Hogan and Whitney Ponds Watershed Survey Report

March 2018

Hogan and Whitney Ponds Association

Prepared by Bruce Wilson, Association Member

ACKNOWLEDGEMENTS

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- Town of Oxford
- Oxford County Soil and Water Conservation District
- Maine Department of Environmental Protection
- Maine Volunteer Lake Monitoring Program
- Jeff Stern of Fiddlehead Environmental Consulting
- Western Foothills Land Trust

Grant Supporters:

- Maine Volunteer Lake Monitoring Program Center for Citizen Lake Science
- New England Grassroots Environment Fund

The Association wishes to express its sincerest gratitude to the full complement of people and organizations identified above whose unwavering support and encouragement made this report possible.

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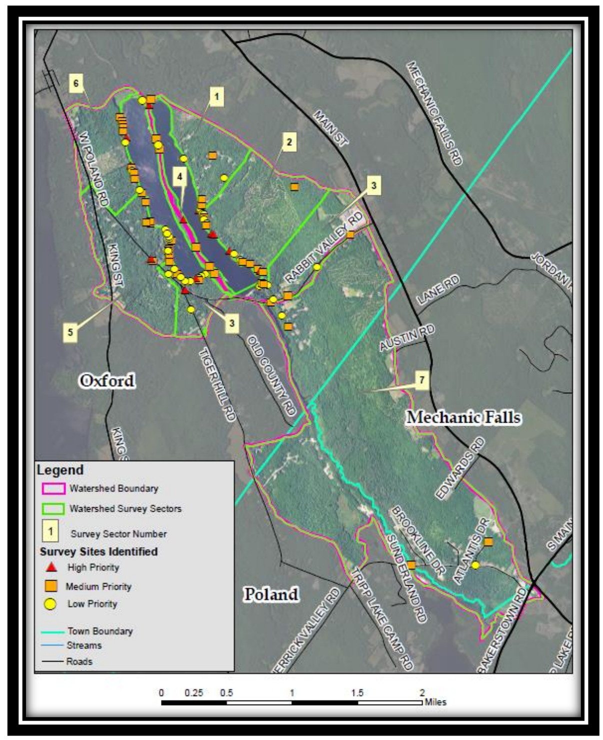
Hogan and Whitney Ponds Watershed Survey: Executive Summary

BACKGROUND:

In the spring and summer of 2017, volunteers from the Hogan and Whitney Ponds Lake Association (Association), with technical support from Maine Department of Environmental Protection (DEP), and the Volunteer Lakes Monitoring Program (VLMP), organized a watershed survey for Hogan and Whitney Ponds (Ponds). The survey effort was prompted by the Association's growing awareness of its broadly-based stewardship responsibilities as it sees its ponds and surrounding watershed under increasing development.

The main purpose of the survey was to identify and prioritize sources of pollution to the Ponds within the watershed. The watershed (see map) covers 5.39 square miles and includes all the land that drains into the two ponds through a network of the Little Androscoggin River, streams, and ditches. Polluted runoff – and the nutrients attached to eroded soil particles – is the largest source of pollution to Maine's lakes. The survey goal was to identify these problem areas. In addition, the survey was carried out to:

- Raise public awareness about the connection between land use and water quality.
- Inspire local property owners to become active stewards of their land by remediating identified pollution sites.
- Establish a network of local partners to help in the education and remediation efforts.
- Use the data from the survey to develop a long-term lake protection strategy for this watershed.



Watershed Erosion Sites

High Impact Shore Erosion

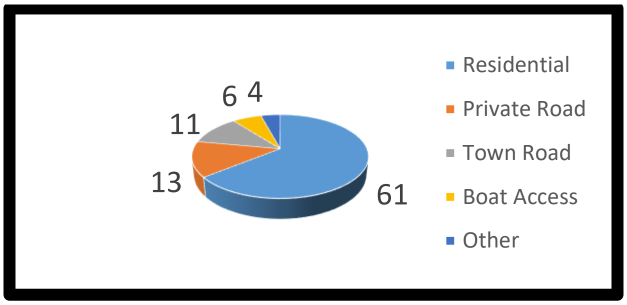
WATERSHED SURVEY:

In June 2017, 20 volunteers attended a morning training and were then partnered into six teams with technical leaders from DEP, VLMP, and paid consultants to visit properties within the watershed to document problem sites. With the use of cameras, GPS units, and standardized field data sheets, each team recorded information on each pollution site including the type of land-use, the impact, and cost, as well as recommendations for fixing the identified problems. These results were compiled in spreadsheets and maps which formed the basis for the more expanded version of this Executive Summary and entitled the *Hogan and Whitney Ponds Watershed Survey* (March 2018).

KEY SURVEY RESULTS:

Volunteers and technical leaders identified 95 sites in the Watershed that are likely to negatively impact water quality. Key findings:

- Erosion sites were identified throughout the watershed across five different land uses. The land owners, road associations, and the town call all help reduce lake pollution.
- Residential areas have the largest number of sites (64%). Many of those sites can be fixed relatively easily with low cost solutions.
- Residences, roads, and boat ramps accounted for almost all of the high and medium impact sites.



Land Use Chart

Impact	Residential	Private Road	Town Road	Boat Access	Other
Low Impact	24 (69%)	7 (20%)	4 (11%)	0 (0%)	0 (0%)
Medium Impact	31 (67%)	5 (11%)	5 (11%)	2 (4%)	3 (7%)
High Impact	6 (43%)	1 (8%)	2 (14%)	4 (29%)	1 (7%)
All Properties	61 (64%)	13 (14%)	11 (12%)	6 (6%)	4 (4%)

Land Use By Impact Table

NEXT STEPS:

- The watershed survey and report are now complete. Next we will begin work with interested parties to fix the sites identified in the survey. This will require cooperation from the Association, landowners, the Town of Oxford, and other partners.
- The Association used the survey data to prepare a Watershed Protection Plan, which outlines a ten-year plan to fix identified problems and prevent new ones. This plan helps Hogan and Whitney Ponds become eligible for DEP grants.
- The Association is working with Oxford County Soil and Water Conservation District and Jeff Stern of the Androscoggin River Watershed Council to apply for a DEP 319 grant to help landowners fix some of the larger and more complex erosion problems identified in the survey. If funded, this project would start in 2018. In the shorter term, letters are being prepared for all property owners with identified erosion problems. The Association will work with them to take the initiative later this spring and summer to correct the problems.

FOR MORE INFORMATION:

For a copy of the full Hogan and Whitney Ponds Survey Report interested readers are encouraged to go to the Association's Facebook page where a link to a PDF version of the report is provided. Please visit: https://www.facebook.com/HoganWhitneyPondsmaine/

PROJECT PARTNERS:

Watershed and Association Residents
Town of Oxford
Maine Department of Environmental Protection
Volunteer Lakes Monitoring Program
Volunteer Lakes Monitoring Program Center for Citizen Lake Science
Soil & Water Conservation District
New England Grassroots Foundation
Western Foothills Land Trust

Introduction

The introduction to this report begins with an important overview of the two ponds within the watershed, a description of the larger watershed surrounding the ponds, and an explanation of nonpoint source pollution ("NPS") – the environmental challenge that has spawned these important surveys. It ends with answers to three important questions: What are the problems in our watershed? Why are the ponds at risk? And what is being done to protect our ponds?

The Ponds and Their Water Quality

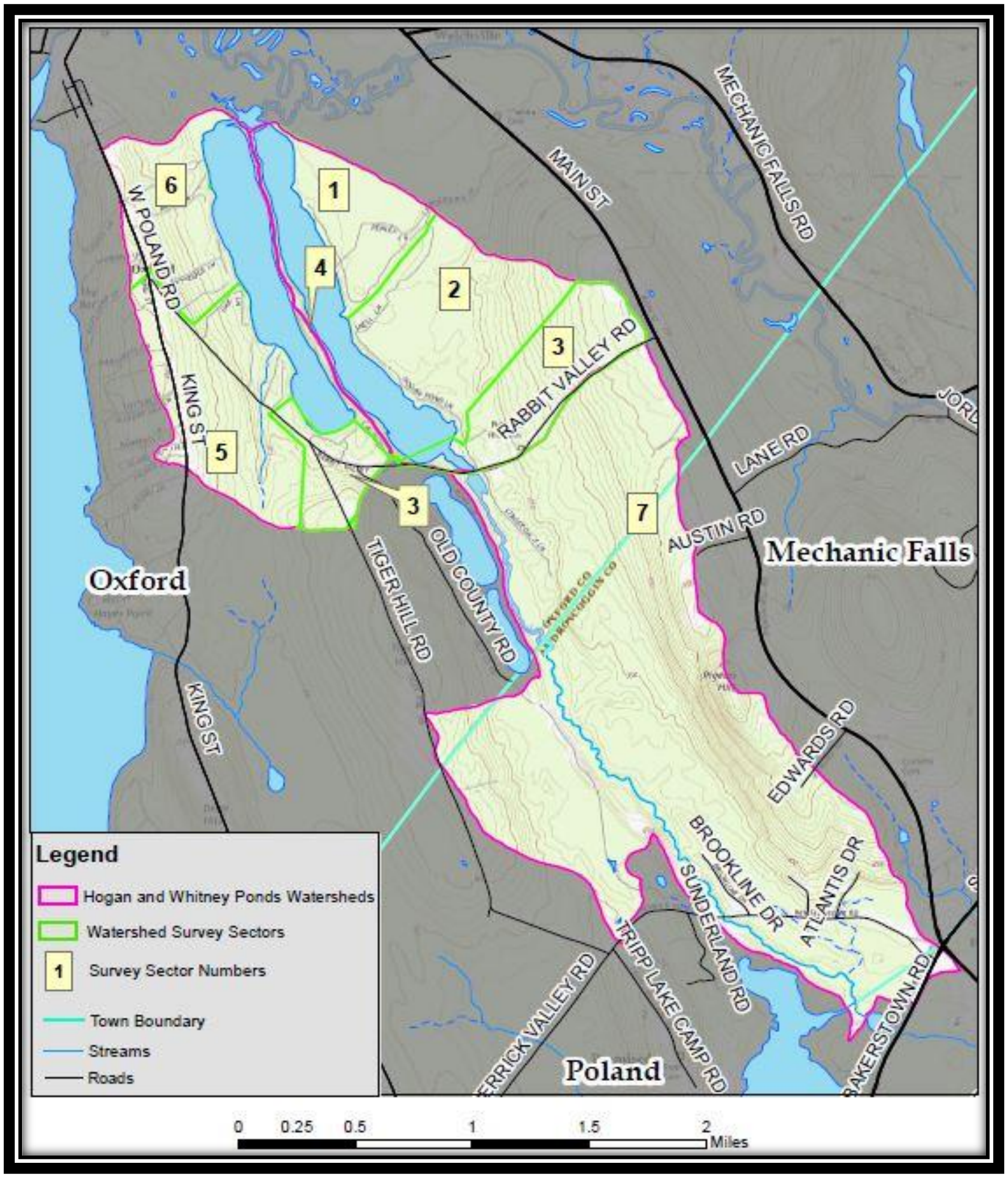
Hogan and Whitney Ponds provide a unique geological setting among Maine's varied lakes. They are separated by an esker (a narrow body of land formed by glaciers) and connected to each other by a navigable stream. These two lakes, each approximately 175 acres, lie within the much larger Androscoggin River watershed. By Maine Department of Environmental Protection ("DEP") designation, both lakes are considered fragile, and the Hogan and Whitney Ponds Association ("Association") has recently grown to appreciate the need to grow our stewardship responsibilities to ensure the long-term health of this ecosystem.

While the lakes share a common watershed and are just a short hop over the 25 foot high esker separating the two, each pond is unique. For example, Hogan Pond is on the state's list for invasive milfoil infestation, while milfoil has just begun to spread to Whitney Pond in the past year. Indeed, most of the energy of the local association has been devoted to eradication of those invasive plants in Hogan and the prevention of widespread milfoil into Whitney Pond.

However, the association is keenly aware of the larger threats to lake water quality and overall land quality by the demands of human activity across the watershed. Our stewardship efforts have intensified as we have watched the expanding development brought on by the Oxford Casino, one of the larger properties in our watershed. We now clearly recognize that storm water runoff is one of the key contributors to lake deterioration and any intervention developed from our systematic collection of data and reporting, and education, of the larger community will be an important step in finding solutions. The Association has used our limited fiscal resources, in addition to milfoil eradication, to conduct annual scientific water quality reviews, and spends a portion of our annual meetings hearing presentations about those data and discussing the implications for our own stewardship responsibilities. It is from those discussions that we developed the need for a watershed survey to help identify and then correct storm water runoff issues.

The Watershed

The generic term "watershed" refers to all of the land area from which stormwater (or rain water) runoff drains to a given surface water – in this case the two ponds. Watershed management focuses on land use activities throughout a watershed with the goal of preventing polluted runoff from those activities from reaching the two ponds. Map 1 offers a visual display of the Hogan and Whitney Ponds Watershed and the seven sectors that the watershed was divided into for purposes of conducting the survey. The watershed for the two ponds encompasses 5.39 square miles of area. The two ponds are geographically located on the south end of the municipality and county of Oxford. The watershed, on the southern extremities of Sector 7, also extends into Androscoggin County and the municipalities of Mechanic Falls and Poland. The watershed is bordered on the east by Route 26 and on the west by Poland Road (also known as King Street). The bulk of the developed properties (and thus the most susceptible to Non-Point Source pollution ("NPS") are on the eastern shores of Hogan Pond and the western edge of Whitney Pond. On the northern end of the watershed rests tributaries of the Little Androscoggin River and the Welchville Dam (at Route 26) which controls the water level of both ponds. On the south end of Hogan Pond are situated two smaller ponds (Green and Mirror) with their own watershed, as well as the outflow of Winterbrook Stream that eventually flows into Tripp Pond. This stream forms the western boundary of the largest of the seven watershed survey sectors on the south end of the watershed; this sector consists mostly of large tracts of undeveloped land.



Map #1: The Complete Watershed and Seven Sectors

Description of Watershed Survey Sectors

Sector 1: The south end of section 1, with access from Campground Lane off Route 26 is where a public campground is located on the eastern shore of Hogan Pond. The campground provides the one public access point for boaters to both ponds in the watershed with direct access to Hogan and indirect access to Whitney via a small stream at the north end, connecting the two ponds. Several small lanes (Penely, Bolster, and Breton) provide access off Campground Lane to the less densely scattered seasonal camps along the upper eastern shores of Hogan Pond.

Sector 2: The vast majority of the small, mostly seasonal cabins on the eastern shores of Hogan Pond are found in sector 2, along Hogan Pond Lane – a one lane private road maintained by property owners with only one access point at Rabbit Valley Road. Much of the northeastern portion of this sector is steep forested land that slopes down to the lake. That forested land has recently undergone significant logging activity.

Sector 3: Sector 3 covers the land at the south end of both of the ponds in the watershed and includes the major access route to most of the shorefront properties via Rabbit Valley Road. This road contributes several significant erosion sites due to runoff from the road. This is also the location of the largest development in the watershed – the Oxford Casino – located at the intersection of Route 26 (Main Street) and Rabbit Valley Road. Also situated at the south end of both ponds is a private, non-profit, church-related camp (Dunns Camp) where approximately 25 cabins are rented on a weekly basis during the summer months.

Sector 4: This sector comprises the small aforementioned esker landmass that separates the two ponds. There are about 20 properties on the esker with each having frontage on both ponds. Two of the properties on the south end are large tracts while the rest of the tax parcels are smaller, with most having small cabins with self-contained generators and outhouses. There is a small one-lane road (Caldwell Lane) running north and south along the length of the esker at its crest.

Sector 5: This sector contains a large number of seasonal properties and small cabins on the western shores of Whitney Pond with private road access off Rabbit Valley Road via Whitney Lane, Green Banks Lane, Perham Lane and Oak Lane. This sector also rises to a crest just beyond its western border across King Street. On the far side of King Street is the watershed that quickly drops to the shores of the much larger Thompson Lake.

Sector 6: The northern half of the western shores of Whitney Pond comprise the boundary of Sector 6. In the southeastern half of this sector can be found a continuation of the small seasonal cabins on the shores of the pond with access off King Street via Quimby Lane, Partridge Lane, Birchwood Lane, Wouri Lane and Colby Shores Road. Several larger tracts of undeveloped land are also found in this sector.

Sector 7: As a result of an initial mapping error in determining sectors for the watershed survey, this large portion of the watershed was omitted. After the error was recognized, an additional sector was defined and surveyed by Association members and DEP staff. It is by far the largest sector in the watershed, encompassing the area south of Rabbit Valley Road, east of Tiger Hill Road, and West of Route 26. Winterbrook Stream is a navigable creek the flows from north to south from the outlet of Hogan Pond, into Tripp Pond in Androscoggin County on the far south end of the Sector. Much of this sector is dominated by Pigeon Hill on the eastern edge and steep forested properties.

Nonpoint Source Pollution

Nonpoint source pollution (NPS), also called polluted runoff, from developed areas is considered to be the highest threat to the water quality of Maine lakes. In undeveloped areas, precipitation and runoff is intercepted and slowed down by trees, shrubs, and ground cover. As water travels over the surface of plants and organic debris on the forest floor, sediment and other particles in stormwater have the opportunity to settle out. Given adequate time, stormwater also seeps into the soil, where it is naturally filtered. In natural systems under typical storm conditions, sediment is mostly trapped before reaching surface waters.

In developed areas, stormwater moves quickly over hard surfaces, such as roofs, roadways and areas of compacted soil, often converging as it exits these surfaces and causing soil erosion. As stormwater speeds its way uninterrupted to surface waters over hard surfaces and other conveyances, it carries along with it eroded soil. When it reaches surface waters, this eroded sediment may deposit in large quantities, smothering native plant and animal communities and increasing water turbidity.

Runoff may also carry nutrients to surface waters, increasing the risk of algal blooms. Phosphorus, an essential nutrient for plants, is attached to eroded soil and sediment particles. In natural watershed systems, phosphorus is in limited supply and this limited availability keeps algae growth in check. However, in developed systems excess sediments in runoff can tip a lake's phosphorus balance.

When too much sediment and phosphorus enter lakes, the phosphorus stimulates plant growth, which can lead to algae blooms. Algae blooms not only make lakes unsuitable for swimming and recreation, they affect water quality and can cause fish kills. Unfortunately, once this enrichment cycle begins, it can be extremely difficult, and costly, to correct. Increased algae growth and the resulting accumulation of dead algae and other organisms on the bottom can deplete the lake's bottom oxygen reserves. Once the lake's bottom water becomes anoxic, a chemical reaction allows phosphorus previously tied to bottom sediments to be released to the water column. An internal recycling of phosphorus within the lake begins, which continues the downward spiral in lake water quality.

Because of the serious threat runoff poses to lake water quality, identifying runoff sites that are likely to contribute sediments to surface waters and developing plans to remediate these sites is essential.

What are the Problems?

Both Hogan and Whitney Ponds are on the DEP priority list of 151 "threatened lakes". This list was created to encourage NPS abatement work in watersheds most vulnerable to NPS pollution. The list is used to help prioritize DEP NPS water pollution control efforts and attract local communities to take action to restore and protect waters threatened by NPS pollution. The use of the term, 'threatened', by DEP refers to unimpaired waters that are subject to potential impacts from NPS pollution. So it is clear that our ponds and associated watershed are on the cusp of dramatic decline and corrective action by the local community will have a high probability of success in remedying the problems and bring the ponds back to better health.

Why are the Ponds at Risk?

A host of reasons help explain the reasons why the two ponds are at risk. First, there is the potential for increased development, as most recently evidenced by the development and expansion of the Oxford Casino on the southeast corner of the watershed. This is expected to bring new support businesses to the area, increasing impervious area and runoff, potentially adding further stress to the ponds. Indeed, there are several larger parcels of land within the watershed that are on the market and could potentially be further developed. Increased development removes the watershed's natural vegetation which acts as filters to slow and disperse rain water from flowing directly into the ponds and carrying contaminated soil with it. Second, there has been little energy and resources devoted to the improvement of the two ponds over the past several decades. Largely this is a function of the general belief that we are a rural region without much cause for alarm as little has changed. The recent increased development around us should be enough to counter that belief. Having identified a significant number of NPS sites throughout the watershed, it is also clear that gravel road maintenance and residential land use choices also may have a significant impact on pond water quality; increased awareness and active stewardship are important elements to reversing declining water quality trends. Finally, our annual scientific tests of water quality suggest that there are high levels of total phosphorus counts and a deficiency of oxygen. These conditions, plus the spread of milfoil into both ponds, along with warmer ambient temperatures, a shortening of the duration of ice cover, and extreme weather events, are all not enhancing lake water quality.

What is Being Done to Protect our Ponds?

The Association has been proactive in developing and carrying out a plan to manage and eventually eradicate the milfoil problem in Hogan Pond. However, even that effort has been challenged by fiscal cutbacks at DEP. Members of the Association have also volunteered to serve as water clarity citizen scientists, taking regular Secchi disk readings of water clarity throughout the summer months. The Association has also provided financial support for more extensive scientific testing of the water in both ponds that occurs once a year. This has been done sporadically over the past several decades but more regularly over the past five years, providing a more scientific baseline. But we also recognize that is not enough so members of the Association also stepped up to conduct this watershed survey to uncover more specific steps that must be taken to deal with NPS pollution around the lake.

Survey Purpose and Methods

This second section of the report addresses the purpose of our survey and details the methods that were used to carry out the survey.

Purpose of the Watershed Survey

The purpose of the survey was designed with the expectation that we could better inform the community about our mission. We envision four specific ways that we hope that might happen. First, the report will hopefully better educate the local community about the health of our watershed in a way that is data driven and evidence based. We have already shared our plans with the Oxford selectmen and will continue to reach out to them and other local groups to share the results once the report is completed.

Second, we recognize that having a scientifically recognized process for identifying problem areas in the watershed will make fund-raising for corrective action a much easier effort. In that regard, we plan to use the survey report as a tool for the development of a watershed-based protection plan, which acts as a stepping stone for a United States Environmental Protection Agency Section 319 Nonpoint Source Management Program implementation grant administered by the DEP.

Third, having such a documented process will help us recruit individual property owners on the two ponds for erosion control efforts with a clearer sense of purpose and direction. As they see their own properties in the larger context of the entire watershed, we hope to better mobilize action by them.

Finally, we hope to grow a network of other like-minded local groups trying to preserve their lakes and lands. We have already begun dialogue with a local land trust for ways to collaborate on water and land stewardship. And we have met with other local lake associations to discuss ways to share insights about the watershed survey process and follow-up steps.

Survey Methods

Following attendance at a Maine Volunteer Lake Monitoring Program ("VLMP") annual workshop, the inspiration for conducting a formal watershed survey on Hogan and Whitney Ponds began. Armed with insights and assistance from Wendy Garland of the DEP, we began the process of planning for a watershed-wide survey effort and opportunity to discuss the importance of watershed stewardship with our watershed community. The following summer, local Association members used materials presented at the workshop and made a presentation at our annual Association meeting. After that presentation we obtained a list of possible volunteers who might be willing to assist in the planning and implementation of the survey. We also received a verbal commitment from the Association to provide some financial support for this effort.

With assistance from the Town of Oxford, we identified properties in the watershed -- about 10 percent of the nearly 3500 properties in the town. This list of properties was used to inform the size of the survey effort required and allowed us to send information to residents in our watershed. Prior to conducting the survey a letter was sent to each property owner outlining the planned survey scope and providing a chance for landowners to opt out (see Appendix A).

To help supplement the limited resources of the Association, the author sought additional funding sources, eventually receiving grants from the Maine Volunteer Lake Monitoring Program Center for Citizen Lake Science and the New England Grassroots Environment Fund. These grants enabled us to hire four technical experts who served as leaders for each of the teams that would collect the data that forms the basis of this report. In addition, the DEP provided two additional experts at no charge so we had a total of six experts that worked with teams of volunteers to survey the six original sectors identified within the watershed (see Appendix B, maps B1-B6).

The survey was performed on June 3, 2017 with the help of 25 dedicated volunteers. About a month before the survey date we mailed letters to all the property owners within the boundaries of the watershed. We asked for property owners to let us know if they did not want us to survey their properties (negative consent). Of the approximately 280 mailed letters, only 10 responded that they did not grant us access onto their properties. Those sites were clearly identified on each sector map as a location not to be surveyed. An equal number of letters were returned as undeliverable. On the day of our visit, we also knocked on property owners' doors reminding them of our letter and confirming their permission. The vast majority of the properties were unoccupied on the day of the survey as most of the watershed properties are vacation properties and it was still very early in the season with most facilities still boarded up for winter.

The survey volunteers met with our six technical experts at the Oxford Town Hall on a Saturday morning for a 90 minute training conducted by two DEP technical experts and two other experts. We were provided with an overview of the survey process and received training on specific characteristics to look for when inspecting properties. Each team used a standardized form to record observations of NPS sites (see Appendix B). Following the short training, the six technical experts disbursed with six small teams of volunteers (typically three or four volunteers) to inspect each of the six assigned sectors. DEP provided detailed maps within each sector with lists of all the properties in those sectors.

During our same-day field visits to each sector, the volunteer team carefully inspected each property with development and direct or indirect access to the two ponds. In addition, any roads, foot paths, boat launches and other manmade access routes to the ponds were also inspected. These included both public and private roads. Datasheets were completed on each documented property where we recorded GPS coordinates, took photographs, identified land-use, assessed the nature of the problem, offered remediation recommendations, and made a general assessment of impact. These results for each site were subsequently entered into an Excel database.

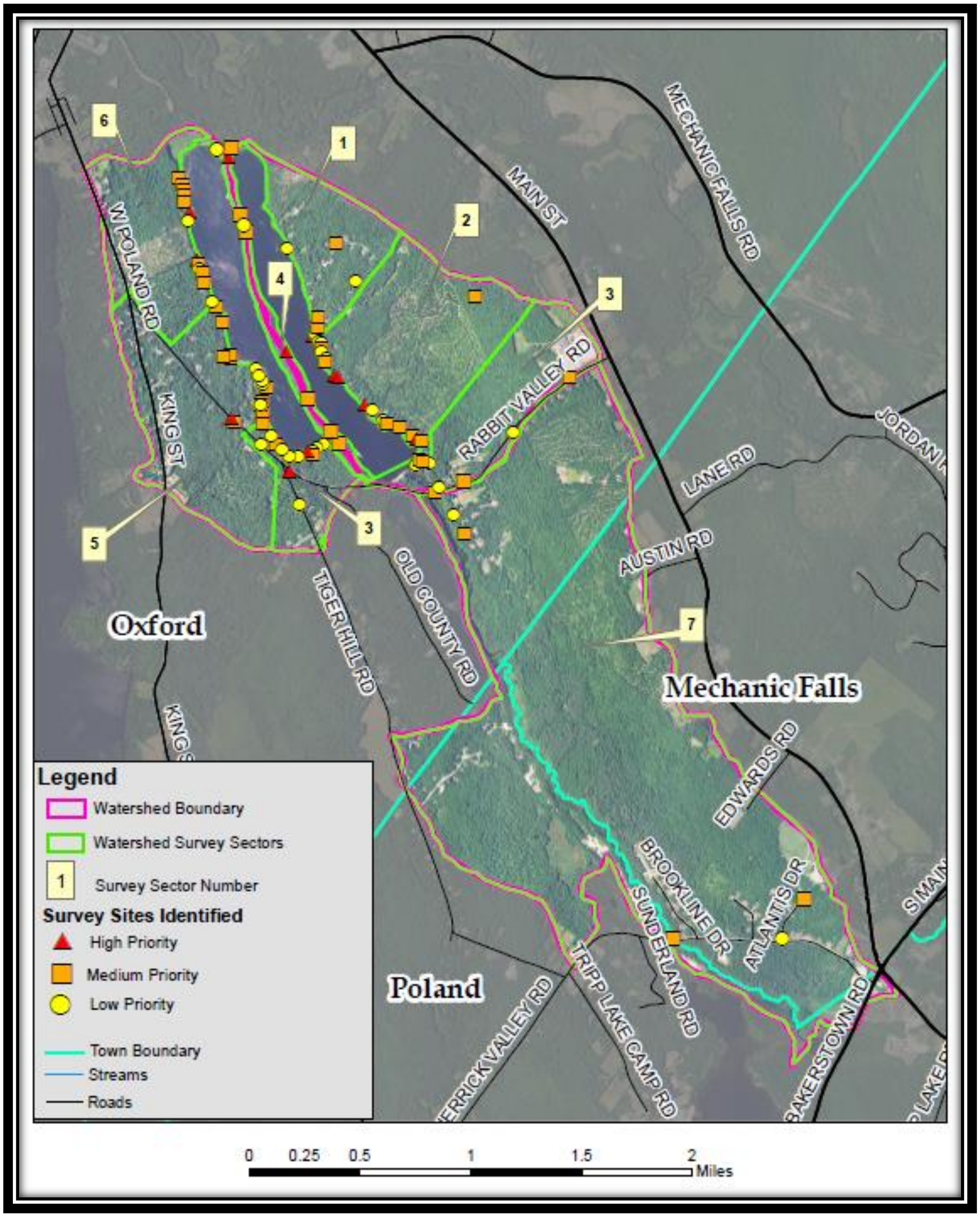
Not all of the six teams were able to complete inspecting all their assigned properties. A small team went out the next day and completed more surveys. Then, over the course of the summer the DEP leadership returned with the author on two separate occasions to complete the data recording process. Additionally, following further review of the stream at the south end of Hogan Pond, it was determined that a large portion of the watershed had not originally been identified. In the Fall of 2017, DEP staff assisted with surveying the newly-identified area, ultimately assigning the area as Sector 7.

Watershed Survey Results

A wealth of information was recorded for each identified NPS pollution site. In this section of the report we delve more extensively into what was learned from that data collection effort. A range of maps, charts, tables, and photographs help with that description. We begin that review by looking at the varied levels of impact across the watershed since the most obvious question that will be posed by curious readers and stakeholders is how extensive are the problems and what level of impact might those pose to the watershed? Then we take a closer look the different land uses where these problem sites arose. And we conclude with the potential costs associated with the problematic sites.

Findings Related to Impact

Map 2 displays the identified nonpoint pollution sites distributed across the seven visited sectors. Our survey work conducted by volunteers and technical experts identified a total of 95 nonpoint source pollution (NPS) sites. These sites are organized on the map by level of impact for remediation: yellow circles are low impact, orange squares are medium impact, and red triangles are high impact. The impact categories were arrived at by assessing each property on a three-point scale for type of erosion, size of the erosion, and whether there are any buffers to redirect the pollution flow. The breakdowns for each of these categories can be seen in the sample survey worksheet found in Appendix C.

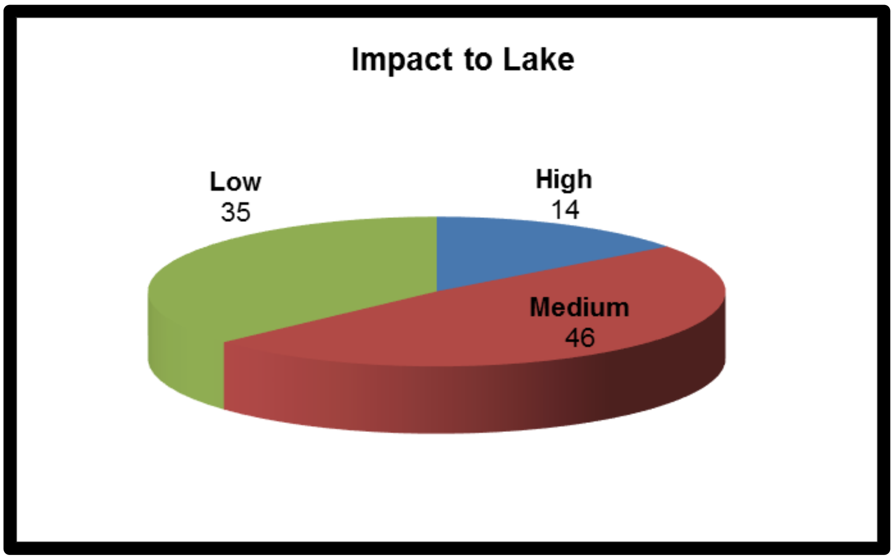


Map #2: Hogan & Whitney Pond Watershed Survey Sites by Impact

A quick glance at the map reveals the obvious: the nonpoint pollution sites are concentrated where most of the houses are located – along the western shores of Whitney and eastern shores of Hogan Ponds. A smattering of additional sites were also identified away from the shore lands, with the majority of those related to road runoff issues. A more detailed set of maps, displaying each sector separately and the distribution of sites by impact, is presented in Appendix C for those interested in a more fine-grained image of the identified sites.

The following pie chart shows allocation of sites across three categories of impact – low, medium, and high. Chart 1 does just that revealing that there are more medium impact than either low or high impact sites with just under half of all the sites being medium. Just over one third of the sites are low impact and the smallest collection of sites are in the high impact category – just 15 per cent.

Chart 1: Pie Chart of Pollution Sites by Impact (N=95)



By way of further explanation of the three levels of impact, we offer three photographic illustrations from our survey visits:

Photo #1: Low impact - sheet erosion from roof vegetation

Photo #2: Medium impact – sheet erosion, no

Photo #3: High impact - gully washing directly to pond

Impact by Pond

Of interest to association members, since we have two nearly identically sized ponds within the watershed, is whether they are any differences between the two of them?   Whitney Pond had 45 sites observed by volunteers and technical experts while Hogan Pond had 33. This can be observed visually by looking more closely at the maps displayed in Appendix C. Whitney also had more tax parcels (not all parcels have building sites on them) than Hogan so that is a partial explanation for the difference in the two sets of observations. To equalize the difference in properties we calculated a simple ratio of pollution sites to total number of properties with the following result: Whitney Pond -- 0.49 , and Hogan Pond -- 0.36. So, even taking into consideration the difference in the number of properties, Whitney inspections produced a somewhat higher ratio of pollution sites than did Hogan.

Digging a bit deeper, what was the distribution of impact among the NPS pollution sites on the shores of the two ponds? In other words, were problems more severe on either of the two ponds? A quick visual inspection of the yellow, orange and red dots along the western shore of Whitney Pond and eastern shore of Hogan Pond does not produce any systematic difference.   Even a more careful accounting, as depicted in the numbers in Table 2, suggests no discernable difference in the level of impact for sites between the two ponds, with both ponds having an identical proportion of sites deemed to be low impact (just over one third), both having very similar proportions (about half) with medium impact sites, and both yielding less than one-fifth of the sites as high impact.

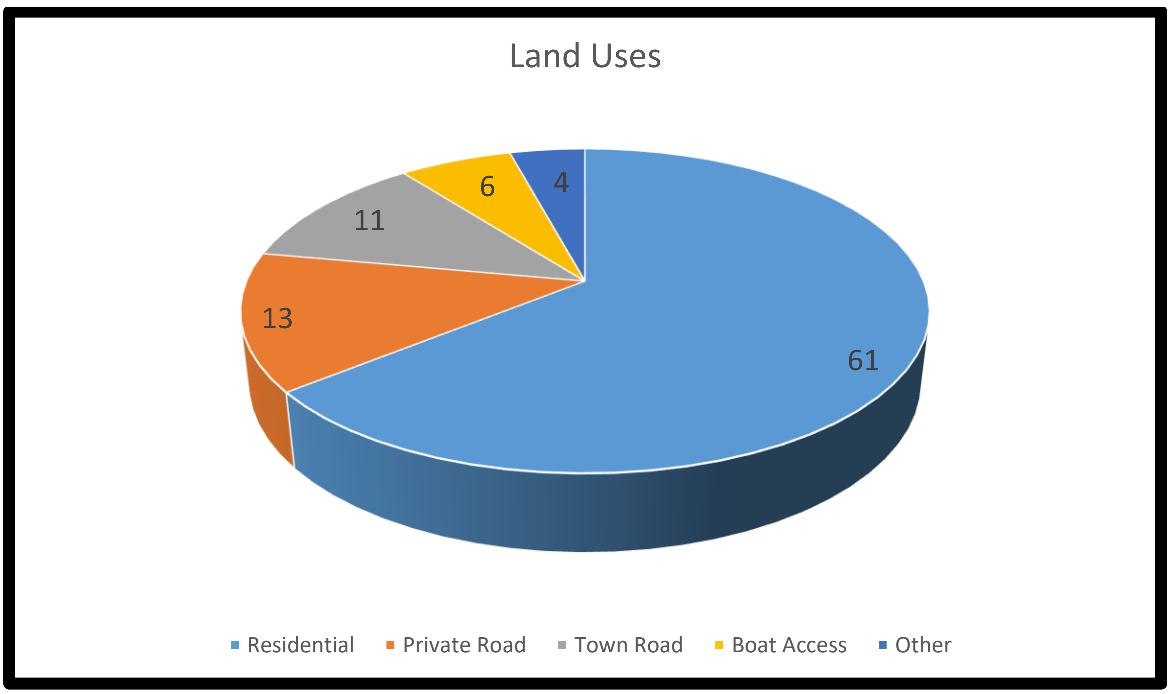
Table 1: Breakdown of Sites by Impact Along the Shores of the Two Ponds

Pond	Low Impact	Medium Impact	High Impact
Hogan Pond	12 (36%)	15 (45%)	6 (18%)
Whitney Pond	16 (36%)	23 (51%)	6 (13%)

Findings by Land-Use Type

The standard format for documenting and reporting NPS pollution sites, as defined by DEP protocol, includes documenting a broad range of different land-use types. In this next section, we take a closer look at the results by land-use type. Chart 2 displays the ten observed types by frequency counts across the entire watershed.

Chart 2: Number of NPS Sites by Land-Use Type: Entire Watershed (N=95)



By far the largest cluster of pollution sites was focused on residential properties (64%). That makes sense since most of the inspected properties were along the two ponds' shorelines and were small, seasonal homes. The second most frequent land-use category was private roads (14%), followed closely behind by town roads (12%). The fourth category (6%) included those areas that provide boat access to the ponds. The remaining category (4%), was “other” which was a mix of just a handful of construction, logging, and driveway sites.

Examples of the four more frequent land-use types are illustrated with sites from the watershed:

Photo #4: Residential land-use

Photo #5: Private Road land-use

Photo #6: Town Road land-use

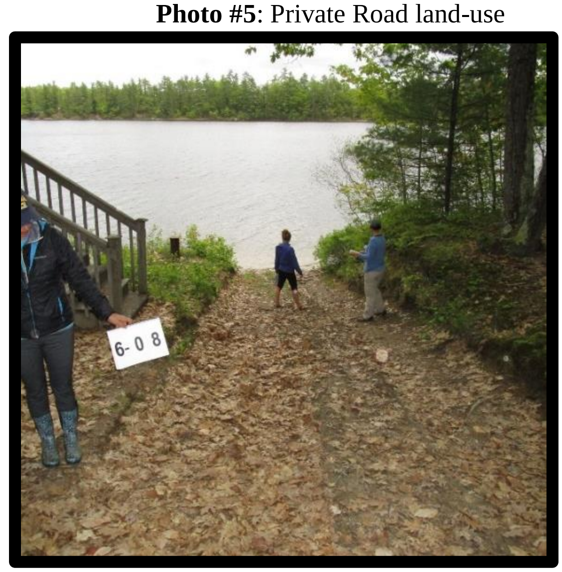


Photo #7: Boat access land-use

Did the two ponds yield different types of land-use pollution sites? The distribution of land-use problem sites between the two ponds varies relative to the proportions for the entire set of properties in the survey. First, Hogan Pond produced a disproportion number of problems with issues related to private roads (twice the sample) with twice the proportion as the entire sample. This is largely a function that the private roads on Hogan are much closer to the pond shoreline than the roads on Whitney with less opportunity for eroded soil to be filtered by buffer areas. On the other hand, Whitney had almost twice as many boat access issues as the overall sample, no doubt a function of no public access to the pond. All of the remaining problems on Whitney were residential.

Table 2: Land-Use by Pond*

Ponds	Residential Land-Use	Private Road Land-Use	Town Road Land-Use	Boat Access Land-Use	Other Land-Use
Hogan	20 (61%)	9 (27%)	1 (3%)	1 (3%)	2 (6%)
Whitney	41 (89%)	0 (0%)	0 (0%)	5 (11%)	0 (0%)
All Properties	61 (64%)	13 (14%)	11 (12%)	6 (6%)	4 (4%)

*The sample size for the two ponds is less than the total of 95 since 16 of the pollution sites are not situated on either pond.

Finally, were there significant differences in impact across the five land-use categories? Table 3 reveals a pattern across the three impact levels that is markedly similar to the entire sample when looking at the distribution of land-use categories. The one major exception is that the boat access problem areas, predominantly situated on Whitney, are five times as likely to be high impact sites than the overall sample.

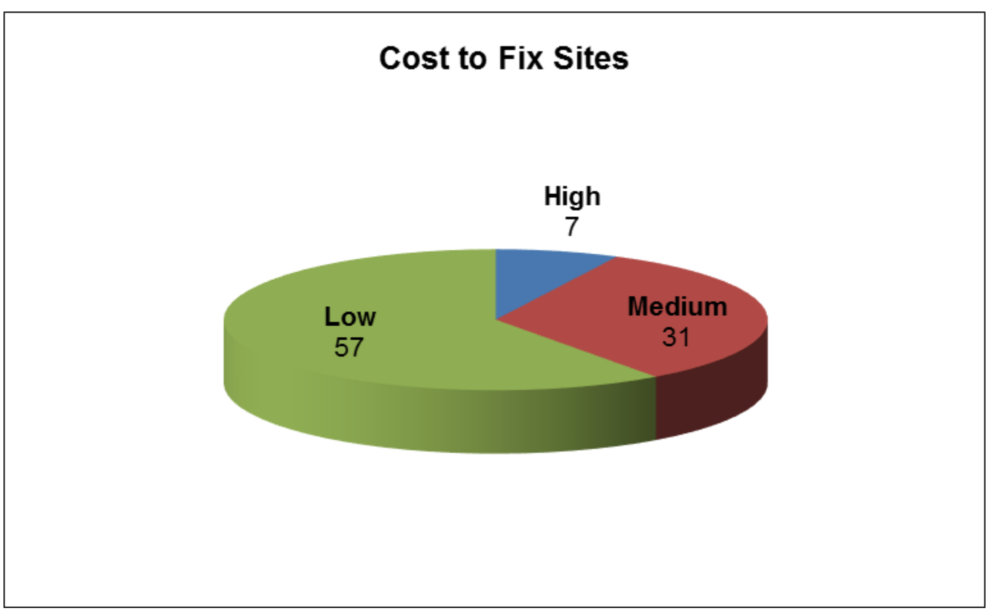
Table 3: Land-Use by Impact

Impact	Residential Land-Use	Private Road Land-Use	Town Road Land-Use	Boat Access Land-Use	Other Land-Use
Low Impact	24 (69%)	7 (20%)	4 (11%)	0 (0%)	0 (0%)
Medium Impact	31 (67%)	5 (11%)	5 (11%)	2 (4%)	3 (7%)
High Impact	6 (43%)	1 (8%)	2 (14%)	4 (29%)	1 (7%)
All Properties	61 (64%)	13 (14%)	11 (12%)	6 (6%)	4 (4%)

Findings by Cost

How much is all of this remedial work going to cost? In this section we explore the distribution of pollution sites by cost. With each inspected site, the volunteer and technical expert teams made an approximate estimate regarding the cost to fix the problem. We used the standard three category designation outlined by DEP of low cost (anything less than $500), medium cost (ranging from $500 to $2500), and high cost (expenses of more than $2500). A simple pie chart in Chart 3 depicts those breakdowns across the three categories:

Chart 3: NPS Sites by Cost



Cost estimates and impact estimates are correlated as one-third of the impact is determined by cost but they are not exactly the same so it is worth illustrating some examples of different sites by varied costs. A low cost fix (correcting roof sheet erosion) is depicted in Photo #8. A more expensive fix, but perhaps with the association-supported budget of a homeowner is the introduction of some buffer plants (Photo #9), and the high cost fix of holding back a bank under some steep stairs to the shoreline will need collective fiscal responsibility (Photo #10).

Photo #8: Low cost – mulch

Photo #9: Moderate cost – vegetative cover

Photo #10: High cost –shoreline stabilization

How expensive are the repairs across the entire watershed? The distribution is heavily weighted to the low end of the cost estimates. That is, nearly two-thirds of all the pollution sites involve remediation efforts that will cost less than $500. This is good news for both homeowners and the groups interested in promoting better stewardship practices. Most of the remaining sites (32 percent) were deemed to be medium cost ($500 to $2500) with only a very small fraction (7 percent) to be high cost. Using a crude measure of $350 for low cost sites, $1500 for medium cost, and a range of $5000 to $25,000 for high cost, then the cost to remediate all the identified problems could be in the ballpark of $100,000 to $240,000.

Are there important differences in repair costs between the two ponds? For the final analysis in this section we explored the differences on the two ponds (see Table 4). Here is where we found some significant differences with the sites on Hogan being less expensive to ameliorate than those on Whitney. That is, Hogan Pond sites were half as likely to have medium cost sites than Whitney, and 38 percent more likely to have low cost repairs. Both sites only had a handful of high cost sites.

Table 4: Cost for Repairing Pollution Sites by Pond*

Repair Costs	Hogan	Whitney
Low	26 (79%)	26 (57%)
Medium	6 (18%)	18 (39%)
High	1 (3%)	2 (4%)

*The sample size for the two ponds is less than the total of 95 since a number of pollution sites are not situated on either pond.

Remediation Options

While it is important to know more about the intricacies of the problems brought on by NPS pollution sites, it is incomplete to just document that they exist. It is also essential to take the next step and learn more about the kinds of remediation that will need to take place to fix the problems.

Types of Remediation for Identified Sites

Fortunately, as part of the survey process each team was trained on recommending a range of solutions for the identified problems and those solutions were recorded and analyzed as part of the survey process. Complicating the storyline is the finding that each NPS pollution site often had multiple solutions, not just one. So, while a site might be improved by installing a layer of erosion-control mulch, that alone may not solve the problem. Instead, the mulch might need to be coupled with a retaining wall or a series of steps to keep the offending soil from finding its way directly into the ponds.

Across the 95 sites documented by this survey, we recorded 299 recommendations to fix the pollution problems for an average of just over three recommendations per site (mean=3.15). Only a small handful of sites (15) could be fixed with just a single recommendation while the rest needed multiple solutions. Indeed, two sites had as many as eight different suggestions to remediate the problem.

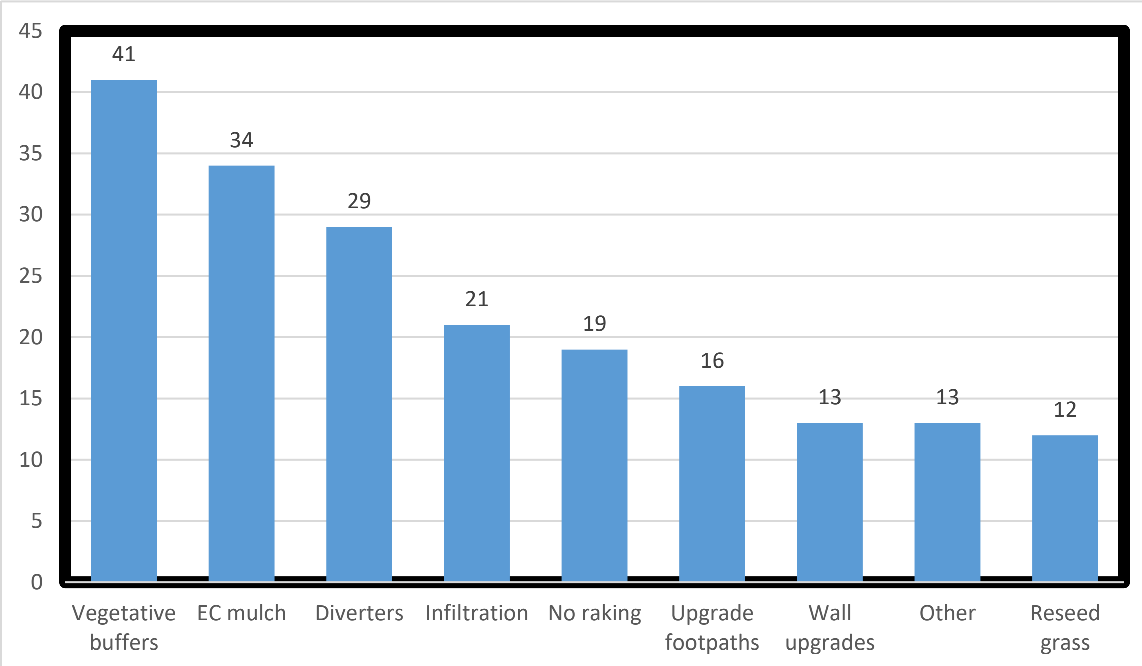
A more careful analysis of the recommendations are in order as they vary markedly in terms of technical expertise required and cost to implement. With respect to technical expertise many of the problems can be executed by property owners with little or no skill required while on the other end of the continuum some recommendations that will require a consulting engineer, heavy equipment, and detailed procedures. By way of example, the simplest fix actually requires no work: just educating property owners to stop raking their soil to remove the natural erosion control created by the natural build-up of pine straw. On the other end of the continuum, some of the road erosion will only be remediated by designing culverts, rerouting diverters, and installing rap-rap to line the entrances and exits to the culverts to protect against scour.

The recommendations tended to cluster around two main land-use types: residential and roads. Thus, it makes more sense to discuss these separately when outlining possible solutions.

Details of Residential Fixes

The majority of all the sites were classified as residential – 51 percent as documented in Chart 4. But accompanying the residential properties are the various water access categories (e.g., paths, trails, boat ramps, etc.) that comprise an important part of the residential properties. Combined, those represent 70 percent of all the pollution sites. A total of 198 recommended fixes were offered by the survey team in these combined residential and water access sites. Twenty different specific recommendations were provided by the visiting teams and those are best represented by eight broad categories of solutions with the following distribution:

Chart 4: Distribution of Residential Solution Categories



The most obvious observation from a quick review of the data in Chart 6 is that no single recommended solution dominates the watershed. Rather, there are a diverse set of solutions that will need to be implemented. In addition, it is noteworthy that ten percent of the problems can be resolved by simply doing nothing. That is, if homeowners stopped raking their properties to remove pine straw, it would go a long way to helping control the water runoff. Another solution that goes hand in glove with the no raking option is the need for more use of erosion control mulch. This is a mulch that is not widely available in all nurseries or big box stores, but can be readily found in a few specialty nurseries. It is a product that is coarser and not as uniformly attractive as the often-tinted mulches found in small bags, but also has the added bonus of binding together more readily so that heavy rains do not wash it away. When purchased in bulk it is reasonably priced and the Association has begun looking for a local supplier and a storage location within the watershed where cooperative land owners can avail themselves of smaller quantities at no cost.

Not all of these recommended solutions are commonly understood by many property owners, and even the terms that are clear (e.g. vegetative buffers) involve specific plants that are better than others at holding back erosion. Thus, in Appendix D we offer more details, with helpful web links for even more information. The five most common residential fixes, as determined by our frequency counts in Chart 4 are illustrated with photographic displays from our survey.

Photo #11: Residential vegetation

Photo #12: Residential mulch

Photo #13: Residential diverters

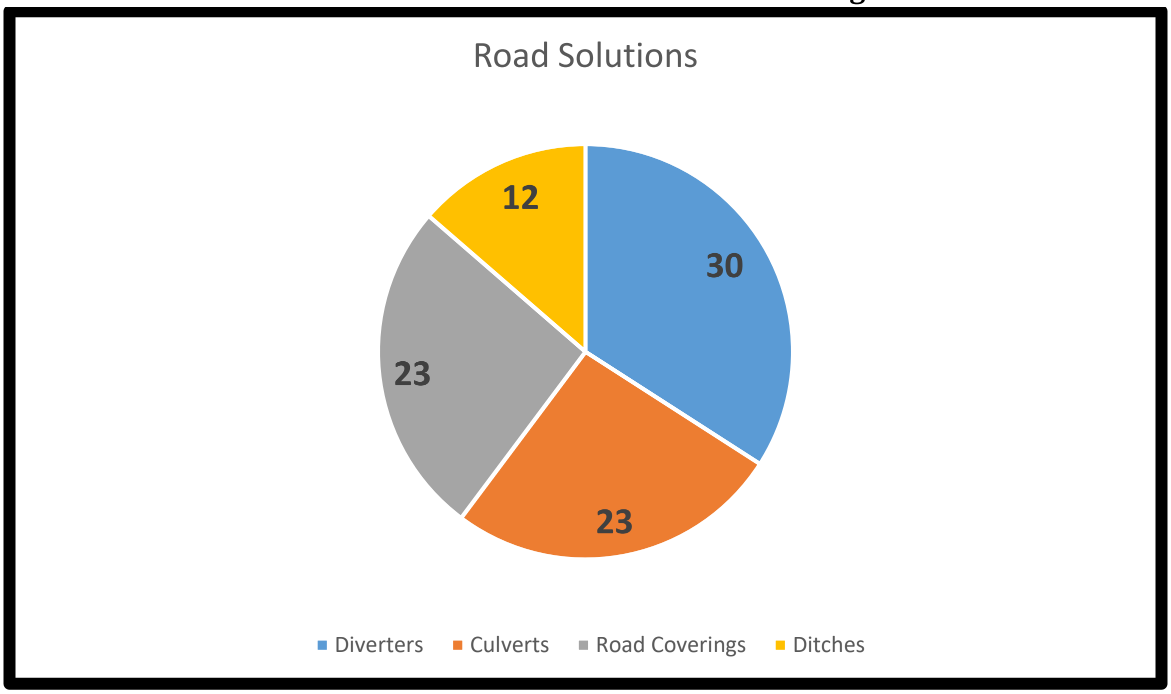
Photo #14: Residential infiltration

Photo #15: Residential: no raking

Road Improvement Details

The second clustering of solutions revolved around the roads in the watershed, with almost all the balance of the remaining 30 percent dealing with issues around roads. With roads there were four categories of solutions, as outlined in Chart 5. One third of the solutions dealt with ways to alter the flow of water as it sought to find the least resistive path to the streams and ponds. One quarter of the recommendations revolved around the construction/repair/maintenance of culverts that allow water to flow under roads. One quarter of the suggestions involved improvements to the road themselves (e.g., crowning), and one in seven of the recommendations (14%) required attention to the ditches along the sides of the roads.

Chart 5: Distribution of Road Solution Categories



The four categories of road solutions are described with photographs from our watershed survey. Photo #16 provides an example of how diverters might be used to re-channel water flows. Photo #17 documents repairs/improvements needed to a faulty culvert. The example from Photo #18 suggests that proper road coverings will diminish water flow to the nearby pond. And, the road ditch in Photo #19 also requires repairs.

Photo #16: Road diverters

Photo #17: Road culvert repair

Photo #18: Road covering

Photo #19: Road ditch repair

Bigger Picture Next Steps

It is an important first step to have a good idea about the kinds of solutions required to fix these pollution site problems. However, without the cooperation and support of property owners (individual residents as well as corporate and municipal owners) all of the suggestions will die a slow death with little or nothing changing to improve the health of the watershed. So it is equally incumbent upon those who helped to assemble these data and the larger Association that encouraged our endeavors to find ways to make sure everyone involved is better informed about the urgency of the problem and the means at their disposal to help be part of the solution. Of course, we recognize that not everyone will get on board, but without more outreach we know that no one will. So the next be step is education, education, and more education. The word needs to get out not only about the problems but also the solutions.

There are a number of next steps we plan to implement once this report has been made public. The first is to reach out to individual property owners, via letter, to describe the problem(s) on their properties and the proposed remediation steps. We will invite them to be part of the solution. The letter will also refer them to the larger report and links to resources that can assist them on their own.

Second, we will reach out to the Town of Oxford, via the selectmen, to outline what we learned at a public meeting since a number of the sites involve municipal roads. We will discuss remedies with them, including efforts to have them partner with us to seek additional funding to support our efforts to correct the problem sites.

Third, we will reach out to other organizations interested in the environmental health of the region and provide them with access to the report in the hopes that they might see ways for us to partner on promoting more healthful stewardship practices. For example, we would hope to encourage large businesses like the Oxford Casino, to help us establish a fund to support corrective actions. We will be happy to also make presentations to those organizations, at their public meetings, if any interest arises.

Fourth, we fully recognize that it is counter-productive for small lake associations like ours to work in isolation to solve these problems. We will hope to build alliances with other like-minded organizations to begin dialogue about more ways to build more comprehensive stewardship plans. On that front, we have already engaged in conversations with the Lakes Association of Norway, the Lake Environmental Association, the Western Foothills Land Trust, the Maine Volunteer Lakes Monitoring Program, the New England Grassroots Environment Fund, and the Androscoggin River Watershed Council to begin that process. This spring we will ramp up those efforts.

Finally, we plan to partner with the Oxford County Soil and Water Conservation District as the fiscal and administrative agent to apply for DEP Implementation Grant, under Section 319 of the

Clean Water Act, to support any corrective actions. In next few month we will be preparing a Watershed-based Protection Plan as the first step towards qualifying for 319 grants, with the expectation that we will apply for an Implementation Grant with the assistance of Jeff Stern at Fiddlehead Environmental Consulting in June, 2018. Additionally, we have a commitment from the Oxford County Soil and Water Conservation District to help the Association fund the cost of writing the Implementation Grant.

Appendix A: Association Letter to Property Owners

Bruce Wilson
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Collingswood, NJ 08108

856-816-1544
bruce.wilson8@verizon.net

> *A watershed survey entails teams of volunteers walking and driving throughout the specified watershed area looking for possible sources of pollution to the pond. Storm water runoff carries nutrients (such as phosphorus) and pollutants (such as sediment) to the ponds and can result in poor water quality. Soil erosion is the single largest pollutant (by volume) to Maine's surface waters.*

May 4, 2017

Dear Hogan or Whitney Pond Watershed Landowner:

I am writing you to let you know that the Hogan and Whitney Ponds Association is planning a survey of the two ponds' watershed on Saturday, June 3, 2017. The purpose of the survey is to locate erosion sites and possible sources of sediment contamination that may be having an impact on the ponds' water quality.

The Hogan and Whitney Ponds watershed is the area where all rain and snowmelt running off the land drains to the ponds. Activities in the watershed that take place a long distance from the pond can have as much impact on water quality as those that occur in the shoreline area. The Hogan and Whitney Ponds watershed covers about 2.6 square miles (see map on back of this letter).

The survey will be conducted by local volunteers assisted by technical experts from the Maine Department of Environmental Protection, the Oxford County Soil and Water Conservation District, and the Maine Volunteer Lake Monitoring Program. We have been fortunate to receive funding to help support this work from the Maine Volunteer Lake Monitoring Program Center for Citizen Lake Science and from the New England Grassroots Environment Fund. Although we hope to conduct all the survey fieldwork on June 3, some follow-up fieldwork also may occur later in June.

Locally-led watershed surveys such as this one have been used successfully throughout Maine to document threats to water quality. The information we gather will be used to give us a better handle on possible sources of pollution to Hogan and Whitney Ponds, to provide opportunities for addressing problem sites, and to provide the information needed for our lake association to apply for grant funds that can be used to fix priority problems. In no way will the information gathered be used for any enforcement purposes.

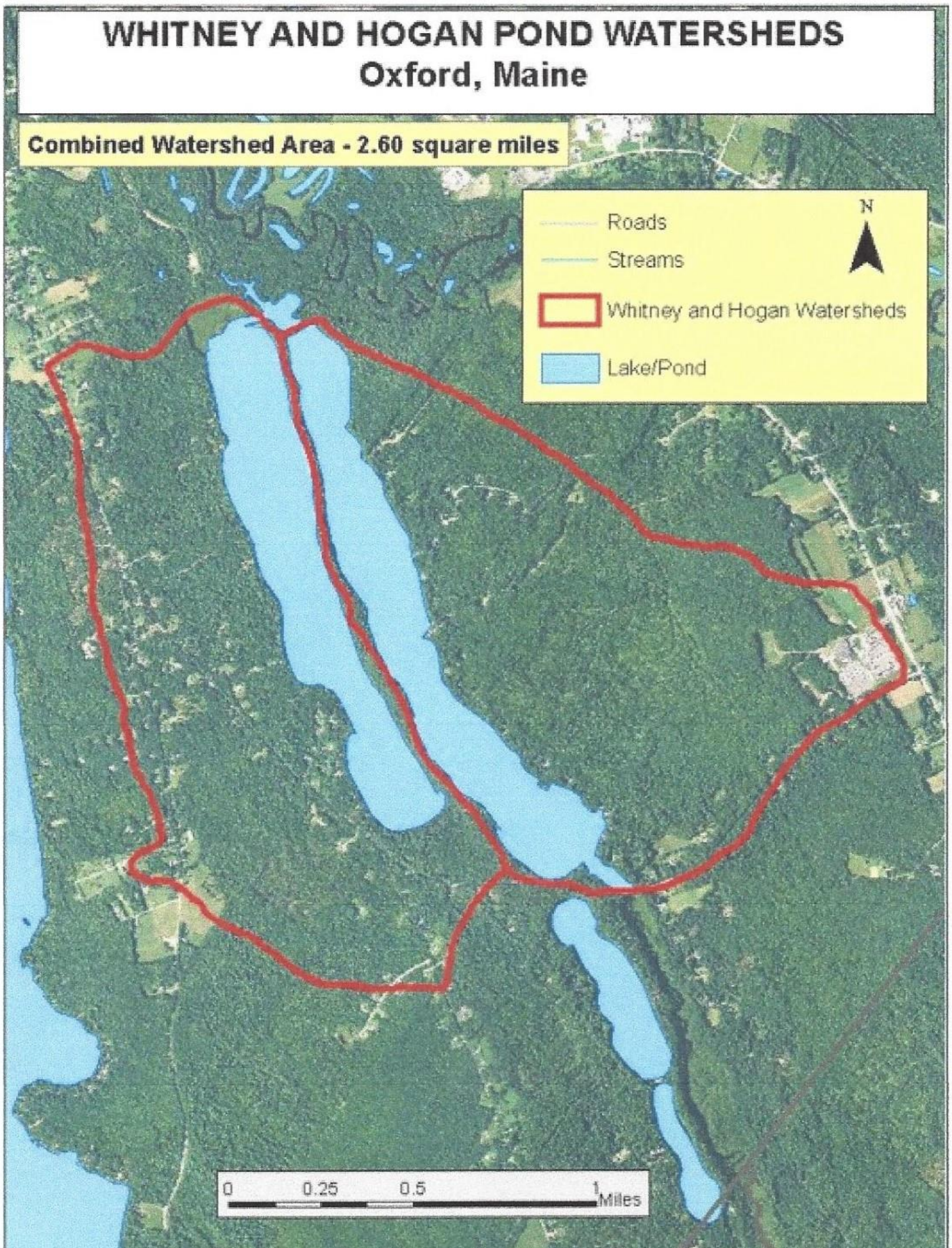
Your participation, as a landowner of property within the Hogan and Whitney Ponds watershed, is purely voluntary. We would like to include your land in this survey, but we will respect your property lines if you do not wish for us to include your property in this survey. Please contact me if you do **not** want us to survey your land, if you would like to volunteer to help conduct the survey, or if you would like to learn more about the Hogan and Whitney Pond Association.

Our association is pleased to lead this project to help protect and enhance the quality of Hogan and Whitney Ponds and promise to keep the community informed about what we learn.

Sincerely,

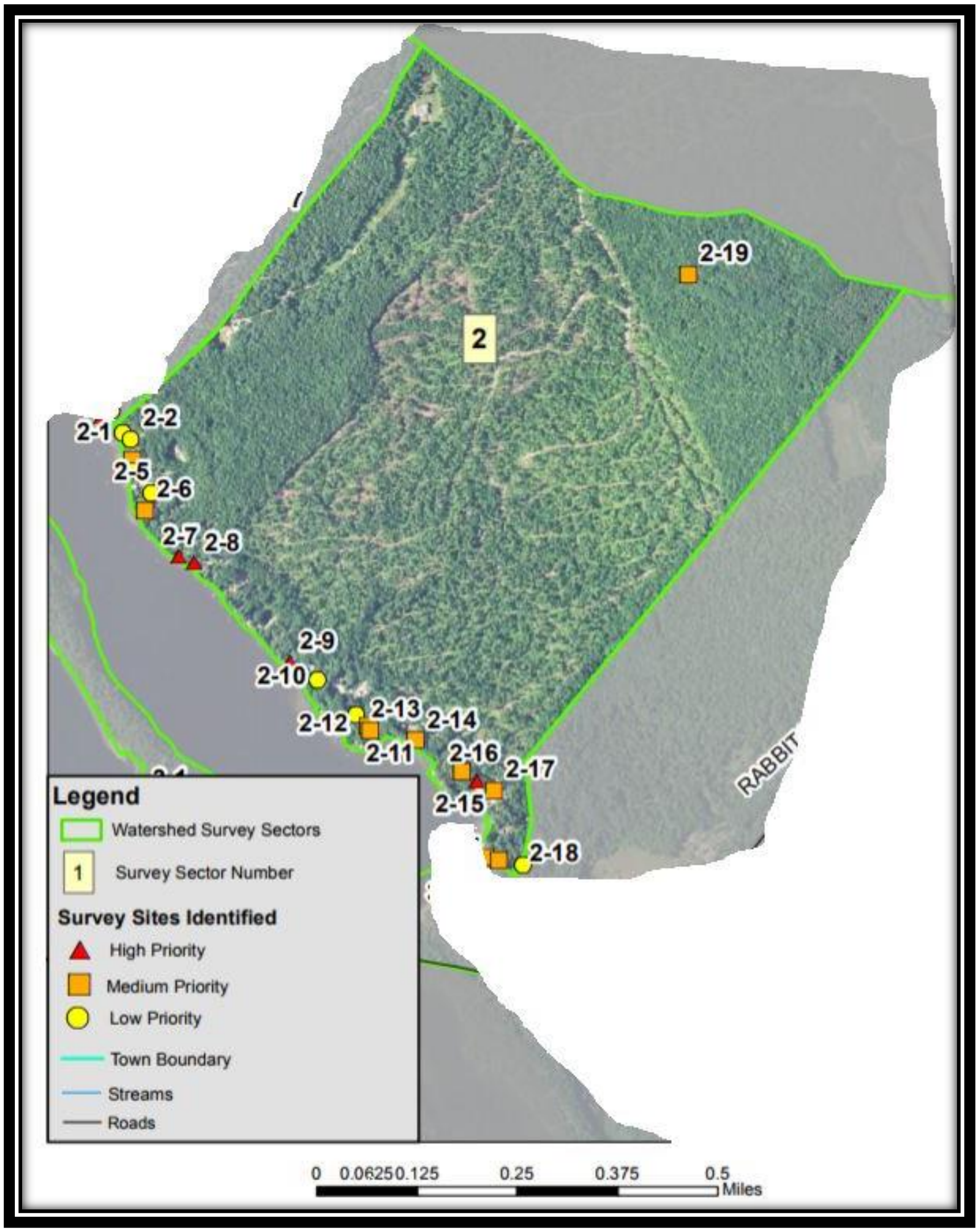
B. Wilson

Bruce Wilson, Volunteer
Hogan and Whitney Pond Association

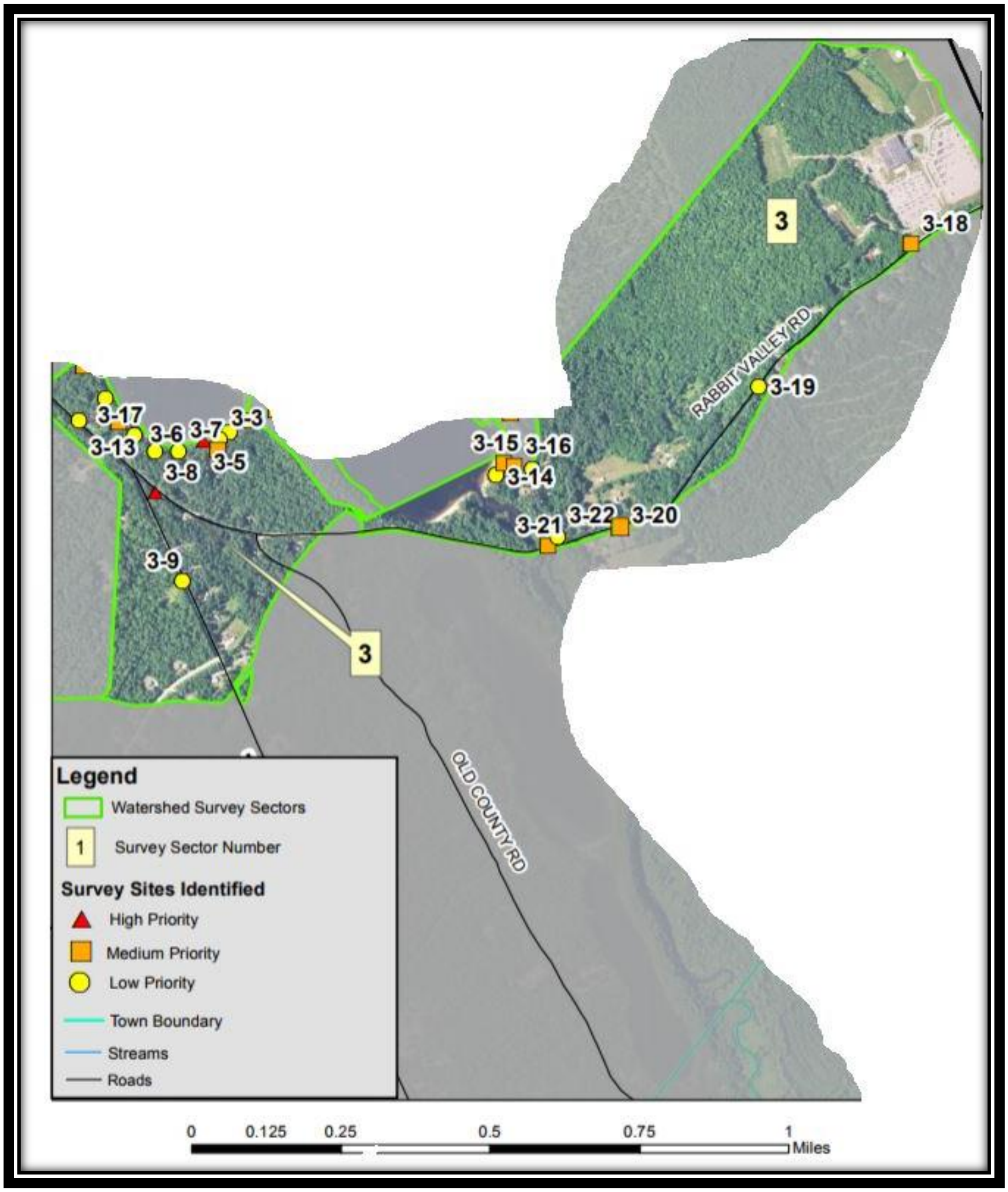

WHITNEY AND HOGAN POND WATERSHEDS
Oxford, Maine
Combined Watershed Area - 2.60 square miles
Roads
Streams
Whitney and Hogan Watersheds
Lake/Pond
N
0
0.25
0.5
1
Miles

Appendix B:
Impact Maps by Sector

Appendix B1: Sector 1

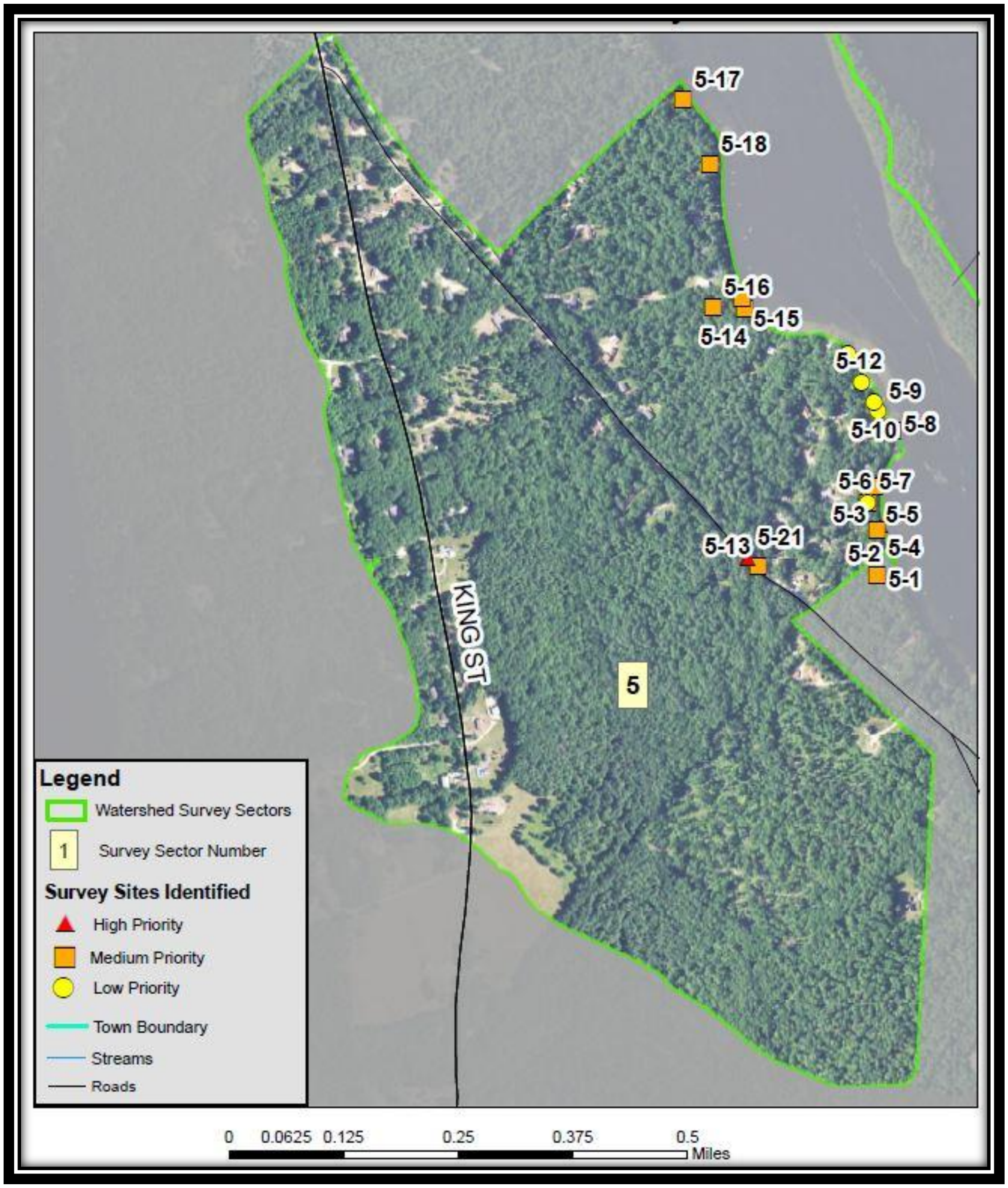


Appendix B2: Sector 2

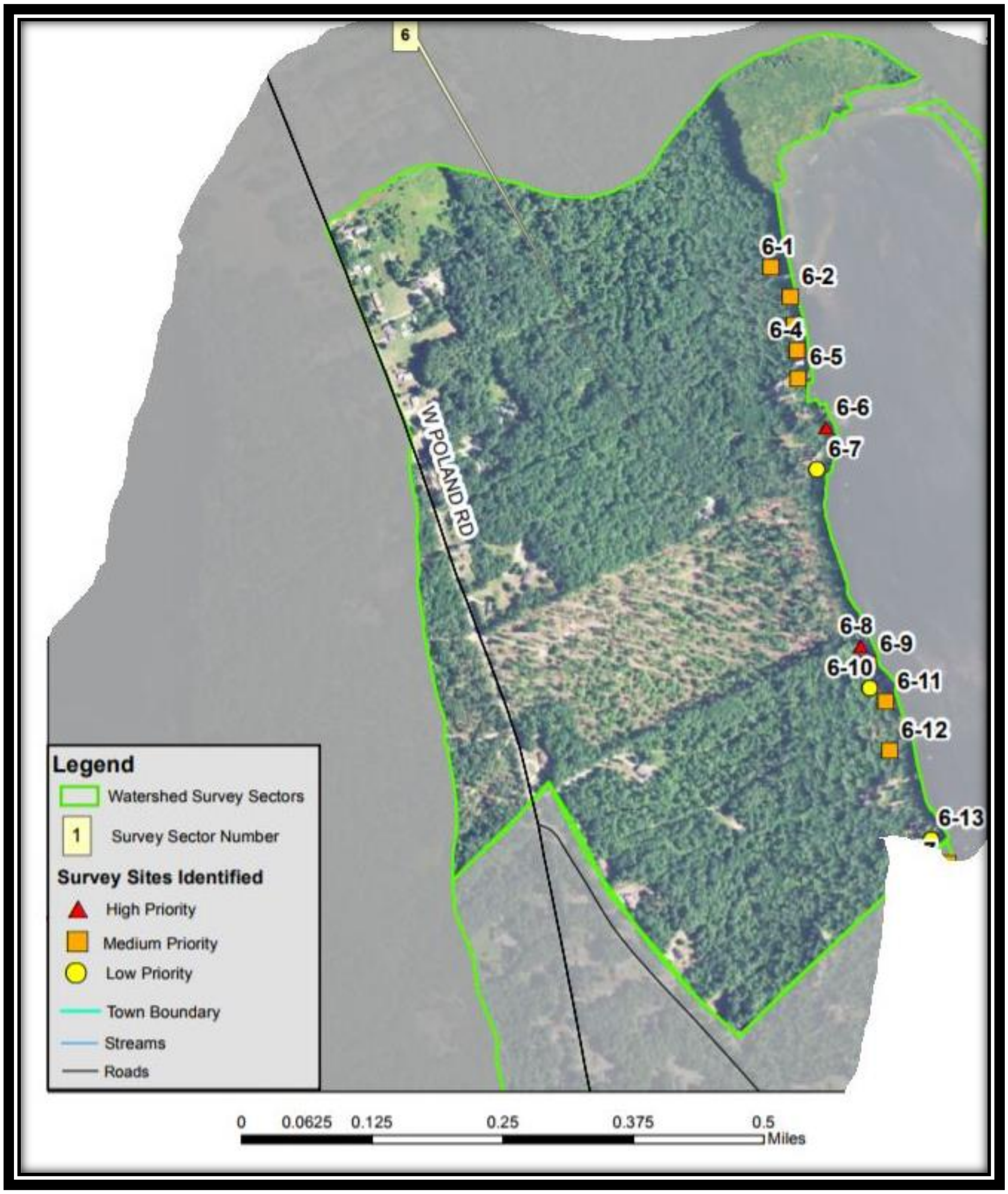


Appendix B3: Sector 3

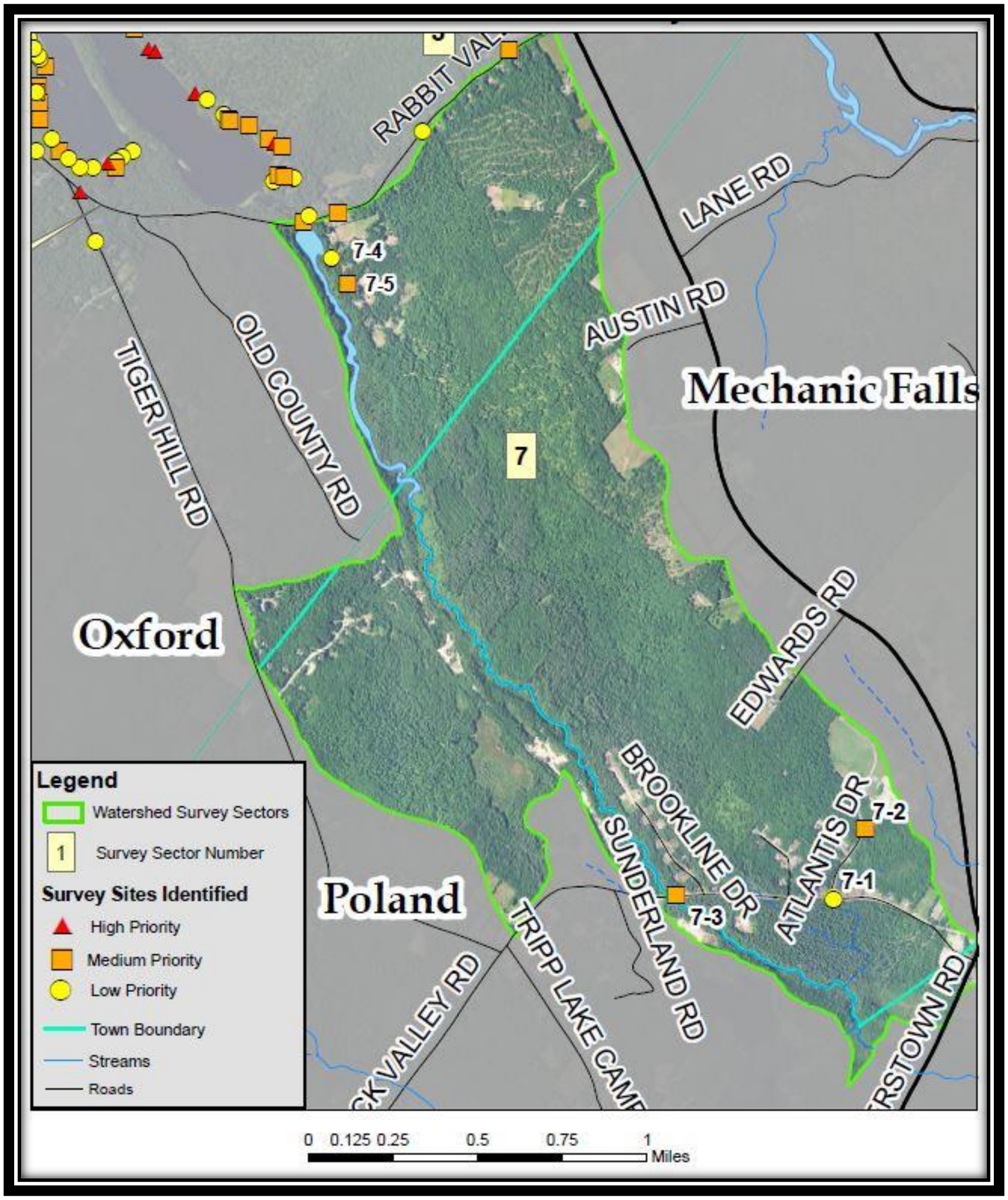
Appendix B4: Sector 4



Appendix B5: Sector 5



Appendix B6: Sector 6



Appendix B7: Sector 7

Appendix C:
Sample Survey Data Sheet

Final Site # ________ Checked by ________ Date ________

Whitney and Hogan Ponds Watershed Survey

REMINDER: Only write up if there is likely transport of sediment or phosphorus into the lake.

Sector & Site ________ Date________ Surveyor Initials ________

Location *(house #, road, utility pole #)* ________

Building Color ________ Landowner Name ________

Tax Map & Lot ________ Talked to Landowner? ________

Flow into Lake via (check ONE): ☐ Directly into Lake ☐ Stream ☐ Ditch ☐ Minimal Vegetation

Note: If flow does not make it into lake, do not fill out a form. It would not be considered a site.

GPS Coordinates in **UTM**
(no degrees or decimal points)

0						

Land Use/Activity Circle ONE	**Description of Problems** Circle ALL that apply	
State Road* Town Road* Private Road* Driveway* Residential Commercial Municipal / Public Beach Access Boat Access* Trail or Path Logging Agriculture Construction Site **OTHER:** * Is it: paved, gravel or other/unknown?	**Surface Erosion** Sheet Rill Gully **Culvert** Unstable Inlet / Outlet Clogged Crushed / Broken Undersized **Ditch** Sheet Erosion Rill Erosion Gully Erosion Bank Failure Undersized **Road Shoulder Erosion** Sheet Rill Gully **Roadside Plow/Grader Berm**	**Soil** Bare Uncovered Pile Delta in Stream/Lake Winter Sand **Roof Runoff Erosion** **Shoreline** Undercut Lack of Shoreline Vegetation Inadequate Shoreline Vegetation Erosion Unstable Access **Agriculture** Livestock Access to Waterbody Tilled Eroding Fields Manure Washing off Site **OTHER:**

Slope: ☐ Flat ☐ Moderate ☐ Steep **Size of Area Exposed or Eroded** (length & width): ______

Recommendations		
Culvert	**Roads / Driveways**	**Paths & Trails**
Armor Inlet/Outlet	Remove Grader/Plow Berms	Define Foot Path
Remove Clog	Build Up	Stabilize Foot Path
Replace	Add New Surface Material	Infiltration Steps
Enlarge	• Gravel	Install Runoff Diverter (waterbar)
Lengthen	• Recycled Asphalt	**Roof Runoff**
Install Culvert	• Pave	Infiltration Trench @ roof dripline
Install Plunge Pool	Reshape (Crown)	Drywell @ gutter downspout
Ditch	Vegetate Shoulder	Rain Barrel
Vegetate	Install Catch Basin	**Other**
Armor with Stone	Install Detention Basin	Install Runoff Diverter (waterbar)
Reshape Ditch	Install Runoff Diverters	Mulch / Erosion Control Mix
Install Turnouts	• Broad-based Dip	Rain Garden
Install Ditch	• Open Top Culvert	Infiltration Trench
Install Check Dams	• Rubber Razor	Water Retention Swales
Remove debris/sediment	• Waterbar	**Vegetation**
Install Sediment Pools	**Construction Site**	Establish Buffer
Other Suggestions:	Mulch	Add to Buffer
	Silt Fence / EC Berms	No Raking
	Seed / Hay	Reseed bare soil & thinning grass
	Check Dams	

Impact: Circle one choice in each column, add the three selected numbers together, and then circle the site's corresponding impact rating (high, medium, or low).

Type of Erosion	Area	Buffers and Other Filters	IMPACT
Gully - **3**	Large - **3**	No filter, all channelized direct flow into lake or stream - **3**	High: 8-9 pts
Rill - **2**	Medium - **2**	Some buffer or filtering, but visible signs of concentrated flow and/or sediment movement through buffer and into lake - **2**	Med: 6-7 pts
Sheet - **1**	Small - **1**	Significant buffer or filtering* - **1**	Low: 3-5 pts

* Confirm there is likely sediment/runoff delivery. If not, do not write up as a site.

Cost to Fix

High:	Greater than $2,500
Medium:	$500-$2,500
Low:	Less than $500

Technical Level to Install

High:	Site requires engineered design
Medium:	Technical person should visit site & make recommendations
Low:	Property owner can accomplish with reference materials

Appendix D:
Links to Resources for Remediation

(1) Cumberland County Soil and Water Conservation District Webpage on "yardscaping":
http://www.maine.gov/dacf/php/pesticides/yardscaping/plants/index.htm

(2)State of Maine web resource links on native plantings for different locations:

- Sun:

http://www.maine.gov/dacf/php/pesticides/yardscaping/plants/swcdplants/sun_plants.pdf

- Sunny rain garden:

http://www.maine.gov/dacf/php/pesticides/yardscaping/plants/swcdplants/sunny_rain_garden.pdf

- Shade:

http://www.maine.gov/dacf/php/pesticides/yardscaping/plants/swcdplants/shade_plants.pdf

- Shady rain garden:

http://www.maine.gov/dacf/php/pesticides/yardscaping/plants/swcdplants/shady_rain_garden.pdf

- Native vines/groundcovers:

http://www.maine.gov/dacf/php/pesticides/yardscaping/plants/swcdplants/native_vines_and_ground_covers.pdf

- Native shrubs:

http://www.maine.gov/dacf/php/pesticides/yardscaping/plants/swcdplants/native_shrubs.pdf

- Native perennials:

http://www.maine.gov/dacf/php/pesticides/yardscaping/plants/swcdplants/perennials.pdf

- http://www.maine.gov/dep/land/watershed/buffhandbook.pdf

A Guide to Creating Vegetated Buffers for Lakefront Properties (1998). This 20-page handbook provides information about landscaping your shoreline for lake protection and helps you get started on planning and planting your shoreline. This manual is available electronically, unfortunately it is no longer available in print.

- http://www.maine.gov/dep/land/watershed/buffer_plant_list.pdf

PDF format - This 50-page publication contains a listing of and details about trees, shrubs, and groundcovers that could be used in planting or improving a buffer in Maine. Plant descriptions include scientific and common names, sun and soil requirements, plant hardiness zone, plant characteristics, and native status. This publication was updated in 2009 to include more native species and to remove species that are now known to be or suspected of being invasive. This manual is available electronically, unfortunately it is no longer available in print.

(3)Maine DEP Best Management Practices (BMP) manuals, handbooks and guides:

http://www.maine.gov/dep/land/watershed/camp/road/gravel_road_manual.pdf

This 106 page gravel road maintenance manual provides camp road owners, contractors, and others with information on maintaining and improving unpaved gravel roads. Includes troubleshooting guide, practical tools and detailed diagrams on ditching, crowning, road surface materials, and other road maintenance practices, as well as checklists and other guidance.

http://www.maine.gov/dep/land/erosion/escbmps/esc_bmp_field.pdf

The purpose of this 125 page handbook is to help land development consultants and contractors incorporate urban Best Management Practices (BMPs) for erosion and sedimentation control into project design, planning, and construction. This compilation of BMPs provides a menu from which project designers and contractors may choose the practices appropriate to specific projects and sites. There are 2 manuals available: a field manual for contractors and a design manual for engineers and designers.

Conservation Practices for Homeowners - Series of 24 fact sheets from DEP and the Portland Water District profiling common conservation practices that homeowners can use to protect water quality. The fact sheets include detailed instructions, diagrams and color photos about installation and maintenance.

- Construction BMPs: https://www.pwd.org/sites/default/files/construction_bmps.pdf

- Dripline Trench: https://www.pwd.org/sites/default/files/dripline_trench.pdf
- Dry Wells: https://www.pwd.org/sites/default/files/dry_wells.pdf
- Erosion Control Mix: https://www.pwd.org/sites/default/files/erosion_control_mix.pdf
- Infiltration Steps - New: https://www.pwd.org/sites/default/files/infiltration_steps.pdf
- Infiltration Trench: https://www.pwd.org/sites/default/files/infiltration_trench.pdf
- Infiltration Steps - Retrofit: https://www.pwd.org/sites/default/files/retrofitted_infiltration_steps.pdf
- Lake Shoreline Riprap: https://www.pwd.org/sites/default/files/Lake-Shoreline-Riprap.pdf
- Live staking: https://www.pwd.org/sites/default/files/live_staking.pdf

- Open-Top Culverts: https://www.pwd.org/sites/default/files/open_top_culvert.pdf
- Paths and Walkways: https://www.pwd.org/sites/default/files/paths_and_walkways.pdf
- Permitting: https://www.pwd.org/sites/default/files/permitting.pdf
- Planting Vegetation: https://www.pwd.org/sites/default/files/Planting_and_maintaining_buffers.pdf
- Plants - full sun & dry: https://www.pwd.org/sites/default/files/plants_sun_and_dry.pdf
- Plants - full sun & moist to wet: https://www.pwd.org/sites/default/files/plants_sun_and_wet.pdf
- Plants - shade & dry: https://www.pwd.org/sites/default/files/plants_shade_and_dry.pdf
- Plants - shade & moist to wet: https://www.pwd.org/sites/default/files/plants_shade_and_wet.pdf
- Plants - part sun & dry: https://www.pwd.org/sites/default/files/plants_part_sun_and_dry.pdf
- Plants - part sun & moist to wet: https://www.pwd.org/sites/default/files/plants_part_sun_and_wet.pdf

- Rain Barrels: https://www.pwd.org/sites/default/files/rain_barrels.pdf
- Rain Gardens: https://www.pwd.org/sites/default/files/rain_garden.pdf
- Rubber Razors: https://www.pwd.org/sites/default/files/rubber_razors.pdf

- [Turnouts: https://www.pwd.org/sites/default/files/turnouts.pdf](https://www.pwd.org/sites/default/files/turnouts.pdf)
- [Waterbars: https://www.pwd.org/sites/default/files/waterbar.pdf](https://www.pwd.org/sites/default/files/waterbar.pdf)