Management Alternatives

Hinesburg Village, Vermont (MMI# 3452-03)

August 24, 2010

I. Project Introduction

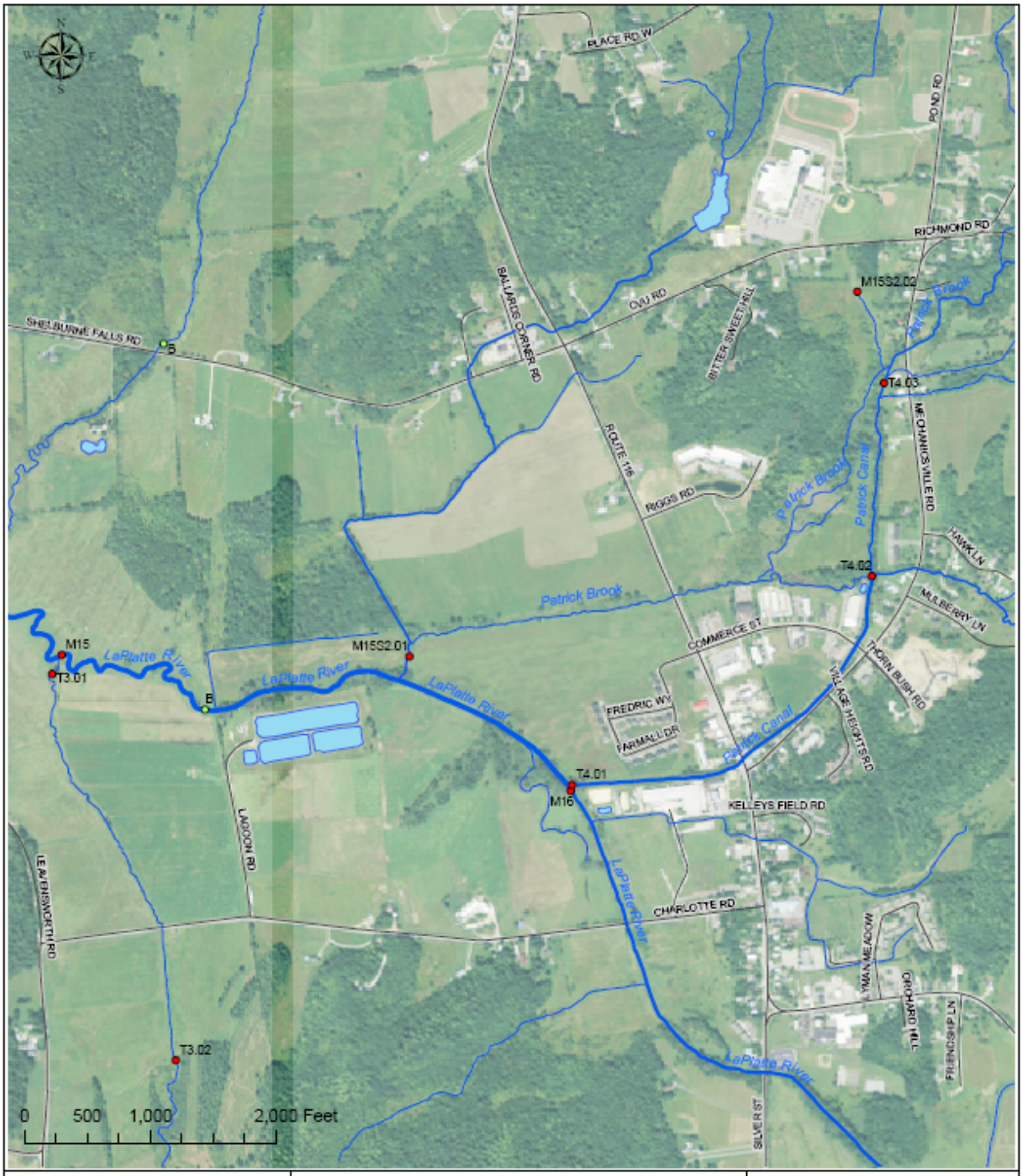
The LaPlatte River runs through Hinesburg Village flowing in a northwest direction just to the west of the village center (reach M15B and lower M16) (Figure 1). Patrick Brook flows behind businesses on Commerce Street, under Route 116 and across a hay field to meet the LaPlatte River just upstream of the Hinesburg Sewage Treatment Plant (M15.S2.01). Patrick canal flows approximately parallel to Mechanicsville Road and joins the LaPlatte River behind the former Saputo Cheese Factory (reach T4.01).

The LaPlatte River system in and around Hinesburg Village has reduced geomorphic and habitat condition (LWP, 2006) and water quality (LWP, 2008). Degraded instream conditions are common around existing developed centers. Channel straightening and berming, and altered flow from stormwater runoff contribute to channel instability. Channel down-cutting (i.e., incision) often results if the bed is more erodable than the bank, as is the case in many locations in the LaPlatte River. As streams incise they lose connection to their floodplains and flood waters are contained within the banks that increases the risk of flood and erosion, and alters aquatic ecosystems.

Floodplains carry overflow from the channel during large storm events, provide sediment deposition locations, and create opportunities for nutrient uptake. When a stream is altered and incised, water is typically trapped within the resulting tall banks allowing the water to move faster and lead to more erosion.

A fist priority to reducing risks and improving resources is to identify functioning floodplain areas and ensure that these natural attenuation areas are not filled or developed. Naturalization of a river corridor protects widespread floodplain function and thus channel health. Active restoration to recreate natural channel bends or re-establish a floodplain are approaches that speed the natural progression of river healing. Stormwater controls can improve riparian and aquatic functions by slowing the flow of water across the land common in natural settings.

The goal of this project is to identify approaches to improve water resources in Hinesburg Village and downstream. This generally consists of naturalizing river function, stabilizing channels, improving water quality, rehabilitating instream habitat, and reducing risks to infrastructure. Milone & MacBroom, Inc. was retained by the LaPlatte Watershed Partnership and Lewis Creek Association to compile existing data in and around Hinesburg Village, conduct a field assessment, and make recommendations for river corridor management alternatives. This memorandum summarizes existing data collected during the Phase II Stream Geomorphic Assessment (LWP, 2006) and the findings of the Corridor Plan (LWP, 2007). Watershed-level studies of stormwater infrastructure and culverts were completed by Milone & MacBroom, Inc. in 2010. Related information collected and presented in the full studies, *LaPlatte River Watershed Stormwater Infrastructure Study* (Schiff and Clark, 2010b) and *LaPlatte River Watershed Culvert Study* (Schiff and Clark, 2010a) has been included here in the Village segment context. Field observations of the watershed during each of these projects have informed the management recommendations. A stream walk was performed on August 13, 2010 by the LaPlatte Watershed Partnership and Milone & MacBroom, Inc. to verify previous findings and make firsthand observations of the stream channel and corridor conditions.



Engineering, Landscape Architecture and Environmental Science MILONE & MACBROOM® 1233 Shelburne Road, Suite 150 South Burlington, Vermont 05403 (802) 864-1600 Fax: (8020 864-1601 www.miloneandmacbroom.com	**Hinesburg Village Center Rivers**		LOCATION: **Hinesburg, Vermont**	
	MM#: 3452-03-2 MXD: M15Alts.mxd SOURCE: VCGI, 2008 NAIP images	**Hinesburg Village**	DATE: 08/20/2010 SCALE: 1" = 1000'	SHEET: **Figure 1**

II. LaPlatte River Segment M15B

A. Summary of Existing Stream Geomorphic Assessment and Corridor Plan Data

This segment extends from the Hinesburg Sewage Treatment Plant (STP) to the confluence with the Patrick Canal, behind the Saputo Cheese property. The stream is low gradient in a wide unconfined valley. The channel bed and banks are non-cohesive sand and silt with patches of clay. The habitat is in poor condition. The segment was historically straightened and continues to have low sinuosity. The riparian buffer is minimal and in most locations has no tree cover.

This dune ripple stream is in fair geomorphic condition and has departed from its reference condition of an E channel to a C channel (VTANR, 2009). The channel is in stage III of the F-stage channel evolution process (Schumm et al., 1984; Simon, 1989). This means that the channel is currently widening after incision. The incision was relatively minor and the channel still has some connection to the floodplain. The widening occurs by eroding the channel banks and forming bars in the channel. The process of widening can lead to channel avulsion where the river changes its course during flooding or blockage with sediment, ice or debris. As the channel adjusts to its desired sinuosity it will slowly meander laterally across the landscape or suddenly avulse.

The corridor plan identified that protecting the river corridor and planting stream buffers should be considered to reduce erosions risks and improve habitat and water quality. It also suggested that an active approach to lowering the floodplain may be preferable to protect the sewage treatment plant.

B. Summary of Stormwater Infrastructure

At the northern end of the village, the LaPlatte River reach M15 remains mostly rural with little existing stormwater infrastructure. However, this reach receives flow from Patrick Brook and the Patrick Canal that both receive runoff from densely developed sections of the village. The densest development in Hinesburg is in the village center along Route 116 from Commerce Street south to the Hinesburg Community School. LaPlatte River reach M15 via M16 and Patrick Brook and Canal receives runoff from this area.

C. Field Observations

Connection to the floodplain was confirmed, with a stronger connection on the left side of the river (channel always referred to looking downstream). The channel bed is a mix of clay, silt, and sand. Sections of cohesive varved clay are visible on the bank along with highly erosive fine

gravel and sand layers. This segment has two distinct sub-segments upstream and downstream of the confluence with Patrick Brook. The downstream sub-segment is actively widening (confirmed Phase II finding of stage III channel evolution), has some sinuosity and appears to be changing course to become more sinuous. Note that channel adjust their sinuosity as they work towards a stable equilibrium slope that is dependent on flow and sediment (Lane, 1955). There is active bar and low floodplain creation occurring. A distinct dune-ripple bed pattern was observed. The banks are vertical or undercut with many active erosion faces.

The upper section of the reach, upstream of the confluence with Patrick Brook, was historically straightened and remains straight. This sub-segment is a long deep run with no distinct bed features. The bed is mucky with a clay/silt mix and significant emergent herbaceous wetland vegetation growing on the channel bed. It appears that this location is still in stage II of channel evolution and has not yet begun to widen. Floodplain connection appears to be good on both sides of the river. Herbaceous vegetation covers the banks and limited buffer. Active cow grazing is occurring just upstream of the sewage treatment plant, with a 25-foot buffer from the river. An old river meander scar is visible through the middle of this field approximately 500 feet from the channel illustrating a former location of the channel prior to straightening. In the upstream part of the segment, the left floodplain has a forested floodplain. An old channel path was observed (visible on map) that provides excellent habitat and overbank flow path. A large mowed meadow on the right bank has a very minimal herbaceous buffer.

The Hinesburg Sewage Treatment Plant (STP) is located adjacent to the river on the left floodplain near the downstream end of the reach. The town investment will be protected if the river would meander in that direction. The floodplain around the sewage treatment plant is approximately 3 feet lower than on the other side of the river. The lower floodplain will carry more overbank flow. Across the river, a narrow herbaceous buffer exists next to a hayed field. The river near the STP is building in channel bars and creating meanders. It is likely that the river would continue to change course in this area because of the straightened section upstream.

D. Recommendations

1. Passive Channel and Corridor Improvements

Naturalize floodplain adjacent to the Hinesburg Sewage Treatment Plant by leaving unmowed. Any mowing necessary for berm preservation should continue. Additional trees and undergrowth around the lagoons will provide natural protection during flood events to slow floodwaters near berms.

Naturalize grazed cow pasture upstream of STP. A natural wooded floodplain upstream of the STP will reinforce floodplain soils and reduce risk of channel avulsion through this field. The visible historic channel meander scar in the field indicates that the river historically moved in this field. It is recommended to naturalize to this meander scar (approximately 500 feet from river).

Preserve wooded floodplain and abandoned channel. This small section has a functioning wooded floodplain and potential overbank flood path intact. These floodplain functions should be preserved.

Increase buffer on right between Patrick Brook and Canal. The buffer is only 5 feet in some locations and has minimal woody vegetation. Ideally the half of the field adjacent to the river would be naturalized to increase floodplain functioning and encourage natural sinuosity of the river to return. Establishment of a wooded floodplain would ultimately protect the development along Fredric Way and any other planned near Route 116. The area behind the Fredrick Way neighborhood appears to have some wetland vegetation and is recommended to not be mowed, except where necessary for upkeep of the existing stormwater pond.

2. Active Channel and Corridor Improvements

Lower and naturalize the floodplain area across the river from the STP. Additional overbank flow capacity opposite the STP will dissipate flood pressure that would otherwise be trapped in the channel and the left floodplain adjacent to the STP. The proposed floodplain elevation in the right overbank would be lowered to or below the existing floodplain elevation around the STP.

Create meander pattern upstream of STP. The straightened section of the reach upstream of the STP is unnatural and the river is working to regain that sinuosity choosing its own path. Guiding appropriate placement of meanders based on reference reach conditions may protect the STP from channel avulsion.

Plant trees on right floodplain between Patrick Brook and Canal. This section of river has minimal woody vegetation.

3. Stormwater Improvements

There are no necessary improvements to existing infrastructure in the M15B subwatershed. There is very little existing infrastructure. Refer to other sections of this report for the stormwater improvements that are recommended in the subwatersheds draining to M15B.

The subwatershed remains mainly undeveloped with a portion of the land zoned Village, along Route 116, and Agriculture. It is important to require stringent stormwater controls if these areas do get developed. General Stormwater Recommendations that address new development have been included in the report *LaPlatte River Watershed Stormwater Infrastructure Study* (Schiff and Clark, 2010b) that would be applicable.

III. LaPlatte River Segment M16

A. Summary of Existing Stream Geomorphic Assessment and Corridor Plan Data

This reach extends from the confluence with the Patrick Canal, behind the Saputo Cheese property, to the confluence with Beecher Hill Brook, near Gilman Road. It travels under Silver Street and Charlotte Road, southeast to northwest, just to the west of the village center. The stream is low gradient in a wide unconfined valley. The channel bed and banks are non-cohesive sand and silt with patches of clay. The habitat is considered to be in fair condition. The segment was historically straightened with berms on the banks and continues to have low sinuosity. The riparian buffer is minimal and in most locations has no tree cover.

The channel is in stage III of the F-stage channel evolution process and in fair condition. This means that the channel is currently widening after incision. The incision was relatively minor and the channel is not entrenched (i.e., it still has connection to the floodplain). The widening occurs by eroding the channel banks and forming bars in the channel. The process of widening can include channel avulsion when the river changes course. As the channel adjusts to its desired sinuosity it is considered to be unstable and highly sensitive to additional changes.

The corridor plan suggested protection of the river corridor and planting perennial native vegetation. It suggested that the Charlotte Road and Silver Street crossings were not adequately sized and should be replaced with larger structures when replaced. Removal of berms was discussed as a possibility if it did not impact habitat.

B. Summary of Stormwater Infrastructure

The large subwatershed draining to M16 was split into three areas for stormwater analysis based on varying land use and stormwater input locations. The downstream sub-reach extends to the Charlotte Road crossing. This area collects water through a ditched tributary that runs along the former Saputo property, under Route 116 and behind the grocery store, church, and Lyman Meadows neighborhood. A majority of the village drains to this tributary, including most of the eastern half of Route 116 through the village. There is a significant amount of impervious surface associated with the older development that was not required to install stormwater treatments that should be examined for treatment opportunities. Of the many impervious areas draining to this tributary, none include significant treatment and only the Saputo factory site, Kelley's Field Drive, and Lyman Meadow neighborhood have stormwater permits. Areas with large impervious surfaces with no permits include businesses along Route 116, specifically the grocery store, church, gas station, diner/creemee stand, and many residences.

The middle section of M16 includes runoff from the remaining section of the village, from Charlotte Road upstream past Hinesburg Community School. Ditches along Charlotte Road collect water from a section of Route 116 with catch basins and pipes. Another series of catch basins and pipes run along the southwest part of the village and drains to a ditch leading to the LaPlatte River downstream of Silver Street. Catch basins along Route 116 in front of the Hinesburg Elementary school, and the area to the east side of Route 116, collect and discharge stormwater near the corner of Silver Street and Route 116. Erosion is taking place at this outfall that conveys untreated stormwater to the LaPlatte River in a ditch along Silver Street. This is a priority treatment location for Hinesburg Village. Hinesburg Community School has two additional direct discharge locations behind the school. None of the five networks described in M16 have significant treatment of the stormwater and each should be considered for mitigation. The only permitted system in this subwatershed is the small lower parking area on the Hinesburg Community School property. The western section of this subwatershed remains mostly in its natural forested state with a few homes and fields.

The upper area of M16 is rural and mostly comprised of agricultural fields and forest. Minimal stormwater infrastructure is in place. Runoff from roads, agricultural fields, and individual homes is conveyed either in ditches or overland.

C. Field Observations

This reach is visibly narrower than the downstream reach (M15B) that also conveys flow from Patrick Brook and Patrick Canal. The reach was historically straightened and retains this straight path with almost no signs of meander building. The channel is a long, deep, slow-moving run with no visible bed features. The slight incision reported in the Phase II assessment was confirmed, and the floodplain is accessible in most locations. The channel evolution stage of III (widening) was also confirmed, although it is early in this stage. The channel banks appeared generally stable and covered with herbaceous vegetation with little erosion. The bed has emergent wetland vegetation growing as well as large mats of submerged algae. The water was turbid.

Between Saputo Cheese, Stella Road, and Charlotte Road a large vegetated wetland exists. This piece of land is a functioning floodplain with good connection to the river. A field on the left bank downstream of Charlotte Road is actively grazed with a 50-foot buffer to the river. The old channel meander that joins the channel in the downstream reach originates in this field. The upstream end of the meander path was not observed. Upstream of Charlotte Road a large field exists on the left bank that is mowed to within 50 feet of river. The unmowed section is only herbaceous vegetation.

Halfway between Charlotte Road and Silver Street the channel passes through a small section of woods. An approximately 6-foot tall berm confines the channel on both banks through this section. The berm on the right side ends downstream of the large mowed lawn, but continues on the left bank all the way to Silver Street. These berms confine the overbank flows, increasing the volume, depth, and velocities in the river. The disconnected floodplain on the left is used for pasture.

A small tributary joins the LaPlatte just upstream of Saputo Cheese. This tributary has been straightened and ditched. It collects stormwater runoff from a large section of the village starting in Lyman Meadows and traveling behind Route 116 businesses and adjacent to Saputo Cheese. In some locations there are stream-like qualities, in others it appears to be an actively managed ditch

Field observations ended at the Silver Street Bridge.

D. Recommendations

1. Passive Channel and Corridor Improvements

Naturalize pasture on left downstream of Charlotte Road. The pasture is actively grazed and currently has a 50-foot herbaceous buffer just downstream of Charlotte Road. That buffer is suggested to be increased to 100 feet in the area across from the wetland on Stella Road. Approximately 500 feet downstream of Charlotte Road an old meander scar indicated that historic path of the river. A few trees are scattered in that area. It is recommended that the area (approximately 500 feet wide) including the historic river path be protected and allowed to naturalize. This will counterbalance the fill and building encroachments across the river at Saputo Cheese by providing for overbank flooding and erosion.

Conserve wetland meadow between Charlotte Road, Saputo Cheese and Stella Road. This meadow provides important floodplain benefits that should be conserved.

Naturalize a wider buffer on left upstream of Charlotte Road. Currently an approximately 50-foot section is left unmowed. This unmowed area should be increased to 100 feet in the short term. The agricultural fields should be considered for conservation and naturalization as undisturbed floodplain in the long term.

Naturalize mowed lawn on right downstream of Silver Street. A portion of the large lawn that is mowed to the edge of the LaPlatte River downstream of Silver Street should be naturalized and allowed to grow trees. Rougher vegetation will slow flood conveyance and reduce erosion risks. Runoff from roadways and structures flowing overland will also be filtered in a more natural buffer.

Manage ditched tributary as a natural stream. Naturalization is recommended and possibly add stormwater treatments suggested in the section below.

2. Active Channel and Corridor Improvements

Berm removal downstream of Silver Street. Removal of the berm on the left bank should be explored. The pasture in the disconnected floodplain could balance the floodwaters now confined to the backyards of homes along Silver Street. The possible removal should consider the impacts of tree removal from the berms.

Reestablish meanders along channel between Silver Street and Saputo Cheese. The channel has been channelized into a straight flow path. Meanders will allow the river to slow flood waters, attenuate sediments, increase habitat values, and gain stability. The historic channel path on the left bank downstream of Charlotte Road is a good candidate for the new channel.

Plant trees on floodplain. Multiple fields exist with only herbaceous vegetation. The target area extends from halfway between Silver Street and Charlotte Road down to Saputo Cheese.

3. Stormwater Improvements

The lower two subwatersheds associated with reach M16 have been targeted for stormwater improvement. A majority of village drains to the tributary in the downstream section of this reach, including most of the eastern half of Route 116 through the village. Treatment potential exists in this area. Stormwater could be diverted from the ditched tributary into the existing treatment pond that was formerly used by the Saputo factory (Figure 2). If this pond will not be used for future plant operations it would serve as potential stormwater detention location. Space for other detention areas exists around the factory site that could be reserved for planned future uses in the area and village expansion. Permeable soils are mapped in the LaPlatte River corridor in this area including the western half of the factory site and portions of the fields both to the north and south of the site which could present opportunities for infiltration based mitigation. Permeable soils are rare in the watershed and thus these locations should be protected for stormwater treatment.

Additional opportunities for stormwater interception are possible in the collection system upstream including expanding the current ditch in Lyman Park to enhance stormwater treatment by establishing

wider detention areas. Stormwater enters the ditch systems behind the gas station, church, and the grocery store at multiple locations and thus small decentralized treatment methods such as rain gardens or infiltration practices may be appropriate. Minimal, if any, mowing should be performed in the swales so thicker vegetation increases hydraulic resistance slowing flow rate and increasing retention times.

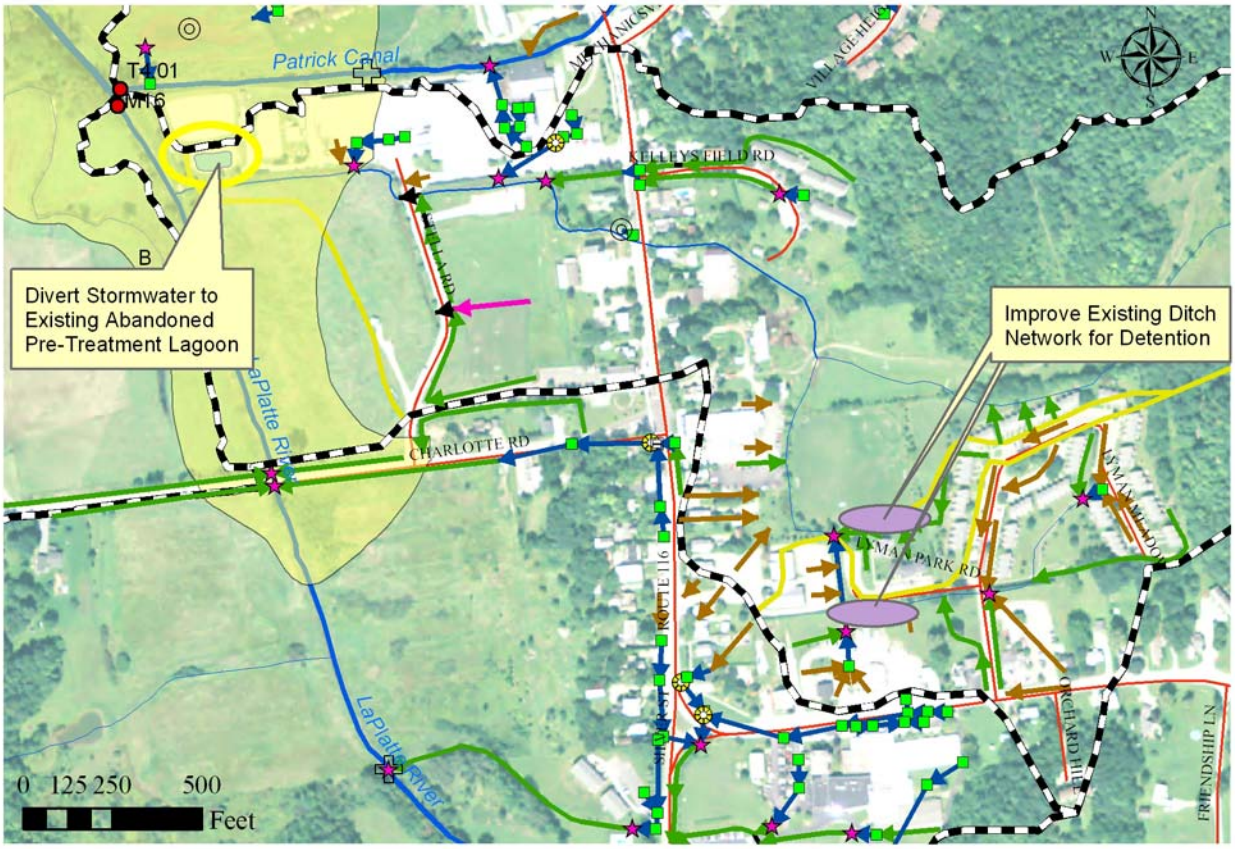


Figure 2: Potential Stormwater Treatment Options in Hinesburg Village Lower M16

The middle section of M16 includes runoff from the remaining section of Hinesburg village, from Charlotte Road upstream past Hinesburg Community School. This subwatershed was targeted for treatment due to high percentage of impervious surface, water quality problems downstream, and local erosion. A multi-celled, terraced detention system is recommended where the piped system meets the ditch at the corner of Silver Street (Figure 3). Multiple detention cells would allow for increased retention times on the sloping corner of land. Water currently rushes out of the pipe and down the existing steep ditch to the LaPlatte River.

Ditches along Charlotte Road collect water from a section of Route 116 with catch basins and stormwater pipes. The ditch that this system discharges to is a grass swale along the road that could be improved into a higher functioning linear rain garden system. Soils located in the area indicate that infiltration could be possible in this location.

Another series of catch basins along the southwest part of the village collects runoff along Route 116 in front of the Hinesburg Elementary school and discharges near the corner of Silver Street and Route 116. Erosion is taking place at this outfall indicating high stormwater flows. Runoff eventually flows through the ditches along Silver Street. The terraced rain garden recommended in this area will thus need to be size for the volume of runoff coming from this and the previously mentioned pipe systems.

Hinesburg Community School has two discharge points behind the school. Multiple opportunities exist for stormwater treatment such as rain gardens or constructed wetlands at the school site (Figure 3). These projects could benefit local stream health and present a hands-on educational opportunity for the students at the Hinesburg Community School to learn about stormwater. The targeted outfall collects runoff from compacted areas of the lawn and discharges behind the play area. Roof runoff should be diverted to the recommended treatment area. Other smaller stormwater projects could be implemented around the school such as inclusion of rain water collection barrels at the roof downspouts and building of small rain gardens in the median strip in front of the school that are now drained by catch basins. Disconnection of impervious surfaces or install of infiltration methods are recommended for the parking areas and the roof that are now discharging to the LaPlatte River near the Silver Street Bridge without treatment. Installation of stormwater treatments may be pursued as part of the reconstruction of the Silver Street Bridge, scheduled for 2011-2012.

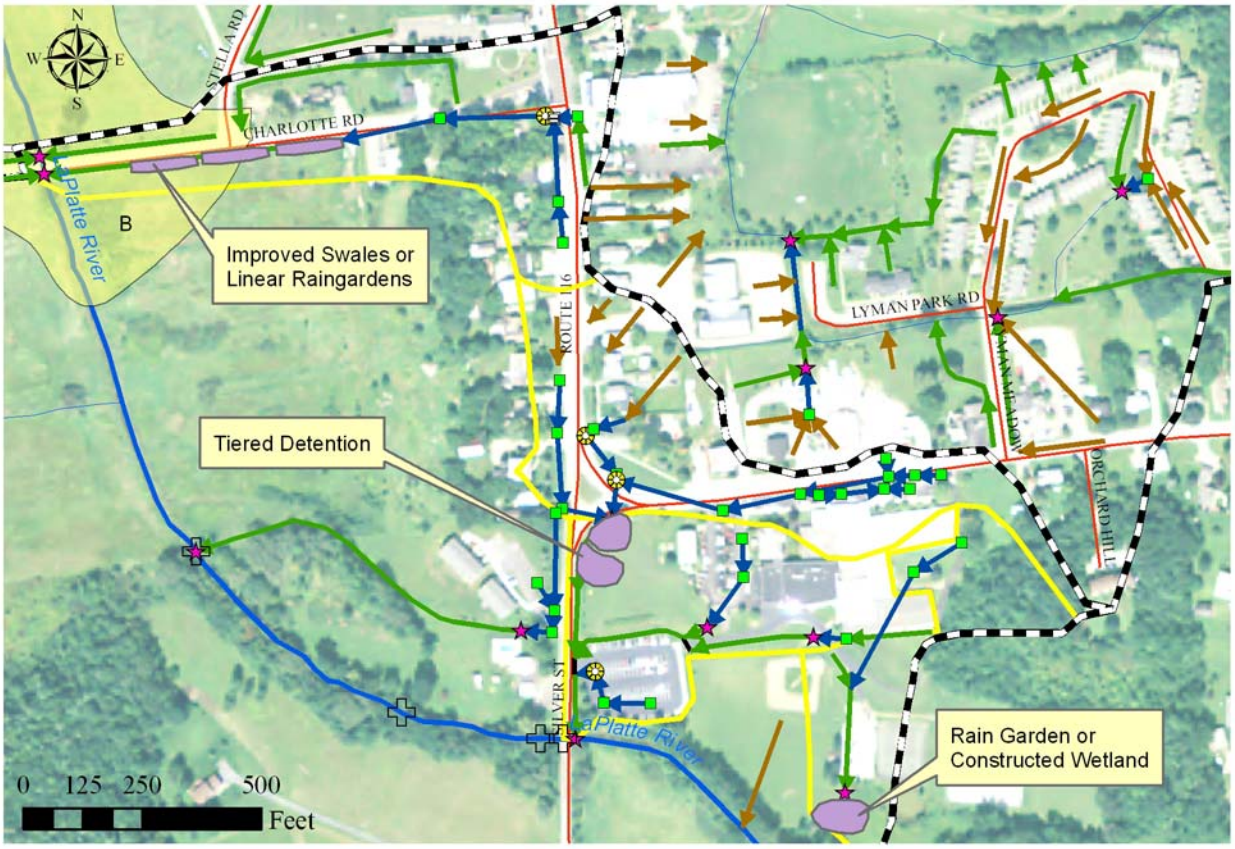


Figure 3: Potential Stormwater Treatment Options in Hinesburg Village Middle M16

IV. Historic Patrick Brook M15.S2.01

A. Summary of Existing Stream Geomorphic Assessment and Corridor Plan Data

Patrick Brook was historically diverted just after crossing under Mechanicsville Road (top of T4.02, M15.S2.01) for use in manufacturing. Although the diversion structure is no longer intact, the majority of the flow continues to go down the Canal. The channel flows through a broad valley. The channel has a dune-ripple morphology and a gravel bed. The reach was historically straightened.

The channel is in good condition, and is in Stage III of channel evolution. Bar formation is occurring. The habitat is in fair condition. Bank and riparian vegetation are poor because of narrow buffers and lack of woody vegetation.

The corridor plan discussed returning the flow to the channel that is now diverted to the Canal. It was suggested that the channel would soon reach equilibrium. The culvert constriction at Route 116 was recommended to be replaced. General river corridor protection was also recommended.

B. Summary of Stormwater Infrastructure

Patrick Brook (M15.S2.01) receives runoff from NRG, businesses on Commerce Street, a section of Route 116, and part of Champlain Valley Union High School (CVU). NRG has treatment in place and is permitted. CVU has multiple detention ponds in place and a state permit. Runoff from the eastern section of Commerce Street is permitted and follows a path either north or south to one of two detention ponds. A series of ditches along Route 116 collects runoff from the western section of Commerce Street and business along the eastern side of Route 116, including a significant amount of impervious area before discharging directly to Patrick Brook. This non-permitted collection system should be examined for treatment prior to outfall. Additional non-permitted impervious areas include development and road runoff along Shelburne Falls Road, CVU Road, Route 116, and Pond Road.

For analysis this watershed was split into two sections including the original mainstem of Patrick Brook and the tributary that joins Patrick Brook just before the confluence with the LaPlatte River. Both subwatersheds were identified as being a priority for stormwater improvements (Schiff and Clark, 2010b). The historic Patrick Brook section receives drainage from Commerce Street. This subwatershed is 9.9% impervious cover and is ranked as one of the highest in the LaPlatte River watershed for runoff depth. The subwatershed that drains to the tributary and includes Ballard's Corner has 6.6% impervious cover and was also identified as having a high runoff depth.

Water quality sampling on Patrick Brook showed increases in turbidity and total Phosphorus between the Mechanicsville Road and Route 116 crossings. Runoff from the commercial development may be influencing water quality. This sampling location is upstream of the outfall discharging water from Route 116 and the gas station on Commerce Road and thus local water quality may be further reduced than data suggest. Stormwater outfalls along Patrick Brook should be targeted for stormwater treatment (LWP, 2008).

C. Field Observations

The lower section of Patrick Brook, from the confluence with the LaPlatte River to Route 116 was historically straightened and has maintained a straight path. A narrow buffer of herbaceous vegetation and some shrubs separates the channel from the hay fields on both sides. Habitat would be improved by increased shade and woody debris in channel. Upstream of Route 116 the channel has riffle-pool morphology and the sinuosity increases. Some bank erosion is present on outer bends as the river regains its meanders. Riffles are gravel and pools have collected thick silt and muck. This section has patches of thick cohesive clay lining the bed. The businesses on Commerce Street maintain a very minimal buffer. In one location the parking lot extends to the top of the bank. This section of channel appears to be very stable.

There is a tributary to Patrick Brook that joins from the east and travels behind Commerce Street. This tributary's flow is intercepted by the Canal at a dam. Recently placed concrete blocks divert water away from this tributary and hold flow in the Canal. The channel between the diversion dam and Patrick Brook has significant additional capacity. A low vegetated floodplain is forming within the larger channel. Many broken beaver dams were observed.

The Route 116 culvert is narrow, constricting the channel with sediment collected upstream. This culvert would need to be replaced if more of the original flow was undiverted to Patrick Brook instead of the Canal.

D. Recommendations

1. Passive Channel and Corridor Improvements

Naturalize a wider buffer along Commerce Street. Currently the riparian vegetation is less than 5 feet wide in many locations. Woody vegetation will help protect the existing development as well as provide more habitat and benefit river processes.

Increase buffer along hay fields between LaPlatte River and Route 116. The buffer is only 5 feet in some locations and has minimal woody vegetation. Half of the field adjacent to the river would ideally be naturalized to increase floodplain functioning and encourage formation of

equilibrium slope (or sinuosity). Establishment of a wooded floodplain would ultimately protect future development along Route 116.

2. Active Channel and Corridor Improvements

Plant trees on floodplain. Multiple fields exist with only herbaceous vegetation. The target area is between the LaPlatte River and Route 116.

Restore a portion of the flow to the tributary behind Commerce Street. The tributary channel has an active functioning floodplain and habitat value that the Canal does not provide. A portion of the flow in the Canal should be allowed to flow into its original channel.

Replace the Route 116 Culvert. This culvert constricts the channel and does not allow the natural transport of sediment and debris. This culvert also has reduced aquatic organism passage.

3. Stormwater Improvements

Patrick Brook (M15.S02.1) was identified as a priority watershed for stormwater treatment based on the ranking analysis and specifically percent impervious surface (Schiff and Clark, 2010b). Between the local gas station and Patrick Brook is a piece of open space that could serve as a location for a stormwater detention pond (Figure 4). A constructed wetland or traditional pond could be built and directly draining runoff from the area could be diverted to the pond via swales or curbing along the back of the parking areas.

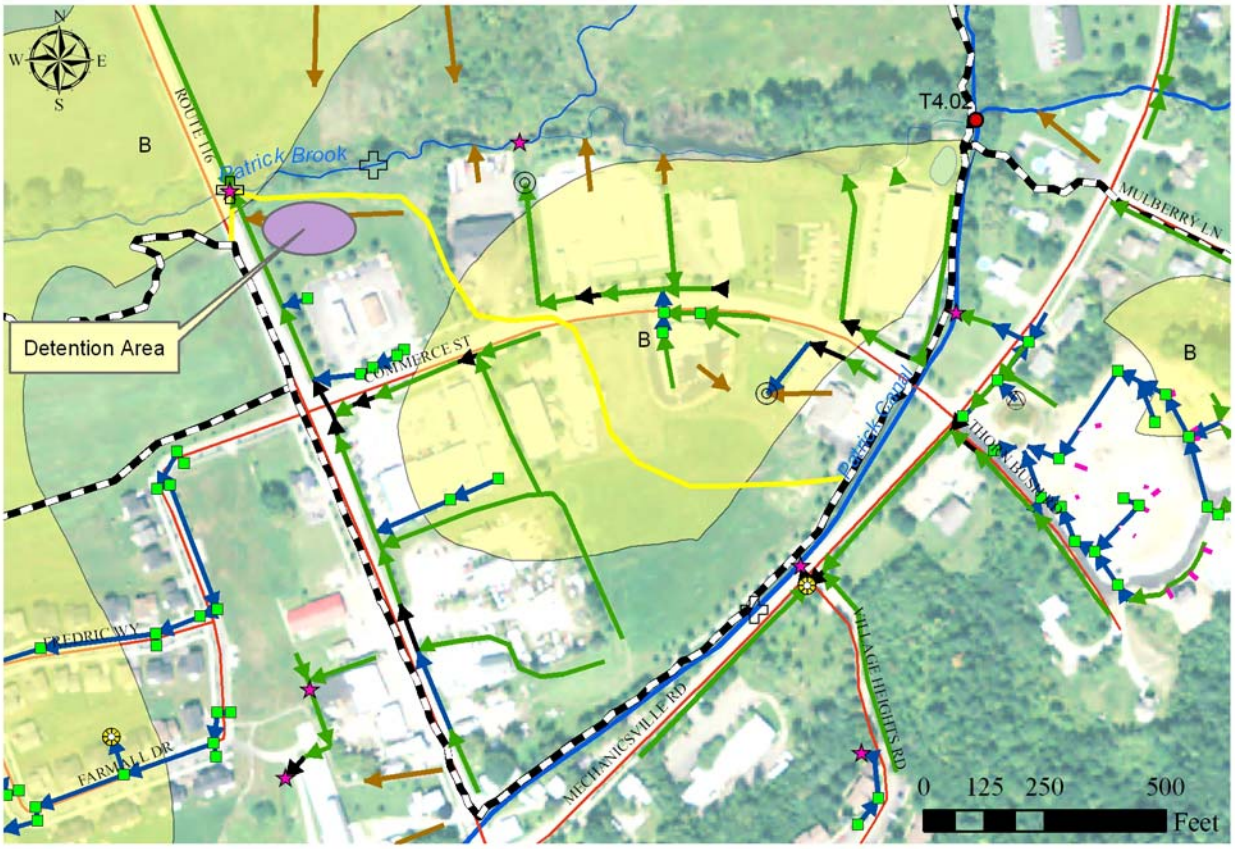


Figure 4: Potential Stormwater Treatment Option in Hinesburg Village Patrick Brook

V. Patrick Canal T4.01

A. Summary of Existing Stream Geomorphic Assessment and Corridor Plan Data

This reach is a man-made canal that carries water diverted from Patrick Brook (M15.S2.01) starting just after Patrick Brook crosses under Mechanicsville Road (at the upstream end of T4.02). The canal also diverts water from an unnamed tributary to Patrick Brook that travels between Hawk and Mulberry Lanes before traveling under Mechanicsville Road and meeting the Canal (at the reach break between T4.01 and T4.02). The canal was dug originally in the 1820's for manufacturing and is currently owned by Saputo Cheese. The entire reach has been straightened and there are berms along most sections. The aggradation of the channel with sediment was noted.

The channel was observed to be incising. This process is likely occurring because high flows are trapped within the channel due to the berms and straightened path. The excess water energy is eroding the bottom of the channel because it is more erodible than the banks. If the water was

able to access the surrounding floodplain it would slow and dissipate the energy reducing channel erosion.

As part of the corridor planning process an outreach letter was sent by the LaPlatte Watershed Partnership to engage the owners of Saputo Cheese in a mutual discussion of future planning efforts (LWP, 2007). The corridor plan did not give specific management or restoration goals for this reach.

B. Summary of Stormwater Infrastructure

This reach was identified to have 21.5% impervious area and one of the subwatersheds identified as a stormwater runoff risk (Schiff and Clark, 2010b). The runoff depth was also one of the highest calculated of the LaPlatte River subwatersheds. This subwatershed was targeted to find options for improvement.

Patrick Brook has been altered in this area to include a bypass canal that is considered as a separate stream reach (T4.01) that runs parallel to Mechanicsville Road. The canal joins the LaPlatte River at the upstream end of M15. This subwatershed receives runoff from permitted systems in residential neighborhoods along Thorn Bush Road, Village Heights Road, Fredric Way, and part of the former Saputo property. The GIS topography mapped the edge of this subwatershed along the centerline of Fredric Way. Field verification of the stormwater systems showed that runoff from the entire Fredric Way neighborhood is collected and routed to the detention pond at the southwest corner of the watershed. Non-permitted or treated runoff includes multiple businesses and residences along Route 116 and Mechanicsville Road. Approximately half of the impervious surface in this subwatershed in non-permitted.

C. Field Observations

Flow has been returning to the original flow paths along historic Patrick Brook because of deterioration of the two diversion structures over time. The upper diversion (at M15.S2.01) is no longer a defined structure, only rubble. The lower diversion (at the reach break between T4.01 and T4.02) is a concrete spillway that has deteriorated and within the last few years has been reinforced with precast concrete blocks, raising the water level in the canal 7 inches.

A seven foot tall dam at Route 116 has impounded water in the low gradient stream for a significant distance upstream, approximately 1300 feet to the Commerce Street crossing. Water in this section is turbid, relatively stagnant, and has emergent aquatic vegetation growing. The slow moving water has allowed soft fine grained and organic sediments to accumulate in the channel. The channel is sandwiched between close development along most of its length including lawns upstream of Commerce Street, Mechanicsville Road, recreation path, and the Saputo Cheese factory. Natural riparian vegetation is minimal, with most of the length

maintained in a “park-like” state. There are homes and garages too close to the canal that may need reinforcement.

D. Recommendations

Create Canal Management Plan. A management plan should be created through a collaboration of the Town of Hinesburg and canal owners, Saputo Cheese. The owners are no longer using the diverted water for manufacturing. A management plan should include study of the hydrology of the canal and determination if some portion of the flow should be returned to its original channel. This study should include a thorough assessment of flow capacity of the original canal. The Patrick Brook Route 116 culvert and channel downstream would receive all un-diverted flow and must be evaluated. The management plan should balance the goals to provide stormwater conveyance and treatment, scenic views, reduce potential flooding and erosion risks, and provide additional fire water. Some local residents have mentioned dredging the canal and this alternative should be considered as part of this study.

1. Passive Channel and Corridor Improvements

Allow canal banks to naturalize. The banks should be allowed to establish natural vegetation. Mowing should stop as far back from the top of bank as possible to create vegetated buffer strip.

2. Active Channel and Corridor Improvements

Restore a portion of the flow to the tributary behind Commerce Street. The tributary channel has an active functioning floodplain and habitat value that the Canal does not provide. A portion of the flow in the Canal should be allowed to flow into its original channel.

3. Stormwater Improvements

As part of the management plan it should be considered that the Canal is essentially a stormwater drainage conveyance. The possibility for increased in-canal stormwater storage and treatment should be explored.

Several of the Patrick Canal subwatersheds have been identified as having degraded geomorphic condition and are high priority for stormwater mitigation. Much of the development in the lower reach (T4.01) is new and has adequate stormwater treatment. The close proximity of the canal to Mechanicsville Road limits opportunity for detention along this degraded reach (T4.02). The upper watersheds have some in-line detention in the form of ponds and dams. Residential development in the upper reaches is dispersed and does not have stormwater treatment. One potential treatment location was identified next to Mechanicsville Road at the base of the cemetery (Figure 5). A detention area at this location could serve as channel overflow during storm events and detain runoff from the cemetery

hillside. The location of this detention area is upstream of T4.02 that has poor geomorphic condition and T4.01 which has significant impervious surface and is therefore vulnerable to stormwater runoff. This site was visited in the field and appears to be a good location for a constructed wetland.

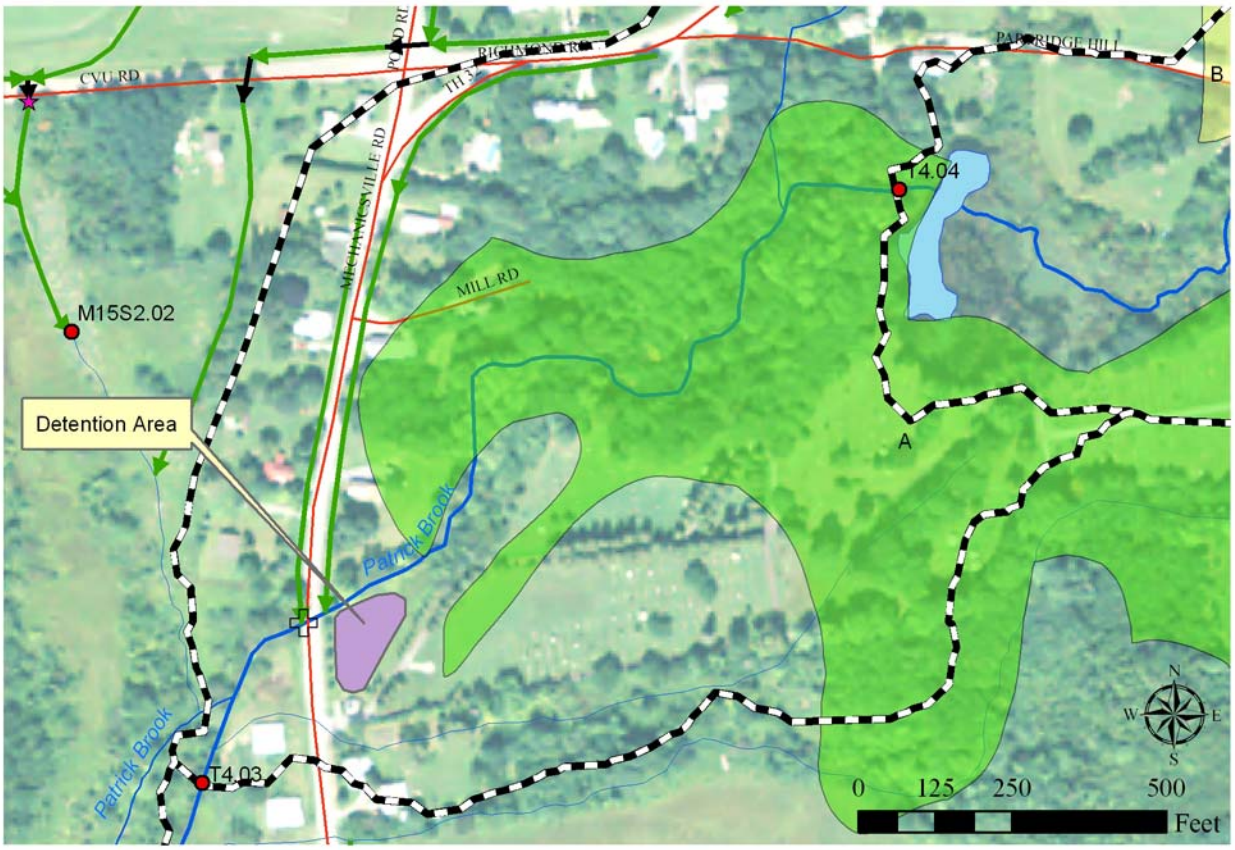


Figure 5: Potential Stormwater Treatment Option in Hinesburg Patrick Canal

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