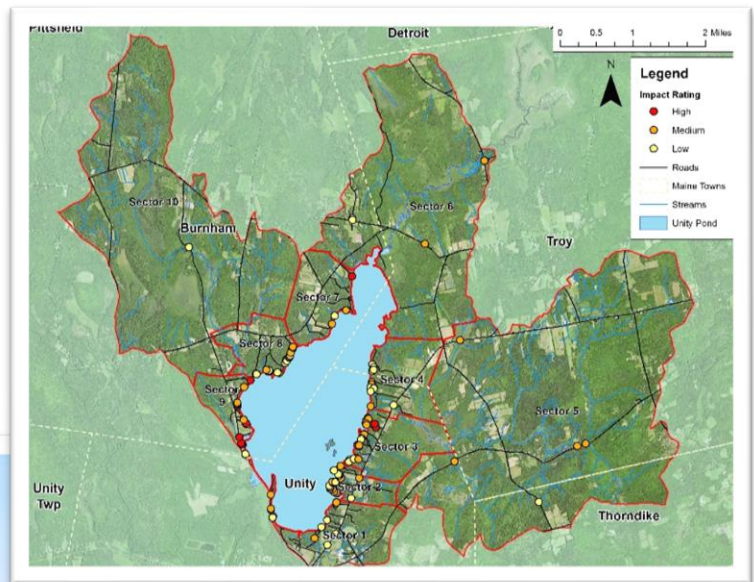


Unity Pond Watershed Survey

Final Report



October 25, 2021

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Introduction

Unity Pond (also known as Lake Winnecook) is an impaired, Great Pond Class A (GPA) lake located in the towns of Unity, Burnham, and Troy, Maine. The 29 square mile watershed also includes part of the town of Thorndike. Three main tributary streams feed into Unity Pond: Meadow Brook, Bithers Brook, and Carlton Stream. These waterways are part of a network of over 100 miles of perennial and intermittent streams that connect dozens of small ponds and over five square miles of wetlands to the lake. A single outlet, Sandy Stream, is located at the southern end of the pond. A railroad bed follows the shoreline of Unity Pond on the southwestern shore, where a railway trestle crosses over the pond's outlet as it becomes Sandy Stream. Sandy Stream drains to a wetland area to the south, then continues into Twenty-five Mile Stream, flowing into the Sebasticook River in Burnham, and eventually draining to the Kennebec River in Winslow. Sandy Stream periodically backflushes into Unity Pond, but the magnitude and frequency of this occurrence is currently unknown.



A watershed consists of all the land area that drains to a particular body of water.

Sixteen percent of the watershed is categorized as urban development. This includes shoreline development (0.8%), non-shoreline development (5.5%), agricultural land (7%), and operated forest lands (2.9%). Undeveloped land (undisturbed/unmanaged forest, grassland, scrub shrub, and wetland) make up 72% of the watershed, and surface water accounts for the remaining 12% of the watershed land area¹. Historically, agriculture has had a relatively large impact on Unity Pond's water quality, although this land use is less prevalent than it once was.

Water Quality Summary

Unity Pond has a maximum depth of 12 meters (41 feet), an average depth of 6 meters (19 feet), and an estimated volume of 57,959,154 m³. The pond flushes 1.23 times per year. Unity Pond is on Maine DEP's 303d list of impaired waters under Category 4-A due to changes in water quality over time and specifically because of persistent, nuisance summer-time algal blooms that occur near annually. Unity Pond's water quality is considered below average and probability for nuisance algal blooms is high because of low dissolved oxygen in deep areas of the pond, and internal recycling of phosphorus.

Water quality data have been collected by Maine DEP, volunteer water quality monitors, and Unity College since 1977 at the deep hole station (Station 1). Secchi disk transparency (SDT, a measure of water clarity) readings collected during this historic sampling period range from a low of 0.8 m (2011 & 2014) to a high of 6.1 m (1978), and average annual SDT ranges from 1.0 m to 4.8 m. A significant decrease in SDT was documented starting in the mid-late 1980s, but is currently considered stable, though below average, and impaired by Maine DEP.

¹ Land cover data is based on the 2004 Unity Pond TMDL and will be updated as part of the 2022 Watershed-based Management Plan.

Between 1990 and 2017, minimum SDT transparencies have not been above 1.5 m and algal blooms occur almost every year often beginning in June in select coves, and lake-wide by late July, persisting until fall turnover. Low oxygen in the bottom 4 to 5 meters of the lake in late summer and early fall before the lake turns over is likely driving these blooms. A sediment analysis conducted by Maine DEP assessed the Al:Fe and Al:P ratios and found that both indicated conditions that promote internal release of phosphorus under anoxic conditions.

Total phosphorus (a measure of algae nutrients) concentrations in the pond range between 12 ppb (1978) and 40 ppb (2016) with an annual average or mean of 23 ppb over the historical sampling period (1977 - 2018). Prior to 1986, Chlorophyll-a (a measure of algae abundance) ranged from 2.9 ppb to 7.2 ppb with an annual average concentration over that time period of 4.5 ppb. After 1986, Chl-a ranged from 4.9 (1988) to 61 ppb (2011) with an annual average of 22 ppb; over four times greater than the pre-1986 average.

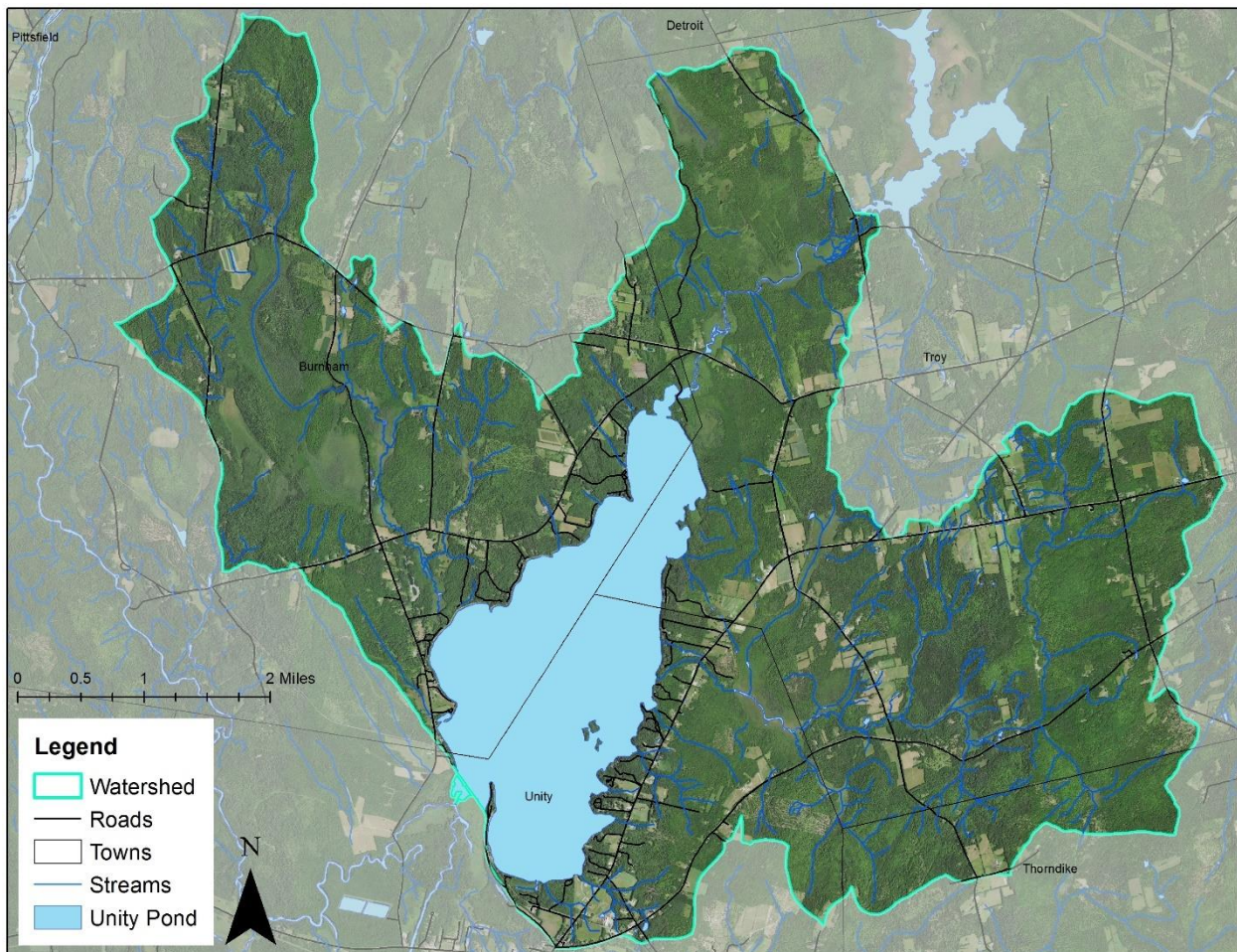



Figure 1 Unity Pond Watershed

Sources of Pollution to Unity Pond

Unity Pond's water quality is impacted by pollution from numerous small, diffuse sources across the pond's watershed. When rain and snowmelt flow across land, they pick up soil, nutrients and other pollutants. This is known as "nonpoint source" pollution (NPS) and is the primary threat to most lakes in Maine.

In an undeveloped, forested watershed, stormwater runoff is slowed and filtered by tree and shrub roots, grasses, leaves, and other natural debris on the forest floor. It then soaks into the uneven forest floor and filters through the soil.



Nonpoint source pollution refers to diffuse pollution from numerous small sources that together can have a significant impact on water quality.

In a developed watershed, however, stormwater does not always receive the filtering treatment the forest once provided. Rainwater picks up speed as it flows across impervious surfaces like rooftops, compacted soil, gravel roads and pavement, and it becomes a destructive erosive force. Studies have shown that runoff from developed areas has 5 to 10 times the amount of phosphorus compared to runoff from forested areas.

Once it enters the pond, this polluted runoff can fuel algae blooms by releasing phosphorus, which is a nutrient that is attached to soil particles, in fertilizers, manure, septic systems and pet waste. Under natural conditions, phosphorus is limited in freshwater systems, which helps limit algae growth. However, when a lake receives extra phosphorus from developed land, algae growth increases dramatically. Sometimes this growth causes choking blooms, but more often it results in small changes in water quality that, over time, damage the ecology, aesthetics and economy of the area.

Runoff from historical land uses such as agriculture, forestry, and industry that have delivered phosphorus-laden sediment to the bottom of the lake in the past adds a second level of concern. In the absence of oxygen (a common summertime occurrence), the stored phosphorus can be released and mixed up into the upper waters of the lake, where it too can fuel algae growth.

Runoff from current development and roads, as well as future development and seasonal conversions needs to be managed properly to prevent delivery of pollutants into Unity Pond, especially along the shoreline where soils can easily be washed into the lake. Runoff from forestry activities can also contribute significant inputs of nutrients and sediments if not managed properly. This may include limiting clear cutting, protecting natural vegetative buffers along waterbodies and wetlands, and limiting runoff from roads that serve as access to the forest resources.

Survey Purpose & Methods

Purpose

The primary purposes of the watershed survey are to:

- ❖ Identify and prioritize existing sources of polluted runoff, particularly soil erosion and stormwater runoff in the Unity Pond watershed
- ❖ Raise public awareness about the connection between land use and water quality and the impact of soil erosion on the water quality of Unity Pond
- ❖ Inspire people to become active watershed stewards by participating in watershed programs such as LakeSmart
- ❖ Use the information gathered to help inform the development of an updated Watershed-Based Management Plan
- ❖ Provide the basis to obtain funding to assist with addressing identified NPS sites
- ❖ Provide recommendations to landowners so that they can voluntarily address NPS issues identified on their properties.

The purpose of the survey was NOT to point fingers at landowners with a documented NPS site, nor was it to seek enforcement action against landowners not in compliance with local ordinances. Friends of Lake Winnecook (FOLW) hope to be able to find ways to work cooperatively with landowners, road associations, and towns to protect water quality.

Local citizen participation was essential in completing the watershed survey and will be even more important in coming years. With the leadership of FOLW and partners such as Waldo County Soil & Water Conservation District (WCSWCD), watershed towns, and the Maine Department of Environmental Protection (Maine DEP), there are ample opportunities for stewardship. The hope is that landowners will reflect on the results of the survey and the recommendations it provides and use some of the recommended conservation measures. Everyone in the watershed has a stake in helping protect the water quality of Unity Pond.

Methods

The Unity Pond watershed survey was conducted on May 22, 2021 with the help of nine local volunteers. Trained technical staff from Ecological Instincts, WCSWCD, Maine DEP, and independent contractors helped lead volunteers across ten watershed survey sectors. Prior to the survey, FOLW sent out letters to all of the property owners in the watershed. Out of 1,332 total parcels, 67 (5% of the total) were excluded from the survey at the landowners' request.

Volunteers were trained in survey techniques during a 1½ hour workshop led by Maine DEP on the morning of May 20, 2021 virtually via Zoom meeting. Volunteers and technical staff met two days later to conduct the survey, documenting sources of NPS pollution across a number of land uses, including roads and road crossings, commercial and residential properties and beach/boat launch sites, using tablets/cell phones and standardized digital watershed field survey forms developed by DEP and created using ESRI's Survey123 software. Volunteers were partnered with

technical leaders and assigned to one of the ten survey sectors. Follow-up survey work was conducted to finish surveying areas that were not completed on the main survey day. This follow up occurred in early June and was led by trained volunteers.

Sources of NPS were identified within each sector and documented. If there was not a direct connection from the potential source of NPS pollution to a ditch, stream, wetland or the lake, then the site was not documented (e.g., an eroding hillslope in which the soil did not leave the site). Potential solutions were recommended, rough estimates were made for the cost of labor and materials for improving the sites, and the overall impact to water quality was determined in the field for each site. Impact rating was based on the severity of erosion, size of the eroded area, and amount of buffering the runoff received.

The data collected during the survey was downloaded and exported into an Excel spreadsheet. Documented NPS sites were plotted on maps using Geographical Information Systems (GIS). Mapping coordinates were manually corrected if needed to account for poor satellite reception or human error in the field based on recorded address or tax map/lot number. A description of NPS sites, recommended actions, and associated costs are discussed in the next section.

Sector Descriptions

The watershed was broken up into 10 sectors each surveyed by a different technical leader and volunteer group. Sector numbers are referenced in the maps and table in the appendices. For example, site “5-01” refers to the first site identified in sector 5. The following provides brief descriptions of each sector.

Sector 1: This sector is located at the southern end of the watershed in Unity and encompasses Kanokolus Road, Main Street, the southern portion of Stagecoach Road, recreational fields, and private lake roads up to Conaefer Lane.

Sector 2: This small sector includes residential development and private roads including Windermere, Hummingbird Lane, Juniper Lane, Hideaway North, and Cross Road.

Sector 3: This sector mainly consists of private lake roads and residential properties off of Bangor Road, from Kingfisher Lane in the south up to Darlene’s Way in the north.

Sector 4: This sector encompasses the northern end of Bangor Road and several private roads including Cunningham Road, Heald Camp Road, Spruce Lane, Redwood Lane, and Robin Lane.

Sector 5: This sector is not directly on the lake but covers the eastern arm of the watershed that drains to Bithers Brook, including parts of Troy, Thorndike, and Unity.

Sector 6: This sector covers the northern tip of the lake and the land draining the northern part of the watershed, including Carlton Stream.

Sector 7: This sector covers private roads and residential properties on the northwest shore of the lake from Hathorne Lane in the north to Weed Lane in the south.

Sector 8: This sector includes several private roads and shorefront properties located off of Pond Road, including Sayward Lane, Royal Pines Lane, and Schneider Lane.

Sector 9: This sector includes all the land area in the southwestern corner of the watershed, from Oakwood Lane down to the Unity Pond outlet.

Sector 10: This sector encompasses the western “arm” of the watershed that drains to Meadow Brook.

Watershed Survey Results

A total of 109 sites were identified across 9 different land uses. The majority of sites were on residential properties. This land use accounted for over half of all sites documented. Private roads, driveways, and town/state roads were the next most common locations (Figure 2).

Of the 109 sites documented, 16 sites, or 14.7% of the total, were considered a high impact to the lake. Most of these were located on the western shore of the pond. These were primarily residential (9 sites), but also included 3 road sites, 3 municipal/public sites, and one boat access site. Medium impact sites accounted for 48.6% of all sites and the remaining 36.7% of sites were considered low impact (Figure 3).

Table 1 shows the breakdown of high, medium, and low impact sites in each land use category. Maps showing the locations of identified sites and their impact rating, as well as the full results spreadsheet, can be found in Appendix A and B. The following is a breakdown of results by sector:

Sector 1: 10 sites (1 high impact), including residential, driveway, town road private road, beach access, and municipal/public land uses

Sector 2: 18 sites (16 residential, 2 state road), all medium and low impact

Sector 3: 21 sites, including residential, driveway, private road, and boat/beach access land uses. Two private road sites were considered high impact, as was one residential site.

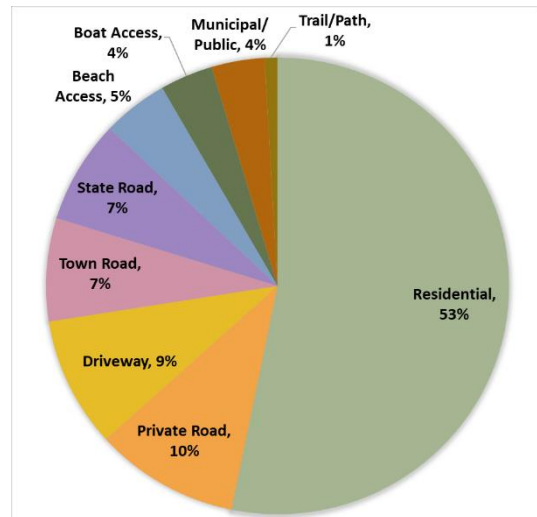


Figure 2. Percentage of sites in each land use category.

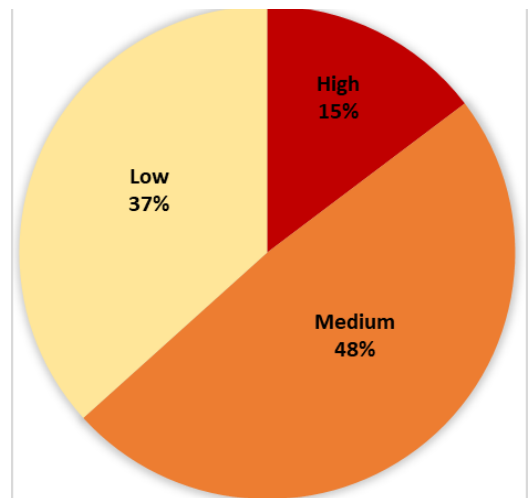


Figure 3. Percentage of sites in each impact rating category.

Sector 4: 12 sites, mainly residential and private roads, along with one driveway and one state road site. All were low and medium impact.

Sector 5: 5 sites, including 3 town road, 1 state road, and 1 driveway site, all low and medium impact.

Sector 6: 3 medium impact state road sites and 2 low impact town road sites.

Sector 7: 3 residential sites (including one high impact) and 1 beach access site.

Sector 8: 19 sites, including residential, driveway, beach/boat access, and private road land uses. One boat access and two residential sites had a high impact rating.

Sector 9: 14 sites, mainly residential land use with 3 municipal/public, 1 state road, and 1 trail/path site. Eight of the sites were rated as high impact.

Sector 10: One low impact town road site.

Land Use	Impact Rating			Total	% of sites
	High	Medium	Low		
Residential	9	27	22	58	53.2%
Private Road	2	8	1	11	10.1%
Driveway	0	4	6	10	9.2%
Town Road	0	3	5	8	7.3%
State Road	1	5	2	8	7.3%
Beach Access	0	3	2	5	4.6%
Boat Access	1	3	0	4	3.7%
Municipal/ Public	3	0	1	4	3.7%
Trail/Path	0	0	1	1	0.9%
Total	16	53	40	109	100%





Table 1. Breakdown of number of sites by land use and impact rating.

Despite the prevalence of agricultural land uses in the watershed, readers may note that there was a lack of sites with an agricultural land use. This is because agricultural land was not surveyed in depth during the watershed survey, and instead will be assessed as part of the development of the Unity Pond Watershed-based Management Plan through a partnership with the Natural Resources Conservation Service (NRCS) and WCSWCD. Erosion issues documented in the survey that were related to agricultural properties would be limited to problems visible from the roadside. Additionally, runoff from agricultural properties that impacted a ditch, for example, may have been classified as road sites. One site in Sector 10 was identified as being impacted by

agricultural runoff, and several other agricultural parcels were noted for follow up during the survey.

Table 2 groups together similar land uses and lists common erosion issues identified at sites found in the survey, as well as recommended measures to address the erosion. A representative photo from the survey is included in each category.

Table 2. Common issues and recommendations for sites identified in each land use category.

Land Use	Common Issues	Recommendations	Photo
Residential	Surface Erosion	Runoff Diverters, Erosion Control Mulch	
	Bare Soil	Limit Raking, Reseed Lawn, Erosion Control Mulch	
	Lack of Vegetation	Plant Buffer or Rain Garden	
	Roof Runoff Erosion	Infiltration Trench	
	Unstable Paths/Lake Access	Infiltration Steps, Crushed Stone, Runoff Diverters	
	Shoreline Erosion	Add Vegetation	
Private Road/Driveway	Surface Erosion	Crown, Add Gravel, Add Recycled Asphalt, Pave	
	Road Shoulder Erosion	Vegetate Shoulder, Erosion Control Mulch	
	Plow/Grader Berm	Remove Berm, Work with Contractor to Prevent	
	Ditch Erosion	Reshape Ditch, Armor or Vegetate Ditch, Turnouts, Check Dams	
	Unstable/Broken Culverts	Replace Culvert, Armor Culvert	
State/Town Road	Unstable/Broken Culverts	Replace Culvert, Armor Culvert	
	Ditch Erosion	Reshape Ditch, Armor or Vegetate Ditch, Turnouts, Check Dams	
	Road Shoulder Erosion	Pave, Vegetate, Add Erosion Control Mulch	
Beach/Boat Access, Trails & Paths, Municipal	Surface Erosion	Add Crushed Stone, Runoff Diverters	
	Bare Soil	Erosion Control Mulch, Crushed Stone	
	Unstable Shoreline Access	Add Vegetation, Add Pavers, Add Crushed Stone	
	Shoreline Erosion	Add Vegetation	

Summary & Next Steps

The 2021 Unity Pond watershed survey identified 109 individual NPS sites. The survey focused on all developed land (with permitted access) that drains to or has the potential to drain to the pond, carrying stormwater and other pollutants of concern. Survey results indicate that a significant portion of NPS sites are located on residential properties and are associated with access to the shoreline. In fact, residential development accounts for 53% of all sites identified. This does not include the private gravel roads and driveways that provide access to these homes and camps, which make up another 19% of documented sites. The cumulative effect of these sites plus the sites located on other land uses result in significant excess phosphorus being delivered to Unity Pond.

The impact of NPS pollution on Unity Pond can be reduced through the combined effort of FOLW, WCSWCD, watershed towns, road associations, and watershed residents. Through a combination of grant funding, LakeSmart and Youth Conservation Corps programs, technical assistance, and education and outreach, FOLW hopes to address all of the sites identified in the survey, starting with the highest impact sites. Already, FOLW has worked with the Town of Burnham to address two high impact sites at the town beach (see before and after pictures below).

The results of this survey will be incorporated into the 2022 Watershed-Based Management Plan. Additional surveys of agricultural and forestry land are also being undertaken to better characterize impacts from these land uses.



What You Can Do

Now that the survey is complete, FOLW will reach out to all landowners with NPS sites identified on their property. If you are contacted, please work with FOLW and other partners to address the issues identified. If you do not have a site on your property, consider LakeSmart certification and learning more about protecting the lake at the resources included below.

Contact information & Resources

For more information about the survey, specific sites identified, technical assistance, or any other questions related to the forthcoming Watershed-based Management Plan, please contact:

FOLW: www.lakewinnecook.org

FOLW Email: friendsoflakewinnecook1@gmail.com

Waldo County Soil and Water Conservation District: www.waldocountysoilandwater.org

Additional Resources:

Maine DEP Manuals and Guides to Reduce Water Pollution:

www.maine.gov/dep/land/watershed/materials.html

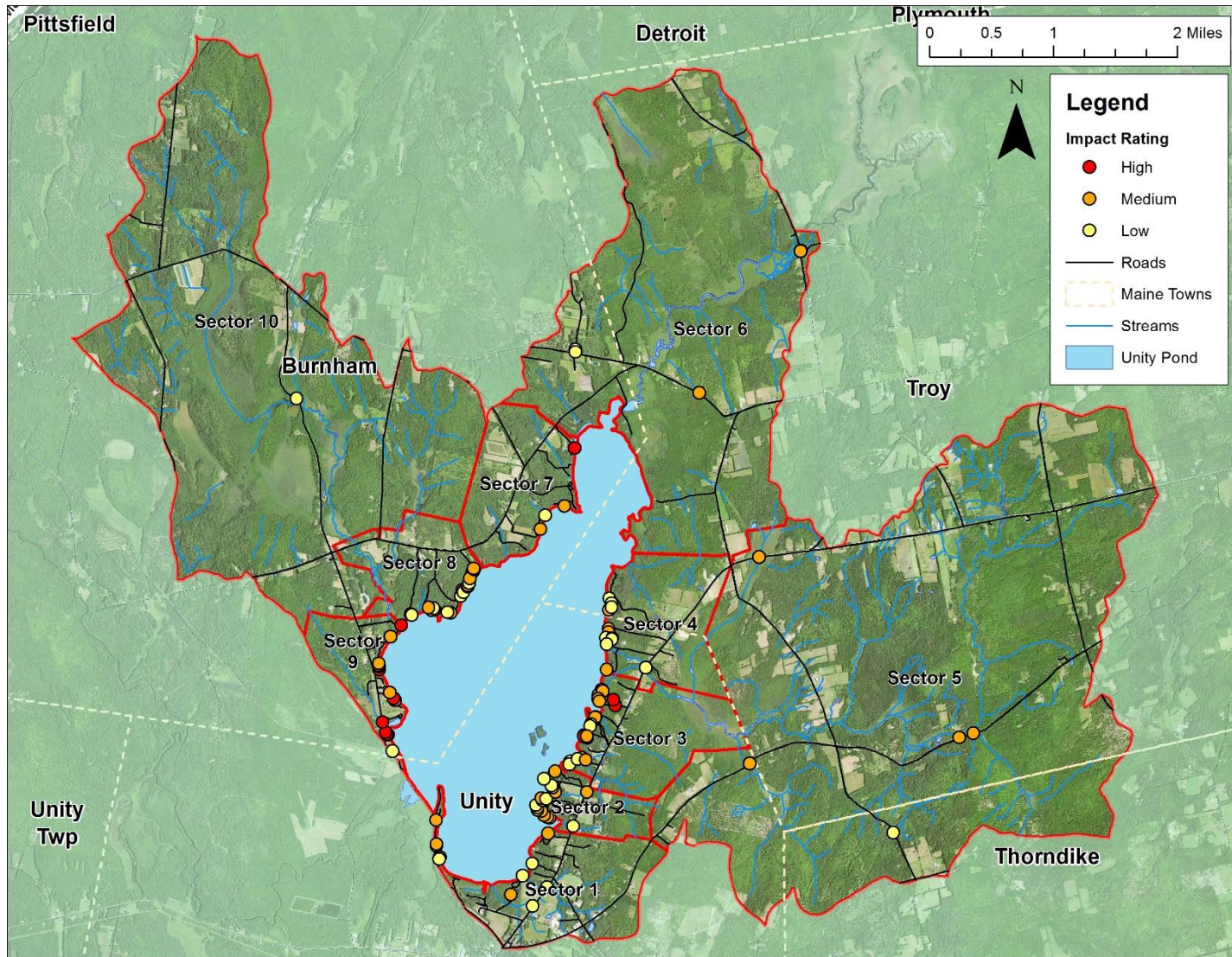
Maine DEP Shorefront Property Owner Information:

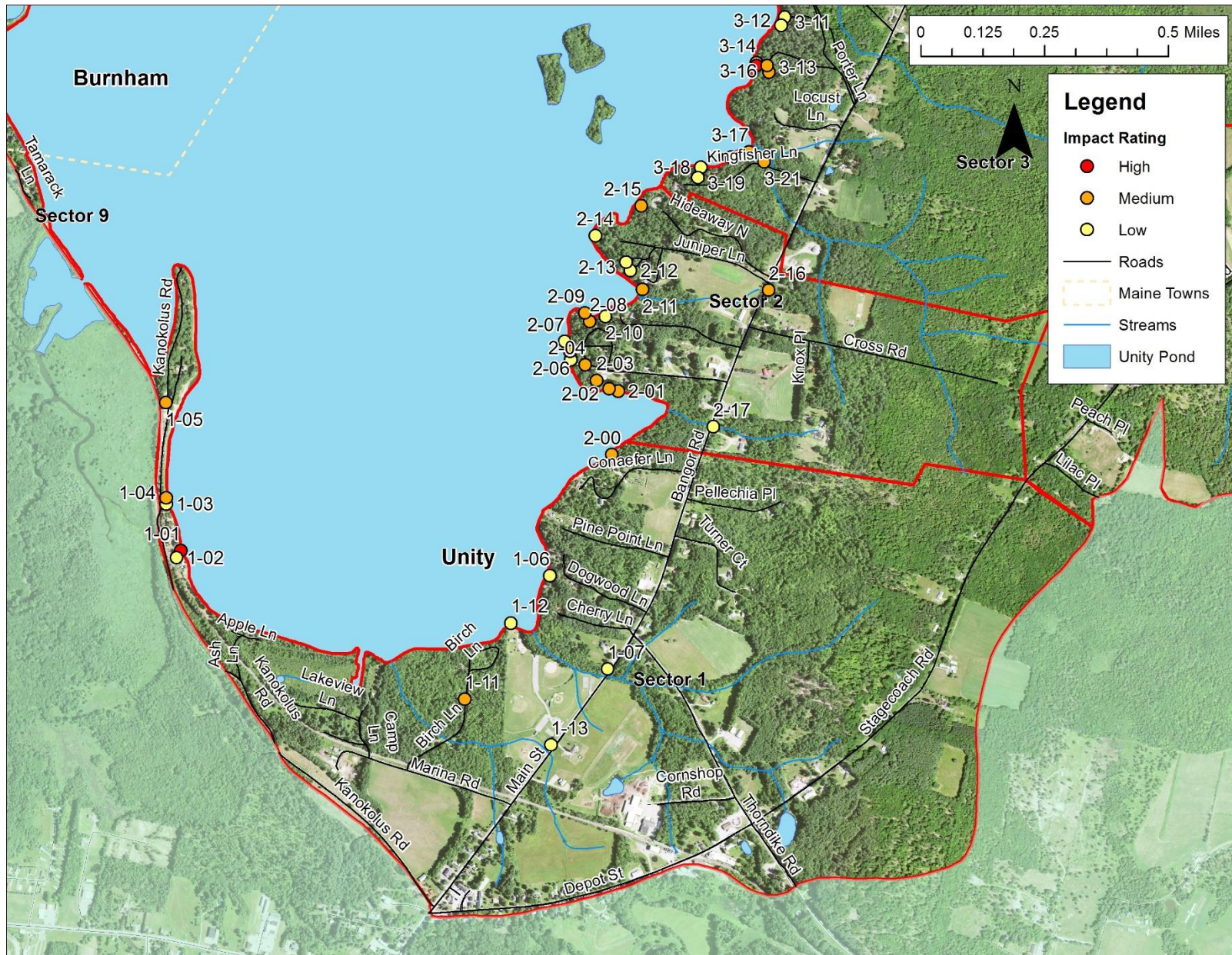
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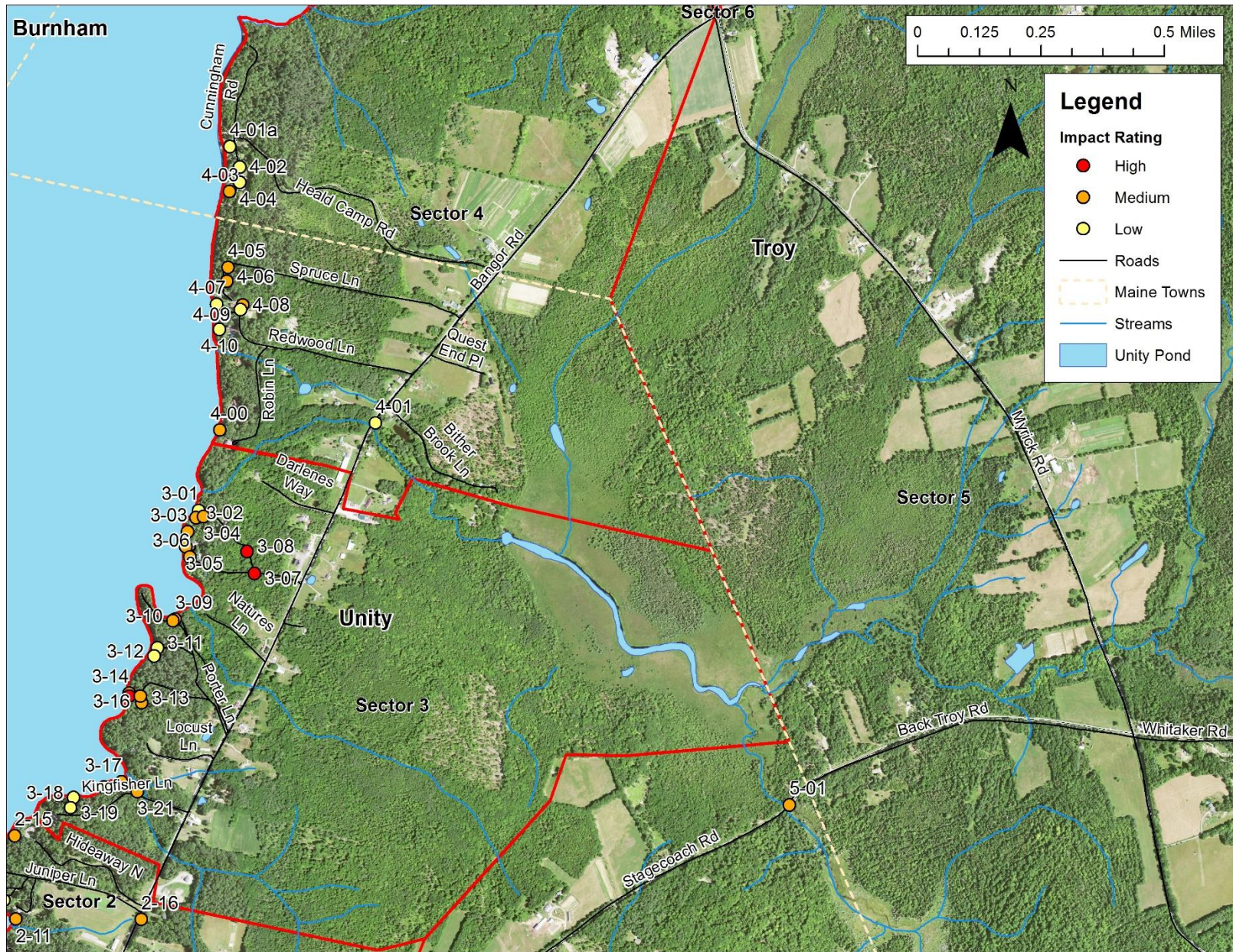
Maine Lakes – LakeSmart Resources: www.lakes.me/lakesmart-resources

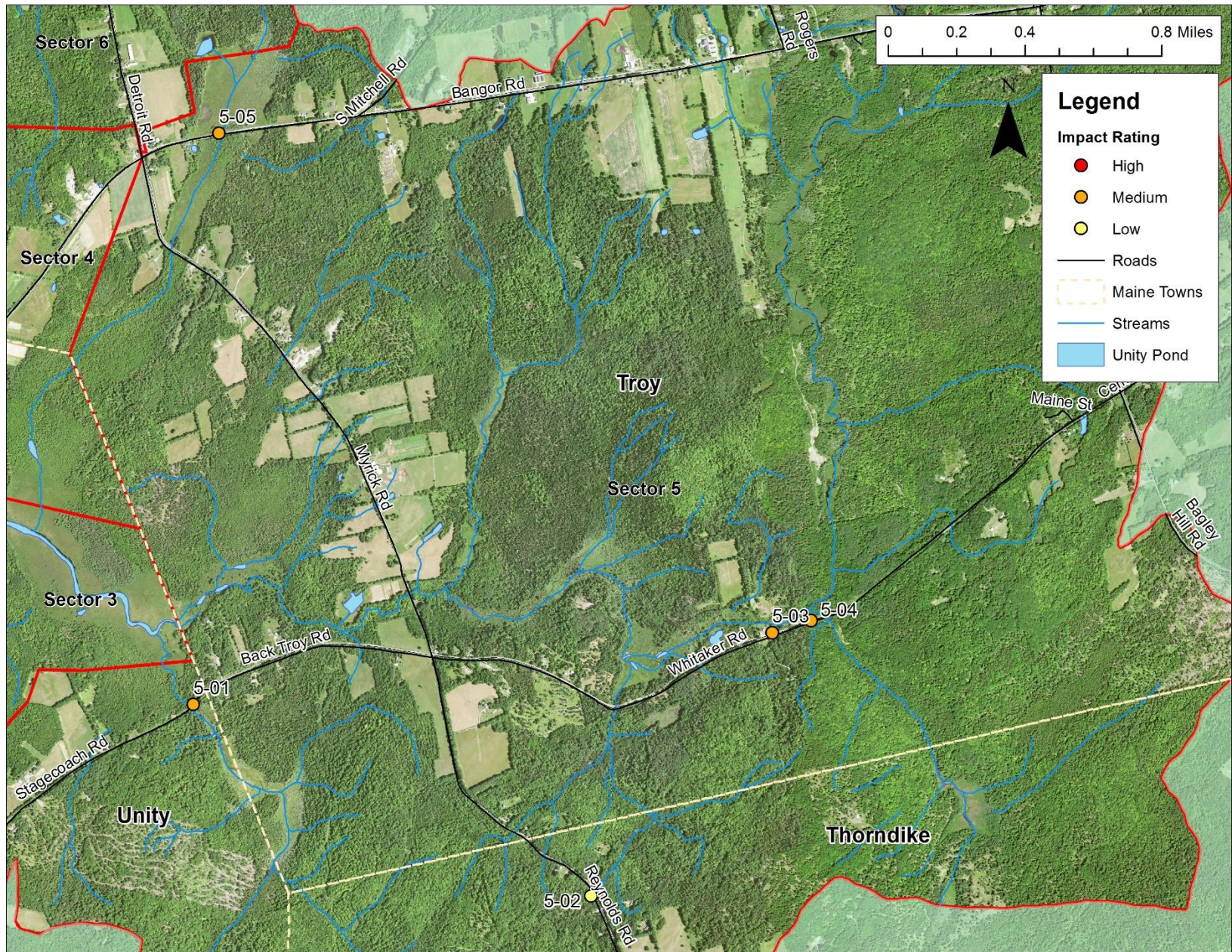
Appendices

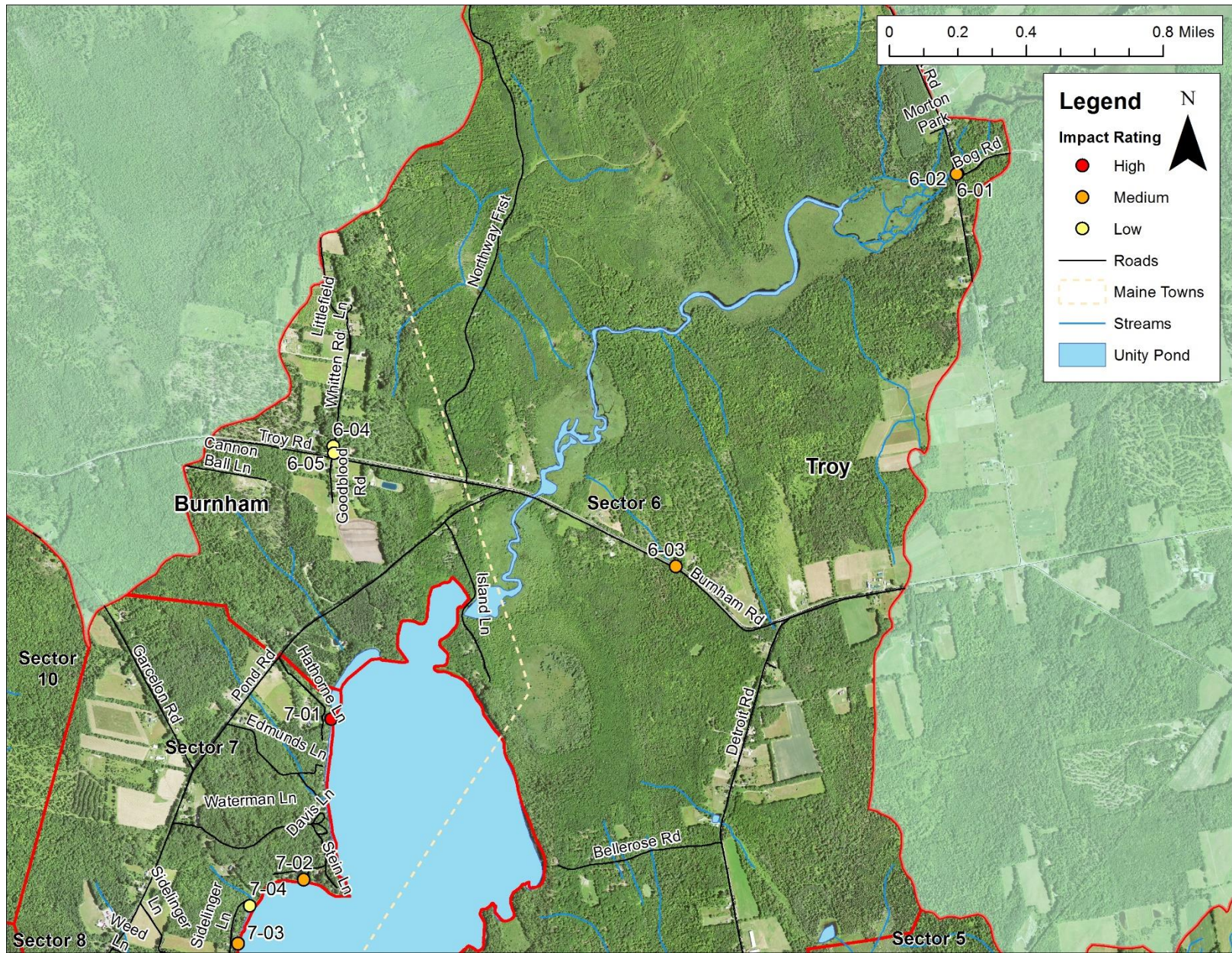
Appendix A: Maps

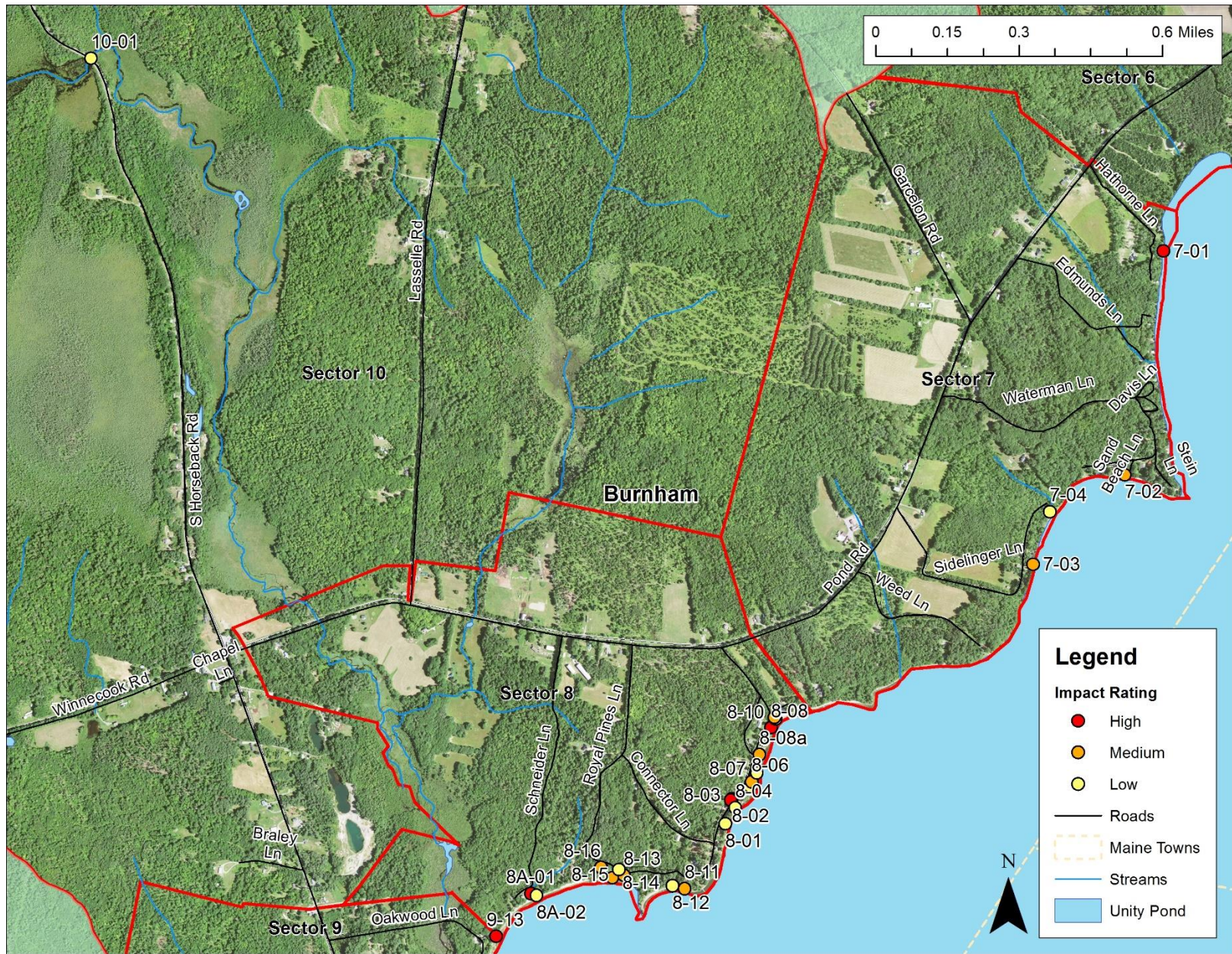


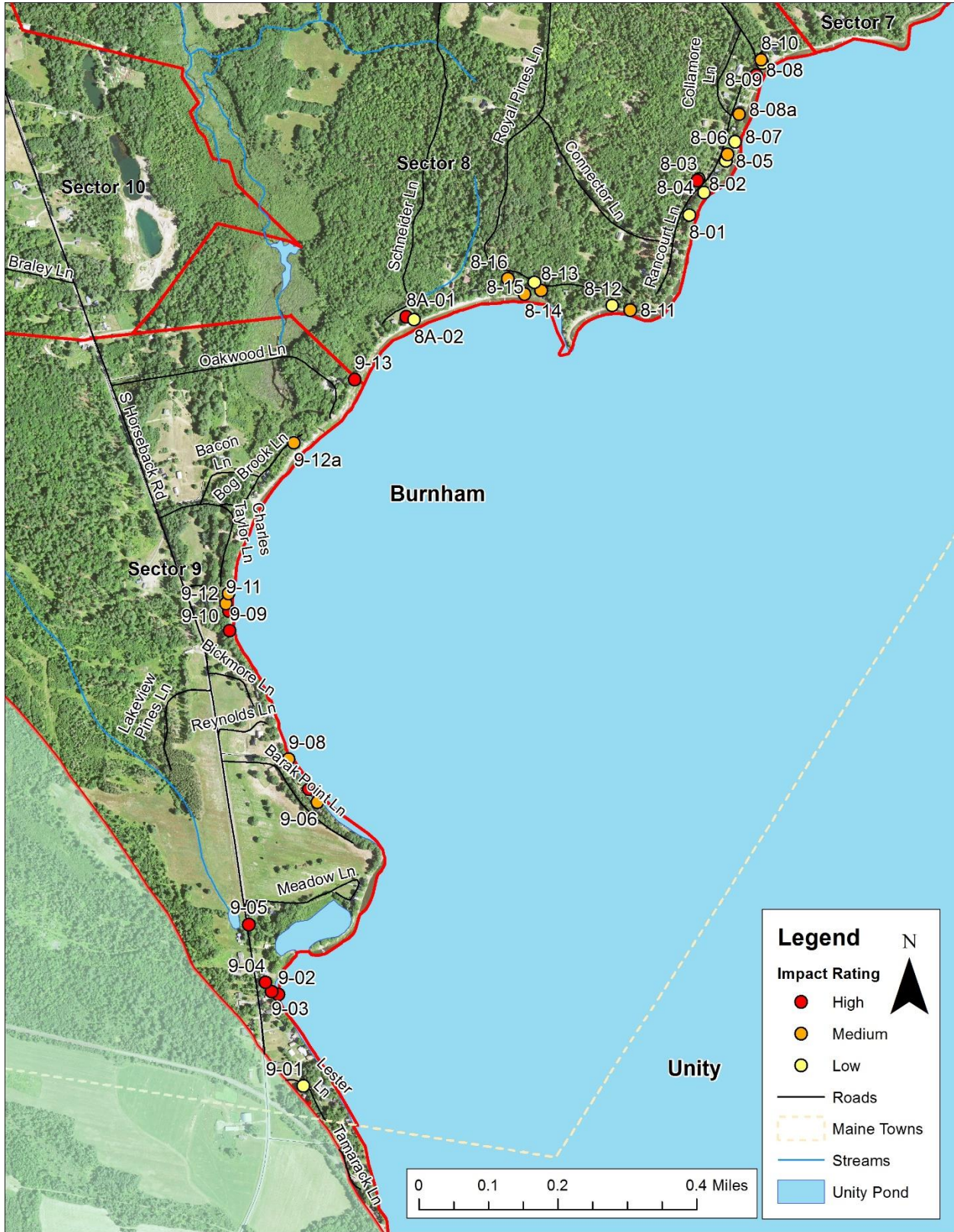












Appendix B: Results Table

Sector & Site	Flow path to lake	Land use	Problem	Recommendations	Impact Rating	Cost to Fix	Technical Level
1-01	Directly into lake	Residential	Surface Erosion-Rill, Shoreline-Lack of Shoreline Vegetation, Shoreline-Undercut, Shoreline-Inadequate Shoreline Vegetation, Shoreline-Erosion	Add to Buffer, Establish Buffer	High	Medium	Low
1-02	Minimal Vegetation	Residential	Surface Erosion-Sheet, Shoreline-Lack of Shoreline Vegetation	Vegetate Ditch, Armor with Stone, Drywell @ gutter downspout, Add to Buffer, Establish Buffer, Rain Garden, Mulch/Erosion Control Mix	Low	Medium	Medium
1-03	Directly into lake	Driveway	Road Shoulder Erosion-Sheet	Vegetate Ditch, Armor with Stone, Vegetate Shoulder	Low	Medium	Low
1-04	Directly into lake	Residential	Road Shoulder Erosion-Gully, Soil-Bare, Shoreline-Erosion	Vegetate Shoulder, Stabilize Foot Path, Define Foot Path, Erosion Control Mulch, Infiltration Steps, Establish Buffer, Reseed bare soil & thinning grass, Mulch/Erosion Control Mix	Medium	Medium	Medium
1-05	Minimal Vegetation	Town Road	Surface Erosion-Sheet, Road Shoulder Erosion-Rill	Build Up Road, Reshape (Crown), Add gravel	Medium	High	High
1-06	Minimal Vegetation	Residential	Surface Erosion-Sheet	Stabilize Foot Path, Define Foot Path, Erosion Control Mulch, Establish Buffer, Add to Buffer, Reseed bare soil & thinning grass	Low	Low	Low
1-07	Stream	Town Road	Culvert-Crushed Broken, Culvert-Unstable inlet/outlet	Replace Culvert, Armor Culvert Inlet/Outlet	Low	High	High
1-11	Stream	Private Road	Surface Erosion-Gully, Culvert-Unstable inlet/outlet	Armor Culvert Inlet/Outlet, Lengthen Culvert, Replace Culvert, Install Plunge Pool	Medium	Medium	Medium
1-12	Directly into lake	Beach Access	Shoreline-Unstable Access	Stabilize Foot Path, Infiltration Steps	Low	Low	Low
1-13	Ditch	Municipal / Public	Culvert-Crushed Broken, Culvert-Unstable inlet/outlet, Road Shoulder Erosion-Gully	Replace Culvert	Low	Medium	Low
2-00	Directly into lake	Residential	Surface Erosion-Gully	Infiltration Steps, Install Runoff Diverter (waterbar)	Medium	Medium	Medium
2-01	Directly into lake	Residential	Surface Erosion-Sheet, Shoreline-Erosion	Add to Buffer, Mulch/Erosion Control Mix	Medium	Low	Low
2-02	Directly into lake	Residential	Surface Erosion-Gully	Establish Buffer, Install Runoff Diverter (waterbar)	Medium	Medium	Low
2-03	Directly into lake	Residential	Roof Runoff Erosion	Infiltration Trench @ roof dripline, Drywell @ gutter downspout	Medium	Medium	Medium

Sector & Site	Flow path to lake	Land use	Problem	Recommendations	Impact Rating	Cost to Fix	Technical Level
2-04	Directly into lake	Residential	Surface Erosion-Sheet, Soil-Bare, Roof Runoff Erosion	Infiltration Trench @ roof dripline, mulch/ECM, reseed bare soil & thinning grass	Medium	Medium	Medium
2-05	Directly into lake	Residential	Surface Erosion-Sheet	Establish Buffer, Install Runoff Diverter (waterbar)	Low	Low	Low
2-06	Directly into lake	Residential	Roof Runoff Erosion, Other: Construction erosion- septic	Seed/Hay, Infiltration Trench @ roof dripline	Medium	Medium	Medium
2-07	Directly into lake	Residential	Surface Erosion-Sheet	Establish Buffer, Install Runoff Diverter (waterbar)	Low	Low	Low
2-08	Directly into lake	Residential	Surface Erosion-Sheet	Infiltration Steps, Install Runoff Diverter (waterbar) , Establish Buffer, Install Runoff Diverter (waterbar)	Medium	Medium	Medium
2-09	Directly into lake	Residential	Shoreline-Lack of Shoreline Vegetation, Shoreline-Erosion	Add to Buffer, Install Runoff Diverter (waterbar)	Medium	Medium	Medium
2-10	Directly into lake	Residential	Surface Erosion-Sheet, Roof Runoff Erosion	Infiltration Steps, Install Runoff Diverter (waterbar)	Low	Low	Medium
2-11	Directly into lake	Residential	Surface Erosion-Rill, Roof Runoff Erosion	Install Runoff Diverter (waterbar), Infiltration Steps, Infiltration Trench @ roof dripline, Install Runoff Diverter (waterbar), Mulch/Erosion Control Mix	Medium	Medium	Medium
2-12	Directly into lake	Residential	Shoreline-Lack of Shoreline Vegetation, Roof Runoff Erosion	Establish Buffer, Infiltration Trench	Low	Low	Low
2-13	Directly into lake	Residential	Shoreline-Lack of Shoreline Vegetation, Shoreline-Erosion	Establish Buffer, Install Runoff Diverter (waterbar)	Low	Low	Low
2-14	Directly into lake	Residential	Surface Erosion-Sheet, Shoreline-Lack of Shoreline Vegetation	Establish Buffer	Low	Low	Low
2-15	Directly into lake	Residential	Surface Erosion-Sheet	Infiltration Steps, Install Runoff Diverter (waterbar), Erosion Control Mulch	Medium	Medium	Medium
2-16	Ditch	State Road	Culvert-Unstable inlet/outlet	Install Plunge Pool	Medium	Low	Low
2-17	Stream	State Road	Culvert-Unstable inlet/outlet	Install Plunge Pool	Low	Low	Low
3-01	Directly into lake	Residential	Surface Erosion-Sheet, Soil-Bare, Shoreline-Lack of Shoreline Vegetation	Define Foot Path, Erosion Control Mulch, Establish Buffer, No Raking, Reseed bare soil & thinning grass	Low	Medium	Low
3-02	Directly into lake	Boat Access	Surface Erosion-Gully, Surface Erosion-Rill, Soil-Bare, Shoreline-Erosion, Shoreline-Unstable Access	Build Up Road, Add gravel, Reshape (Crown), Install Runoff Diverters-Waterbar, Install Runoff Diverters-Rubber Razor	Medium	Medium	Medium
3-03	Directly into lake	Residential	Surface Erosion-Rill, Soil-Bare	Define Foot Path, Erosion Control Mulch, No Raking, Reseed bare soil & thinning grass	Medium	Medium	Low
3-04	Directly into lake	Private Road	Surface Erosion-Rill, Surface Erosion-Sheet, Road Shoulder Erosion-Rill	Remove Grader/Plow Berms, Add gravel to road, Build Up, Reshape (Crown), Vegetate Shoulder, Install Runoff Diverters-Broad-based Dip	Medium	Medium	Medium

Sector & Site	Flow path to lake	Land use	Problem	Recommendations	Impact Rating	Cost to Fix	Technical Level
3-05	Directly into lake	Residential	Surface Erosion-Sheet, Surface Erosion-Rill, Shoreline-Lack of Shoreline Vegetation, Shoreline-Erosion, Shoreline-Unstable Access	Establish Buffer	Medium	Medium	Medium
3-06	Directly into lake	Boat Access	Surface Erosion-Rill, Surface Erosion-Sheet, Road Shoulder Erosion-Rill, Road Shoulder Erosion-Sheet, Shoreline-Erosion, Shoreline-Unstable Access	Build Up Road, Add gravel, Install Runoff Diverter (waterbar)	Medium	Medium	Medium
3-07	Directly into lake	Private Road	Surface Erosion-Rill, Surface Erosion-Sheet, Roadside Plow/Grader Berm	Remove Grader/Plow Berms, Build Up Road, Add gravel, Reshape (Crown)	High	High	Medium
3-08	Directly into lake	Private Road	Surface Erosion-Rill, Surface Erosion-Sheet, Roadside Plow/Grader Berm	Add gravel to road, Reshape (Crown) Road	High	High	Medium
3-09	Directly into lake	Driveway	Surface Erosion-Gully	Add gravel to road, Install Runoff Diverter (waterbar)	Medium	Medium	Medium
3-10	Directly into lake	Private Road	Surface Erosion-Gully, Roadside Plow/Grader Berm	Add gravel to road, Install Runoff Diverters-Broad-based Dip, Install Runoff Diverters-Waterbar	Medium	High	Medium
3-11	Directly into lake	Residential	Surface Erosion-Sheet, Soil-Bare	Stabilize Foot Path, Define Foot Path, Infiltration Steps, Erosion Control Mulch, Mulch/Erosion Control Mix	Low	Low	Low
3-12	Directly into lake	Residential	Surface Erosion-Sheet, Soil-Bare	Establish Buffer, No Raking, Reseed bare soil & thinning grass, Mulch/Erosion Control Mix	Low	Low	Low
3-13	Directly into lake	Beach Access	Surface Erosion-Gully	Reshape (Crown) Road, Install Runoff Diverters-Waterbar	Medium	Medium	Low
3-14	Directly into lake	Residential	Surface Erosion-Sheet, Surface Erosion-Rill, Soil-Bare, Shoreline-Inadequate Shoreline Vegetation, Shoreline-Erosion, Shoreline-Unstable Access	Reseed bare soil & thinning grass, Add to Buffer, No Raking, Mulch/Erosion Control Mix	Medium	Low	Medium
3-15	Directly into lake	Residential	Shoreline-Undercut, Shoreline-Inadequate Shoreline Vegetation, Shoreline-Erosion	Establish Buffer, Rip Rap	High	High	High
3-16	Minimal Vegetation	Driveway	Surface Erosion-Sheet, Surface Erosion-Rill	Add gravel to road, Reshape (Crown) Road, Mulch/Erosion Control Mix	Medium	Medium	Low
3-17	Directly into lake	Residential	Surface Erosion-Rill, Surface Erosion-Sheet, Soil-Bare, Shoreline-Erosion	Stabilize Foot Path, Install Runoff Diverter (waterbar), Reseed bare soil & thinning grass, No Raking, Add to Buffer, Install Runoff Diverter (waterbar), Mulch/Erosion Control Mix	Medium	Low	Low

Sector & Site	Flow path to lake	Land use	Problem	Recommendations	Impact Rating	Cost to Fix	Technical Level
3-18	Directly into lake	Residential	Surface Erosion-Sheet, Shoreline-Lack of Shoreline Vegetation	Add to Buffer, No Raking, Reseed bare soil & thinning grass, Mulch/Erosion Control Mix, Install Runoff Diverter (waterbar)	Low	Low	Low
3-19	Directly into lake	Driveway	Surface Erosion-Sheet, Surface Erosion-Rill	Reshape (Crown) Road, Install Runoff Diverters-Rubber Razor	Low	Low	Low
3-20	Directly into lake	Residential	Surface Erosion-Sheet, Soil-Bare	Stabilize Foot Path, Establish Buffer, Mulch/Erosion Control Mix	Low	Low	Low
3-21	Stream	Private Road	Culvert-Unstable inlet/outlet, Culvert-Crushed Broken, Road Shoulder Erosion-Sheet, Road Shoulder Erosion-Rill	Replace Culvert, Armor Culvert Inlet/Outlet, Lengthen Culvert	Medium	High	Medium
4-00	Directly into lake	Residential	Surface Erosion-Sheet	Infiltration Steps, Install Runoff Diverter (waterbar), Erosion Control Mulch, Establish Buffer	Medium	Medium	Medium
4-01	Stream	State Road	Road Shoulder Erosion-Rill, Shoreline-Erosion	Build Up Road, Pave, Rip Rap	Low	Low	Low
4-01a	Minimal Vegetation	Residential	Surface Erosion-Rill, Soil-Delta in Stream/Lake, Roof Runoff Erosion	Vegetate Ditch, Armor with Stone, Infiltration Trench @ roof dripline, Drywell @ gutter downspout, Rain Barrel, Add to Buffer, Install Runoff Diverter (waterbar), Mulch/Erosion Control Mix, Rain Garden	Low	Low	Low
4-02	Ditch	Private Road	Surface Erosion-Gully, Culvert-Unstable inlet/outlet, Culvert-Clogged, Ditch-Gully Erosion, Ditch-Bank Failure, Road Shoulder Erosion-Sheet, Soil-Bare	Armor Culvert Inlet/Outlet, Remove Clog, Install Plunge Pool, Armor Ditch with Stone, Reshape Ditch, Remove debris/sediment, Install Sediment Pools	Low	Low	Low
4-03	Minimal Vegetation	Residential	Surface Erosion-Gully, Roof Runoff Erosion	Infiltration Trench @ roof dripline, Drywell @ gutter downspout, Rain Barrel	Medium	Low	Low
4-04	Minimal Vegetation	Driveway	Surface Erosion-Sheet, Ditch-Undersized, Ditch-Sheet Erosion, Road Shoulder Erosion-Sheet, Roof Runoff Erosion	Install Ditch, Install Check Dams, Reshape (Crown) Road, Vegetate Shoulder, Install Catch Basin, Install Runoff Diverters-Open Top Culvert, Install Runoff Diverters-Rubber Razor, Infiltration Trench @ roof dripline, Drywell @ gutter downspout, Rain Barrel, Install Runoff Diverter (waterbar), Mulch/Erosion Control Mix, Rain Garden, Infiltration Trench	Low	Medium	Medium
4-05	Minimal Vegetation	Private Road	Surface Erosion-Gully, Culvert-Undersized, Ditch-Bank Failure, Ditch-Gully Erosion, Ditch-Undersized, Road Shoulder Erosion-Sheet, Soil-Bare	Install Culvert, Armor with Stone, Reshape Ditch, Install Check Dams, Add gravel to road, Install Runoff Diverters-Broad-based Dip, Reshape (Crown) Road, Install Catch Basin, Install Runoff Diverters-Open Top Culvert, Install Runoff Diverters-Rubber Razor, Install Runoff Diverters-Waterbar	Medium	Medium	Medium

Sector & Site	Flow path to lake	Land use	Problem	Recommendations	Impact Rating	Cost to Fix	Technical Level
4-06	Ditch	Private Road	Surface Erosion-Gully, Culvert-Unstable inlet/outlet, Culvert-Undersized, Ditch-Gully Erosion, Ditch-Bank Failure, Ditch-Undersized, Road Shoulder Erosion-Gully, Soil-Bare	Armor Culvert Inlet/Outlet, Install Plunge Pool, Vegetate Ditch, Armor with Stone, Remove debris/sediment	Medium	Medium	Low
4-07	Directly into lake	Residential	Surface Erosion-Sheet, Shoreline-Lack of Shoreline Vegetation, Roof Runoff Erosion	Establish Buffer, Install Runoff Diverter (waterbar), Rain Garden, Water Retention Swales, Rip Rap	Low	Low	Low
4-08	Ditch	Residential	Surface Erosion-Gully, Culvert-Unstable inlet/outlet, Culvert-Undersized, Ditch-Gully Erosion, Road Shoulder Erosion-Sheet, Soil-Bare	Armor Culvert Inlet/Outlet, Install Plunge Pool, Vegetate Ditch, Armor with Stone, Reshape Ditch	Medium	Medium	Low
4-09	Directly into lake	Residential	Surface Erosion-Sheet, Shoreline-Lack of Shoreline Vegetation, Roof Runoff Erosion	Infiltration Trench @ roof dripline, Drywell @ gutter downspout, Rain Barrel, Establish Buffer, Rain Garden, Install Runoff Diverter (waterbar), Rip Rap	Low	Low	Low
4-10	Directly into lake	Residential	Surface Erosion-Sheet, Shoreline-Lack of Shoreline Vegetation, Shoreline-Inadequate Shoreline Vegetation, Shoreline-Erosion	Define Foot Path, Establish Buffer, Add to Buffer, Rain Garden	Low	Low	Low
5-01	Stream	Town Road	Culvert-Clogged, Culvert-Unstable inlet/outlet, Other: potholes	Remove Culvert Clog, Armor Culvert Inlet/Outlet, Reshape (Crown) Road	Medium	Medium	Medium
5-02	Stream	Town Road	Road Shoulder Erosion-Rill, Soil-Bare, Other: steep unstable bank where culvert is	Armor Culvert Inlet/Outlet	Low	Medium	Medium
5-03	Stream	Driveway	Surface Erosion-Gully, Other: stream crossing on driveway- did not investigate but may need attention.	Build Up Road, Add gravel, Reshape (Crown), Install Runoff Diverter-Rubber Razor	Medium	Medium	Medium
5-04	Stream	Town Road	Culvert-Unstable inlet/outlet, Road Shoulder Erosion-Rill, Road Shoulder Erosion-Gully	Armor Culvert Inlet/Outlet, Install Ditch, Install Sediment Pools, Vegetate Shoulder	Medium	Medium	Medium
5-05	Stream	State Road	Culvert-Crushed Broken, Culvert-Undersized, Culvert-Unstable inlet/outlet, Other: culvert totally rusted out	Replace Culvert, Armor Culvert Inlet/Outlet, Enlarge Culvert, Lengthen Culvert	Medium	High	Medium
6-01	Stream	State Road	Surface Erosion-Sheet, Ditch-Undersized, Road Shoulder Erosion-Sheet	Rip Rap	Medium	Low	Medium

Sector & Site	Flow path to lake	Land use	Problem	Recommendations	Impact Rating	Cost to Fix	Technical Level
6-02	Stream	State Road	Surface Erosion-Gully, Road Shoulder Erosion-Sheet	Install Ditch, Install Sediment Pools	Medium	Medium	Medium
6-03	Ditch	State Road	Surface Erosion-Sheet, Ditch-Sheet Erosion, Road Shoulder Erosion-Sheet	Vegetate Ditch, Reshape Ditch, Armor with Stone	Medium	Medium	High
6-04	Ditch	Town Road	Surface Erosion-Sheet, Ditch-Bank Failure	Vegetate Ditch, Armor with Stone, Reshape Ditch, Remove Invasive Plants	Low	Medium	Medium
6-05	Ditch	Town Road	Ditch-Sheet Erosion, Road Shoulder Erosion-Sheet	Armor Culvert Inlet/Outlet, Vegetate Ditch, Armor with Stone, Vegetate Shoulder, Remove Invasive Plants	Low	Low	Medium
7-01	Directly into lake	Residential	Surface Erosion-Gully, Ditch-Gully Erosion	Armor with Stone, Install Turnouts	High	Medium	Medium
7-02	Directly into lake	Beach Access	Surface Erosion-Rill, Soil-Bare, Shoreline-Erosion, Shoreline-Unstable Access	Define Foot Path, Stabilize Foot Path, Establish Buffer	Medium	Medium	Low
7-03	Ditch	Residential	Surface Erosion-Rill, Ditch-Rill Erosion	Vegetate Ditch, Armor with Stone	Medium	Medium	Medium
7-04	Directly into lake	Residential	Ditch-Sheet Erosion, Ditch-Rill Erosion	Vegetate, Rain Garden	Low	Low	Low
8-01	Directly into lake	Residential	Surface Erosion-Sheet, Soil-Bare, Shoreline-Unstable Access	Define Foot Path, Erosion Control Mulch, Infiltration Steps, Add to Buffer, Reseed bare soil & thinning grass	Low	Low	Low
8-02	Directly into lake	Private Road	Surface Erosion-Rill, Culvert-Unstable inlet/outlet, Culvert-Undersized, Other: Drainage possibly former stream downcutting. Heavy flow in spring and road overtopping. Erosion on downstream side of culvert.	Enlarge Culvert, Armor Culvert Inlet/Outlet, Replace Culvert, Armor Ditch with Stone, Install Check Dams	Medium	High	Medium
8-03	Minimal Vegetation	Boat Access	Surface Erosion-Gully, Soil-Bare, Shoreline-Erosion, Shoreline-Unstable Access, Other: Grassy private boat launch wet and impacted by vehicles creating ruts.	Stabilize	High	Medium	Medium
8-04	Directly into lake	Residential	Surface Erosion-Sheet, Soil-Bare, Shoreline-Lack of Shoreline Vegetation, Other: Bare soil in planting area above riprap.	Add to Buffer, Reseed bare soil & thinning grass, Mulch/Erosion Control Mix	Low	Low	Low
8-05	Directly into lake	Driveway	Surface Erosion-Sheet, Soil-Bare, Shoreline-Lack of Shoreline Vegetation, Other: Dirt brought in for driveway and	Establish Buffer, Reseed bare soil & thinning grass	Low	Low	Low

Sector & Site	Flow path to lake	Land use	Problem	Recommendations	Impact Rating	Cost to Fix	Technical Level
			lawn but not seeded and loose dirt close to lake.				
8-06	Minimal Vegetation	Residential	Surface Erosion-Rill, Soil-Bare, Shoreline-Undercut, Shoreline-Lack of Shoreline Vegetation, Shoreline-Inadequate Shoreline Vegetation, Shoreline-Unstable Access, Roof Runoff Erosion	Infiltration Trench @ roof dripline, Establish Buffer, Rain Garden	Medium	Medium	Medium
8-07	Minimal Vegetation	Residential	Surface Erosion-Sheet, Soil-Bare, Shoreline-Inadequate Shoreline Vegetation, Shoreline-Lack of Shoreline Vegetation, Shoreline-Erosion, Roof Runoff Erosion	Drywell @ gutter downspout, Rain Barrel, Establish Buffer, Reseed bare soil & thinning grass, No Raking	Low	Low	Low
8-08	Directly into lake	Residential	Surface Erosion-Gully, Shoreline-Undercut, Shoreline-Inadequate Shoreline Vegetation	Add to Buffer, Rip Rap	High	High	Medium
8-08a	Minimal Vegetation	Boat Access	Surface Erosion-Rill, Soil-Bare, Shoreline-Undercut, Shoreline-Unstable Access, Shoreline-Erosion, Other: Uncovered sand pile	Infiltration Steps, Define Foot Path, Erosion Control Mulch, Establish Buffer, Reseed bare soil & thinning grass	Medium	Medium	Medium
8-09	Minimal Vegetation	Driveway	Surface Erosion-Sheet, Soil-Bare, Other: Extended driveway/boat launch all the way to shoreline.	Install Runoff Diverters-Rubber Razor	Low	Low	Medium
8-10	Stream	Private Road	Culvert-Unstable inlet/outlet, Other: Culvert misaligned	Armor Culvert Inlet/Outlet	Medium	Low	Low
8-11	Minimal Vegetation	Residential	Surface Erosion-Gully, Shoreline-Undercut, Shoreline-Lack of Shoreline Vegetation, Shoreline-Erosion	Establish Buffer, Rip Rap	Medium	High	Medium
8-12	Directly into lake	Beach Access	Surface Erosion-Sheet, Soil-Bare, Shoreline-Unstable Access	Define Foot Path, Erosion Control Mulch, Infiltration Steps, Establish Buffer, No Raking, Reseed bare soil & thinning grass	Low	Low	Low
8-13	Directly into lake	Residential	Surface Erosion-Rill, Soil-Bare, Shoreline-Undercut, Shoreline-Unstable Access, Shoreline-Lack of Shoreline Vegetation, Shoreline-Erosion, Other: Firepit ash close to shore	Define Foot Path, Erosion Control Mulch, Establish Buffer, No Raking, Reseed bare soil & thinning grass	Medium	Low	Medium

Sector & Site	Flow path to lake	Land use	Problem	Recommendations	Impact Rating	Cost to Fix	Technical Level
8-14	Directly into lake	Beach Access	Surface Erosion-Rill, Soil-Bare, Shoreline-Unstable Access, Shoreline-Inadequate Shoreline Vegetation, Shoreline-Erosion, Shoreline-Undercut, Other: Sheet erosion over bare soil in yard	Define Foot Path, Erosion Control Mulch, Infiltration Steps, Establish Buffer, No Raking, Reseed bare soil & thinning grass, Rip Rap, Mulch/Erosion Control Mix	Medium	Medium	Medium
8-15	Minimal Vegetation	Driveway	Surface Erosion-Sheet, Soil-Bare	Install Runoff Diverters-Open Top Culvert, Add gravel	Low	Medium	Medium
8-16	Minimal Vegetation	Driveway	Surface Erosion-Sheet	Install Runoff Diverters-Rubber Razor	Medium	Medium	Medium
8A-01	Directly into lake	Residential	Surface Erosion-Sheet, Surface Erosion-Gully, Soil-Bare, Shoreline-Inadequate Shoreline Vegetation	Establish Buffer, Add to Buffer, No Raking, Reseed bare soil & thinning grass, Water Retention Swales, Mulch/Erosion Control Mix	High	Low	Low
8A-02	Directly into lake	Residential	Surface Erosion-Sheet, Soil-Bare, Shoreline-Inadequate Shoreline Vegetation	No Raking, Reseed bare soil & thinning grass	Low	Low	Low
9-01	Directly into lake	Trail or Path	Surface Erosion-Sheet, Shoreline-Inadequate Shoreline Vegetation	Install Runoff Diverters-Broad-based Dip , Define Foot Path, Infiltration Steps, Establish Buffer	Low	Low	Medium
9-02	Directly into lake	Municipal / Public	Surface Erosion-Gully, Culvert-Unstable inlet/outlet, Ditch-Bank Failure, Ditch-Gully Erosion, Road Shoulder Erosion-Sheet, Soil-Winter Sand, Shoreline-Lack of Shoreline Vegetation, Shoreline-Inadequate Shoreline Vegetation, Shoreline-Erosion, Shoreline-Unstable Access	Install Plunge Pool, Vegetate Ditch, Armor Ditch with Stone, Reshape Ditch, Install Check Dams, Install Sediment Pools, Establish Buffer	High	High	High
9-03	Directly into lake	Municipal / Public	Surface Erosion-Gully, Surface Erosion-Sheet, Soil-Bare, Shoreline-Lack of Shoreline Vegetation, Shoreline-Erosion	Establish Buffer, Mulch/Erosion Control Mix, Rip Rap	High	High	High
9-04	Directly into lake	Residential	Surface Erosion-Gully, Soil-Bare, Shoreline-Lack of Shoreline Vegetation, Shoreline-Inadequate Shoreline Vegetation, Shoreline-Erosion	Add to Buffer, Establish Buffer, Rip Rap	High	High	High
9-05	Directly into lake	State Road	Surface Erosion-Sheet, Culvert-Unstable inlet/outlet, Road Shoulder Erosion-Rill, Road Shoulder Erosion-Sheet, Soil-Bare	Armor Culvert Inlet/Outlet, Install Plunge Pool, Remove debris/sediment, Reshape Ditch, Rip Rap	High	High	High
9-06	Directly into lake	Residential	Shoreline-Undercut, Shoreline-Lack of Shoreline Vegetation, Shoreline-Erosion,	Establish Buffer, Add to Buffer	Medium	Medium	Medium

Sector & Site	Flow path to lake	Land use	Problem	Recommendations	Impact Rating	Cost to Fix	Technical Level
			Shoreline-Inadequate Shoreline Vegetation				
9-07	Directly into lake	Residential	Surface Erosion-Sheet, Shoreline-Undercut, Shoreline-Lack of Shoreline Vegetation, Shoreline-Inadequate Shoreline Vegetation, Shoreline-Erosion, Roof Runoff Erosion	Establish Buffer, Add to Buffer, Rip Rap	High	Medium	Medium
9-08	Directly into lake	Residential	Surface Erosion-Sheet, Shoreline-Undercut, Shoreline-Lack of Shoreline Vegetation, Shoreline-Inadequate Shoreline Vegetation, Shoreline-Erosion, Roof Runoff Erosion	Infiltration Trench @ roof dripline, Drywell @ gutter downspout	Medium	High	High
9-09	Directly into lake	Municipal / Public	Surface Erosion-Rill, Shoreline-Undercut, Shoreline-Inadequate Shoreline Vegetation, Shoreline-Erosion	Rip Rap	High	High	High
9-10	Directly into lake	Residential	Surface Erosion-Sheet, Shoreline-Undercut, Shoreline-Lack of Shoreline Vegetation, Shoreline-Erosion	Rip Rap	High	High	High
9-11	Directly into lake	Residential	Surface Erosion-Sheet, Shoreline-Undercut, Shoreline-Erosion, Shoreline-Lack of Shoreline Vegetation	Add to Buffer, Reseed bare soil & thinning grass, Mulch/Erosion Control Mix	Medium	Medium	Medium
9-12	Directly into lake	Residential	Surface Erosion-Sheet	Define Foot Path, Stabilize Foot Path, Infiltration Steps, Erosion Control Mulch	Medium	Medium	Medium
9-12a	Minimal Vegetation	Residential	Surface Erosion-Sheet, Soil-Bare, Shoreline-Lack of Shoreline Vegetation, Shoreline-Inadequate Shoreline Vegetation, Shoreline-Erosion	Add to Buffer, Establish Buffer, Rip Rap	Medium	Medium	Medium
9-13	Directly into lake	Residential	Surface Erosion-Sheet, Surface Erosion-Gully, Surface Erosion-Rill, Shoreline-Undercut, Shoreline-Lack of Shoreline Vegetation, Shoreline-Erosion	Add to Buffer, Establish Buffer, Rip Rap	High	High	High
10-01	Stream	Town Road	Culvert-Undersized, Culvert-Unstable inlet/outlet, Road Shoulder Erosion-Sheet, Agriculture-Manure Washing off Site	Enlarge Culvert, Armor Culvert Inlet/Outlet	Low	Medium	Medium