Best Management Practice training for road crews, planning boards and conservation commissions.
- Require permit applicants to consult the CCSWCD about erosion and sediment controls
- Help the MDEP enforce the Erosion and Sediment Control Law, which requires landowners to **properly** install and maintain erosion control practices (e.g.., staked hay bale barriers, silt fences, and mulch) anytime filling or soil disturbance activities are conducted.

Schools:

Raymond schools, especially as we grow into the Middle School level, can teach about Raymond lake and stream ecology, start our own adopt-a-stream program, and devise ways to protect, cleanup, and enhance our waterbodies. Some towns are now funding summer Youth Conservation Corps to educate their kids and provide watershed residents with cheap labor to complete simple, low-cost BMP projects.

Mayfly Nymph

Lake Associations:

Other than the Raymond Waterways Protective Association, which monitors four of our lakes, there are no lake associations on any of the lakes in Raymond. Lake Associations are valuable entities in that they focus concern and action for residents who share a cherished asset, their lake. Water quality protection is just one of many issues that lake associations traditionally address, but it may be the most important. Associations on other lakes in Maine have developed successful short and long term educational outreach programs for their communities and, several have established Youth Conservation Corps to install and maintain Best Management Practices throughout their watersheds.

Agencies:

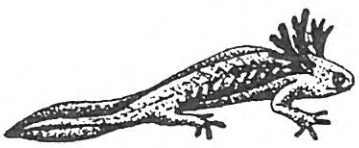
Staff at Maine DEP Land and Water Bureau and the Cumberland County Soil and Water Conservation District are available to provide technical assistance and help facilitate workshops such as *How to plant a vegetated buffer*, *How polluted runoff affects lake water quality*, *How to construct and install an open top culvert* and assist with other educational outreach programs. Staff from these agencies have worked extensively on the Raymond Pond and Crescent Lake watershed surveys and are eager to support further watershed protection efforts in our town.

NEXT STEPS

The Raymond Conservation Commission is partnering with the CCSWCD to apply for grant funds to build BMP demonstration projects and watershed education workshops for the Raymond Pond and Crescent Lake watershed communities. If we are funded, we will repair several of the erosion sites identified in this and the Raymond Pond survey using methods and installations that demonstrate some of the most effective erosion control practices. The more important goal of these projects is to encourage others to recognize their value and act to use similar conservation measures. This is done by enlisting volunteers to participate in the demonstration projects and by setting up workshops, tours and other means of public outreach and technology transfer. These EPA Nonpoint Source Implementation Grants projects usually last for two years and are funded up to 60% of the total project costs.

While the BMP demonstration projects are a useful, short-term step, they will not be very effective without a strong, enduring, watershed management framework. We need a **watershed team** approach in Raymond to strengthen the relationships between public and private sectors and give those of us who depend on lakes for our health, livelihood, and quality of life a meaningful role in the management of our resource. We need to act on the suggestions given in this report.

The **value** of Raymonds streams and lakes are threatened by stormwater runoff, even more so as the town continues to grow. Uncontrolled stormwater from future land-uses can greatly impair water quality. Property values can plummet when water becomes polluted. More money will be lost in years to come and problems will only get worse if water quality awareness, management and protection are not improved. The good news is that each of us can participate to protect our lakes.



Salamander
Larva

Appendix A

Glossary

Algal Bloom: A growth of algae resulting from excessive nutrient (phosphorus) levels or other physical and chemical conditions that enable algae to reproduce rapidly. The overgrowth of algae can form scums and mats which, when they decay, reduce the amount of oxygen in water.

Best Management Practices (BMP's): Also known as *Conservation Practices*, these are techniques to reduce sources of polluted runoff (construction, agriculture, timber harvesting, residential development and stormwater) and their impacts. BMP's are often low cost, common sense approaches to reduce stormwater volumes and velocity and keep soil out of lakes and streams. Manuals describing these techniques are available through Maine DEP.

Buffer: See *Vegetated Buffer*

Crown: Shaping of a road so that the middle (crown) is higher than the edges. For gravel roads, ½ to ¾ inches of crown is needed for each foot of road width. This feature allows all surface water to drain quickly into the roadside ditches, rather than travel along, and scour the road surface.

Dissolved Oxygen (DO): Oxygen that is dissolved in the water. Aquatic organisms need dissolved oxygen to survive.

Ditch Turnout: A Best Management Practice used to direct runoff from a ditch into a vegetated buffer. This shortens the distance that water flows in the ditch which reduces the water's volume and speed and helps prevents ditch erosion.

Diversion: A Best Management Practice used to intercept and direct surface water runoff. Diversions are usually channels or depressions with a supporting ridge on the lower side, constructed across or at the bottom of a slope.

Level Lip Spreader: Disperses concentrated stormwater flow (such as that discharged by a turnout, catch basin or culvert) in a sheet-flow action across a wide, vegetated area.

Mulch: Hay, bark, or other organic material placed in layers over bare ground surfaces to prevent erosion, conserve soil moisture, minimize soil temperature fluctuations, and aid in the establishment of vegetation.

Open-top Culvert: A long, narrow (4 inches wide) open-top box structure, placed across a road and installed flush with the road surface. This structure collects and directs road surface runoff to roadside ditches or turnouts.

Phosphorus: An element found throughout the environment; it is a nutrient essential to all living organisms. Phosphorus binds to soil particles, is found in fertilizers, sewage, and motor oil, and is often found in high concentrations in stormwater runoff. The amount of phosphorus present in a lake determines the lake's production of algae. A very small increase in phosphorus levels can dramatically increase algae growth.

Polluted Runoff: Runoff that has picked up contaminants or nutrients from the landscape as it flows over the surface of the land to a waterbody. Soil erosion, fertilizers and malfunctioning or poorly maintained septic systems contribute to polluted runoff.

Vegetated Buffer: Areas of undisturbed vegetation between a developed area and a waterbody that are used to capture pollutants being transported in surface water. Buffer vegetation can include trees, shrubs and ground cover plants, that are planted, transplanted, or growing naturally.

Waterbar: A diversion ditch and/or hump (landscape timber or earthen) installed across a trail or road to divert runoff from the surface before the flow gains enough volume and velocity to cause soil erosion.

Watershed: The land area within which water drains to a particular river, stream or body of water. A watershed includes hills, lowlands, and the body of water into which the land drains. Watershed boundaries are defined by the ridges of land separating watersheds. All land is located in a watershed.

APPENDIX A:

CRESCENT LAKE WATER QUALITY INFORMATION

Appendix A: Crescent Lake Water Quality Information

Information in this Appendix is abstracted from data sheets provided by the Volunteer Lake Monitoring Program. Raymond Waterways Protective Association volunteers have been taking water clarity (secchi disk) readings and water chemistry (e.g., dissolved oxygen, chlorophyll-a, phosphorous, etc.) samples from Crescent Lake since 1974.

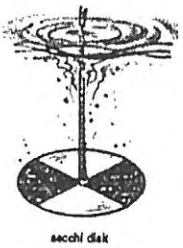
Water Clarity

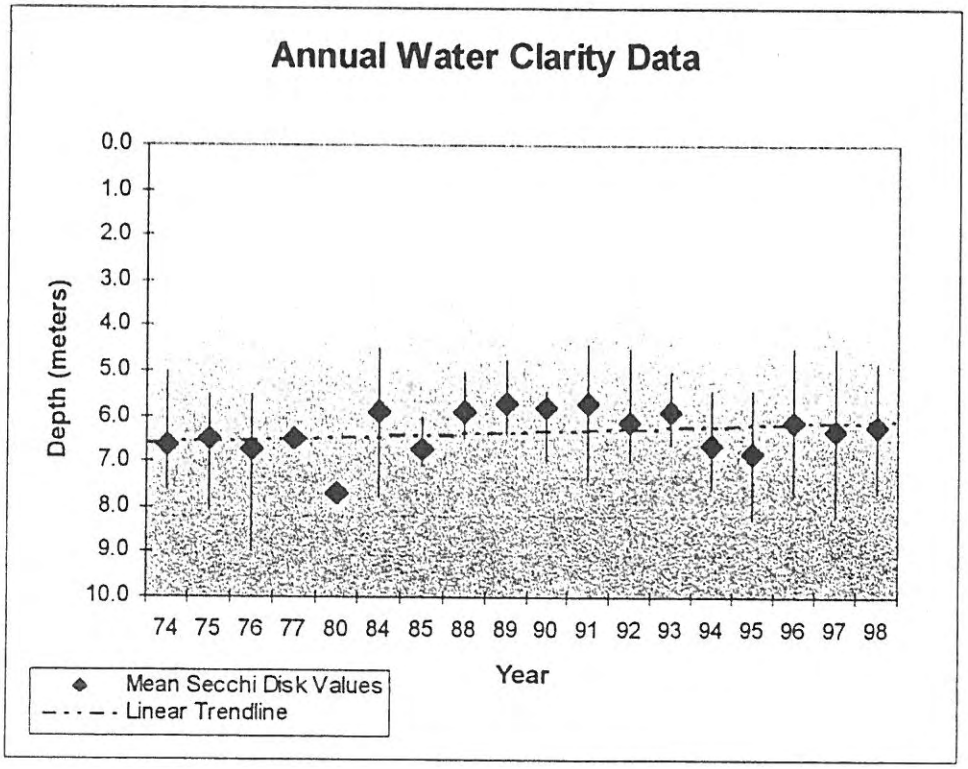
No single feature of lakes affects people's enjoyment of the resource more than water clarity. Mainers and visitors alike enjoy green forests, not green lakes!

Factors that affect water clarity include:

- **Algal growth** - as the growth of algae increases, water clarity decreases. As algal growth continues, green mats can form that will affect clarity, property values, odor, and overall enjoyment of the resource.
- **Solids** - any particles floating in the water, most commonly soil and plant material.
- **Color** - a natural yellow-brown color associated with lakes that receive wetland drainage. Many Maine lakes were more highly "tea" colored than normal during the summer of 1998 due to heavy rains in June of that year.

Secchi disk depth is a measure of water clarity:

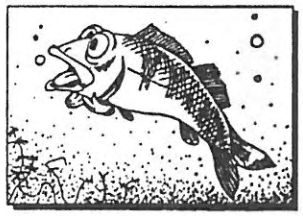




Water clarity appears to have decreased slightly over the 25 year Crescent Lake monitoring period. A substantial increase in development in the watershed has occurred during this period, and is likely to continue into the future. This development, unless properly built, will further degrade the water clarity and quality of Crescent Lake.

Dissolved Oxygen

All aquatic plants and animals need oxygen to survive. The amount of **dissolved oxygen (D.O.)** in the water is an indicator of water quality and the level of life a waterbody can support. Cold water fish species need about 5 parts per million (ppm) of dissolved oxygen to survive, and even higher levels to grow and reproduce. Fish that are exposed to low D.O. levels are susceptible to viral pathogens.



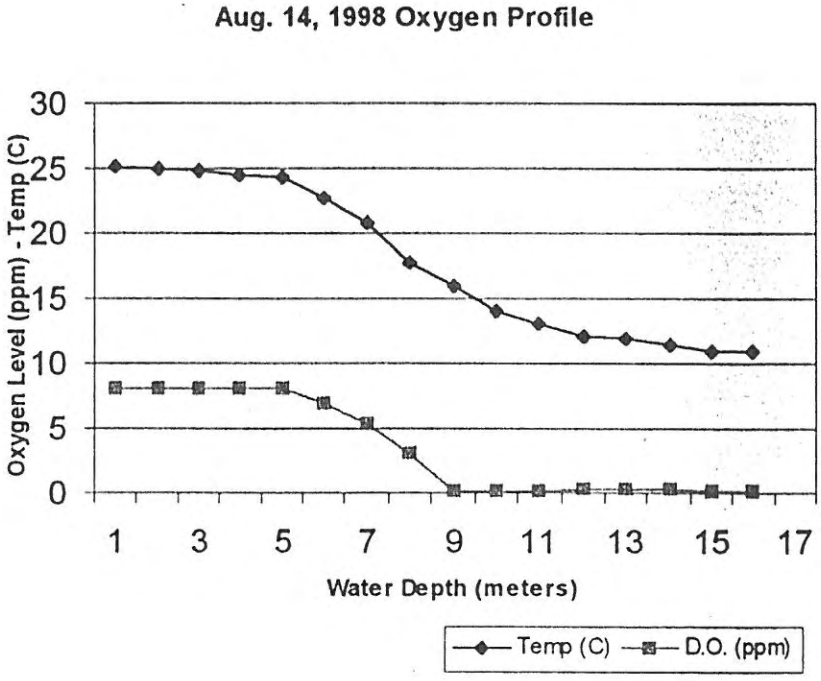
During the 1970's, 80's, and most of the 1990's D.O. levels remained relatively stable. However, in August 1998 the amount of D.O. in the colder water experienced an alarming decline. This occurred in most other lakes and ponds in Maine in the late summer of 1998 as well. The decline was a result of the large quantities of runoff received during the 13 inch rain storm event in June, 1998. Excess nutrient loading and algae production are two major factors that can reduce D.O. levels in Crescent Lake.

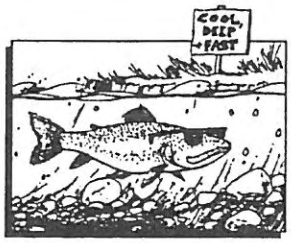
Overall, lake monitoring data indicate a likely decline in water quality, yet future monitoring is necessary to confirm a trend. MDEP categorizes Crescent Lake's water quality as 'moderate/sensitive'.

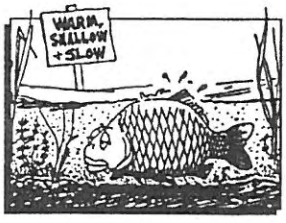
This graph shows the temperature and D.O. readings taken on August 14, 1998, for every meter of depth in Crescent Lake, from the surface (0 meters) to the bottom (15 meters or 49.2 feet).

A dramatic reduction of D.O. is seen at the thermocline (transition between warm and cold water), with significant D.O. depletion observed in the colder bottom water of the lake.

Healthy lakes do not exhibit this severe drop in D.O. in the colder, bottom waters.







APPENDIX B:

MDEP PERMITTING PROCEDURES

Appendix B: Permitting ABC's

In some cases, land owners and road associations will need to obtain local, state, or federal permits prior to implementing some of the conservation practices suggested in this report. In addition to the local permits needed for working within the Raymond's shoreland zone, a Natural Resource Protection Act (NRPA) permit is required from the Maine Department of Environmental Protection when soil is disturbed within 100 feet of a protected natural resource (i.e. lake or stream) or in an area where dirt or soil can wash into water or wetlands.

The following are general guidelines for determining the need for a MDEP permit. The permit applications, as well as MDEP staff, have much more specific and discerning information on the need for these permits. If you have any doubt, call the MDEP Field Services at 822-6300. Staff will promptly answer your questions or possibly visit your property.

Activities requiring permits:

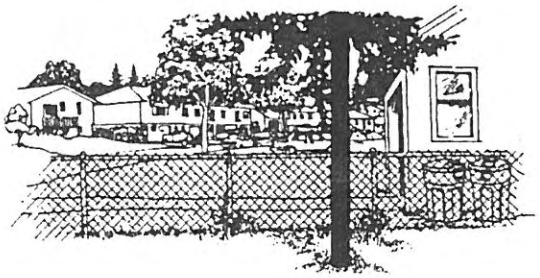
- Excavating
- Tilling
- Bulldozing
- Dredging
- Adding soil to establish vegetation
- Filling
- Draining / dewatering

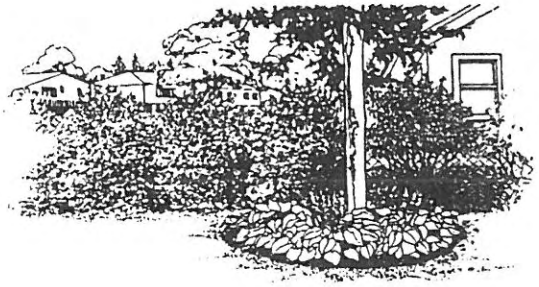
Activities that do not require a permit:

- Planting a few shrubs or creating minor soil disturbance associated with reseeding
- Activities carried out in an area with existing barriers (i.e., ice berms, existing retaining walls) or site conditions (i.e., negative slopes) such that material could not wash into a water resource

How to apply for Permit-by-Rule with the MDEP:

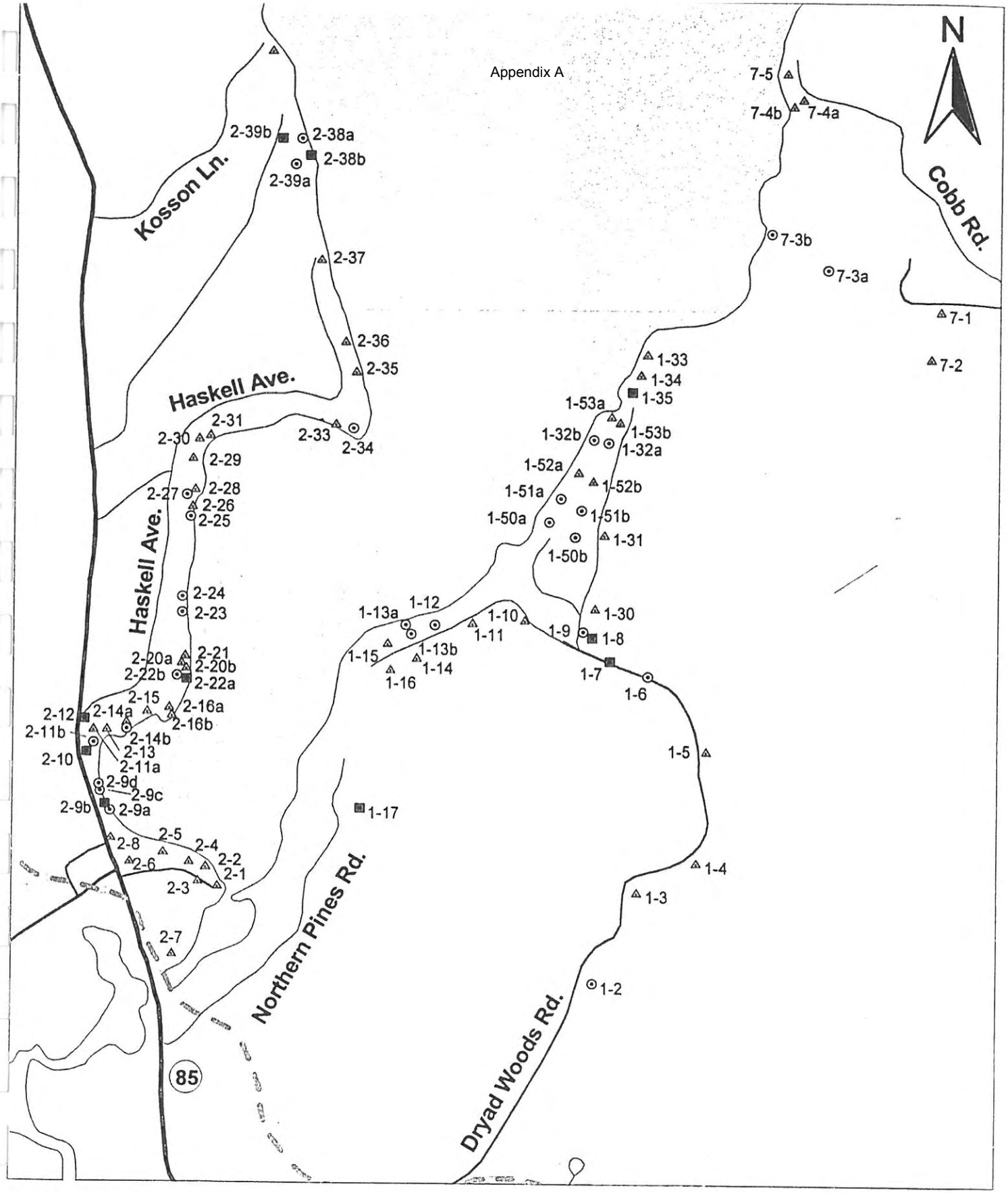
1. Fill out a notification form. Forms are available from your Town Code Enforcement Officer or the Maine DEP office on Canco Rd. in Portland (822-6300).
2. Permit-by-Rule requires that you follow performance based standards. It is important that you obtain, understand and follow these standards so you comply with the law.
3. A Permit-by-Rule application will be reviewed by Maine DEP within 14 days. If you do not hear from Maine DEP within 14 days, you can assume your permit is valid. (In fact, if you "walk in" to Maine DEP, they have the ability to waive the 14 day processing period, provided that the permit and its requirements, photographs, map and fee are complete.)





APPENDIX C:

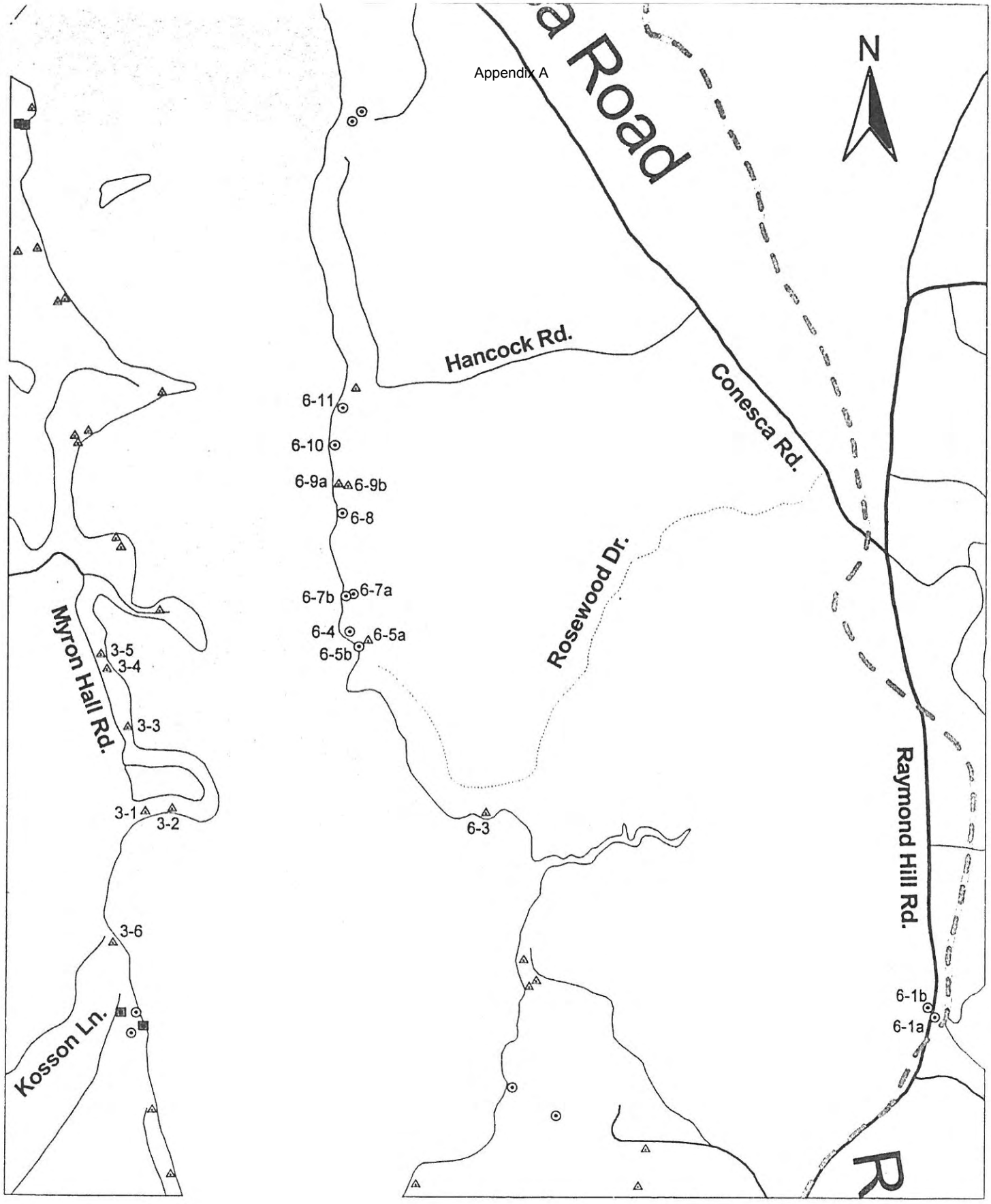
SURVEY RESULTS



0 900 Feet

Sites
- Low Impact Site
- Medium Impact Site
- High Impact Site

Figure C-1
Sectors 1, 2, and 7
Erosion Sites



Sites
- Low Impact Site
- Medium Impact Site
- High Impact Site

0 2000 Feet

Figure C-2
Sectors 3 & 6
Erosion Sites

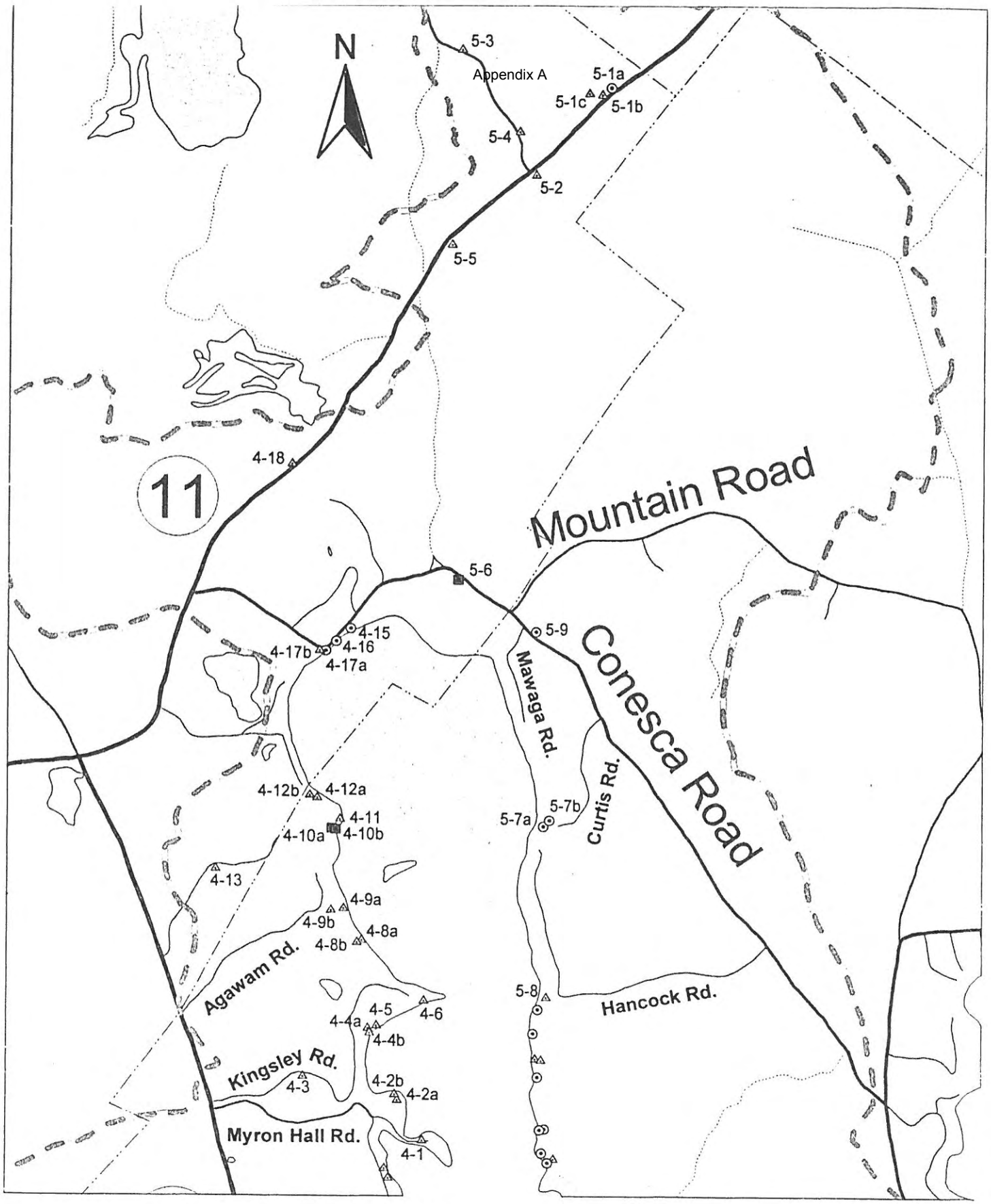


Figure C-3
Sectors 4 & 5
Erosion Sites

Table C-1
Crescent Lake Erosion Sites

Sector--Site #	Land Use	Tax Map&Lot #	Street Name	Type of Problem	Length x Width of Problem Area (feet)	Recommendations	Impact of Site	Technical Level to Install	Cost
1--2	private road	12 & 57	Dryad Woods Road	ditch erosion, unstable culvert inlet	520x3	reshape/vegetate ditch, dig diversion ditch to field, rip rap culvert inlet	medium	medium	medium
1--3	private road	12 & 57	Dryad Woods Road	ditch erosion	400x4	reshape/vegetate ditch	low	low	low
1--4	private road	12 & 57	Dryad Woods Road	ditch erosion	300x3	clear/vegetate ditch	low	low	low
1--5	private road	12&57, 32&12	Dryad Woods Road	ditch erosion	400x3	vegetate ditch, shorten turnouts	low	low	low
1--6	private road	32&12	Dryad Woods Road	road erosion	300x5	maintain buffer between road and stream	medium	low	low
1--7	private road	32&12	Big Pine Road	road erosion	150x5	dig ditch on stream side of road, improve existing turnout	high	low	low
1--8	private road	32&12	Dryad Woods Road	streambank erosion at former bridge crossing	15x60	remove timbers, vegetate and/or rip rap streambanks	high	medium	low
1--9	private road	32&12	Dryad Woods Road	unstable culvert inlet/outlet	20x15	clear culvert, rip rap inlet/outlet, build plunge pools at ends	medium	low	medium
1--10	private road	32&12	Big Pine Road	plugged culvert	20x30	clear culvert, vegetate dirt pile at north end of culvert	low	low	low
1--11	driveway	32&9, 32&10	Big Pine Road	parking area erosion	300x20	add crushed stone or gravel, mulch non-parking areas	low	low	medium
1--12	residential	32&8	Big Pine Road	slope erosion between camp and lake	100x100	mulch bare areas, establish vegetated buffer, terrace/vegetate slope, establish paths	medium	low	low
1--13a	residential	32&6	Big Pine Road	slope erosion between camp and lake	100x20	mulch or peastone under deck, vegetate slope	medium	medium	medium
1--13b	driveway	32&6	Big Pine Road	parking area erosion	50x15	install check dam or water bar at bottom of parking area	medium	medium	medium
1--14	driveway	32&7	Big Pine Road	driveway erosion	50x20	divert water off driveway, install water bars, add crushed stone or gravel	low	low	low
1--15	residential	32&5	Big Pine Road	slope erosion between camp and lake	30x30	establish a vegetatated buffer	low	low	low
1--16	driveway	32&3	Big Pine Road	driveway erosion	50x20	divert water off driveway with turnouts, add crushed stone or gravel	low	low	low
1--17	private road	12&56	Northern Pines	road erosion	300x300	reshape road surfaces, add 2 culverts, 3 plunge pools, level lip spreader and check dam	high	medium	medium
1--30	private road	32&12, 32&15	Dryad Woods Road	ditch erosion	500x3	vegetate and maintain ditch, add new culvert under road to reduce ditch length	low	low	low
1--31	private road	32&16-19	Dryad Woods Road	ditch erosion	500x3	vegetate and maintain ditch, add new culvert with plunge pool at stream/road junction	low	low	low
1--32a	driveway	32&20	Dryad Woods Road	driveway erosion	60x20	divert water at top of drive, install 2 waterbars across driveway, add crushed/pea stone	medium	low	low
1--32b	residential	32&20	Dryad Woods Road	shoreline erosion	40x3	establish a vegetated buffer	medium	low	low

Appendix A

Table C-1
Crescent Lake Erosion Sites

Sector--Site #	Land Use	Tax Map&Lot #	Street Name	Type of Problem	Length x Width of Problem Area (feet)	Recommendations	Impact of Site	Technical Level to Install	Cost
1--33	residential	33&2A	Dryad Woods Road	slope erosion between camp and lake	30x20	establish a vegetated buffer	low	low	low
1--34	residential	33&2B	Dryad Woods Road	slope erosion between camp and lake	30x20	establish vegetated buffer, install winding pathway, store dock above ground on blocks	low	low	low
1--35	residential	33&2	Dryad Woods Road	parking area erosion and bare soil around camp	100x100	mulch bare soil for the short term, reinforce slope and vegetate for the long term	high	high	high
1--50a	residential	32&15	Dryad Woods Road	parking area and slope erosion to lake	80x40	establish a vegetated buffer on slope	medium	medium	medium
1--50b	driveway	32&15	Dryad Woods Road	driveway erosion	300x15	build crown in driveway, divert water away from driveway, install waterbars with turnouts	medium	medium	medium
1--51a	residential	32&16	Dryad Woods Road	shoreline erosion	100x30	establish vegetated buffer, construct terraces or steps to lake	medium	medium	medium
1--51b	driveway	32&16	Dryad Woods Road	driveway erosion	200/15	build crown in driveway, install waterbars with turnouts	medium	medium	medium
1--52a	residential	32&18	Dryad Woods Road	shoreline erosion	80x3	establish a vegetated buffer, terrace pathway	low	low	low
1--52b	driveway	32&18	Dryad Woods Road	driveway erosion	70x15	grade driveway so that runoff discharges to buffer to the southwest	low	low	low
1--53a	residential	33&1	Dryad Woods Road	shoreline erosion	70x3	establish a vegetated buffer with dedicated pathway to lake	low	low	low
1--53b	driveway	33&1	Dryad Woods Road	driveway erosion	100x20	install logs at bottom of parking area to create a check dam	low	low	low
2--1	residential	31&53	Litchfield Road	slope erosion beside camp	101x8	establish vegetated buffer, install waterbar to divert runoff to buffer	low	low	low
2--2	residential	31&52	Litchfield Road	slope erosion	125x10	seed and mulch	low	low	low
2--3	private road	31&51, 31&52	Litchfield Road	road erosion	230x16	improve existing turnouts, install waterbar across road to a plunge pool	low	low	low
2--4	residential	31&51	Litchfield Road	slope erosion	(10x50)+(120x10)	mulch bare soil, install waterbar across flowpath to divert runoff to buffer	low	low	low
2--5	residential	31&48	Litchfield Road	slope erosion between camp and lake	45x10	mulch and/or vegetate bare soil, install waterbar across slope to divert runoff to buffer	low	low	low
2--6	driveway	31&45	Litchfield Road	driveway erosion	50x13	install waterbar with turnout to buffer	low	low	low
2--7	residential	31&57	Route 85	pathway erosion	150x6	terrace and/or install logs or timbers across path to divert runoff to buffer, mulch path	low	low	low

Table C-1
Crescent Lake Erosion Sites

Sector--Site #	Land Use	Tax Map&Lot #	Street Name	Type of Problem	Length x Width of Problem Area (feet)	Recommendations	Impact of Site	Technical Level to Install	Cost
2--8	state road	31&45	Route 85	road shoulder erosion	400x6	dig shallow ditch along Route 85, install check dams or plunge pools in ditch	low	medium	medium
2--9a	public beach	31&43	Route 85	shoreline erosion	105x10	place rip rap along eroding shore	medium	high	high
2--9b	public beach	31&43	Route 85	slope erosion between parking and beach	34x17	mulch and/or vegetate bare soil, establish a dedicated pathway	high	medium	medium
2--9c	public beach	31&43	Route 85	slope erosion around tree	30x20	mulch bare soil around tree	medium	medium	medium
2--9d	public boat ramp	31&43	Route 85	slope erosion on each side of ramp	40x8	armor halfway up slopes from ramp with stone or concrete, vegetate remainder of slopes	medium	medium	medium
2--10	state road	31&42	Route 85	ditch erosion	300x4	install plunge pool in ditch, clean ditch, consider cross culvert under Route 85	high	high	high
2--11a	residential	31&42	Route 85	slope erosion between camp and lake	25x40	establish a vegetated buffer, leave pine needles on ground	low	low	low
2--11b	driveway	31&42	Route 85	ditch erosion	30x1	install speed bump/waterbar with turnout to buffer, consider infiltration for turnout water	medium	high	high
2--12	state road	31&41, 31&42	Route 85	ditch erosion	70x8	install catch basin on east side of Route 85 with cross culvert to buffer on west side	high	medium	medium
2--13	residential	31&41	Haskell Avenue	slope erosion next to camp	30x80	terrace slope to slow and divert runoff, establish vegetated buffer	low	medium	medium
2--14a	residential	31&39	Haskell Avenue	slope erosion next to camp	15x4	install waterbar to divert runoff from ball court, install dry well for down spouts, vegetate	low	medium	medium
2--14b	residential	31&39	Haskell Avenue	failing retaining wall	75x1	rebuild retaining wall using accepted practices and procedures	medium	low	low
2--15	private road	31&37	Haskell Avenue	road erosion	75x16	build crown in road, install waterbar with turnout to buffer	low	low	low
2--16a	residential	31&30	Haskell Avenue	slope erosion next to camp	75x10	dig diversion ditch for runoff from driveway, terrace slope to slow runoff, vegetate	low	low	low
2--16b	residential	31&30	Haskell Avenue	shoreline erosion	50x3	establish dense vegetation on shoreline with well-rooted plants	low	low	low
2--20a	driveway	31&19, 31&27	FL121	driveway erosion	400x15	build crown in driveway, install 3 waterbars with turnouts to buffer	low	low	low
2--20b	residential	31&19, 31&27	Haskell Avenue	erosion in front of garage	(30x10)+(75x15)	install waterbar with turnout to buffer, repair erosion next to garage with stone-filled trench	low	low	low
2--21	residential	31&19	Haskell Avenue	slope erosion on both sides of camp	100x90	terrace and/or install logs or timbers across slope to divert runoff to buffer, vegetate	low	low	low

Appendix A

Table C-1
Crescent Lake Erosion Sites

Sector--Site #	Land Use	Tax Map&Lot #	Street Name	Type of Problem	Length x Width of Problem Area (feet)	Recommendations	Impact of Site	Technical Level to Install	Cost
2--22a	residential	31&27	Haskell Avenue	slope erosion between camp and lake	50x20	install logs or timbers across slope to divert runoff to buffer, build rock trench under dripline	high	medium	medium
2--22b	driveway	31&19, 1&27	FL121	driveway erosion	100x10	build crown in driveway, install sediment trap at bottom of parking area	medium	medium	medium
2--23	private road	_	Haskell Avenue	road erosion	75x15	install speed bump/waterbar at end of pavement, ditch N side of road, install sediment trap	medium	low	medium
2--24	private road	31&7	Haskell Avenue	road erosion	155x10	build crown in road, install 2 waterbars with turnouts to buffer	medium	low	low
2--25	residential	30&62	Haskell Avenue	slope erosion around picnic table	20x20	install log or berm at low end to slow runoff, mulch area in use, vegetate remaining area	medium	low	low
2--26	residential	30&61	Haskell Avenue	slope erosion around swing, downspout erosion	30x30	place timber at low end of swing area and add mulch, construct crushed stone trench at downspouts	low	low	low
2--27	residential	30&59	Haskell Avenue	parking area erosion	80x100	rock-line south ditch and install sediment trap near lake, install timber and add mulch below camp	medium	high	medium
2--28	residential	30&58	Haskell Avenue	slope erosion both sides of camp, shore erosion	20x10	stabilize shoreline, let buffer grow, mulch bare areas, divert roof runoff into buffer	low	low	low
2--29	residential	30&56	Haskell Avenue	slope erosion next to camp, pathway erosion	70x30	terrace and/or install logs or timbers across slope to divert runoff to buffer, mulch	low	low	low
2--30	residential	30&55	Haskell Avenue	slope erosion below deck and next to camp	30x20	let buffer grow, divert downspout flow to buffer, terrace and vegetate remaining slope	low	low	low
2--31	driveway	30&54	Haskell Avenue	driveway erosion	60x10	install waterbar with turnout to buffer	low	low	low
2--33	residential	30&40	Haskell Avenue	shoreline erosion	65x3	reduce size of beach, let buffer grow, stabilize shoreline with well-rooted plants	low	low	low
2--34	residential	30&39	Haskell Avenue	shoreline erosion	20x3	remove fill, reestablish former topography and vegetated buffer	medium	low	low
2--35	residential	30&37	Haskell Avenue	shoreline erosion	35x3	establish vegetated buffer	low	low	low
2--36	residential	30&35	Haskell Avenue	slope erosion between camp and lake	50x30	use only stairs to access lake, reinforce slope with earth-stabilizing materials, vegetate	low	medium	medium
2--37	residential	30&28	Haskell Avenue	pathway erosion next to camp	30x8	terrace and/or install logs or timbers across path to divert runoff to buffer, mulch path	low	low	low

Appendix A

Table C-1
Crescent Lake Erosion Sites

Sector--Site #	Land Use	Tax Map&Lot #	Street Name	Type of Problem	Length x Width of Problem Area (feet)	Recommendations	Impact of Site	Technical Level to Install	Cost
2--38a	commercial	12&53	Route 85	slope and shoreline erosion	133x115	install level spreaders at bottom of slope, build steps to reduce trampling of bank, mulch	medium	medium	medium
2--38b	commercial	12&53	Route 85	slope erosion on beach access area, stormwater outfall	120x200	consider ditch and/or low diversion berm across slope to sediment trap, rip rap stormwater outfall	high	high	high
2--39a	commercial	12&53	Route 85	slope erosion and runoff from camping area	160x150	construct swale with berm around perimeter of camping area, silt fence around soil piles	medium	low	low
2--39b	commercial	12&53	Route 85	slope erosion and runoff, catch basin	150x170	divert runoff into shallow swales to maximize infiltration, consider upgrading catch basin	high	high	high
3--1	residential	29&21	FR 132	slope erosion between camp and lake	20x30	establish a vegetated buffer with dedicated pathway to lake, don't rake duff layer	low	low	low
3--2	residential	29&20	FR 132C1	slope erosion between camp and lake	35x20	establish a vegetated buffer with dedicated pathway to lake, don't rake duff layer	low	low	low
3--3	driveway	29&14	FR 132	driveway erosion	10x20	install waterbars with turnouts, establish a vegetated buffer at bottom of driveway	low	low	low
3--4	residential	29&11	FR 132	slope erosion between camp and lake	10x10	establish a vegetated buffer with dedicated pathway to lake	low	low	low
3--5	residential	29&10	FR 132	slope erosion between camp and lake	50x3	establish a vegetated buffer, install logs or timbers across path to divert runoff to buffer	low	low	low
3--6	driveway	12&51	Kosson Lane	driveway erosion	40x20	add crushed stone or gravel, install waterbars with turnouts, establish vegetated buffer	low	low	low
4--1	residential	29&26	Myron Hall Road	slope erosion on island path from shore to camp	40x20	reduce width of pathway and mulch, establish vegetated buffer on unused area	low	low	low
4--2a	residential	29&3	Myron Hall Road	slope erosion leading to beach and dock	44x12	terrace slope and vegetate	low	low	low
4--2b	residential	29&3	Myron Hall Road	slope erosion on area above concrete bulkhead	12x18	add loam, mulch, and vegetate	low	low	low
4--3	private road	29&39, 29&40	Kingsley Road	road erosion	400x15	build crown in road, install waterbars with turnouts	low	low	low
4--4a	residential	12&37A	Kingsley Road	slope erosion between trailer and lake	70x40	install winding pathway, vegetate slope, restore tree canopy	low	low	low

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Table C-1
Crescent Lake Erosion Sites

Sector--Site #	Land Use	Tax Map&Lot #	Street Name	Type of Problem	Length x Width of Problem Area (feet)	Recommendations	Impact of Site	Technical Level to Install	Cost
4--4b	residential	12&37A	Kingsley Road	soil sloughing from cut in slope	12x30	reshape to a flatter slope and vegetate using erosion control blankets	low	medium	low
4--5	residential	12&38	Kingsley Road	pathway erosion	73x8	mulch pathway	low	low	low
4--6	residential	12&37	Kingsley Road	slope erosion next to beach	17x26	re-route foot traffic around slope to terrace above beach, vegetate slope	low	low	low
4--8a	residential	?&65	FL 135A	unstable bank at lake access	10x3	stabilize bank by terracing, mulch and vegetate	low	low	low
4--8b	residential	?&65	FL 135A	pathway erosion	72x3	install logs or timbers across path to divert runoff to buffer, mulch path	low	low	low
4--9a	residential	?&60	Frog Hollow Road	pathway erosion	142x3	terrace and/or install logs or timbers across path to divert runoff to buffer, mulch path	low	low	low
4--9b	private road	?&60	Frog Hollow Road	road erosion	164x15	add gravel, build crown in road, install open-top culverts and turnout with sediment trap	low	high	high
4--10a	commercial	_	Agawam Road-Casco	slope erosion in area between lawn and beach	75x100	divert runon away from area using berm and level spreader, mulch pathway to beach	high	high	high
4--10b	commercial	_	Agawam Road-Casco	beach erosion	45x43	diverting runon from Site 4-10a should solve problem	high		
4--11	commercial	_	Agawam Road-Casco	pathway erosion	36x5	terrace or install steps, mulch path	low	low	low
4--12a	commercial	_	Agawam Road-Casco	slope erosion in cabin courtyard	270x100	add crushed stone or mulch to courtyard, restrict access to lake shore, establish buffer	low	low	low
4--12b	commercial	_	Agawam Road-Casco	slope erosion between tennis courts and lake	_	establish a vegetated buffer and dedicated pathway	low	low	low
4--13	private road	_	Agawam Road-Casco	unstable road bank	350x15	dig ditch on south side of road, install culvert under road with plunge pools at both ends	low	high	high
4--15	public beach	_	Edwards Road	slope erosion next to beach, undercut bank	86x2	reshape and rip rap bank, establish a vegetated buffer and dedicated pathways	medium	medium	high
4--16	public beach	_	Edwards Road	eroding sand fill and rip rap bank	140x2	reconstruct rip rap bank, establish a vegetated buffer over sand fill and rip rap	medium	medium	high
4--17a	town road	_	Edwards Road	road shoulder erosion	128x5	install turnout with level spreader at discharge point to lake, establish vegetative buffer	medium	medium	medium
4--17b	public beach	_	Edwards Road	pathway erosion	17x3	construct steps down bank or add logs across path to slow runoff and erosion	low	low	low
4--18	state road	_	Route 11	unstable culvert inlet/outlet	20x12	place rip rap around culvert inlet/outlet	low	low	low

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Table C-1
Crescent Lake Erosion Sites

Sector--Site #	Land Use	Tax Map&Lot #	Street Name	Type of Problem	Length x Width of Problem Area (feet)	Recommendations	Impact of Site	Technical Level to Install	Cost
5--1a	state road	_	Route 11	ditch erosion	800x4	install soft armor (mat) on ditch bottom and sides, vegetate, construct sediment trap(s)	medium	high	high
5--1b	driveway	_	Route 11	driveway erosion	200x2	add gravel, build crown in driveway, install waterbars with turnouts to ditch and buffer	low	low	low
5--1c	residential	_	Route 11	slope erosion and runoff from lot	75x4	seed and mulch bare soil	low	low	low
5--2	state road	_	Route 11/Johnson Road	unstable culvert inlet/outlet	_	install longer culvert, rip rap inlet/outlet, clean up winter sand	low	high	high
5--3	town road	_	Johnson Road	winter sand from road is burying culvert	_	install longer culvert, rip rap inlet/outlet, clean up winter sand	low	high	high
5--4	town road	_	Johnson Road	road shoulder erosion	300x2	clean up winter sand	low	low	low
5--5	state road	_	Route 11	culvert plugged with winter sand	_	clean up winter sand, consider constructing sediment traps in ditch	low	low	low
5--6	town road	_	Edwards Road	unstable culvert inlet/outlet	20x20	install larger culvert (rip rap entire downstream side as alternative), rip rap inlet/outlet	high	high	high
5--7a	private road	15&56	Curtis Road	driveway erosion accelerated by gutter discharge	200x2	add coarser gravel to driveway, install waterbars with turnouts to buffer	medium	low	low
5--7b	commercial	15&56	Curtis Road	pathway erosion	300x2	terrace and/or install logs or timbers across path to divert runoff to buffer, mulch path	medium	low	low
5--8	residential	15&26 or 27	Hancock Road	exposed soil pile	10x5	remove or cover pile	low	low	low
5--9	town road	_	Conesca Road	road shoulder erosion	500x2	armor road shoulder with stone or other erosion-resistant material	medium	medium	medium
6--1a	town road	12&?	Raymond Hill Road	soil erosion around bridge abuttments	50x10	place rip rap and vegetate around abuttments from stream up to road shoulder	medium	low	medium
6--1b	town road	12&?	Raymond Hill Road	road shoulder erosion	150x6	dig ditch on west side of road, construct sediment trap before stream	medium	medium	medium
6--3	residential	12&75	Rosewood Drive	pathway erosion	38x6	mulch path	low	low	low
6--4	residential	15&18	Crescent Shore Road	slope erosion and runoff from lawn	96x58	expand vegetated buffer up the slope from lake, seed lawn, consider terracing the lawn	medium	low	medium
6--5a	residential	15&17	Crescent Shore Road	bare soil with no erosion controls	117x130	install silt fence downslope of bare area, seed and mulch	low	low	low
6--5b	residential	15&17	Crescent Shore Road	bare soil in picnic/shore area	28x30	establish vegetated buffer along shore, mulch picnic area, consider terracing area	medium	low	low

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Table C-1
Crescent Lake Erosion Sites

Sector--Site #	Land Use	Tax Map&Lot #	Street Name	Type of Problem	Length x Width of Problem Area (feet)	Recommendations	Impact of Site	Technical Level to Install	Cost
6--7a	residential	15&19	Crescent Shore Road	pathway erosion	210x5	terrace and/or install logs or timbers across path to divert runoff to buffer, mulch path	medium	low	low
6--7b	residential	15&19	Crescent Shore Road	bare soil in picnic/shore area	33x47	establish vegetated buffer along shore, mulch picnic area, divert runon away from area	medium	low	low
6--8	residential	15&21	Crescent Shore Road	pathway erosion	80x4	terrace and/or install logs or timbers across path to divert runoff to buffer, mulch path	medium	low	low
6--9a	residential	15&22	Crescent Shore Road	pathway erosion	85x3	terrace and/or install logs or timbers across path to divert runoff to buffer, mulch path	low	low	low
6--9b	residential	15&22	Crescent Shore Road	driveway erosion	240x25	construct retaining wall at bottom of driveway, install waterbars across driveway, vegetate	low	low	low
6--10	residential	15&23	Crescent Shore Road	pathway erosion	155x4	terrace and/or install logs or timbers across path to divert runoff to buffer, mulch path	medium	low	low
6--11	residential	15&24	Crescent Shore Road	pathway erosion	85x3	terrace and/or install logs or timbers across path to divert runoff to buffer, mulch path	medium	low	low
7--1	private road	12&63	Naomi Road	road erosion	200x13	add gravel, install waterbar such that runoff is diverted to a level lip spreader on north side of road	low	low	low
7--2	private road	12&63	Naomi Road	road erosion	80x12	build crown in road, install waterbar with turnout to level spreader and buffer	low	low	low
7--3a	private road	12&63	Naomi Road	road erosion	500x12	install waterbars with turnouts to level spreaders and buffer, plunge pool for culvert outlet	medium	low	low
7--3b	commercial	12&63	Naomi Road	slope erosion on beach	150x50	construct retaining wall to terrace beach	medium	low	medium
7--4a	driveway	33&4	FR187A2	driveway erosion	200x13	install waterbar with turnout to buffer, avoid raking area behind basketball hoop	low	low	low
7--4b	residential	33&4	FR187A2	slope erosion between driveway and dock	53x15	establish vegetated buffer along shore, terrace or waterbar to divert runoff to buffer	low	low	low
7--5	driveway	33&6	Cobb Road	driveway erosion	150x12	install waterbar with turnout to buffer, place railroad tie at bottom of drive to retain sediment	low	low	low

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