

**FLOOD RESILIENCE PLAN**  
**for the**  
**Town of Glover, Vermont**

**Prepared by**

**Meghann Carter**

**NorthWoods Stewardship Center**

**East Charleston, VT**

**in cooperation with the Glover Planning Commission and Glover Selectboard**

**February, 2015**

**Paid for in part by the Barton Hydro Project Municipal Planning Grant**

## **Introduction**

With an all-hazards mitigation plan now written and pending approval, the Town of Glover is obligated to begin to address identified pertinent hazards, one of which is flooding and fluvial erosion. The purpose of this plan is to identify key hazard areas which are most likely to be affected by flood and fluvial erosion and to propose potential actions to minimize these hazards and their impacts.

Potential major points of impact include dams, culverts, bridges, and infrastructure such as roads and buildings within the floodplains.

## **Goals**

- (1) Identify areas of greatest risk to flooding and fluvial erosion within the Town of Glover.
- (2) Develop recommendations for future actions to create a flood-and fluvial erosion-safe Glover, minimizing threats to public safety, property, and water quality.

## **Flooding and Fluvial Erosion in Vermont**

Flooding and fluvial erosion are Vermont's most common and costly types of natural disaster and over time, many compounding factors have increased Vermont's susceptibility to flood damage. As climate change affects global temperature fluctuations, storms of greater power and higher frequency are anticipated, and indeed this trend has been observed in recent decades. This trend had led to global, state, and regional efforts to better prepare for these events by identifying sensitive resources, key areas of vulnerability, and implementing mitigations. In the interest of promoting local flood resilience, as of July 1, 2014, according to new legislation (Act 16), any newly adopted or readopted municipal or regional plan must have a Flood Resilience Plan Element. See Appendix A for an Act 16 Summary.

## **Town Resources and Background**

### ***Watersheds***

Approximately 92% of the town of Glover (22,740 acres) falls within the Lake Memphremagog Watershed, with the remaining area lying within the Lake Champlain and Connecticut River watersheds.

The Memphremagog watershed includes 4 sub-basins; the Johns River, Black River, Barton River, and Clyde River watersheds. Of these, the Black River and Barton River watersheds include portions of Glover, with most of the town's surface waters draining from the Barton River watershed. Each of these rivers flow generally north into Lake Memphremagog, which in turn drains north via Quebec's Magog and St. Francis rivers to the St. Lawrence River. The Barton River watershed is fed by an area of approximately 162 square miles, from its headwaters in southern

Glover to its outlet into Lake Memphremagog at the South Bay Wildlife Management Area in Coventry, VT. The Black River watershed runs from headwaters in the town of Albany and also empties into Lake Memphremagog in Coventry. The Black River itself does not flow through Glover.

The Upper Lamoille River watershed is fed by an area of approximately 722 square miles, beginning at headwaters located in the town of Greensboro. The Lamoille River flows southwest from Greensboro until it reaches the Jackson Dam in Hardwick, where it turns west until emptying into Lake Champlain in Milton, VT. The Lamoille River itself does not flow through Glover, but 1,856 acres of its watershed lies within the southern part of the town.

The 64 acre portion of the Miller's Run watershed, a subwatershed of the Passumpsic River watershed, that falls within Glover also excludes the Passumpsic River itself. The Passumpsic River watershed is fed by an approximately 504 square mile area, with many branches converging in the town of Lyndon and flowing south before reaching the Connecticut River at Barnet. The Passumpsic River is one of the largest tributaries of the northern Connecticut River.

The Town of Glover contains two lakes, Shadow Lake and Lake Parker; four ponds, Clarks Pond (also known as Tildy's Pond), Daniels Pond, an unnamed pond called the Beaver Pond by locals, and Sweeney Pond; and many streams and rivers including an approximately 7.9 mile stretch of the Barton River and its headwaters.

### ***Elevation/Topography***

Glover is characterized by a highly varied topography; with tall hills contrasting sharply with low, wet valleys. In high volume rain events, this topography causes water flowing across impervious surfaces (such as roads) to pick up speed and cause erosive damage, as well as transporting sediment and debris and causing culvert blockages. Blocked culverts can lead to flooding across roads and driveways, property loss or damage, and the washing out of the culverts.

The tallest prominences in Glover, all over



Figure 1: Watersheds in the town of Glover

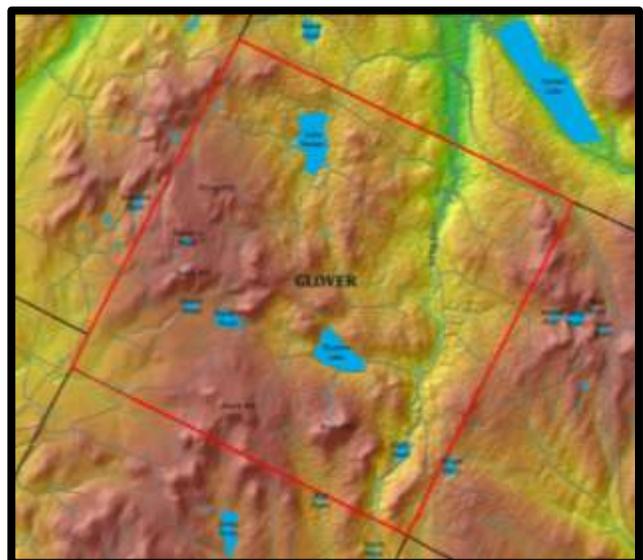


Figure 2: Topography of the town of Glover

2,200 feet in elevation, are the two peaks of the Black Hills in the south, and Pepin Hill to the west.

### Soil Types

Within Glover, soil types fall into 4 categories of sensitivity to erosion; Highly Erodible, Potentially Highly Erodible, Not Erodible, and Unrated (NRCS HELCLASS). The majority of the soils in Glover (62%) are ranked as Potentially Highly Erodible, due to soil textures and slopes that result in a high sensitivity to erosion when the soils are disturbed or exposed.

**Table 1: Erodibility of Soils in Glover**

Erodibility	Acres	Percentage of Soils
Not Erodible	394.0	2.34%
Unrated	926.28	5.49%
Potentially Highly Erodible	10485.91	62.14%
Highly Erodible	5067.35	30.03%

Glover is located within the Northern Vermont Piedmont biophysical region, an area known for its moderate to cool climate, hilly topography, and rich soils.

At the time of the most recent glacial recession approximately 12,000 years ago, large amounts of sediment were deposited as glacial outwash. The retreating glacier also created a much larger than present day proglacial Lake Memphremagog, with a shoreline approximately 300 feet higher than its current level. The further retreat of the glacier in the next few thousand years allowed the proglacial Lake Memphremagog to disperse, leaving the lake bottom sediment composed of silts and clays, along with the coarser glacial outwash, as the parent material for today’s fertile valley soils. The upland soils are more often glacial till that was deposited by the melting glacier.

### Flood History

Though sudden snow melts or rain coinciding with snow melt will often bring the Barton River up into the backyards and cellars in low-lying parts of Glover Village, there have been some flood and erosion events which have been historically notable.

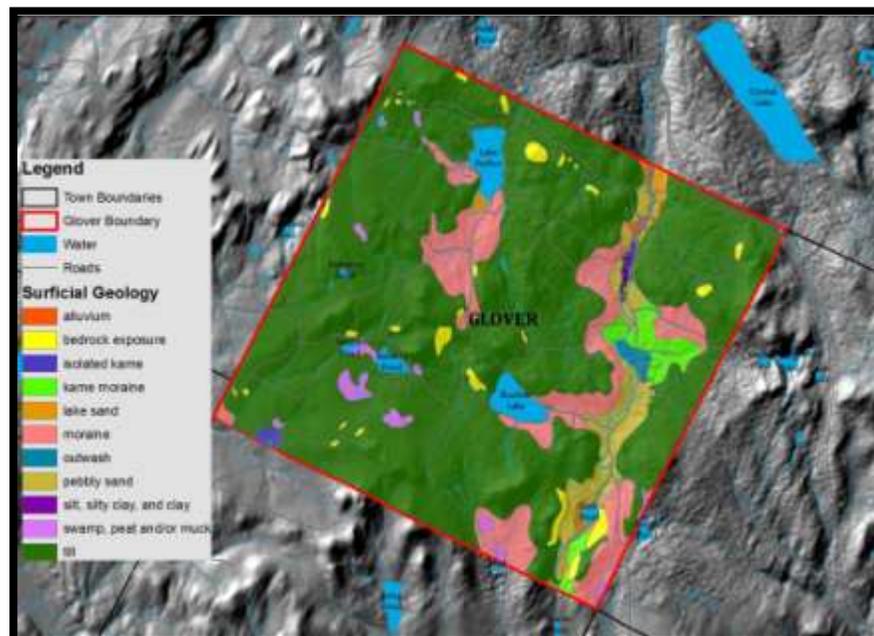


Figure 3: Surficial geology of the town of Glover

1810 – June 6<sup>th</sup> – a work crew consisting of 40 to 60 men and boys from Glover, in an attempt to increase water flow to power their mill, began excavating a channel from what was, then, Long Pond to Clarks Pond and then to the Barton River. The unstable, sandy soil of the area gave way, emptying the entire pond into the Barton River within a few minutes, destroying bridges, mills, riparian trees, and farm fields.

1927 – November – record-breaking rainfall and the resulting flooding caused significant damage, including one bridge lost in West Glover and a damaged sawmill. In Glover Village, one house and a blacksmith shop were lost. For more information on this infamous flood, see *History of the town of Glover, Vermont*.

1997 – July – flooding in Glover village caused damage to the town hall, church, and firehouse. Cellars were flooded in several homes and many culverts washed out (approximately 200 were replaced). Some erosion also occurred at the bridge in Glover village and Sand Hill Road was washed out.

2011 – May – heavy rain caused two culverts on Rodgers Rd to be washed out. They had previously been partially blocked by beavers.

2011 – August – during Hurricane Irene the King Road culvert washed out, and there was some erosion on Phillips Rd.

2012 – May 29 – heavy rain in north end of Glover caused significant damage to King Road and Dexter Mountain Road, the Sargent Lane Bridge abutment was undermined, and there was some damage to Sand Hill Road.

More significant, in terms of damage done and costs incurred, is the issue of fluvial erosion. More information on fluvial erosion in Glover can be found in the Areas of Special Consideration section.

### ***Barton River***

The Barton River flows south to north along the east side of Glover. The headwaters of the river are located in the southeast corner of Glover, originating with Clark's Pond and meander and flow slowly northward through approximately 3.8 miles of forest, farm fields, and wetlands until changing to a steeper, more confined channel approaching the village of Glover. The current stream height and average volume discharged on any given day can be found on the usgs.gov website. The stream gauge for the Barton River is located near Coventry, VT, many miles north and downstream of Glover.

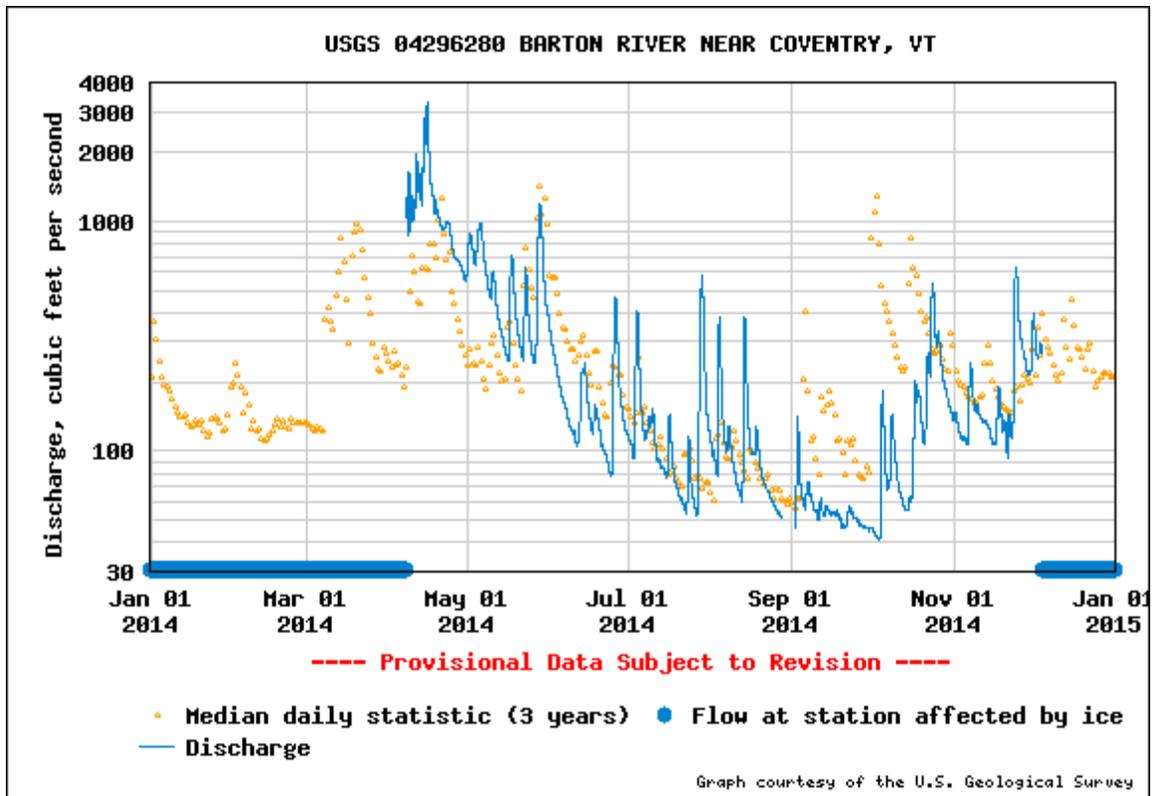


Figure 4: One year of daily statistics for the Barton River

### ***Dam Breaks***

There are three dams within the town of Glover. The Shadow Lake Dam is the largest of these with the potential to cause the most damage in the event of a breach. It is classified as a “Class 2” or “Significant Hazard” dam by the Vermont Dam Inventory (VDI) and at the last inspection of the dam in 2012, it was determined to be in poor condition due to a general lack of upkeep. Since this report, all cited issues (i.e. cutting of trees and brush on the dam and immediately downstream, patching concrete, filling in low spots on the dam, rebuilding stone walls at the gatehouse outflow, and updating of the Emergency Action Plan) have been corrected. This dam drains into the Barton River by way of the Shadow Lake Brook, which runs generally parallel to Shadow Lake Road. In the event of a sunny-day failure of this dam, the report states that the result could be stream bank erosion, overtopping of at least one road crossing within the area studied, and inundation of the first floor of a house in the low area adjacent to Perron Hill Road. A storm-day failure of this dam could result in stream bank erosion, overtopping of at least 4 road crossings, and inundation of two houses in the low area adjacent to Perron Hill Road. Any major breach in the Shadow Lake Dam will have downstream consequences, not only for the 3 miles of riverside addressed in the dam break report, but for any low-lying and highly developed areas such as Glover Village and Barton. This is discussed further in the Areas of Special Consideration section.

The dam located at the outlet of Lake Parker is classified as a “Class 3” or “Low Hazard” dam. The Daniels Pond Dam does not appear on the VCGI dams layer because it consists of a granite block set across the culvert at the outlet which controls the height of the water and is not adjustable.

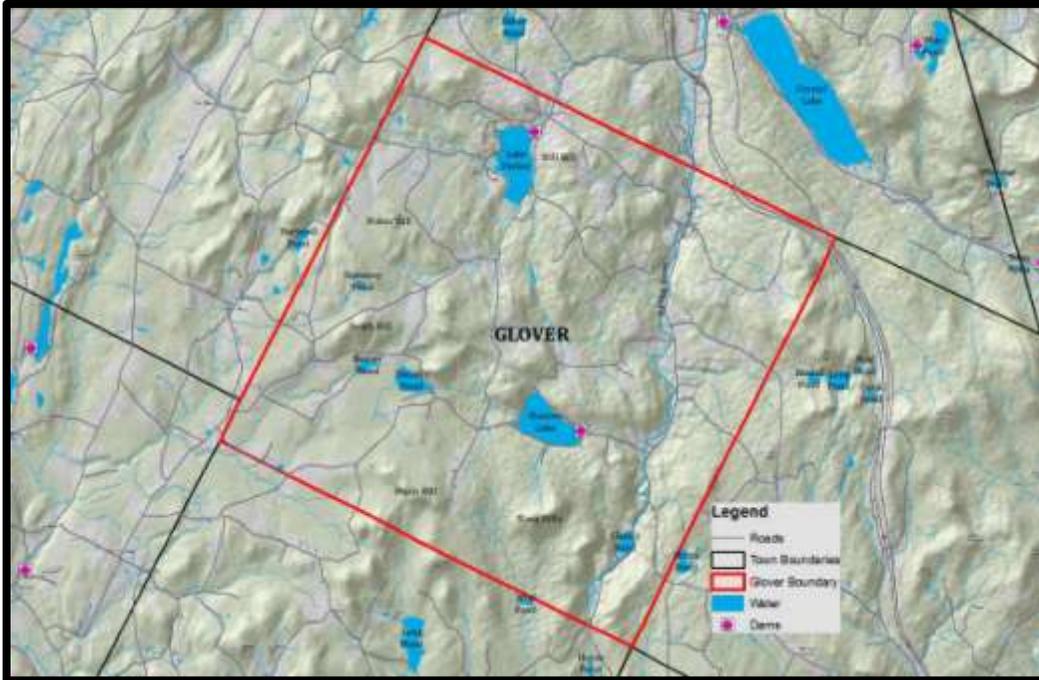


Figure 5: Dams within the town of Glover

***Floodplains***

A floodplain is an area of flat land surrounding a stream or river where, during periods of flooding water can overflow and spread out, slowing the current. Floodplains play a critical role in diminishing the hazards of flooding by allowing natural geomorphic processes to lower the flow velocity and lessen the rate of incision during high-volume water events. When a stream or river is allowed to meander through its natural floodplain, rather than being constricted or straightened by human encroachments, the energy and speed of the water is dissipated somewhat, reducing the sediment load and debris transported downstream. If the stream is straightened, the rate of incision will be increased and the resulting sediment and debris transported downstream will cause more damage.

***River Corridors***

A River Corridor map shows the areas around rivers and streams which are critical in their environmentally and economically sustainable management as they approach dynamic equilibrium. River corridors generally include floodplains and all land within the meander width of the



Figure 6: River corridor map from the ANR Natural Resource Atlas

river. Maintaining these lands free of human-generated river obstructions and allowing the river to approach equilibrium can improve channel stability and reduce the risk of downstream flooding and fluvial erosion. The Rivers Program is run by the VT Agency of Natural Resources, which provides technical assistance, outreach, and education for municipalities in restoring or maintaining their river corridors. Preliminary river corridor maps have been developed for the rivers and many streams within the entire state of Vermont.

Maps of River Corridors within Glover can be found on the VT ANR Natural Resource Atlas website at <http://anrmaps.vermont.gov/websites/anra/>.

### ***Riparian Area Restoration***

A riparian area is the zone immediately adjacent to waterways, usually containing trees and shrubs and natural regeneration of these. It serves many purposes including the filtration of runoff, decreasing the rate of erosion on stream banks, and cooling the water through shading. Maintaining a high quality riparian area can dramatically increase water quality downstream. Riparian areas fall within the floodplain, and restoring these areas provides streams and rivers the opportunity to reclaim some of their natural meander within the floodplain.

There are state-funded programs which can help landowners do restoration plantings within their unbuffered or insufficiently buffered riparian zones. Within the Memphremagog watershed, there is a program called Trees for Streams Memphremagog (TFSM), which provides an 80% funding match for trees and shrubs, and fully covers the cost of administration and labor for planting. Through the same grant which funds the TFSM program, there is also a Lakeshore Buffering program, with the same 80% funding match, but different size restrictions on planting sites. There is also the Lakewise Program, which provides technical assistance to landowners to improve their shoreline and alleviate the effects of lakeshore development. More information can be found on their website at [www.watershedmanagement.vt.gov](http://www.watershedmanagement.vt.gov).

### ***Uplands and Wetlands***

Though upland areas are not at great risk of being flooded, the management of these areas can affect the flooding and erosion downstream. Clearing of natural vegetation and creation of impervious surfaces in upland areas hinders stormwater absorption, increasing the amount of runoff and its flow. These factors lead to more debris and sediment transport, decreasing water quality, adversely

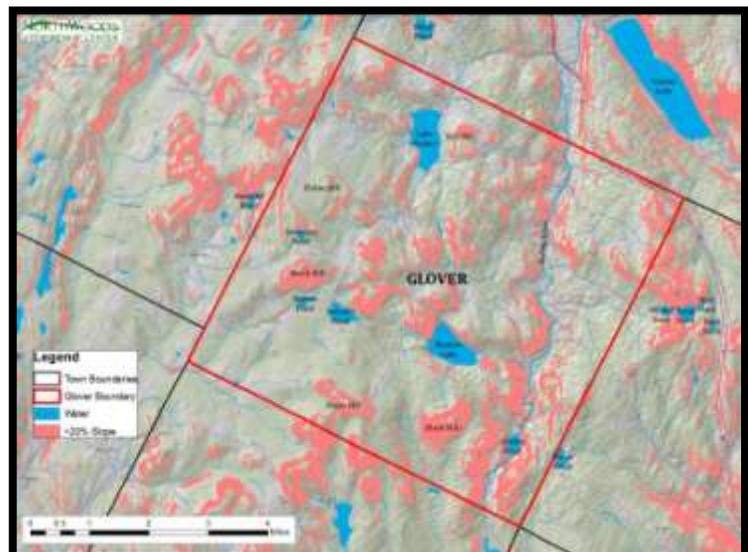


Figure 7: Slopes greater than 20% in the town of Glover

affecting stream banks and ditches, and clogging culverts. These effects can be alleviated by applying best management practices in upland forests and agricultural areas; limiting the amount of impervious surfaces associated with roads and development, managing stormwater runoff, protecting wetland natural communities, and minimizing alteration of stream channels and floodplains. Steep (>20% grade) forested upland slopes should be avoided during any development or clearing to avoid erosion due to stormwater runoff.

Wetlands are vital to the absorption of water in high-volume water events. The naturally porous nature of the ground, vegetation, and topography allow water to be retained within them, slowing the reentry of floodwaters into the waterways and reducing the negative effects associated with flooding downstream. They are also highly sensitive to disturbance. These factors contribute to the significant value of wetlands, and the resulting regulation surrounding their management. With the exceptions of active farmland, pre-existing structures, and permitted public highway projects, all state significant wetlands are required by state law to have a buffer zone between them and any management activities in order to protect their vital functions. Any wetland classified as Class II must have a fifty foot buffer surrounding it, and any Class 1 wetland must have a hundred foot buffer surrounding it. These Vermont Wetland Rules can be found in Appendix B.

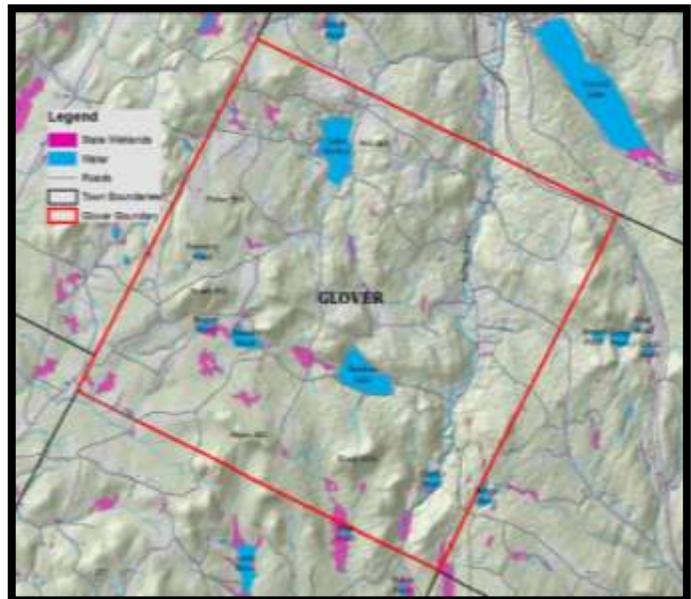


Figure 8: State wetlands within the town of Glover

There are no Class I wetlands found within Glover, according to the Vermont State Wetland Inventory, though there are 741 acres of Class II wetlands and 21 acres of Class III wetlands.

The protection of these valuable resources can be accomplished through the Use Value Appraisal (UVA) Program, also called “Current Use”. The UVA Program allows the valuation of forest and farmland to be lowered, thereby lowering the taxes on that land, as long as the land remains in its current use as forest or farmland. Lowered taxes are an incentive to landowners to limit development on ecologically valuable land resources, preserving the natural functions of features such as upland slopes and wetlands. Landowners can learn more about the Current Use program by visiting <http://www.state.vt.us/tax/pvrcurrentuse.shtml>.

## ***Transportation Infrastructure***

### **Bridges**

Glover has adopted the Town Road and Bridge Standards, meaning any new bridges built in the Town of Glover must meet the following standards: “Replacement of existing bridges...

and any new bridges... must be designed in accordance with the VTrans Hydraulics Manual, and, in the case of perennial streams, conform to the statewide Stream Alteration standards." The Town Road and Bridge Standards Agreement can be found in Appendix C.

The last town-wide bridge and culvert inventory was completed in 2010, with annual updates showing repairs and replacements submitted to the VT Agency of Transportation (VTrans) via mail. These inventories and updates are under the purview of the town road foreman.

## Roads

The Town Road and Bridge Standards which Glover has adopted dictate the minimum standards for road construction and maintenance, including standards for both paved and gravel roads.

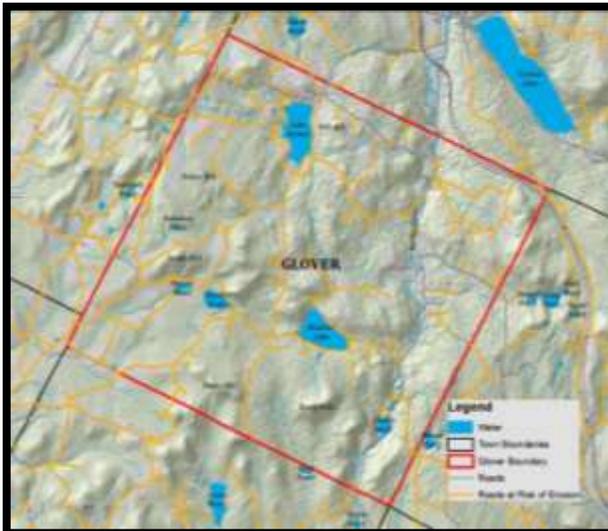


Figure 9: Roads with potential erosion risk within the town of Glover

All or part of the following Class 2-4 roads in Glover have been identified by the Agency of Natural Resources as being potential erosion areas: Aldrich Lane, Anderson Homestead, Andersonville Road, Apple Lane, Auger Heights, Bailey Lane, Beach Hill Road, Bear Call Road, Bickford Lane, Borland Road, Buchanan Place, Cemetery Loop, Clark Road, Cold Spring Lane, County Road, Daniels Pond Road, Deer Lane, Dexter Mountain Road, Drew Place, Duck Pond Road, Dunbar Place, Dwinell Drive, Griffin Place, Hinman Road, King Place, King Road, Larose Lane, Leland Lane, Lilac Lane, Lyman Lane, Maple Lane,

Meadow Lane, Mill Place, Monette Place, Mud Island Road, North Greensboro Road, Page Place, Parish School Road, Parker Road, Perron Hill, Phillips Road, Pine Place, Quarry Hill, Rodgers Road, Salmon Place, Sand Hill Road, Sargent Lane, Shadow Lake Road, Shields Lane, Square Road, Stevens Road, Still Hill, Stone Shore, Talbot Lane, Tetrault Lane, Town Highway 19, Town Highway 21, Town Highway 35, Town Highway 49, Town Highway 53, Town Highway 54, Town Highway 79, Thompson Place, Trevits Place, Urie Drive, Vance Lane, West Shore Road, White Road, and Young Road. These represent the majority of the roads within the Town of Glover because at least some portion of the majority of the roads in Glover is gravel and is therefore susceptible to erosion.

Several Class 4 roads within the Town of Glover are non-residential erosion risks which wash out on a regular basis during summer storms. Repairing and maintaining these roads costs the town approximately \$5000 per average sized storm. Three roads in particular fit

this description; Still Hill, Sand Hill, and Swamp Road. These roads are discussed further in the Areas of Special Consideration section.

### **Culverts**

In order to be in compliance with the current Vermont Town Road and Bridge Standards, “[r]eplacement of existing [road] culverts and any new culvert must have a minimum culvert diameter of 18 inches” and “[a]ll new driveway culverts must have a minimum diameter of 15 inches”. Any future maintenance or replacement of culverts should comply with these standards to ensure safety from flooding.

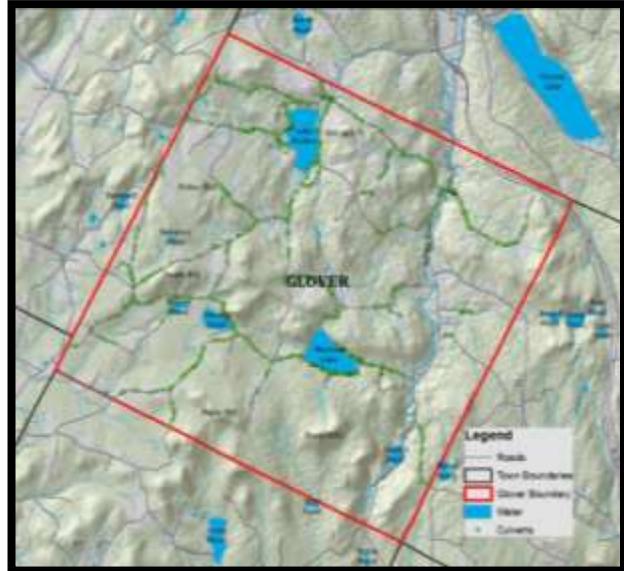


Figure 10: Culverts within the town of Glover

### **Local Planning/Funding Resources**

#### ***Memphremagog Watershed Stream Geomorphic Assessment (SGA)***

A Stream Geomorphic Assessment is a tool that can help predict the evolution of the hydrological landscape within a watershed, identify areas of point source pollution with greatest need for restoration, locate areas which are most susceptible to flooding, and determine the impacts of human development on rivers over time.

Stream Geomorphic Assessments were completed for portions of the Memphremagog Watershed from 2005-2011, including phases 1 and 2. Phase 1 is the initial remote sensing step, where data is collected from past studies and maps, aerial photographs, and limited field surveys. This phase is designed to determine which areas of the stream or river are in need of more in-depth study. Phase 2 is the rapid field-assessment phase, where in-depth data is collected through field visits, verifying and building on Phase 1 findings and helping to determine where remediation is most needed. SGA work was completed in 2008 by the NorthWoods Stewardship Center, following state of Vermont Department of Environmental Conservation (VTDEC) guidelines, on the portion of the Barton River mainstem that crosses Glover, as well as reaches downstream of the town. Phase 1 was completed for all of these reaches while Phase 2 was only completed for several.

The River Corridor Plan for the Barton and Johns River can be found in Appendix F.

#### ***Emergency Relief Assistance Fund (ERAF)***

In the event of a federally-declared disaster, ERAF provides a state-funded match for Federal Public Assistance through the Federal Emergency Management Agency (FEMA), provided that the town applying for Public Assistance meets FEMA requirements. When there is a federally-declared

disaster, FEMA will provide 75% of the funding for an approved Public Assistance project, with the remaining 25% non-federal match provided by the state and town where the project occurs.

As of October 23, 2014, the State of Vermont will contribute 7.5% toward the cost of recovery, leaving towns responsible for the remaining 17.5% of the total cost of the project. Communities that take steps to mitigate the risks of the hazards associated with disasters can increase the state's funding match from 7.5% up to 17.5%.

There are four basic measures which towns can adopt in order to qualify for a 12.5% state match: "(1) adopt the most recent Agency of Transportation Town Road and Bridge Standards, (2) adopt or take steps toward adopting a flood hazard bylaw which is adequate enough to secure participation in the National Flood Insurance Program (NFIP), (3) adopt a local hazard mitigation plan, and (4) adopt a Local Emergency Operations Plan (LEOP)". Participation in FEMA's Community Rating System (CRS) can increase the state match from 12.5% to 17.5%, with the town paying 7.5% of the non-federal share of the cost of the recovery project. Alternatively, the town can receive the 17.5% match by "adopting a river corridor protection bylaw that meets or exceeds state model regulations and guidelines".

Glover is currently eligible for 7.5% state matching funds in the event of a disaster. All criteria for earning a 12.5% match have been met except for adopting a Local Hazard Mitigation Plan, which is written and has been submitted to FEMA for review.

**Table 2: FEMA Public Assistance Funds Awarded to Glover 1999-2014**

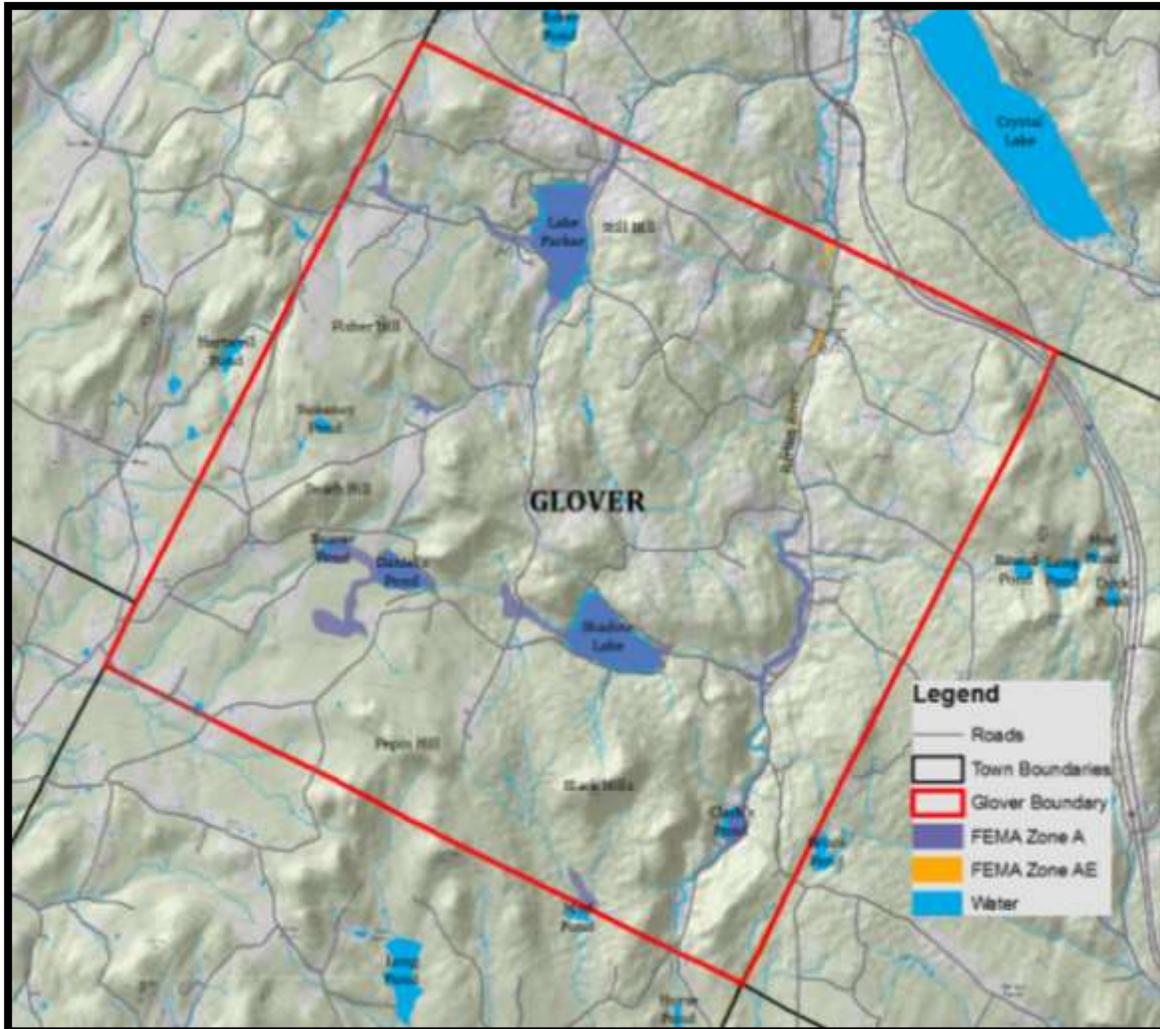
DISASTER NUMBER	DECLARATION DATE	INCIDENT TYPE	FEDERAL SHARE OBLIGATED
4163	1/29/2014	Severe Ice Storm	\$7,312.46
4066	6/22/2012	Severe Storm(s)	\$302,100.87
1995	6/15/2011	Severe Storm(s)	\$70,191.37
1715	8/3/2007	Severe Storm(s)	\$62,353.09
3167	4/10/2001	Snow	\$1,641.70
1307	11/10/1999	Severe Storm(s)	\$2,184.59

### ***Road and Bridge Standards***

The Vermont Town Road and Bridge Standards are designed to provide a minimum set of standards for the construction, repair, and maintenance of roads, bridges, and culverts. Their purpose is to improve safety, promote best management practices, and ensure functional transportation systems. Glover has adopted the Town Road and Bridge Standards, which can be found in section 7-1 of the VTrans Orange Book. Adopting these standards is one of four requirements for earning a 12.5% match in funding from the state for Public Assistance Funds.

## ***National Flood Insurance Program (NFIP)***

The NFIP is a federal program which is designed to mitigate flood losses through effective local ordinances and to provide affordable flood insurance for property owners. Towns that participate in NFIP are required to mitigate losses in Special Flood Hazard Areas (SFHAs) through floodplain management ordinances. SFHAs are areas which are inundated in 100-year floods. Glover is a member of the National Flood Insurance Program, which allows the residents of the town to purchase flood insurance.



**Figure 11: FEMA-mapped Flood Zones within the town of Glover**

Since 1991, Glover has had a Flood Insurance Rate Map (FIRM), which shows flood risk zones within the town. The majority of the town is Zone X, which means they are outside of the 500-year flood zone, and in little to no danger of being inundated in a flood. There are also areas which are classified as Zone A, which means they are within the SFHA, but the base flood elevations have not been determined. There are also small areas of the town, located on the northern section of the Barton River, which are classified as Zone AE, which means they are within the SFHA and the base flood elevations have been determined. These FIRMs are difficult to read and understand, are

probably out of date, and provide very little useful information as stand-alone documents. To help with understanding the FIRMs, there is a tutorial for reading these maps in Appendix D.

Participating in NFIP is one of four requirements for earning a 12.5% match in funding from the state for Public Assistance Funds.

### ***Flood Hazard Area Regulation (FHAR)***

Glover adopted a set of Flood Hazard Area Regulations in July of 1991. These regulations set standards and rules for permitting and development within the FEMA mapped flood zones. More recent FHAR tend to be more comprehensive, including precautions which are not present in the currently adopted regulations. A model FHAR which can be adapted and used for the Town of Glover can be found in Appendix E.

### ***Local Emergency Operations Plan (LEOP)***

A Local Emergency Operations Plan is a guide to the immediate post-disaster period, a critical time to have an organized disaster response prepared. This plan establishes an incident command system, identifies vulnerabilities, designates operations centers, and lists local resources which will come into play in a disaster situation. Keeping an up-to-date LEOP can save lives, time, and property. Glover has updated its LEOP as of April 10, 2014. Maintaining an up-to-date LEOP is one of four requirements for earning and 12.5% match in funding from the state for Public Assistance Funds.

In 1997, the Glover Firehouse was moved to a site outside of the FEMA mapped 100-year flood zone.

### ***Local Hazard Mitigation Plan (LHMP)***



Figure 12: Zone AE and structures within Glover Village

Having a local hazard mitigation plan allows a municipality to identify and prioritize actions that the community can take in order to reduce or eliminate the risks of hazards associated with natural and man-made disasters such as high wind events, flooding and fluvial erosion, terrorist attacks, or disease outbreaks. A local hazard mitigation plan is required by FEMA in order for a town to be eligible for grant funding, which can allow the community to address their vulnerabilities before disaster strikes. By designing a community to be resilient in the face of disaster, the costs to rebuild and repair, as well as the loss of life and

property, are reduced.

As of 2014, a hazard mitigation plan for the Town of Glover has been developed, and is in the revision process pending approval. Once the plan has been approved, Glover will have accomplished all four requirements for earning and 12.5% match in funding from the state for Public Assistance Funds.

### **Areas of Special Consideration**

In the Village of Glover, especially on the west side of the river, the shallow slope and relatively high development density creates an area that seems likely to be affected during a flood event. In this area, Red Sky Trading, the Currier's Store & Post Office, the Union House Nursing Home, and the Federated Church are fully or partially within the FEMA flood zone, the 100-Year-Flood Zone. In this flood zone, there is a 26% chance that there will be a flood within a thirty year period. Although the Glover Village School is located outside of the FEMA-mapped flood zone, it is within 100 feet of both the flood zone to the south and the unnamed brook to the north. The firehouse is located approximately 40 feet outside of the flood zone. Though these structures are within the flood zone, historically they have not been repetitive loss structures and have not suffered damage as a result of their proximity to the Barton River, including during the recent dramatic flood events which affected the rest of the state. For this reason, no actions are recommended for this area at this time.

Other areas to consider are those immediately surrounding lakes and ponds. These are also areas of high structure density, as well as areas which are likely to be affected during floods. These areas are also historically unaffected by flooding, and the VT Shoreline Protection Act restricts development and land management within 250 feet of any lake or pond which is greater than 10 acres. There are 5 such lakes in Glover including Lake Parker, Shadow Lake, Daniels Pond, Clarks Pond, and the Beaver Pond. For these reasons, no actions are recommended for this area at this time.

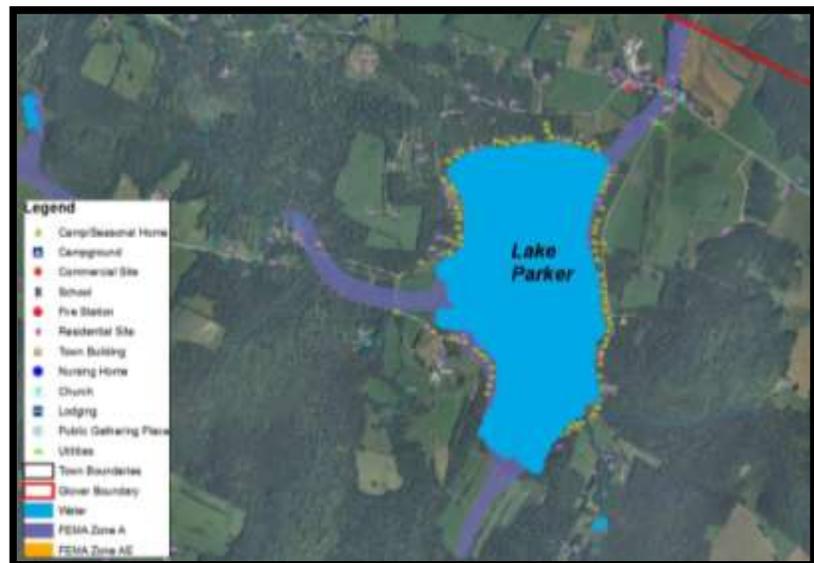


Figure 13: Zone A and structures surrounding Lake Parker

In the future, if (a) the predictions of a pattern of increasing severity and frequency of storms hold true and (b) these become areas of repetitive losses, then this course of inaction will need to be reevaluated.

While inundation within Glover has caused minimal structural damage, it has caused the washing-out of several Class 4 roads, which can be expensive to repair and maintain. An estimate by the town road foreman suggests that repairing these Class 4 roads after a significant storm can cost the town between \$5000 and \$6000 in labor, equipment use, and supplies. Three non-residential roads which have been most affected by fluvial erosion are Sand Hill, Still Hill, and Swamp Road.

There are a few options for mitigating this cost to the town; (a) improve storm water management infrastructure on these steep, erosion-prone roads to prevent future washouts, and (b) reclassify these town highways as trails, thereby removing the obligation of maintaining them from the town. While reclassifying the roads as trails will save the town money in the short term, it gives rise to another issue, which is that when future storms hit, there will still be movement of sediment into waterways, reducing water quality downstream. If the storm water management infrastructure is improved to a point where the roads are no longer regularly washing out and there is less sediment input, the town will be able to keep the roads at their current classification and save money on future repairs. If that is not an option for Glover due to the costs of improving infrastructure, reclassifying the roads as trails and then organizing planting efforts to try to stabilize the soils could mitigate the erosion and resulting sedimentation during future storms.

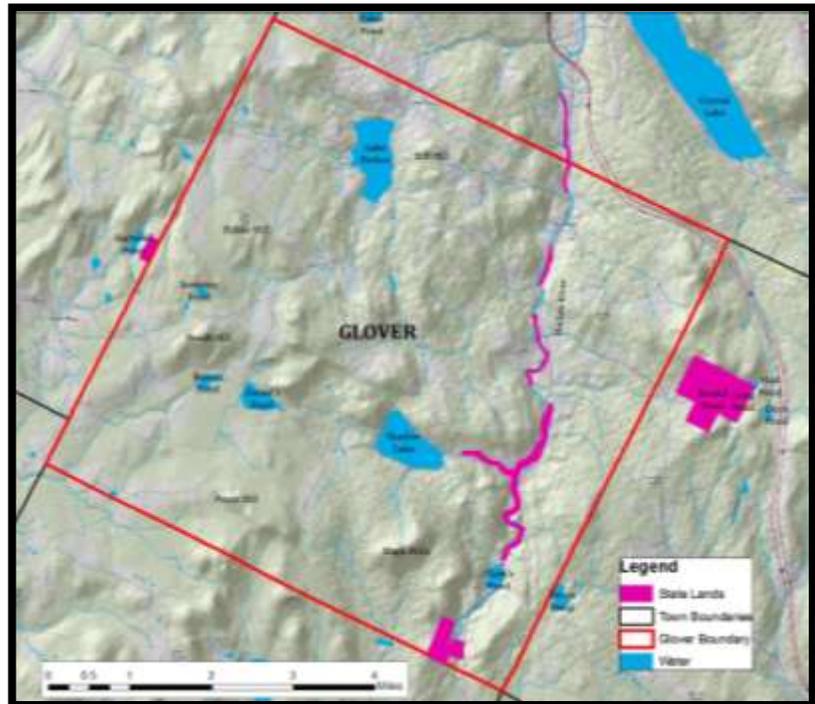


Figure 14: State-owned land within the Town of Glover

### ***State Land in Glover***

The State of Vermont owns approximately 319.73 acres within Glover. The majority of this is along the Barton River stream banks and the headwaters. The state is responsible for the state of the slopes, forests, and riparian zones in these areas.

## Recommendations

- (1) Take advantage of all cost-share and town assistance programs which can help fund survey or mitigation efforts.
- (2) Maintain bridges, roads, ditches, and culverts to Town Road and Bridge Standards in order to avoid incurring additional flood damage costs associated with failure of these critical structures.
- (3) Maintain an up-to-date Local Emergency Operations Plan and Local Hazard Mitigation Plan. These are both critical for the prevention of risks to life, safety, and property in the event of a catastrophic event.
- (4) Modify and adopt updated Flood Hazard Area Regulations based on the Vermont Model Inundation Hazard Regulations 2 (Appendix E).
- (5) Work with the VT ANR to fine-tune River Corridor and Flood Zone maps using a combination of modern mapping techniques and anecdotal and experiential information on flood and fluvial erosion events within the town.
- (6) Since many mitigation actions aren't within the power of the town, but lie with the landowners and town residents, Glover should host a series of landowner education workshops including ones on ecologically sound forest management practices, water quality, and riparian buffers. In forest management practice educational presentations, there should be special attention paid to the detrimental effects of logging on hillsides with greater than 20% slope.
- (7) To avoid continued sedimentation due to fluvial erosion of steep gravel roads, as well as the monetary costs associated with the repairs required by the same, the Town of Glover should assess the Class 4 roads which have the most frequent and costly washouts to determine the economic viability of replacing or installing storm water management infrastructure such as culverts or modifying drainages to better divert water from roadways. If improving the infrastructure is not a viable option for the town, the Selectboard should consider reclassifying the roads as trails (to remove the obligation to repair or maintain them) and taking steps to prevent sedimentation by planting trees and shrubs in areas most prone to fluvial erosion.