
STORMWATER MANAGEMENT PLAN FOR ALBURGH

FINAL REPORT

Stone Project ID 14-053

March 19, 2015

Prepared for:

Friends of Northern Lake Champlain
P.O. Box 58
Swanton, VT 05488
Tel. / 802.355.0694
E-Mail / denisefnlc@gmail.com
Friends of Northern Lake Champlain

Prepared by:

Stone Environmental, Inc.
535 Stone Cutters Way
Montpelier, VT 05602
Tel. / 802.229.4541
E-Mail / sei@stone-env.com

ACKNOWLEDGEMENTS

This project was performed by Stone Environmental, Inc. for the Friends of Northern Lake Champlain and the Town of Alburgh with funding provided by Vermont Department of Environmental Conservation - Ecosystem Restoration Program.

Table of Contents

ACKNOWLEDGEMENTS	1
1. INTRODUCTION.....	3
1.1. Project Background	3
1.2. Goals of this Project	4
2. GENERAL DESCRIPTION OF THE STUDY AREAS	5
2.1. Mud Creek.....	5
2.2. Sucker Brook.....	5
2.3. Other Watersheds in Alburgh	5
3. EXISTING PLANS AND DATA.....	6
3.1. Watershed-Based Assessments	6
3.2. Town-Wide Assessments and Programs	6
4. STORMWATER PROBLEM AREAS.....	8
4.1. Identification of Problem Areas.....	8
4.2. Evaluation of Problem Areas	8
4.3. Conceptual Solutions to High Priority Problem Areas	8
4.3.1. East Alburgh Road (Problem Area ID: LC-16)	10
4.3.2. Greenwoods Road (Problem Area ID: MC-02).....	11
4.3.3. Littlewoods Road (Problem Area ID: MC-05)	12
4.3.4. Alburgh School (Problem Area ID: MC-07)	13
4.3.5. Route 129/Alburgh Country Club (Problem Area ID: SB-01).....	14
5. NEXT STEPS.....	15
6. REFERENCES.....	16
APPENDICES	17
APPENDIX A : WATERSHED MAP	18
APPENDIX B : STORMWATER MANAGEMENT PLANNING LIBRARY.....	20
APPENDIX C : PROBLEM AREA DATA SHEETS	34
APPENDIX D : DRAINAGE AREA MAPS FOR PRIORITY STORMWATER PROBLEM AREAS	49

1. INTRODUCTION

Water knows no political boundaries, and thus evaluations of water quality tend to be undertaken within watershed boundaries and involve land areas in multiple towns. From a water quality perspective, it would be ideal to manage water resources along watershed lines—but the reality is that many decisions, particularly those about land use, are made at the level of towns or individual sites.

A Town-wide Stormwater Management Plan is responsive to existing landscape characteristics across all watersheds within local political bounds. It connects land use, stormwater management, floodplain management, river management, and public infrastructure needs to more effectively address all of the issues which contribute to water quality impairment or improvement. Within this Plan, localized stormwater problems are examined at a larger scale (e.g., town-wide) to determine their relative contributions, and to aid in setting priorities for addressing challenges related to stormwater runoff. As adjoining towns also take increasingly comprehensive views of stormwater management issues and planning, these plans are one-stop resources that can improve coordination and increase opportunities for collaboration in meeting watershed-related needs across political boundaries.

1.1. Project Background

As precipitation falls on an undisturbed, natural landscape and moves through the hydrologic cycle, it flows through a complex system of vegetation, soil, groundwater, and surface waters. Natural events have shaped these components over time to create a system that can efficiently handle stormwater through evaporation, transpiration, infiltration, and runoff. Alterations to the landscape change the way it responds to precipitation events. Management of land use, rainfall, storm runoff, and surface water (streams and lakes) are interrelated, and the management practices chosen all influence water quality and stream health.

Watersheds are interconnected networks in which a change at any location can carry throughout the system.

There are many factors that influence exactly how stormwater runoff from a particular site will affect other areas of the watershed. The degree and type of impact varies from location to location, but it can be significant relative to other sources of pollution. Stormwater runoff affects water quality, water quantity, habitat and biological resources, public health, and the aesthetic appearance of the receiving water. Stormwater controls, in contrast, are typically conceived and implemented on a project-by-project basis. These projects are analyzed for their individual stormwater impacts, not in the context of their impact on an interconnected hydrologic and hydraulic system. It is well documented, however, that the cumulative effects of individual land surface changes dramatically influence flooding conditions and contribute to degradation of water quality (NRC 2009).

Watershed management practices in Alburgh have direct impacts on water quality in local creeks and streams (e.g., Mud Creek, Sucker Brook), as well as Lake Champlain. The findings of one study (Troy et al. 2007) suggest that “land-use changes in the Basin have increased phosphorus levels in Lake Champlain, especially conversion of agricultural areas and forests to developed uses.”

Vermont’s streams, rivers, and Lake Champlain are vital economic resources. As such, the quality of local receiving waters affects both economic interests and quality of life in the surrounding areas. Throughout the

What is a watershed?

A **watershed** is any area of land in which all water runoff from its surface flows to the same drainage point. Watersheds are sometimes referred to as drainage areas.

Watersheds are important because they are the basic unit of analysis for all surface water management. They come in all shapes and sizes, and are defined based on the intended study area.

Champlain Valley, the local economy depends, in part, on revenue gained from outdoor activities enjoyed in and on the water. Protecting the quality of surface waters is one of the most important commitments communities can make to protect the economic interests of residents.

Taken together, these elements emphasize the need for a holistic planning effort that considers the interconnected nature of land use, stormwater management, and river management in order to achieve overall watershed goals.

1.2. Goals of this Project

In order to protect Lake Champlain, the quality and quantity of stormwater runoff from existing development throughout the watershed must be well-managed. Given Alburgh's proximity to the lake, pollutants washed from the landscape during wet weather events have little time to attenuate or decay before reaching the lake – increasing the importance of properly managing stormwater runoff.

The ultimate goal of this project is to provide the Town of Alburgh with a list of high priority water resource concerns, including conceptual solutions for each, which will inform and support the development and implementation of restoration projects in an efficient and targeted manner. The Stormwater Management Plan incorporates information from existing plans and datasets to create a single, town-specific resource to guide future stormwater management activities. This Stormwater Management Planning Library, included as Appendix B, is a valuable resource for the future regarding any water quality-related work in Alburgh.

This Stormwater Management Plan also:

- Identifies stormwater-related areas of active erosion or other sources of sediment that are being delivered directly to water bodies in the Town of Alburgh, as well as Lake Champlain;
- Develops recommendations to address stormwater problems, including:
 - A list of problem areas that can assist stakeholders in directing resources to high priority projects;
 - Conceptual solutions for high-priority problem areas (Section 4.3); and
 - Potential revisions to town ordinances to encourage location-specific management activities.

2. GENERAL DESCRIPTION OF THE STUDY AREAS

The Town of Alburgh is located in Grand Isle County in northwest Vermont. The town has a total area of 29 square miles of land, or 18,560 acres. As of the 2010 census, the population of the town was 1,998. The Town has two significant streams, Sucker Brook and Mud Creek, as well as many intermittent streams and drainage canals that flow into Lake Champlain (see Figure 1, Appendix A for a map of watershed boundaries). Development in the area is primarily concentrated in Alburgh Village.

2.1. Mud Creek

The majority of the northern interior of the Town of Alburgh is drained by Mud Creek, which flows south from the Canadian border, through Mud Creek Pond, and into the Northeast Arm of Lake Champlain.

2.2. Sucker Brook

Sucker Brook drains a small portion of the interior of southern Alburgh, flowing southwest through the Alburgh Golf Links and into Lake Champlain near the north end of the La Motte Passage.

2.3. Other Watersheds in Alburgh

A small portion of the Town, located along the eastern edge of town between the Missisquoi Bay Bridge and the Canadian border, drains to Missisquoi Bay. Other near-shore areas of Alburgh drain, either directly or through small, intermittent streams or drainage canals, into Lake Champlain.

3. EXISTING PLANS AND DATA

Numerous and varied groups and individuals have invested considerable effort in evaluating different components of Alburgh's water resources, and the important interface between water resources and local land use decisions. At times these evaluations have followed watershed boundaries and other times they have followed political boundaries. The following sections identify evaluations that have been done to date and pull out the pieces 1) most relevant to Alburgh and 2) most relevant to future efforts to develop a list of strategic, prioritized projects that could be undertaken to improve water quality in and around Alburgh.

3.1. Watershed-Based Assessments

The watershed-based assessments summarized below and presented in more detail in Appendix B of this report are generally led by the Agency of Natural Resources (VTANR). These include:

- Basin planning, completed primarily to guide VTANR in its own work and in collaborative projects with the public, municipalities, and other State and federal agencies. The basin plans have a five-year scope. The *Water Quality Management Plan for Northern Lake Champlain Direct Drainages* (VTANR, 2009) covers the Town of Alburgh.
- Critical source area (CSA) evaluation, to identify areas of the landscape that, absent proper management, are likely to produce disproportionate amount of phosphorus loading to adjacent waterways. In 2011, detailed data about the distribution of potential CSAs of phosphorus pollution in the Missisquoi Bay basin were developed using a Soil and Water Assessment Tool (SWAT) model.
- Stream geomorphic assessments (SGA), undertaken to understand the natural tendencies of a particular reach of stream or river, its current condition, and what changes may be anticipated in the future. No stream geomorphic assessments have been completed for streams in Alburgh.
- Water quality monitoring and biological assessments; there are two sampling sites (#46 and #50) that have been routinely monitored since 1992 as part of the *Long-Term Water Quality and Biological Monitoring Project for Lake Champlain* that are located off Alburgh's shores.
- TMDL development, to establish the maximum amount of a pollutant (e.g., bacteria, nutrients, excess stormwater flows) that a waterbody can assimilate and still meet state-established water quality standards. TMDLs are based on the relationship between pollution sources and in-stream water quality conditions, and a TMDL addresses a single pollutant or stressor for each waterbody. The previously approved Lake Champlain phosphorus TMDL is currently under review by EPA Region 1 (VTDEC, 2012).

3.2. Town-Wide Assessments and Programs

In addition to the watershed-based assessments, a number of data sources are developed on a municipality-by-municipality basis. These are important to fold into any effort to develop a list of strategic, prioritized projects that could be undertaken to improve water quality in and around Alburgh. These include direct feedback from the Town, work by the Vermont Agency of Transportation (VTrans), and past and current planning initiatives.

- In meetings with Stone Environmental, Town officials identified 13 areas of concern and priority projects throughout Alburgh, ranging from shoreline erosion to undersized culverts to areas with localized flooding. See Figure 2 and Table 1 in Appendix B for a map and table of these areas of concern and priority projects.

- VTrans-sponsored programs, including routine inspections of bridges and culverts and grant opportunities provided by the Better Backroads Program, have identified a number of potential culvert projects to protect existing infrastructure whose implementation would also improve stormwater management.
- Alburgh's Town Plan states desire for the Town to be known both for its conservation of natural resources and as a place where all people can enjoy the beauty and recreational opportunities of Lake Champlain. To protect lake water quality, a 50 foot undeveloped and vegetated buffer strip is required for new development, as measured from the high water mark of 99 feet above sea level.

4. STORMWATER PROBLEM AREAS

One of the goals of this Plan is to develop a comprehensive list of stormwater problems. To achieve this goal, a thorough effort was made to identify existing problem areas, and then to evaluate existing conditions and potential solutions.

4.1. Identification of Problem Areas

The first task was to identify the location and nature of existing drainage problems, and where appropriate, to gather field data for further analysis. The approach to identifying potential problem areas included the following elements:

- Reviewing existing plans and data, as described in Section 3, and noting the locations of any concerns related to stormwater
- Engagement with local officials, including:
 - April 23, 2014, kick-off meeting with Town Clerk, Road Foreman and Select Board
 - Sept 17, 2014, meeting with Town Clerk
- Targeted site visits to verify problem areas (June 2014)
- Documentation (with photos) of existing problem areas

A “problem area data sheet” was developed and used as a guide to ensure consistent information was collected as site visits were completed. Fourteen potential problem areas and retrofit opportunities were identified and geo-located. The data sheets for all of the potential project locations identified in the Town of Alburgh are provided in Appendix C of this report.

4.2. Evaluation of Problem Areas

Working from the list of potential problem areas and retrofit opportunities, each location was visited and the site was directly observed. Where an unresolved problem was found, photos were taken, and observations were made about the source or cause.

Each problem area was given a score with the intent of generally assessing the severity of existing problems, removing low priority problem areas from the dataset, and providing general guidance on the relative order in which the problems should be addressed when considered town-wide (Appendix C). Scores were assigned as follows:

Level	Classification
1	Outside of project scope or infeasible to remedy due to project size.
2	Stable, but problem could escalate with future change in surrounding land use.
3	Small to moderate erosion and/or drainage problems are present; issues could be readily addressed.
4	Significant erosion and/or drainage problems are present; issues may be readily addressed.

4.3. Conceptual Solutions to High Priority Problem Areas

In Alburgh, seven problem areas were assigned a Level 3 or 4 classification. Two of these problem areas (LC-15 and LC-17) were identified as agriculture-related concerns and shared with the Agency of Agriculture for

further evaluation and follow-up. The five remaining, as well as a retrofit opportunity at the town school, were subject to more detailed investigation. The first phase of the detailed investigation involved desktop analysis to determine:

- Drainage area contributing to the known problem,
- Underlying soils, with particular attention to the presence of highly erodible soils (e.g., $k > 0.17$),
- Location of any existing stormwater infrastructure,
- Proximity to the nearest surface water feature,
- Whether the Town identified the area for planned future growth, and
- Potential location or locations most suitable for stormwater treatment practices, taking into account topography and existing development (if any).

A map of each high-priority problem area including all of these features was prepared (Appendix D). These sites were revisited to further investigate treatment potential and gather information for conceptual solutions, including more detailed information on the contributing drainage area, soil conditions, and traffic and pedestrian flow. These data were collected in order to better evaluate anticipated water quality benefits and constructability. In some locations, several areas were grouped together because of the inter-related nature of the stormwater management needs. In other locations, conceptual solutions were not developed for one of the following reasons:

- The stormwater concerns involve issues where it would be not be appropriate for the Town to assume a leadership role (e.g., private property);
- The stormwater concern did not rise to the level of demanding immediate action.

In total, five conceptual solutions were developed to address problem areas and retrofit opportunities; each is described in the following sections.

4.3.1. East Alburgh Road (Problem Area ID: LC-16)

The boat launch at the intersection of Pauline Drive and East Alburgh Road is very steep (in excess of 15%) and, because of the way it is tied into the road, is serving as a direct conduit for stormwater runoff from both roads and other directly connected impervious surfaces (e.g., driveways and roofs) to Lake Champlain. There is considerable evidence that gravel from the road shoulder and road surface, as well as from the boat ramp itself, is being washed down the ramp and into Lake Champlain. The location of the boat launch is shown in Figure 1 in yellow, and a possible location for alternative conveyance in green.

The Town has indicated improvements to East Alburgh Road will be made in 2015, including paving. This project will likely reduce the amount of gravel available to be mobilized. Further, reshaping this corner could prevent runoff from traveling along the edge of the boat ramp. Assuming stormwater will be redirected as part of this paving project, it will be important to ensure that the runoff is carefully directed to the lake and not allowed to create a concentrated, erosive flow in the shoreland area to the north of the boat launch. A step-pool conveyance or stone lined channel are two possible approaches.



Figure 1. Existing boat launch (highlighted in yellow) and possible location for alternative stormwater conveyance along East Alburgh Road (highlighted in green).

4.3.2. Greenwood Road (Problem Area ID: MC-02)

The eastern end of Greenwood Road bisects a largely agricultural area in northeast Alburgh, although there are a number of residences immediately adjacent to the roadway. As with much of the town, the area along Greenwood Road is characterized by little topographic relief and a high groundwater table.

Approximately ¼ of a mile west of the intersection with Henry Road, a large agricultural drainage ditch empties into the roadside ditch (Figure 2). Both drainage features appear to have been recently maintained, but were not stabilized and there is evidence of continuing erosion. A new farm access has also been installed near the eastern end of the yellow area highlighted on Figure 2, which appears to compound some of the drainage issues. A utility pole located directly in the roadside ditch will impact options for providing adequate ditching. At a minimum, a robust vegetative cover needs to be re-established to stabilize these drainage features. It will be important to reach out to the landowner to determine if alternatives exist to routing the agricultural drainage wholly to the roadside ditch.



Figure 2. The location of potential ditch improvements on Greenwood Road is highlighted in yellow.

4.3.3. Littlewoods Road (Problem Area ID: MC-05)

A culvert that conveys roadside and agricultural drainage from along Littlewoods Road under Martell Road and toward Mud Creek Pond appears to be undersized. As a result, a moderate scour pool has formed at the culvert inlet, creating an unstable condition. In addition, the headwall at the culvert outlet is failing and has begun to tip, causing the road shoulder along the west side Martell Road to collapse (Figure 3).

Given the deteriorating condition of the culvert, culvert headwall, and surrounding banks, it is a good candidate for replacement. The replacement culvert should be long enough to accommodate 2:1 (H:V) slopes at the inlet. The culvert should be sized such that it matches the stream's bankfull width, and so that 1/6th of the culvert can be buried at bankfull stream width to provide a natural bottom.



Figure 3. The location of a culvert replacement opportunity at the intersection of Littlewoods Rd and Martell Rd (highlighted in yellow).

4.3.4. Alburgh School (Problem Area ID: MC-07)

Currently, stormwater runoff from impervious surfaces at the Alburgh School is largely unmanaged. Runoff from the portions of the roof on the School Street side of the building flows east across the parking lot toward the green space between the basketball court and the road, as indicated in Figure 4. Stormwater currently flows along the shoulder of School Street for approximately 200 feet, before crossing under the road and into a ditch that parallels Carle Street.

The green space between the basketball court and the road is a good candidate location for a stormwater management practice that would slow stormwater runoff from the school and allow gravel from the parking lot to settle out. Much of Alburgh is characterized by high groundwater conditions, and therefore additional site investigation would be required before a specific practice could be recommended for this site.



Figure 4. Aerial view of Alburgh School site which has a significant amount of unmanaged impervious cover, including the building roof and parking area. A potentially suitable area for a stormwater management practice is highlighted in yellow.

4.3.5. Route 129/Alburgh Country Club (Problem Area ID: SB-01)

The Alburgh Country Club occupies a significant parcel of land along the western shore of Alburgh, across from the bridge to Isle La Motte. The Club property includes a drainage feature that runs from north to south approximately parallel to but 250 feet west of the access road, eventually crossing under Route 129 and discharging, untreated, to Lake Champlain. During the field work done in support of this report, sediment was observed moving in the drainage feature and erosion along the channel banks was also evident.

There appears to be an opportunity within the road right-of-way to manage the runoff conveyed by this drainage feature before it is discharged to the lake. A more comprehensive solution would likely yield enhanced results, but would necessitate the involvement of the Country Club.

There are a number of certification programs that encourage golf courses to protect and enhance natural areas within the facility, including one run by Audubon International (<http://www.auduboninternational.org/acsp-golf-certified>). Although outside the purview of the Town, a watershed group or other interested party might wish to work with the Country Club to help them pursue such a certification.



Figure 5. Direct drainage from the Alburgh Country Club to Lake Champlain (highlighted in yellow).

5. NEXT STEPS

This document represents an extensive effort to identify and evaluate potential stormwater problem areas throughout the Town of Alburgh. Several high priority potential stormwater improvement projects were identified in Section 4 that the Town could pursue directly, or could work with partners to pursue funding to address.

Beyond addressing the specific problem areas identified in this plan, there are often opportunities to improve management of stormwater runoff that arise as part of routine municipal projects, such as the substantial reconstruction of a road surface or intersection. Grant funds may be available to cover the incremental cost of addressing stormwater runoff as part of such projects, if stormwater management is considered early enough in the design. It is often significantly more cost-effective and efficient to incorporate stormwater management measures into a planned municipal project, as compared to the construction of a “stand alone” stormwater management retrofit.

In addition to exploring opportunities to address current stormwater management needs, Alburgh can also take steps to prevent future stormwater problems by considering a local ordinance specifically designed to protect water resources. Such an ordinance could incorporate one or more of the following elements:

- Require that a certain amount of stormwater runoff be treated as part of all development and redevelopment projects;
- Require that drainage from private property that discharges to the municipal stormwater drainage system (including roadside ditches) be connected in a manner such that it will not adversely impact or overwhelm the municipal system; and,
- Articulate a clear preference for low impact development practices that seek to infiltrate and soak away, as opposed to store and release, stormwater runoff into the land use and development regulations.

The Vermont League of Cities and Towns (VLCT) Municipal Assistance Center offers water resources technical assistance for municipalities seeking to promote water quality and water resource protection. VLCT has developed model regulations for both riparian area protection and low impact development stormwater management practices.

6. REFERENCES

National Research Council (NRC), 2009. *Urban Stormwater Management in the United States*. Committee on Reducing Stormwater Discharge Contributions to Water Pollution, Water Science Technology Board, Division on Earth and Live Studies. Last accessed at http://www.nap.edu/openbook.php?record_id=12465&page=R1 on December 27, 2013.

Troy, et al. 2007. *Technical Report No. 54 - Updating the Lake Champlain Basin Land Use Data to Improve Prediction of Phosphorus Loading*. Lake Champlain Basin Program. Last accessed at http://www.uvm.edu/giee/pubpdfs/Troy_2007_Lake_Champlain_Basin_Program.pdf on December 27, 2013.

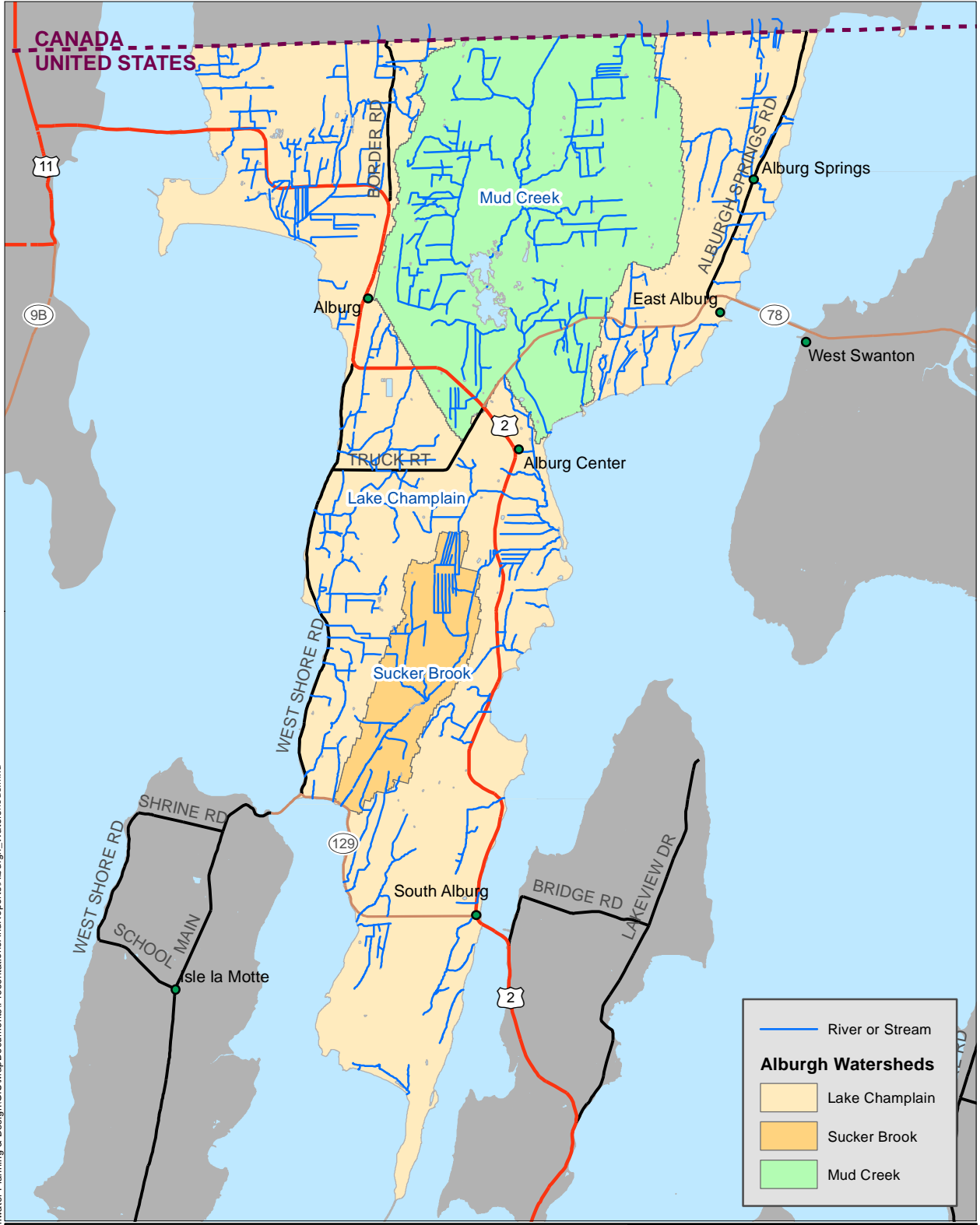
U.S. Census Bureau, 2011. U.S. Census Bureau American FactFinder web page. Last accessed at <http://factfinder2.census.gov> on May 2014.

VTANR, 2009. Water Quality Management Plan for the Northern Lake Champlain Direct Drainages. February 2009. Last accessed at http://www.vtwaterquality.org/planning/docs/pl_basin5.Finalplan.pdf on December 11, 2014.

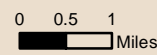
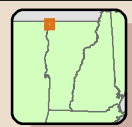
Vermont Department of Environmental Conservation, Watershed Management Division (VTDEC), 2012. State of Vermont 2012 303(d) List of Waters, Part A: Impaired Surface Waters in Need of TMDL. Approved by USEPA Region 1 on June 13, 2012. Last accessed at http://www.vtwaterquality.org/mapp/docs/mp_2012_303d_Final.pdf on December 27, 2013.

APPENDICES

APPENDIX A: WATERSHED MAP



	River or Stream
Alburgh Watersheds	
	Lake Champlain
	Sucker Brook
	Mud Creek



Sources: Watershed Boundaries: NHD Plus 2;
Administrative Boundaries, Roads: VCGI.

Watershed Boundaries

Alburgh Stormwater Management Planning

C:\Proj-14\WRM\14-053 FNLC Stormwater Planning & Design\GIS\Map Documents\Presentation\AndReports\Alburgh_Watersheds.mxd

APPENDIX B: STORMWATER MANAGEMENT PLANNING LIBRARY

STORMWATER MANAGEMENT PLANNING LIBRARY

TOWN OF ALBURGH

May 2014

Prepared for:

Friends of Northern Lake Champlain
P.O. Box 58
Swanton, VT 05488
Tel. / 802.933.6677
E-Mail / info2FNLC@gmail.com

Prepared by:

Stone Environmental, Inc.
535 Stone Cutters Way
Montpelier, VT 05602
Tel. / 802.229.4541
E-Mail / info@stone-env.com
Stone Project ID / 14-053

Table of Contents

1. BACKGROUND	23
2. INTRODUCTION.....	23
3. WATERSHED-BASED ASSESSMENTS	24
3.1. Lake Champlain Long-term Water Quality and Biological Monitoring Project.....	24
3.2. Draft Water Quality Management Plan for the Northern Lake Champlain Direct Drainages .	25
3.3. Identification of Critical Source Areas of Phosphorus in the Vermont Sector of the Missisquoi Bay Basin	25
3.4. Stream Geomorphic Assessment Final Reports.....	26
4. MUNICIPALITY-SPECIFIC ASSESSMENTS.....	26
4.1. Town Feedback.....	26
4.2. Vermont Agency of Transportation-Sponsored Programs.....	26
4.2.1. Vermont Online Bridge and Culvert Inventory Data	26
4.2.2. Stream Geomorphic Assessment, Failure Modes Data	27
4.2.3. Better Backroads Program.....	27
4.2.4. Ecosystem Restoration Program Projects.....	27
4.3. Vermont DEC Stormwater Permitting Program	28
4.3.1. State Stormwater Permits	28
4.3.2. Environmental Research Tool.....	28
4.4. Town of Alburgh Town Plan	28
5. OTHER RELATED INFORMATION	29
5.1. NRCS Conservation Practice #558—Roof Runoff Structure	29
6. CONCLUSIONS.....	29
FIGURES AND TABLES	31

1. BACKGROUND

Water has no political boundaries. As such, evaluations of water quality tend to be undertaken along watershed boundaries and to involve land areas in multiple municipalities, counties, and, in the case of the Lake Champlain, countries. Although from a strict water quality perspective it would be ideal to manage our water resources along watershed lines, the reality is that many decisions, in particular decisions about land use, are made at the local level. This report is designed to summarize the information currently available from the suite of reports that speak to water quality in the various ponds and streams that pass through or are located wholly within the Town of Alburgh, Vermont. Although water quality assessment data dating back to the early 1970s is available for the Lake Champlain watershed, this summary focuses on assessments and reports that have been prepared in the past twenty years. This report will serve as the basis for developing an Alburgh-specific list of strategic, prioritized projects that could be undertaken to improve water quality.

2. INTRODUCTION

The Town of Alburgh is located in Grand Isle County in northwest Vermont. The town has a total area of 29 square miles of land, or 18,560 acres¹. As of the 2010 census, the population of the town was 1,998.² The town has two significant streams, Sucker Brook and Mud Creek, as well as many intermittent streams and drainage canals that flow into Lake Champlain (see Figure 1 for a map of watershed boundaries). Development in the area is primarily concentrated in Alburgh Village.

The majority of the northern interior of the Town of Alburgh is drained by Mud Creek, which flows south from the Canadian border, through Mud Creek Pond, and into the Northeast Arm of Lake Champlain. Sucker Brook drains a small portion of the interior of southern Alburgh, flowing southwest through the Alburgh Golf Links and into Lake Champlain near the north end of the La Motte Passage. A small portion of the Town, located along the eastern edge of town between the Missisquoi Bay Bridge and the Canadian border, drains to Missisquoi Bay. Other near-shore areas of Alburgh drain, either directly or through small, intermittent streams or drainage canals, into Lake Champlain.

Numerous and varied groups and individuals have invested considerable effort in evaluating different components of Alburgh's water resources, and the important interface between water resources and local land use decisions. At times these evaluations have followed watershed boundaries and other times they have followed political boundaries. The following sections identify evaluations that have been done to date and pull out the pieces 1) most relevant to Alburgh and 2) most relevant to future efforts to develop a list of strategic, prioritized projects that could be undertaken to improve water quality in and around Alburgh.

¹ 2011 Alburgh Town Plan, http://www.alburghvt.org/documents/2011_townplan.pdf

² 2010 US Census data, <http://www.census.gov/2010census/popmap/>

3. WATERSHED-BASED ASSESSMENTS

The ongoing assessments described below are generally led by the State of Vermont's Agency of Natural Resources (ANR). These include:

- Basin planning efforts, whose main purpose is to guide ANR in its own work and in collaborative projects with the public, municipalities, and other state and federal agencies. The basin plans have a five-year scope. The Town of Alburgh is located in the Northern Lake Champlain Direct Drainages (Basin #5), where a draft plan was approved in October 2009 by the Agency of Natural Resources³. Although a small portion of Alburgh is within the Missisquoi River Basin, the town is not included in that Basin's plan⁴.
- Stream geomorphic assessment work, undertaken to understand the natural tendencies of a particular reach of stream or river, its current condition, and what changes may be anticipated in the future. To date, no stream geomorphic assessments have been completed for stream segments within Alburgh.
- In-stream water quality assessment work, including water chemistry and biological assessments, where available.

3.1. Lake Champlain Long-term Water Quality and Biological Monitoring Project⁵

The Long-Term Water Quality and Biological Monitoring Project for Lake Champlain has been in operation since 1992. The project is conducted by the Vermont Department of Environmental Conservation (DEC) and the New York State Department of Environmental Conservation, with funding provided by the Lake Champlain Basin Program and the two states.

The current monitoring program grew from the Lake Champlain Diagnostic-Feasibility Study conducted by Vermont DEC and New York State DEC from 1990-1991. The Diagnostic-Feasibility Study focused primarily on the measurement of phosphorus and chloride concentrations in the lake and its tributaries to develop a phosphorus loading budget and mass balance model for Lake Champlain. The present long-term monitoring project continued sampling a subset of the lake and tributary station network established in 1992, and extended the program to include a broader range of chemical and biological measurements. The primary purpose of the current monitoring program is to detect the long-term effects of management actions and other changes in the environment on the lake.

The monitoring network includes 15 lake stations representing major lake segments with distinct physical and water quality characteristics. The program also monitors 21 major tributaries to the lake, all of which have continuous stream flow gauges in operation. The exception is the large LaChute Creek watershed (702 km²) in New York, which does not have a gauge and has not been monitored. Monitoring staff from both Vermont and New York are responsible for sample collection.

³ http://www.vtwaterquality.org/planning/htm/pl_northernlcb.htm

⁴ http://www.vtwaterquality.org/mapp/docs/mp_Basin06Plan.pdf

⁵ http://www.anr.state.vt.us/dec/waterq/lakes/htm/lp_longterm.htm

While there are no tributary sampling stations in Alburgh, sampling sites 46 (Isle La Motte off Rouse's Point) and 50 (Missisquoi Bay) are located in Lake Champlain off Alburgh's shores. It is important to understand that while the in-lake stations are located near Alburgh, in-lake conditions at these stations are truly a reflection of the larger area(s) of the Lake Champlain basin upstream of the monitoring stations.

3.2. Draft Water Quality Management Plan for the Northern Lake Champlain Direct Drainages⁶

The Water Quality Management Plan for the Northern Lake Champlain Direct Drainages, most recently revised in February 2009, overviews water resources, and identifies concerns and threats to water quality within portions of Vermont that drain directly to the northern portion of Lake Champlain. Utilizing recommendations from a broad array of stakeholders, the Plan summarizes strategies and specific actions to guide efforts to sustain and improve water quality and aquatic habitat over the next five years.

The Plan's road network and stormwater-related strategies include the following:

- Support strategies for reducing phosphorus found in the Clean and Clear Action plan and Clean and Clear Work Plan. Assist communities in identifying specific projects and funding and assist in developing additional strategies as needed.
- Support the Vermont Department of Environmental Conservation River Management Program to promote stream stability and reduce phosphorus loading from stream bank and stream channel erosion in the Lake Champlain Basin through a comprehensive program of assessment, protection, management, restoration, and education.
- Enhance the Vermont Better Backroads Program throughout the Lake Champlain Basin with staffing for technical assistance and increased funding for erosion control grants to towns.
- Prevent and control erosion of sediment and phosphorus at construction sites statewide by maintaining staffing at the Vermont Department of Environmental Conservation for training and education, inter-agency coordination, permit review, and compliance assistance.
- Offer technical assistance to towns in the Lake Champlain Basin seeking to provide better water quality protection through local ordinances and other municipal actions.
- Protect and/or restore riparian wetlands.

3.3. Identification of Critical Source Areas of Phosphorus in the Vermont Sector of the Missisquoi Bay Basin⁷

Critical Source Areas are areas of the landscape that, absent proper management, are likely to produce disproportionate amount of phosphorus loading to adjacent waterways. Detailed data about the distribution of potential Critical Source Areas (CSAs) of phosphorus to Missisquoi Bay were developed using a Soil and Water Assessment (SWAT) model. The areas identified using this modeling approach were selected primarily by their soils, landscape features, proximity and connectivity to streams, and the land use or farm crop

⁶ http://www.vtwaterquality.org/planning/docs/pl_basin5.Finalplan.pdf

⁷ http://www.lcbp.org/wp-content/uploads/2013/04/63_Missisquoi_CSA.pdf

practices that are in place or are likely to be in place. To view this data in an interactive map, visit lcbp.stone-env.com.

From a stormwater management standpoint, phosphorous critical source areas are areas of development (including roads) with a high potential for stormwater runoff. In general, roads with steeper grades are particularly vulnerable to runoff and likely to be identified as CSAs. In Alburgh, the CSAs identified by the model include:

- Alburgh Springs Road (just south of Greenwoods Road)
- Greenwoods Road (0.7 miles north of intersection with Little Woods Road)

3.4. Stream Geomorphic Assessment Final Reports⁸

No stream geomorphic assessments have been completed for streams in Alburgh. When such assessments are conducted, the results are designed to direct future stream corridor restoration and protection measures.

4. MUNICIPALITY-SPECIFIC ASSESSMENTS

In addition to the watershed-based assessments, a number of pieces of data are developed on a municipality-by-municipality basis. These are important to fold into any effort to develop a list of strategic, prioritized projects that could be undertaken to improve water quality in and around Alburgh. These include direct feedback from the Town, work by the Vermont Agency of Transportation, as well as past and current planning initiatives.

4.1. Town Feedback

In meetings with Stone Environmental, Town officials identified 13 areas of concern and priority projects throughout Alburgh, ranging from areas of shoreline erosion to undersized culverts to areas with localized flooding. See Figure 2 and Table 1 for a map and table of concern areas and priority projects.

4.2. Vermont Agency of Transportation-Sponsored Programs

4.2.1. Vermont Online Bridge and Culvert Inventory Data⁹

Vermont has 2,699 long structures (bridges and culverts) greater than 20 feet on interstate, state, and town routes and another 1,276 short structures between 6 and 20 feet on the state system that the state Agency of Transportation (VTrans) inspects. Inspections are conducted every 24 months on long structures and every 60 months on short structures unless conditions warrant more frequent inspections. Data collected as part of these inspections can help identify not only bridges and culverts with structural deficiencies but also structures that may be adversely impacting water quality. The system does not contain any bridge information for Alburgh, but does contain a detailed accounting of 312 culverts in Alburgh. Of these, 28 culverts were identified during

⁸ <https://anrnode.anr.state.vt.us/SGA/finalReports.aspx>

⁹ <http://apps.vtrans.vermont.gov/BridgeAndCulvert/Login.aspx?ReturnUrl=%2fBridgeAndCulvert%2fDefault.aspx>

2004 as being in “fair” or worse overall condition. Since the last update of this inventory by VTrans, the Town has replaced or upgraded several of these culverts, primarily in conjunction with road paving projects.

4.2.2. Stream Geomorphic Assessment, Failure Modes Data¹⁰

Failure Modes- Problems and Causes

This document records the failure modes of select bridges and culverts. The tables provide a structure number and a road name for the structure. Typical problems with structures are scouring of the bank, other erosion issues, and poor structure placement. No information is available for structures in Alburgh.

Structure Failure Modes

This document is similar to the Failure Modes Problems and Causes, but includes issues such as sediment deposits, obstructed structures, floodplain problems, and beaver dams. Again, no information is available for structures in Alburgh.

4.2.3. Better Backroads Program¹¹

The Better Backroads Program helps fund work on gravel roads to alleviate erosion issues and improve water quality, using grants to municipalities, under the leadership of VTrans and VANR. In 2013, in response to federal funding requirements and program needs, VTrans and VANR made a variety of changes to this program, including use of state (rather than federal) funding, and movement of administrative and technical assistance from the Northern Vermont Resource Conservation and Development Council to VTrans.

The Vermont Local Roads Program¹², sponsored by the Vermont Agency of Transportation (VTrans) and the Federal Highway Administration (FHWA) and currently operated from St. Michael’s College, provides information, training and technical assistance to cities, towns and villages in Vermont. This is done through seminars and workshops, distribution of materials and technical assistance to fulfill service requests. The administration and technical assistance offered through this program will also be transitioning from St. Michael’s College to VTrans in 2015¹³

The Town of Alburgh has not obtained grants from the Agency of Natural Resources and the Better Backroads Program to address erosion issues that threaten public roads and bridges.

4.2.4. Ecosystem Restoration Program Projects¹⁴

There are no listed Ecosystem Restoration Program (ERP) projects located in the Town of Alburgh.

¹⁰ <https://anrnode.anr.state.vt.us/SGA/datasets/selectReport.aspx?sortType=Town&bid=06&bnm=Missisquoi>

¹¹ <http://vtransengineering.vermont.gov/sections/environmental/betterbackroads>

¹² <http://www.vermontlocalroads.org/index.html>

¹³ <http://www.leg.state.vt.us/docs/2014/bills/Passed/H-872.pdf>

¹⁴ <http://www.vtwaterquality.org/erp/projects/>

4.3. Vermont DEC Stormwater Permitting Program

4.3.1. State Stormwater Permits

Currently, Vermont DEC requires that a stormwater permit be obtained when any construction, new development, or redevelopment results in impervious or disturbed area equal to or greater than one acre, with stricter requirements in watersheds that are classified as stormwater impaired. The State has developed a suite of technical standards for stormwater-related mitigation that are outlined in the Vermont Storm Water Management Manual, Volumes I and II. For example, the goal of a stormwater management program during construction is to mitigate sediment loss during storm events—while during and after construction, the objective is to maintain as much of the pre-developed hydrology as possible.

4.3.2. Environmental Research Tool¹⁵

ANR's Environmental Research Tool allows the user to look up the location of stormwater permits that have been issued by ANR, as well as hazardous waste sites, brownfields, and spills. There are seven post-construction stormwater permits that have been issued to sites in Alburgh accessible through the tool. Most of the issued permits are up-to-date (they have not expired), though in several instances annual or semi-annual inspections may not have been regularly completed or submitted to ANR. The age, style, size, and upkeep of an existing permitted facility – particularly facilities constructed prior to 2002 – may make it a strong candidate for improvement to enhance stormwater management capabilities.

Permit no.	Site name	permit date	expiration date	restatement of compliance due date
3646-9010	Alburgh Mobil	11/16/2004	08-05-2010	11-16-2014
6802-9015	Alburgh Golf Links	7/25/2013	07-25-2023	None listed
3475-9010.R	Alburgh Industrial Park	11-17-2010	11-17-2020	11-17-2015
4116-9015	Champlain Estates Subdivision	3-1-2006	03-01-2016	12-20-2015
6758-9015	Jolley Associates New Gas Station (same location as Alburgh Mobil above, so not clear whether the older permit is actually expired)	1-3-2013	01-03-2023	01-03-2018
4226-9015	North Prospect Holdings LLC- Phase II	8-1-2006	08-01-2016	08-01-2009
4089-9015	Timeline Architecture	7-25-2006	07-25-2016	07-25-2011

4.4. Town of Alburgh Town Plan¹⁶

Three sections of the 2011 Alburgh Town Plan relate to stormwater management: Natural and Cultural Environment (Chapter 5); Utilities, Facilities, and Services (Chapter 7); and Transportation (Chapter 8).

¹⁵ <http://www.anr.state.vt.us/WMID/StormWater.aspx>

¹⁶ http://www.alburghvt.org/documents/2011_townplan.pdf

The Natural and Cultural Environment chapter includes a summary of surface water resources (Mud Creek, Sucker Brook, and Lake Champlain) and flood hazard areas, including a summary of the Town’s history with and participation in the National Flood Hazard Insurance Program (NFIP). Shoreline flooding is clearly identified as an area of ongoing interest and concern.

The Utilities, Facilities, and Services chapter contains a brief description of the town’s municipal water supply systems (including water sources and distribution system service areas) and wastewater treatment facilities. It does not identify specific stormwater management measures that the Town routinely deploys. The Recreation section of this chapter notes that roadway widening is needed to support the tourism industry in Alburgh (p. 61), but does not specify how increased stormwater runoff from wider roads might be managed.

The Transportation chapter includes a summary of Vermont Agency of Transportation (VTrans) records regarding “sufficiency ratings” for the state highways within Alburgh (VT Routes 2, 78, and 129). Other than for the Missisquoi Bay Bridge on VT Route 78, where a replacement bridge was opened for traffic in May 2007, no information is included regarding the town’s bridges/culverts or their maintenance. Often times, it is cost effective to combine the construction of additional stormwater management measures for road-related runoff with bridge construction, and so it is important to understand the timing of bridge replacement projects.

5. OTHER RELATED INFORMATION

There are a significant number of farm operations in Alburgh. Farmsteads (especially barn areas) often contain a large amount of impervious surface and may be an important source of stormwater pollution.

5.1. NRCS Conservation Practice #558—Roof Runoff Structure¹⁷

NRCS Standard #558 addresses the management of stormwater from farm structures; specifically, where roof runoff from precipitation needs to be:

- diverted away from structures or contaminated areas;
- collected, controlled, and transported to a stable outlet; or
- collected and used for other purposes such as irrigation or animal watering facility.

The total barn roof area on a farm can be substantial, often in excess of one acre (the threshold for state stormwater regulation in the developed landscape), and therefore roof runoff from farm barns can be an important source of unmanaged stormwater.

6. CONCLUSIONS

This report is part of a larger project, funded by Vermont DEC, which will ultimately lead to a set of community-specific, prioritized projects to address stormwater runoff. Rather than starting from scratch in

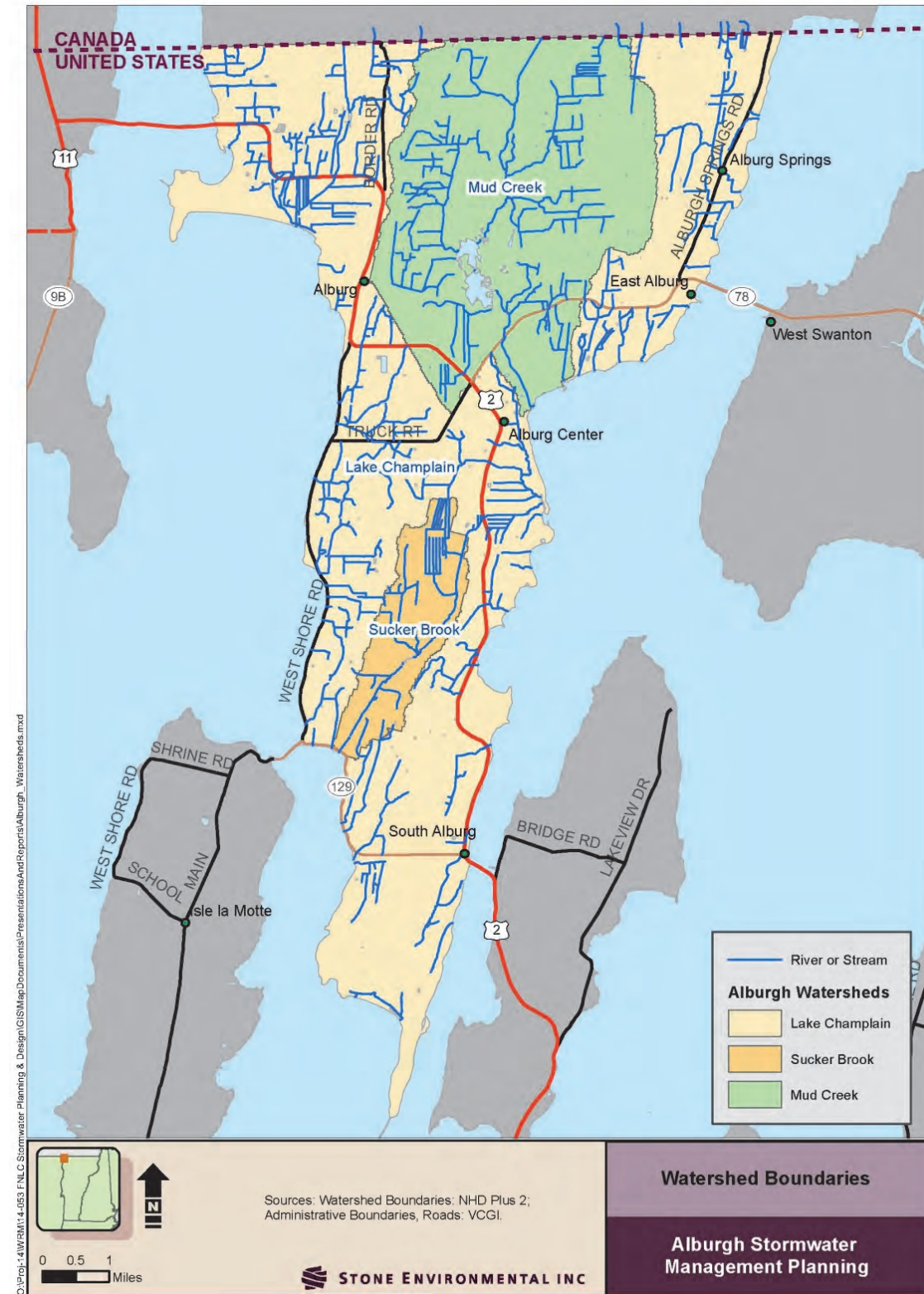
¹⁷ <http://efotg.sc.egov.usda.gov/references/public/VT/VT558-0311.pdf>

identifying stormwater management needs, the project (and this report) is drawing from the extensive library of water quality assessments and information that already exists, and augmenting them with interviews with local officials.

As this report demonstrates, there are numerous agencies and entities whose activities touch on various aspects of water quality in the Lake Champlain watershed in general, and in the Town of Alburgh more specifically. This work is dynamic and ongoing, and so, while this summary is believed to be comprehensive, it will be important to periodically review and update the content to ensure the most current information can be incorporated. A comprehensive inventory of existing water quality assessments serves as a basis for connecting land use, stormwater management, floodplain management, river management activities; and public infrastructure needs to more effectively address all of the issues which contribute to degradation of a watershed.

FIGURES AND TABLES

Figure 1. Alburgh watershed boundaries.



STONE ENVIRONMENTAL INC

Figure 2. Areas of concern and priority projects identified by town officials and other sources.




Table 1. Areas of concern and priority projects identified by town officials and in other sources.

ID	Watershed	Problem Type	Description	ID Source
LC-1	Lake Champlain	Infrastructure	Culvert condition "fair" in 2004 inventory	VOBCIT inventory
LC-2	Lake Champlain	Erosion	Shoreline erosion, especially at south end of road. Roadway is very close to the lake, continual problems with erosion. Culvert at south edge of this area in "fair" condition	Town feedback
LC-3	Lake Champlain	Infrastructure	Several culverts in "fair" or worse overall condition. May have been remedied when road was paved 3-4 years ago.	VOBCIT inventory, Town feedback
LC-4	Lake Champlain	Infrastructure	Culverts identified as being in "fair" overall condition; these remain an area of concern.	VOBCIT inventory, Town feedback
LC-5	Lake Champlain	Drainage	Springtime problems with ponding and runoff	Town feedback
LC-6	Lake Champlain	Erosion, Drainage	Undersized culverts, historic fill, road erosion during high water periods.	Town feedback
LC-7	Lake Champlain	Infrastructure	Two culverts identified as being in "fair" overall condition	VOBCIT inventory
LC-8	Lake Champlain	Infrastructure	One culvert identified as being in "critical" overall condition	VOBCIT inventory
LC-9	Lake Champlain	Drainage	Culvert at the border crossing replaced recently (with a larger culvert), but area still floods and is not influenced by beaver activity	Town feedback
LC-10	Lake Champlain	Drainage	Town will be taking a closer look at drainage issues along this entire road in preparation for paving – eval. appreciated.	Town feedback
LC-11	Lake Champlain	Erosion	A variety of issues noted related to slush, water, snow, and brush.	Town feedback
LC-12	Lake Champlain	Erosion	Erosion noted on both sides of road, especially in areas of steeper slopes.	Town feedback
LC-13	Lake Champlain	Infrastructure	Culvert at 24 Greenwoods Rd also marked as being in "critical" overall condition in 2004 inventory.	VOBCIT inventory
LC-14	Lake Champlain	Infrastructure	Culvert at east end of road marked as being in "fair" overall condition in 2004 inventory.	VOBCIT inventory
LC-15	Lake Champlain	Infrastructure	Culvert identified as being in "urgent" condition in 2004 inventory.	VOBCIT inventory
LC-16	Lake Champlain	Erosion, Infrastructure	Shoreline erosion issues; road often in danger of being lost to lake; have been historic problems with culverts in this area as well.	Town feedback
MC-1	Mud Creek	Infrastructure	Culvert identified as being in "poor" overall condition in inventory – but fixed when road was paved two years ago. Confirm in field.	VOBCIT inventory; Town feedback
MC-2	Mud Creek	Infrastructure	Culvert identified as being in "critical" condition in inventory.	VOBCIT inventory
MC-3	Mud Creek	Drainage, Infrastructure	Two culverts identified as being in "fair" or "critical" overall condition in 2004 inventory; these have not been replaced and cause erosion/ponding during high water conditions.	VOBCIT inventory, Town feedback
MC-4	Mud Creek	Drainage, Infrastructure	Complaints regarding drainage recently received from 226 Greenwoods Rd (water coming in from east and undermining a trailer?) and 152 Greenwoods Rd.	VOBCIT inventory; Critical Source Areas
MC-4	Mud Creek	Drainage, Infrastructure	Two culverts identified as being in "fair" condition in 2004 inventory. This section of Greenwoods Rd. also identified as having a high potential for stormwater runoff.	VOBCIT inventory; Critical Source Areas study
SB-1	Sucker Brook	Infrastructure	Culvert may be channel restriction ; overall condition identified as "critical" in 2004 inventory	VOBCIT inventory, Town feedback

APPENDIX C: PROBLEM AREA DATA SHEETS

Problem Area Data Sheet

Problem Area ID: LC-10	Latitude: 44.978305°	Longitude: -73.247539°
Watershed: Lake Champlain		
Location: Boutah Rd, slightly east of Metevier Dr		
Problem Type: Erosion		
Identification Source: SWMP Assessment		
Ownership: Private		
Classification: 2		

Date of Field Data Collection: 06-25-2014

Description of Observed Conditions:

Farm road (or similar private access) running parallel to Boutah Road is significantly eroded, and was flooded during field observation. Area may be used by ATVs. There is no evidence that water is leaving this site, and therefore impacts to areas other than natural features of the site itself appear likely to be minimal.

Field Photos




Photo 1. Flooded private access road; note 1' high bank on left side which seems to show some signs of erosion

Photo 2. Area of probable ATV use

Prioritization Ranking Factors

Relative Impact	Frequency	Current Condition	Urgency	Impact to public infrastructure?	Realistic to fix?	Impacts beyond water resources?	Part of a larger or systemic problem?
2	2	3	2	N	Y	N	N

Problem Area Data Sheet

Problem Area ID: LC-11	Latitude: 44.991542°	Longitude: -73.236530°
Watershed: Lake Champlain		
Location: Boutah Rd at Littlewoods Rd		
Problem Type: Retrofit Opportunity		
Identification Source: SWMP Assessment		
Ownership: Public		
Classification: 2		

Date of Field Data Collection: 06-25-2014

Description of Observed Conditions:
 The green space in the Y-intersection of Littlewoods Rd and Boutah Rd offers an opportunity for a stormwater retrofit that would better manage stormwater runoff from the adjoining road surfaces.

Field Photos




Photo 1. Green space at the intersection of Littlewoods and Boutah Rds.

Photo 2. Existing drainage along Littlewoods Rd

Prioritization Ranking Factors							
Relative Impact	Frequency	Current Condition	Urgency	Impact to public infrastructure?	Realistic to fix?	Impacts beyond water resources?	Part of a larger or systemic problem?
2	2	1	1	N	Y	N	N

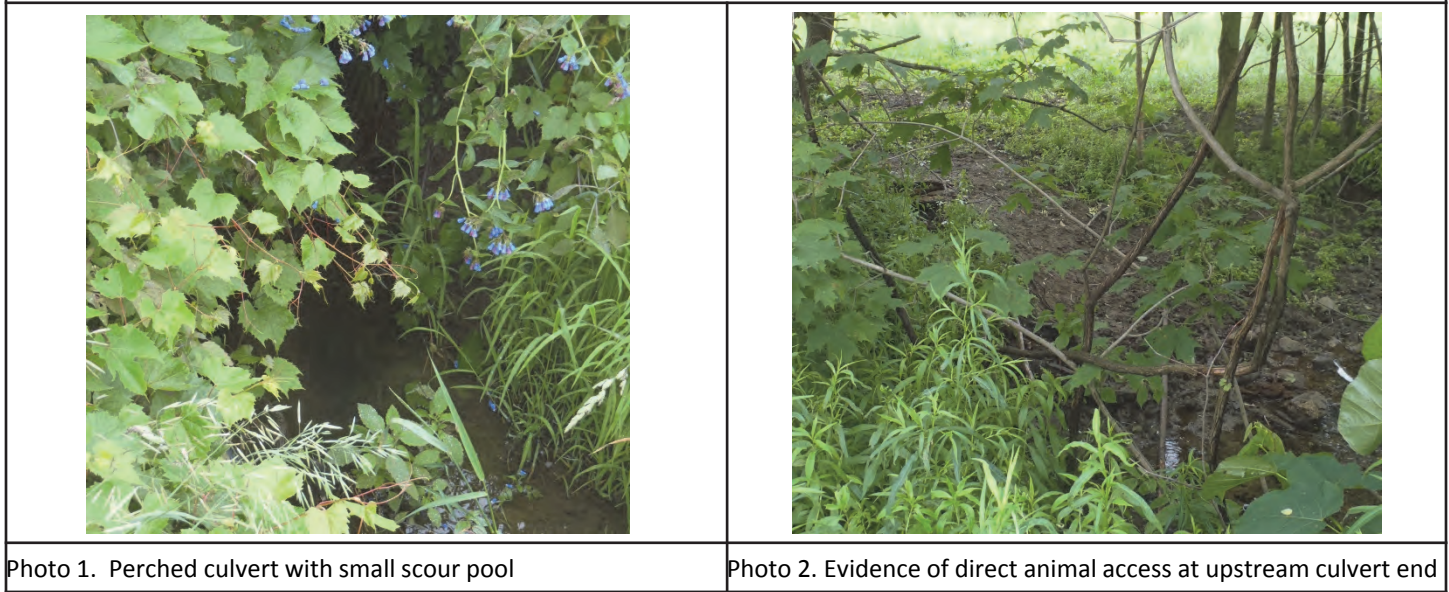
Problem Area Data Sheet

Problem Area ID: LC-14	Latitude: 44.982968°	Longitude: -73.227821°
Watershed: Lake Champlain		
Location: Alburgh Springs Rd, Just north of RR crossing		
Problem Type: Infrastructure, Animal Access		
Identification Source: SWMP Assessment		
Ownership: Public/Private		
Classification: 2		

Date of Field Data Collection: 06-25-2014


Description of Observed Conditions:
 Downstream end of culvert is perched <1' above channel; evidence of direct animal access at upstream end of culvert

Field Photos



Prioritization Ranking Factors							
Relative Impact	Frequency	Current Condition	Urgency	Impact to public infrastructure?	Realistic to fix?	Impacts beyond water resources?	Part of a larger or systemic problem?
2	2	2	1	Y	Y	N	N

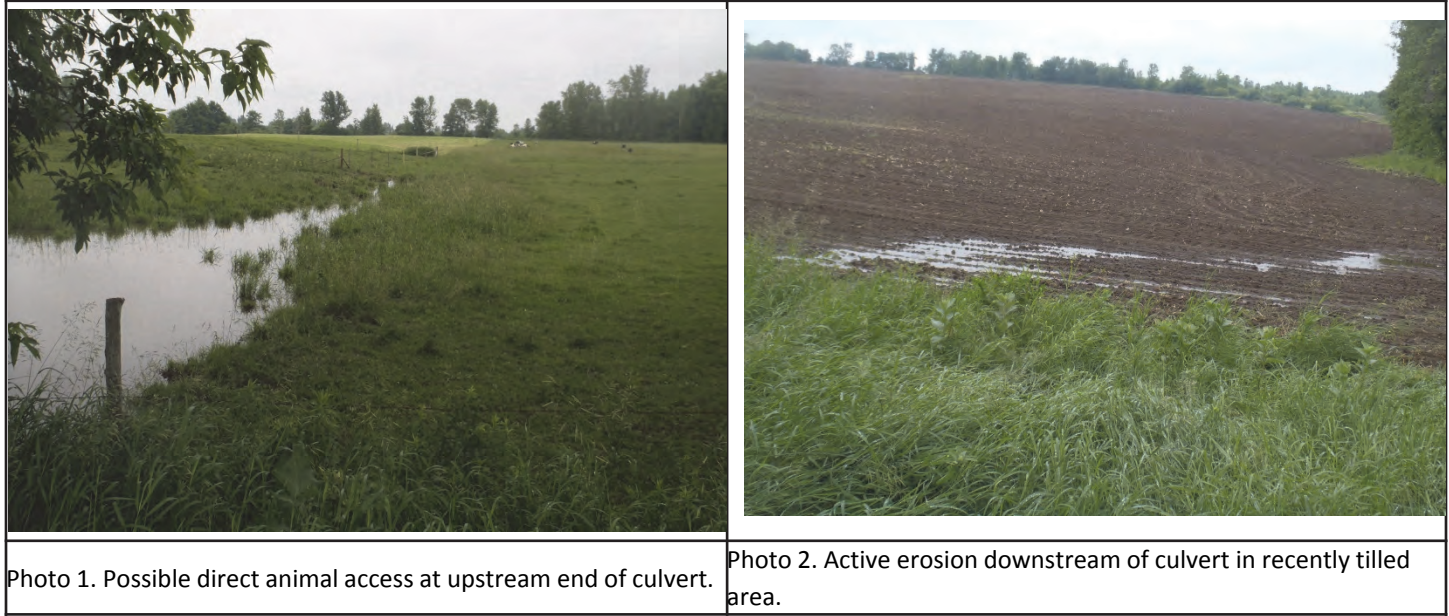
Problem Area Data Sheet

Problem Area ID: LC-15	Latitude: 44.982968°	Longitude: -73.227821°
Watershed: Lake Champlain		
Location: Fox Hill Rd, 800 ft west of Alburgh Springs Rd		
Problem Type: Erosion, Animal Access		
Identification Source: SWMP Assessment		
Ownership: Private		
Classification: 3		

Date of Field Data Collection: 06-25-2014


Description of Observed Conditions:
 Downstream end of cross culvert is discharging directly into recently tilled annual cropland and actively eroding; unclear if animals have direct access to upstream area. This concern has been forwarded to the Agency of Agriculture.

Field Photos



Prioritization Ranking Factors							
Relative Impact	Frequency	Current Condition	Urgency	Impact to public infrastructure?	Realistic to fix?	Impacts beyond water resources?	Part of a larger or systemic problem?
2	2	3	2	N	Y	Y	N

Problem Area Data Sheet

Problem Area ID: LC-16	Latitude: 44.974031°	Longitude: -73.228671°
Watershed: Lake Champlain		
Location: Pauline Dr, at East Alburgh Rd		
Problem Type: Erosion		
Identification Source: SWMP Assessment		
Ownership: Private		
Classification: 3		

Date of Field Data Collection: 06-25-2014

Description of Observed Conditions:
 Extremely steep boat launch is providing a direct conduit for stormwater runoff from the neighborhood to Lake Champlain; shoulder of boat launch is actively eroding. Town has indicated plans for resurfacing East Alburgh Rd in 2015, which could offer an opportunity to redirect and better manage stormwater runoff from this neighborhood.

Field Photos



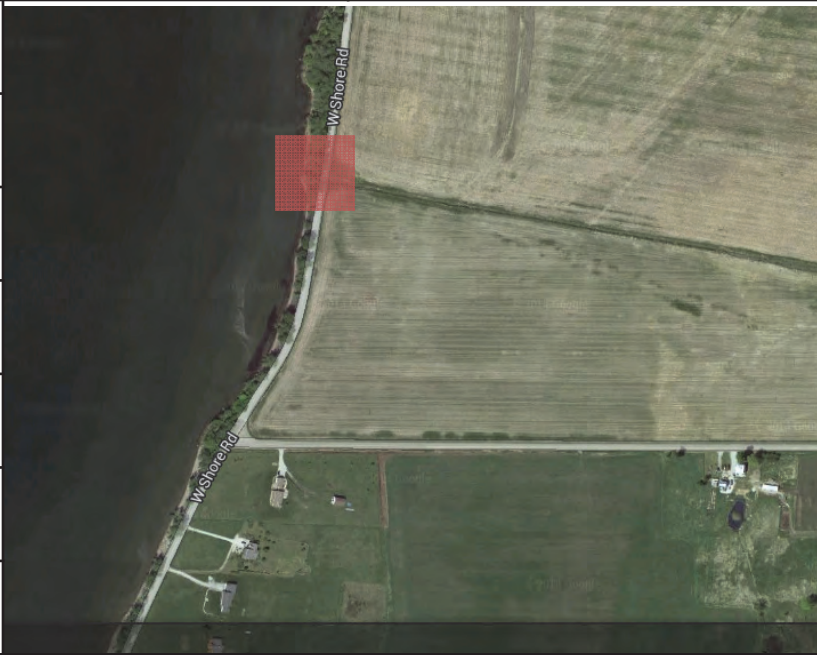
Photo 1. Some visible evidence of gravel from road washing down boat launch into lake.



Photo 2. Perspective on steep boat launch.

Prioritization Ranking Factors							
Relative Impact	Frequency	Current Condition	Urgency	Impact to public infrastructure?	Realistic to fix?	Impacts beyond water resources?	Part of a larger or systemic problem?
2	3	2	2	Y	Y	N	N

Problem Area Data Sheet

Problem Area ID: LC-17	Latitude: 44.953410°	Longitude: -73.305922°
Watershed: Lake Champlain		
Location: West Shore Rd., ~1 mile south of Route 2		
Problem Type: Erosion		
Identification Source: SWMP Assessment		
Ownership: Private		
Classification: 3		

Date of Field Data Collection: 06-25-2014

Description of Observed Conditions:
 Ditch draining two farm fields with very narrow buffers discharges directly into Lake Champlain; significant sediment deposits below culvert. This concern has been forwarded to the Agency of Agriculture.


Field Photos



Photo 1. Narrow buffers along ditch	Photo 2. Downstream end of culvert discharging directly into Lake Champlain.
-------------------------------------	--

Prioritization Ranking Factors							
Relative Impact	Frequency	Current Condition	Urgency	Impact to public infrastructure?	Realistic to fix?	Impacts beyond water resources?	Part of a larger or systemic problem?
2	3	3	2	N	Y	N	N

Problem Area Data Sheet

Problem Area ID: LC-18	Latitude: 44.983771°	Longitude: -73.314765°
Watershed: Lake Champlain		
Location: Firehouse Rd., ~1 mile west of Route 2		
Problem Type: Erosion		
Identification Source: SWMP Assessment		
Ownership: Private		
Classification: 2		

Date of Field Data Collection: 06-25-2014 and 08-15-2014

Description of Observed Conditions:

Significant unstabilized areas on Firehouse Road immediately adjacent to Lake was observed in June. It was suggested that this work might have been undertaken to ensure it was completed in advance of shoreline management requirements scheduled to take effect July 1. In revisiting the site in mid-August, vegetation had established, although the drainage feature shown in Photo 2 below continued to show some evidence of on-going erosion/sedimentation.

Field Photos



Photo 1. Significant unstabilized area.




Photo 2. Evidence of sediment leaving site and being washed into Lake Champlain.

Prioritization Ranking Factors

Relative Impact	Frequency	Current Condition	Urgency	Impact to public infrastructure?	Realistic to fix?	Impacts beyond water resources?	Part of a larger or systemic problem?
2	3	3	2	N	Y	N	N

Problem Area Data Sheet

Problem Area ID: MC-01	Latitude: 44.954049°	Longitude: -73.281799°
Watershed: Mud Creek		
Location: Town Highway 4, ~2000 ft SW of Route 2		
Problem Type: Infrastructure		
Identification Source: VOBCIT Inventory		
Ownership: Public		
Classification: 2		

Date of Field Data Collection: 06-25-2014

Description of Observed Conditions:
 Upstream end of culvert is partially plugged with leaves and other debris; buffer at downstream end is being mowed and there is some evidence of erosion in the channel. This road is known locally as "Truck Route".

Field Photos




Photo 1. Upstream of culvert.

Photo 2. Downstream culvert end

Prioritization Ranking Factors							
Relative Impact	Frequency	Current Condition	Urgency	Impact to public infrastructure?	Realistic to fix?	Impacts beyond water resources?	Part of a larger or systemic problem?
2	2	2	1	Y	Y	N	N

Problem Area Data Sheet

Problem Area ID: MC-02	Latitude: 45.004297°	Longitude: -73.247359°
Watershed: Mud Creek		
Location: Greenwood Rd, approx ¼ mile west of Henry Rd		
Problem Type: Erosion		
Identification Source: Town		
Ownership: Public/Private		
Classification: 3		

Date of Field Data Collection: 06-25-2014

Description of Observed Conditions:
 Recent ditching along Martell Rd and in adjoining agricultural land raw, with spoil piles left adjacent to ditch. Agricultural land has been plowed to edge of ditch (no buffer). The agricultural concern has been shared with the Agency of Agriculture.

Field Photos




Photo 1. Raw ditch along Greenwood Rd; agricultural land plowed to edge of ditch.

Photo 2. More raw ditch, agricultural drainage ties directly into roadside ditch at lower left corner of photo

Prioritization Ranking Factors							
Relative Impact	Frequency	Current Condition	Urgency	Impact to public infrastructure?	Realistic to fix?	Impacts beyond water resources?	Part of a larger or systemic problem?
2	2	2	2	N	Y	N	N

Problem Area Data Sheet

Problem Area ID: MC-03	Latitude: 45.004297°	Longitude: -73.247359°
Watershed: Mud Creek		
Location: Greenwood Rd, approx ½ mile north of Littlewoods Rd		
Problem Type: Drainage/Erosion		
Identification		
Source: Town		
Ownership: Public/Private		
Classification: 2		

Date of Field Data Collection: 06-25-2014

Description of Observed Conditions:
 Poor drainage along Greenwood Rd causing poor vegetation establishment; roadside ditch parallels a second, more substantial drainage feature about halfway between the homes and the road.

Field Photos




Photo 1. Evidence of pool drainage; note second drainage feature in mid-ground of photo.

Photo 2. Poor drainage along the eastside of Greenwood Rd

Prioritization Ranking Factors							
Relative Impact	Frequency	Current Condition	Urgency	Impact to public infrastructure?	Realistic to fix?	Impacts beyond water resources?	Part of a larger or systemic problem?
1	2	2	1	N	Y	N	Y

Problem Area Data Sheet

Problem Area ID: MC-05	Latitude: 44.990902°	Longitude: -73.261842°
Watershed: Mud Creek		
Location: Littlewoods Rd at Martell Rd		
Problem Type: Infrastructure		
Identification Source: Town		
Ownership: Public		
Classification: 3		

Date of Field Data Collection: 06-25-2014


Description of Observed Conditions:
 Culvert carrying stormwater runoff from the southside of Littlewoods Rd under Martell Rd has significant scour pools at both ends. The headwall at the downstream end of the culvert is failing and the road shoulder is collapsing.

Field Photos



Prioritization Ranking Factors							
Relative Impact	Frequency	Current Condition	Urgency	Impact to public infrastructure?	Realistic to fix?	Impacts beyond water resources?	Part of a larger or systemic problem?
2	2	3	2	Y	Y	Y	N

Problem Area Data Sheet

Problem Area ID: MC-06	Latitude: 44.982961°	Longitude: -73.261199°
Watershed: Mud Creek		
Location: Martell Rd., ½ mile south of Littlewoods Rd		
Problem Type: Infrastructure		
Identification Source: VOBCIT Inventory		
Ownership: Public		
Classification: 2		

Date of Field Data Collection: 06-25-2014

Description of Observed Conditions:
 Culvert carrying unnamed tributary to Mud Creek under Martell Rd is poorly aligned with stream and appears undersized. Road shoulder is eroding over downstream end of culvert; upstream end appears okay.

Field Photos



Prioritization Ranking Factors							
Relative Impact	Frequency	Current Condition	Urgency	Impact to public infrastructure?	Realistic to fix?	Impacts beyond water resources?	Part of a larger or systemic problem?
2	2	2	1	Y	Y	N	N

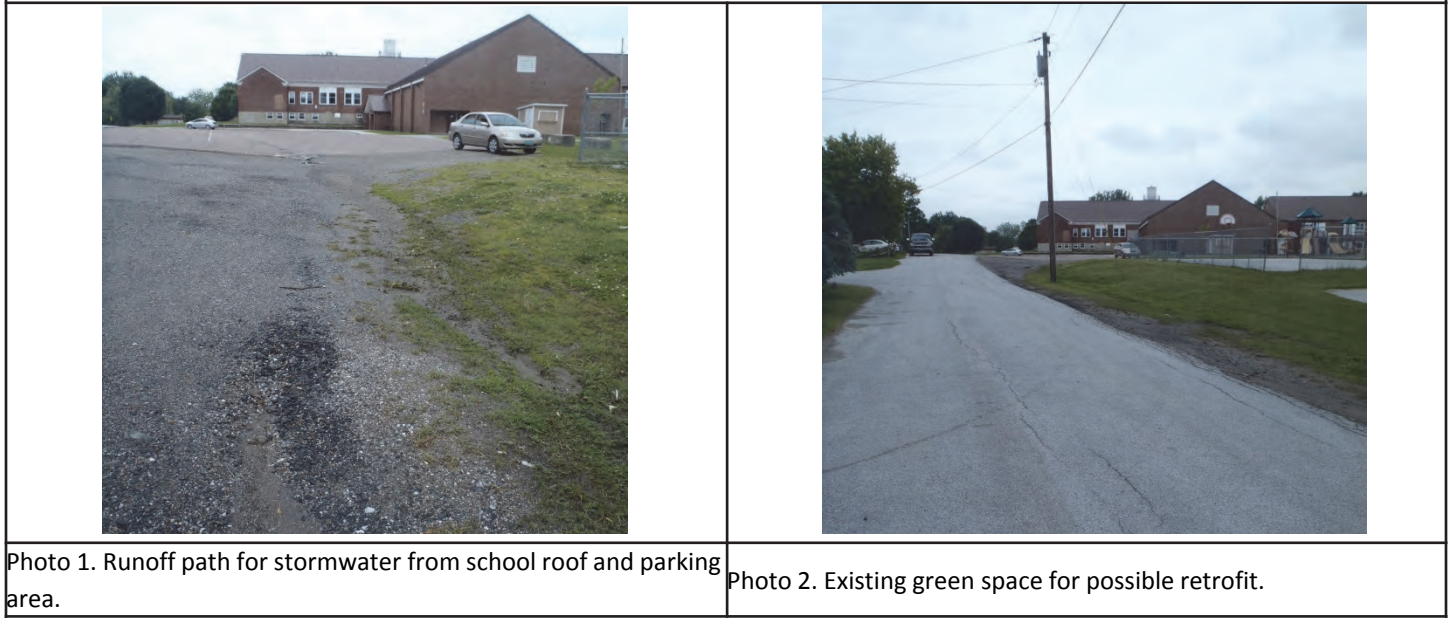
Problem Area Data Sheet

Problem Area ID: MC-07	Latitude: 44.978613°	Longitude: -73.297852°
Watershed: Mud Creek		
Location: School St., just east of Route 2		
Problem Type: Retrofit Opportunity		
Identification Source: SWMP Assessment		
Ownership: Public		
Classification: 2		

Date of Field Data Collection: 06-25-2014


Description of Observed Conditions:
 Stormwater runoff from roof of school and attendant parking lot is currently unmanaged, but there is a green space between School St and the basketball court that could be retrofit to capture, filter and slow the runoff.

Field Photos



Prioritization Ranking Factors							
Relative Impact	Frequency	Current Condition	Urgency	Impact to public infrastructure?	Realistic to fix?	Impacts beyond water resources?	Part of a larger or systemic problem?
2	3	2	1	Y	Y	N	N

Problem Area Data Sheet

Problem Area ID: SB-01	Latitude: 44.903273°	Longitude: -73.305425°
Watershed: Sucker Brook		
Location: Route 129, by Alburgh Country Club		
Problem Type: Erosion		
Identification Source: SWMP Assessment		
Ownership: Private		
Classification: 3		

Date of Field Data Collection: 06-25-2014

Description of Observed Conditions:
 Ditch conveying water from the Alburgh Country Club is eroding; water flows under Route 129 and directly into Lake Champlain.

Field Photos



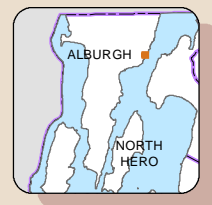
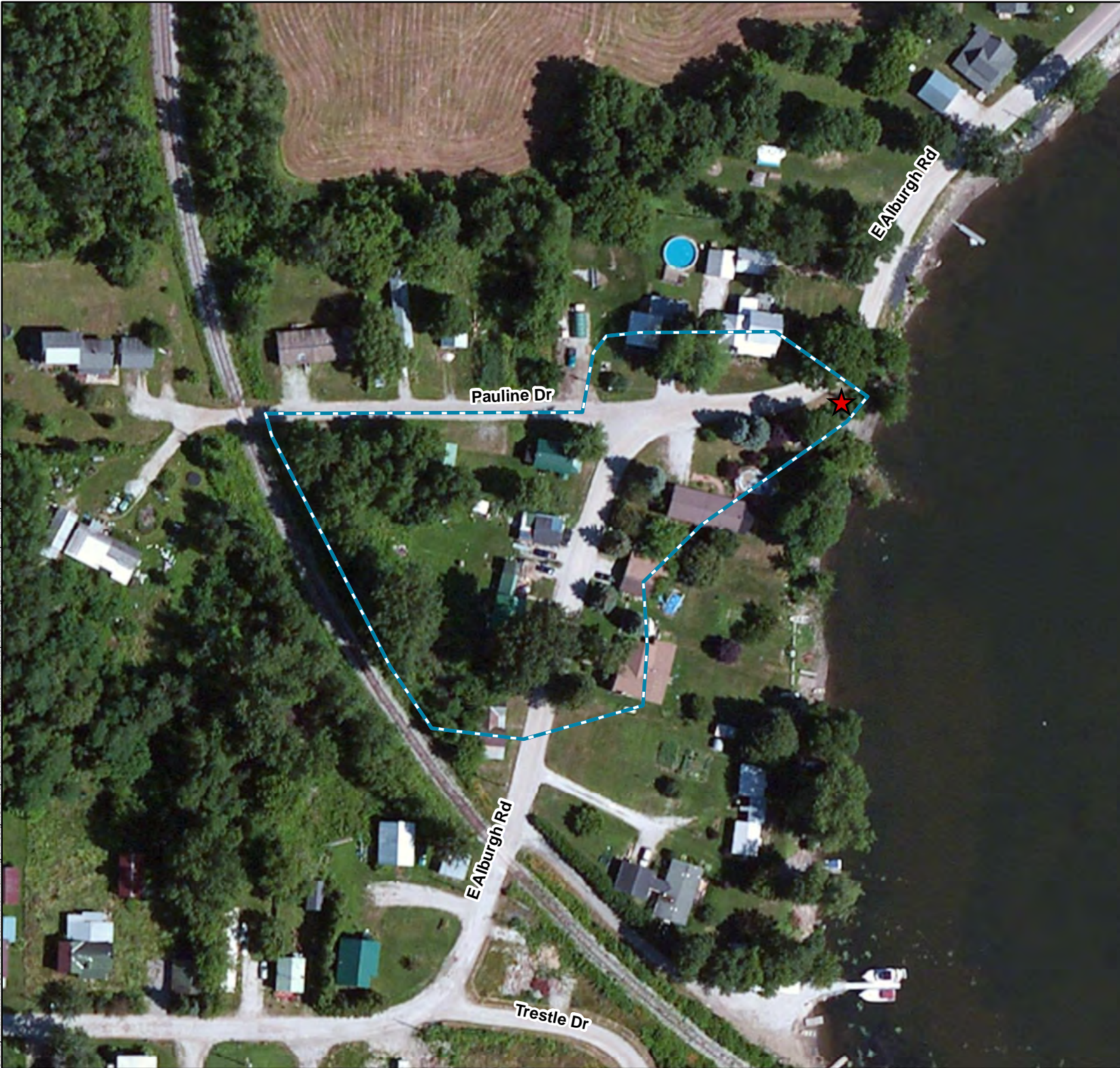
Photo 1. Active erosion above culvert.


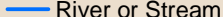


Photo 2. Downstream of culvert.

Prioritization Ranking Factors							
Relative Impact	Frequency	Current Condition	Urgency	Impact to public infrastructure?	Realistic to fix?	Impacts beyond water resources?	Part of a larger or systemic problem?
2	3	2	2	N	Y	N	N

APPENDIX D: DRAINAGE AREA MAPS FOR PRIORITY STORMWATER PROBLEM AREAS

O:\Proj-14\WRM14-053\FNL\GIS\MapDocuments\Presentation\Reports\Alburgh_SWP\Map1_Alburgh_EastAlburghRd.mxd



-  SW Treatment Opportunity
-  River or Stream
-  Highly Erodible Soils
-  Drainage Area (2.1 Acres)

Treatment Opportunity:
Improvements to East Alburgh Road are planned for 2015, including paving. Reshaping this corner could lay the foundation for better managing stormwater runoff from this neighborhood.

Sources: Problem Areas: Stone;
Highly Erodible Soils, Hydrography,
Roads: VCGI; Imagery: esri.

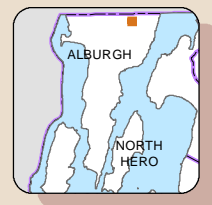






East Alburgh Rd

Alburgh Stormwater Management Planning

AL-1

\\cis11net\drv\o\proj-14\WRM\14-053_FNL_C Stormwater Planning & Design\GIS\MapDocuments\Presentation\Reports\Alburgh_SWPA\Map2_Alburgh_GreenwoodsRd.mxd



-  SW Treatment Opportunity
-  River or Stream
-  Highly Erodible Soils
-  Drainage Area (11 Acres)

Treatment Opportunity:
 A large agricultural drainage ditch empties into an unstable roadside ditch. At a minimum, a robust vegetative cover needs to be established to stabilize this drainage feature; physical measures –such as rock lining - may also be appropriate given the potential volume of water.

Sources: Problem Areas: Stone;
 Highly Erodible Soils, Hydrography,
 Roads: VCGI; Imagery: esri.

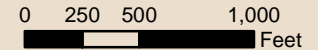
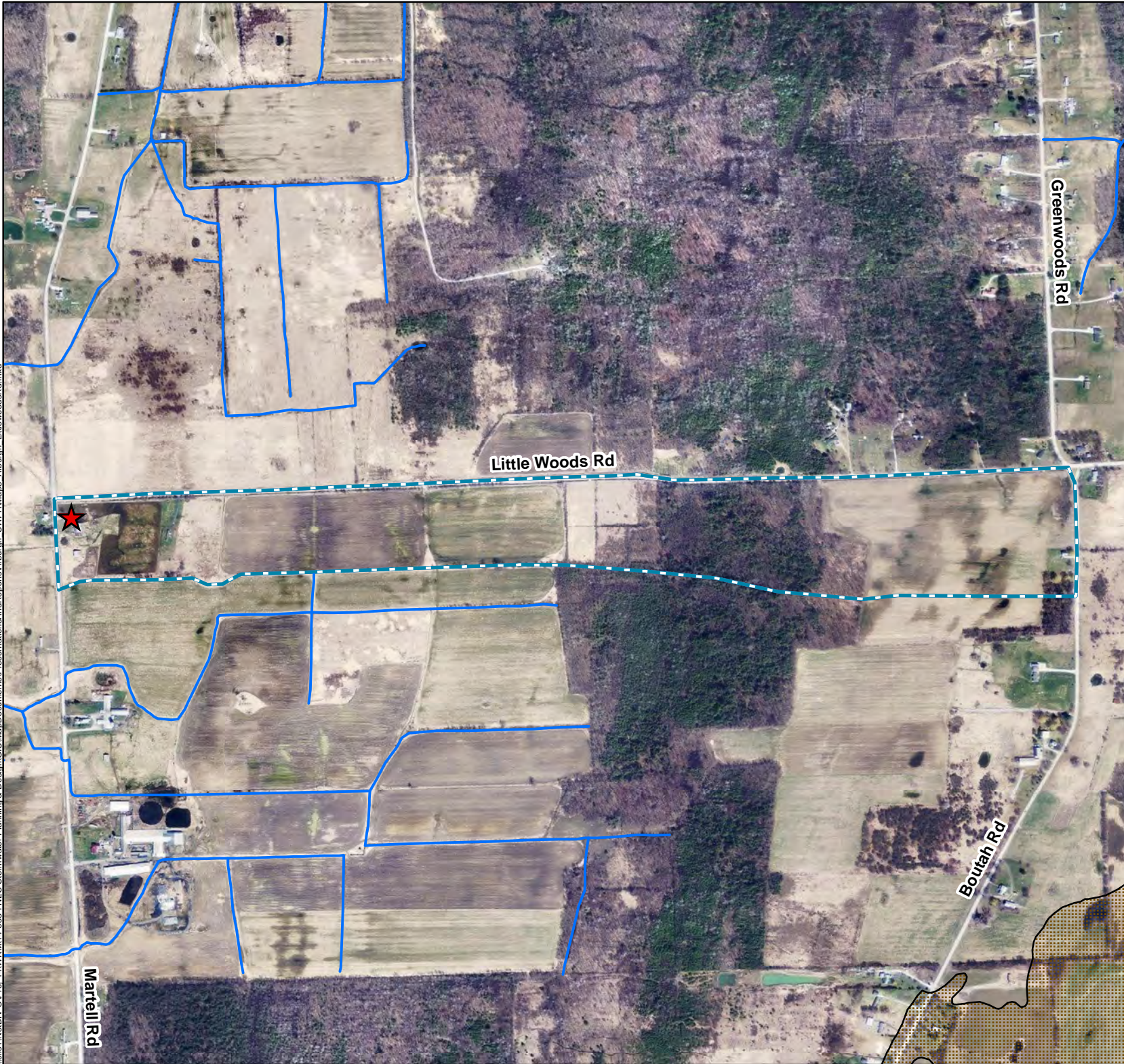






Greenwoods Rd

Alburgh Stormwater Management Planning

AL-2

\\cis11net\drv-c\proj-141\WRM14-053_FNL_C Stormwater Planning & Design\GIS\MapDocuments\Presentation\Reports\Alburgh_SWP\Map3_Alburgh_LittlewoodsRd.mxd



-  SW Treatment Opportunity
-  River or Stream
-  Highly Erodible Soils
-  Drainage Area (96 Acres)

Treatment Opportunity:
 Given the deteriorated condition of the culvert - which conveys roadside and agricultural drainage from along Littlewoods Road under Martell Road - culvert headwall, and surrounding banks, it is a good candidate for replacement.

Sources: Problem Areas: Stone;
 Highly Erodible Soils, Hydrography,
 Roads: VCGI; Imagery: esri.

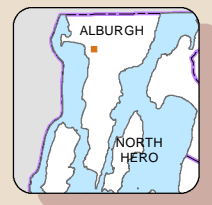
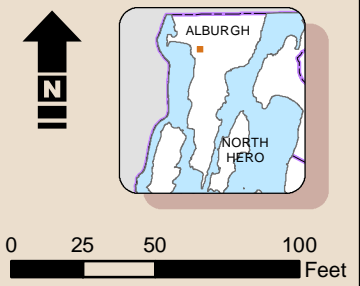


Littlewoods Rd

Alburgh Stormwater Management Planning

AL-3

\\cfs1\NetDvc-0\Proj-14\WRM\14-053_FNLG_Stormwater_Planning_&_Design\GIS\MapDocuments\Presentation\Reports\Alburgh_SWP\Map4_Alburgh_SchoolSt.mxd



- SW Treatment Opportunity
- River or Stream
- Highly Erodible Soils
- Drainage Area (1.0 Acres)

Treatment Opportunity:
 Currently stormwater runoff from nearly an acre of impervious surfaces at the Alburgh School is largely unmanaged and runs off along the shoulder on the northside of School Street. The green space between the basketball court and the road is a good candidate location for a potential stormwater retrofit.




Sources: Problem Areas: Stone;
 Highly Erodible Soils, Hydrography,
 Roads: VCGI; Imagery: esri.

STONE ENVIRONMENTAL INC

School St	AL-4
Alburgh Stormwater Management Planning	

\\fs1\NetDvc-O\Proj-14\WRM\14-063 FNLC Stormwater Planning & Design\GIS\MapDocuments\Presentation\Anr\Reports\Alburgh_SWP\Map5 Alburgh_CountryClub.mxd



-  SW Treatment Opportunity
-  Drainage Area (30.2 Acres)
-  Highly Erodible Soils

Treatment Opportunity:
 A drainage feature that runs from north to south approximately parallel to but 250 feet west of the Alburgh Country Club access road is contributing sediment directly to Lake Champlain. There appears to be an opportunity within the road right-of-way to manage the runoff conveyed by this drainage feature before it is discharged to the lake.

Sources: Problem Areas: Stone;
 Highly Erodible Soils, Hydrography,
 Roads: VCGI; Imagery: esri.



Alburgh Country Club

Alburgh Stormwater Management Planning

AL-5