Vermont Lake and Watershed Action Plans

Technical Guidelines for Conducting a LWAP

Issues and Objectives, Methods and Assessments, Process, and Reporting

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The Purpose of Lake and Watershed Action Plan

A Lake and Watershed Action Plan (LWAP) is designed to identify and communicate the problems and fixes within a lake watershed to best protect water quality, wildlife habitat, and the lake's ecosystem health. These plans answer the questions "what issues threaten the health of our lake the most?" and "what can we do about them?"

♦ Why Conduct a LWAP?

A Watershed is…
All the land area that drains to a common body of water, like streams and runoff from all the land uses in the area draining to Coles Pond below in Jamaica, VT.

According to a U.S. Environmental Protection Agency (USEPA) study of lakes across the country, the health of Vermont's lakes has been measured to be lower than both the northeast region and the national average in terms of percent of shoreland that is either in fair or poor condition, as measured by the extent of clearing, lawns, and development near the shoreline. When a lake's natural vegetation is removed and replaced by lawns and impervious surfaces, fish and wildlife habitat degrades, shores erode, nutrient loading to the lake increases, and the lake is more vulnerable to water quality problems such as algae blooms. Cleared shores are also more susceptible to erosion during flood events.

In addition to the threats from shoreland development, lakes receive stormwater runoff from other land uses in the watershed, including roadways. Each lake has its own set of public roads, private roads, and driveways and how these are managed will have an influence on the lake's condition. The LWAP will determine the extent of impact from road systems on lake water quality and highlight the stretches in most need for improvement to reduce erosion and runoff.

Additionally, tributary flow and loading of phosphorus and sediment to a lake can fuel aquatic plant beds, negatively impact recreational use, and lead to increases in a lake's nutrient levels, which in turn can lead to algal blooms. A greater understanding of the tributaries of concern will be determined through a LWAP and planning can occur to mitigate any identified issues.

Ultimately, the purpose of a LWAP is to provide clear guidance on the steps for protecting a Lake and its watershed and maintaining or improving its current condition. When a lake's ecosystem is healthy, then Vermont residents can enjoy or benefit from all the existing uses they are accustomed to in these water bodies, such as recreation, aquatic habitat, and aesthetic conditions.[1]

♦ LWAP Description

A Lake Watershed Action Plan (LWAP) is an assessment to identify the greatest threats to the lake ecosystem, including impacts on water quality and wildlife habitat from stormwater runoff and from altered, cleared, or converted shorelands. LWAPs are designed to answer specific concerns about each lake, for example, what land uses within the watershed cause the greatest stress to a lake ecosystem. Each lake has different land use patterns and understanding exactly which ones are causing

[1] (See Section 7 for more info on a specific lake conditions and how to access the Vermont Lake Score Card.)

degradation to the lake will help guide restoration and protection efforts. The LWAP assesses and compares the varying land uses and provides a ranking of the greatest threats to the lake along with recommendations for fixing the problems. A LWAP combines an assessment of a lake's shoreland, tributaries, and hydrologically connected roads and leads to an individual planning guide that prioritizes restoration and protection actions for that lake. A LWAP can also help identify cumulative impacts on a lake ecosystem, thereby helping lake stakeholders "see the bigger picture" and identify situations where the combination of individual stressors may be leading to declines in lake health.

A LWAP is an investigation into potential threats to the lake's ecosystem health, and the process should be participatory with the lake association or similar local organizations, lake users, shoreland owners, the Town, and other stakeholders or interested groups and people. A LWAP Final Report will also include a list of prioritized problems and solutions and provide a table of projects. This prioritized list of projects and strategies is intended to address the sources of pollution and habitat degradation identified in the assessment, with some of these projects benefitting from preliminary ecological and conceptual design work as part of the LWAP development process. The prioritized list of projects can feed into the DEC Watershed Projects Database and be considered for funding under the Clean Water Initiative Program (CWIP) and other sources. Given CWIP's focus on meeting water quality restoration targets, often contained in Total Maximum Daily Load (TMDL) Phosphorus Reduction Plans, a project must have a primary objective of *water quality improvement* if is to be considered for CWIP funding. The LWAP may also contain recommendations to preserve natural features and functions of a lake and its watershed, encourage use of low impact green stormwater infrastructure, and maintain the aesthetic and recreational uses of lakes.

♦ Economics

Today, Vermont lakes offer a wide variety of recreational opportunities. Some people visit a lake for just a day, but many people own homes or camps located on the lake shore. The presence of lakes in Vermont has an important impact on the economy of both local areas around the lakes as well as for the entire state.


Lake Sunrise.


Barry Solomon

People come to watch birds and wildlife and to enjoy nature. Hunting and fishing for recreational purposes are also very popular and are an important part of the economy of Vermont. According to the VT Boating Association, sport fishing, pleasure boating, sailing, as well as the summer influx of cruising vessels from out of state and Canada adds up to over 750 million dollars into Vermont's economy every year**.** And, according to the Lake Champlain Basin Program total tourism-related expenditures in the Basin, were estimated at $3.8 billion in the late 1990s. Vermont's clean and healthy lakes help generate a strong economy, and LWAPs are a tool to help Vermonters maintain excellent water quality in and around their lakes. For example, a recent UVM study estimates that if phosphorus inputs to Missisquoi Bay of Lake Champlain are eliminated, local tourism

will increase by $28.5 million and property sales by $11.2 million between now and 2050.[2]

Objectives

♦ Four Main Objectives

1. Produce a Report based on a survey of a lake's watershed, identifying the primary sources of water quality and habitat degradation impacting the lake condition, including the health of the shoreland buffer and for sources of phosphorus and sediment loading to the lake. The LWAP Report will include a ranking of the greatest threats to a lake and best solutions to mitigate the issues.

2. Involve community members in learning how they are the most essential solution for clean and healthy lakes. In most watersheds, more than 85 percent of land is privately owned and without public participation in the LWAP process, few solutions can be applied without private property participation.

3. Within the Report, provide a map and an estimate of relative sediment and phosphorus load from each of the primary "sectors" of a lake's watershed into the Lake. The LWAP should strive to utilize existing load estimates if available from an existing study or TMDL.

4. Identify and Prioritize between 10-30 projects, including shoreland BMPs, that can be implemented in the lake watershed to address lake stressors. The LWAP should also prioritize these projects using evaluation criteria based on: Relative phosphorus loading; water quality benefits; project feasibility; maintenance requirements; costs; and any additional benefits. Finally, the LWAP can include conceptual designs (roughly 30% design) for at least five of the priority projects.

The LWAP GOAL

The goal of a LWAP is to evaluate water quality conditions and related stressors in a lake and its watershed to identify the greatest threats to the lake ecosystem, including sources of increased stormwater runoff and associated sediment and nutrients as well as other important stressors such as invasive species, habitat loss, erosion, and other threats that may lead to loss or degradation of defined uses under the Vermont Water Quality Standards.

♦ Which Lakes Have LWAPs?

Initial Lake Watershed Action Plans in Vermont were developed through a collaborative effort between Fitzgerald Environmental Associates LLC and the Lamoille County Conservation District, with support from the VTDEC Watershed Planning Program and Lakes and Ponds Program staff. The initial LWAPs, developed at Lake Eden and Lake Elmore, generally followed the VT Agency of Natural Resources (ANR) Stormwater Master Planning Guidelines and have similar water quality restoration goals. These LWAPs made adaptations needed to ensure that the assessments were suited to these lake watersheds in Lamoille County, where the impervious surface area is not the primary focus.

Citizen lake watershed surveys have been taking place in Vermont for decades using a "Citizen Lake and Watershed Survey" approach intended to help a lake association, town conservation or planning commission, and other concerned parties learn about what kinds of problems or activities may be affecting a lake, and to aid decisions about what to do to protect or improve a lake's water quality and mitigate any stressors to that lake. These citizen surveys were a useful approach to identify problems affecting a lake, but needed stronger local leadership for the implementation of projects to address

[2] Gourevitch J.D. et al., Quantifying the social benefits and costs of reducing phosphorus pollution under climate change, Journal of Environmental Management, Volume 293, 1 September 2021,

these problems, and therefore VT DEC Lakes and Ponds began to support a more rigorous comprehensive and supported approach to project identification using a combination of fieldwork, use of GIS data for spatial analysis, review of existing lake and stream water quality data, and development of a prioritized project list and conceptual designs for a subset of these projects. This approach has now been used on Lakes Eden, Elmore, and Dunmore.

Copies of existing LWAPs can be found on the Lakes and Ponds Program website here: https://dec.vermont.gov/watershed/lakes-ponds/lakeshores-lake-wise/resources

Process

♦ Essential Elements to Conducting a LWAP

- **Local Participation**. From the start, the effort requires local interest and support, and the process must be participatory, led by a lake association (or similar local organization) with input from town conservation or planning commissions and local conservation partners (Conservation Districts or Watershed Groups). Additionally, State Agency expertise and funding (when available) is an important component of LWAP development, particularly for technical expertise to support field assessments. The addition of expertise from private sector consulting firms is also a potentially important element of LWAP development, particularly regarding spatial analysis, project prioritization, and development of conceptual designs. Finally, a clear designation of the roles and responsibilities of each actor in the development of a given LWAP is a useful initial step in any planning exercise.

- **Spatial Analysis**. The use of GIS and other spatial analysis tools, like the ANR Atlas and LiDAR imagery, and VTDEC water quality data to gather existing information about land uses and water quality conditions in the watershed is recommended to define and describe the watershed and guide field survey work. GIS data can include high resolution land cover data for the lake watershed, aerial photography, sub-watershed mapping, impervious surface data, soil data, and parcel data. The spatial analysis should draw from and build on existing datasets,

LWAP Approach Uses Scientific Method

1. Ask a Question.
For most LWAPs, the question being asked is, "What are the greatest threats to the health of the lake ecosystem, including degrading water quality and wildlife habitat?"

2. Design Methods.
- Collect and compile existing monitoring data, GIS and other spatial data information on land use, climate, and topography.
- Conduct field surveys along the shoreland, roadways and tributaries.

Assessments should identify sources of stormwater pollution and the land uses that cause or contribute to stormwater and wildlife habitat loss.

3. Tally Results.
The results of the study should answer whether the Lake has the features in its watershed to prevent and filter stormwater, and if there is at least 70 percent native vegetation along buffer areas for protecting the Lake's biodiversity and resiliency to climate changes, from droughts to floods.

4. Analysis and Communication.
Communication is essential to the success of these Plans. Increased public engagement and participation throughout the LWAP process creates greater interest in learning about the results. Action steps should be clearly conveyed from the results of the LWAP to local stakeholders.

studies, TMDLs, and sector-based assessments to the extent possible. Municipal road assessment and survey information, where available, can also be quite useful in the spatial analysis phase of an a LWAP and in preparing to conduct field assessments.

- **Watershed Data Library / Reference Section**: A watershed data library helps to collect all relevant information on lake and shoreline conditions, stormwater runoff, road assessment, and watershed management into one place to guide further LWAP elaboration. Additionally, new spatial analysis conducted or maps developed with available data to support the LWAP can be included in the watershed data library. Furthermore, water quality data, relevant reports from local groups, existing stormwater master plans and/or river corridor plans are examples of other documents to compile and assess in a watershed data library. Alternatively, a clear reference section at the end of a document can meet these source documentation recommendations and serve the same purpose as a standalone watershed data library.

- **Field Preparation**. To conduct an LWAP, three core areas of field assessment are generally required, and more details about conducting these assessments is provided in the Methods Section below.

♦ Reporting

To date, LWAPs in Vermont have been funded privately, by contributions from lake associations, and with DEC CWIP funding. Lake Champlain Basin Program (LCBP) funds will soon be used to support the development of four LWAPs. Reporting on the use of funds by funding recipients is an important aspect of accountability, and DEC has established milestones and deliverables based on project type for all CWIP funding initiatives, which are included in the scope of work of all grant and contract agreements. Future LCBP grant agreements may also include some unique reporting requirements, and to ensure consistency across LWAP development in Vermont as well as eligibility for subsequent project implementation funding, these LWAP Technical Guidelines include some required deliverables (where applicable) that actors developing LWAPs should strive to complete. Consistency in LWAP deliverables allows for comparison of broad-based lake issues and solutions, the level of pollution to lakes, and the means for comparing success of LWAPs over time, and these required deliverables provide consistent outcomes for all LWAPs regardless of the funding source.

- **LWAP Milestones and Deliverables**

A list of required milestones and deliverables for LWAPs is shown in Table 1 below, which is adapted from Appendix C of the Vermont Clean Water Initiative Program SFY 2021 Funding Policy. These milestones and deliverables are subject to change periodically, and it is therefore the responsibility of grantees to confirm with their grantor that they are following current requirements. Some detailed explanation of a few of the deliverables in Table 1 is provided below:

  - A **batch import file** (BIF) is a required deliverable for assessment or planning grants resulting in project identification. All projects identified and prioritized are required to be entered into the BIF. The BIF is used to incorporate "proposed" projects, that support Vermont Tactical Basin Plan strategies, into the Watershed Projects Database (WPD). The most recent version of the BIF is available at: https://dec.vermont.gov/water-investment/cwi/grants/resources.

- **Locator maps** need to be submitted for each project identified under an assessment or planning grant. Locator maps must be created using the ANR Atlas Clean Water Initiative Program Grant Screening Layer which identifies potential natural resource conflicts and permitting needs for a given area. Project locator maps should be downloaded from the Atlas Screening Layer for each project identified in the LWAP, and, if required, the maps should be submitted to the grantor as a PDF. Please see the CWIP Application Manual, Appendix 1, for instructions on how to create these maps.

- A **final LWAP report,** including sites assessed, potential water quality threats identified and ranked, site maps developed, and mitigation strategies identified. The final report will often include specific information about the three core field assessments conducted in a LWAP (see "Field Methodology" section below for more details). Details about deliverable expectations for each of these three field assessment types for an LWAP is included in Table 1 below. It is important to note that the requirements for these field assessments, when completed in the context of a LWAP, may not be identical to standalone field assessments, especially for road erosion and stream geomorphology. Additionally, many of the requirements in Table 1 are only applicable if these project types are included in the five projects selected for conceptual design in a final LWAP Report.

Clean Water Initiative Funding:

The VTDEC provides funding for a range of clean water projects. These funds are administered by the Clean Water Initiative Program. To fully understand the funding opportunities, learn about how related phosphorus loading reductions are tracked, and obtain a list of specific requirements for Lake Watershed Action Plan funding (which are important to understand, especially for Final Reporting), please visit the CWIP Grants website for more information.

You can find the current CWIP Funding Policy at https://dec.vermont.gov/water-investment/cwi/grants.

Table 1: Adapted from Vermont Clean Water Initiative Program SFY 2021 Funding Policy, Appendix C, Table 5.

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Lake Project Type	Milestones	Deliverables
Lake Watershed Action Planning	Project initiated, RFP issued, and sub-contractor selected (if applicable), hold introductory meetings, develop work plans	• Copy of RFP, signed sub-contract, and statement of reasoning for contractor selection (if applicable) • Work Plans w/ Timeline
	Develop LWAP Teams and Hold Kickoff meeting with stakeholders (e.g., lake association)	• LWAP Team Meeting minutes including date and number in attendance
	Library of pre-existing data sources and relevant GIS layers created	• Watershed Data Library / Reference Section • GIS with map of field assessment site locations, boundaries for evaluation (includes segmented road network and GIS-determined hydrologically connected road segments if applicable) • ANR Atlas Locator Map of Watershed
	Lake Shoreland and Lake Wise Assessments complete (if applicable)	• Locator maps with site photo(s) of identified problems • Project summaries that identify site/design considerations, permitting needs, cost estimates, restoration/water quality improvement objectives and goals, and level of landowner commitment

	LWAP Roadway Assessments complete (if applicable)	• Description of the approach used for the roadway assessment section of the LWAP, which could draw from one of the following suggested approaches:
		  ○ Use Municipal Roads General Permit (MRGP) road erosion inventory methodology for municipal roads and
		  ○ Adapt/adopt MRGP inventory with DEC approval for non-municipal road networks
		• Field inventory of hydrologically connected road segments determining segments that do not, partially, and fully meet standards
		• Locator maps with site photo(s) of hydrologically connected road segments that do not or only partially meet standards
		• Project summaries that identify site/design considerations, permitting needs, and best management practices necessary to bring road segments into fully meeting standards, associated cost estimates, and level of landowner commitment

	Stream Geomorphic Assessment (SGA) Lite (VT DEC Phase 2 – Rapid Stream Assessment Protocol) or Stream Wise Assessments complete (if applicable)	• Report on reach prioritization method and landowner contact • Completed SGA Lite Assessment (Phase 2 – Rapid Stream Assessment) if applicable • Stream Wise assessment sheets if applicable

Lake Project Type	Milestones	Deliverables
		• Locator maps with site photo(s) of identified problems • Project summaries that identify site/design considerations, permitting needs, cost estimates, restoration/water quality improvement objectives and goals, and level of landowner commitment
	Project Scoping: Prioritization criteria developed; project prioritization completed	• Graphs and pie charts showing greatest threats to lake by sector • List of criteria used for prioritization (must include level of landowner commitment) • Complete Project Prioritization Table (list of Problem Areas) that shows benefits for lake water quality
	Meeting(s) with stakeholders to review project prioritization	• Meeting minutes including date and number in attendance
	Restoration plans, including recommended BMPs, Conceptual Designs developed for a subset of prioritized projects, and regulatory reviews	• Restoration plans of prioritized projects including synthesis of prior completed project deliverables, 30% conceptual designs, written landowner commitment to next project step, and refined permit and cost-estimates
	Lake Watershed Action Plan complete	• Lake Watershed Action Plan Final Report, including synthesis from prior completed project deliverables, Batch Import File, and locator maps of projects identified
	Present Completed LWAP to Stakeholders / Public	• Public Presentation, posted on DEC or Lake Association Website
	Project complete	• Final Performance Report; press release.

- **LWAP Final Report Example Outline**

A LWAP Final Report should be written to address all the stakeholders, local to state, summarizing assessment findings and potential projects. The LWAP can be organized several ways but should aim to be a clearly laid out and user-friendly document that describes the process used to conduct this multi-sector assessment and provides a prioritized project list. Below is an example report outline from the Lake Eden LWAP.

Example Final LWAP Report Outline and Content Included - Lake Eden

Field Methodology

The field assessment component of each LWAP analysis should include three core assessments:

- Shoreland
- Roadways
- Tributaries

To evaluate these lake watershed areas, the methods involve review of electronic data and tools for watershed pre-assessment in addition to on-site field visit evaluations. (See information under **Process** about office pre-assessments and suggested resources for this preparatory work.) Below is information about Field Assessments. DEC recommends that entities involved in developing a new LWAP try to use existing sector-based assessments and other relevant analytical work to the extent possible. However, it is possible that new field assessments will be needed even when some existing assessment work is available to make updates and fill gaps.

♦ Shoreland Assessment

- Lake Wise Assessments

It is essential to engage and encourage as many property shoreland owners to participate in the LWAP, especially as their property may need essential improvements to protect water quality and wildlife habitat. Lake Wise Assessments provide a prioritized list of recommendations for each property assessed. Many lakes have active Lake Wise Evaluators already providing shoreland technical assistance along the shore and the VTDEC Lake Wise Program can help with questions about current Evaluators, Evaluator trainings, and support for Lake Wise assessments.

- Lake Wise Assessment Forms

The Lake Wise Program has a property evaluation form, which evaluates properties based on driveway area, structure and septic systems, recreation area, and shorefront and lake access: https://dec.vermont.gov/sites/dec/files/wsm/lakes/Lakewise/docs/lp_evaluationforms.pdf

The Lake Wise Program has a template for recording the LW assessment data and it can be found here: https://dec.vermont.gov/watershed/lakes-ponds/lakeshores-lake-wise/events

Additionally, the Lake Wise Google Map shows what shoreland properties have already been assessed: https://dec.vermont.gov/watershed/lakes-ponds/lakeshores-lake-wise/lakewisemap

- Boat Around the Shore

Shorelands can be miles long, and boating along the lake and observing the shore from the water can help identify elements of shoreland properties that need improvement. A "Shore Boat Tour" can uncover obvious issues of erosion, excessive clearing, road runoff, and required lakeshore stabilization practices and identify problematic shallow water habitat areas in an efficient manner. Many lake association members or other lake users may be willing to provide boat rides, perhaps in a pontoon boat, and this teamwork helps fuel local participation and engagement in the LWAP process. Bringing a Map and GPS and mapping in the field using pre-printed Lake Wise property evaluation forms are helpful steps to support this effort.

♦ Roadway Assessments & Surveys

- Public Road Assessments

Under the Municipal Roads General Permit, Towns have been conducting the Road Erosion Inventory to identify and prioritize road problem areas. This data is available from the Agency of Natural Resources website and searchable by each town. Visit this site to learn what is known about the public road conditions in a Lake's watershed. Public road field surveys can cross reference the existing inventory data and/or be guided by this data or contribute to it when new issues are found. County Road Erosion Assessment, Municipal Road Erosion Inventory, Bridge & Culvert Assessments, and ANR atlas layers are tools to help identify private and public road problems. Visit the MRGP page for full information on road erosion inventory information for public roads.

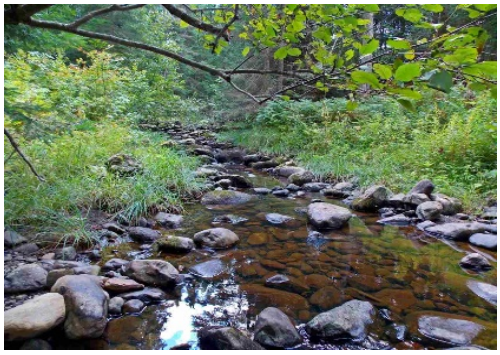
In the LWAP, roads can be categorized by Agency of Transportation class and defined by length per class and percentage of watershed road length as was done in the Lake Eden LWAP. Existing town plans, road erosion assessments, bridge & culvert assessments, VTDEC hydrologically connected road segment data, LiDAR data, and local stormwater infrastructure mapping can all be used to identify areas of high sedimentation and nutrient loading due to road, embankment, and ditch erosion, undersized culverts, or heavy amounts of stormwater runoff. Road assessments and subsequent project recommendations can be done with the goal of aiding the Town Roads Department to proactively stabilize roads and maintain any existing stormwater management features to avoid future stormwater problems and possibly even come into compliance with the VTANR Municipal Roads General Permit.

- Roadway Assessment Forms

Link to Road Erosion Inventory:
https://anrweb.vt.gov/DEC/IWIS/MRGPReportViewer.aspx?ViewParms=True&Report=Portal

Link to more MRGP information:
https://dec.vermont.gov/watershed/stormwater/permit-information-applications-fees/municipal-roads-program

♦ Stream Assessments



Stream assessments should be used to identify problem areas where stream bank erosion is a significant nutrient and sediment source, or where improved stream/wetland function could reduce sediment and nutrient loads to receiving waters. Stressors identified in a stream walk can include undersized and misaligned culverts and bridges, bank and gully erosion, headcuts, and absence of a vegetated buffer.

Like the Shoreland Assessments, there are two field sheets available to use to assess if a tributary is well protected, healthy, and not contributing sediment or phosphorus to the lake. The Stream Wise Assessment focuses on riparian area health while the Stream Geomorphic Assessment can reveal erosive conditions between the riverbank as well as flooding issues. Used together, these assessments can determine river issues. If the parties developing a LWAP need assistance determining which stream assessment approach is best suited to the unique needs of their lake watershed, they can reach out to DEC Lakes & Ponds program and River Program Staff for guidance.

- Stream Wise Field Assessment

The Stream Wise Program is newly developed (2021) with LCBP funding and support from public and private partners and modelled after the Lake Wise Program's approach. Stream Wise Assessments lead to solutions for problems identified along riparian areas and inspire riparian homeowners to manage their property using watershed-friendly best management practices. Field sheets are available on the Lake Wise web site under the Resources Section.
https://dec.vermont.gov/watershed/lakes-ponds/lakeshores-lake-wise/resources

- VT DEC Stream Geomorphic Assessment Lite

The other stream assessment, also available on the link above, is a modified Phase 2 VT Rivers Program Stream Geomorphic Assessment, that focuses on channel and embankment erosion, channel characteristics, stream crossings, buffers, and other point features of interest (stormwater inputs, beaver impoundments, debris jams).

♦ Other

Trail Systems, Timber Stands, Farming Operations, Wastewater Treatment Plants, Large Resort Areas, Interstates, or Concentrated Downtown Areas may need separate assessments and/or additional Stormwater Master Planning efforts. Large scale "other" land uses in the watershed that need further investigation and assessment should be noted as such in the Final Report. If there is local interest and sufficient funding, a LWAP could include an assessment of

Project Prioritization

Each LWAP may use a slightly different formula to prioritize the projects. Reviewing completed LWAPs for how this has been done for other lakes will help in deciding the best and most relevant criteria to use to rank projects. In general, the project prioritization process should, using field data points collected with GPS during the assessments, identify key characteristics for each site driving increased storm-water runoff and pollutant loading. These GIS observations, along with field-based observations of site characteristics, can be summarized in a project prioritization table. Factors such as the potential for each

project to improve water quality, potential to reduce environmental impact, project feasibility, co-benefits, estimated project cost, and phosphorus removal efficiency ($/pound of phosphorus) should also influence project prioritization. Some LWAPs have used the Unified Scoring Prioritization for Stormwater Master Plans document developed by VTDEC to guide project prioritization efforts and have adapted this approach to meet the specific needs of a lake watershed.

Below are some ***suggestions*** of criteria to use for prioritizing projects and for example, assigning them a value from 1-5, with 5 as the highest ranking, then summing the criteria together for final scores.

- Enhances Natural Buffers
- Phosphorus Loading
- Sediment Loading
- Wildlife Benefits
- Project Feasibility
- Maintenance Requirements
- Location (access)
- Hydrological Connectivity
- Public Demonstration Site
- Protects Other Restoration Efforts
- Landowner Support
- Constructability
- Costs, including BMP unit costs & adjustments
- Water Quality Benefits (sediment & nutrient reduction effectiveness)

Problem areas identified during field tours of the study area can be assigned numerical scoring metrics that are weighted to assist in prioritizing each project based on water quality benefits, project feasibility, maintenance requirements, costs, and any additional benefits. Once a prioritization approach is determined, potential projects can be scored based on the defined evaluation criteria and grouped into categories (e.g., high, medium, and low priority). For high priority projects, selected based on defined prioritization categories, summary sheets can be developed that can be used to obtain input from project stakeholders during subsequent meetings to discuss and refine the final project prioritization list.

Additionally, and as mentioned in Objective #3 on page five of this document, the LWAP should provide an estimate of relative sediment and phosphorus load from each of the three primary "sectors" of a lake's watershed (shoreland, streams, and roads) into the Lake. Based on the distribution of project types, as well as each project's watershed location, size, and existing nutrient/sediment load, one can estimate the relative load from each of the three primary "sectors" of the lake watershed into the lake. This loading estimate will facilitate project prioritization efforts and ensure that the appropriate focus is being placed on addressing primary sources of sediment and nutrient loading to a given lake.

♦ Conceptual Designs

Once project stakeholders have reviewed and agreed on a ranking for the various projects identified and described in the draft LWAP, around five projects should be chosen for conceptual design development (30% design). Concept designs typically include the following elements

- A site plan with contours, existing stormwater infrastructure, and proposed design elements
- Where relevant, hydrologic and hydraulic modeling data of the contributing drainage area and proposed BMP sizing and design specifications
- Typical details for proposed practices
- A preliminary cost opinion

See this website for CWIP program design guidance:
https://dec.vermont.gov/sites/dec/files/documents/ERPDesignTerminologyandGuidance.pdf

♦ Prioritization Resources

The Clean Water Initiative Program offers a worksheet on "Unified Scoring Prioritization for Stormwater Master Plans."
https://dec.vermont.gov/sites/dec/files/wsm/erp/docs/SWMP%20Unified%20Matrix_Final.pdf

Watershed Consulting Stormwater Master Plan for Berlin also shows a ranking system for prioritizing projects based on pollution load reduction and costs.
https://centralvtplanning.org/wp-content/uploads/2012/03/Berlin-Final-SWMP.pdf

Problems and Solutions

♦ **Problem Overview**

Lake water quality and ecological functions and values are impacted by land uses on the immediate shoreland and further into the watershed. Lakes are best protected by natural shorelands. Some of the most affordable solutions to mitigating stormwater issues are changing cultural habits from clearing and planting lawn to the use of native plantings in swales, berms, raingardens, no-mow zones and for increasing buffer width along the water's edge.

Messaging to property owners should be specific on actions to take to protect the lake. In many situations, a property owner could mitigate stormwater runoff issues by reducing their lawn, reintroducing alternative vegetation types, or minimizing parking areas to lessen compaction and impervious surface sprawl. Solutions, especially project proposals, should not be designed to accommodate or mitigate land management practices that are not "lake-friendly," such as those commonly found in suburbanized landscapes. In these situations, there are often relatively straightforward solutions, such as those mentioned above., Instead, solutions and more complex project proposals should focus on managing runoff at sites where there is no "easy" solution and where technical expertise and additional funding is needed, such as erosion associated with a failing culvert or large amounts of runoff associated with a public parking area.

In most cases, clearing shorelands leads to bank instability and erosive slope runoff. While hardscapes or seawalls may temporarily stabilize shorelands, they do not provide the benefits of natural shoreland vegetation: wildlife / pollinator habitat, wave and flood protection, temperature moderation, sediment attenuation, and filtration of stormwater runoff. Restoring natural shoreland communities by vegetation plantings is often the most affordable / best solution for restoring a healthy lake ecosystem.

Understanding land use in the watershed and identifying possible point and non-point sources of nutrients and sediment carried via tributaries and stormwater runoff from roads into a lake is an important element of a LWAP's assessment process and can lead to the identification of best management practices or projects to reduce nutrient loading, particularly in watersheds that are scored to be disturbed or highly disturbed under the VT Lake Scorecard. Additionally, understanding the conditions of streams and any contribution of sediment from streambank erosion into a lake, particularly during intense precipitation events, is an important part of the LWAP problem / solution

identification process. Specific problems and solutions for stream and road sectors of the LWAP will be included in future versions of these Technical Guidelines.

♦ Shoreland Best Management Practices

Shoreland Best Management Practices (BMPs) are designed for minimal disturbance of the shore for maximum efficiency to soak up stormwater and protect wildlife habitat. The best BMP for lake protection is a vegetated buffer. All vegetative treatments should be the first choice of solutions. And it is possible to install a raingarden with the long-term plan of allowing this treatment area to grow into a succession of a natural areas. The Lake Wise Shoreland Best Management Practices include both vegetative and structural treatments and can be found on the Lake Wise web site. https://dec.vermont.gov/watershed/lakes-ponds/lakeshores-lake-wise

♦ Green Stormwater Infrastructure Practices

Green Stormwater Infrastructure is a suite of "systems and practices that restore and maintain natural hydrologic processes in order to reduce the volume and water quality impacts of stormwater runoff." Riparian buffers, green roofs, bioswales, cisterns, permeable pavements and constructed wetlands are all examples of GSI. More information is available on the GSI Website: https://dec.vermont.gov/water-investment/cwi/solutions/developed-lands/green-infrastructure

♦ Bioengineering Designs and Solutions

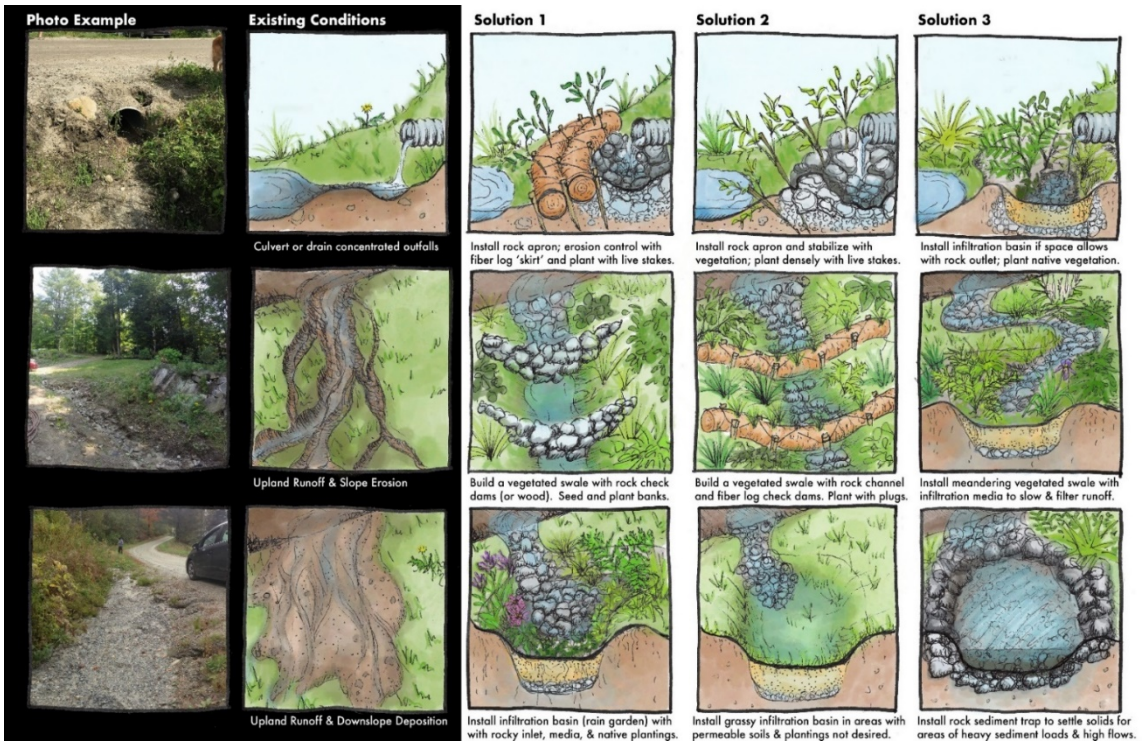
A complete Guide on Vermont Lake Bioengineering Practices for bank stabilization will be available on the Natural Shoreland Erosion Control Certification web site fall 2021. Examples of upland shoreland and shoreline stabilization solutions from this guide include the concepts, illustrated below.

Vegetative swale with rock check dam treats 98% of road runoff to lake

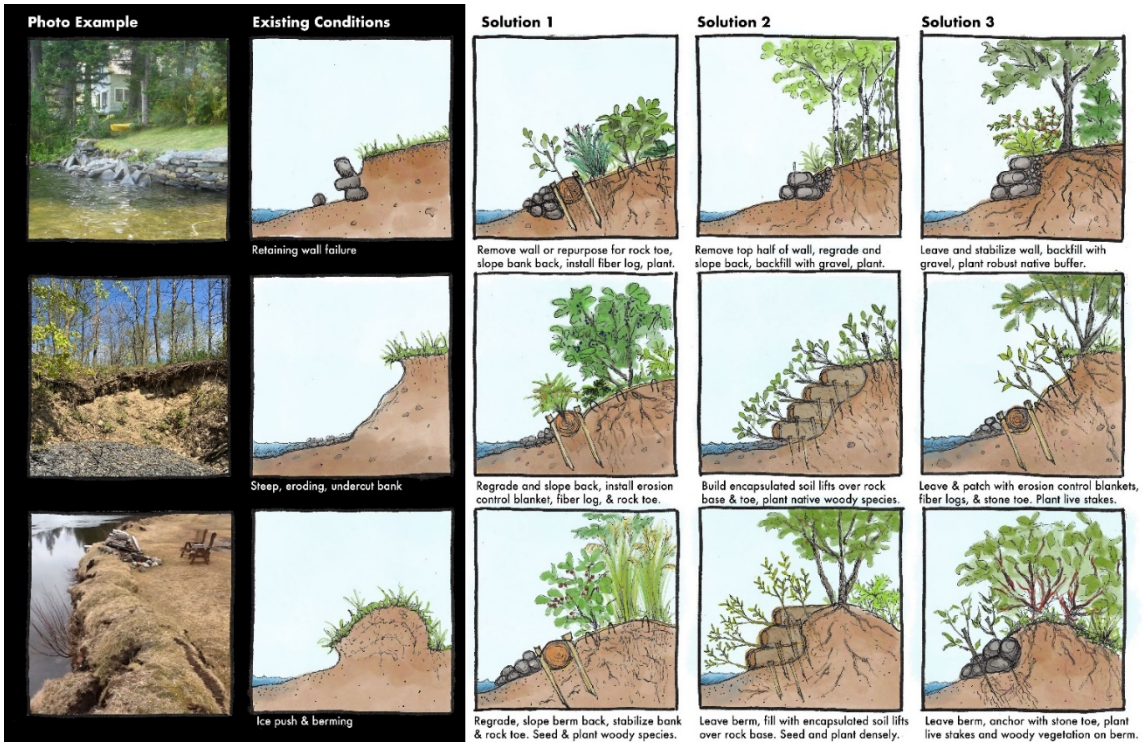
Lake Shore Permitting

To learn about what permits may be required for certain BMPs, visit the Shoreland Permitting web site. Also, learn who the regional Permitting Specialist is for each lake at this website.

Upland Shoreland Solutions - *Fall 2021 Vermont Bioengineering Guide, by Watershed Consultants, Nectar Design, and Holly Greenleaf*



Shoreline Bioengineering - *Fall 2021 Vermont Bioengineering Guide, by Watershed Consultants, Nectar Design, and Holly Greenleaf*



Informational Sources

Vermont Water Quality Standards
https://dec.vermont.gov/sites/dec/files/documents/wsmd_water_quality_standards_2016.pdf
Vermont Lakes and Ponds Web Site
https://dec.vermont.gov/watershed/lakes-ponds
Vermont Water Quality Monitoring
https://dec.vermont.gov/watershed/map/monitor#River%20Programs
Vermont Tactical Basin Planning
https://dec.vermont.gov/water-investment/watershed-planning
Shoreland Permitting
https://dec.vermont.gov/watershed/lakes-ponds/permit
The Natural Shoreland Erosion Control Certification Course and Bioengineering Information
https://dec.vermont.gov/watershed/lakes-ponds/lakeshores-lake-wise/nsecc
Vermont Lake Wise and Shoreland BMPs
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Vermont Green Stormwater Infrastructure
https://dec.vermont.gov/water-investment/cwi/solutions/developed-lands/green-infrastructure
Vermont Clean Water Initiative Program Grant Opportunities
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Vermont Clean Water Initiative Program Funding Policy
https://dec.vermont.gov/sites/dec/files/wsm/erp/docs/2021-02-04_FINAL_FY21_CWIPFundingPolicy_signed.pdf
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Lake and Watershed 0.5 Meter Impervious Surface Data
https://anrmaps.vermont.gov/websites/Documents/DEC_LakesLandcover/
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2018 VT Guide to SW Management workbook
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https://dec.vermont.gov/sites/dec/files/wsm/lakes/Lakewise/docs/lp_FormingLakeAssociations.pdf