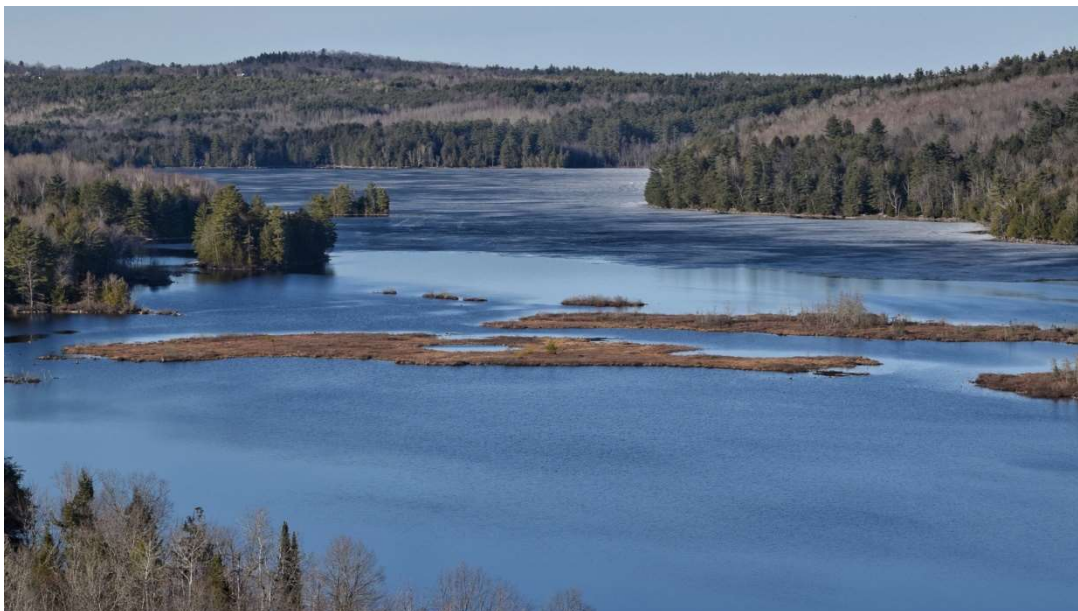


Torsey Pond
Watershed-Based Protection Plan
2020-2030



March 2020

Cobbossee Watershed District



Acknowledgments

The Torsey Pond Watershed-Based Protection Plan was made possible by the cooperative efforts of several individuals and organizations. The following organizations and individuals participated in the development of this survey:

- **Cobbossee Watershed District (CWD)**
- **Torsey Pond Association (TPA)**

Specifically,

- **Steering Committee** members included Keith Coulling, Darcy Whittemore, Dave Roberts, Sandra Gorry, and Bill Monagle (CWD).
- **Funding** for this project, in part, was provided by the Torsey Pond Association.
- The **Watershed-Based Protection Plan** was prepared by CWD Project Manager, Bill Monagle.

For additional information or copies of the report, contact:

*Cobbossee Watershed District
P.O. Box 418, Winthrop, ME 04364
207-377-2234
cwd@fairpoint.net*

Table of Contents	Page
Background Information	3
Identification of the Causes or Sources of the NPS Threat	5
Watershed Plan Goals and Objectives	8
Schedule and Milestones to Guide Plan Implementation	9
Proposed Management Measures	12
Pollutant Load Reductions	14
Water Quality Results Monitoring	14
APPENDIX A	15

Cover Photo by Ryan Burton.

1. Background Information

A. Document Purpose and Scope

The purpose of this Watershed Based Plan, herein after referred to as the “plan”, is to lay out a strategy and schedule for NPS mitigation and water quality protection efforts for the Torsey Pond watershed over the next ten years (2020 through 2030). This plan is associated with the Torsey Pond Watershed Survey, conducted in 2016 as a joint effort between the Torsey Pond Association and the Cobbossee Watershed District (CWD). The CWD prepared the plan with assistance and input from the Torsey Pond Association.

The plan was developed to satisfy national watershed planning guidelines provided by the EPA. EPA requires *nine-element* plans for impaired watersheds, but allows *alternative* plans in several cases including for protection of high quality or unimpaired waters. Maine DEP accepts alternative plans for unimpaired lakes that have completed a recent watershed survey provided that the plans follow EPA and MDEP guidance and include minimum planning elements. The Torsey Pond Watershed Based Protection Plan meets these eligibility criteria, and the plan was written to include the EPA and Maine DEP required planning elements (sections 2 through 6 in the plan cover EPA’s five elements for alternative watershed-based plans).

B. Watershed Background

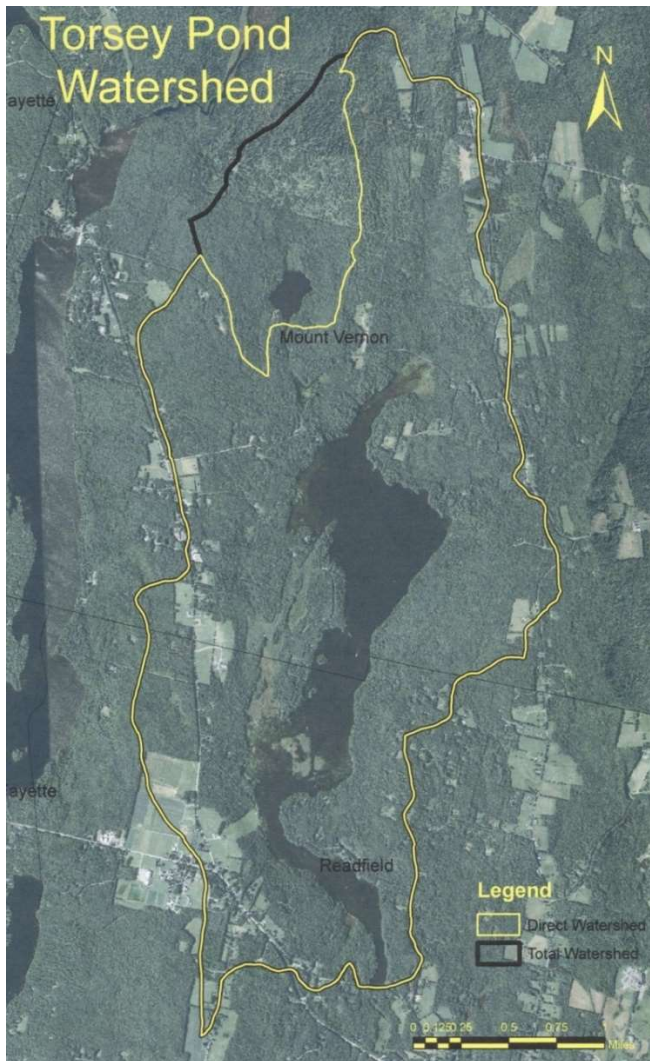
Torsey Pond is a 568 acre pond, within a 6.1 sq. mi. watershed (Fig. 1), located approximately 12 miles northwest of Augusta in the Towns of Readfield and Mt. Vernon, Kennebec County, Maine, and easily accessible from Route 17. Torsey Pond generally represents a headwater lake of the Cobbosseecontee (Cobbossee) Stream watershed - although smaller Desert Pond (22 ac.) resides upstream - and outflows directly to Maranacook Lake. Torsey Pond has a maximum depth of 45 feet, a mean depth of 10 feet, and flushes 1.1 times per year. Hydrologically, the major sources to the pond are the outflow of Desert Pond and several small, primarily intermittent, tributaries. Land use in the watershed was determined by employing the website, www.modelmywatershed.org, which describes land use based on National Land Cover Data (2011). The watershed is largely wooded (71%) and the primary cultural land uses in the watershed are residential and agriculture (primarily hayland, cultivated crops, and pasture). Overall, the watershed is minimally developed (5%) and there is moderate shoreland development around the pond. Access to the approximately 9.5 miles of shoreline is accessed by way of a dozen private roads, all of which consist of graveled surfaces. Open water comprises 16.3% of the total watershed.

There is a public boat launch facility located on Old Kents Hill Road along the south shore adjacent to the outlet dam, as well as several privately owned boat launching sites. Torsey Pond is popular for both open-water fishing and ice-fishing. Of the 15 species of fish reported in the pond, three species (American eel, brook trout, rainbow smelt) are listed as high-priority in the State's 2005 Comprehensive Wildlife Conservation Strategy. The Maine Inland Department of Inland Fisheries and Wildlife’s “Beginning with Habitat” has designated the south-central area of the pond as breeding grounds for bald eagles.

C. Summary of Prior Watershed Work

As discussed below, and based on water quality data collected by the CWD over the past 40 years, Torsey Pond has exhibited an enviable history of good, stable water clarity. The only organized activities involved a 1997 survey of camp (i.e., gravel) roads in the watershed and a 2016 watershed survey coordinated by the CWD and performed by volunteers of the Torsey Pond Association. Both projects were locally funded. As this survey revealed a modest list of problem sites, there has been little cause for investing in the implementation of watershed-wide nonpoint-source pollution controls, but there were identified nearly two dozen NPS sites that mostly pertained to road related (e.g., culverts, ditches, surfaces) problems in relatively close proximity to the pond that warrant future attention.

Figure 1 – Torsey Pond Direct Watershed

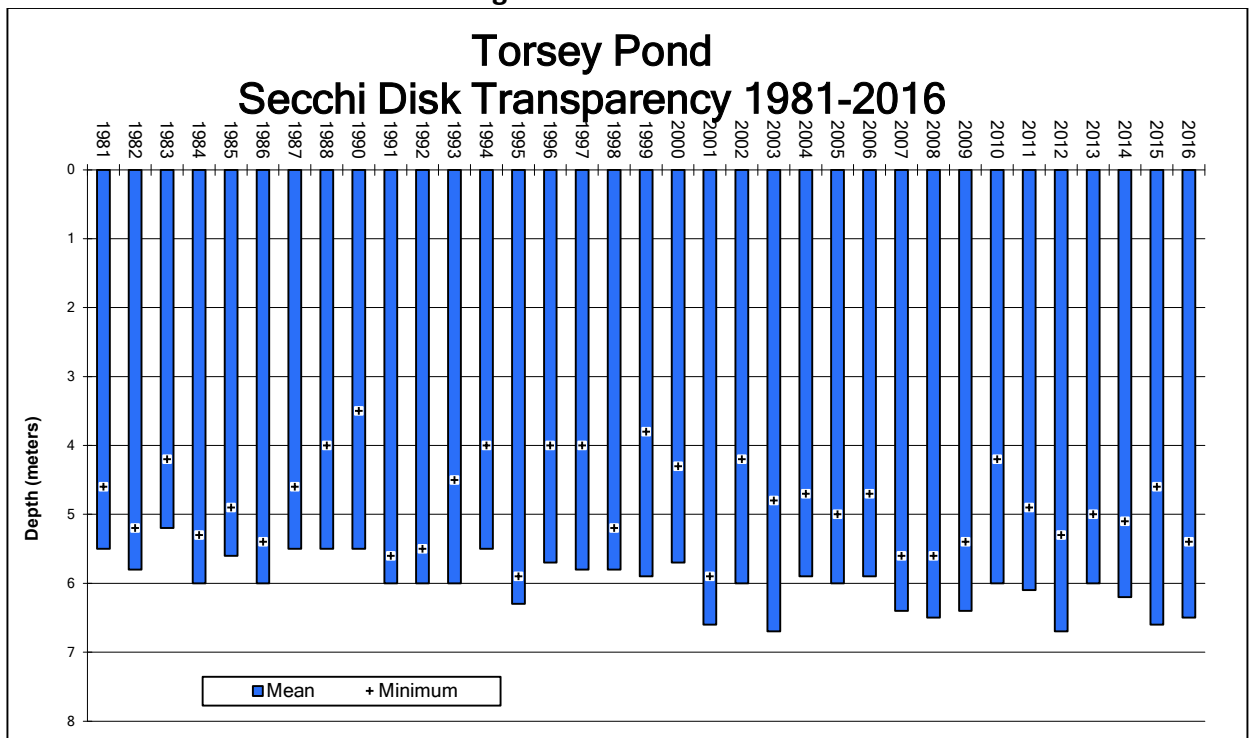


2. Identification of the Causes or Sources of the NPS Threat

A. Water Quality Summary

The Cobbossee Watershed District (CWD) has been monitoring Torsey Pond water quality since the early 1980s. The CWD staff conducts regular water quality monitoring of Torsey Pond from May through October of each year. Routine water quality parameters monitored include temperature, dissolved oxygen, and Secchi Disk Transparency (SDT), with Total Phosphorus and Chlorophyll-a monitored on a 3-year rotational basis (see Appendix A). Throughout this period, the water quality has been relatively stable with above average water clarity compared to other Maine lakes. In fact, trend analysis suggests a slight and gradual improvement over time with the mean visibility for the years 1981- 2016 hovering around 6.0 meters (Figure 2). The average clarity was 6.5 meters in 2016, which was not unusual, but 2016 was a rather dry year with reduced stormwater runoff from the surrounding watershed. The most recent (2014) state average for Maine lakes was 4.8 meters. Algal blooms have never been observed in this lake; minimum visibility on record since 1975 was 3.5 meters in 1990. Phosphorus concentrations have been generally between 7 and 11 parts-per-billion (ppb) and have not changed much since CWD's first measurements in 1976. A phosphorus concentration of 15 ppb or higher is generally considered the level above which algal blooms occur. Chlorophyll-a, a photosynthetic pigment present in plants, including algae, is a good indicator of algae concentration

Figure 2.



and over the years the levels measured in Torsey have been consistent with moderate productivity and good water clarity. Oxygen depletion in the pond does occur during summer periods at depths from 7 or 8 meters to the bottom and usually persists until the fall overturn.

B. Threatened Status

Torsey Pond is on the Maine NPS Priority Watersheds List and designated as Agriculturally Threatened. This is largely due to the fact that agriculture has been on the wane in recent years, but summertime hypolimnetic anoxia suggests that historical nutrient loading to the pond from farms may have been substantial. Relative to agriculture, there is minimal intense development such as commercial operations or densely developed subdivisions throughout the watershed. Other threats, not listed specifically by the Maine DEP for Torsey Pond, include soil erosion, particularly associated with gravel road surfaces and unstable roadside ditches (see Section 2.C below). Additionally, it bears noting that the bottom waters of Torsey Pond become devoid of dissolved oxygen during summer months raising the possibility of internal loading as a source of phosphorus, although no noticeable water quality impacts have been observed. The hypolimnetic anoxia does, however, limit habitat for coldwater fishes (e.g., brook trout).

C. Watershed NPS Threats

As is the case with most lakes of Maine, Torsey Pond's water quality is most threatened by excessive phosphorus loading. Phosphorus tends to be the nutrient in least supply relative to demand and therefore exerts the most control over algal production. Small increases in phosphorus cause lake algae populations to increase and water clarity to decline. High levels can cause dense algae blooms, which can lead to oxygen depletion in the bottom of the lake when the blooms decompose. This can result in the loss of cold water fisheries. Phosphorus runoff increases significantly in developed landscapes. Stormwater flows across roads, driveways, residential properties and other developed areas and picks up phosphorus in soluble form or attached to eroded soil particles. A study by Maine DEP of two similar sized watersheds, one undeveloped and one that contained residential development, found that phosphorus export from the developed watershed was up to 10 times greater than the forested one (Dennis, 1985). In the mid-1970's, an early assessment of Torsey Pond water quality and watershed characteristics was conducted as part of the Water Quality Management Plan for the Southern Kennebec Valley (1977). This effort was jointly performed by the Southern Kennebec Valley Regional Planning Commission, the Cobbossee Watershed District, and the United States Environmental Protection Agency (Region I). The shallowness and low flushing rate of Torsey Pond combine to provide good conditions for algae growth, and therefore, phosphorus loading must be carefully limited in this sensitive lakeshed.

The earliest formal survey of Torsey Pond's watershed was conducted in 1997 by the Torsey Pond Association in cooperation with the CWD and the Readfield Code Enforcement Office. This survey effort focused on camp road and public road related sources of erosion and sedimentation. There were three roads that were assigned a High Priority ranking. The more recent locally-funded Torsey Pond Watershed Survey Project was undertaken in 2016 to identify and document specific Nonpoint Source Pollution (NPS) problem sites where Best Management Practices (BMPs) should be implemented to reduce sediment and/or phosphorus loading to the pond as well as identifying those roads, or segments thereof, where responsible road maintenance appears to be lacking. The 2016 survey identified and prioritized NPS problem sites for future BMP implementation based on their severity and their suitability for corrective measures. The survey process and results also served to

prepare citizens, road associations, and municipalities for understanding and accepting their own active roles in regularly maintaining their own roads and protecting the lake, and provides a foundation for the development of a long-range watershed-based protective plan to guide implementation efforts in the watershed.

In general, there were 11 subcategories of NPS sites described, and in several cases, a particular site satisfied more than one category. There were 23 documented sites; most were a composite of smaller NPS sites, totaling 59 in all. Twenty-two (22) percent were considered to be High Priority, 52 percent as Medium Priority, and 26 percent as Low Priority. Priority ranking was based on a combination of factors including the extent of erosion and the proximity to a water resource or

drainage channel, in most cases with the intent being to rank the sites based on the degree of threat to lake water quality. A breakdown of NPS sites by type is shown in Table 2 below. As the data suggest, and as expected given the survey design, the majority of NPS sites that were identified were related to either private or public roads. This is also reflected in the range of problem descriptions, as 90% of all identified NPS problems were related to either road surface erosion, clogged or eroded culverts, ditch erosion, or shoulder erosion. Land classified as agriculture failed to account for any of the NPS-related problems – as expected considering there has been a wane in agriculture throughout the watershed and properties currently related to livestock keeping generally denied access or a willingness to be surveyed. The results were not unexpected, as the NPS survey was to be conducted from edge of properties along public and private roadways, with property owner permission required for a more in-depth inspection.

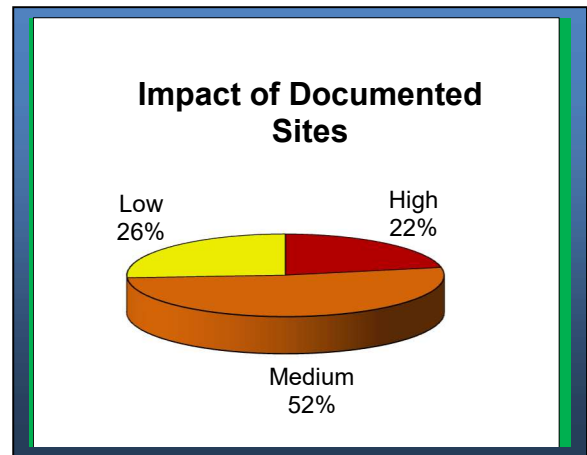


Table 2. Occurrence of Identified NPS Sites by Type

LAND USE TYPE	Number of NPS Sites
Private Road Surface Erosion	9
Public Road Surface Erosion	9
Private Driveway Surface Erosion	1
Private Boat Launch Erosion	2
Ditch Erosion	16
Shoulder Erosion	9
Culvert (undersized, clogged, or broken)	4
Public Boat Launch Erosion	1
Grader Berms	5
General Site Erosion – Gulley / Ravine	1
Shoreline Erosion	2

In general, to most efficiently address NPS problems as identified in this survey, it is recommended that the highest priority sites be tackled first. Of the 6 high priority sites, 5 were related to roads. The Appendices include the Watershed Survey Report, including a map of the associated NPS sites (Appendix A) and a Site-Tracker Spreadsheet presenting the complete NPS survey results (Appendix B). Site-specific BMPs to address these problems should be prescribed prior to work being performed as conditions may have changed since the survey was performed. The most common BMPs to address the 16 road related sites will be re-grading and stabilization of roadside shoulders, adding surface material to eroded roads and reshaping them as required, replacing new culverts where needed and stabilizing culvert inlets and outlets, and reshaping and stabilizing roadside ditches and installing turnouts to buffer areas where deemed beneficial. Costs in dollars (2016) to repair the average camp road related problems generally will likely run between \$4,000 and \$10,000 per site. Camp roads with multiple problems can be expected to be proportionately more expensive.

3. Watershed Plan Goals and Objectives

Overall Goal: The overall plan goal is to maintain the Class GPA water quality standards in Torsey Pond by limiting phosphorus and sediment loading to the pond. This will be achieved through the following actions over the coming ten year period (2020-2030):

- **Reduce current sources of phosphorus loading** by fixing between 10 and 15 of the 23 sites identified in the watershed survey. This will be achieved by providing targeted outreach, technical assistance from the CWD on road related sites and seeking assistance from either the LakeSmart Program provided by the Maine Lakes Society or the LakeSmart-Start! Program offered by the Friends of the Cobbossee Watershed for residential, shorefront, and other problem sites. In general, most NPS sites could be addressed with local funding, but if necessary to accomplish desired goals, cost-sharing assistance may be provided via a Clean Water Act §319 NPS watershed project to install conservation practices at larger NPS sites identified in the watershed survey.
- **Limit new sources of phosphorus loading** by facilitating improved land use practices and ongoing maintenance activities. This objective will be met by conducting outreach and providing technical assistance to residents, road associations, farmers (i.e., agriculture and livestock), and municipal officials of the Towns of Readfield and Mt. Vernon.
- **Build local capacity** for watershed stewardship by encouraging the formation of road associations and working closely with the Torsey Pond Association and the Friends of the Cobbossee Watershed to encourage participation in mitigation work.
- **Conduct ongoing assessment of lake and watershed conditions** by monitoring lake water quality and setting up and maintaining the NPS Site Tracker.

4. Schedule and Milestones to Guide Plan Implementation

A. Action Plan and Schedule

An estimated schedule (Tables 3 & 4) of actions items to prevent NPS problems and to address existing NPS sites and land uses - particularly those of highest priority with greatest potential benefit - was developed to guide future watershed activities.

Table 3 – Implementation Schedule

2020-2023	<ul style="list-style-type: none"> • Encourage participation in the Maine Lake Society’s LakeSmart Program and the Friends of the Cobbossee Watershed’s LakeSmart-Start! Program. • Begin notifying key landowners of medium and high priority NPS sites about problems on their properties/private roads and provide the necessary technical assistance (CWD). • Landowners self-fund NPS sites based on technical assistance from CWD.
2023-2025	<ul style="list-style-type: none"> • Conduct EPA Section 319 watershed project (if funded) with targeted cost-sharing and matching funds for high priority sites. • Friends of Cobbossee Watershed provide watershed education and technical assistance to shorefront landowners via LakeSmart-Start! program and Youth Conservation Corps. • Reach out to the agricultural land owners to review agricultural practices and/or livestock-keeping practices, including waste management.
2020 - 2030	<ul style="list-style-type: none"> • CWD continues monitoring lake water quality, managing lake water levels, and providing technical assistance to citizens and local planning boards to limit impact from new development.

B. Plan Oversight and Partner Roles

The Torsey Pond Watershed-Based Protection Plan will primarily be carried out by the Cobbossee Watershed District with support from the Friends of the Cobbossee Watershed, Torsey Pond Association, local town officials, and private landowners and road associations.

- **CWD** will be primarily responsible for Plan implementation; provide technical assistance to private road associations and property owners; conduct water quality monitoring; promote watershed stewardship through public announcements in the Local Advertiser; and work with the member watershed towns to control phosphorus loading from new development.
- **Friends of the Cobbossee Watershed** will provide education and outreach via their Watershed Education Program, Tadpole Patrol Program and their website and newsletter, and technical assistance via their Lake-Smart Start! and Youth Conservation Corp programs.
- **Private road associations and landowners** will address NPS issues on their properties and conduct ongoing maintenance of BMPs.

- **CWD** will set up and use the NPS Site Tracker to identify new NPS sites and prompt ongoing maintenance.
- The **Town of Readfield** will provide continued funding support for the CWD, its water quality monitoring program, and other lake protection related programs and also work to address NPS problems and conduct regular maintenance on town road sites.
- **Maine DEP** would provide technical assistance and the opportunity for financial assistance through the NPS Grants Program, if a Section 319 grant were secured.
- **EPA** may provide CWA Section 319 funds and guidance.
- **Natural Resource Conservation Service** will provide guidance regarding agriculture and livestock keeping (e.g., nutrient and waste management plans) and serve as a source of funding (EQIP).

C. Plan Outputs and Milestones

Organizational Outputs

- Contact made with all property owners and/or road associations with medium to high priority NPS sites identified in watershed survey
- Increase in number of Road Associations formed
- NPS Tracker maintained by CWD
- If needed, CWD applies for 319 grant for Phase I project

NPS Mitigation Outputs

- 6 NPS sites fixed by landowners through private funding (self-funded)
- 30 technical assistance visits (CWD staff and/or LakeSmart or Lake-Smart Start!)
- 12 high and medium impact NPS sites fixed with cost sharing assistance
- Estimated pollutant load reductions achieved by installed BMPs

Water Quality Outcomes

- Maintains current water quality and continues to meet Maine's lake GPA standards
- Stable trend for lake water clarity and spring overturn total phosphorus concentration

Table 4 – Action Items and Milestones	Schedule	Who	Potential Funding Sources
<i>Reduce current sources of P loading to the lake by addressing NPS sites identified in the watershed survey and other sites</i>			
Provide Tech assistance & outreach to shorefront/road assoc.	2020-2030	CWD, FOCW	CWD, FOCW
6 Self-funded BMPs at NPS Sites	2020-2030	Private	Private
Provide opportunity for cost-sharing assistance to install BMPs at NPS sites			
12 Private Roads (High & Medium Priority sites.)	2023-2025	Private	EPA (319), Private
15 Residential Shorefront – Youth Conservation Corps	2023-2025	Private/FOCW	EPA (319), Private
1 Residential/non-shorefront large gully erosion (1 site)	2023-2025	Private	EPA (319), Private
Notify those landowners with High Priority NPS Survey sites	2020-2030	CWD	CWD
<i>Limit new sources of phosphorus loading to lake</i>			
Work with road associations and land owners to promote road related BMPs	2020 - 2030	CWD, TPA	Private, EPA (319)
Conduct 2 Public Demonstrations to Highlight BMPS	2023-2025	CWD	EPA (319), CWD
Work with local municipal planning boards to ensure stormwater compliance and phosphorus control for new developments	Ongoing	CWD	CWD
Reach out to agricultural land owners to review current practices and promote changes where necessary.	2023-2025	CWD	NRCS (EQIP), EPA 319
<i>Build or maintain local capacity for watershed stewardship</i>			
Apply for Section 319 Watershed Implementation Grant	2023	CWD	CWD
Continue raising funds to support Friends of Cobbossee Watershed programs	Ongoing	FOCW	Private, Towns, EPA (319)
Maintain close communication with Torsey Pond Association	Ongoing	CWD, FOCW	CWD, FOCW
Promote Road Association formation	2020 - 2030	CWD	EPA (319), CWD
<i>Conduct ongoing lake and watershed assessment</i>			
Conduct lake water quality monitoring	Ongoing	CWD	CWD
NPS Site Tracker annual use and maintenance	Ongoing	CWD	CWD

5. Proposed Management Measures

The *Torsey Pond Watershed Survey Report* lists specific management measures recommended for each of the NPS erosion problems identified during the survey. Typical problems and management measures for the most common land uses identified in the watershed survey are described in the sections below. Recommendations follow guidelines found in Maine DEP publications including the *Gravel Road Maintenance Manual*, *Conservation Practices for Homeowners* fact sheet series, and *Erosion and Sediment Control Manual*. The recommended BMPs would accomplish the plan goal of reducing phosphorus and sediment loading to the pond by stabilizing bare soil and erosion and diverting, infiltrating or filtering polluted runoff before it reaches the pond.

In addition to structural BMPs recommended for each problem, public education and outreach efforts will also be needed to promote responsible stewardship and ongoing maintenance activities. The NPS Site Tracker that has been developed will be used by the Cobbossee Watershed District with support from Maine DEP on an ongoing basis to identify new problems and to prompt maintenance on sites fixed through the plan.

A. Private Roads and Driveways

The watershed survey identified 23 NPS major sites with nearly half (10) of these related to private road surface-related problems, with many others associated with ditches, culverts, etc., supporting these roadways. Most of these sites were rated “Medium” impact compared to other problems in the watershed. Private roads accounted for 4 of the 6 high priority NPS sites identified during the survey. Common problems included poor road surface shaping, moderate to severe ditch or road surface erosion, and grader/plow berms trapping surface runoff on the road surfaces, and clogged or undersized culverts. The most common BMPs recommended in the survey included:

- reshaping (crowning or super-elevating) the road surface;
- removing berms that trap runoff on the road surface;
- installing waterbars to divert water off the road
- establishing road ditches
- cleaning, enlarging and stabilizing ditches; and
- install ditch turnouts where need
- armoring culvert inlets and outlets.

The plan aims to address most (18) of the private road sites. Initially, road associations and property owners will be offered technical assistance and encouraged to address the problem sites without grant support. It is anticipated that voluntary action will result in at least a half dozen of problems being fixed. Ongoing maintenance is critical to long term performance of these BMPs and prevention of new NPS problems. As a result, the plan calls for periodic inspections of implemented BMPs through the NPS Site Tracker. Follow up contact will be made by the Cobbossee Watershed District to road associations and landowners for any maintenance needs.

B. Residential Shoreline Development

Shoreline development was a focus of the watershed survey in a very general manner as only those few NPS sites visible from the connecting camp roads were to be documented. Although no NPS problems on private shorefront properties were documented, the general consensus is that there are cases where improvements can be made, either to correct shoreline erosion related problems, or to encourage the installation of shorefront buffers and other diversion/infiltration practices. It should be noted that over the past decade, the Friends of the Cobbossee Watershed have offered the services of their LakeSmart-Start! Program and Youth Conservation Corps to shorefront owners to plant shoreline buffers and/or apply geo-textile and rip-rap to eroded shorelines. This program has been very popular and successful and based on continued requests for service for property owners. In general, some of the more common BMPs likely to be prescribed would include:

- Vegetated buffers;
- Shoreline stabilization
- Erosion control mulch;
- Rain Gardens;
- Runoff diverters below impervious surfaces; and
- Infiltration trenches along roof driplines and stabilization of bare soil.

The services provided by the CWD to the towns is a basic function of the CWD and not reliant on special grant funding. Services provided by the Friends of the Cobbossee Watershed would likely require grant-related support (i.e., Section 319) for dedicating their Youth Conservation Corps to an individual lake such as Torsey Pond in order to fix a reasonable number of sites within a scheduled timeframe.

C. State and Town Roads

There were nine town road sites identified in the watershed survey. Two sites were rated high impact and four were rated medium impact. A few of these sites that involved unstable ditches have been partially addressed (i.e., rock-lined) by the Town of Mt. Vernon, and the town recently stabilized (i.e., paved) a moderately eroded section of Desert Pond Road. These sites bear continued monitoring. Several of the medium priority sites involved moderate surface, ditch, and/or shoulder erosion. It is anticipated that these may be addressed by the respective municipalities as a function of routine maintenance.

The NPS Site Tracker can be used to prompt periodic inspections of these sites and communication with both the Towns of Readfield and Mt. Vernon about future maintenance needs.

6. Pollutant Load Reductions

Pollutant load reductions will be estimated for many NPS sites that are mitigated to help demonstrate the value of BMPs to reduce the amount of sediment and phosphorus entering the pond. Pollutant load reductions will be estimated and reported to Maine DEP for any future work funded by CWA Section 319 grants. Pollutant load reduction will be made using methods approved and recommended by the Maine DEP and EPA. These estimates can be used to further prioritize projects in the watershed.

7. Water Quality Results Monitoring

Maine water quality criteria require that lakes and ponds have a stable or improving trophic state and be free of culturally induced algal blooms. CWD will continue to monitor Torsey Pond from May through October for parameters including Secchi disk transparency (SDT), temperature, and dissolved oxygen, and on a 3-year rotation basis will monitor the pond for Chlorophyll-a and Total Phosphorus.

MDEP conducts Secchi disk trend analysis every two years as part of their Integrated Water Quality Monitoring and Assessment report. Trend reporting (positive, negative or stable) will assist in determining whether the plan meets its goal of having stable or improving water quality over time.

Appendix A. Water Quality Data for Torsey Pond

WATER QUALITY: Year	SECCHI DISK VISIBILITY, meters		TOTAL PHOSPHORUS, parts per billion (ppb)			CHLOROPHYLL-A, ppb			OXYGEN DEPLETION
	Mean	Minimum	Mean, epilimnion	Spring	Late Summer, epilimnion	Mean	Max.	Late Summer values	Upper limit of anoxia, meters
1981	5.5	4.6			11	4.1	6.6	3.4	
1982	5.8	5.2			9	3.2	4.0		
1983	5.2	4.2							7
1984	6.0	5.3							7
1985	5.6	4.9		8					9
1986	6.0	5.4		10					9
1987	5.5	4.6							8
1988	5.5	4.0			8				7
1989		4.7							7
1990	5.5	3.5		11					7
1991	6.0	5.6	10	8	8	3.3	4.6	3.8	7
1992	6.0	5.5			10			2.3	7
1993	6.0	4.5			9			4.5	8
1994	5.5	4.0	10	8	9	4.6	6.3	4.3	7
1995	6.3	5.9			10			4.6	8
1996	5.7	4.0			8			3.4	7
1997	5.8	4.0	10	9	11	5.3	8.4	6.8	8
1998	5.8	5.2			7			5.8	6
1999	5.9	3.8			9			3.8	7
2000	5.7	4.3	12	11	8	4.3	7.0	5.1	7
2001	6.6	5.9			12			4.4	7
2002	6.0	4.2			11			3.8	7
2003	6.7	4.8	9	9	11	3.7	4.7	4.4	8
2004	5.9	4.7			12			5.5	7
2005	6.0	5.0			12			2.9	7
2006	5.9	4.7	9	9	9	3.9	4.8	2.9	7
2007	6.4	5.6							8
2008	6.5	5.6			9			2.8	7
2009	6.4	5.4	8	12	7	4.1	5.2	3.6	7
2010	6.0	4.2							7
2011	6.1	4.9							8
2012	6.7	5.3	8	9	7	3.7	5.9	2.2	7
2013	6.0	5.0							7
2014	6.2	5.1							7
2015	6.6	4.6	8	7	7	4.0	6.2	4.3	8
2016	6.5	5.4							7
Mean SDT	6.0								

anoxia = oxygen less than 1 part per million

Epilimnion = top layer of warmer, oxygenated water