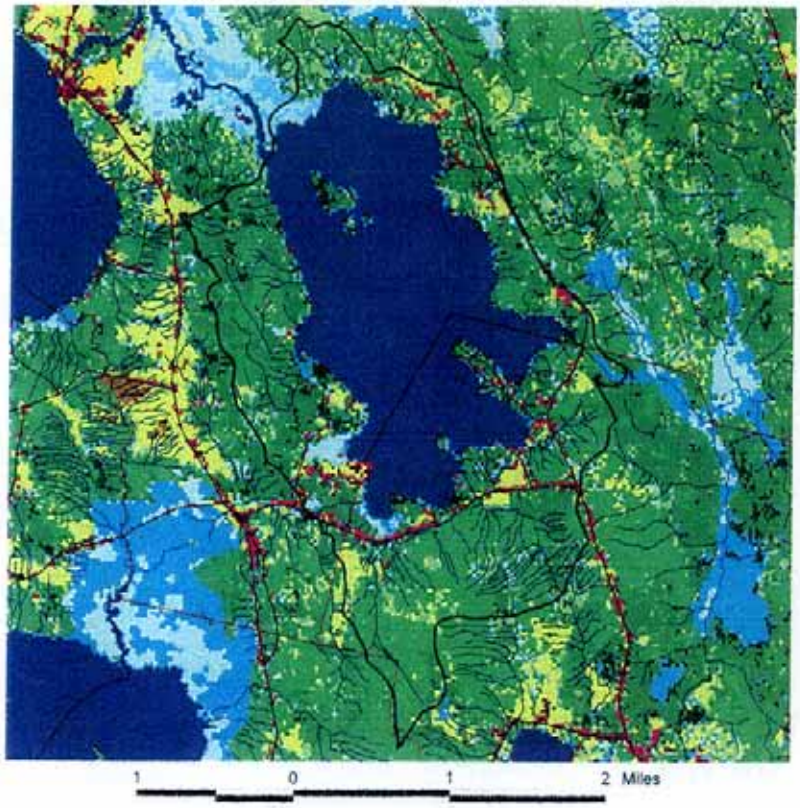
East Pond Watershed

Nonpoint Source Pollution Survey

East Pond Watershed Land Cover Types



Belgrade Regional Conservation Alliance
Watershed Protection Program
March 2000

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Watershed Volunteers:

Carrie Brooke	Sheila Jobber
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Wayne Ham	Timothy Wess

Technical Staff:
Linda Bacon, Maine Department of Environmental Protection
Mary Ellen Dennis, Department of Environmental Protection
Rachel Gallant, Americorps Member
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Nancy Olmstead, Americorps Member

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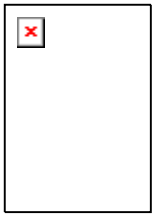

Belgrade Regional Conservation Alliance
PO Box 250
Belgrade Lakes, ME 04918
207-495-6039

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A Clean Lake is a Reflection of Us All

1.0 Introduction:

1.1 Background:

East Pond has a surface area of 1,670 acres and a direct watershed of 4.2 square miles. East Pond empties into North Pond in Smithfield village via the Serpentine, which has an open water area of 164 acres and a watershed of 6.2 square miles. A dam, owned by the East Pond Association and located in Smithfield village, controls the height of the water in East Pond and the Serpentine. The East Pond watershed is located in the towns of Smithfield and Oakland. The Serpentine is located primarily in Smithfield, but its watershed stretches into Norridgewock. The Serpentine is the out-flow for East Pond and therefore technically a part of the watershed of North Pond, but its influence on the water quality of East Pond leads us to consider it in conjunction with East Pond. (see Appendix 1: East Pond and the Serpentine, p.16).

During the spring and summer months of 1999, volunteer Watershed Stewards conducted a watershed survey of East Pond and the Serpentine, under the guidance of the Belgrade Regional Conservation Alliance (BRCA) Watershed Program. Volunteers roamed the watershed searching for signs of potential Nonpoint Source (NPS) Pollution. NPS Pollution often occurs during "runoff events" (i.e. rain storms, snow melt) as the result of land-use activities. It can also originate from poor fertilizing practices on farms or lawns, or it can come from failing onsite sewage disposal (septic) systems. Sediment, and the phosphorus bound to it, are the most significant NPS pollutants in this lake. Phosphorus is the limiting nutrient that controls the growth of algae in East Pond. Phosphorus can enter the waterbody directly or bound up with soil particles (sediment). Sediment not only contributes to phosphorus loading, but also can directly smother aquatic plants and invertebrates or fish spawning areas when it washes into a lake or stream. Surveyors focused on identifying sites where soil erosion could carry sediment and phosphorus into the lake or a tributary.

East Pond has had water quality problems during the past decade. There have been intense algae blooms (explosive, excessive growth) in 1991, 1993-95, 1998 & 1999. The lake is rated as having "partially impaired water quality" by the DEP. Concerns about the algae blooms spurred the East Pond Association to start a special fund to defray the costs of finding a solution to the excess algae in East Pond. In 1999, Colby College students, under Professor David Firmage, conducted an intensive study of the watershed in order to identify the sources of phosphorus input. They also are studied techniques to remove or inactivate the phosphorus in the lake. (For more information on East Pond Water Quality see Appendix 2, p.17, and the 1999 Colby Study –due out in March 2000 - which will be available from the BRCA Watershed Program for the cost of copying and mailing).

East Pond is included on Maine's Nonpoint Source Priority List, due, in part, to the degree of impairment already seen in the recurrent algae blooms and the threat of more problems from Nonpoint Source Pollution. This survey is part of the wider effort by the Belgrade Regional Conservation Alliance (BRCA) to develop a Watershed Management Plan for the Belgrade Chain. The BRCA has received a grant from the Maine Department

of Environmental Protection (DEP) to develop this Plan, and survey work is underway on North Pond and Great Pond. The survey of Salmon Lake/ McGrath Pond was completed in the fall of 1998 and a Report issued in January 1999 (copies available from the BRCA Watershed Program for $9.50).

1.2 Land Use:
The 1991 Colby College Study – "An Analysis of East Pond and the Serpentine Watersheds in Relation to Water Quality" – listed 173 developed or developable lots in the Oakland section of the watershed, and one lot restricted to tree growth; 266 developed or developable lots in Smithfield, and 22 in tree growth; and, on the outer edge of the watershed, 8 developable lots in Belgrade. They noted that there was a 22% increase in the number of houses along the shoreline of East Pond between 1970 and 1990. And a couple of future developments they mentioned in that report – Lake Ridge Condos and Eastwood Road – are now being developed. There are also two commercial children's camps on the lake and a commercial cottage rental business. The three farms identified in the 1991 Report have been reduced to one small livestock operation and some hayfields in the Serpentine watershed.

2.0 Objectives:

This project had three major objectives:
1. Identify and prioritize Nonpoint Source Pollution sites (particularly erosion sites) within the East Pond and Serpentine watersheds.
2. To increase public awareness of the effects of stormwater runoff and erosion on lake water quality.
3. To recommend mitigation measures to deal with the problems discovered.

3.0 Methods:

3.1 Background:
Trained volunteers conducted the East Pond Survey. During the winter months, John Jemison conducted a Watershed Stewards training program for interested volunteers. Then in April a training session, based upon the manual – "Lake Watershed Surveys: How to Conduct a NPS Phosphorus Survey" – gave the volunteers a basic knowledge of NPS and watershed protection issues. Volunteers were recruited from the three lake associations – East Pond Association, North Pond Association, and Belgrade Lakes Association, from the Watershed Stewards, and from the general public.

The volunteers participated in a one-day training session, on April 24, 1999. Cynthia Kuhns of Lake and Watershed Resource Management Associates of Turner, Maine, and Rob Mohlar of the Kennebec County Soil & Water Conservation District, conducted the training. Participants learned how to recognize and document potential erosion sites. The upper Great Pond watershed was divided up into 22 sectors and eleven were immediately

assigned, including all of East Pond and the Serpentine (5 survey sectors). Survey teams consisted of two or three members. Non-assigned sectors were surveyed by the BRCA Watershed Program Coordinator with assistance from the Maine DEP. The teams conducted their surveys during May, June and July. Ideally, surveys would be conducted in April and May when water tables are high and erosion from snowmelt and runoff is readily apparent and before the trees and bushes leaf out (A Citizens Guide to Lake Watershed Surveys). However, this was one of the driest springs on record, there were few rains in May and June (or July). The surveyors therefore just had to do their best with what the weather provided.

The BRCA Watershed Program Coordinator carried out the follow-up of survey reports with assistance from Maine DEP staff. This follow-up confirmed the findings of the volunteers, proposed solutions to the problems, developed cost estimates, and prioritized the sites. This follow-up also served as a chance for a second survey of these sectors, and additional sites were identified. Both the surveyors and the follow-up team were supplied with literature and pamphlets on lake and water quality issues, which were distributed to homeowners and any other interested member of the public.

3.2 Sectors

The East Pond Watershed was divided into 4 survey sectors delineated on a topographical map (see Map 1, p.26ff), and the Serpentine one Sector (see Map 6, p.26ff). Each sector extends from the shoreline to the high point of the watershed, thus encompassing all land types and uses. The East Pond Sectors are:

Sector E-1: This sector is located in the Town of Smithfield and includes the northeast portion of the East Pond watershed. The northern boundary starts on the east side of the entrance to the Serpentine and heads north to the ridge dividing Clark Brook from East Pond. From there it follows that ridge southeasterly until it meets the eastern boundary of the watershed, just east of East Pond Road and just north of East Wood Estates. The boundary then parallels (to the east), or is contiguous with East Pond Road south to Cardinal Lane. It then parallels Cardinal Lane west down to the lake.

Sector E-2: This sector is in the Towns of Smithfield and Oakland on the eastern shore of East Pond. The northern boundary is Cardinal Lane in Smithfield, off East Pond Road. The easterly bound is East Pond Road south to the county line, where it moves to the east along the high ground. The southern bound is the small watercourse that empties into East Pond beside the State Boat Launch Ramp. This sector includes the highly developed area of Brickett Point.

Sector E-3: This sector is entirely within the Town of Oakland. It begins on East Pond Road at the State Boat Launch Ramp and goes south to Rte 137. It includes the southern end of East Pond from Tyler Corner to the Oakland-Smithfield townline. The shoreline and most development is north of Route 137. To the south is the north slope of Mutton Hill, which is largely undeveloped. This sector contains Camp Manitou and Alden Camps.

Sector E-4: This sector is almost entirely within the Town of Smithfield (part of Camp Mantuoka is in the Town of Oakland), and includes the western shoreline of East Pond. The western boundary is the ridge top just to the east of Routes 8 & 137. The northern boundary extends from where Elm Acres Lane meets Routes 8 & 137 easterly to the entrance to the Serpentine.

3.3 Ranking of Sites (see Tables starting on page 34)
For each verified site, general recommendations have been made for remediation or stabilization. In addition, each site has been given a ranking based upon technical level to implement, degree of impact, cost of remediation and priority. The criteria used are as follows:

Technical Level to Install:

Low – Quick fix, landowner can usually do the work, minimal training needed, a possible Belgrade Lakes Conservation Corps project, contractor not necessary.
Medium – Moderate complexity, technical assistance might be necessary, some equipment needed.
High – Complex project, technical assistance or engineering needed, equipment necessary.

Impact:

Relative impact is assigned to each site based upon the following criteria as well as the best judgement of the Follow-up team.
Low – Eroding site with *limited transport off site*, even if the site is large
Medium – Sediment transported off site to buffer or wetland, usually greater than 100 square feet of impact.
High – Direct flow to tributary or lake; usually greater than 100 square feet of disturbance.

Cost:

None - -$0 -
Low - <$500
Medium - $500-$2500
High - >$2500

Priority:

The Priority Ranking is determined by combining all the above factors.

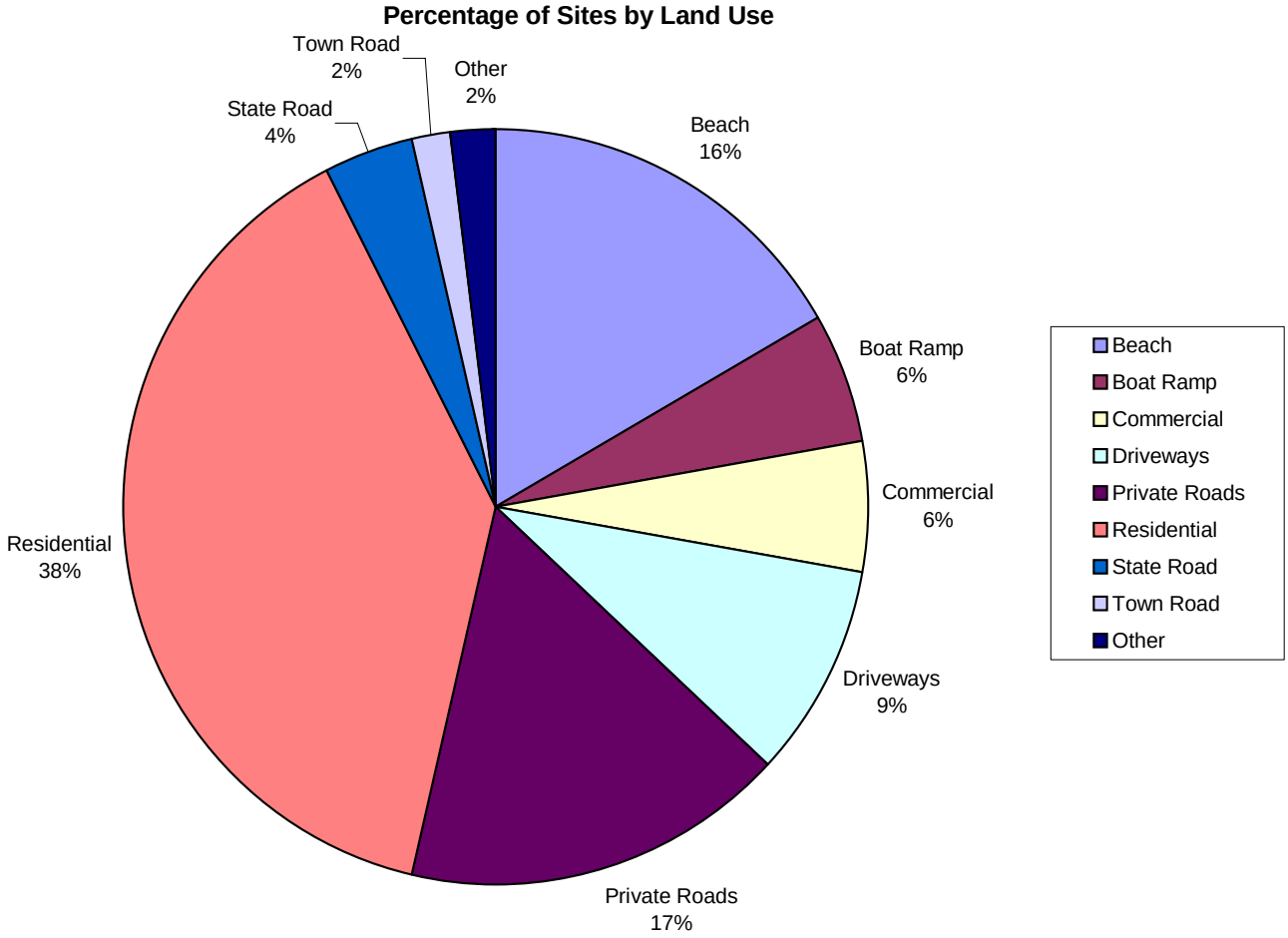
4.0 Results – East Pond

4.1 Site Identification
Volunteers identified 65 potential impact sites. Of these, 29 were determined to have an impact on water quality. Of the other 33 sites, 7 were Posted (No Trespassing with Gated Roads) so could not be verified, and 26 were either not a threat to water quality, or no

longer a problem (the case with several construction sites), or could not be located. During the follow-up process, the BRCA staff identified an additional 28 sites for a total of 57 sites potentially contributing to a decline in water quality in the East Pond watershed.

4.2 Sites by Land Use:
East Pond

Beach – 9
Boat Ramp – 3
Commercial – 3
Driveways – 6
Other – 2 (stream & snow mobile trail)
Private Road – 9
Residential – 21
State Road – 2
Town Road – 2



East Pond Watershed Survey Results

Almost half of the 57 sites in the East Pond watershed are residential or driveways - 47%. Camp roads (Private Roads) make up another 17%, and Boat Access areas are another

6%. Thus over two thirds of the problems identified are directly associated with development in the watershed. Eroding beaches are the next largest group at 16% of sites. Town and state roads make up only 6% of the problems found.

The maps (p. 26ff) show the locations of all the sites by sector. The Tables (p. 33ff) summarize the problems found at each site. These tables include Land Use, Type of Problem, Recommendations, and cost estimates. The tables also Prioritize the identified sites.

4.3 Typical Problems and Suggested Remedies by Land Use Type

Beach: (9 sites)
The typical problem beach on East Pond is just too large. The lack of buffers lets runoff travel over the sand carrying sediment into the lake. Also, bare sand does not protect the shoreline from erosion.
Remedies:

- Reduce length of beaches by allowing volunteer shrubs and bushes to grow in, or with deliberate buffer plantings
- Plant buffers above the beaches to filter runoff
- Riprap upper edge of beach (where eroding from wave action)

Boat Ramp: (3 sites)
The typical boat ramp problem is that runoff down the ramp is carrying sediments into the lake. Two of these are private ramps, but one is the Fish & Game Ramp on East Pond.
Remedies:

- Waterbars to divert runoff from going down the ramps
- Better surface materials – decreased erosion

Commercial: (3 sites)
The commercial sites are all areas of heavy use. The typical problem was wear and tear from foot traffic or runoff from the roofs of the many structures.
Remedies:

- Seed and mulch bare areas
- Use fences and plantings to channel traffic to prepared paths
- Restrict open access to waterfronts
- Move incompatible uses away from lakes (e.g. basketball courts)

Driveways: (6 sites)
Surface erosion and clogged culverts are the principle problems occurring with driveways. The clogged culverts are especially worrying because they could cause a washout of the entire driveway, carrying large amounts of sediment into the lake.
Remedies:

- General maintenance
- Cleaning out ditches
- Maintaining a stable shaped surface.

Private Roads: (9 sites)
Surface erosion and clogged culverts are the principle problems found on Private (Camp) Roads in the East Pond watershed. These are maintenance issues. The shape of the roads, i.e. crown and shoulders, is also an issue (see Camp Road Maintenance Manual). Poorly constructed or poorly maintained camp roads pose a major threat to water quality as they can channel runoff until the point where it begins to erode the road surface material, which is carried into the lake.
Remedies:

Remove grader berms
Reshape and crown roads
Maintain culverts and ditches
Enhance turnouts
Install waterbars
Seed and mulch, or riprap, to stabilize ditches.

Residential: (21 sites)
Of the 21 Residential sites, 15 had inadequate buffers, 11 had patches of bare soil, and 4 sites had moderate to severe surface erosion. Shoreline erosion was not a great problem; a lot of places had done work to protect the shore with riprap. Roof runoff and runoff from driveways were problems at some sites. And one site had an outdoor shower that drained directly into a small tributary running into East Pond.
Remedies:

BUFFERS, BUFFERS, BUFFERS. Let the natural vegetation grow-up, or do plantings, but ESTABLISH BUFFERS
Bare soil should be seeded and mulched, and where grass won't grow, shade tolerant groundcovers should be planted. (see The Buffer Handbook Plant List)
Stop raking the leaves and duff from their yards.
Waterbars and turnouts will stop runoff from eroding boat access areas.
Gutters and crushed stone driplines can control the problems from roof runoff.
Plumb outdoor showers to septic system

State Roads: (2 sites)
The 2 sites along Rte 137 were associated with clogged culverts and eroding shoulder material.
Remedies:

Better shoulder material
Culvert inlet/outlet protection (riprap)
Ditch maintenance.

Town Road: (2 sites)
East Pond Road in Oakland, heading north from Tyler Corner to just past the entrance to the Fish and Wildlife Boat Ramp, has clogged culverts, a shoulder berm that does not allow water to leave the road surface, eroding ditches.

The Thomasville Road, off Rte 137, has a culvert that needs riprap protection and a severely eroding shoulder.
Remedies:

Riprap ditches
Riprap culvert headers
Reshape the ditches
Remove the shoulder berm.

Other: (2 sites)
In this category are one natural erosion site and one manmade. The first is the stream by the Fish and Wildlife Boat Ramp, which is eroding the bank as it, enters the lake. The second is the point where the snowmobile trail leaves the lake, near Eastwood Road, and cuts through the berm.
Remedies:

Riprap and seeding.
Better surface material

5.0 Discussion – East Pond

East Pond turned green again this year (1999). This is both aesthetically and ecologically bad for the lake, and potentially fiscally bad for the towns that surround it.

Any attempt to control the algae blooms in East Pond must begin by addressing the phosphorus that is added to the lake every time it rains. Runoff picks up nutrients and carries them into the lake to feed the algae that turn the water green and make swimming and boating unpleasant. Studies by Colby College (1991 and 1999) identified internal phosphorus loading as the principal cause of algae blooms; however, both studies emphasized the need to stop more phosphorus from reaching the lake as a major step toward controlling algae growth. Removing phosphorus from the water is a difficult, expensive, and not always successful endeavor. Preventing phosphorus from entering the lake is relatively easy and inexpensive. The methods are well known and proven.

None of the sites surveyed seemed to be in direct violation of the Shoreland Zoning Act; however, discussions with property owners revealed a feeling that there needed to be stricter enforcement of the Shoreland Zoning regulations.

This survey of East Pond points out that the greatest source of phosphorus containing runoff is associated with residential development around the lake. While the are three sites (1 Commercial and 2 State Road sites) that individually could have a High Impact on phosphorus pollution levels, there are 24 Low Impact sites (5 Driveways, 6 Private Roads, 13 Residential) associated with residential development that cumulatively have a far greater impact on water quality than the High Impact sites. The decline in water quality can be likened to a “death by a thousand cuts.” There is no one person or entity to blame for the NPS (Nonpoint Source) Pollution going into East Pond – we are all responsible for a little bit. And those bits add up!

Every property owner around the shoreline of East Pond as well as those who are close to tributaries should be conscious of what constitutes NPS Pollution, and of the remedies that are available. The Belgrade Regional Conservation Alliance has a collection of free pamphlets from the Maine DEP on NPS Pollution. The Watershed Program Coordinator and/or the Belgrade Lakes Conservation Corps Director would be happy to consult with homeowners and road associations about what they can do to reduce phosphorus runoff from their properties. The Kennebec County Soil & Water Conservation District has an engineer available whose primary function is to consult with property owners about NPS pollution control.

Private (Camp) Roads are potentially a serious threat to water quality. Continual maintenance and upgrading are important. Clogged culverts, surface and ditch erosion all can carry phosphorus-laden sediment into the lakes. This Survey did not look at the future potential of camp roads to contribute NPS pollution to the lakes, only at existing problems. If a camp road needed attention (as a road), but was not a threat to the watershed, it is not listed in this report. The Colby 1999 Study did an intensive assessment of camp roads (see The Colby 1999 Report Summary). The Kennebec County Soil & Water Conservation District has a Camp Road Maintenance Manual that is available to landowners and road associations. They also have an engineer whose services are available to groups within the watershed.

The Town and State Road sites can have a large impact on the lake because they cross and impact tributaries that flow directly into the lake. These sources of NPS pollution are associated with culverts. Failing headwalls, or no headwall at all, allow shoulder materials to erode into tributary streams. Another problem associated with Town and State Roads was the poor quality of the material used on the shoulders – the fine sandy material often used can too easily wash into streams and the lake.

Of the 56 sites identified, 50 were considered to require only a Low Level of Technical expertise to remediate. That means that they could be addressed by the property owner with reference to the appropriate pamphlets from Maine DEP or consulting with the BRCA Watershed Program. The remaining six sites were considered to be in the Medium Technical Level, only because they would require the use of heavy equipment. The problems identified in the East Pond watershed are problems that can be readily addressed by property owners, the lake association, and individuals. There is no reason to wait for “someone” to fix these sources of Phosphorus pollution; ordinary citizens can address 89% of them with just a little guidance.

On 39 of the sites (70%), the cost of remediation is estimated to be less than $500. Of the remaining sites, the remediation on 14 sites is estimated to cost between $500 and $2500. The remaining 3 sites, all of them Private Roads in need of serious work, are estimated to cost more than $2500 but less than $5000. The total estimated dollar cost of controlling NPS phosphorus pollution (from these identified sites) in the East Pond Watershed is less than $100,000. This would go a long way toward eliminating the phosphorus trigger that starts algae blooming.

6.0 Recommendations – East Pond

Town Officials, property owners, business people in the watershed of East Pond all need to become advocates for the lake. Everyone who lives around or comes to visit East Pond needs to become a promoter of sound watershed management. This means seeking ways of reducing or eliminating erosion from driveways and roads; planting buffer strips; eliminating bare soil around houses and yards; educating family and friends to watershed protection practices; and using phosphate free fertilizers.

A good way to begin would be for all property owners to commit to planting or enhancing a buffer strip between the lake and the developed portion of their lot. The old ideal of a lawn leading down to the lake must be changed to one of shrubs and trees along the shore. The East Pond Association could sponsor a contest for the best new buffer and the best enhanced existing buffer. The BRCA has a number of free pamphlets from ME DEP about buffers and how they work.

The East Pond Association is doing good work promoting lake issues, they need to continue this work and see that every new property owner knows about water quality issues and remedies. The BRCA Watershed Program could help with pamphlets and literature from the Maine DEP and others –BRCA has a folder that can be distributed to new dwellers in the watershed. These organizations could involve realtors in disseminating this information.

Town officials, road commissioners, and any other groups that work within the watershed can work to inform themselves about Best Management Practices (BMP's) that limit the amount of phosphorus entering the lake from road maintenance and construction activities. The Maine Department of Transportation (DOT) has training programs on road construction and maintenance and their relationship to water quality. Private Road Associations need to become informed about these practices and insist that the contractors they hire be knowledgeable on NPS Pollution issues. Even better would be hiring only contractors who have been Certified by the Maine DEP NPS Pollution training program. Road Associations must become proactive on maintenance issues; preventing road problems before they become water quality issues. Good road maintenance is also cheaper in the long run.

Town officials can further promote water quality through planning and code enforcement. The Shoreland Zoning needs to be uniformly and consistently enforced. This could mean the need for more hours for the Code Enforcement Officer in each town to adequately follow up on activity in the watershed. And, once again, BMP's and water quality protection strategies must be in place throughout the watershed not just within the area defined by the Shoreland Zoning Act.

7.0 The Serpentine:

7.1 Sector (see Map 6, p26ff)
Sector S-1: This sector is primarily within the Town of Smithfield, but extends up the slopes of Wilder Hill and Ross Hill in Norridgewock. The southern boundary extends from Elm Acres Lane across the west side of the entrance to the Serpentine to meet the northern boundary of Sector E-1. The western boundary parallels Route 8 & 137 to the Village of Smithfield, it then heads north to the crest of Mount Tom, and then northwest to a point in Norridgewock on Oak Hill Road just north of the townline. The northern boundary travels back southeast to meet Wilder Hill Road, follows the road to the top of Wilder Hill, then loops over to the crest of Ross Hill, and then by a series of ridges southeast to the point where East Pond Road meets Route 8. The eastern boundary parallels East Pond Road (mostly to the west) south to Eastwood Estates Road.

The Serpentine Watershed is different from East Pond in many ways – foremost being that it is mostly a wetland, so not subject to the residential pressure of the lake, and we are also dealing with far fewer sites – 7 rather than 56 – so percentages may be more skewed. Here, still, Residential sites make up 29% of the problem areas.

8.0 Results – The Serpentine

8.1 Site Identification
Volunteers identified 2 potential impact sites. Of these, 1 was determined to have an impact on water quality. The other site was outside the Serpentine watershed. During the follow-up process, the BRCA staff identified an additional 6 sites for a total of 7 sites potentially contributing to a decline in water quality in the Serpentine watershed.

8.2 Sites by Land Use:

The Serpentine
Agriculture - 1
Other (manmade pond) – 1
Residential – 2
State Road - 2
Town Road - 1

One third of the six sites identified in the Serpentine watershed are residential. Town and state roads make up one half of the problems found. As this area is largely upland and wetland with no shoreline, the problems and the percentages of problems are quite different from those on East Pond.

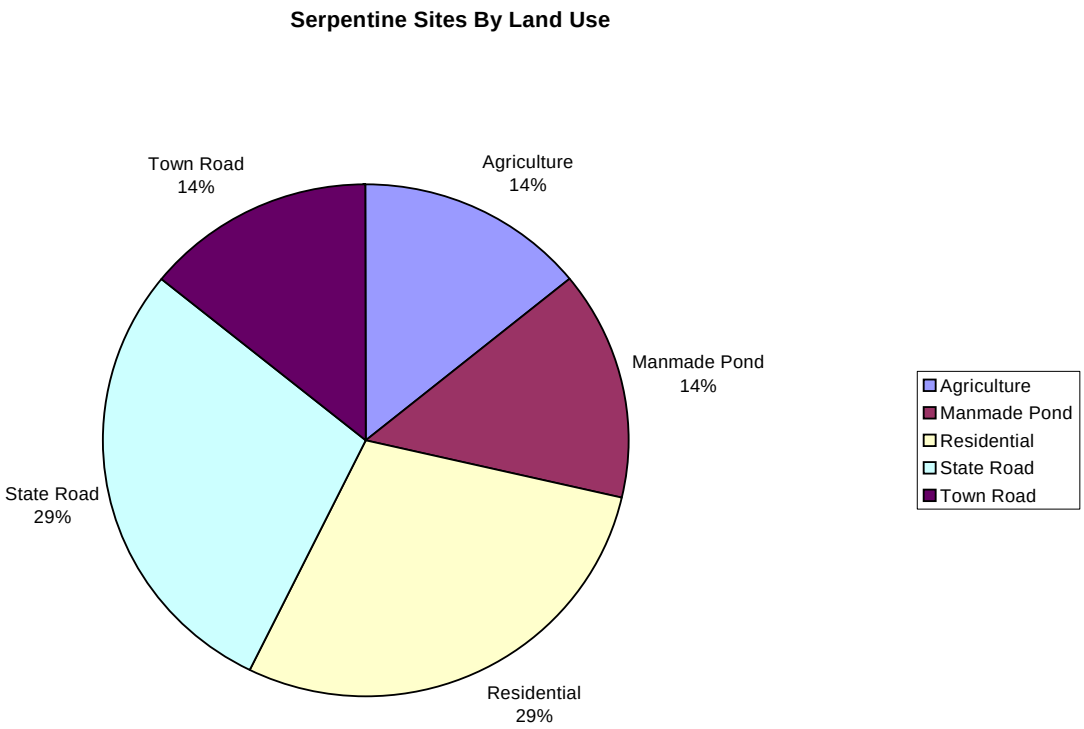
Map 6 (page 26ff) shows the locations of all the sites. Tables summarizing the problems found at each site are found on page 33ff. These tables include Land Use, Type of Problem, Recommendations, and cost estimates. The tables also prioritize the identified sites

8.3 Typical Problems and Suggested Remedies by Land Use Type

Agriculture: (1 site)
The one agricultural site was a drainage swale off Rte 8 in Smithfield. Cattle were being allowed to wander through the swale, which drains back to Sucker Brook.
Remedies:

Fence off the drainage area
Seed and mulch,
Allow to grow up in native vegetation

The Serpentine Watershed Survey Results



Other: (1 site)
This manmade pond had some serious erosion problems at the earthen dam.
Remedies:

Seed and mulch
Erosion controls – silt fence

Residential: (2 sites)
The two residential sites were shore properties located on the Serpentine stream itself, and had typical shore problems with no buffers and driveway erosion.

Remedies:

ESTABLISH BUFFERS.

Bare soil should be seeded and mulched, and where grass won't grow, shade tolerant groundcovers should be planted.

Waterbars and turnouts

Gutters and crushed stone driplines can control the problems from roof runoff.

State Roads: (2 sites)

Both the sites along Rte 8 involved eroding shoulders and one had a partially clogged culvert.

Remedies:

Better maintenance of culverts,

Better material on shoulders

Town Road: (1 site)

This site had a severely eroded ditch.

Remedies:

Reshape ditch,

Seed and mulch,

Turnouts to divert runoff into buffer areas

9.0 Discussion – The Serpentine

Five of the seven identified NPS Pollution sites in the Serpentine watershed are typical of the sites found around East Pond – the exceptions being the Agricultural site and the "Other" – an earthen dam. There are two sites associated with residences along the Serpentine proper, two State Road sites associated with culverts along Route 8, and one Town Road site, again a culvert. Problems around culverts allow sediment to wash directly into tributaries and then be carried down to the lake. Shoulder erosion is often caused by the build up of a berm of material that does not allow runoff to flow in a continuous sheet off the road, but rather channels it along the road where it picks up both sediment and velocity before it finally flows into the ditch or tributary.

The two residential sites (one of which involves a row of three camps) both lack buffer strips between the camps and the Serpentine – "Lawn-to-Lake" situations. The planting of a strip of plants and bushes, at least 25 feet wide, would serve as a barrier to phosphorus without diminishing the view from any of these camps. It would have an added advantage of lessening the amount of lawn that needs to be mowed!

The Agricultural site is quite far from the Serpentine proper, but appears to drain directly into Sucker Brook. There is a wide drainage swale leading back across the pasture away from Route 8, and cows were roaming freely through it and churning the bottom into muck. Fencing the cows out and allowing the vegetation to regrow would solve this problem. Perhaps, the Natural Resources Conservation Service (NRCS) or the County Soil and Water Conservation District should be consulted (which would push the Technical Level designation to Medium) to ensure that the swale continues to function properly in draining the road and fields.

The "Other" site – a Manmade Pond on the side of Mount Tom – has a large area of bare soil around the earthen dam (which backs up a tributary of the Serpentine). It looks like a section of the dam may have washed out in the recent past. At the very least, the area should be seeded and mulched to deter erosion. Here, again, a consultation with the NRCS or CSWCD might be helpful.

10.0 Recommendations – The Serpentine

Town Officials and property owners in the watershed of the Serpentine all need to become advocates for lake water quality. Although most of the watershed is distant from open water, actions taken far upstream can have a large impact on water quality in both East Pond and North Pond. This means seeking ways of reducing or eliminating erosion from driveways and roads; planting buffer strips; eliminating bare soil around houses and yards; educating family and friends to watershed protection practices.

A good way to begin would be for all property owners along the Serpentine proper to commit to planting or enhancing a buffer strip between the stream and the developed portion of their lot. The old ideal of a lawn leading down to the water must be changed to one of shrubs and trees along the shore. The East Pond Association could sponsor a contest for the best new buffer and the best enhanced existing buffer along the Serpentine as well as on the lake itself.

The East Pond Association is doing good work promoting lake issues, they need to continue this work and see that every new property owner knows about water quality issues and remedies. The BRCA Watershed Program could help with pamphlets and literature from the Maine DEP and others – they have a folder that could be distributed to new dwellers in the watershed.

Town officials, road commissioners, and any other groups that work within the watershed can work to inform themselves about Best Management Practices (BMP's) that limit the amount phosphorus entering the lakes from construction sites. The Maine DOT has training programs on road construction and maintenance and their relationship to water quality. Private Road Associations need to become informed about these practices and insist that the contractors they hire at least be knowledgeable in NPS Pollution issues, if not Certified by the Maine DEP. Road Associations must become proactive in maintenance issues. Preventing road problems before they become water quality issues – good road maintenance is also cheaper in the long run.

Town officials can further promote water quality through planning and code enforcement. The Shoreland Zoning needs to be uniformly and consistently enforced. This could mean the need for more hours for the Code Enforcement Officer in each town to adequately follow up on activity in the watershed. And, once again, BMP's and water quality protection strategies must be in place throughout the watershed not just within the area defined by the Shoreland Zoning Act.

References:

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Congress of Lake Associations (COLA) and Maine Department of Environmental Protection. 1997. A Citizen’s Guide to Lake Watershed Surveys: How to Conduct a Nonpoint Source Phosphorus Survey. Publication #: DEPLW-41-A97.

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Department of Biology. Colby College. Waterville, Me. “DRAFT Summary and Recommendations (East Pond)”. Problems in Environmental Science Course BI 493, 1999.

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Michaud, M. 1992. Camp Road Maintenance Manual: A Guide for Landowners. Kennebec County Soil & Water Conservation District, Augusta.

Appendix 1: East Pond and the Serpentine:

Studies conducted by Colby College students under the guidance of David Firmage established that the Serpentine, while technically the outlet of East Pond, does (in rains of more than 2.5”) actually drain into East Pond.

> Backflushing of the Serpentine into East Pond can occur after storms greater than 2.5 in. This
> Figure is based on observations after the Sept. 26 storm and is probably conservative. Back-
> flushing may also occur after less rainfall. The effects of backflushing may increase nutrient loading into East Pond from the Serpentine wetland. (p. 80)

Further studies were carried out in 1999 by Colby students to assess this nutrient load, and where it is coming from.

Appendix 2: East Pond Water Quality

Appendix 3: East Pond Survey Summary

Belgrade Regional Conservation Alliance
Watershed Project

East Pond Survey
Identified Nonpoint Source Pollution Sites[1]
Volunteer Survey 1999

56 Sites:

Beaches	-	9 sites	=	17%
Boat Ramps	-	3 sites	=	6%
Commercial	-	3 sites	=	6%
Driveways	-	5 sites	=	8.5%
Other (misc.)	-	2 site	=	1.5%
Private Roads	-	9 sites	=	17%
Residences	-	21 sites	=	39%
State Roads	-	2 sites	=	3.5%
Town Roads	-	2 site	=	1.5%

Driveways and Residential sites account for almost half (47.5%) of the identified problem areas. If we add in the Private Roads going to these residences, almost two-thirds (64.5%) of the sites are associated with shoreline development.

LOW PRIORITY Sites = 3 Beaches, 2 Boat Ramps, 5 Driveways, 2 Other, 3 Private Roads, 12 Residential, 1 State Road site.
MEDIUM PRIORITY Sites = 6 Beaches, 1 Boat Ramp, 2 Commercial, 4 Private Roads[2], 9 Residential, 1 State Road, 2 Town Road site.

TECHNICAL LEVEL TO INSTALL:
LOW = 9 Beaches, 3 Boat Ramps, 3 Commercial, 5 Driveways, 2 Other, 5 Private Roads, 20 Residential, 2 State Roads, 1 Town Road
MEDIUM = 4 Private Roads, 1 Residential, 1 Town Road

LOW IMPACT Sites = 2 Beaches, 2 Boat Ramps, 5 Driveways, 2 Other, 6 Private Roads, 13 Residential, 1 State Road site.
MEDIUM IMPACT Sites = 7 Beaches, 1 Boat Ramp, 2 Commercial, 3 Private Roads, 8 Residential, 2 Town Road site.
HIGH IMPACT Sites = 1 Commercial, 2 State Road sites.

[1] Nonpoint Source Pollution = the simplest definition is "runoff." This carries *phosphorus* from eroding soils, as well as fertilizers, pesticides, manure and pet wastes into streams and lakes. These nutrients can spur algae growth.
[2] The reason that only 7 of the 9 Private Road sites are prioritized is that 2 were far enough from the lake to be deemed of No Impact.

LOW COST Sites = 8 Beaches, 2 Boat Ramps, 1 Commercial, 5 Driveways, 2 Other, 4 Private Roads, 17 Residential sites.
MEDIUM COST Sites = 1 Beach, 1 Boat Ramps, 2 Commercial, 2 Private Roads, 4 Residential, 2 State Road, 2 Town Road sites.
HIGH COST Sites = 3 Private Road sites.

Total Estimated Costs = (maximum) $19,500[3] + $35,000[4] + $15,000[5] = **$69,500**

This figure does not include the approximately 20 sites we were not able to survey due to gated roads and No Trespassing signs. We can get an approximate figure for all the sites by taking the average cost per site ($1,241.00), multiplying it by 20, and adding that amount ($24,820) to the total above = **$94,320.**

Town Road Sites:

Oakland - 1

T- 1 - East Pond Road from where it begins sharply descending (heading north from Rte 137) to Brickett Point Rd.
Estimated cost $2500.
Culvert and Ditch erosion
Shoulder maintenance

T-2 - Dead End Road off Rte 137 just east of Smithfield town line.
Estimated cost $2500
Erosion around culvert

==========

EXPLANATION OF RATINGS:

Technical Level to Install

High – site requires an engineered design
Medium – technical person should visit the site and make recommendations
Low - property owner can accomplish the BMP with proper reference materials

Impact – keep in mind: size of impact, slope, soil type, amount of eroded soil, proximity to waterbody or buffer, and the size of the buffer

High – direct flow to tributary or lake; usually greater than 100 square feet of disturbance
Medium – sediment transported off site to buffer or wetland; less than 100 square feet of impact
Low - eroding site with limited transport off site, even if the disturbed area is l arge

Cost

High - greater than $2,500
Medium - $500 - $2,500
Low - less than $500

[3] 39 Low Cost Sites figured at $500 each
[4] 14 Medium Cost Sites figured at $2500 each
[5] 3 High Cost Sites figured at $5000 each

Appendix 4: Serpentine Survey Summary

Belgrade Regional Conservation Alliance
Watershed Project

The Serpentine Survey
Identified Nonpoint Source Pollution Sites[6]
Volunteer Survey 1999

7 Sites:

Agriculture	-	1 site	=	14%
Other (misc.)	-	1 site	=	14%
Residences	-	2 sites	=	29%
State Roads	-	2 sites	=	29%
Town Roads	-	1 site	=	14%

LOW PRIORITY Sites = 1 Agricultural, 1 Other (manmade pond), 2 Residences, 2 State Road, and 1 Town Road sites.

TECHNICAL LEVEL TO INSTALL:
LOW = 1 Agricultural, 1 Other, and 2 Residential sites
MEDIUM = 2 State Road and 1 Town Road sites

LOW IMPACT Sites = 1 Agricultural, 2 Residences, 2 State Road, and 1 Town Road Sites
MEDIUM IMPACT Sites = 1 Other (Manmade Pond)

LOW COST Sites = 1 Agriculture, 1 Other (Manmade Pond), 2 Residences, and 1 State Road site.
MEDIUM COST Sites = 1 State Road and 1 Town Road site

Total Estimated Costs = (maximum) $2,500[7] + $5,000[8] = **$7,500**

Town Road Sites:
Smithfield:
ST-1 – Culvert on Sand Hill Road where it crosses Sucker Brook

[6] Nonpoint Source Pollution = the simplest definition is "runoff." This carries *phosphorus* from eroding soils, as well as fertilizers, pesticides, manure and pet wastes into streams and lakes. These nutrients can spur algae growth.
[7] 5 Low Cost Sites figured at $500 each
[8] 2 Medium Cost Sites figured at $2500 each

EXPLANATION OF RATINGS:

Technical Level to Install

High – site requires an engineered design

Medium – technical person should visit the site and make recommendations

Low - property owner can accomplish the BMP with proper reference materials

Impact – **keep in mind: size of impact, slope, soil type, amount of eroded soil, proximity to waterbody or buffer, and the size of the buffer**

High – direct flow to tributary or lake; usually greater than 100 square feet of disturbance

Medium – sediment transported off site to buffer or wetland; less than 100 square feet of impact

Low - eroding site with limited transport off site, even if the disturbed area is large

Cost

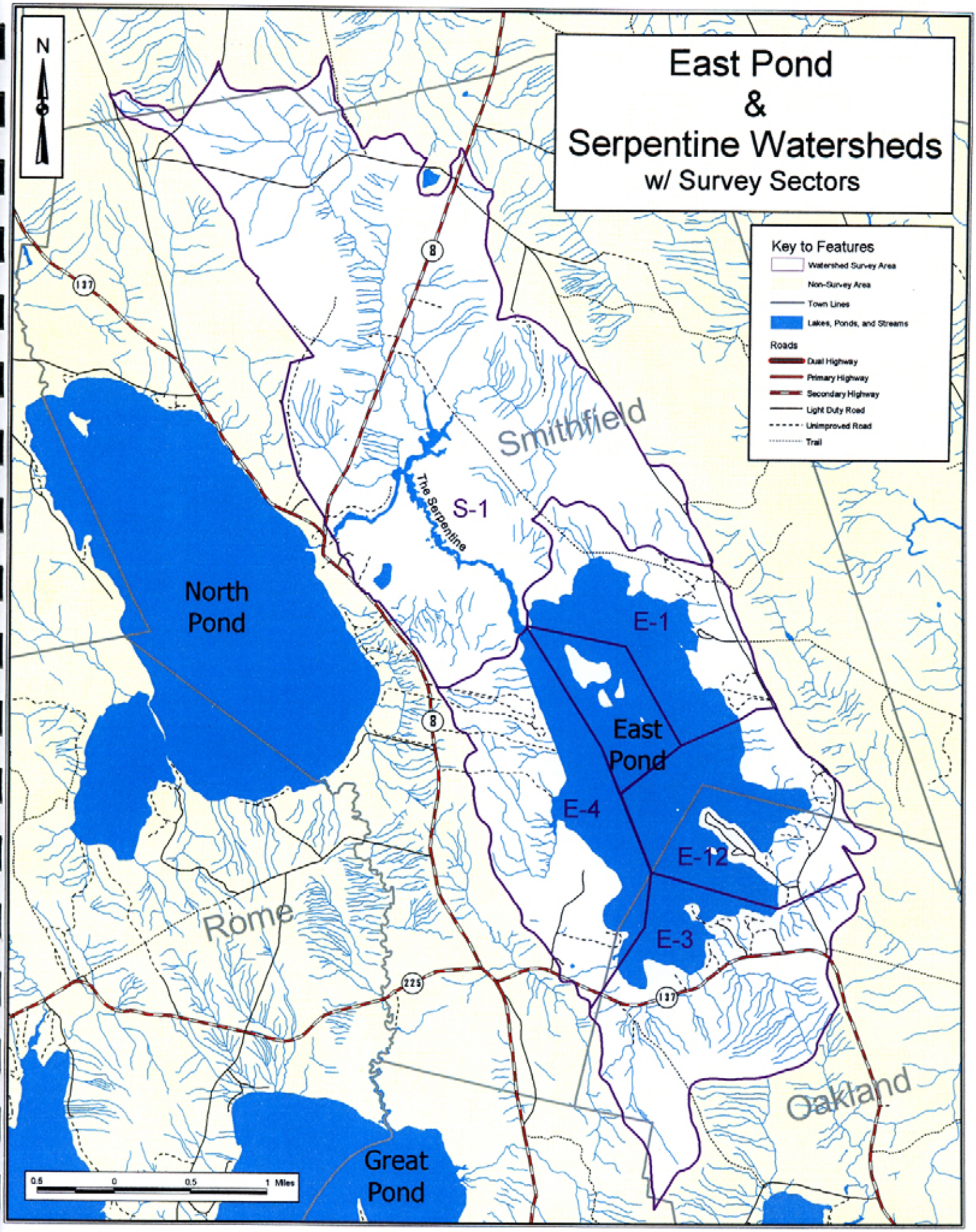
High - greater than $2,500

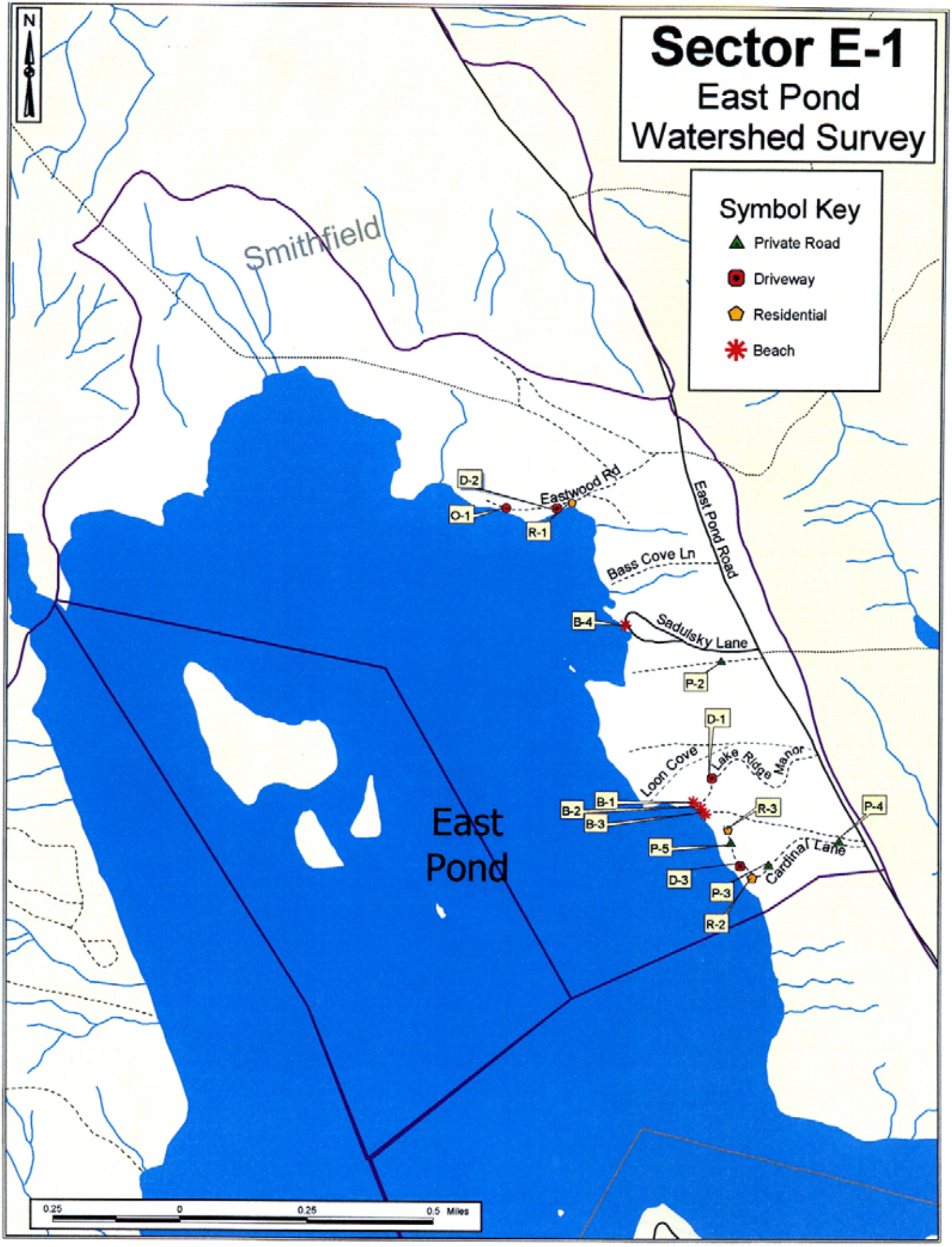
Medium - $500 - $2,500

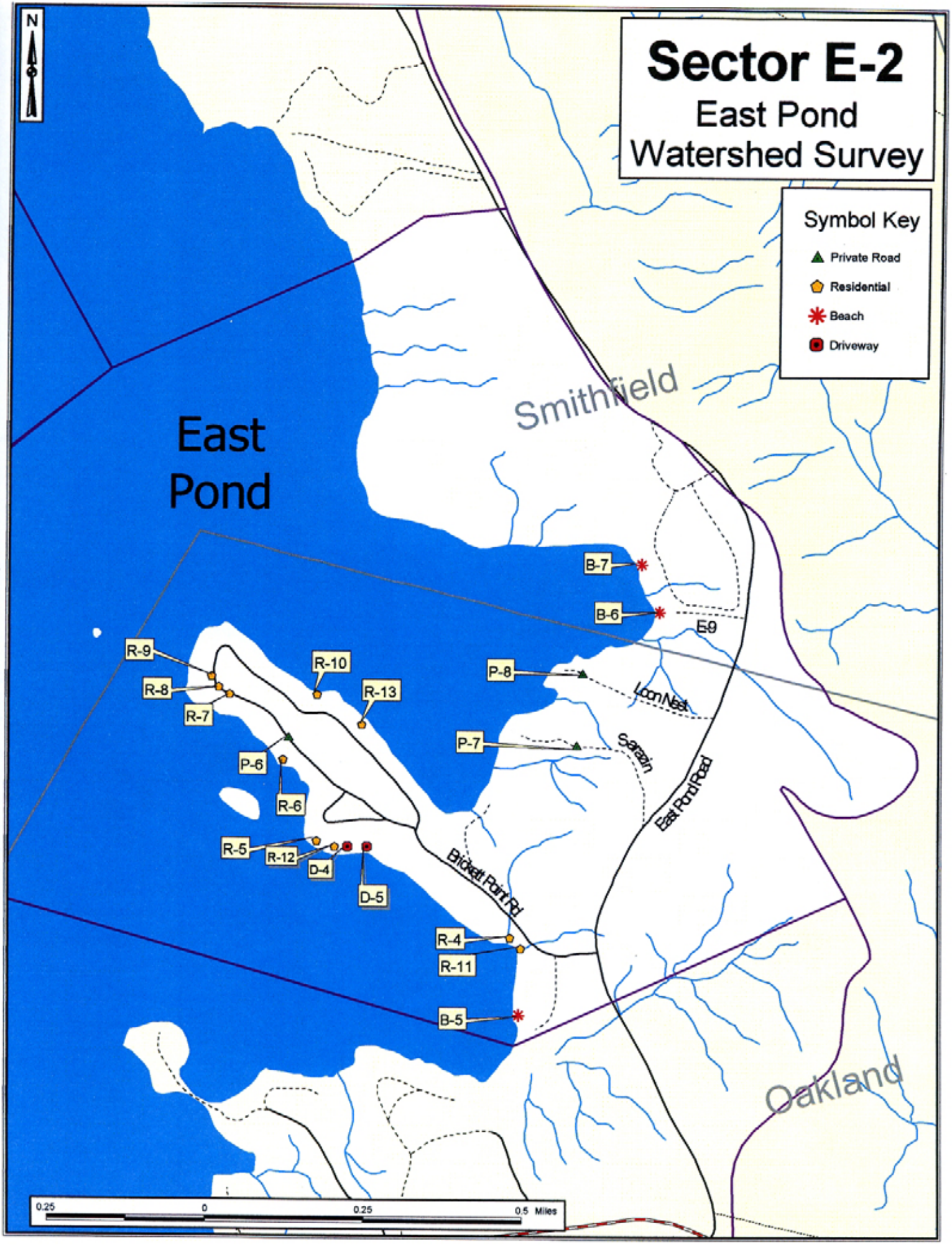
Low - less than $500

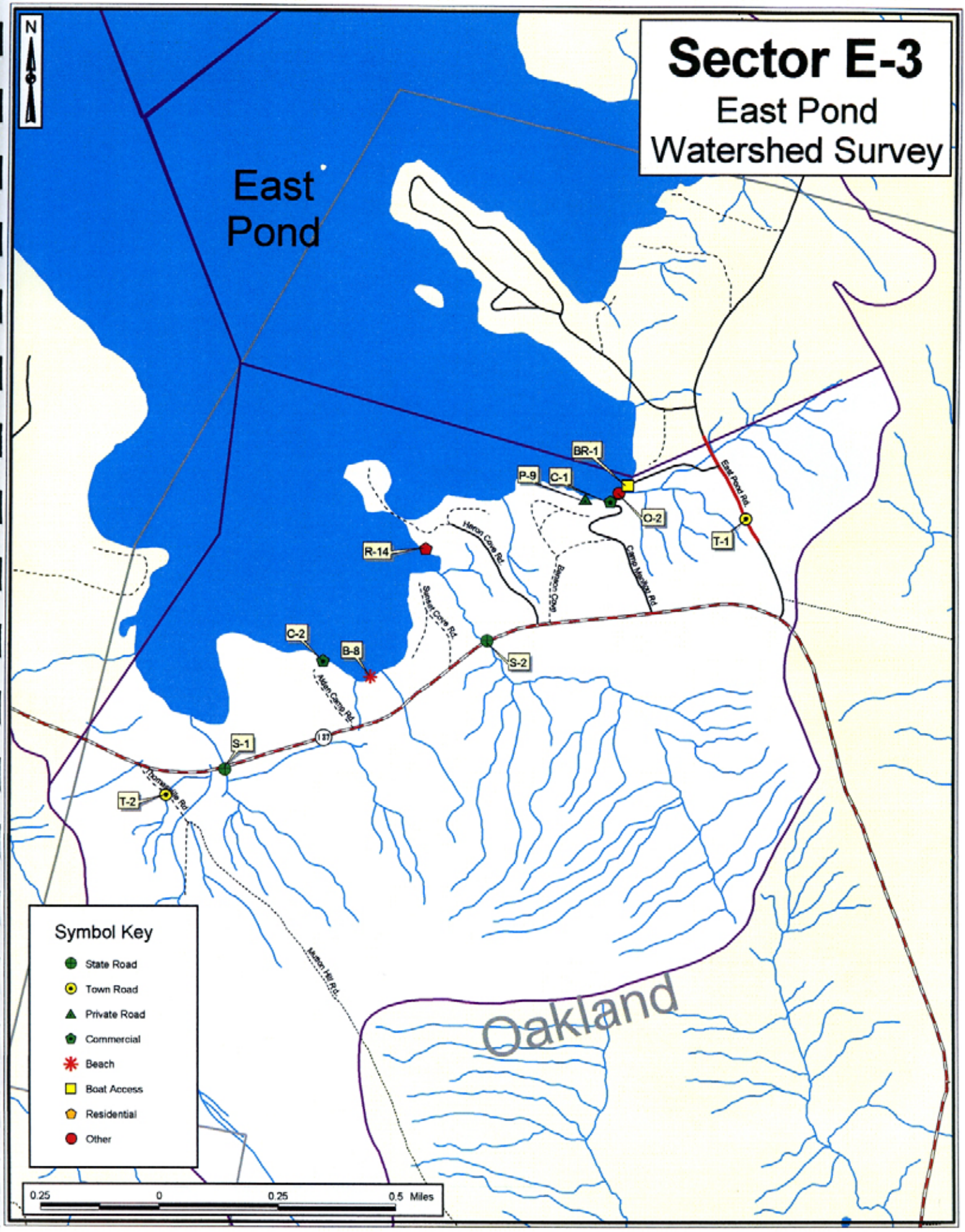
MAPS:

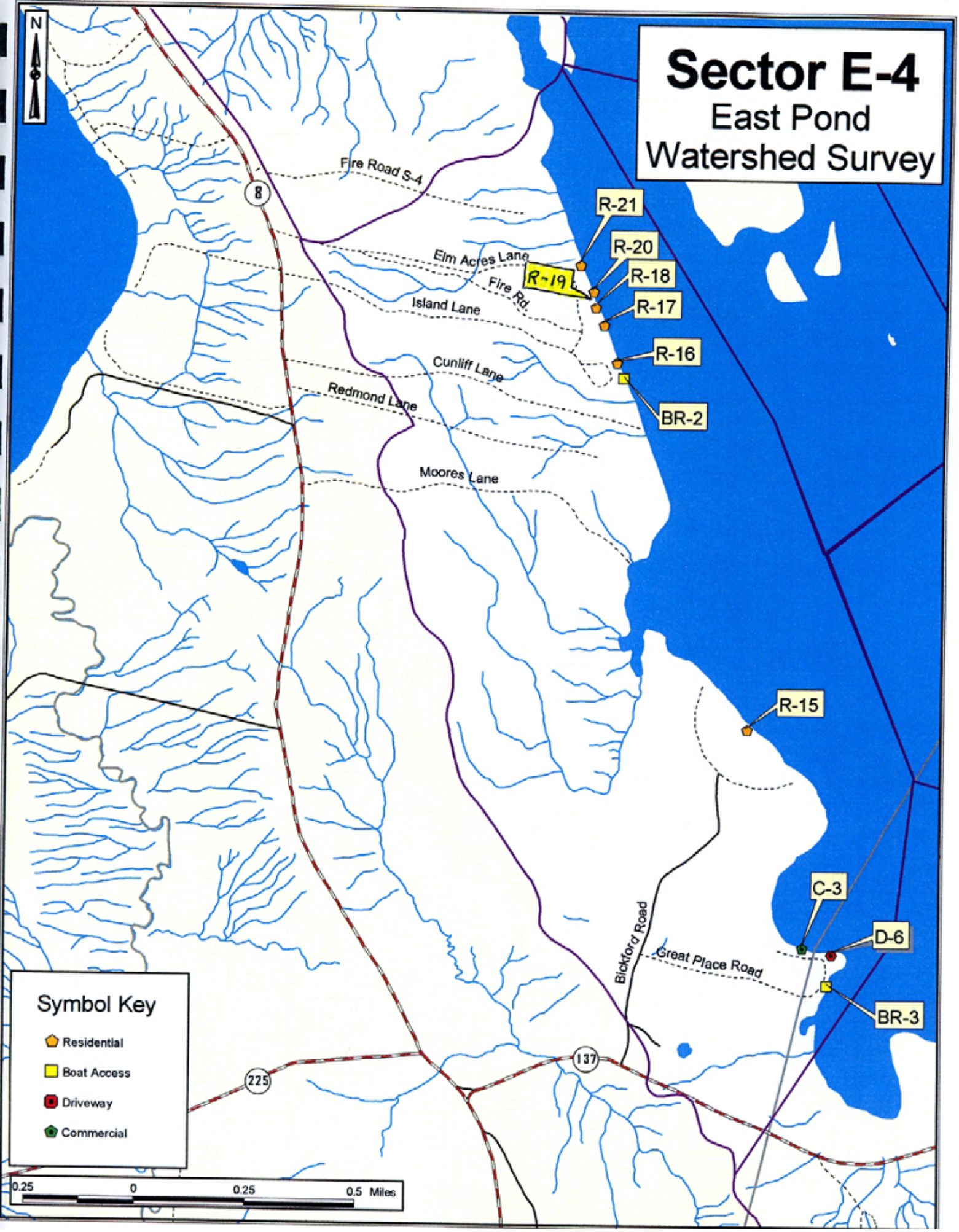
East Pond
Sector Maps with Site Locations

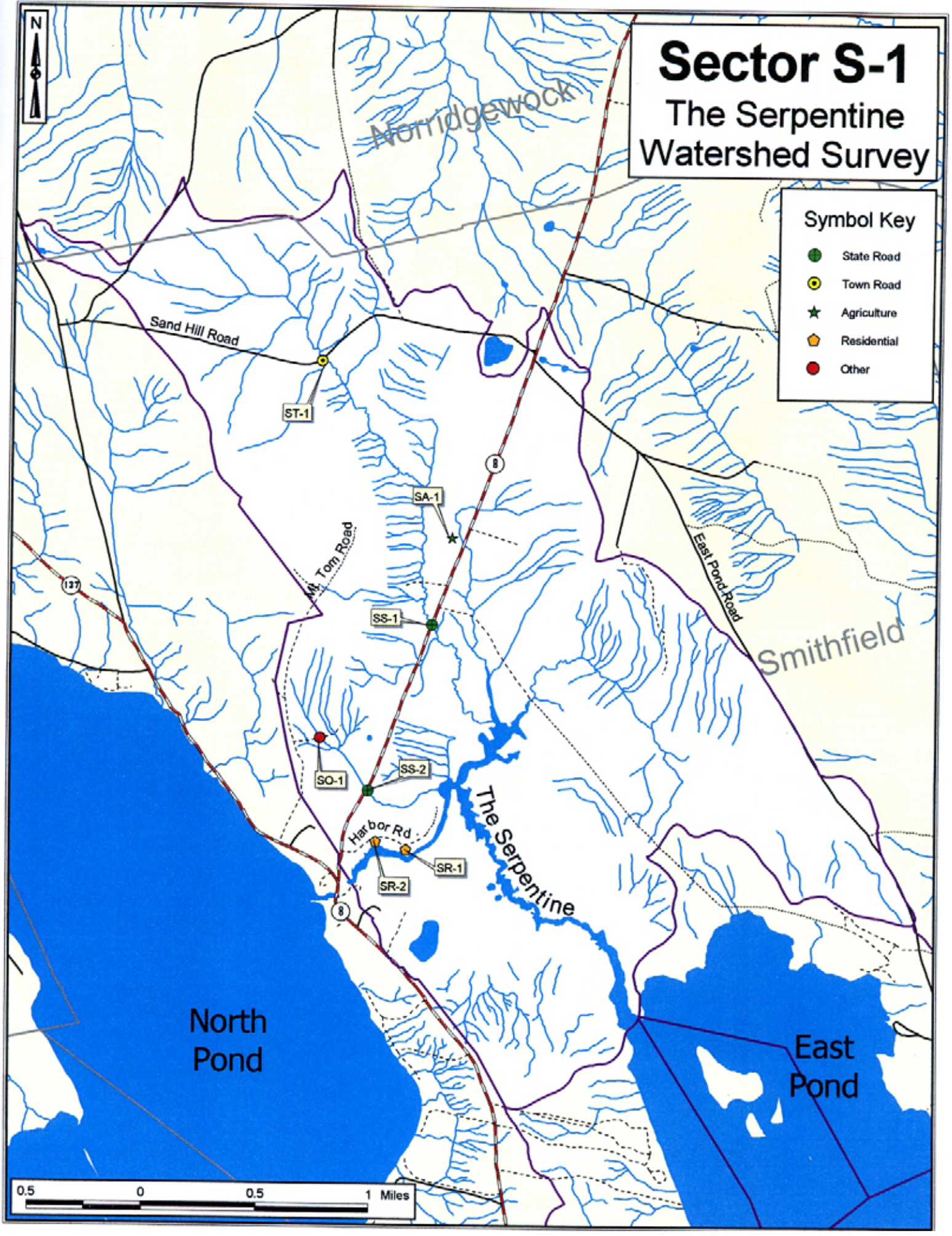

East Pond
&
Serpentine Watersheds
w/ Survey Sectors
N
Key to Features
Watershed Survey Area
Non-Survey Area
Town Lines
Lakes, Ponds, and Streams
Roads
Dual Highway
Primary Highway
Secondary Highway
Light Duty Road
Unimproved Road
Trail
Smithfield
The Serpentine
S-1
North Pond
E-1
East Pond
E-4
E-12
E-3
Rome
Oakland
Great Pond
0.5 0 0.5 1 Miles
8
137
225


Sector E-1
East Pond
Watershed Survey
Symbol Key
Private Road
Driveway
Residential
Beach
N
Smithfield
East Pond
East Pond Road
Eastwood Rd
Bass Cove Ln
Sadulsky Lane
Loon Cove
Lake Ridge Manor
Cardinal Lane
D-1
D-2
O-1
R-1
R-2
R-3
B-1
B-2
B-3
B-4
P-2
P-3
P-4
P-5
D-3
0.25
0
0.25
0.5 Miles


Sector E-2
East Pond
Watershed Survey
Symbol Key
Private Road
Residential
Beach
Driveway
N
East
Pond
Smithfield
Oakland
B-7
B-6
E9
P-8
Loon Nest
P-7
Sarain
East Pond Road
R-9
R-8
R-7
R-10
R-13
P-6
R-6
R-5
R-12
D-4
D-5
Bickett Point Rd
R-4
R-11
B-5
0.25
0
0.25
0.5 Miles


Sector E-3
East Pond
Watershed Survey
East Pond
N
BR-1
P-9
C-1
O-2
T-1
East Pond Rd.
R-14
Heron Cove Rd.
Beacon Cove
Camp Meeting Rd.
Stewart Cove Rd.
C-2
B-8
S-2
Algers Camp Rd.
S-1
T-2
Thompson Rd.
Mutton Hill Rd.
Oakland
Symbol Key
State Road
Town Road
Private Road
Commercial
Beach
Boat Access
Residential
Other
0.25
0
0.25
0.5 Miles


Sector E-4
East Pond
Watershed Survey
N
Fire Road S-4
8
R-21
R-20
R-19
R-18
R-17
R-16
BR-2
Elm Acres Lane
Fire Rd.
Island Lane
Cunliff Lane
Redmond Lane
Moores Lane
R-15
C-3
D-6
BR-3
Bickford Road
Great Place Road
137
225
Symbol Key
Residential
Boat Access
Driveway
Commercial
0.25
0
0.25
0.5 Miles


Sector S-1
The Serpentine Watershed Survey
Symbol Key
State Road
Town Road
Agriculture
Residential
Other
N
Norridgewock
Sand Hill Road
ST-1
SA-1
Mt. Tom Road
East Pond Road
Smithfield
SS-1
SS-2
SO-1
Harbor Rd
SR-1
SR-2
The Serpentine
North Pond
East Pond
137
8
0.5 0 0.5 1 Miles

TABLES:

East Pond Watershed Sites

East Pond Survey Sites

Sector & Site ID	Map ID Number	Land Use	Type of Problem	Length or Area	Recommendations	Technical Level to Install	Impa
E-1 #1	B-1	Beach	Shoreline Erosion	150'	Establish Buffer & Riprap	Low	Mediu
E-1 #12	B-2	Beach	Shoreline Erosion	30'	Establish Buffer & Riprap	Low	Low
E-1 #M-7	B-3	Beach	Shoreline Erosion	30'	Establish Buffer & Riprap	Low	Low
E-1 #M-8	B-4	Commercial Beach	Lack of Buffer	300 yds	Establish Buffer	Low	Mediu
E-2 #1	B-5	Beach	Bare Soil/Direct Flow to Lake/Moderate Surface Erosion	1500 sq.ft.	Vegetate/ Waterbar/Seed & Mulch	Low	Mediu
E-2 #M-17	B-6	Beach	Lack of Buffer	60	Establish Buffer	Low	Mediu
E-2 #M-19	B-7	Beach	Lack of Buffer	80'	Establish Buffer	Low	Mediu
E-3 #8	B-8	Beach	Shoreline Erosion	300'	Establish Buffer/ Riprap/ Shorten Beach	Low	Mediu
E-4 #1	B-9	Beach	Direct Flow to Lake/ Shoreline Erosion	100'	Establish Buffer/Reshape Area	Low	Mediu
E-3 #M-2	BR-1	Boat Ramp	Direct Flow to Lake - Surface Erosion	30' x 20'	Widen Ramp and Stablize Area	Low	Mediu
E-4 #8	BR-2	Boat Ramp	Direct Flow to Lake/ Erosion/ Unstable Banks	8'x20'	New Surface Material/ Reshape	Low	Low
E-4 #M-1	BR-3	Boat Ramp	Direct Flow to Lake/ Moderate Surface Erosion	8'x30'	Waterbars/ New Surface Material	Low	Low
E-3 #5	C-1	Commercial Camp	Direct Flow to Lake - Surface Erosion	75' x 100'	Reshape, Seed & Mulch, Gutter on Cabin, New Surface Material on Paths	Low	High

East Pond Survey Sites

Sector & Site ID	Map ID Number	Land Use	Type of Problem	Length or Area	Recommendations	Technical Level to Install	Impa
E-3 #M-6	C-2	Commercial	Direct Flow to Lake - Bare Soil	1500 sq.ft.	New Surface Material/ Waterbars/ Cover Dirt Pile	Low	Mediu
E-4 #M-3	C-3	Commercial Camp/ Basketball Court	Direct Flow to Lake/ Moderate Surface Erosion/ Bare Soil	30' x 50'	Establish Buffer/ Vegetate/ Move Basketball Court/ Gutters on Buildings	Low	Mediu
E-1 #4	D-1	Driveway	Clogged Culvert	N/A	Cleanout Culvert Outlet	Low	Low
E-1 #13	D-2	Driveway	Slight Surface Erosion	5,400 sq.ft.	Maintenance	Low	Low
E-1 #M-2	D-3	Driveway	Clogged Culvert	40'	New Culvert	Low	Low
E-2 #M-6	D-4	Driveway	Direct Flow to Lake - Surface Erosion/ No Buffer	60'x10'	Establish Buffer/ Waterbar or Turnout	Low	Low
E-2 #M-7	D-5	Driveway	Direct Flow to Lake/ Mod. Surface Erosion/ No Buffer/ Bare Soil	50'x25' + 60' Driveway	Establish Buffer/ Vegetate/ Waterbar or Diversion/ Seed & Mulch (2 Cottage Drives)	Low	Mediu
E-4 #M-2	D-6	Driveway	Direct Flow to Lake/ Modrate Surface Erosion	100'	Reshape/ Waterbars/ Detention Basin	Low	Low
E-1 #16	O-1	Other - Snowmobile Trail	Moderate Surface Erosion - Where Trail Leaves Lake	4'x4'	Seed & Mulch	Low	Low
E-3 #2	O-2	Other -stream	Stream Undercutting Bank as Enters Lake	10'	Riprap	Low	Low

East Pond Survey Sites

Sector & Site ID	Map ID Number	Land Use	Type of Problem	Length or Area	Recommendations	Technical Level to Install	Impa
E-1 #6	P-1	Private Road	Surface Erosion	360 sq. ft.	Maintenance	Low	Low
E-1 #7	P-2	Private Road	Clogged Culvert	N/A	Cleanout Culvert Outlet	Low	Low
E-1 #M-1	P-3	Private Road	Moderate Surface Erosion	510 sq. ft.	Redirect Drainage/Vegetate	Low	Mediu
E-1 #M-3	P-4	Private Road	Moderate Ditch Erosion	300 yds	Turnouts needed	Medium	Mediu
E-1 #M-6	P-5	Private Road	Moderate Surface Erosion	1,400 sq.ft.	Maintenance/ Reshape Road	Low	Low
E-2 #9	P-6	Private Road	Clogged Culvert/ Unstable Inlet-Outlet	5'x8'	Maintenance/ Plunge Pool at Outlet	Low	Low
E-2 #M-15	P-7	Private Road	Severe Surface Erosion	1100'	Build up Road/ Watebars-Turnouts/ New Surface Material	Medium	Low
E-2 #M-16	P-8	Private Road	Moderate Surface Erosion/ Poor Drainage	1200'	Build Up Road/New Surface Material/ Turnouts	Medium	Low
E-3 #M-3	P-9	Private Road	Moderate Surface Erosion/ Stockpiled Soil	330 sq.ft	Reshape/ Waterbars/ Erosion Controls/ Vegetate/ Cover Soil Pile	Medium	Mediu
E-1 #9	R-1	Residential	Moderate Surface Erosion	5,500 sq.ft.	Vegetate	Low	Low
E-1 #M-4	R-2	Residential	Direct Flow to Lake/ Lack of Buffer	100'	Establish Buffer	Low	Low
E-1 #M-5	R-3	Residential	Direct Flow to Lake/ Bare Soil	2,450 sq.ft.	Seed & Mulch	Low	Low

East Pond Survey Sites

Sector & Site ID	Map ID Number	Land Use	Type of Problem	Length or Area	Recommendations	Technical Level to Install	Impa
E-2 #2	R-4	Residential	Direct Flow to Lake/ Bare Soil/ No Buffer	100 ft	Establish Buffer/ Vegetate/ Seed & Mulch	Low	Mediu
E-2 #4	R-5	Residential	Direct Flow to Lake/ Bare Soil/ No Buffer	20x80'	Establish Buffer/ Install Waterbar or Turnout	Low	Mediu
E-2 #8	R-6	Residential	Direct Flow to Lake/ Bare soil/ No Buffer	4 cottages 150'	Establish Buffer/ could use a little Riprap at shoreline	Low	Low
E-2 #10	R-7	Residential	Severe Surface Erosion/ No Buffer/ Bare Soil	4600 sq. ft.	Establish Buffer/ Vegetate/ Waterbar or Turnout	Low	Mediu
E-2 #11	R-8	Residential	Surface Erosion/ No Buffer	5000 sq. ft.	Establish Buffer/ Vegetate/ Seed & Mulch	Low	Mediu
E-2 #12	R-9	Residential	Direct Flow to Lake/ No Buffer/ Bare Soil	4200 sq. ft.	Establish Buffer/ Vegetate/ New Surface Material Under Porch	Low	Mediu
E-2 #18	R-10	Residential	Direct Flow to Lake/ No Buffer	30'	Establish Buffer	Low	Low
E-2 #M-3	R-11	Residential	Bare Soil/ No Buffer	50 ft	Establish Buffer/ Vegetate/ Seed & Mulch	Low	Low
E-2 #M-5	R-12	Residential	Direct Flow to Lake/ Bare Soil/ No Buffer	100'	Establish Buffer/ Vegetate/New Surface Material	Low	Low
E-2 #M-14	R-13	Residential	Direct Flow to Lake/ No Buffer	100'	Establish Buffer	Low	Low

East Pond Survey Sites

Sector & Site ID	Map ID Number	Land Use	Type of Problem	Length or Area	Recommendations	Technical Level to Install	Impa
E-3 #M-5	R-14	Residential	Direct Flow to Lake/ No Buffer/ Bare Soil	500 sq.ft	Establish Buffer/ Vegetate/ Seed & Mulch	Low	Low
E-4 #3	R-15	Residential	Direct Flow to Lake/ No Buffer	100'	Establish Buffer	Low	Low
E-4 #9	R-16	Residential	Direct Flow to Lake/ Moderate Surface Erosion/ No Buffer/ Unstable Boat Acces	100' & 10'x20'	Establish Buffer/ Reshape area/ New Surface Material	Low	Mediu
E-4 #10	R-17	Residential	Lack of Buffer	80'	Establish Buffer	Low	Low
E-4 #11	R-18	Residential	Direct Flow to Lake/ Bare Soil/ Unstable Boat Access	10'x60'	Vegetate/ Reshape Access/ New Surface Material	Low	Mediu
E-4 #12	R-19	Residential	Direct Flow to Lake/ Bare soil	10'x40'	Establish Buffer/ Reshape area/ Vegetate/ Define Paths	Low	Mediu
E-4 #15	R-20	Residential	Moderate Surface Erosion/ Shoreline Erosion	10'x30' & 12'	Waterbars/ Vegetate/Gutters to Divert Flow/ Riprap	Low	Low
E-4 #M4	R-21	Residential	Direct Flow to Trib./ Outdoor Shower	N/A	Connect Shower to Septic	Medium	Low
E-3 #10	S-1	State Road	Clogged Culvert/ Poor Shoulder Material	8' x100'	New Surface Material on Shoulder/ Culvert Outlet Protection	Low	Low

East Pond Survey Sites

Sector & Site ID	Map ID Number	Land Use	Type of Problem	Length or Area	Recommendations	Technical Level to Install	Impa
E-3 #M-4	S-2	State Road	Direct Flow to Trib./ Moderate Shoulder Erosion/ Clogged Culvert	30'	Erosion Controls / Riprap	Low	High
E-3 #1&3	T-1	Town Road	Direct Flow to Trib./ Shoulder Erosion/ Severe Ditch Erosion/ Clogged Culvert	One Quarter Mile	Maintenance/ Remove Berm/ Riprap Culverts and Ditch/ Reshape Ditch	Low	Mediu
E-3 #M-7	T-2	Town Road	Direct Flow to Trib/ Severe Shoulder	N/A	Maintenance/ Culvert Inlet-Outlet Protection/ Riprap	Medium	Mediu