Shadow Lake Watershed Action Plan Report

Phase 2 - Streams

December 2025

Prepared for:

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Introduction & Purpose

Shadow Lake in Glover, VT has undergone recent hydrologic changes with respect to increased flood activity and the broken dam. A combination of low lake levels and increased sedimentation have revealed large deltaic mounds at many of the lake's stream outlets. Concerned lakeshore landowners contacted the Orleans County Natural Resources Conservation District (OCNRCD) in an effort to learn more about what was causing the appearance of these deltas, and what options landowners had to address them. OCNRCD staff then enlisted the help of the Memphremagog Watershed Association (MWA) to complete stream surveys of all of the lake's major tributaries. This report focuses on the results of those surveys, and does not explore in detail the ongoing situation regarding the lowered lake levels and destabilized dam.

This report is intended to be used alongside the Shadow Lake Watershed Action Plan (LWAP) Phase 1 Final Report completed by OCNRCD and Watershed Consulting in March of 2024. The Shadow Lake LWAP was only partially completed due to funding availability at that time. In Phase 1, the lakeshore, roads, and major stream crossings were thoroughly surveyed, but the streams and their headwaters were not able to be covered. This Phase 2 report attempts to complete the LWAP process and give a full view of the watershed's water quality threats.

This work was funded by MWA's project development grant and the OCNRCD's lakes capacity grant, both awarded by the Memphremagog Clean Water Service Provider (CWSP) with Leahy Great Lakes Fishery Commission funds. Objectives for these grants include identifying and developing potential projects that aim to reduce phosphorus loading and improve fish habitat. This report along with potential water quality project summaries will be submitted as deliverables for these grants, and made available to VTDEC's Watershed Management Division. Landowner outreach will continue for the identified phosphorus reduction and habitat improvement projects following the completion of the assessment report and associated project prioritization tables.

Methods & Process

In May 2025 OCNRCD & MWA staff began assessing Shadow Lake's perennial streams and stormwater inputs to locate contributing sediment sources. These sources are typically areas with accelerated erosion including bank failure, channel headcuts and incision, problematic crossings, and gullying inputs. Rapid stream survey methods were used to evaluate the tributaries. Rapid stream surveys combine data collection methods from the Phase 2 "Lite" Stream Geomorphic Assessments (SGA; VTDEC, 2009) and the VFWD Riparian Streambank Assessment protocols. These surveys map and describe observations such as bank erosion, headcuts, gullies, log jams, beaver dams, stormwater inputs, bank erosion, and grade controls. Rapid stream surveys were completed by walking the streams on foot from the lake outlet to the headwaters. Field observations were collected electronically using MWA's customized ESRI Field Map™. Surveys did not only follow each channel's main stem, but also continued up

ephemeral and intermittent drainages, contributing gullies, or other areas where water quality issues were suspected.

Where discrete potential water quality or habitat improvement projects were identified, a Potential Project Summary Sheet was created using an ESRI Survey123™ form generated by MWA. This digital field form included a project name & identifier, location and property information, description of the problem/opportunity, potential BMPs or other remedies. It also includes possible co-benefits, relevant measurements and metrics (e.g., length, width, & depth of a gully), photos, and other information that was pertinent to phosphorus reduction calculations, cost estimations, or project scoping and prioritization efforts.

Study Area & Survey Findings

The Shadow Lake watershed drainage area is 5.3 square miles (Figure 1). Priority streams to be assessed were identified through a desktop watershed review. These streams were approved for assessment by the VTDEC Basin 17 Watershed Planning Supervisor, Ben Copans. The priority streams include four unnamed perennial tributaries that outlet to the north and south lakeshores, sections of the feeder brook along Perron Hill & Hinman Rd, and a portion of the Daniel's Pond outlet brook (Figure 2). These streams are referred to by the street names that they are nearby. Approximately 4.0 total stream miles were assessed for water quality stressors and opportunities to improve fish habitat.

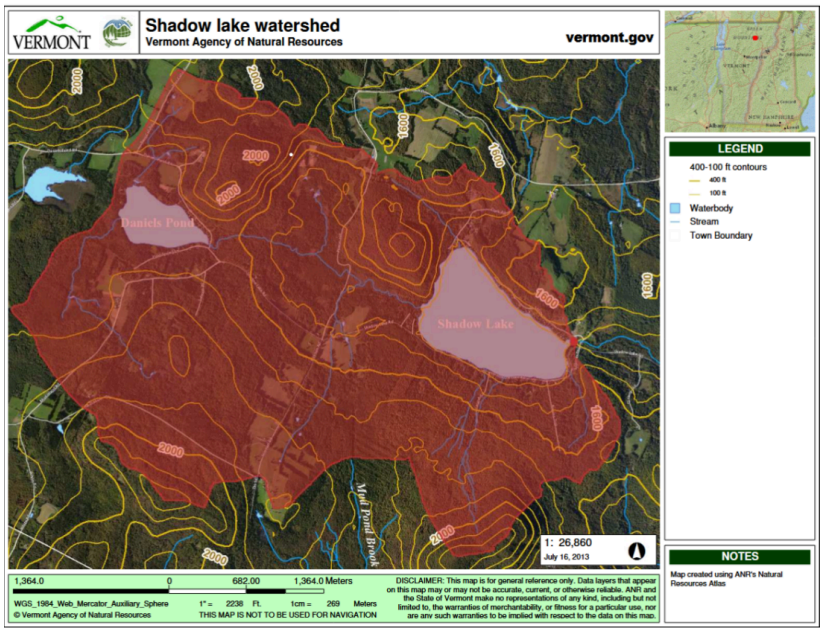


Figure 1: A map of the Shadow Lake watershed and tributaries (https://shadowlakeassociation.org)

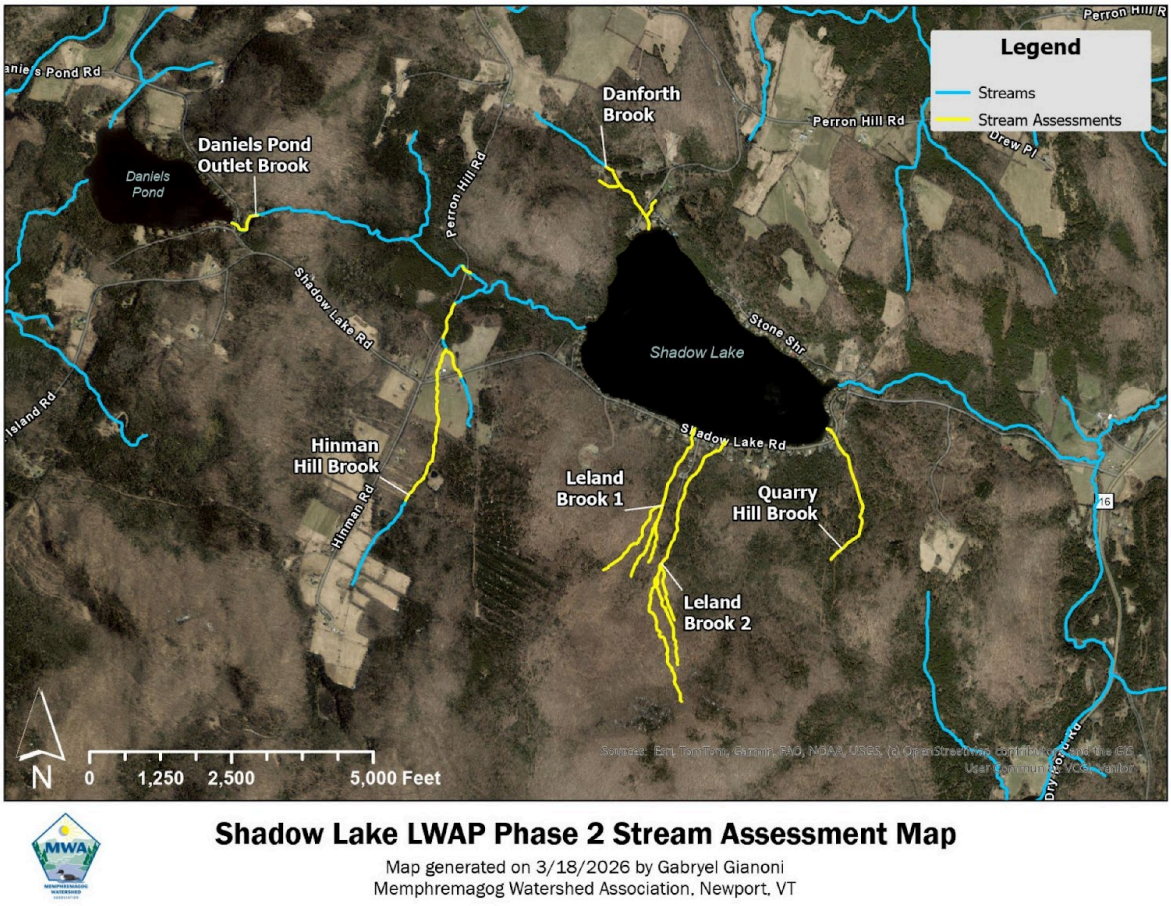


Figure 2: A map of assessed Shadow Lake tributaries in yellow.

More than 200 field observations were recorded during the rapid stream surveys (Figure 3). There were 22 stream crossings documented, including culverts, bridges, and fords. 52 erosive features identified including bank scour and failure, headcuts, gullies, channel incision, and erosion associated with stream crossings. There were over 43 log jams collecting large amounts of sediment and stabilizing steep sections of stream. 23 flood chutes were recorded, which is where the stream split and carved a new channel that reconnected to the stream downslope. This indicates that streams are naturally adjusting and are finding alternative flow paths to help them function during high flow events. 5 wetlands were also documented, 2 of which are not recorded in the VSWI Wetlands ANR map layer.

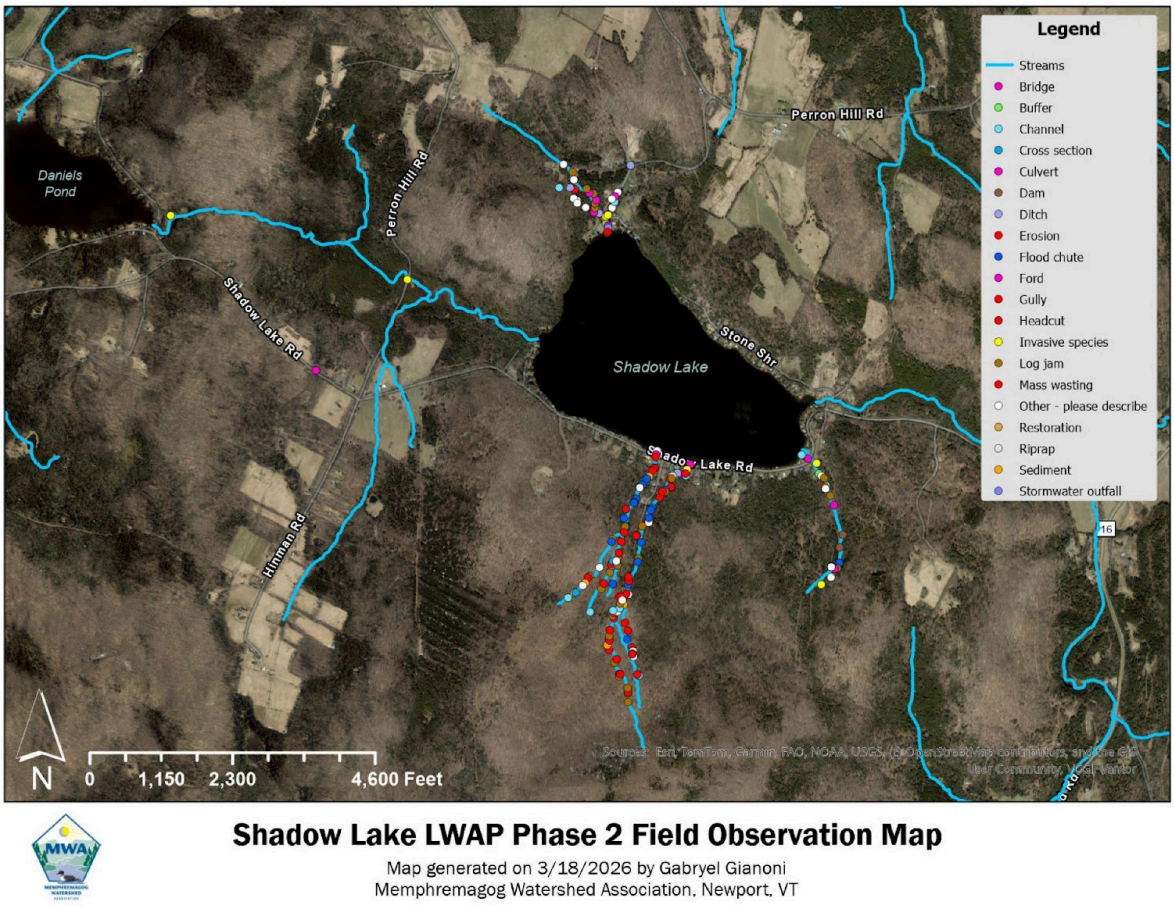


Figure 3: Map of field observation points on the main Shadow Lake tributaries.

Stream Assessment Summaries:

After completion of the rapid stream surveys, stream assessment summaries were written describing the channel conditions and noting key observations. Sediment source locations were identified with a description of the problem and suggested best management practices. Potential clean water and habitat improvement projects are more thoroughly described and documented in individual project summaries (Pages 14-25).

Leland Brook 1 & 2:

The two major tributaries that outlet to the south shore of Shadow Lake near Leland Lane are referred to as “Leland Brook 1 & 2”. Leland Brook 1 is located to the west of Leland Lane (44.664308°, -72.226061°) and Leland Brook 2 is to the east (44.663776°, -72.223874°) (Figure 2). These streams are of particular concern to the landowners near the tributary outlets because of the especially large sediment deposits which complicate lake access and recreational

use. Due to the streams' proximity to one another, their shared forest management, and their similar slopes, flow patterns, and adjustment processes these two brooks are summarized together. The surveys revealed that both streams are actively adjusting to the increased amount of water coming through the system. This can be observed in temporarily increased erosion along banks in the form of moderate undercutting, as well as in the creation of new flood chutes that act to expand the volume of water these channels can hold at one time. The 2023 and 2024 July floods likely exacerbated these changes, although increased rainfall is a trend we can expect to see long into the future.

Both streams have multiple channels that confluence in their headwaters. Each of these channels were surveyed to the top where the water began to seep out of the ground. The headwaters flow down a low grade and are in great condition with little to no incision observed. Downstream of the headwaters are very steep slopes with several step pools, log jams, flood chutes, and contributing forest seep flows. Continuing downstream the main channels become armored with large cobbles and boulders, and pools are filled with fine sediments. There were a few areas of incision where both channels have carved deeper into the landscape. However, this occurred where the grade of the slope was extremely steep, and can be typical of hillsides with highly erodible soils. Evidence of channel widening was observed throughout both reaches. This is a natural process where the outer banks of meanders erode and undercut. Several flood chutes, or side channels have formed as a result of log and rock jams. These chutes and jams allow for sediment deposition and water to get out of its channel to access the adjacent floodplain. Most of these side channels have formed over time and have rocked themselves in, so they are no longer a source of sediment. Having multiple stable channels allows for the flow to be split resulting in lower velocities and less erosive energy working through the mainstem. There was a large amount of dislodged wood observed in the stream. This was probably from blown out log jams during high flow events, causing the sediment previously trapped behind the jam to flow downstream. There were also several headcuts along both tributaries ranging from 0.5ft to 3.5ft as well as a small mass wasting or bank failure event. These erosive features are contributing sediment sources and will be explored for potential to stabilize utilizing clean water funding.

The hillslope hydrology has been altered as a result of past forest management activities which compact soils and concentrate flows particularly in the headwaters. The adjacent forested areas did appear to be stable with very few observations of skid trail or forest road erosion connecting to the brooks. Multiple skid trail fords were encountered and all were stable. There are a handful of areas where forest road acceptable management practices (AMPs) could be improved. Leland Brook 1 has a single washed-out, undersized culvert about 600ft upstream of Shadow Lake Rd. This is a contributing sediment source, and the culvert should be removed and the bank stabilized. Old tire ruts were observed concentrating flows to a ford on Leland Brook 2

about 0.25 miles upstream of Shadow Lake Rd. These ruts are not of high concern and contribute a very low amount of sediment but should be stabilized before they become an issue.

As the streams approach Shadow Lake Rd, the slope becomes less steep, causing sediment to settle in the channel. Leland Brook 1 has a very silty streambed, with some bank erosion and scour near the Shadow Lake Road culvert. The lower reach of Leland Brook 2 shows evidence of the channel being reworked following the large flood events. Some streambanks have been riprapped for bank protection, private foot bridges re-installed, and a new drainage ditch installed. Upstream of the Shadow Lake Rd crossing, Leland Brook 2 channel is scoured with observed sediment deposition. The culvert outlets for both tributaries are perched as they enter Shadow Lake due to the lake level influenced by the nonfunctioning dam. The timeline for dam repair is unclear, and the culverts should not be adjusted/regraded to match stream dimensions until the lake level and dam situation is fully fleshed out. If the current lake level becomes the new Mean Water Level, culverts that outlet to the lake should be regraded to improve Aquatic Organism Passage (AOP) and reduce erosion and scour.

Although the above mentioned features contribute to the sedimentation at the outlets of these channels, addressing most or all of these potential areas for stabilization would be unlikely to dramatically decrease the amount of sediment being deposited at these outlets. Natural processes will continue to add sediment to these deltas for the foreseeable future. Additionally, Leland Brook 2's delta was significantly contributed to by road washouts in the recent floods. DEC's lakeshore permitting specialist for the region, Laura Woods, has indicated that she would be able to issue permits for the dredging of these deltas due to their association with recent floods. Making and financing such a decision would be up to the respective landowners.

Quarry Hill Brook:

The tributary that outlets at the southeast corner of Shadow Lake near the public beach access area is referred to as "Quarry Hill Brook" (GPS: 44.664088°, -72.216382°) for the purposes of this report. The stream is in great shape. This is particularly notable considering the very steep grade in some sections and active forest management practices. There is a system of forest roads that are near Quarry Hill Brook, but only two cross the channel. The culvert crossing in the headwaters is undersized, perched 1ft at the downstream outlet, and the inlet header is sloughing rocks into the channel. This structure should be upsized and regraded to match the channel dimensions. This would make the structure more flood resilient and reduce scour below the perched culvert. If structure replacement and regrading is not feasible, consider stabilizing both the inlet header and the stream below the outlet with stone armoring to

minimize erosion. AOP is not a huge concern because there are steep waterfalls downstream that act as a fish barrier. The second forest road crossing is a bridge about halfway up the channel, which is stable and of no concern.

There is a retaining pond near the upstream culvert that appeared stable. The substrate in the upper reaches is made up of smaller cobbles and fine silt and sand. Moving downstream of the culvert is a small, abandoned beaver wetland rebounding with woody vegetation. The old beaver dams are breached but are still trapping sediment and the channel has not become incised. The stream starts to have a moderately steep grade downstream of the wetland and then gets progressively steeper with cascades and waterfalls below the bridge. These steep reaches are lined with large cobbles and boulders that naturally armor the banks and bed of stream. There are a few log jams and flood chutes that have formed in these stretches as well, both signs of healthy stream habitat and adjustment.

At the base of the slope the stream flows into a small wetland area near Shadow Lake Rd. There is an opportunity to improve 100ft of woody buffer along the left bank of the stream where it abuts a private lawn. This would enhance habitat and filtration of nutrients within the stream's sensitive riparian zone. The wetland does have a patch of invasive goutweed that should be treated before further spread occurs. The Shadow Lake Rd culvert is perched 2ft at the outlet. This is an AOP issue that should be addressed. Consider regrading structure to improve AOP. From the crossing, the stream flows 120ft to the lake with a retaining wall along the right bank. If the retaining wall fails, consider removing and installing engineered soil lifts with native vegetation to stabilize the bank.

Overall, the Quarry Hill Brook is dominated by natural conditions and requires very little intervention. It does not present a significant threat to Shadow Lake's water quality, and should weather future flood events well.

Danforth Brook:

The tributary that intersects Danforth Road and outlets on the north shore of Shadow Lake is referred to as "Danforth Brook" (44.674921°, -72.229369°) in this report. The survey covered the length of the channel from the lake to the private road crossing about a quarter mile west of Clark Rd as well as its ephemeral streams. The assessment revealed that portions of this reach are more significantly impacted by forested land use types including logging and sugarbush operations. These uses have resulted in some instances of erosion, gullying, and unstable banks that should be stabilized through the bolstering of acceptable management practices (AMPs) and considering alternative best management practices (BMPs) that go above and beyond forest management expectations.

The private drive culvert at the top of the surveyed reach is undersized and a flood risk. There is a large deposit of road materials ponding and damming off the channel below the culvert outlet. The culvert was most likely overtopped during a recent flood event and washed the road out into the stream. Consider upsizing the structure and removing excess material for the channel to flow naturally. This would greatly reduce the risk of structure failure and the stream overtopping the road and potentially heading down the private drive.

Downstream of the culvert, the channel is moderately sloped with several sediment trapping log jams. The streambed substrate consists of smaller cobbles, gravels, and fines. Two forest road crossings were observed, the upper being a removed log pole ford that was stable and the lower is a problematic culvert. The culvert is greatly undersized which resulted in the road washing out around it. This structure should be removed and replaced with a stabilized ford or a properly sized and graded pipe to improve flood resiliency. If this is a logging structure, it should have been removed during site closeout.

There are two gullying ditches that confluence Danforth Brook upstream of Danforth Rd. The upper gully is in a steep and erosive ditch dug out of the seepy forest for access to a sugarbush. The gully should be stabilized with woody checks to arrest erosion and trap sediment where it is most erosive. Consider turning the ditch out where it is possible to break up flows. The lower gully confluences just above Danforth Rd and is on a forest road used to access a spring box. The road is on a seepy slope where flows are concentrated on the road and in the ditch, where it is gullying. The road and ditch need several disconnection practices in place to direct flows to the forest to be infiltrated, preventing it from emptying sediment into Danforth Brook. Consider installing frequent waterbars, broad based swales, and turnouts along the road and ditch to break up flows and reduce erosive forces. Alternatively consider removing and obliterating the road and ditch to restore hillslope hydrology.

The Danforth Rd culvert is undersized with an eroding outlet header and is an AOP issue from the perched outlet. Upsize and regrade the structure to match the upstream and downstream dimensions and grades. This will reduce erosion and improve AOP and flood resiliency. Downstream, the stream substrate is mostly gravels and fine silts and sand. The channel is slightly incised and is lacking a robust woody buffer along the right bank. This presents an excellent opportunity to plant a riparian buffer and allow native revegetation to improve bank stability, habitat, and filtration of stormwater.

There is a small channel that confluences Danforth Brook below the Maynard Drive crossing. This channel forms from a rocky forested seep off Clark Rd and flows into a small wet meadow above Maynard Drive. The stream flows through a cobbly forest reach before crossing Maynard Dr and meeting with Danforth Brook. The stream crossing has an eroding outlet header from runoff that could be stabilized. Clark road has road runoff that is hydrologically connected to the

small channel. Road runoff flows off the road shoulder and down a steep slope where it deposits road materials in the small channel. A runoff path also flows down the side of Clark Rd and down to the Maynard Drive crossing. Consider installing armored turnouts with woody slash below them to direct water to stable areas where the erosive energies can be dissipated. Alternatively, consider insloping the road to direct water into the ditch on the other side of the road. This would involve installing more robust ditch management practices such as stone lining, check dams, and frequent drainage cross culverts. Additionally, there is a small population of the invasive species Japanese knotweed between Clark Road and the unnamed stream that should be removed to prevent further downstream spread and eventual contamination of the lake.

Hinman Brook:

The stream that feeds into Shadow Lake from Daniels Pond has multiple tributaries, in this report “Hinman Brook” refers to the branch that flows adjacent to Hinman Rd & Perron Hill Rd. The upper reach along Hinman Rd is in relatively good condition, flowing through a section of contiguous forest with a low to moderate grade slope. The headwaters split into multiple small channels that flow through seepy areas. Going downslope, there are a handful of stream crossings that are undersized and slightly perched but are functioning and mostly stable. A portion of Hinman Brook is diverted to a pond where the outlet pipe is perched and there is sediment deposited below.

The channel flows out of the forest and onto a parcel with a hay field and narrow woody riparian buffer. This stream reach has small to large cobbles and is stable. There is opportunity for the stream buffer and no mow zone to be widened to improve habitat and filtration of runoff and nutrients. The brook is steep and armored with large boulders for a small stretch as it approaches Shadow Lake Rd. The Shadow Lake Rd crossing is undersized, and the downstream outlet could not be surveyed without landowner permission. It would benefit the health of this stream if the structure were upsized to match stream dimensions. Downstream of the crossing, the brook flows through an agricultural field that lacks a woody buffer. This is another opportunity to plant a vegetated buffer. Also, an exclusion fence could be installed to keep any grazing livestock out of the channel. There are two manmade agricultural ponds nearby that impact a smaller branch to this tributary. The removal and subsequent remediation of these ponds would benefit natural stream and wetland hydrology while minimizing the risk of future unplanned failures. Downstream of these ponds Hinman Brook then flows into floodplain forest and then to a large undeveloped wetland before entering Shadow Lake.

Daniel's Pond Outlet Brook:

Only a short portion of Daniels Pond Outlet Brook (44.674412°, -72.257029°) was assessed from Daniels Pond to the wetland upstream of Shadow Lake Rd. This reach has structures that are very close to the channel and should consider installing no mow zones and a woody buffer as space allows. The wetland channel is slightly incised and has woody vegetation established. There is a small patch of invasive phragmites in the wetland that should be removed to prevent further spread into the wetland.

Besides the few concerns listed above, this channel appears healthy. The extensive wetland complex that buffers either side of the stream as it moves towards Shadow Lake provides vital ecological services both for habitat, flood resiliency, and watershed health overall.

Additional Watershed Suggestions

- The growing deltaic mounds where sediment is being deposited at the outlets of the lake's tributaries are a blank slate for vegetative regrowth. These are likely locations for the introduction of invasive species such as japanese knotweed (*Reynoutria japonica*) and common reed (*Phragmites australis*). Continuous monitoring of these sites in conjunction with the proactive planting of native species can prevent the spread of invasives and encourage the establishment of additional lakeshore habitat.

- The few wetlands within the watershed should be prioritized for preservation and protection. They are an invaluable resource that slow and store flood waters and sediment while also providing critical habitat that fosters a hotbed of biodiversity.

- Unless located directly upstream of a crossing (like a bridge or culvert), allow fallen woody debris such as dead trees, branches, and leaf litter to remain in stream channels. This debris provides important habitat for aquatic organisms, and also helps to capture sediment, slow stormwater, and generally benefit watershed health.

- Any privately or municipally owned stream crossings require monitoring and maintenance. If a culvert becomes plugged up by sediment and debris it can result in catastrophic failure during the next high flow event. This leads to a loss of tax dollars, privately owned funds, travel delays, and degradation of ecosystem health. To prevent this, private citizens can and should monitor nearby crossings for any potential blockages and clear such obstructions *before* they result in more costly problems. This can often be accomplished with a shovel and a pair of workboots.

- Developed and actively managed lands such as open lawns and hayfields convey stormwater and many contaminants across overland flow without allowing for significant infiltration. This is why it is important to “buffer” any surface water such as a stream or lakeshore with robust woody vegetation such as trees and shrubs. These woody species’ complex root systems help to stabilize steep banks while infiltrating and slowing stormwater running across otherwise open areas. There are many areas within this watershed where a riparian or lakeshore buffer could be added.

Project Summaries

12 discrete potential projects were identified during the stream assessments. Individual project summaries were created for each potential project. The projects were then prioritized based on MWA’s LWAP and project development criteria. You can find both the criteria and the table of prioritized projects hyperlinked in the appendices below.

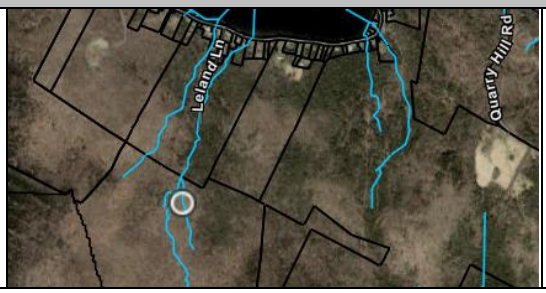
- Appendix A: Prioritization Criteria [click here to review]
- Appendix B: Prioritization Table [click here to review]

On the following pages you will find each of the project summaries.

A picture of the “Ebony Jewelwing” (Calopteryx maculata) spotted in a wetland draining into Shadow Lake during field assessments.

Potential Project Name: Headcut stabilization along unnamed Shadow Lake Stream off Leland Ln in Glover

Project Type:	Floodplain/Stream Restoration - Preliminary Design
Lat/Long	44.656889, -72.228053
Land Ownership:	Private - VLT Easement



Description: Several headcuts and gullying stream reaches along Leland Ln Brook East tributaries ranging from 1ft to 5ft. Multiple stream sections with unstable streambanks.

3ft headcut on channel.

BMP Description: Consider stabilizing headcuts with wood and creating step pools below to reduce scour and improve stability.

WQ Benefits	Landowner Interest	Cost / Feasibility	O&M / Longevity	Co-Benefits	Total Score
14	0	4	2	3	23

Phosphorus Reduction: 5.9 kg/P/yr

Landowner Interest: VLT is interested in implementing the work. Will Marlier is connected with the landowner.

Cost / O&M: $15,000-30,000, Low expense & labor requirements

Notes/Comments: This potential project is on a VLT conservation easement and is managed for timber. Phosphorus reduction value reflects 10 headcuts being stabilized on 3 perennial channels in the headwaters. Each headcut reduces 0.59 kg/P/yr, totaling 5.9 kg/P/yr. Co-benefits include addressing a chronic problem area, improving potential fish habitat, and sustainable timber harvest land use compatibility. Permits include stream alteration and army corps general permit.

Potential Project Name: Buffer planting along unnamed Shadow Lake brook near Perron Hill Rd in Glover

Project Type:	River - Planting
Lat/Long	44.674398, -72.229037
Land Ownership:	Private

Description: The headwaters of this Shadow Lake brook start at two ditches at the base of a hay field that feeds into a pond before continuing downslope. The first ditch is 350ft long and the second ditch is 200ft long.

Google maps image of ditch and pond in headwaters.

BMP Description: Opportunity to plant a woody riparian buffer planting. Evaluate for erosion within ditch and consider installing check dams if downcutting. Potential to remove pond and plug ditches to restore wetland and hillslope hydrology if landowners choose to cease hayfield management.

WQ Benefits	Landowner Interest	Cost / Feasibility	O&M / Longevity	Co-Benefits	Total Score
10	0	5	2	2	19

Phosphorus Reduction: 1.07 kg/P/yr – potentially not eligible for P crediting if deemed a non-perennial stream.

Landowner Interest: No contact made.

Cost / O&M: $10,000 – $15,000 including plants and installation (planting estimated to cost roughly $7,000), Moderate cost and low maintenance.

Notes/Comments: No permission was obtained to walk this section of stream. Property needs to be assessed to further understand the extent of restoration potential. Assumed a 35ft buffer and costs estimated using the DEC average buffer cost. If considering ditch and pond removal, potential phosphorus reduction to restore 1.7 acres of wetland = 3.6 kg/P/yr going from moderate to high floodplain connectivity. Co-Benefit - improves existing BMPs and is compatible with agricultural land uses. No permits are required for planting a buffer, as planting is an exempt permitting practice.

Potential Project Name: Ditch stabilization along an unnamed Shadow Lake Brook off Clark Rd in Glover

Project Type:	Forestry - Design
Lat/Long	44.676033, -72.231065
Land Ownership:	Private

Description: Ditched channel within sugarbush is gullying. Ditch is 11ft wide x 5.5ft deep in most erosive section.

Unraveling ditch among saplines within sugarbush.

BMP Description: Consider stabilizing ditched channel with woody check dams to reduce water velocities, erosion, and sediment loading.

WQ Benefits	Landowner Interest	Cost / Feasibility	O&M / Longevity	Co-Benefits	Total Score
10	0	5	2	2	19

Phosphorus Reduction: 0.93 kg/P/yr

Landowner Interest: No contact made.

Cost / O&M: $10,000 - $15,000. Low cost and maintenance.

Notes/Comments: Phosphorus reduction calculations were conservative given the average dimensions of the gully were on the small end. Co-benefits include improving flood resilience and sustainable timber harvest land use compatibility. Potential permits include a Stream Alteration permit, Army Corps General permit, and wetlands general permit.

Potential Project Name: Forest road & streambank stabilization on unnamed brook off Leland Ln in Glover

Project Type:	Forestry - Design
Lat/Long	44.661381, -72.226579
Land Ownership:	Private

Description: Opportunity to improve forest Acceptable Management Practices (AMPs) and stabilize erosive stream features to reduce sediment loading.

1. Forest road crossing improvement - Blown out forest road culvert crossing with exposed structure (44.675424, -72.230621).
   - BMP Description: Remove structure and regrade channel, consider replacing with a ford, or upsize structure. Decommission road per AMPs if forest management activities are complete.
2. Shallow tire rut gullies on steep soggy slope connected to brook at ford crossing (44.661381, -72.226579).
   - BMP Description: Diver flow to or stabilize tire ruts. Consider installing waterbars above stream crossing to reduce sediment loading. Address issue before road begins to erode further. Decommission road per AMPs if forest management activities are complete.
3. Headcut from seepy slope concentrating flow on an old forest road (44.660666, -72.227234).
   - BMP Description: Stabilize and improve disconnection practices.
4. Mass wasting streambank stabilization - bank soils are sloughing and actively eroding (44.660435, -72.22817).
   - BMP Description: Stabilize the toe of the slope or deflect high velocity flows with woody materials.



1 - Washed out culvert crossing, 2 - tire rut gully to stream, 4 – mass-wasting on streambank.

WQ Benefits	Landowner Interest	Cost / Feasibility	O&M / Longevity	Co-Benefits	Total Score
11	0	5	2	3	21

Phosphorus Reduction: 2.46 kg/P/yr total including culvert removal/replacement = 1.77 kg/P/yr, road gully erosion improvements = 0.192 kg/P/yr, forest road stabilization = 0.087 kg/P/yr, and mass wasting stabilization = 0.41 kg/P/yr

Landowner Interest: No contact made.

Cost / O&M: $10,000 -15,000, Low cost & maintenance.

Notes/Comments: Co-benefits include improving existing BMPs and flood resilience, and sustainable timber harvest land use compatibility. Potential permits include stream alteration and an army corps general permit

Potential Project Name: Buffer planting off unnamed brook off Shadow Lake Rd near beach parking lot

Project Type:	River - Planting
Lat/Long	44.663381, -72.215931
Land Ownership:	Private

Description: Area along an alder wetland lacking a sufficient woody riparian buffer.

Left bank with a small buffer along the wetland.

BMP Description: Consider widening the no mow zone and planting a buffer along left bank to improve bank stabilization, filtration of sediment and nutrients, and wildlife habitat.

WQ Benefits	Landowner Interest	Cost / Feasibility	O&M / Longevity	Co-Benefits	Total Score
4	0	6	2	1	13

Phosphorus Reduction: 0.05 kg/P/yr

Landowner Interest: No contact made.

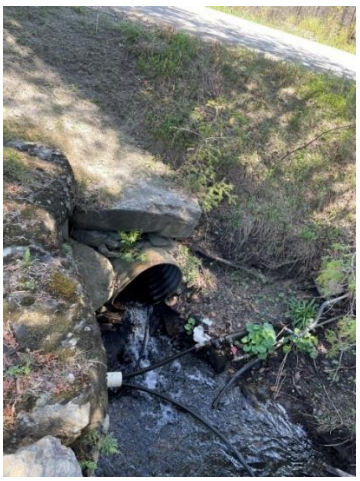
Cost / O&M: Less than $1,000 for plants and install.

Notes/Comments: Assumed a 35ft riparian buffer along a 100ft section of brook and used the DEC average buffer cost to estimate phosphorus reduction values. Co-benefits include enhancing lakeshore natural communities. No permits are required, as buffer plantings are exempt practices.

Potential Project Name: Culvert upgrade below Shadow Lake Rd along unnamed brook near beach parking lot

Project Type:	Floodplain/Stream Restoration - Preliminary Design
Lat/Long	44.664103, -72.216645
Land Ownership:	Town

Description: A 2ft diameter CMP culvert with a 2ft perch is preventing aquatic organism passage (AOP). The left bank is eroding, and the right bank has a retaining wall that continues to the lake.



Perched culvert outlet.

BMP Description: Consider upsizing structure to match stream dimensions. Upgraded crossing should consider aquatic organism passage (AOP) if fish are present. Stabilize outlet and streambanks around culvert to reduce scour and improve flood resiliency.

WQ Benefits	Landowner Interest	Cost / Feasibility	O&M / Longevity	Co-Benefits	Total Score
10	0	4	1	4	19

Phosphorus Reduction: 0.89 kg/P/yr

Landowner Interest: No contact made.

Cost / O&M: $15,000 – $30,000, moderate cost and maintenance requirements.

Notes/Comments: Alder wetland upstream of crossing. Reduced Aquatic Organism Passage (AOP) due to low lake level caused by the damaged dam. Consider holding off on culvert upgrades until dam is repaired or the new lake level has been established. Co-benefits include improving existing BMPs, fish habitat, flood resiliency, and enhances lakeshore natural communities. Culvert replacement may require a Stream Alteration permit, Army Corps General permit, and wetlands registration. Cutting of trees greater than 3" diameter may impact potential bat roosting habitat.

Potential Project Name: Forest road stabilization along an unnamed Shadow Lake brook off Danforth Rd in Glover

Project Type:	Forestry - Design
Lat/Long	44.675424, -72.230621
Land Ownership:	Private

Description: Gullying forest road and ditch that is eroding and concentrating flows to the stream. Gully originates above springs alongside road and continues down the road surface and into the ditch. Undersized forest road crossing upstream of the outlet to the brook with evidence of overtopping.

Forest road ditch gullying (left) and undersized cross culvert (right).

BMP Description: Stabilize forest road and apply disconnection practices such as waterbars, swales, and turnouts. Upsize crossing structure to allow passage of high flows. Consider closing out road sections that are no longer in use. Opportunity for road decommission or road obliteration methods to restore hillslope hydrology and reduce sediment loading.

WQ Benefits	Landowner Interest	Cost / Feasibility	O&M / Longevity	Co-Benefits	Total Score
12	2	5	2	2	23

Phosphorus Reduction: 6.21 kg/P/yr

Landowner Interest: Landowner is interested.

Cost / O&M: $10,000 – $15,000, Low cost and maintenance

Notes/Comments: Phosphorus reduction value includes 5.32 kg/P/yr (forest rd) + 0.89 kg/P/yr (culvert upgrade), note that forest road phosphorus calculations are expected to be reduced following the reworking of the forest road interim P calculator. Co-benefits include improving existing BMPs and sustainable timber harvest land use compatibility. Potential permits include Stream Alteration permit, Army Corps General permit, and wetlands registration. Cutting of trees greater than 3” diameter may impact potential bat roosting habitat.

Potential Project Name: Buffer planting and pond removal along unnamed brook near Parron Hill Rd in Glover

Project Type:	River – Planting; Wetland Restoration - Preliminary Design
Lat/Long	44.666385, -72.243369
Land Ownership:	Private

Description: Stream with adjacent hay fields and a narrow woody, riparian buffer. There are two ponds on the property.

Steam section without a buffer downstream of Shadow Lake Rd.

BMP Description: Consider planting a woody riparian buffer along several stretches of stream. Widen buffer and interplant in other stretches. Opportunity to decommission ponds and restore wetlands.

WQ Benefits	Landowner Interest	Cost / Feasibility	O&M / Longevity	Co-Benefits	Total Score
11	1	4	1	3	20

Phosphorus Reduction: 7.67 kg/P/yr

- 1.8 acre buffer planting = 4.05
- 0.8 acre wetland restoration = 3.62 kg/P/yr

Landowner Interest: VLT is interested in implementing the work.

Cost / O&M: $15,000 - $30,000, Moderate cost and low maintenance.

Notes/Comments: VLT conservation easement on property. VLT owns the property is actively looking to sell to an agricultural producer. P calcs assumed a 35ft buffer. Costs estimated using the DEC average buffer cost. Co-benefits include improving existing BMPs and fish habitat and is compatible with agriculture land use needs. Potential permits may include Stream Alteration, Army Corps General permit, and wetlands restoration waiver.

Potential Project Name: Culvert upgrade off Danforth Rd in Glover

Project Type:	Floodplain/Stream Restoration - Preliminary Design
Lat/Long	44.674989, -72.229439
Land Ownership:	Private

Description: A 15-in-diameter CMP culvert is undersized and has a 1.3-ft perched outlet. The outlet header is failing. Structure does not provide aquatic organism passage (AOP) and poses a fluvial erosion risk during floods.

Undersized culvert with a perched outlet and eroding header.

BMP Description: Consider replacing structure with larger pipe. Ensure pipe is installed to provide full AOP if trout are present in stream.

WQ Benefits	Landowner Interest	Cost / Feasibility	O&M / Longevity	Co-Benefits	Total Score
11	2	4	1	4	22

Phosphorus Reduction: 1.77 kg/P/yr

Landowner Interest: Contact made.

Cost / O&M: $15,000 - $30,000, moderate expense & labor requirements

Notes/Comments: Reduced Aquatic Organism Passage (AOP) Co-benefits include addressing a chronic problem area, improving fish habitat and flood resiliency, and enhancing lakeshore natural communities. Work beyond road the ROW may require Stream Alteration permit, Army Corps General permit, and wetlands registration. Cutting of trees greater than 3” diameter may impact potential bat roosting habitat.

Potential Project Name: Road Erosion BMPs off Clark Rd in Glover

Project Type:	Road Project - Implementation
Lat/Long	44.67551, -72.22881
Land Ownership:	Town

Description: Steep road section with insufficient disconnection practices and gullying ditch. Seems to be recently worked, but few opportunities for disconnection practices due to adjacent hillslopes. Observed one cross culvert halfway down the road with a steep and eroding outlet. Garder berms present.

Clark road runoff paths, ditches, and road runoff deposits near stream.

BMP Description: Consider installing check dams and or stone lining in the ditch. Add cross culvert and/or disconnection practices where feasible. Remove grader berms and stabilize cross culvert outlet.

WQ Benefits	Landowner Interest	Cost / Feasibility	O&M / Longevity	Co-Benefits	Total Score
9	0	5	1	3	18

Phosphorus Reduction: 0.072 kg/P/yr

Landowner Interest: No contact made.

Cost / O&M: $10,000 - $15,000, Low cost and maintenance.

Notes/Comments: Co-benefits include improving existing BMPs, flood resiliency, and enhances lakeshore natural communities. No permits are required if work is limited to the existing road ROW. Work beyond road ROW may require Stream Alteration permit, Army Corps General permit, and wetlands registration. Cutting of trees greater than 3" diameter may impact potential bat roosting habitat.

Potential Project Name: Road Erosion BMPs along Maynard Dr in Glover

Project Type:	Road Project - Implementation
Lat/Long	44.674911, -72.229131
Land Ownership:	Private

Description: Road runoff from Clark Rd connects flows to unnamed tributary. Approximately 80ft of Maynard Drive flows to the stream crossing.

Road runoff flowing from Clark Rd to Maynard Dr crossing.

BMP Description: Regrade road surface to improve sheet flow to adjacent wooded areas, consider installing a waterbar and or turnout to disconnect concentrated flows.

WQ Benefits	Landowner Interest	Cost / Feasibility	O&M / Longevity	Co-Benefits	Total Score
9	0	6	2	2	19

Phosphorus Reduction: 0.036 kg/P/yr

Landowner Interest: No contact made

Cost / O&M: $5,000, Low expense & labor requirements

Notes/Comments: Co-benefits include improving existing BMPs and enhancing lakeshore natural communities. No permits are required if work is limited to the existing road ROW.

Potential Project Name: Buffer planting along unnamed brook and Shadow Lake confluence off Danforth Rd in Glover

Project Type:	River - Planting
Lat/Long	44.674398, -72.229037
Land Ownership:	Private

Description: Lakeshore and stream have inadequate woody buffer. Stream outlet with large delta of sediment.

Shadow lake shoreline and stream outlet without a woody buffer.

BMP Description: Widen no mow zone and plant a woody buffer to improve filtration of nutrients, wildlife habitat, and shoreline & streambank stability. Consider planting low-growing woody species to maintain viewshed. Consider planting native wetland species throughout exposed delta sediments.

WQ Benefits	Landowner Interest	Cost / Feasibility	O&M / Longevity	Co-Benefits	Total Score
5	2	6	2	2	17

Phosphorus Reduction: 0.16 kg/P/yr

Landowner Interest: Landowner is interested.

Cost / O&M: Less than $5,000. Low expense & labor requirements

Notes/Comments: Assumed a 35ft buffer width along the lakeshore and brook. Co-benefits include improving fish habitat and enhancing lakeshore natural communities. No permits required as buffer plantings are exempt practices.