# STORMWATER MANAGEMENT PLAN FOR FRANKLIN

**FINAL REPORT**

**Stone Project ID 14-053**

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# 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 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 water. 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.

**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.

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 have direct impacts on water quality in local creeks and streams (e.g., Pike River, Rock River, McGowan Brook), as well as downstream waterbodies (e.g., Lake Carmi and, ultimately, Lake Champlain). Any decisions that affect land use have stormwater management ramifications and, in turn, impact all downstream water resources. The findings of one recent 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 lakes, including Lake Carmi and Lake Champlain, are vital economic resources. The quality of local receiving waters affects both economic interests and quality of life in the surrounding areas. Throughout the Champlain basin, the local economy depends, in part, on the 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. Project Goals

One of the stated goals of the Franklin Municipal Plan is to: *maintain, improve, and protect the quality of Franklin's water resources* (Town of Franklin, 2012). In order to achieve this goal, the quality and quantity of stormwater runoff from existing development must be well-managed.

The Town has identified a number of needed supports, including:

- Development which degrades water quality should not be allowed.
- Streams, ponds, rivers, and wetlands should be maintained in a natural state and protected from pollutants so they can provide their natural functions. Buffer strips should be encouraged where necessary to minimize adverse effects on the ecosystem.
- Development within shoreland and streambank areas should maintain existing vegetation, prevent soil erosion, prevent pollution of the water body and be set back so as not to detract from the natural beauty or cause harm to the environment.
- Application of lawn fertilizers and pesticides should be discouraged or controlled along lakeshores and streambeds. Best Management Practices and or Accepted Management Practices are strongly encouraged as a means of protecting water resources.
- Development near surface waters must be low density, provide adequate protection from pollution.

The ultimate objective of this stormwater management planning project is to support the Town in achieving its goal, by providing the Town of Franklin with a list of high priority water resource concerns and conceptual solutions that will support the development and implementation of future restoration projects in an efficient and targeted manner.

This Stormwater Management Plan first incorporates information from existing plans and datasets to create a single, town-specific resource to guide future stormwater management activities. The resulting Stormwater Management Planning Library, included as Appendix B, is a valuable resource for water quality-related work in Franklin.

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 Franklin;
- 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 that would encourage consideration of stormwater management opportunities as development and redevelopment projects are pursued locally.

# 2. GENERAL DESCRIPTION OF THE STUDY AREAS

The Town of Franklin is located in Franklin County in northwest Vermont. The town has a total area of 29.75 square miles. As of the 2010 Census, the population of the town was 1,405 (U.S. Census Bureau, 2011). Franklin has a number of rivers, streams and lakes and ponds within its borders, including Lake Carmi and portions of the Pike River, Rock River, McGowan Brook, and several unnamed tributaries to the Missisquoi River. Development in the area is primarily concentrated in Franklin Village and along the shores of Lake Carmi.

The majority of the eastern two-thirds of the Town of Franklin drains either to Lake Carmi or to the Pike River. Relatively small areas along Franklin's southern boundary are in the Missisquoi River watershed. The western third of Franklin lies in the Rock River watershed, and drains primarily west into Highgate, then north into Quebec and ultimately to Missisquoi Bay. Each of these watersheds is described below, and watershed boundaries are shown on Map 1 in Appendix A.

## 2.1. Pike River

The Pike River originates in the hills of Berkshire then makes its way west to Franklin briefly, where Lake Carmi outlets into the river. The Pike then arcs north into Quebec, before turning to the west and eventually south, ultimately flowing into the Missisquoi Bay. Canada contains 85% of the river's watershed area. Agriculture is the dominant land use in the watershed.

## 2.2. Lake Carmi

Lake Carmi is a large, relatively shallow lake; it is 1,402 acres in size and has a maximum depth of 33 feet (VTANR 2008). The lake is oriented north-south and measures approximately three miles long. Lake Carmi has extensive wetlands in its watershed, most notably Franklin Bog at its southern end. Somewhere within the Franklin Bog lies the divide between the Pike River and Missisquoi River watersheds. A small, wetland-edged pond, Little Pond, is located within the Lake Carmi watershed on the eastern side, and this pond's outlet, Marsh Brook, is the largest tributary to the lake.

The lake is located in an agricultural region of the state, and 44% of its watershed is tilled or untilled farm land. There are five dairy farms in the watershed, as well as many acres of hay, corn, and pasture fields leased by farms located outside of the Carmi watershed. Forty-five percent of the watershed is wooded or wetland, including a large portion of Franklin Bog. Apart from fairly intensive shoreline development, composed primarily of seasonally occupied cottages and camps, low-density residential development is spread throughout the watershed.

The lake is natural, but a dam controls the water level and elevates the water about 2 feet over its natural level. The dam is located at the north end of the lake and drains north into the Pike River. The dam, originally constructed in the mid-1800s, was rebuilt in the early 1970s and is now owned by the Vermont Department of Environmental Conservation.

## 2.3. Rock River

The Rock River has its headwaters in the southeast corner of Highgate and flows northeast into Franklin, draining the western third of the town. The Rock River then turns to the west and back into Highgate before traveling north into Phillipsburg, Quebec. The Rock River ultimately empties into Missisquoi Bay. The state has identified pollutants of concern in the Rock River as nutrients and sediment. The pollutants are attributed

primarily to agricultural runoff. Within one to three years (roughly 2014-2016), the State of Vermont will develop TMDLs for both the Rock River and Saxe Brook (VTDEC 2012).

## 2.4. Other Watersheds in Franklin

Relatively small areas along Franklin's southern boundary are in the Missisquoi River watershed, and drain through various unnamed tributaries to that river. The headwaters of McGowan Brook, which also drains south to the Missisquoi River, are located in the south-central part of Franklin.

# 3. EXISTING PLANS AND DATA

Numerous and varied groups and individuals have invested considerable effort in evaluating Franklin's water resources, and the important interface between water resources and local land use decisions. At times, these evaluations have followed watershed boundaries, while at other times they have followed political boundaries. The following sections identify evaluations completed over the past ten years, with emphasis on work most relevant to the Town of Franklin, and on efforts to develop a list of strategic, prioritized projects that could be undertaken to improve water quality in and around Franklin. A more detailed review of each assessment is included as Appendix B of this report.

## 3.1. 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, the main purpose of which 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 *Missisquoi River Basin Water Quality Management Plan*, revised in March of 2013, overviews water resources and identifies concerns and threats to water quality within the more than 619 square miles of Vermont that drain to Missisquoi Bay. In addition, in 2008, the USDA's Natural Resource Conservation Service (NRCS) completed the *Missisquoi Areawide Plan*, a watershed-based plan specifically structured to inform and help guide the conservation efforts of partner agencies and cooperating farmers.
- 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. A stream geomorphic assessment has been completed for the Rock River.
- Water quality assessment work, including water chemistry and biological assessments. Biomonitoring data on macroinvertebrate and fish community health are available for multiple stations on the Rock River. In addition, since 2008, in-stream water samples have been collected by the Franklin Watershed Committee at up to 20 sites in Franklin for one or more years; all sites are in the Lake Carmi watershed and are located on named and unnamed tributaries to Lake Carmi. In-lake water samples have been collected by volunteer monitors in Lake Carmi since 1980.
- Total Maximum Daily Load (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 or in-lake water quality conditions. A TMDL addresses a single pollutant or stressor for a waterbody, so more than one TMDL may need to be developed for a particular receiving water. A phosphorus TMDL for Lake Carmi was approved by EPA Region 1 in 2009. The previously approved Lake Champlain phosphorus TMDL is currently under review by EPA Region 1, and may ultimately require the application of additional best management practices (BMPs) throughout the Lake Champlain watershed. The Rock River is also listed as an impaired surface water in need of a TMDL.

## 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 Franklin. These include direct feedback from the Town, work by the Vermont Agency of Transportation, and past and current planning initiatives.

- In meetings with Stone Environmental, Town officials identified 12 areas of concern and priority projects throughout Franklin, ranging from areas of shoulder erosion and flooding to undersized culverts. See Figure 4 and Table 4, Appendix B for a map and table of concern areas and priority projects, as well as a map of the locations of concerns identified in the stream geomorphic assessments.
- VTrans-sponsored programs, including both routine inspections of bridges and culverts and grant opportunities provided by the Better Backroads Program, have identified a number of potential projects to protect existing infrastructure whose implementation would also improve stormwater management.
- Three sections of Franklin's 2012 Municipal Plan relate to stormwater management: Community Utilities (Chapter 8), Transportation (Chapter 10), and Natural Conditions and Features (Chapter 12). Franklin's 2013 Development Regulations also contain language specific to stormwater management through the implementation of minimum buffer distances from the edges of surface waters.

# 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 stormwater management concerns, 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 location of any concerns related to stormwater
- Engagement with local officials, including:
  - March 24th kick-off meeting with Town Clerk and Road Foreman
  - September 17th follow-up meeting with Town Clerk and Road Commissioner
- Targeted site visits to verify problems areas (April and May 2014)
- Documentation (with photos) of existing problem areas

A "problem area data sheet" was developed and used as a guide to ensure that consistent information was collected as site visits were completed. Nearly 30 potential problem areas were identified and geo-located. The data sheets for all of the problem areas identified in the Town of Franklin are provided in Appendix C of this report.

## 4.2. Evaluation of Problem Areas

Working from the list of potential problem areas, the Consultant Team visited each potential problem area to directly observe the site. Where an unresolved problem was found, photos were taken of any areas of active erosion, and observations were recorded 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

The 17 problem areas that were assigned a Level 3 or 4 classification 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 as a priority 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, conceptual solutions were not developed for one of the following reasons:

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

In total, six conceptual solutions were developed to address problem areas that were assigned a Level 3 or 4 classification. The following sections describe each of the conceptual solutions.

### 4.3.1. Towle Neighborhood Road (Problem Area IDs: LC-03 and LC-04)

Roadside ditches in the highlighted areas shown in Figure 1, below, are in poor condition. Banks above the culvert inlets and outlets in both locations are over-steepened and are actively collapsing. The farm (also visible in Figure 1) appears to allow animals direct access to areas where both culverts outlet, exacerbating the problems.

Conditions along Towle Neighborhood Road could be improved by installing headwalls at the inlets to both culverts, and providing rock-lined splash pools at both culvert outlets. In addition, there is an approximately 300-foot section of roadside ditch that carries water from the outlet of the more northern culvert to the south that needs to be stabilized. Without animal exclusion from these areas, however, efforts to stabilize the outlets and ditch are likely to be overwhelmed.

*Figure 1. Towle Neighborhood Road Problem Areas. Significant roadside erosion was observed in both areas highlighted in yellow; problems appear to be exacerbated by animal access to the streams in both areas.*

### 4.3.2. Gallup Road (Problem Area ID: PK-01)

Gallup Road is a gravel road that runs roughly parallel to the Canadian border, east from Richard Road. A 600-foot section of roadside ditch, along the southern edge of the road and highlighted in Figure 2, was observed to be bare and actively eroding. In addition, the ditch has a steep back slope that is leading to slumping. Significant evidence of sediment transport was observed.

The ditch could be stabilized by making it wider, with a parabolic-shaped bottom. The ditch may need to be stone lined in sections where it is not possible to achieve a sustainable back slope. Stone check dams could also be employed in order to reduce flow velocities, limit sediment transport, and potentially create opportunities for infiltration in the ditch.

*Figure 2. Gallup Road Problem Area. Highlighted location indicates the ditch improvement opportunity.*

### 4.3.3. Franklin Fire & Rescue (Problem Area ID: PK-10)

Runoff from the Franklin Fire & Rescue facility, as well as the portions of Homestead Drive, Main Street, and the Dick Wright Ford dealership (approximated by the yellow highlighted area shown in Figure 3), currently drain directly (e.g., untreated) to the southwest corner of the Fire & Rescue parking lot and into an unnamed tributary of the Pike River. The corner of the parking lot has been shaped to facilitate this drainage pattern, with asphalt extended over the embankment and to the stream edge. In the immediate area of this drainage, there is evidence of sediment deposition and high flows.

Although it may be difficult to fully capture and treat the runoff from the highlighted area, there are a number of opportunities to better manage the runoff. One of the easiest would be to redirect the roof leader from the Fire & Rescue building, which currently discharges onto the parking lot, to a cistern. The Town has indicated that Fire & Rescue regularly washes their emergency service vehicles, and the roof runoff could be harvested for this use. Additional opportunities include creating storage in the green space north of Homestead Drive, as well as working with the owner of the Ford dealership to identify unneeded impervious surface that could be removed, and/or locations to manage stormwater on-site. The NRCS soil survey indicates that both Homestead Drive and the Ford dealership are located in an area of loamy fine sand with moderate infiltration capacity, but high groundwater, so opportunities for stormwater infiltration may be limited.

*Figure 3. Franklin Fire & Rescue Problem Area. A priority area for stormwater retrofits is highlighted in yellow.*

### 4.3.4. Franklin Town Garage (Problem Area ID: PK-11)

Runoff from the Franklin Town Garage, as well as from the portion of the Park & Ride facility located at the end of Homestead Drive, approximated by the yellow highlighted area shown in Figure 4, is conveyed directly (e.g., untreated) to an unnamed tributary of the Pike River. Runoff from these areas drops into a catch basin indicated by the red circle in Figure 4, and is conveyed via both closed pipe and open channel to the unnamed tributary of the Pike River. There is evidence of sediment transport in and around the catch basin, as well as at the outlet of the conveyance to the open channel; the open channel is indicated in purple in Figure 4.

Although it may be difficult to fully capture and treat the runoff from the highlighted area, it may be possible to redirect a portion of the runoff from the Town Garage to the green space the separates the Park & Ride facility from Homestead Drive. The NRCS soil survey indicates that the green space is likely located in an area of stony loam soils that may have some capacity for infiltration-based practices, depending on the depth to groundwater. Additionally, the open channel potion of the conveyance could be retrofitted to improve management of stormwater runoff from the Town Garage.

*Figure 4. Franklin Town Garage Problem Area. A priority area for stormwater retrofits is highlighted in yellow; an existing catch basin is highlighted in red; and the open channel portion of conveyance from the catch-basin to the stream is highlighted in purple.*

### 4.3.5. State Park Road (Problem Area ID: LC-10)

Recent construction along State Park Road has resulted in significant erosion in an area immediately adjacent to Marsh Brook. Photos of the area in 2009, available thru Google Maps, suggest that a stone retaining wall which ran parallel to State Park Road has been removed. Although the landowners appear to have attempted basic erosion control measures (e.g., seed and mulch), the measures have failed and the area is actively eroding. If allowed to continue, the erosion will likely impact State Park Road.

Although the removal of the stone retaining wall likely explains, at least in part, the erosion parallel to State Park Road, it is unclear what may have triggered the erosion south of the driveway. In the 2009 aerial photos, available from Google Maps, this area appears well-vegetated and stable. It will be important to involve the landowner, in addition to the Town, in devising a strategy for addressing this problem area.


*Figure 5. Area of active erosion near the intersection of State Park Road and Marsh Farm Road.*

# 5. NEXT STEPS

This document represents an extensive effort to identify and evaluate potential stormwater problem areas throughout the Town of Franklin. Several high priority potential stormwater improvement projects, including conceptual solutions, 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 process. 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, the Town of Franklin can take steps to prevent future stormwater problems by expanding how stormwater management is addressed in zoning regulations. Currently, proposed subdivisions containing more than two lots are required to undergo a review process; submittal requirements include the locations of existing and proposed utilities, a grading and landscaping plan, a "stormwater management plan for collection and discharge of stormwater with written description and contours in sufficient detail to indicate clearly the method of stormwater management on the site", and "designs for any bridges or culverts that may be required"(Town of Franklin, 2013). Section 6.12 of the Regulations provides specific review standards related to stormwater management, including a requirement that drainage facilities in subdivisions shall be designed to accommodate the 10-year design storm, while Town road system facilities shall accommodate the 25-year design storm.

In addition to these requirements, the Town could articulating 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.

A specific example of how this might be accomplished would be:

- Revising parking standards to encourage minimal use of impervious surface. For example:
  - Providing a definition of a "parking space" as 9' by 18' (162 square feet) in order to prevent the construction of over-sized spaces.
  - Recommending or requiring smaller stalls for compact cars, up to 30% of the total number of parking spaces.
  - Re-evaluating specified parking requirements to prevent the creation of surplus parking. This could involve establishing parking requirements which reflect average parking demand rather than maximum demand, and replacing "parking minimums" in the Regulations with "parking maximums".
  - Giving the Planning Commission the power to reduce parking requirements conditionally.

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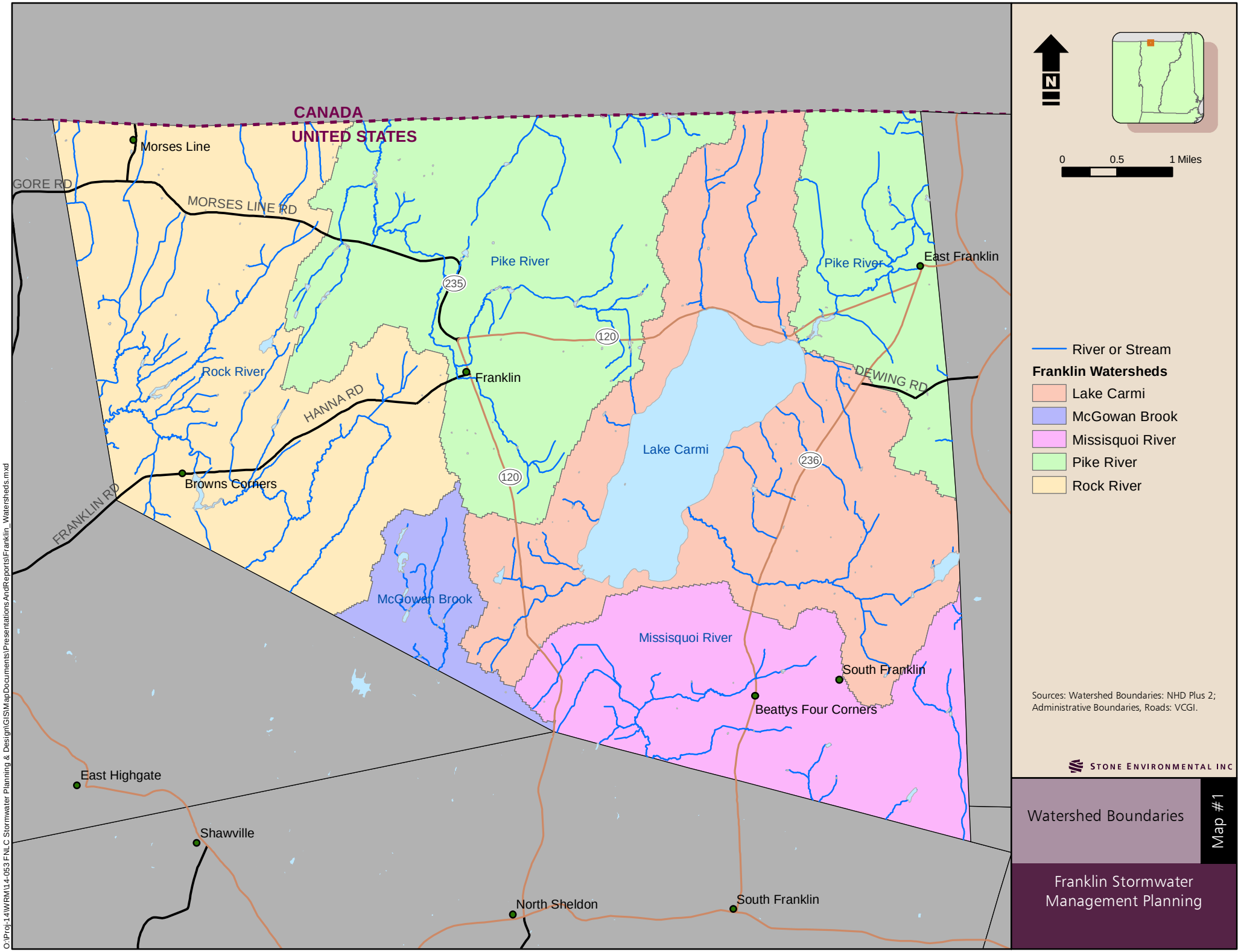
# APPENDICES

# APPENDIX A : WATERSHED MAP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Pike River
East Franklin
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120
Rock River
Franklin
DEWING RD
HANNA RD
Lake Carmi
236
120
Browns Corners
FRANKLIN RD
McGowan Brook
Missisquoi River
South Franklin
Beattys Four Corners
East Highgate
Shawville
North Sheldon
South Franklin
N
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0.5
1 Miles
River or Stream
Franklin Watersheds
Lake Carmi
McGowan Brook
Missisquoi River
Pike River
Rock River
Sources: Watershed Boundaries: NHD Plus 2;
Administrative Boundaries, Roads: VCGI.
STONE ENVIRONMENTAL INC
Watershed Boundaries
Map #1
Franklin Stormwater
Management Planning
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# APPENDIX B : STORMWATER MANAGEMENT PLANNING LIBRARY

# FINAL

# STORMWATER MANAGEMENT PLANNING LIBRARY

## TOWN OF FRANKLIN

**July 23, 2014**


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# Table of Contents

# 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. For example, the Missisquoi River watershed area includes part or all of twenty northern Vermont communities in three counties. 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 rivers, lakes, and streams that pass through or are located wholly within the Town of Franklin, Vermont. Although water quality assessment data dating back to the early 1970s is available for the Missisquoi River watershed, and dating back to 1980 for the Lake Carmi 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 a Franklin-specific list of strategic, prioritized projects that could be undertaken to improve water quality.

# 2. INTRODUCTION

The Town of Franklin is located in Franklin County in northwest Vermont. The town has a total area of 29.75 square miles[1]. As of the 2010 Census, the population of the town was 1,405[2]. Franklin has a number of rivers, streams and lakes and ponds within its borders, including Lake Carmi and portions of the Pike River, Rock River, McGowan Brook, and several unnamed tributaries to the Missisquoi River (See Figure 1 for a map of watershed boundaries). Development in the area is primarily concentrated in Franklin Village and along the shores of Lake Carmi.

The majority of the eastern two-thirds of the Town of Franklin drains either to Lake Carmi or to the Pike River. Relatively small areas along Franklin's southern boundary are in the Missisquoi River watershed, and drain through various unnamed tributaries to that river. The headwaters of McGowan Brook, which also drains south to the Missisquoi River, are located in the south-central part of Franklin. The western third of Franklin lies in the Rock River watershed, and drains primarily west into Highgate, then north into Quebec and ultimately to Missisquoi Bay.

Numerous and varied groups and individuals have invested considerable effort in evaluating different components of Franklin'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 Franklin 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 Franklin.

[1] 2011 Franklin Town Plan, http://www.franklinvermont.com/2012TownPlanAdoptedmay82012.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 Franklin is within the Missisquoi Basin, which plan was last updated in March of 2013[3].
- 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. Stream geomorphic assessments have been completed for the main stem of the Rock River in Franklin.
- In-stream or in-lake water quality assessment work, including water chemistry and biological assessments.

## 3.1. Missisquoi Bay Watershed Phosphorous Load Monitoring Program[4]

This document locates river flow gages and phosphorus sampling areas on the Missisquoi River, as well as in other locations within the Missisquoi Bay watershed. While there are no water quality sampling stations associated with this program in Franklin, there is a flow gage station that was added in 2001 to support the phosphorus load monitoring programs, located on the Pike River at East Franklin, Vermont (USGS 04294300, with a drainage area of 89.3 $km^2$).

## 3.2. Missisquoi River Watershed Water Quality Management Plan[5]

The Missisquoi River Basin Water Quality Management Plan, most recently revised in March of 2013, overviews water resources, and identifies concerns and threats to water quality within the more than 619 square miles of Vermont that drain to the Missisquoi River. 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 high priority strategies include the following:

- Implement projects to meet the phosphorus reduction targets for Lake Champlain and Lake Carmi, and to meet the bacteria reduction targets for Berry, Godin and Samsonville Brooks.
- Work with towns, VTrans and private landowners to use existing culvert assessments to identify appropriate replacement size and placement to improve fish passage and the geomorphic stability of the stream.

[3] http://www.vtwaterquality.org/mapp/docs/mp_Basin06Plan.pdf

[4] http://plan.lcbp.org/assets/files/task-comment-files/Missisquoi%20P%20Load%20Monitoring%20Plan.pdf

[5] http://www.vtwaterquality.org/mapp/docs/mp_Basin06Plan.pdf

- Use the Critical Source Area study to direct technical and financial agricultural resources to identified critical sources.
- Work with towns to protect river corridors and promote flood resiliency by establishing Fluvial Erosion Hazard zones and buffer zones in local zoning.
- Identify wetlands on agricultural lands for phosphorus retention, and in the river corridor for sediment attenuation, and then prioritize and conserve and/or restore.
- Encourage use of the basin's rivers and lakes to increase people's appreciation of the water resources.
- Assist the towns in addressing specific wastewater treatment infrastructure upgrade needs identified in the Clean Water Fund's forthcoming Water Survey.

More specifically, the Plan identifies the following concerns for waters in Franklin, as described below:

- Lake Carmi has been identified as "impaired" due to phosphorus enrichment, and the Lake Carmi Phosphorus Total Maximum Daily Load (TMDL) or phosphorus load reduction target was approved by EPA on April 8, 2009.
- The Rock River, from the Vermont/Quebec border upstream 13 miles to Hanna Road just southwest of Franklin Village, has been identified as an "impaired surface water in need of a TMDL" due to agricultural runoff and nutrient enrichment.
- The Missisquoi River (whole length) is considered to be stressed from high sediment loads, turbidity, nutrient enrichment, and increased water temperature, likely from agricultural land uses, loss of riparian vegetation, and stream-bank erosion.

### 3.3. Missisquoi Areawide Plan[6]

In 2008, the NRCS completed the Missisquoi Areawide Plan, a watershed-based plan designed to reduce the phosphorus load delivered to Missisquoi Bay. The document was structured to inform and help partner agencies and cooperating farmers. The Areawide Plan consists of a series of water quality improvement strategies that target efforts to specific priority areas. The strategies were developed in consultation with local stakeholders and representatives of various state and federal agencies. The Areawide Plan was designed to help move conservation implementation actions away from a "first come, first served basis" in order to target financial and technical resources to the areas of the watershed with the greatest conservation need. The plan includes a considerable amount of geospatial data, including information on farmstead location, annual crop and hay lands, and the adjacency of cropland to areas with steep slopes.

### 3.4. Identification of Critical Source Areas of Phosphorus in the Vermont Sector of the Missisquoi Bay Basin[7]

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

[6] http://www.nrcs.usda.gov/wps/portal/nrcs/detail/vt/technical/dma/?cid=stelprdb1176944

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

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 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 steep grades are particularly vulnerable to runoff and likely to be identified as CSAs. In Franklin, the CSAs identified by the model include:

- Morses Line Road (0.7-1.0 miles north of Franklin Village)
- Messier Road (0.7 miles south of Morses Line Road)
- Hanna Road (especially near Highgate line and near Webster Road intersection)
- Webster Road (from Highgate line 1.3 miles north)
- North Sheldon Road (near Swamp Road intersection)
- Riley Road (south end near Rte. 120)
- Franklin Village (near several stream crossing locations)
- Middle Road (0.8 miles north of Franklin Village)
- Gallup Road (Rte. 120 to Middle Road; 0.9 miles north of Middle Road)
- Boston Post Road
- Route 120 (at public beach on north shore of Lake Carmi)
- Hammond Shore Road (near Harrison Drive, Jenne Drive)
- Patton Shore Road (near Scottish Lane)
- Sandy Bay Road (Riley Road to Blackwoods Road intersection)
- Mullen Shore Road (Riley Road to Westcott Shore Road intersection)
- Westcott Shore Road (near Patterson Point Road)

## 3.5. Stream Geomorphic Assessment Final Reports[8]

A stream geomorphic assessment has been completed for the Rock River. The assessment results are designed to direct future stream corridor restoration and protection measures. The nature of each section of the watershed is characterized and each reach described. Potential restoration projects identified during this work with ties to stormwater management and/or high flows are listed and briefly described below by stream and stream reach.

[8] https://anrnode.anr.state.vt.us/SGA/finalReports.aspx

As part of the Phase 2 Stream Geomorphic Assessment process, each of the nine bridge and culvert crossings located in the Franklin portion of the Rock River mainstem was assessed following VTANR protocols. The constriction status of assessed crossing structures, including the additional 5 minor structures encountered, is depicted graphically in Figure 2. All of the structures encountered in Franklin had spans which were undersized with respect to the width of the bankfull stage (and therefore were also constricting of the flood prone width).

### 3.5.1. Phase 2 Stream Geomorphic Assessment, Rock River Watershed[9]

Potential restoration projects identified during this work with ties to stormwater management and/or high flows are listed and briefly described below by stream and stream reach. See Figure 3 for a stream geomorphic assessment map.

- M10 (Hanna Road, Franklin): Previously channelized sections at upstream end of reach and mid-reach. Livestock have direct access to the stream leading to streambank erosion and nutrient inputs.
- M09-F (Hanna Road, Franklin): Non-cohesive, erodible fill material has been placed in the floodplain to support two water tanks for pesticide mixing.
- M09-F (Hanna Road/Browns Corner Road, Franklin) Channelization, dredging, berming leading to entrenchment and loss of floodplain access. Erosional gullies at tile drain outlets from corn field along riverbank.
- M09-D (Beaver Meadow Road, Franklin): portion of Rock River flow has been diverted to ditched channel which drains pastureland and receives tile drainage from channels between pasture paddocks. Livestock fencing at channel bankfull.
- M07-B (Barnum Rd, Franklin): Downstream of the gorge; equilibrium channel with bedrock grade controls. Livestock with direct access to the stream; negligible tree buffers.
- M07-A (Barnum Road crossing - Barnum Rd, Franklin): Upstream end of segment: culvert crossing is significantly undersized with respect to bankfull width. Large downstream scour pool has developed, leading to erosion.
- M07-A (Barnum Road, Franklin): Mid-stream runoff contributing areas coincident with actively cropped fields and extending beyond the geomorphically defined corridor.

## 3.6. LaRosa Volunteer Data[10,11] (2008 – 2013)

Since 2008, water samples have been collected by the Franklin Watershed Committee at up to 20 sites in Franklin for one or more years; all sites are in the Lake Carmi watershed and are located on named and unnamed tributaries to Lake Carmi. Samples were analyzed by the VT DEC's LaRosa laboratory for total phosphorus and turbidity. All sample results are available online at the sources listed below, and are

[9] https://anrnode.anr.state.vt.us/SGA/report.aspx?rpid=54_CPA&option=download

[10] http://www.vtwaterquality.org/cfm/larosavm/mp_larosavolmon.cfm

[11] http://anrweb.vermont.gov/dec/dec/VolunteerMonitoriing.aspx (2013 data only)

summarized in Table 1. Average total phosphorus measurements on an annual basis in monitored streams and ponds in the Lake Carmi watershed are generally elevated. A few tributaries, such as Marsh Brook and Sandy Bay Brook, routinely have annual average total phosphorus levels exceeding 100 ug/L. Unfortunately, it is not possible to determine what portion of the measured pollutant load is attributable to stormwater runoff as compared to other sources (such as agriculture).

### 3.7. Lay Monitoring Lake Water Quality Data[12] (1979-2013)

Since 1980, in-lake water samples have been collected in Lake Carmi by volunteer monitors. Volunteers collect water samples that are analyzed for total phosphorus, chlorophyll-a, and Secchi transparency. All sample results are available online at the source listed below, and are summarized in Table 3. Mean annual total phosphorus measurements at Station 1, near the center of Lake Carmi, declined from nearly 40 ug/L in the early 1980s to 22-25 ug/L in the late 1990s and early 2000s. However, since 2002, mean annual total phosphorus concentrations have generally been at or above 30 ug/L (Table 2).

### 3.8. Rock River Targeted BMP Implementation Project (VT DEC, 2010 – present)

The Rock River Watershed Targeted Best Management Practice (BMP) Implementation Project is an attempt to quantify the effect of agricultural BMPs on water quality. The project began in 2010, with NRCS and the UVM Extension Service providing assessments and technical assistance to approximately 16 farms within the study area. Vermont DEC constructed water quality monitoring stations within the Rock River watershed both upstream and downstream of the treatment area. FNLC trained volunteers to take water samples, which are submitted to the DEC laboratory for analysis. Sampling points are in Highgate (Station #14, Cassidy Rd at Bouchard Rd) and Franklin (Station #20, Barnum Rd, North of Brown's Corner Rd). Farms that drain to the downstream station were recruited to add BMPs to their land, providing a comparison to the un-treated area above the upstream station. Given that the BMPs are still being implemented, current project data have not been analyzed for changes in water quality. Pre-BMP data does show that concentrations of total phosphorous, dissolved phosphorous and total suspended solids are all significantly greater at the downstream sample location.

## 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 Franklin. These include direct feedback from the Town, work by the Vermont Agency of Transportation, as well as past and current planning initiatives.

[12] https://anrweb.vermont.gov/dec/dec/LayMonitoring.aspx

## 4.1. Town Feedback

In meetings with Stone Environmental, Town officials identified 12 areas of concern and priority projects throughout Franklin, ranging from areas of shoulder erosion and flooding to undersized culverts. See Figure 4 and Table 3 for a map and table of concern areas and priority projects.

## 4.2. Franklin Watershed Committee[13]

The Franklin Watershed Committee (FWC) was founded with the purpose of restoring water quality in Lake Carmi by identifying and reducing inputs of phosphorus from the land in the Lake Carmi Watershed. Originally formed as the Carmi Watershed Committee in 1994, the FWC has since expanded its mandate to encompass Lake Carmi, its tributaries, and other bodies of water affected by activity within the Town of Franklin. Programs and practices FWC manages include, but are not limited to:

- Stabilizing and repairing ditches, culverts, streams, and stretches of shoreline that were eroding and contributing to Lake Carmi's sediment load
- Collaborating with the VT ANR to develop a Total Maximum Daily Load (TMDL) analysis for phosphorus in Lake Carmi
- Coordinating volunteers to collect in-lake and tributary water quality samples in the Lake Carmi watershed (see Sections 3.6 and 3.7)
- Coordinating and facilitating landowner participation in the VT-DEC Lake Wise Program to promote best shoreline management practices (funded by an ERP grant in 2013-2014).

## 4.3. Vermont Agency of Transportation-Sponsored Programs

### 4.3.1. Vermont Online Bridge and Culvert Inventory Data[14]

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 contains basic information for seven bridges, and contains no information about culverts in Franklin.

### 4.3.2. Stream Geomorphic Assessment, Bridge and Culvert Data[15]

*Bridge and Culvert Summaries*

In addition to the stream geomorphic assessment data described in Section 3.5, the Vermont Stream Geomorphic Assessment data management system (SGA-DMS) also contains a series of bridge and culvert

[13] http://www.franklinwatershedvt.org/

[14] http://apps.vtrans.vermont.gov/BridgeAndCulvert/Login.aspx?ReturnUrl=%2fBridgeAndCulvert%2fDefault.aspx

[15] https://anrnode.anr.state.vt.us/SGA/datasets/selectReport.aspx?sortType=Town&bid=06&bnm=Missisquoi

assessments completed in 2011, which are not recorded in the Vermont Online Bridge and Culvert Inventory (Section 4.2.1). This database contains assessment results for 83 culverts in Franklin. While many of the attributes describe the condition of streams upstream and downstream of culverts, several conditions noted in the inventory were considered to be potential indicators of roadway-related stormwater erosion issues:

- Scour threatening culverts or wing walls (upstream or downstream of road crossings)
- Bank armoring failures (upstream or downstream of road crossings)
- High levels of streambank erosion near road crossings
- Culverts obstructed by sediment or deformation
- Narrative comments indicating a road erosion or other problem to be verified

A total of 41 culverts in Franklin met one or more of these criteria (Table 3).

*Failure Modes- Problems and Causes*

This document records the failure modes of a select group of bridges and culverts along the Rock River through Franklin, as well as around Lake Carmi. 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. Reports are currently available for the following structures and stream crossings:

- Rock River at Barnum Road (culvert)
- Rock River at Beaver Meadow Road (culvert)
- Rock River at Browns Crossing Road (culvert)
- Unnamed Tributary to Rock River at Browns Crossing Road (three culverts)
- Unnamed tributary (Sisco Brook) to Lake Carmi at Dewing Road (two culverts)
- Sisco Brook at Middle Road (culvert)

*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. Report data are available for 83 culverts located throughout Franklin.

### 4.3.3. Better Backroads Program[16]

The Town of Franklin and the Franklin Watershed Committee have been successful in obtaining grants from the Agency of Natural Resources and the Better Backroads Program to address at least one pressing erosion issue that threatened public roads and bridges.

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

[16] http://www.vtwaterquality.org/erp/htm/backroads.htm

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 Program[17], 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 2015[18]

### 4.3.4. Ecosystem Restoration Program Projects[19]

Franklin has two listed Ecosystem Restoration Program (ERP) projects. Below is a brief description of each project and its status:

| Project | ERP Program | Description | Start Year | Status |
|---|---|---|---|---|
| Rock River | Basin Planning | Rock River Priority Project Implementation | 2006 | Complete |
| Swamp Road | Better Backroads | Install stone lined ditches | 2009 | In progress |

## 4.4. Vermont DEC Stormwater Permitting Program

### 4.4.1. 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.

### 4.4.2. Environmental Research Tool[20]

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 eight stormwater permits that have been issued to sites in Franklin accessible through the tool. All of these permits are construction permits for projects that did not require post-construction stormwater practices, or for subdivisions that were never constructed (and so the permit status is "terminated" in the ANR database).

[17] http://www.vermontlocalroads.org/index.html

[18] http://www.leg.state.vt.us/docs/2014/bills/Passed/H-872.pdf

[19] http://www.vtwaterquality.org/erp/projects/

[20] http://www.anr.state.vt.us/WMID/StormWater.aspx

## 4.5. Town of Franklin, Vermont Municipal Plan[21]

Three sections of Franklin's 2012 Municipal Plan relate to stormwater management: Community Utilities (Chapter 8), Transportation (Chapter 10), and Natural Conditions and Features (Chapter 12).

The Community Utilities section contains a brief description of the town's water and wastewater treatment systems. While this section describes the town's water source, water distribution system, and private on-site wastewater treatment systems, it does not identify any specific stormwater management measures that the Town routinely deploys.

The Transportation section includes information about the Town of Franklin's road network, including basic information about a Road Surface Management Survey for the Town completed by the Northwest Regional Planning Commission in the fall of 1998. This project included a computer package for inventorying, costing, and prioritizing work efforts to meet local need, which was developed by Vermont Local Roads. However, these data have not been updated since 1998 due to the software being outdated. It is not clear whether the RSMS included an inventory of the town's bridges or culverts. 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.

The Natural Features section includes a summary of surface water resources (Lake Carmi and Towle Pond). This section briefly discusses flood hazard areas, including a summary of minimum National Flood Hazard Insurance Program (NFIP) standards. This section contains a map of the Town's watersheds, but does not otherwise name or describe rivers or streams in the Town. The natural soil conditions across much of Franklin (low soil permeability, shallow depths to bedrock, and high water tables), which pose challenges for both development and low-impact stormwater management strategies, are also noted in this section.

The Natural Features section describes recent efforts to improve water quality in Lake Carmi led by the Franklin Watershed Committee (FWC). The work is guided by the action items in the Lake Carmi Phosphorus TMDL which include septic outreach, shoreline management, outreach and repair, stream surveys and repairs, and working with farmers and landowners to reduce loading to the lake. Members of the FWC work collaboratively to bring about action on important issues such as road inventory and culvert upgrade issues, and Carmi Public Beach stabilization and maintenance. Members of the FWC have secured grant funding from the Center for Clean and Clear, Lake Champlain Basin Program, Agency of Natural Resources, Better Back Roads, Farmer's Watershed Alliance, Watershed License Program, Allstate Insurance Company, and Chevron Corporation.

Franklin's 2013 Development Regulations[22] also contain language specific to stormwater management through the implementation of minimum buffer distances from the edges of surface waters. While the building of new structures within these setback zones is not permitted, and the construction of new public parking lots is not permitted within 100 feet of shorelines or stream banks, the regulations are silent regarding other important aspects of stormwater management in these buffer zones. For instance, there is no language requiring the planting or maintenance of naturally vegetated stream or shoreline buffers, nor is there any language that

[21] http://www.franklinvermont.com/2012TownPlanAdoptedmay82012.pdf

[22] http://www.franklinvermont.com/Development%20Regulations%20Adopted%20December%202012.pdf

prevents lawns, driveways or boat accesses, decks, or other impervious surfaces that are not structures from being installed in the setback area.

*Franklin Land Development Regulations: Dimensional Standards for Structures and Lots by Zoning District (2013)*

| | Village | Rural Residential/ Agricultural | Shoreland/ Recreation | Conservation |
|---|---|---|---|---|
| Setback, Stream | 50 Feet | 50 Feet | 50 Feet | 100 Feet |
| Setback, Shoreline | N/A | N/A | 1 Unit Seasonal Dwelling: 25 Feet<br>1 Unit Year Round Dwelling & 2 Unit Seasonal: 50 Feet | N/A |

Proposed subdivisions containing more than two lots are required to undergo a review process; submittal requirements include the locations of existing and proposed utilities, a grading and landscaping plan, a "stormwater management plan for collection and discharge of stormwater with written description and contours in sufficient detail to indicate clearly the method of stormwater management on the site", and "designs for any bridges or culverts that may be required". Section 6.12 of the Regulations provides specific review standards related to stormwater management, including a requirement that drainage facilities in subdivisions shall be designed to accommodate the 10-year design storm, while Town road system facilities shall accommodate the 25-year design storm.

I don't think it is reasonable to assume a 50 foot setback is a stormwater protection ordinance. Unless the language states vegetated buffer or planted buffer there is nothing to prevent lawns, parking lots etc from being installed in the setback area.

# 5. OTHER RELATED INFORMATION

There are a significant number of farm operations in Franklin. Farmsteads (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 Structure[23]

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.

[23] http://efotg.sc.egov.usda.gov//references/public/VT/VT558-0311.pdf

# 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 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 Missisquoi, Pike, Rock, and Lake Carmi watersheds in general, and in the Town of Franklin 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 & TABLES

*Figure 1. Franklin watershed boundaries.*

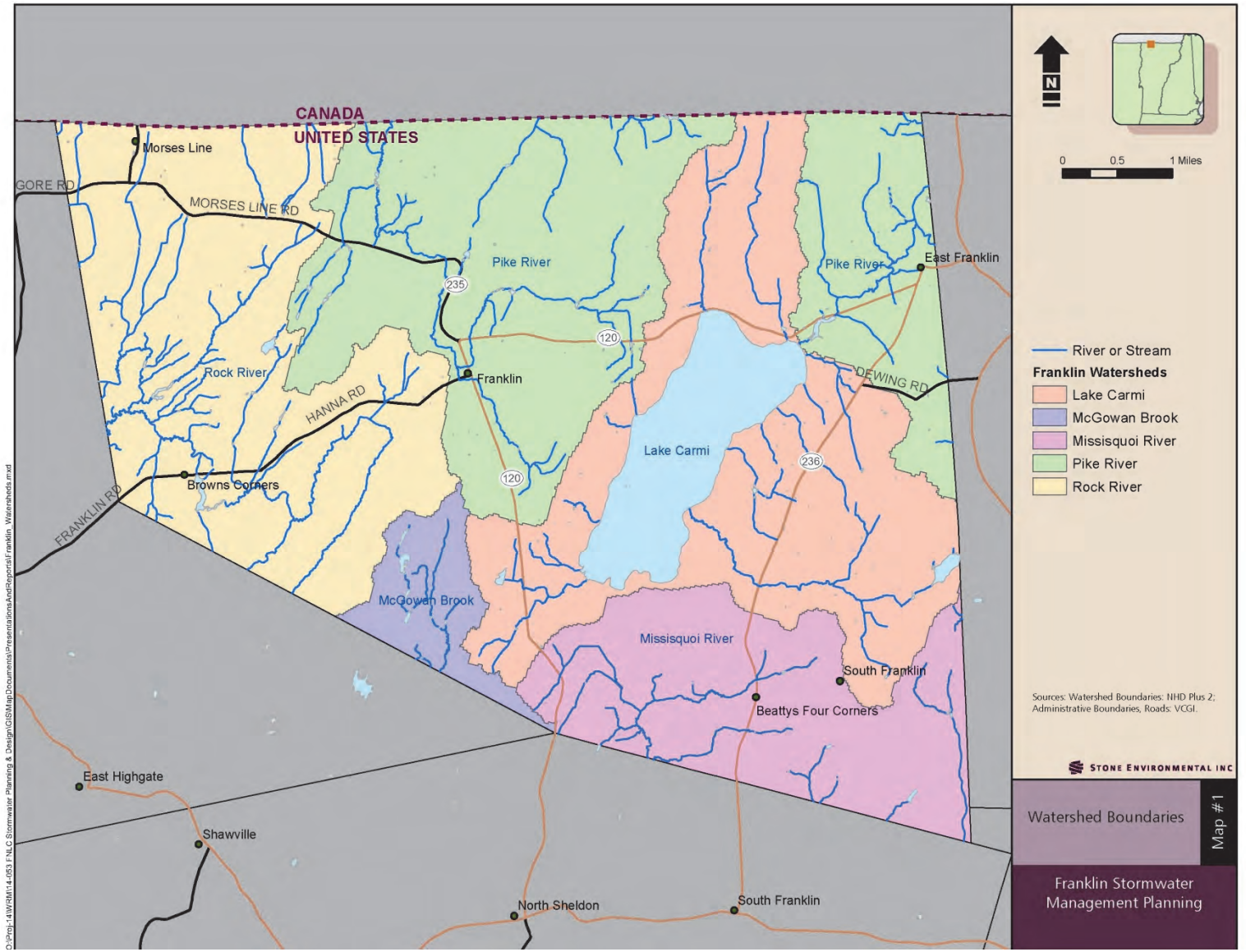


*Figure 2. Constriction status of bridge and culvert crossings encountered during Phase 2 Stream Geomorphic Assessments, Rock River watershed, 2006.*

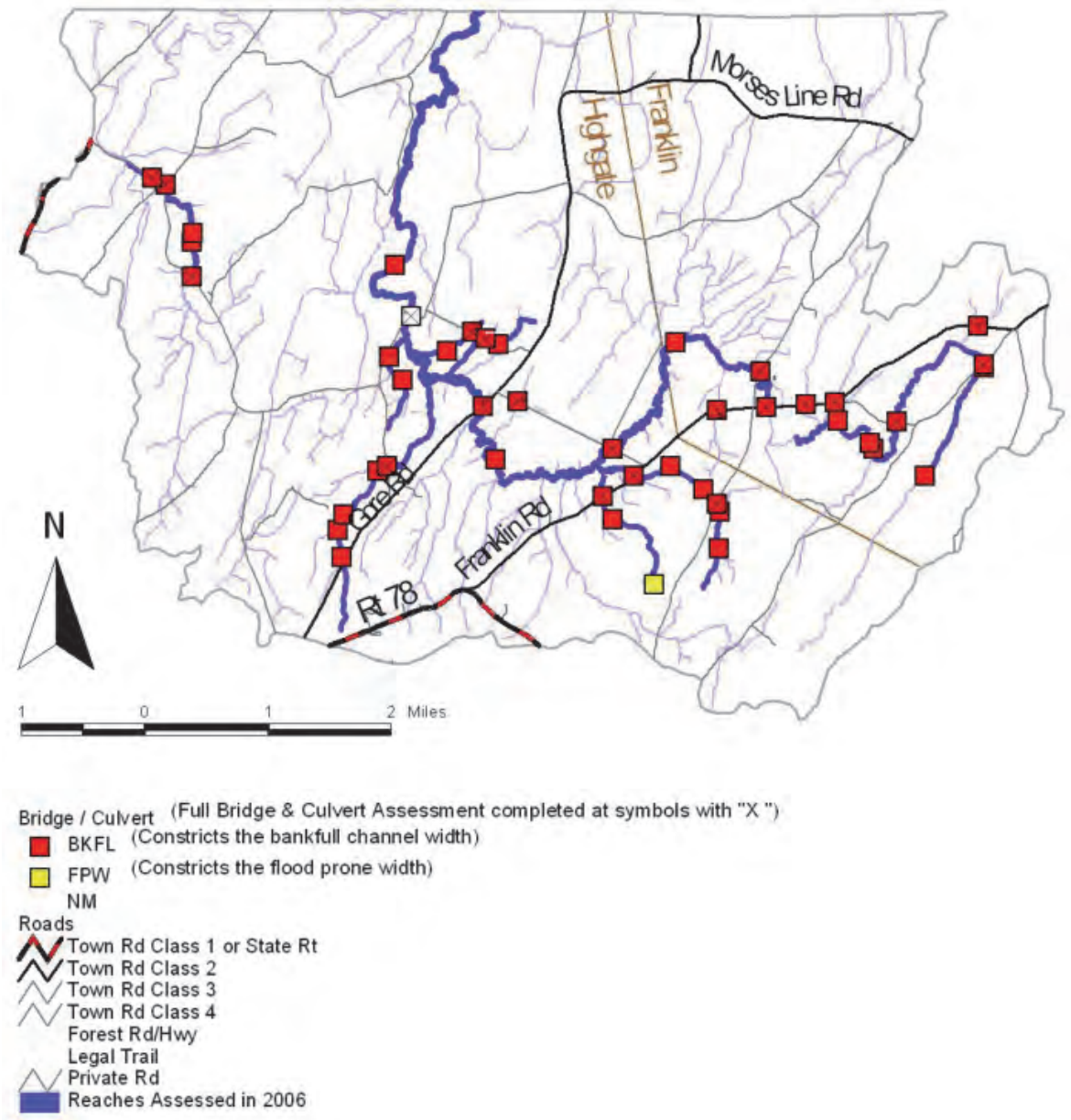


*Figure 3. Rock River reaches and stream geomorphic assessment status.*

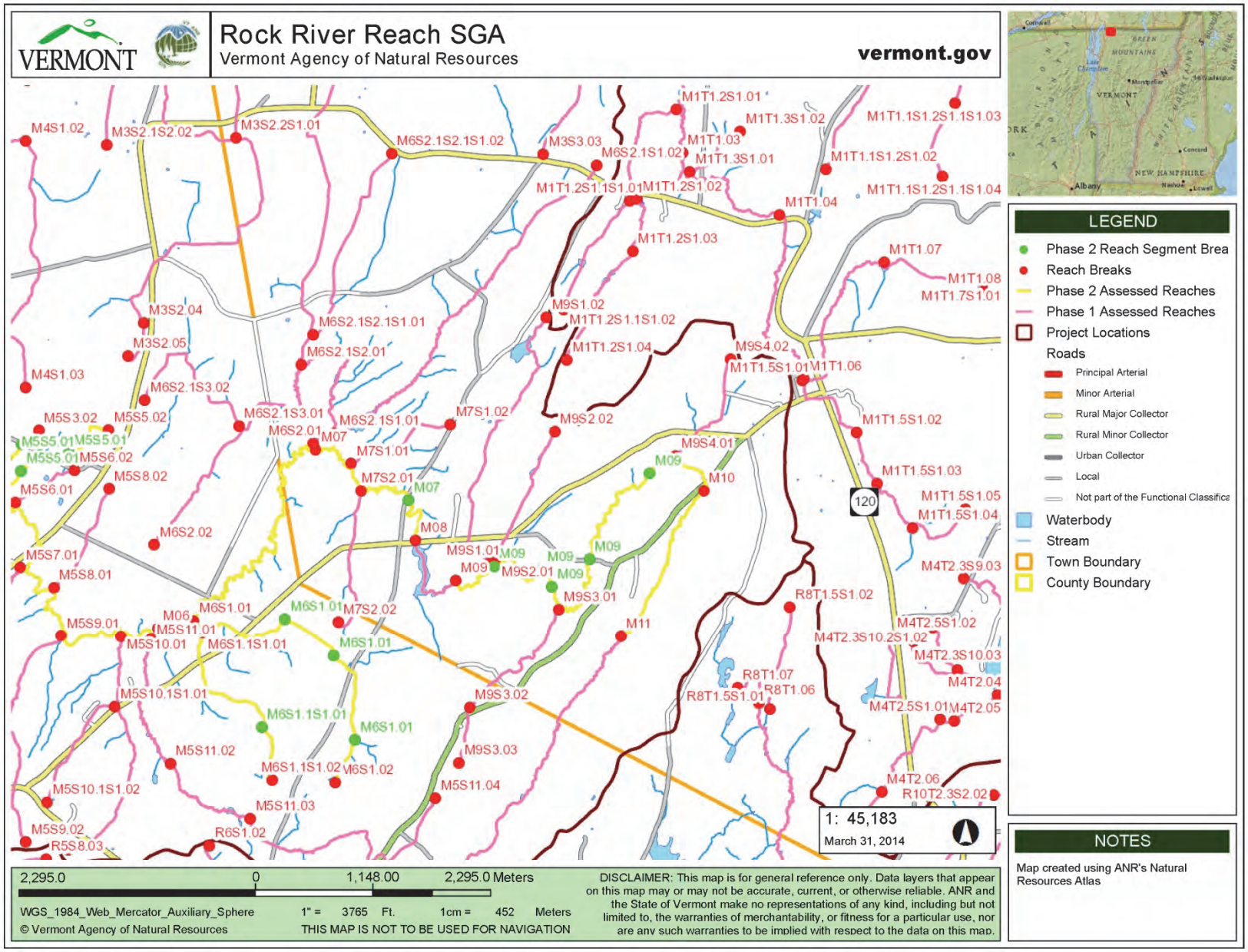


*Table 1. Tabulated summaries of pollutant concentrations for LaRosa Volunteer Data monitoring sites in Lake Carmi tributaries.*

| Location | Average Total Phosphorus (ug/L) | | | | | | Average Turbidity (NTU) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
| Alder Run at Middle Rd | 38 | 38 | 46 | 25 | 68 | 31 | 3.5 | -- | 3.5 | -- | -- | -- |
| Dewing Brook at Dewing Rd near mouth | 147 | 90 | 272 | 38 | 41 | 94 | 3.6 | -- | 4.6 | 3.3 | 2.2 | 12.8 |
| Dickys Brook at Lake Rd near mouth | 45 | 50 | 39 | 38 | 36 | 58 | 5.5 | -- | 4.6 | 6.4 | 5.7 | 3.4 |
| Dickys Brook at Middle Rd | -- | -- | -- | -- | -- | 28 | -- | -- | -- | -- | -- | -- |
| Dickys Brook at Rainville Field | -- | -- | -- | -- | -- | 32 | -- | -- | -- | -- | -- | -- |
| Hammond Brook North near mouth | 33 | -- | -- | 33 | 27 | 33 | 3.6 | -- | -- | 4.1 | 3.0 | 1.7 |
| Hammond Brook South near mouth | 47 | -- | 44 | 60 | 46 | 52 | 2.4 | -- | 2.6 | 1.2 | 2.8 | 1.7 |
| Kanes Brook near mouth | 76 | -- | 69 | 87 | 48 | 126 | 6.1 | -- | 3.8 | 9.2 | 6.8 | 4.4 |
| Little Pond Rd Culvert North | 399 | -- | -- | 399 | 273 | 89 | -- | -- | -- | -- | -- | -- |
| Little Pond Rd Culvert West | 307 | -- | -- | 307 | 489 | 365 | -- | -- | -- | -- | -- | -- |
| Little Pond Road Culvert | -- | -- | -- | -- | -- | 527 | -- | -- | -- | -- | -- | -- |
| Marsh Brook at Lake Carmi State Park near mouth | 135 | 151 | 152 | 113 | 157 | 90 | 3.4 | -- | 3.4 | 1.7 | 4.4 | 3.4 |
| Marsh Brook at State Park Rd | -- | -- | -- | -- | -- | 115 | -- | -- | -- | -- | -- | -- |
| Marsh Brook at Towle Neighborhood Rd North | -- | -- | -- | -- | -- | 121 | -- | -- | -- | -- | -- | -- |
| Marsh Brook at Towle Neighborhood Rd South | 165 | 87 | 201 | 217 | 233 | 154 | -- | -- | -- | -- | -- | -- |
| Prouty Brook near mouth | 48 | -- | 53 | 38 | 40 | 59 | 15.0 | -- | 14.8 | 13.3 | 16.7 | 7.7 |
| Sandy Bay Brook at Black Woods Rd near mouth | 222 | 173 | 264 | 201 | 262 | 238 | 19.1 | -- | 16.8 | 25.4 | 15.5 | 7.4 |
| Wagner Drain Tile | -- | -- | -- | -- | 2022 | 386 | -- | -- | -- | -- | -- | -- |
| Westcott Brook near mouth | 39 | -- | 44 | 29 | 36 | 48 | 5.9 | -- | 5.8 | 8.6 | 2.6 | 14.7 |

*Table 2. Tabulated summaries of pollutant concentrations for the lay lake water quality monitoring program in Lake Carmi.*

| | Station 1 | | | Station 2 | |
|---|---|---|---|---|---|
| Year | Mean Secchi Depth (m) | Mean Chl-a Concentration (ug/l) | Mean Total Phosphorus (ug/l) | Mean Secchi Depth (m) | Mean Chl-a Concentration (ug/l) |
| 1979 | 1.5 | 15.2 | -- | 1.5 | 13.8 |
| 1980 | 1.7 | 23.7 | -- | 1.8 | 23.1 |
| 1981 | 1.9 | 19.2 | -- | 2.0 | -- |
| 1982 | 1.9 | 17.4 | -- | 2.0 | -- |
| 1983 | 1.9 | 25.5 | 29.6 | 1.9 | -- |
| 1984 | 1.5 | 30.1 | 34.9 | 1.5 | -- |
| 1985 | 1.5 | 30.5 | 38.5 | 1.6 | -- |
| 1986 | 1.3 | 27.1 | 37.5 | 1.4 | -- |
| 1987 | 1.8 | 15.0 | 29.9 | 1.7 | -- |
| 1988 | 2.0 | 14.4 | 27.5 | 2.0 | -- |
| 1989 | 2.4 | 12.9 | 29.2 | 2.5 | -- |
| 1990 | 1.7 | 40.4 | 28.0 | 1.7 | -- |
| 1991 | 2.1 | 13.0 | 27.0 | 2.1 | -- |
| 1992 | 2.2 | 13.6 | 29.5 | 2.2 | -- |
| 1993 | 1.8 | 14.6 | 26.8 | 1.8 | -- |
| 1994 | 2.2 | 10.3 | 23.8 | 2.2 | -- |
| 1995 | 2.1 | 14.9 | 25.7 | 2.1 | -- |
| 1996 | 2.1 | 10.5 | 27.1 | 2.1 | -- |
| 1997 | 2.5 | 8.5 | 23.7 | 2.4 | -- |
| 1998 | 2.2 | 7.6 | 23.2 | 2.2 | -- |
| 1999 | 2.1 | 20.4 | 26.6 | 2.1 | -- |
| 2000 | 2.5 | 12.1 | 25.8 | 2.5 | -- |
| 2001 | 2.9 | 10.8 | 24.5 | 3.2 | -- |
| 2002 | 2.7 | 8.0 | 24.1 | 2.5 | -- |
| 2003 | 2.2 | 16.2 | 31.8 | 2.0 | -- |
| 2004 | 2.3 | 13.3 | 30.3 | 2.3 | -- |
| 2005 | 2.2 | 15.6 | 29.5 | 2.2 | -- |
| 2006 | 1.2 | 35.6 | 47.1 | 1.2 | -- |
| 2007 | 2.8 | 12.1 | 29.3 | 2.5 | -- |
| 2008 | 1.9 | 16.2 | 38.1 | 1.9 | -- |
| 2009 | 1.9 | 16.1 | 41.2 | 1.9 | -- |
| 2010 | 2.4 | 15.3 | 36.2 | 2.2 | -- |
| 2011 | 2.1 | 12.2 | 33.6 | 2.0 | -- |
| 2012 | 2.3 | 13.2 | 31.5 | 2.2 | -- |

*Figure 4. Areas of concern and priority projects identified by town officials and SGA reports.*

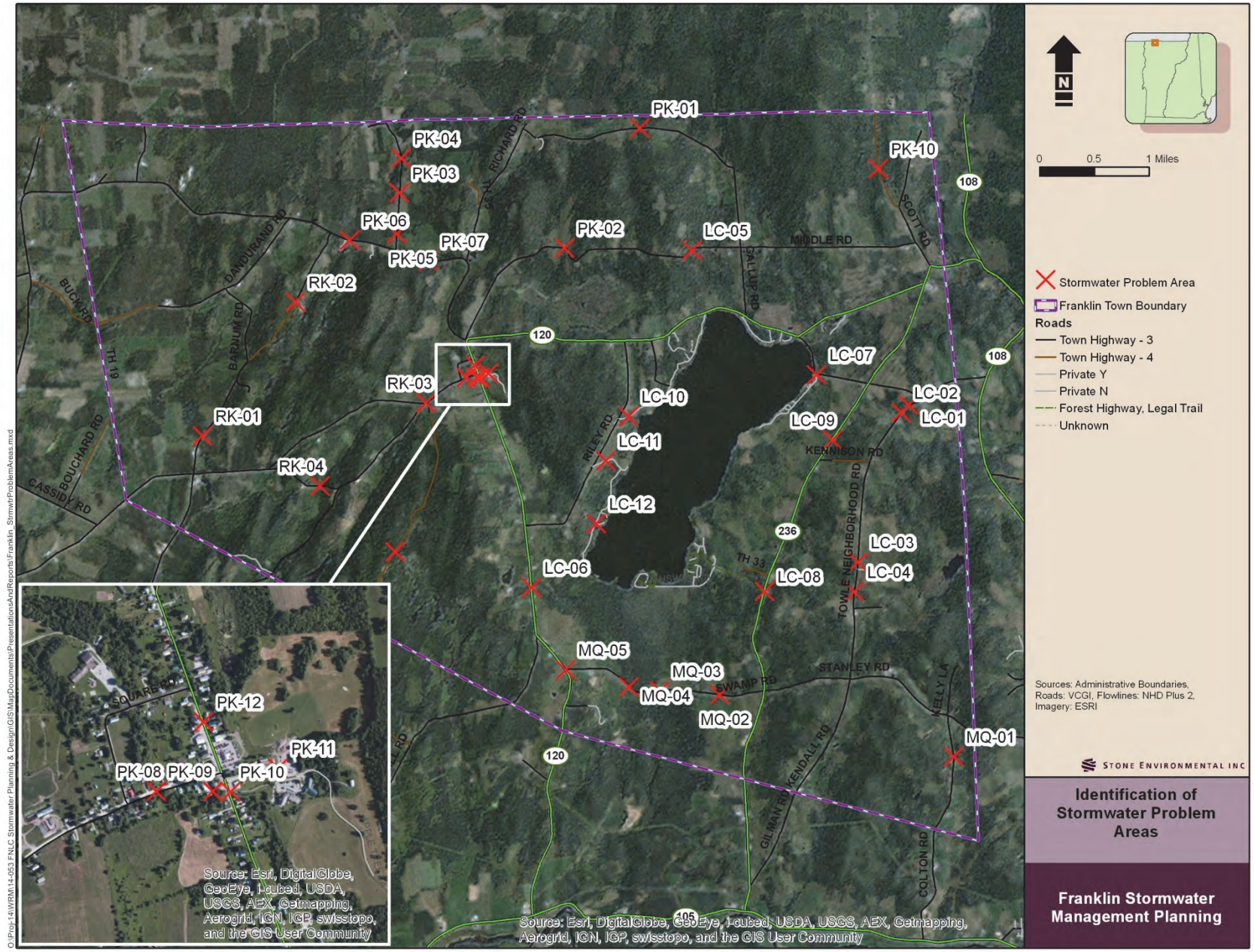


*Table 3. Areas of concern and priority projects identified by town officials and SGA or CSA reports.*

| ID | Watershed | Problem Type | Description | ID Source |
|---|---|---|---|---|
| LC-01 | Lake Carmi | Erosion | Hillside runoff causes road erosion | Town Feedback |
| LC-02 | Lake Carmi | Erosion | Hillside runoff causes road erosion | Town Feedback |
| LC-05 | Lake Carmi | Infrastructure; Erosion | Perched culvert; nearby ditches narrow and eroding | Town Feedback |
| LC-06 | Lake Carmi | Infrastructure; Erosion | Culvert is too short for the current road width. The pavement surface above outlet collapsing. | Town Feedback |
| LC-08 | Lake Carmi | Infrastructure; Erosion | High levels of bank erosion up and downstream; scouring threatens culvert upstream and downstream; downstream bank armor failing; large pool d/s, culvert footer is slumping in | Geomorphic Assessment |
| LC-09 | Lake Carmi | Erosion | Area identified as having high potential for stormwater runoff / potential critical P source | Critical Source Areas Study |
| LC-10 | Lake Carmi | Erosion | Area identified as having high potential for stormwater runoff / potential critical P source | Critical Source Areas Study |
| LC-11 | Lake Carmi | Erosion | Area identified as having high potential for stormwater runoff / potential critical P source | Critical Source Areas Study |
| LC-12 | Lake Carmi | Erosion | Area identified as having high potential for stormwater runoff / potential critical P source | Critical Source Areas Study |
| MG-01 | McGowan Brook | Erosion | Area identified as having high potential for stormwater runoff / potential critical P source | Critical Source Areas Study |
| MQ-01 | Missisquoi River | Erosion | Steep area of road; challenging to get water off the road | Town Feedback |
| MQ-02 | Missisquoi River | Flooding | Water overtops the road during large rain events | Town Feedback |
| MQ-03 | Missisquoi River | Erosion | Perched culvert; uncontrolled runoff from adjacent property | Geomorphic Assessment |
| MQ-04 | Missisquoi River | Infrastructure | Water runs very fast through this culvert; high level of downstream bank erosion | Town Feedback; Geomorphic Assessment |
| MQ-05 | Missisquoi River | Erosion | Area identified as having high potential for stormwater runoff / potential critical P source | Critical Source Areas Study |
| MG-01 | McGowan Brook | Erosion | Area identified as having high potential for stormwater runoff / potential critical P source | Critical Source Areas Study |
| PK-01 | Pike River | Flooding | Water regularly flows over the road; no culverts | Town Feedback |
| PK-02 | Pike River | Erosion | Steep road section | Town Feedback |
| PK-03 | Pike River | Erosion | Hillside runoff causes road erosion | Town Feedback |
| PK-04 | Pike River | Infrastructure | Old culvert | Town Feedback |
| PK-05 | Pike River | Erosion | Channel scour threatens wing walls upstream and downstream | Geomorphic Assessment |
| PK-06 | Pike River | Erosion | Scouring threatens culvert upstream and downstream. | Geomorphic Assessment |
| PK-08 | Pike River | Erosion | Area identified as having high potential for stormwater runoff / potential critical P source | Critical Source Areas Study |
| PK-09 | Pike River | Erosion | Area identified as having high potential for stormwater runoff / potential critical P source | Critical Source Areas Study |
| PK-10 | Pike River | Erosion | Area identified as having high potential for stormwater runoff / potential critical P source | Critical Source Areas Study |
| PK-11 | Pike River | Erosion | Area identified as having high potential for stormwater runoff / potential critical P source | Critical Source Areas Study |
| PK-12 | Pike River | Infrastructure; Erosion | Culvert blocked by woody debris; bank armor failing us; high bank erosion upstream; houses directly abutting us and ds., high water velocity even in low flow. Area identified as having high potential for stormwater runoff / potential critical P source. | Geomorphic Assessment; Critical Source Areas Study |
| RK-01 | Rock River | Infrastructure | Upstream end of segment: culvert crossing is significantly undersized with respect to bankfull width. Large downstream scour pool has developed, leading to erosion. | Geomorphic Assessment |

| ID | Watershed | Problem Type | Description | ID Source |
|---|---|---|---|---|
| RK-02 | Rock River | Erosion | Area identified as having high potential for stormwater runoff / potential critical P source | Critical Source Areas Study |
| RK-03 | Rock River | Erosion | Area identified as having high potential for stormwater runoff / potential critical P source | Critical Source Areas Study |
| RK-04 | Rock River | Flooding; Infrastructure | Road floods out regularly; “floating road”; log mat under the gravel; culvert is under water and dimensions cannot be assessed | Town Feedback; Geomorphic Assessment |

# APPENDIX C : PROBLEM AREA DATA SHEETS

# Problem Area Data Sheet

| | | |
|---|---|---|
| **Problem Area ID:** LC-01 | **Latitude:** 44.977952° | **Longitude:** -72.835615° |

**Watershed:** Lake Carmi

**Location:** Towle Neighborhood Rd, 750 ft south of Dewing Rd

**Problem Type:** Infrastructure

**Identification Source:** Town Feedback

**Ownership:** Local

**Classification:** 3


**Date of Field Data Collection:** 4-14-2014

**Description of Observed Conditions:**

Outlet of cross-culvert under Towle Neighborhood Road is perched and there is active erosion below the outfall. Some large stone has been placed below the outlet, but this has not fully resolved the issue.

**Field Photos**

Photo 1. Culvert inlet

Photo 2. Culvert outlet

**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: LC-02 | Latitude: 44.976930° | Longitude: -72.836989° |
|---|---|---|

**Watershed:** Lake Carmi

**Location:** Towle Neighborhood Rd, 1200 ft south of Dewing Rd

**Problem Type:** Infrastructure

**Identification Source:** SWMP Assessment

**Ownership:** Local

**Classification:** 3


**Date of Field Data Collection:** 4-14-2014

**Description of Observed Conditions:**

Culvert is too short for current road width. Banks above the culvert inlet and outlet are over-steepened and actively eroding.

**Field Photos**

Photo 1. Perched culvert outlet

Photo 2. Downstream bank erosion

**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 | Y | Y | N` | N |

# Problem Area Data Sheet

| **Problem Area ID:** LC-03 | **Latitude:** 44.957182° | **Longitude:** -72.844940° |
|---|---|---|

**Watershed:** Lake Carmi

**Location:** Towle Neighborhood Rd, 1 mi. north of Stanley Rd

**Problem Type:** Infrastructure

**Identification Source:** SWMP Assessment

**Ownership:** Local

**Classification:** 4

**Date of Field Data Collection:** 4-14-2014

**Description of Observed Conditions:**

Banks above the culvert inlet and outlet are over-steepened. Ditch banks immediately downstream of the culvert are actively eroding. Adjoining agricultural field above the culvert outlet (west side of Towle Neighborhood Road) was recently ditched and is actively eroding; evidence of recent animal access downstream of the culvert outlet.

**Field Photos**

Photo 1. Culvert inlet

Photo 2. Culvert outlet

**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-04 | **Latitude:** 44.953297° | **Longitude:** -72.845571° |

**Watershed:** Lake Carmi

**Location:** Towle Neighborhood Rd, 0.8 mi. north of Stanley Rd

**Problem Type:** Erosion/infrastructure

**Identification Source:** SWMP Assessment

**Ownership:** Local

**Classification:** 3

**Date of Field Data Collection:** 4-14-2014

**Description of Observed Conditions:**

Marsh Brook crossing. Banks above the culvert inlet and outlet are too steep. Banks are actively collapsing and have covered both the inlet and outlet. Some evidence of direct animal access to area around culvert outlet.

**Field Photos**

Photo 1. Bank above culvert inlet

Photo 2. Culvert outlet and bank collapse

**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? |
|---|---|---|---|---|---|---|---|
| 3 | 2 | 3 | 3 | Y | Y | N` | N |

# Problem Area Data Sheet

| Problem Area ID: LC-05 | Latitude: 44.998202° | Longitude: --72.876111° |
|---|---|---|

**Watershed:** Lake Carmi

**Location:** Middle Rd., 0.5 mi west of Gallup Rd.

**Problem Type:** Erosion

**Identification Source:** Town Feedback

**Ownership:** Local

**Classification:** 1


**Date of Field Data Collection:** 4-14-2014

**Description of Observed Conditions:**

Culvert outlet is perched two feet above the current streambed. Stream banks immediately downstream are actively eroding. Nearby ditches are narrow and incising. Given proximity to Lake Carmi, failing banks may be an important sediment source. Further investigation is required.

**Field Photos**

Photo 1. Perched culvert outlet

Photo 2. Downstream bank erosion

**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 | Y |

# Problem Area Data Sheet

| | | |
|---|---|---|
| **Problem Area ID:** LC-06 | **Latitude:** 44.998202° | **Longitude:** --72.876111° |

**Watershed:** Lake Carmi

**Location:** N. Sheldon Rd. 0.5 mi south of Riley Rd.

**Problem Type:** Infrastructure

**Identification Source:** Town Feedback

**Ownership:** Local

**Classification:** 3


**Date of Field Data Collection:** 4-14-2014

**Description of Observed Conditions:**

The culvert is too short for the current road width. The bank above the culvert outlet is very steep and has collapsed over the opening. The pavement surface above the outlet is beginning to collapse.

**Field Photos**

Photo 1. Culvert inlet

Photo 2. Bank collapse over culvert outlet

**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 | Y | Y | N` | N |

# Problem Area Data Sheet

| **Problem Area ID:** LC-07 | **Latitude:** 44.974529° | **Longitude:** -72.861334° |
|---|---|---|

**Watershed:** Lake Carmi

**Location:** Hammond Shore Rd., ¼ mile SW of intersection w/ Harrison Rd

**Problem Type:** Infrastructure

**Identification Source:** SGA

**Ownership:** Private

**Classification:** 3

**Date of Field Data Collection:** 5-22-2014

**Description of Observed Conditions:**

Culvert under Hammond Shore Rd is too short; shoulders on both side of road are actively collapsing into the channel. The culvert receives significant road runoff and agricultural drainage.

**Field Photos**

Photo 1. Culvert inlet, with visible sediment load from road surface

Photo 2. Agricultural and roadside drainage to 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 | 2 | 2 | 2 | Y | Y | N | Y |

# Problem Area Data Sheet

| **Problem Area ID:** LC-08 | **Latitude:** 44.979997° | **Longitude:** -72. 843849° |
|---|---|---|

**Watershed:** Lake Carmi

**Location:** State Park Rd, 350 ft south of intersection with Dewing Rd

**Problem Type:** Infrastructure

**Identification Source:** SGA

**Ownership:** State

**Classification:** 2


**Date of Field Data Collection:** 5-22-2014

**Description of Observed Conditions:**

Sinkhole in the road shoulder has formed above the upstream end of the culvert; rocks have been installed in an effort to stabilize the scour pool at the downstream end of the culvert.

**Field Photos**

Photo 1. Sinkhole in east shoulder of State Park Rd, above culvert

Photo 2. Stabilization measures at downstream end 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 | 2 | 2 | 1 | Y | Y | Y | N |

# Problem Area Data Sheet

| Problem Area ID: LC-09 | Latitude: 44.973262° | Longitude: -72.849885° |
|---|---|---|

**Watershed:** Lake Carmi

**Location:** State Park Rd

**Problem Type:** Erosion

**Identification Source:** SWMP Assessment

**Ownership:** Private

**Classification:** 3


**Date of Field Data Collection:** 5-22-2014

**Description of Observed Conditions:**

Logging road and landing on the east side of State Park Rd, approximately 500 feet north of Kennison Rd, has not been properly closed out and is actively eroding. Undersized culvert (12") used to convey existing roadside drainage under access.

**Field Photos**

Photo 1. Logging road and landing

Photo 2. Log landing

**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 | 3 | N | Y | N | N |

# Problem Area Data Sheet

| Problem Area ID: LC-10 | Latitude: 44.953359° | Longitude: -72.862298° |
|---|---|---|

**Watershed:** Lake Carmi

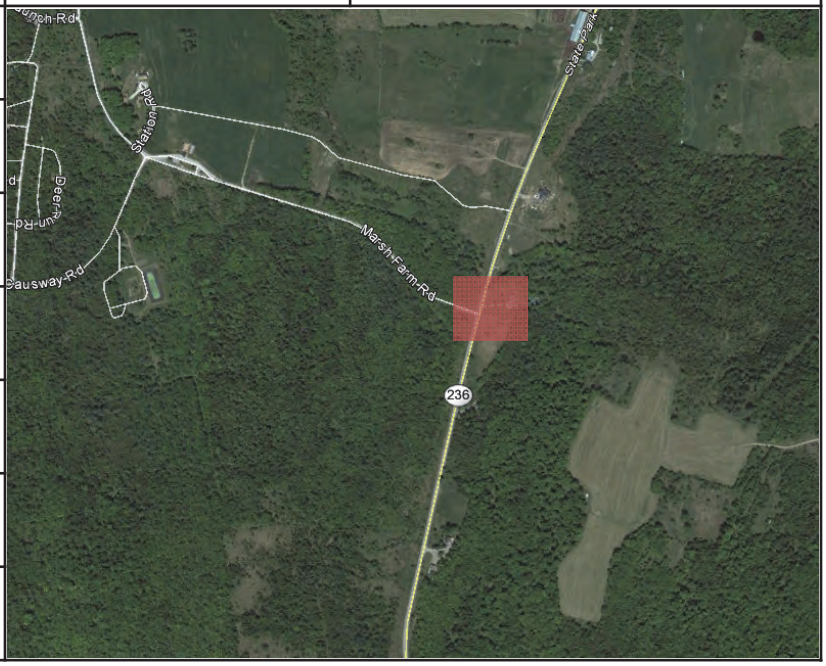
**Location:** State Park Rd

**Problem Type:** Erosion

**Identification Source:** SWMP Assessment

**Ownership:** Local/Private

**Classification:** 4




**Date of Field Data Collection:** 5-22-2014

**Description of Observed Conditions:**

Recent ditching along State park Rd. in front of #3006 and across from the entrance to the park is actively failing.

**Field Photos**

Photo 1. Looking south along State Park Rd across from park entrance

Photo 2. Looking north along State Park 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? |
|---|---|---|---|---|---|---|---|
| 3 | 2 | 3 | 3 | Y | Y | N | N |

# Problem Area Data Sheet

| Problem Area ID: LC-11 | Latitude: 44.982046° | Longitude: -72.852895° |
|---|---|---|

| | |
|---|---|
| **Watershed:** | Lake Carmi |
| **Location:** | Dewing Rd and Hammond Shore Rd |
| **Problem Type:** | Retrofit Opportunity |
| **Identification Source:** | SWMP Assessment |
| **Ownership:** | Local |
| **Classification:** | 2 |


**Date of Field Data Collection:** 5-22-2014; 9-26-2014

**Description of Observed Conditions:**

Recent/on-going construction ditching on Dewing Rd., approximately 200 feet east of the intersection with Hammond Shore Rd., has resulted in discharge of sediment to Lake Carmi. Reported to DEC Enforcement on 05/23/14. Site was found to have been seeded when revisited on 09/26/14.

**Field Photos**

Photo 1. Looking east along Dewing Rd. from Hammond Shore.

Photo 2. Looking west along Dewing Rd. to Lake Carmi from Hammond Shore.

**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 | 3 | Y | Y | N | N |

# Problem Area Data Sheet

| **Problem Area ID:** MQ-01 | **Latitude:** 44.931538° | **Longitude:** -72.827022° |
|---|---|---|

**Watershed:** Missisquoi River

**Location:** Colton Road, south of Stanley Road

**Problem Type:** Erosion

**Identification Source:** Town Feedback

**Ownership:** Local/private

**Classification:** 1


**Date of Field Data Collection:** 4-14-2014

**Description of Observed Conditions:**

Bank above culvert outlet is over-steepened and failing. Animal access is contributing to erosion. A scour pool has formed at the outlet.

**Field Photos**

Photo 1. Scour pool at culvert outlet

Photo 2. Evidence of animal access above culvert outlet

**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? |
|---|---|---|---|---|---|---|---|
| 3 | 2 | 3 | 2 | Y | Y | Y | N |

# Problem Area Data Sheet

| **Problem Area ID**: MQ-02 | **Latitude:** 44.939859° | **Longitude:** -72.873922° |
|---|---|---|

**Watershed:** Missisquoi River

**Location:** Swamp Rd.

**Problem Type:** Infrastructure

**Identification Source:** Town Feedback

**Ownership:** Local

**Classification:** 1


**Date of Field Data Collection:** 4-14-2014

**Description of Observed Conditions:**

Culvert is submerged and filled with sediment. The culvert is not aligned with the stream and scour pools have developed at the inlet and outlet. Road sediment is migrating directly into the stream channel.

**Field Photos**

Photo 1. Culvert inlet is submerged

Photo 2. Culvert outlet

**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? |
|---|---|---|---|---|---|---|---|
| 3 | 2 | 3 | 2 | Y | Y | Y | Y |

# Problem Area Data Sheet

| Problem Area ID: MQ-03 | Latitude: 44.940005° | Longitude: -72.881607° |
|---|---|---|

**Watershed:** Missisquoi River

**Location:** Swamp Rd.

**Problem Type:** Infrastructure

**Identification Source:** SGA

**Ownership:** Local

**Classification:** 1


**Date of Field Data Collection:** 4/14/14

**Description of Observed Conditions:**

Outlet of 36" corrugated metal pipe is perched. Scour pool has formed at the outlet. Self-storage facility to the east appears to discharge uncontrolled stormwater runoff to the pool at the upstream end of the culvert (see MQ-04).

**Field Photos**

Photo 1. Culvert inlet

Photo 2. Scour pool formed at culvert outlet

**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 | Y | Y | Y | Y |

# Problem Area Data Sheet

| **Problem Area ID:** MQ-04 | **Latitude:** 44.940148° | **Longitude:** -72.880920° |
|---|---|---|

**Watershed:** Missisquoi River

**Location:** Swamp Road, 1 mile west of State Park Rd

**Problem Type:** Retrofit Opportunity

**Identification Source:** SWMP Assessment

**Ownership:** Local

**Classification:** 2


**Date of Field Data Collection:** 5-22-2014

**Description of Observed Conditions:**

Uncontrolled stormwater runoff from Favereau's Storage runs along road shoulder and discharges to unnamed tributary to Lake Carmi. Runoff flows along fence-line; some signs of localized erosion including where reaches tributary (see MQ-03). Town reports that right-of-way in this area is 25' from road centerline.

**Field Photos**

Photo 1. Uncontrolled runoff from self-storage facility

Photo 2. Runoff flows along fence to tributary

**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 | Y | Y | N | N |

# Problem Area Data Sheet

**Problem Area ID:** MQ-05 | **Latitude:** 44.940558° | **Longitude:** -72.887363°


**Watershed:** Missisquoi River

**Location:** Swamp Road, 0.65 miles east of N. Sheldon Road

**Problem Type:** Infrastructure

**Identification Source:** Town feedback

**Ownership:** Local

**Classification:** 2

**Date of Field Data Collection:** 4-14-2014

**Description of Observed Conditions:**

Banks above culvert inlet and outlet are over-steepened and collapsing. There is inadequate cover between the top of the culvert and the bottom of the pavement. Town indicated that a project was planned at this location for late 2014 or spring 2015.

**Field Photos**

Photo 1. Culvert inlet

Photo 2. Culvert outlet

**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 | Y | N |

# Problem Area Data Sheet

| | | |
|---|---|---|
| **Problem Area ID:** PK-01 | **Latitude:** 45.014021° | **Longitude:** -72.879483° |

**Watershed:** Pike River

**Location:** Gallup Rd.

**Problem Type:** Local drainage

**Identification Source:** Town Feedback

**Ownership:** Local

**Classification:** 4


**Date of Field Data Collection:** 4-14-2014

**Description of Observed Conditions:**

Narrow ditches with steep back slopes. Ditch bottoms are not vegetated nor stone lined , and are actively eroding.

**Field Photos**

Photo 1. Steep back slope

Photo 2. Bare ditch bottom showing evidence of significant sediment transport

**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? |
|---|---|---|---|---|---|---|---|
| 3 | 2 | 3 | 2 | Y | Y | Y | N |

# Problem Area Data Sheet

| Problem Area ID: PK-03 | Latitude: 45.005578° | Longitude: -72.930489° |
|---|---|---|

**Watershed:** Pike River

**Location:** Pidgeon Hill Road

**Problem Type:** Local drainage

**Identification Source:** Town feedback

**Ownership:** Local

**Classification:** 3


**Date of Field Data Collection:** 4-14-2014

**Description of Observed Conditions:**

Hillside runoff travelling down road bed due to inadequate ditching and lack of road crown, leading to erosion of road surface .

**Field Photos**

Photo 1. Shallow ditch

Photo 2. Gravel road surface erosion

**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 | Y | Y | Y | Y |

# Problem Area Data Sheet

| | | |
|---|---|---|
| **Problem Area ID:** PK-05 | **Latitude:** 45.010182° | **Longitude:** -72.930190° |

**Watershed:** Pike River

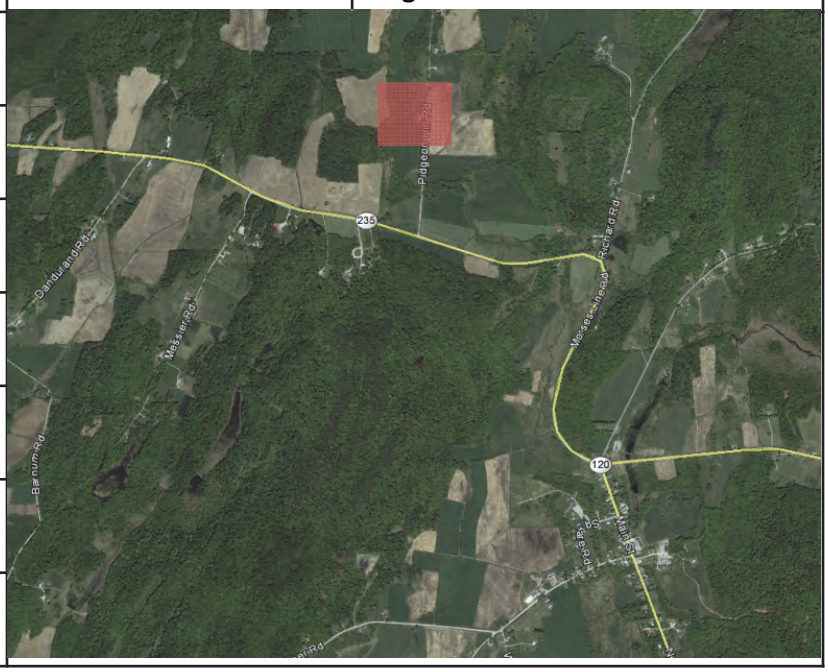
**Location:** Pidgeon Road, 300 feet north of Morses Line Rd.

**Problem Type:** Infrastructure

**Identification Source:** SWMP Assessment

**Ownership:** Local

**Classification:** 1




**Date of Field Data Collection:** 4-14-2014

**Description of Observed Conditions:**

The 8 foot dia. culvert is too short and slightly perched (<6”); large scour pool has formed at culvert outlet. Appears that culvert may have been installed incorrectly (squashed culvert set “sideways”?). Banks above the inlet and outlet are steep (1:1). The culvert is no longer in line with the stream, and further meandering could impact road. U.S. Fish and Wildlife Service is currently evaluating options for retrofitting this culvert to address aquatic organism passage.

**Field Photos**

Photo 1. Culvert inlet

Photo 2. Culvert outlet

**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 | 3 | Y | Y | Y | Y |

# Problem Area Data Sheet

| Problem Area ID: PK-06 | Latitude: 44.999468° | Longitude: -72.939739° |
|---|---|---|

**Watershed:** Pike River

**Location:** Morses Line Rd., near Chickadee Dr.

**Problem Type:** Infrastructure

**Identification Source:** SGA

**Ownership:** Local/Private

**Classification:** 3


**Date of Field Data Collection:** 5-22-2014

**Description of Observed Conditions:**

Downstream end of culvert is perched approximately 2' above the channel bottom and a scour pool has formed. Area immediately upstream of the culvert appears to be intensively managed and includes a series of paths and footbridges adjacent to and over the stream. Bank slumping/failures also evident upstream of culvert.

**Field Photos**

Photo 1. Culvert inlet

Photo 2. Perched culvert outlet and scour hole

**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:** PK-07 | **Latitude:** 44.996620° | **Longitude:** -72.925091° |
|---|---|---|

**Watershed:** Pike River

**Location:** Morses Line Rd., 400 ft. west of Richard Rd.

**Problem Type:** Infrastructure

**Identification Source:** SWMP Assessment

**Ownership:** Local/Private

**Classification:** 3


**Date of Field Data Collection:** 5-22-2014

**Description of Observed Conditions:**

Downstream end of culvert is broken and failing. Significant bank erosion, including slumping of the road shoulder, evident. Direct animal access to the stream in this location is likely exacerbating all noted impacts.

**Field Photos**

Photo 1. Culvert outlet

Photo 2. Culvert outlet with evidence of animal access

**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:** PK-08 | **Latitude:** 44.981335° | **Longitude:** -72.917603° |

**Watershed:** Pike River

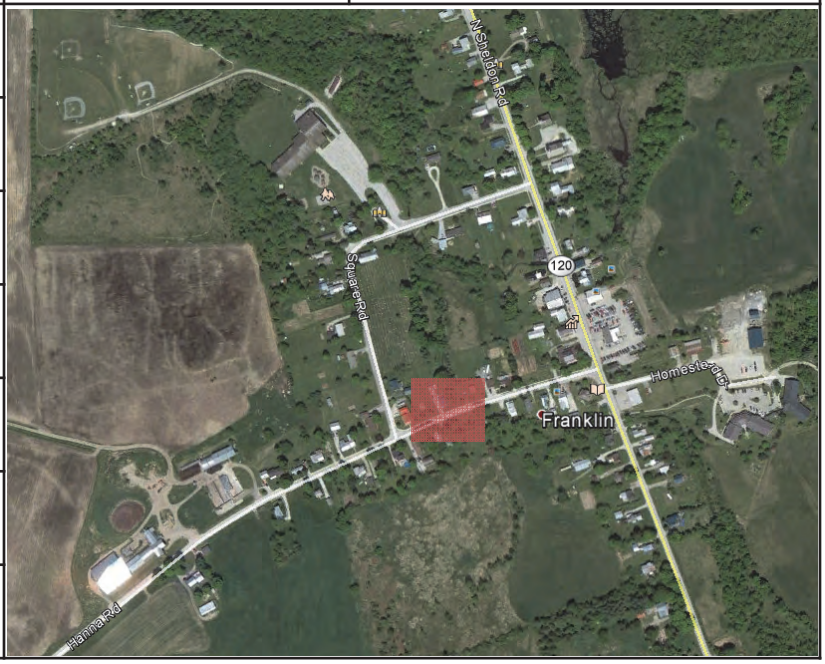
**Location:** Hanna Rd, west of intersection w/ Main St. in Franklin Village

**Problem Type:** Retrofit Opportunity

**Identification Source:** CSA; SWMP Assessment

**Ownership:** Local/Private

**Classification:** 2




**Date of Field Data Collection:** 5-22-2014

**Description of Observed Conditions:**

Stormwater runoff along Hanna Rd. could be directed to existing green space on the south side of the road. Would require landowner cooperation and the modification of several existing drop inlets.

**Field Photos**

Photo 1. Looking east on Hanna Rd. toward Village

Photo 2. Looking west

**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 | Y | Y | N | N |

# Problem Area Data Sheet

| | | |
|---|---|---|
| **Problem Area ID:** PK-09 | **Latitude:** 44.981314° | **Longitude:** -72.915973° |

**Watershed:** Pike River

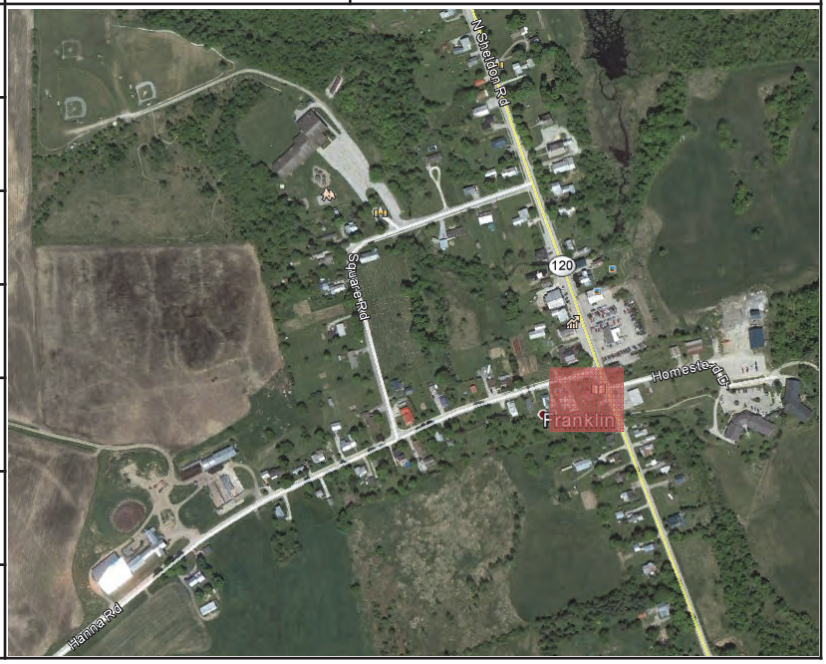
**Location:** Corner of Hanna Rd and Main St. in Franklin Village

**Problem Type:** Retrofit Opportunity

**Identification Source:** CSA; SWMP Assessment

**Ownership:** Local/Private

**Classification:** 2




**Date of Field Data Collection:** 5-22-2014

**Description of Observed Conditions:**

Stormwater runoff from the Post Office, Library, Town Offices, and attendant parking could be captured and treated prior to discharge.

**Field Photos**

Photo 1. Looking toward stream between Post Office and Library, standing on Hanna Rd.

Photo 2. Looking back toward Hanna Rd from the stream bank; some evidence of minor erosion in yard.

**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:** PK-10 | **Latitude:** 44.981281° | **Longitude:** -72.915332° |
|---|---|---|

**Watershed:** Pike River

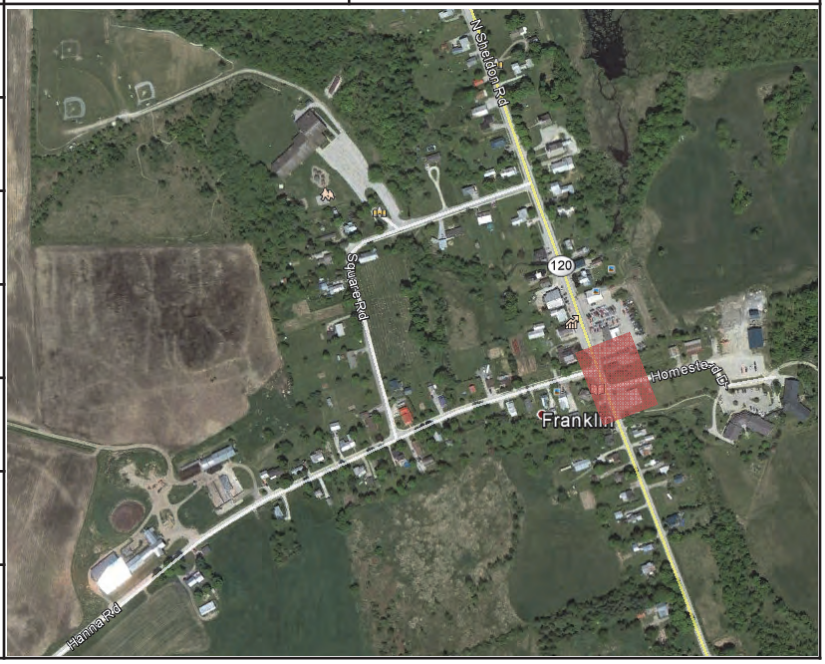
**Location:** Franklin Fire & Rescue
Main St. in Franklin Village

**Problem Type:** Retrofit Opportunity

**Identification Source:** CSA; SWMP Assessment

**Ownership:** Local

**Classification:** 3




**Date of Field Data Collection:** 5-22-2014

**Description of Observed Conditions:**

Stormwater runoff from Fire & Rescue building and parking lot, as well as a portion of N. Sheldon Rd and local Ford dealership, drains un-treated to stream at the corner of the lot.

**Field Photos**

Photo 1. Site drains to small tributary at the lower right corner of the photo.

Photo 2. Looking south along Main St toward the Fire & Rescue building.

**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? |
|---|---|---|---|---|---|---|---|
| 3 | 3 | 2 | 2 | Y | Y | Y | N |

# Problem Area Data Sheet

| Problem Area ID: PK-11 | Latitude: 44.981829° | Longitude: -72.913811° |
|---|---|---|

**Watershed:** Pike River

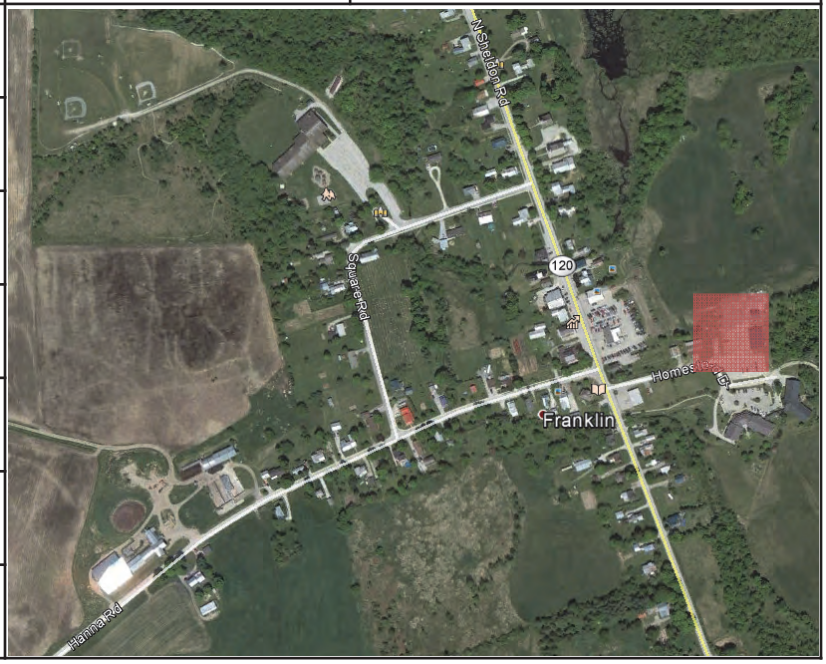
**Location:** Franklin Town Garage

**Problem Type:** Retrofit Opportunity

**Identification Source:** CSA; SWMP Assessment

**Ownership:** Local

**Classification:** 4




**Date of Field Data Collection:** 5-22-2014

**Description of Observed Conditions:**

Stormwater runoff from the Town Garage and attendant (gravel and paved) parking areas drains to a catch basin and discharges to a small swale hear the Franklin Homestead before reaching a small stream.

**Field Photos**


Photo 1. Town Garage draining to single catch basin near the stop sign

Photo 2. Evidence of sediment from the Town Garage reaching the catch basin; possible retrofit location shown in background

**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? |
|---|---|---|---|---|---|---|---|
| 3 | 3 | 2 | 2 | Y | Y | Y | N |

# Problem Area Data Sheet

| | | |
|---|---|---|
| **Problem Area ID:** PK-12 | **Latitude:** 44.982852° | **Longitude:** -72.916263° |

**Watershed:** Pike River

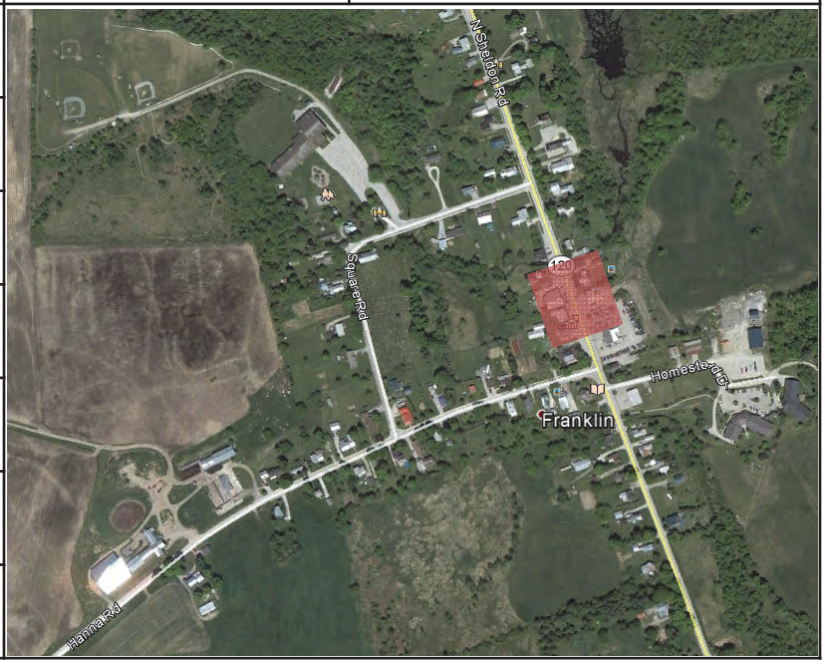
**Location:** Main St.

**Problem Type:** Retrofit Opportunity

**Identification Source:** SGA; CSA; SWMP Assessment

**Ownership:** State/Private

**Classification:** 1




**Date of Field Data Collection:** 5-22-2014

**Description of Observed Conditions:**

Stormwater runoff from the Franklin General Store building and parking, as well as a section of Main St., drains along the northwest edge of Main St. to a small tributary to the Pike River.

**Field Photos**

Photo 1. East side of Main St., drainage from Ford dealership north to unnamed Pike tributary

Photo 2. West side of Main St. drainage from Franklin General Store north to unnamed Pike tributary

**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 | Y | N |

# Problem Area Data Sheet

| | | |
|---|---|---|
| **Problem Area ID:** RK-01 | **Latitude:** 44.973445° | **Longitude:** -72.966837° |

**Watershed:** Rock River

**Location:** Barnum Rd., 2000 ft north of Browns Corner Rd

**Problem Type:** Infrastructure

**Identification Source:** SGA

**Ownership:** Private

**Classification:** 3


**Date of Field Data Collection:** 4-14-2014

**Description of Observed Conditions:**

Corrugated metal culvert is too short for the current width of the road. Bank slopes above inlet and outlet are too steep; road shoulder is actively eroding above culvert outlet.

**Field Photos**

Photo 1. Culvert inlet

Photo 2. Culvert outlet

**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 | Y | Y | Y | N |

# Problem Area Data Sheet

| Problem Area ID: RK-04 | Latitude: 44.966896° | Longitude: -72.944953° |
|---|---|---|

**Watershed:** Rock River

**Location:** Beaver Meadow Rd.

**Problem Type:** Infrastructure

**Identification Source:** Town Feedback

**Ownership:** Local

**Classification:** 1


**Date of Field Data Collection:** 4/14/14

**Description of Observed Conditions:**

Road floods regularly. Road is built through a beaver meadow. Water was less then a foot below road surface on either side. Culvert was completely submerged on both ends.

**Field Photos**

Photo 1. Water on either side of Beaver Meadow Rd.

Photo 2. Flooded beaver meadow.

**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? |
|---|---|---|---|---|---|---|---|
| 3 | 3 | 2 | 3 | Y | N | Y | N |

# Problem Area Data Sheet

| Problem Area ID: RK-05 | Latitude: 44.973686° | Longitude: -72.930405° |
|---|---|---|

**Watershed:** Rock River

**Location:** Hanna Rd.

**Problem Type:** Infrastructure

**Identification Source:** SWMP Assessment

**Ownership:** Local

**Classification:** 3


**Date of Field Data Collection:** 5-22-2014

**Description of Observed Conditions:**

Large, black plastic, perched culvert carrying road and agricultural drainage under farm access road discharges just above downstream end of culvert carrying the Rock River under Hanna Road. Some erosion is visible at the downstream ends of both culverts and a small sinkhole has formed along the guardrail at the upstream end of the Rock River culvert.

**Field Photos**

Photo 1. Confluence of drainage and the Rock River

Photo 2. Small sinkhole on southeast side of Hanna 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 | 2 | 2 | Y | Y | Y | Y |

# APPENDIX D : DRAINAGE AREA MAPS FOR PRIORITY STORMWATER PROBLEM AREAS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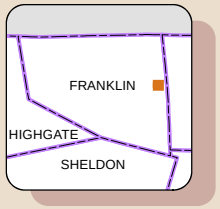


0 50 100 200
Feet

SW Treatment Opportunity
River or Stream
Highly Erodible Soils
Drainage Area

Treatment Opportunity:
LC-01: Culvert headwalls and splash pads at culvert outlets would help mitigate impacts associated with oversteepened banks and scour

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

STONE ENVIRONMENTAL INC

**Towle Neighborhood Rd**

**LC-01/02**

**Franklin Stormwater Management Planning**

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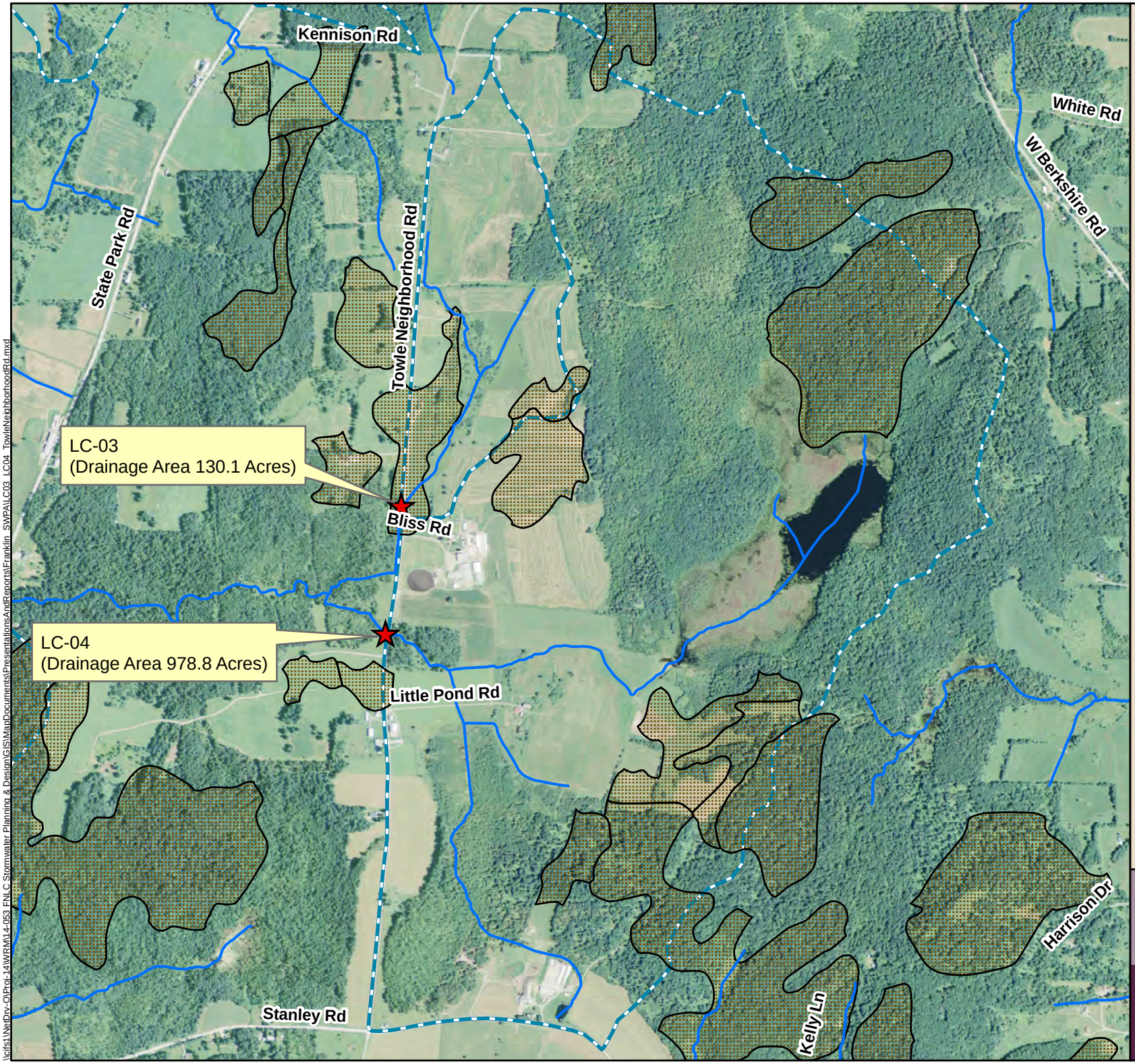


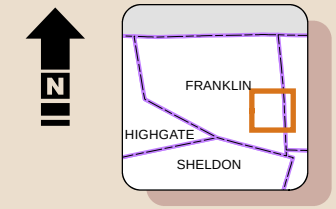


0 375 750 1,500
Feet

SW Treatment Opportunity

River or Stream

Highly Erodible Soils

Drainage Area

Treatment Opportunity:
LC-03/LC-04: Culvert headwalls at the inlets of both culverts and the outlet of LC-04 are needed. Approximately 300 feet of road shoulder south of LC-03 on the west-side of Towle Neighborhood Rd needs stabilization. Animal exclusion fencing at both culvert inlets is critical to long-term project viability.

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

STONE ENVIRONMENTAL INC

**Towle Neighborhood Rd**

**LC-03/04**

**Franklin Stormwater Management Planning**

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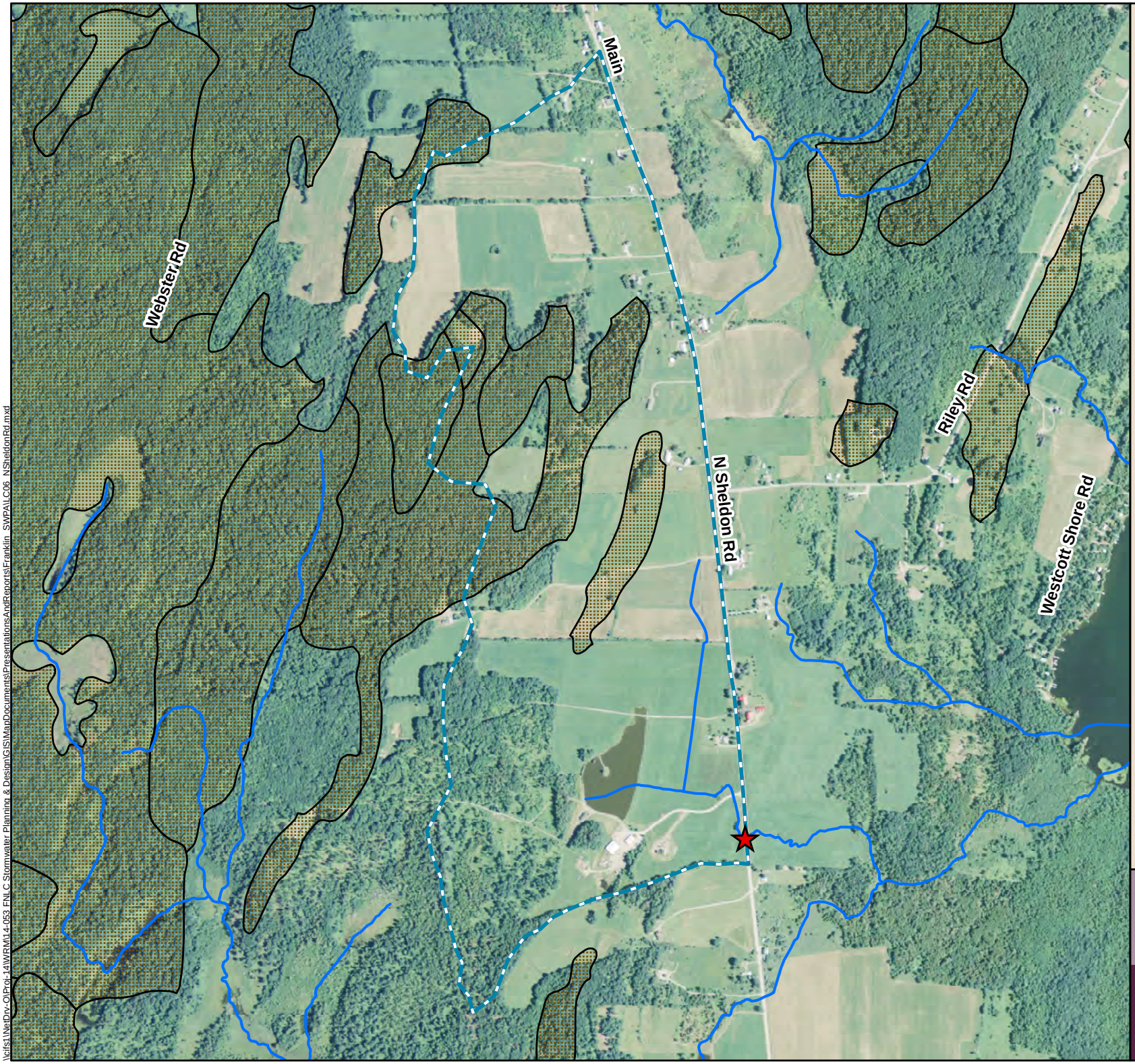


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FRANKLIN
HIGHGATE
SHELDON

0 375 750 1,500
Feet

SW Treatment Opportunity
River or Stream
Drainage Area (361.4 Acres)
Highly Erodible Soils

Treatment Opportunity:LC-06: Culvert headwall and splash pads at culvert outlet would help mitigate impacts associated with oversteepened banks and scour

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

STONE ENVIRONMENTAL INC

**North Sheldon Rd**

**LC-06**

**Franklin Stormwater Management Planning**

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FRANKLIN
HIGHGATE
SHELDON

0 100 200 400
Feet

SW Treatment Opportunity
River or Stream
Highly Erodible Soils
Drainage Area (57.9 Acres)

Treatment Opportunity:
LC-07: Agricultural drainage should be reshaped to reduce erosion; installation of stone at culvert inlet and outlet would provide temporary stabilization. Ultimately, the culvert needs to be replaced.

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

STONE ENVIRONMENTAL INC

**Hammond Shore Rd**

**LC-07**

**Franklin Stormwater Management Planning**

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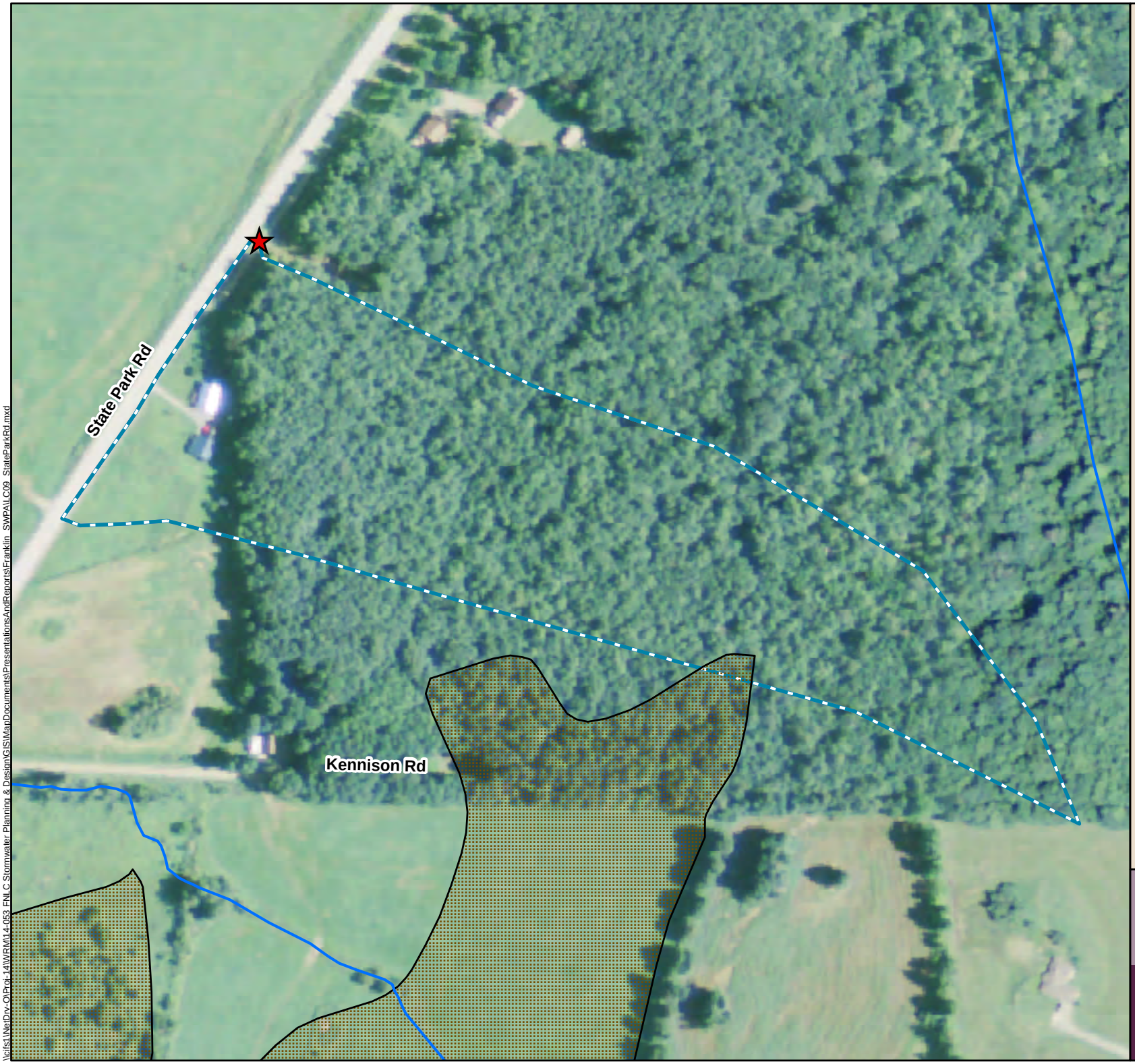


N

FRANKLIN
HIGHGATE
SHELDON

0 75 150 300
Feet

SW Treatment Opportunity
River or Stream
Highly Erodible Soils
Drainage Area (13.8 Acres)

Treatment Opportunity:
LC-09: Culvert is undersized and needs to be replaced; logging area needs proper close-out and stabilization.

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

STONE ENVIRONMENTAL INC

**State Park Rd**

**LC-09**

**Franklin Stormwater Management Planning**

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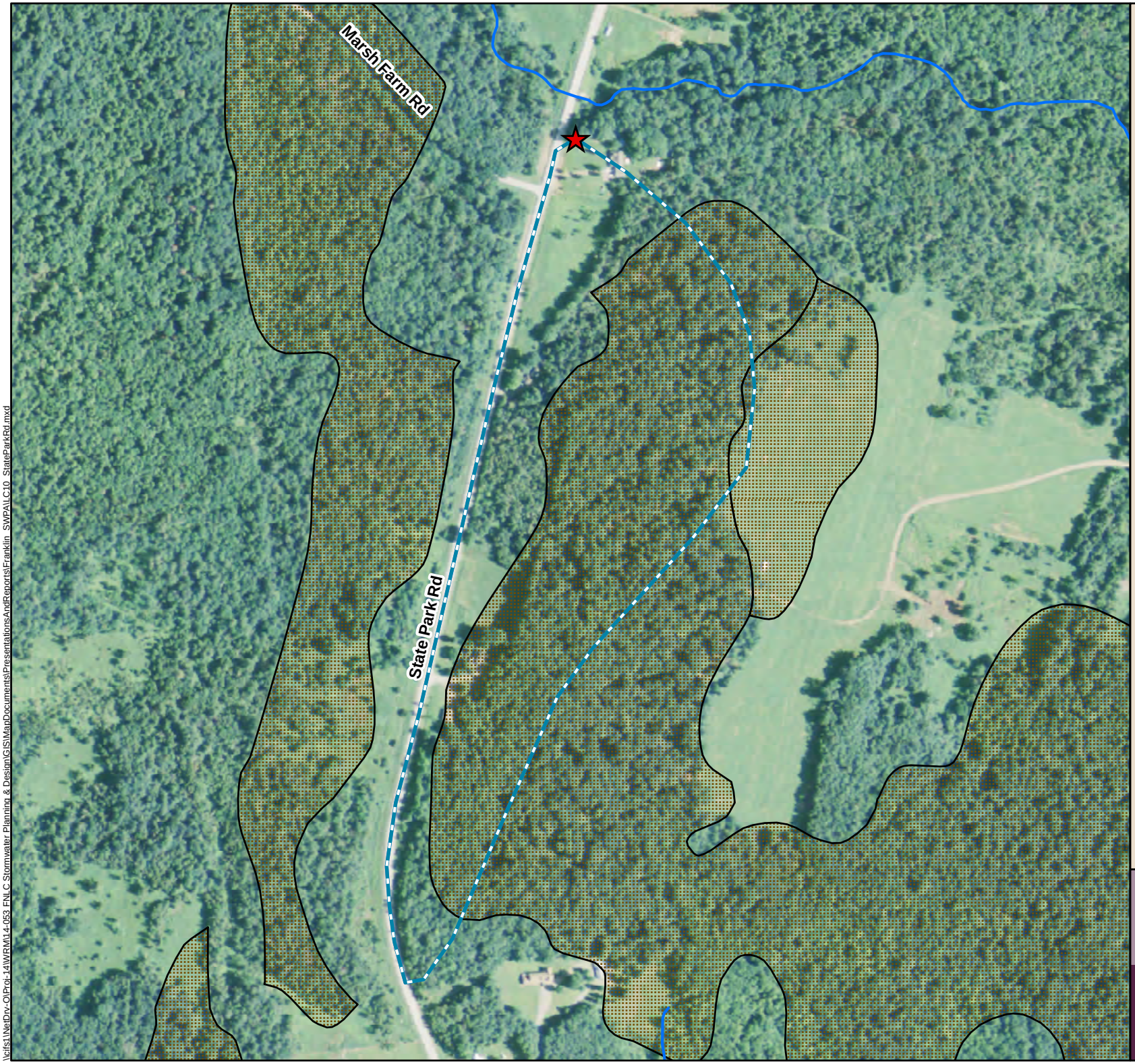


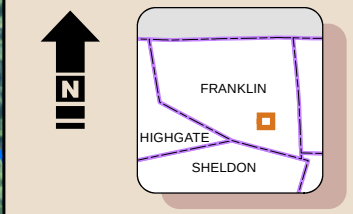


0 125 250 500
Feet

SW Treatment Opportunity

River or Stream

Drainage Area (37.1 Acres)

Highly Erodible Soils

Treatment Opportunity:
LC-10: Temporary stabilization measures have failed.
A comprehensive erosion prevention and sediment control plan need to developed and implemented for this area.

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

STONE ENVIRONMENTAL INC

**State Park Rd**

**LC-10**

**Franklin Stormwater Management Planning**

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FRANKLIN
HIGHGATE
SHELDON

0 50 100 200
Feet

SW Treatment Opportunity
River or Stream
Highly Erodible Soils
Drainage Area (12.9 Acres)

Treatment Opportunity:
PK-01: The roadside ditch along the southside of Gallup Rd should be reshaped and stabilized with either vegetation or rock.

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

STONE ENVIRONMENTAL INC

**Gallup Rd**

**PK-01**

**Franklin Stormwater Management Planning**

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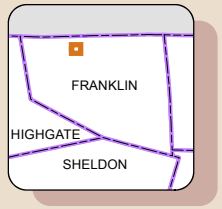


0 100 200 400
Feet

SW Treatment Opportunity
River or Stream
Drainage Area (8.2 Acres)
Highly Erodible Soils

Treatment Opportunity:
PK-03: Improving the road crown (1/4" to ½" per ft) and roadside ditching would improve drainage and reduce the amount of water running down the road.

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

STONE ENVIRONMENTAL INC

**Pidgeon Hill Rd**

**PK-03**

**Franklin Stormwater Management Planning**

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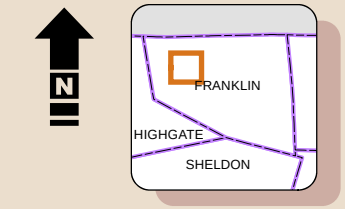


SW Treatment Opportunity

River or Stream

Drainage Area (506.6 Acres)

Highly Erodible Soils

Treatment Opportunity:
PK-06: Establishment of a natural buffer along the water course as it flows toward Morses Line would help improve stream condition. A splash pad at the culvert outlet would help mitigate existing scour.

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

STONE ENVIRONMENTAL INC

**Morses Line Rd**

**PK-06**

**Franklin Stormwater Management Planning**

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N

FRANKLIN
HIGHGATE
SHELDON

0 100 200 400
Feet

SW Treatment Opportunity
River or Stream
Highly Erodible Soils
Drainage Area (38.9 Acres)

Treatment Opportunity:
PK-07: Given the deteriorating condition of the culvert and surrounding banks, it is a good candidate for replacement. Animal exclusion fencing at the culvert outlet is critical to long-term stream stability.

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

STONE ENVIRONMENTAL INC

**Morses Line Rd**

**PK-07**

**Franklin Stormwater Management Planning**

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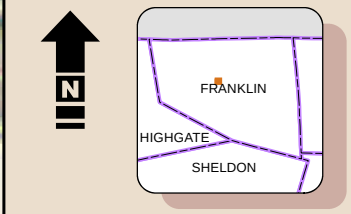


0 25 50 100
Feet

SW Treatment Opportunity
River or Stream
Highly Erodible Soils
Drainage Area (0.7 Acres)

Treatment Opportunity:
PK-10: Redirect the roof leader from the Fire & Rescue building to a cistern; install a bio-swale in the green space to the north of Homestead Drive to capture runoff from Main Street.

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

STONE ENVIRONMENTAL INC

**Main St**

**PK-10**

**Franklin Stormwater Management Planning**

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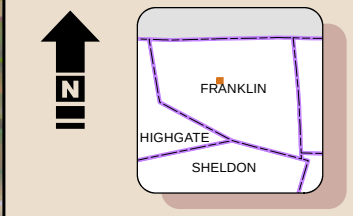


0 25 50 100
Feet

SW Treatment Opportunity

River or Stream

Highly Erodible Soils

Drainage Area (1.2 Acres)

Treatment Opportunity:
PK-11: Construct a stormwater treatment practice in the green space the separates the Park & Ride facility from Homestead Drive to capture runoff.

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

STONE ENVIRONMENTAL INC

**Franklin Town Garage**

**PK-11**

**Franklin Stormwater Management Planning**

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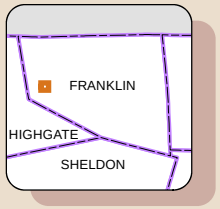


0 62.5 125 250
Feet

SW Treatment Opportunity
River or Stream
Highly Erodible Soils
Drainage Area (44.1 Acres)

Treatment Opportunity:
RK-01: Given the deteriorating condition of the culvert and surrounding banks, it is a good candidate for replacement.

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

STONE ENVIRONMENTAL INC

**Barnum Rd**

**RK-01**

**Franklin Stormwater Management Planning**

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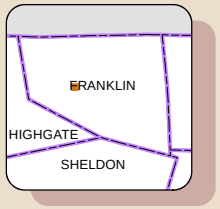


0 25 50 100
Feet

SW Treatment Opportunity
River or Stream
Highly Erodible Soils
Drainage Area (1.1 Acres)

Treatment Opportunity:
RK-05: The segment of roadside ditch between the farm road and the Rock River should be reshaped and stabilized.

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

STONE ENVIRONMENTAL INC

**Hanna Rd**

**RK-05**

**Franklin Stormwater Management Planning**

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