UPPER WELLS RIVER BASIN

STREAM GEOMORPHIC ASSESSMENT and RIVER CORRIDOR PLAN

Groton, Ryegate, Newbury and Topsham, Vermont

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1.0 EXECUTIVE SUMMARY

In January 2015 the Connecticut River Watershed Council and the Caledonia County Natural Resources Conservation District, as part of a project funded by the Vermont Agency of Natural Resources Ecosystem Restoration Grant Program, engaged Redstart to conduct a Phase 2 Stream Geomorphic Assessment (SGA) on roughly 10 miles of the "Upper" Wells River mainstem and 19 miles on 8 other tributaries (Fig. 1) and to produce a Phase 2 SGA report and River Corridor Management Plan (RCMP).

Stream Geomorphic Assessment and River Corridor Planning

Fluvial (= flow-related) geomorphology (geo = earth, morphology = shape) is the study of the physical river forms and processes that explain many of the current conditions observed in streams. Streams have a natural tendency to maintain equilibrium between the amount and power of water moving through the system and the amount and type of sediment being carried by that water. With significant changes in the landscape and development patterns in the last 200 years, many streams in Vermont, including the Wells River and some of its tributaries, have been confined to deeper, straighter channels and lost access to historic floodplains. Additional stress has come from changes in precipitation timing and patterns, notable in flash flooding in portions of the Wells basin in 2014 in addition to the impacts of Tropical Storm Irene in 2011.

The work reported here is based on protocols and guidelines developed by the Vermont River Management Program, designed to identify a range of top-priority issues with a goal of managing toward, protecting, and restoring the fluvial geomorphic equilibrium condition of Vermont's rivers and streams as a means to help resolve conflicts between human investments and river dynamics in an economically and ecologically sustainable manner. Objectives following from this goal include:

1. fluvial erosion hazard mitigation;
2. sediment and nutrient load reduction; and
3. aquatic and riparian habitat protection and restoration

Assessments typically proceed through a series of phases that integrate information from an overarching watershed context down to project-specific scales, with each previous stage informing the successors. Phase 1 is a preliminary analysis of the condition of the stream through remotely sensed data such as aerial photographs, maps, and 'windshield survey' data. Phase 2 involves "rapid assessment fieldwork" to inform a more detailed analysis of adjustment processes that may be taking place, whether the stream has departed from its reference conditions, and how the river might continue to evolve in the future. River Corridor Plans analyze the data from the Phase 1 and 2 assessments to inform project prioritization and methodology. Phase 3 involves detailed fieldwork for projects requiring survey and engineering-level data and is not included with this report.

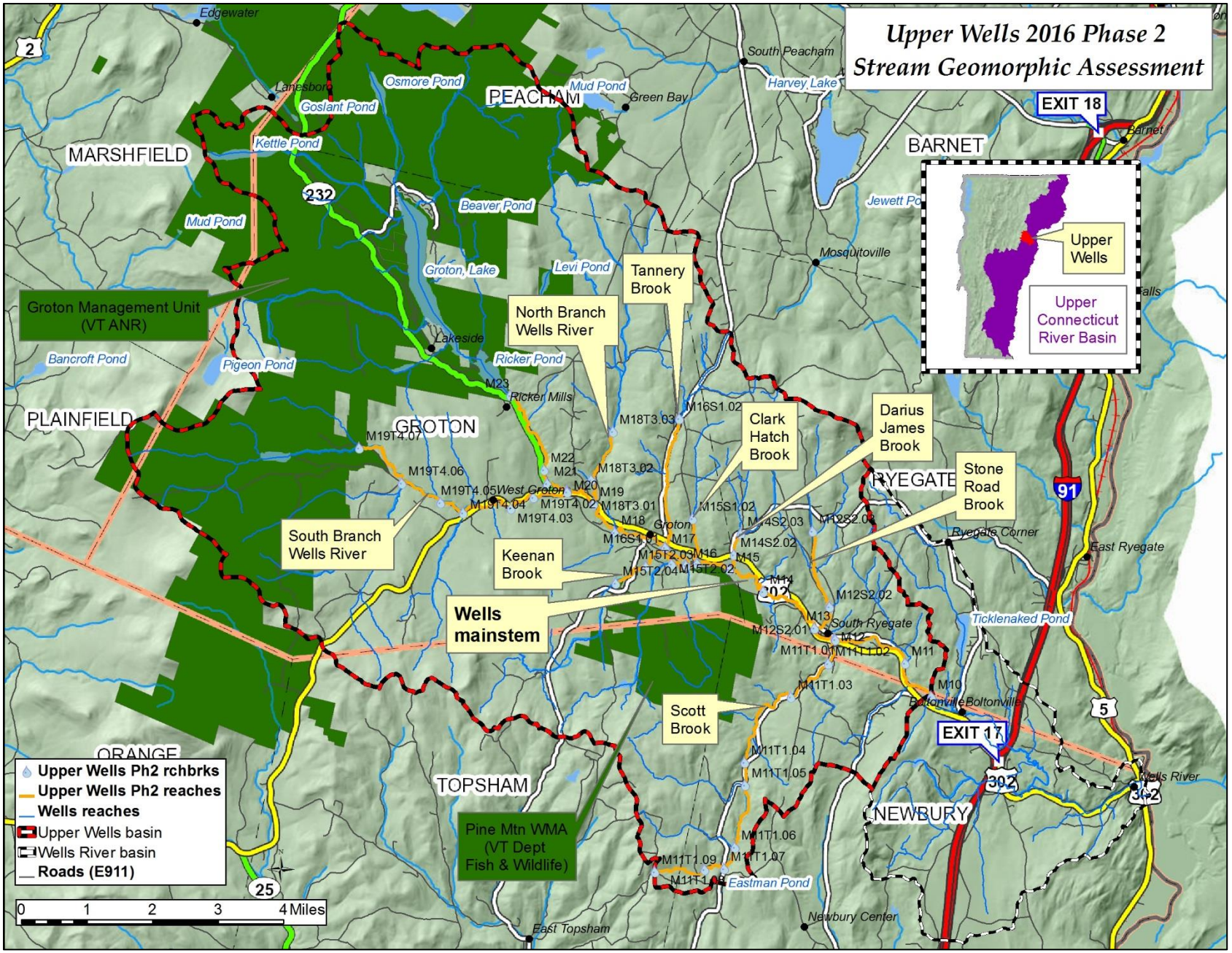


Figure 1. Overview map for Upper Wells River Basin 2015-2016 assessment.

Assessment summary

Thirty-eight reaches (a reach is a relatively homogenous section of stream, based primarily on physical attributes such as valley confinement, slope, sinuosity, dominant bed material, and bed form) comprising roughly 29 linear miles of stream in the Upper Wells basin were included in Phase 2 assessment. Based on field assessment of current physical conditions these streams were divided into 55 segments (a segment is a relatively homogenous section of stream, within a reach, that differs from other portions of the reach based on parameters other than those mentioned above for reach classification; e.g., degree of floodplain encroachment, presence/absence of ledge or waterfalls spanning the stream bed, presence/absence of vegetated riparian buffers and general corridor conditions, abundance of springs/seeps/adjacent wetlands/stormwater inputs, or degree of channel alterations).

Current physical conditions on the assessed streams in the Upper Wells basin indicate:

1) The Upper Wells basin includes frequent channel straightening related to an extensive road network in proximity to streams, plus the presence of the Montpelier-Wells River railbed and Rte. 302 (Scott Highway) cutting off access to historic floodplains in several areas.

2) With highly erodible sediments left as the legacy of a complex glacial history, channel straightening has entailed historic channel incision (aka downcutting or bed degradation) in much of the basin. While this has restricted access to historic floodplains in many areas, there were few areas identified with a complete loss of access to historic floodplains.

3) Recent lower level flooding (rapid heavy snowmelt in April 2014) was in evidence in many of the assessed streams, highlighting impacts (primarily heightened erosion) in areas with restricted floodplain access

4) The worst flood damages following Irene in 2011 appear to have occurred in areas of limited floodplain access and downstream of channel constrictions (such as undersized culverts, bridges, and old abutments and mill infrastructure). Undersized structures (and/or structures with alignment to the stream that reduces effective width) are numerous and widespread in the basin.

5) Aggradation (sediment deposition) following recent floods appears to have offset some historic incision, rebuilding access to floodplains in major floods if not lower level floods.

6) With this background, 50 of the 52 segments fully assessed in 2015 fieldwork in the Upper Wells basin were classed in Fair geomorphic condition (undergoing Major adjustments). Two segments (Wells mainstem reach M20 from Puffer ballfield up to Rte. 232-State Forest Rd.; Scott Brook M11T1.06B downstream of corner of Swamp Rd. and Topsham Rd.) were classed in Good condition (Minor adjustments). No stream segments were considered in Poor condition (Extreme adjustments). Three stream segments were excluded from full geomorphic assessment (per protocols) due to active beaver ponds and wetlands with accompanying lack of a defined stream channel, but basic habitat data was

collected for these segments and they were clearly playing an important role in tempering flood impacts.

7) Primary channel adjustments at this point in time entail widening and planform adjustments (primarily lateral migration), increasing risks to encroachments in the corridor and increasing the importance of limiting such encroachments. Allowing more extensive meanders reduces channel slope and thus helps to dissipate stream power

8) Tributary streams in assessed portions of the upper Wells basin are frequently able to rebuild meanders and access to floodplains through a combination of debris jams and sediment retention in areas where these materials are available and these type of stream dynamics are not in conflict with investments in the corridor.

9) Long-standing channel management practices frequently remove large wood from fulfilling this important role, and it is important to consider carefully whether the practice is necessary in any given instance. In addition, bridges and culverts need to be sized adequately to pass wood and sediment as well as water for these functions to be fulfilled.

Project recommendation summary

Project prioritization for this 2016 River Corridor Plan for the Upper Wells basin features (in order of descending priority):

- Watershed (largely municipal) strategies, especially hazard mitigation planning, capital planning and prioritization for addressing undersized stream crossing structures, and drainage and stormwater management
- Buffer protection and establishment, ideally in conjunction with corridor protection and/or integrated restoration projects. Notwithstanding the emphasis on buffers being integrated with larger projects, stand-alone buffer projects could be implemented to good benefit on Darius James reach M14S2.01; Scott Brook segment M11T1.03C; South Branch segment M19T4.03B; and Wells mainstem reaches M17, M18 and M19.
- Reach-scale corridor protection projects: Wells mainstem segment M17B, reaches M14 and M15, South Branch reach M19T4.06, segment M19T4.03B; Wells mainstem reach M09 (identified in previous corridor plan but priority reconfirmed by value of attenuation for current lack of floodplain access in reach M10)
- Reach-scale restoration projects: Tannery Brook segment M16S1.01A Rte. 302 bridge replacement, information gathering for addressing old Tannery structure just upstream; Scott Brook reach M11T1.02 old mill remains removal and road relocation at downstream end into top of reach M11T1.01; information gathering for potential of lowering railbed and removing old abutments in South Branch reach M19T4.01A; Wells mainstem reach M13 corridor protection and buffer plantings, evaluate bridge removal and Brown Rd. floodplain reconnection; evaluate removing old abutments in Wells mainstem segment M10B, potential for lowering railbed there and into downstream end of reach M11; remove channel constrictions at downstream end of South Branch reach M19T4.04

Funding options for replacement of private bridges will be a challenging issue for long-term reach-scale restorations (including M11T1.01 along Church St. in South Ryegate, M19T4.02 along Rte. 302 in Groton, and M19T4.05 along Seyon Pond Rd. in Groton), and it is highly recommended that an effort be made to contact structure owners and compile information on how such replacements were funded post-Irene (if such a document does not now exist). It is further recommended that a summary report of the compiled information be provided to the Road Commissioners, Selectboards and Planning Commission members in the four towns of the study area.

A more complete table of prioritized projects can be found in Section 6.2 (Project Prioritization) of this report. A "catalogue" of projects, with varying priorities, can be found for each reach with the reach descriptions in Section 6.1, and a consolidated catalogue is found in Appendix 6. A full list of assessed bridges and culverts, findings of the assessments, and potential for retrofitting culverts that impede passage for fish and other aquatic organisms can be found in Appendix 8. Primary analyses leading to the project recommendations are found in Section 5.1.3, Existing Sediment Regime Departure Analysis (summarized in tables at the end of the section), and Section 5.2, Sensitivity Analysis.

2.0 INTRODUCTION

When Tropical Storm Irene swept through Vermont in August 2011, large scale and rapid changes occurred in many portions of the state and incurred hundreds of millions of dollars in damages.

The data and planning processes presented here aim to broaden our understanding and help break an escalating cycle that requires an increasing level of investment to rebuild and/or protect property, livelihoods and ecosystems from damage and hazards caused by flooding, erosion and nutrient loading. Further impetus for these efforts has come from efforts to address ecological impacts tied to nutrient loading in Lake Champlain on the western side of Vermont and, more pertinent to this current report, in Long Island Sound at the downstream end of the Connecticut River basin.

Large-scale changes involving rivers and streams (including land clearing, damming, dredging, straightening and filling of floodplains) have altered the balance of water and sediment in those systems, and many of the heightened erosion and flood impacts being felt in Vermont today are related to such changes. While streams eventually return to some sort of balance, the adjustment processes for that to happen are currently active in many areas and are often the drivers of impacts felt on a local level (though the reasons for the adjustment processes are often not evident at the local scale). Although large-scale floods can shorten the time frame of active adjustments, these changes often unfold on a time-scale measured in decades; many of the processes evident today are related to significant land and water use changes that occurred over the last 200 years.

Stream Geomorphic Assessment (SGA) is part of a science-based process that can help elucidate these relationships and make communities more flood resilient. Fluvial geomorphology is the study of how water and sediment move within the landscape, both over distance and over time.

- Fluvial: of or related to rivers and streams (i.e., flowing waters)
- Geomorphology: Geo = earth; morphology = shape

Extensive experience and observation indicate that a stream with a balance of these inputs will erode its banks and change course to a relatively minor degree, even in flood situations. Impacts from Irene are one indicator of the degree to which the current state of streams in Vermont diverges from this type of equilibrium (Fig. 2).



Figure 2.This sediment plume entering Long Island Sound from the mouth of the Connecticut River was evident in satellite imagery nearly a week after Irene had moved through the state of Vermont, indicating tremendous amounts of erosion in response to the storm. (*Photo credit: NASA 2011*)

The data and analyses presented here identify a range of top-priority issues to help achieve a goal of managing toward, protecting, and restoring the fluvial geomorphic equilibrium condition of Vermont's rivers and streams as a means to help resolve conflicts between human investments and river dynamics in an economically and ecologically sustainable manner (Kline 2010; VT-RMP Alternatives 2003). Objectives following from this goal include:

1. fluvial erosion hazard mitigation;
2. sediment and nutrient load reduction; and
3. aquatic and riparian habitat protection and restoration

The work reported here is based on protocols and guidelines developed by the Vermont River Management Program (VT-RMP 2009; Kline 2010), which are designed to guide assessments through a series of phases that integrate information from an overarching watershed context down to project-specific scales, with each previous stage informing the successors. By assessing underlying causes of channel instability at both watershed and localized scales, management efforts can be directed toward long-term solutions that help curb escalating costs and efforts directed toward resolving conflicts with ongoing stream processes.

Assessment results are summarized in this report, and preliminary analysis is presented through the use of stressor, departure, and sensitivity analysis maps to integrate the findings in a more understandable and intuitive manner. This analysis informs a process designed to identify, catalogue, and prioritize technically feasible projects that can help reduce flood and erosion hazards along stream corridors, improve water quality and aquatic habitat, and enhance recreational opportunities.

2.1 PROJECT OVERVIEW

In January 2015, the Connecticut River Watershed Council (CRWC), in conjunction with the Caledonia County Natural Resources Conservation District (CCNRCD; collectively "the Project Partners") and as part of a project funded by the Vermont Agency of Natural Resources Ecosystem Restoration Grant Program, contracted with Redstart, Inc. to conduct a Phase 2 geomorphic assessment of the Upper Wells River basin in east central Vermont and develop a River Corridor Plan based on the results. This work builds on and feeds into previous efforts in the Wells basin including a Phase 2 geomorphic assessment and River Corridor Plan for portions of the lower Wells in Newbury as well as the Basin 14 Tactical Basin Plan-2015 crafted by the Vermont Watershed Management Division (VT-ANR WMD 2015). The River Corridor plan for the lower Wells (Redstart 2009) further documents grassroots community efforts in the Wells basin, and both the Caledonia County and White River Natural Resource Conservation Districts have been active in identifying and implementing projects to improve watershed health. Cumulatively these efforts represent a sampling of broad-based efforts to address water quality and ecosystem health in the Wells River basin, all efforts leading up to the report presented here.

> Stream geomorphic assessments (SGA) provide the basis for stream alteration regulatory decisions, technical assistance for fluvial conflict resolution, stream corridor protection and restoration, flood hazard mitigation and water quality protection. The assessment data is critical to prioritization of riparian and fluvial process-related water quality restoration and protection projects, project design alternatives analyses, and project design criteria. SGA provides insight into the social, economic and ecological interrelationships between people and fluvial systems and as such, it is also a valuable educational tool. (VT-ANR WMD 2013)

Stream Geomorphic Assessment in Vermont is typically divided into phases (phases of the geomorphic assessment process are further discussed in section 4, Methods, of this report). A Phase 1 assessment is a preliminary analysis through remotely sensed data such as aerial photographs, maps, and 'windshield survey' data collection. Caledonia County Natural Resource Conservation Districts worked with Redstart to conduct Phase 1 assessment on 247 reaches in the overall Wells basin in 2007-2008.

Phase 2 involves rapid assessment fieldwork. Based in part on the results of the Phase 1 work, roughly 6.3 miles of the Wells River mainstem (as far upstream as Boltonville) were included in the lower Wells basin Phase 2 work in Newbury (Redstart 2009), which then informed development of a River Corridor Plan and project implementation for that area.

River Corridor Plans analyze the data from the Phase 1 and 2 assessments to inform project prioritization and methodology. Based on the previous lower Wells Corridor Plan, plus the results of previous Phase 1 and 2 work, a scoping meeting was held in January 2015 to select another roughly 29 stream miles to be included in the Phase 2 assessment and River Corridor Plan preparation presented here. The Project Partners (Northern River Steward Ron Rhodes for CRWC, District Manager Kerry O'Brien for CCNRCD), former VT ANR basin planner Jim Ryan, VT ANR River Management River Scientist Gretchen Alexander, and Redstart selected

another 10.3 miles of the Wells mainstem up to Ricker Pond in Groton, plus portions of eight tributaries, for assessment in 2015 and inclusion in the 2016 Upper Wells River Corridor Plan.

3.0 BACKGROUND INFORMATION

3.1 GEOGRAPHIC SETTING

3.1.1 Watershed description

The Phase 2 stream geomorphic assessment reported here was conducted on streams of the Upper Wells River basin; a similar assessment was conducted in the Lower Wells basin in 2008-2009 (Redstart 2009). The Wells River basin lies within the larger Connecticut River watershed and is part of the Vermont Department of Environmental Conservation's Tactical Basin 14, which includes the Stevens, Wells, Waits, and Ompompanoosuc watersheds as well as the Connecticut River direct tributaries located between the Passumpsic and White River confluences with the Connecticut River mainstem (Fig. 3).



Figure 3.Vermont Watershed Management Tactical Planning Basins.

The Wells River watershed drains approximately 100 square miles (~64,000 acres), or less than 1% of the total watershed area for the Connecticut River. It is roughly 22 miles (37 km) long, with headwaters originating along a ridge line in the northwest portions of Groton State Forest and entering a series of lakes, ponds and small tributaries in the northwestern and western portions of the overall basin. From the headwaters of the Osmore Branch in Peacham, the primary thread of the Wells extends through several lakes and ponds for roughly 6 miles. Beginning downstream of Lake Groton and Ricker Pond the Wells mainstem flows an additional 16 miles along a northwest to southeast axis, joining with the North and South Branches and Keenan Brook in the Town of Groton, plus Scott Brook in South Ryegate, and eventually draining to the confluence with the Connecticut River in the village of Wells River. Elevations range from roughly 3340 feet along the highest parts of the watershed to 400 feet at the mouth.

There are seven large lakes and ponds in the Wells River watershed, including Lake Groton (422 acres), Kettle Pond (109 acres), Ricker Pond (95 acres), Ticklenaked Pond (54 acres), Osmore Pond (48 acres), Noyes Pond (39 acres), and Levi Pond (20 acres). There are numerous large and

significant wetlands in the Wells River watershed. The largest wetland, Peacham Bog, is entirely within the Groton State Forest and is protected, but there are many smaller wetlands on private property that also provide important functions and values.

The 2008-2009 Phase 2 assessment evaluated eight reaches on the "Lower Wells" mainstem. That project extended from the mouth of the Wells to the town line between Newbury and Ryegate. The "Upper Wells" Phase 2 assessment, as reported here, comprises the portion upstream of the Boltonville Dam near the Newbury-Ryegate town line (Fig. 1). This drainage covers roughly 87 square miles (~55,750 acres) and includes roughly 10.3 miles of the Wells mainstem downstream of Ricker Pond (if lakes and ponds are included as part of the mainstem it is ~16.4 mi. from the headwaters), as well as portions of the North and South Branches of the Wells and six other tributaries (Tannery, Keenan, Clark Hatch, Darius James, Scott, and Stone Road Brooks).

3.1.2 Political jurisdictions

The Wells River basin includes most of the town of Groton, smaller but substantial portions of Newbury, Ryegate, Topsham, and Peacham, and very small headwaters portions in Plainfield and Marshfield. The Upper Wells assessment area lies primarily within Groton and Ryegate, with most of Scott Brook and a small section of the Wells mainstem being located in Newbury, and the most upstream portion of Scott Brook crossing into the town of Topsham.

The Towns of Groton and Ryegate are within Caledonia County. The Northeast Vermont Development Association fulfills the functions of a regional planning commission for Groton and Ryegate, which are also served by the Caledonia County Natural Resources Conservation District. The Towns of Newbury and Topsham are within Orange County; served by the Two Rivers-Ottauquechee Regional Commission and White River Natural Resources Conservation District.

Village within the above towns are all relatively small in terms of population (2010 Census Bureau figures; Vermont Indicators Online): Groton, the largest village in the project area, has a population of 1,005. Other small villages in the watershed include West Groton, Ricker Mills, South Ryegate, Boltonville, and Wells River; the first three of which are in the Upper Wells project area.

These villages are all found along stream channels. As in much of New England, stream power played a large role in the location and development of these villages, with the remains of many mill sites observed along the mainstem and its tributaries during the 2015 assessment work described in this report. Streams provided water power for sawmills, grist mills, manufacturing facilities and other uses.

Within the Wells River watershed, ten dams appear on the State "dams" layer from Vermont Center of Geographic Information (VCGI). Six are listed as still in service. Three of these are within the "Lower Wells" assessment area: Adams Paper Company dam in Newbury, Boltonville #11 owned by Essex Hydro Associates in Boltonville, and Ticklenaked Pond Outlet owned by Paul Thomas in Ryegate. Three State-owned dams are found within the "Upper Wells"

assessment area, at the outlets of Ricker Pond, Lake Groton, and Noyes Pond (on the South Branch). Three other historic dams have been removed, all from within the village of Groton, and the historic dam at the outlet of Ricker Pond has been breached.

3.1.3 Land use history and current general characteristics

Land use history in the Upper Wells River basin is closely related to the bedrock underlying different portions of the basin, as well as the glacial legacy reflected in the surficial geology. At the present time (2015-16) upstream portions of the basin are largely occupied by State of Vermont-owned lands collectively managed as the Groton Management Unit (GMU). Soils are shallow and stony here, and better suited for growing trees than agricultural crops; a fact that has dictated land use of the GMU from the early settlement to present day. The Long Range Plan for the GMU provides an excellent and succinct description of the land use history for upstream portions of the Upper Wells basin (VT-ANR 2008). The GMU includes nearly 17,500 acres in the Upper Wells basin (31.4% of the overall Upper Wells basin). The State of Vermont also owns another roughly 2,300 acres (4.1% of the overall Upper Wells basin) in the Pine Mountain Wildlife Management Area located in the downstream portion of the basin (Fig. 1). In this region, lowland areas were farmed for cheese and wool during much of the 1800s. High-elevation slopes were managed for hemlock and other softwood species to feed the bobbin mill and tannery in Groton Village. Railroad access was developed in 1872 (Montpelier and Wells River Railroad), providing a wider market for lumber products, and extensive harvesting took place during the period of 1885-1910 (http://www.crossvermont.org/images/page_maps/brochure/Pine_Mt_WMA.pdf).

The Upper Wells River basin is located within the Northern Vermont Piedmont biophysical region, a region largely characterized by hilly terrain dissected by numerous streams, calcium-rich bedrock, and moderate climate (Thompson and Sorenson 2000). Downstream portions of the basin include good agricultural land (especially along the Wells mainstem) on “sweet soils” (i.e., calcium-rich) that also support rich forests and other natural communities that thrive on these soils. These communities include remarkable expanses of cedar swamps and forests along Scott and Keenan Brooks in particular, where glacial processes deposited and/or carved out some unusual “transverse” valleys that have contributed to the presence of swamps, beaver-controlled wetlands, and fertile lands which support many homesteads and small farms.

Although also located within the Northern Vermont Piedmont biophysical region, the upstream portions of the Upper Wells basin are located on granitic bedrock and thin soils derived from that basis. These soils, and the cooler climate found at higher elevations in the headwaters-region, lead to the establishment of natural communities more characteristic of the Northeastern Highlands biophysical region (Thompson and Sorenson 2000).

Glacial processes roughly 10-12,000 years ago left a series of ponds and wetlands that have played a prominent role in the land use of this area, with early Native American use including a known settlement site on present-day Lake Groton. Substantial recreational use of the lakes and ponds of the region since the late 1800s continues to the present.

Native American use of the region has included low intensity hunting grounds and transient use, but the Wells River valley also provided a known travel route up the mainstem to present day Ricker Pond and Lake Groton, overland to present day Kettle Pond, and up through the headwaters of the Upper Wells and over to the Winooski River basin (VT-ANR 2008).

Although the Upper Wells drainage has had substantial agricultural use of the rich soils along the larger floodplains following European settlement, the hilly topography and thin upland soils of the basin have largely led to a long history of intensive timber harvesting, even in areas of more calcareous bedrock. At the start of the 20th century it was noted in Newbury (on the more calcareous soils) that " Extensive ledges, bare or covered with shallow soil, are mostly clothed with woods, the second, third, and in some instances the fourth or fifth growth since the original forest was removed" (Wells 1902). Upland areas on the more calcareous soils were also frequently used for pasturelands.

European settlement, clearing and timber harvesting in the Upper Wells basin was accompanied by an extensive network of small dams, mills (sawmills, grist mills) and water-powered factories in much of the 19th and into the 20th century, and walls, foundations and other remains of the infrastructure of these uses was still evident along many of the streams included in the assessment reported here. With the exception of Groton, the villages of the basin peaked in population during the 1800s (Fig. 4).

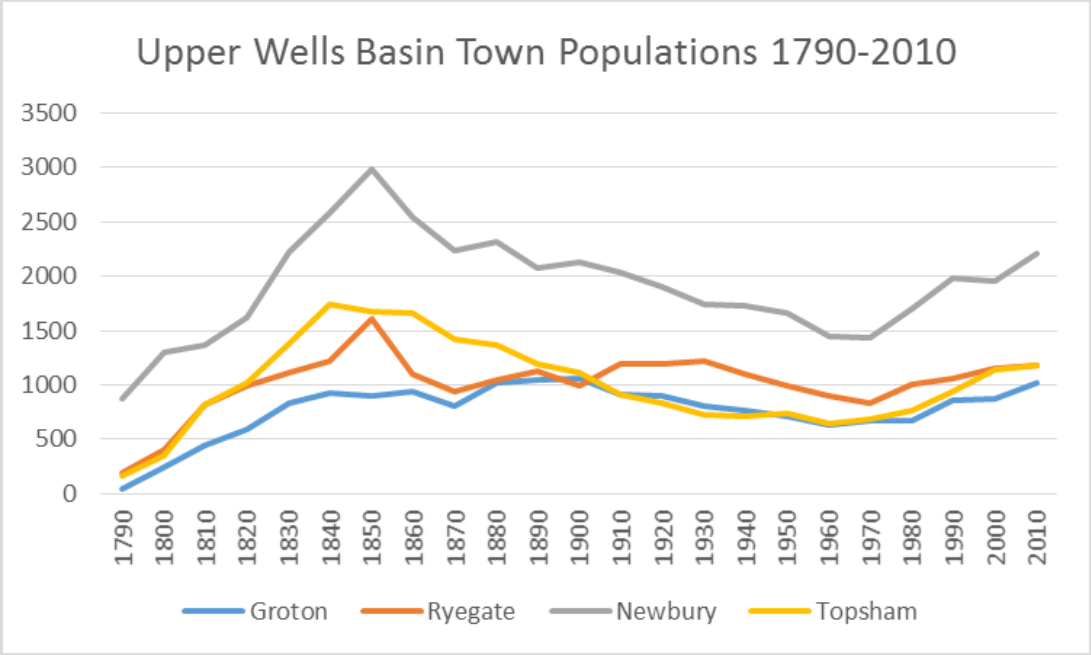


Figure 4. Historical population trends in towns of the Upper Wells basin.

Timber harvesting intensified with the arrival of the Montpelier and Wells River Railroad in 1873 due to both the ability of the railroad to transport wood products and the use of wood to power railroad engines. The railroad also brought significant recreational traffic to the lakes and ponds of Groton starting in the late 1800s, and this use as well as a number of industrial timber-related industries pushed the population of Groton to a peak near the turn of the 20th century. The

Upper Wells has ample evidence of a variety of industrial activities in Groton, and industrial stonesheds (now vacant or converted to other uses) are still prominent along the old railbed in South Ryegate.

Several large fires started by the smokestacks of the railroad engines (as well as other causes) have also left their legacy on the landscape, and in combination with the history of timber harvesting have left a very young forest in much of the Upper Wells basin. This factor intensifies long-standing management practices (removing woody debris from streams) in contributing to a relative dearth of large woody debris observed in streams of the Upper Wells basin.

State of Vermont land purchases in the Upper Wells basin were initiated in 1919, and Civilian Conservation Corps work during the 1930s was instrumental in creating the infrastructure for an extensive park and campground system that plays a major role in the year round recreation, forestry and wildlife habitat management that dominates the land use of the basin in the 21st century (VT-FPR 2008). Although this management provides some of the more extensive wildlife habitat in the state, the overall basin is fairly characteristic of the Northern Vermont Piedmont, "a region with numerous small farms, forestlands mostly managed for timber production, and a dense network of roads and settlements" (Thompson and Sorenson 2000).

Many rivers were affected by straightening and maintenance along valley walls when railroads were built along the rivers in the 19th century, frequently narrowing the valley width significantly and sometimes pinning the river between the valley wall and the bed on which the railroad was built. Within the project area, most of the mainstem has been, in some way, affected by the building and maintenance of a west-east railroad line. Reaches M10, M11, M15, and M16 list the railroad bed as an encroachment. Topographic maps from 1935 show the presence of Route 302 and the railroad line in close proximity. Currently, within the project area, the railway line is defunct. There are portions that exist now as trails or roadbed.

Though undocumented, it is likely that in the days of river transport of logs, the Wells River was straightened and periodically "snagged" (debris removed) to keep the channels clean for efficient transport of logs to the rail line. All the mainstem reaches show significant evidence of straightening and manipulation. Water flows on the Wells have also been significantly regulated, both historically and more recently, by existing dams in the project area.

According to 2002 land cover/land use analysis (UVM-SAL 2002), the Wells River watershed in the early 21st century is 75% forested, with almost half of this comprised of mixed conifer-broadleaf forest. (Fig. 5). Agricultural land use in the watershed occupies only 4% of the land base, with half of this in cultivated row crop production. Roughly 15% of the overall watershed land use is comprised of residential and transportation land uses. Agricultural and residential uses are concentrated mostly in the valley locations, and to some extent in the uplands of Ryegate and Newbury. Groton is primarily forest land.

Hydric soils are displayed on the land use/land cover map as a potential indicator of wetland conversion when these soils overlap with "urban" or agricultural land use. Hydric soils occupy roughly 25.8% of the overall land area in the basin, and more than a quarter of this (~6.9% of the overall land area) is now in "urban" and agricultural land use areas.

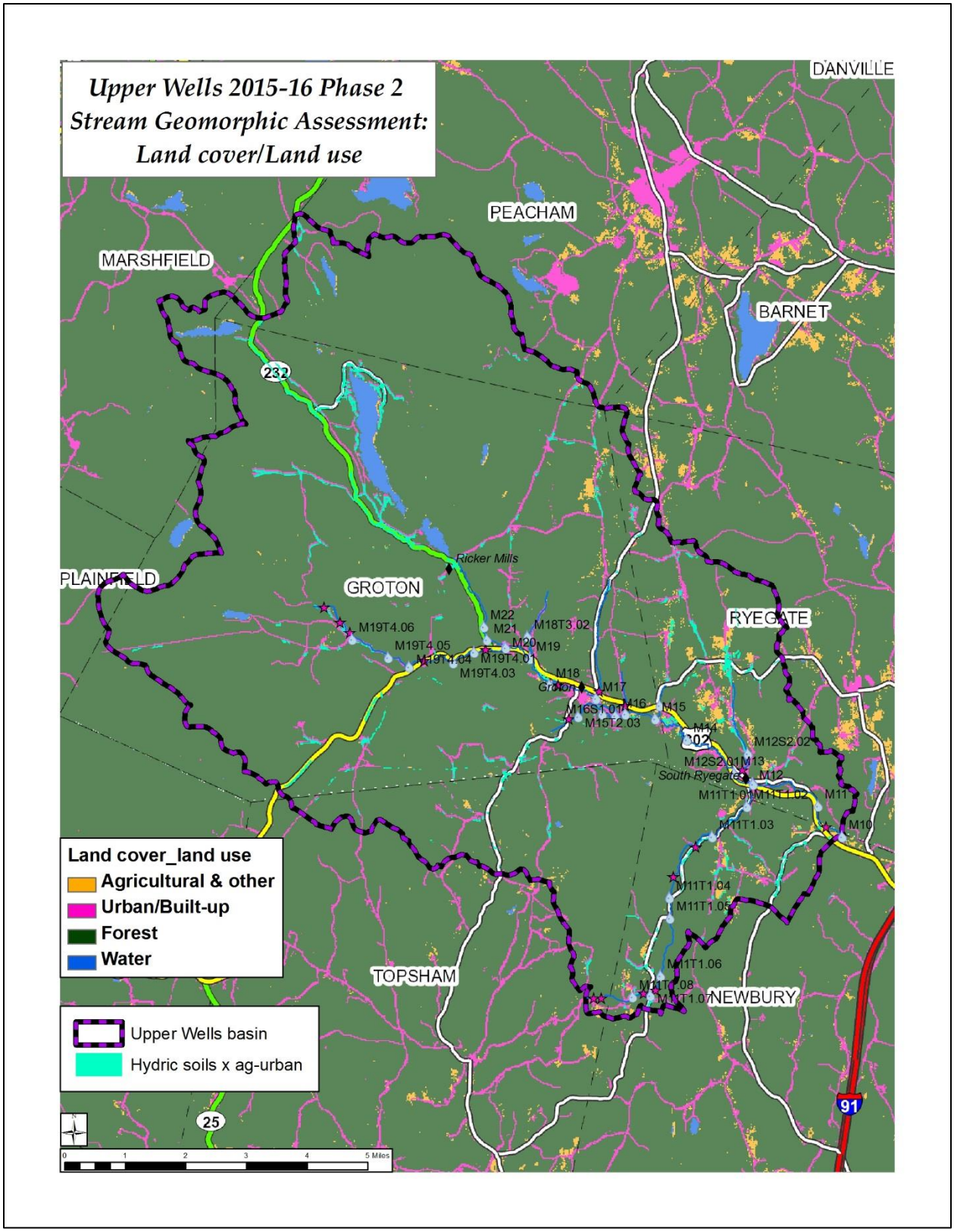


Figure 5. Land use/land cover map for the Upper Wells basin

Loss of wetland attenuation can heighten flood impacts and alter stream hydrology. While the ~6.9% conversion of overall land area in this basin is not an extreme figure, preliminary research has indicated that "urban" land use conversions approaching 10% of a subwatershed can be sufficient to be reflected in stream dynamics (Booth and Jackson 1997), but scale dependency may entail greater effects on smaller streams and thresholds as low as 5% total impervious surface may have consequences for stream biota (Fitzgerald 2007).

Compared with historic times, roads play an increasingly important role in the watershed. Residents in the towns of the Upper Wells basin report traveling an average of nearly half an hour for employment (Vermont Indicators Online 2010) and agricultural and forestry enterprises are frequently faced with hauling products and equipment over increasing distances.

With this degree of mobility in the current economy of the watershed, roads are a focal point for residential concerns and municipal and state budgets. The increase in road use puts pressure on stream channels when they share narrow valleys that are hard pressed to accommodate both, leading to recurrent conflicts between infrastructure location and inevitable stream processes. Vermont Route 302 runs directly beside the South Branch and mainstem for much of their lengths. Most of the tributaries assessed in 2015 are similarly located directly adjacent to roads for at least some significant proportion of their length.

3.2 GEOLOGIC SETTING

The Wells River watershed lies within an area divided between two basic bedrock delineations. Silurian-Devonian and Ordovician bedrock units are found in the west and east, respectively (Figs. 6 and 7). Gile and Waits River formations dominate these bedrock units, consisting primarily of metamorphic schists and phyllites, with lesser amounts of slate, limestone, quartzite, greenstone, amphibolite, and other minerals. These rocks were deposited about 400 million years ago as sediments in a warm tropical ocean. Heat and pressure later changed these into metamorphic rocks (around 350 million years ago), during the collision of the old North American continent with another of the Earth's plates in a mountain-building event.

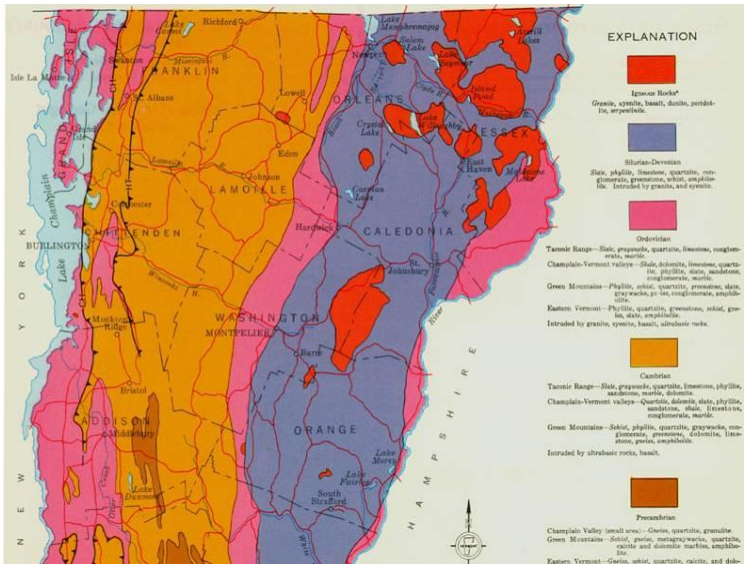


Figure 6. Bedrock geology map for central Vermont

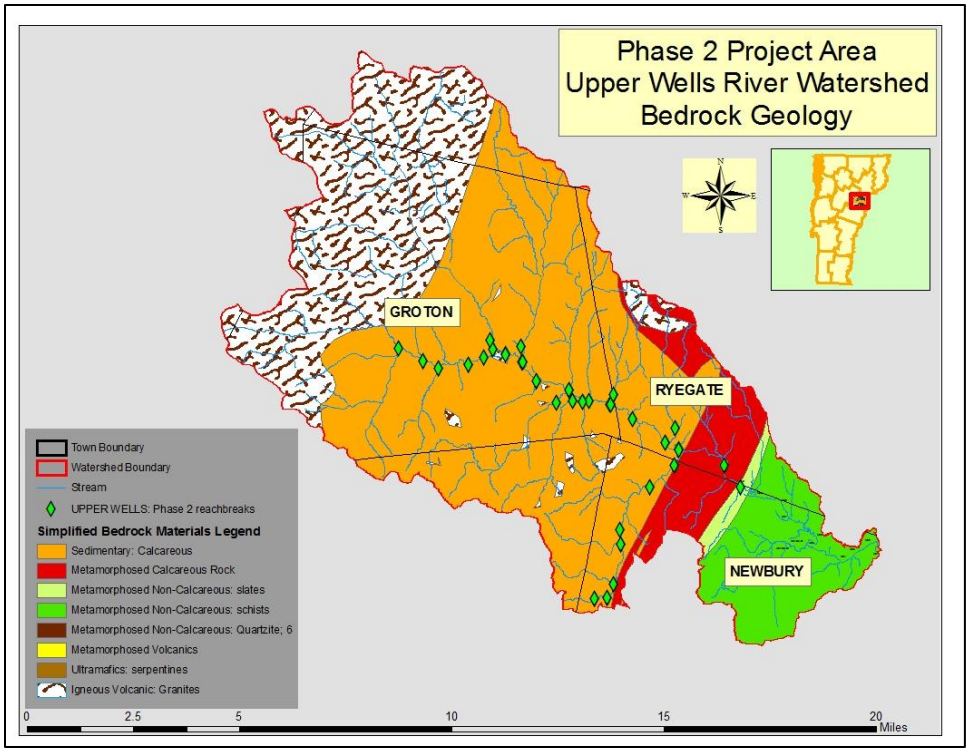


Figure 7. Bedrock geology map for Wells River Watershed

3.2.1 Surficial geology

In the Wells River region almost all of the surficial materials owe their origin, either directly or indirectly, to the Laurentide ice sheet. The Laurentide ice sheet was the last continental-scale glacier that covered all of New England. It first formed in the Hudson's Bay region of Canada sometime between 80–100,000 years ago. As the climate slowly cooled, the ice sheet grew and advanced slowly towards New England, flowing south and east, across Vermont to New Hampshire and beyond. As the ice sheet advanced and thickened it eventually overwhelmed and completely buried the Green Mountains (as well as the Adirondacks and White Mountains) and, by approximately 23,000 years ago, extended as far south as Long Island. Climate rapidly warmed and the ice sheet responded by thinning and retreating to the north, leaving most of Vermont ice-free by approximately 14,000 years ago. (Wright and Larsen, 2004)

Since the retreat of the glacier, the Wells River and its tributaries have reworked the glacial, glaciofluvial, and glaciolacustrine deposits that were left behind after the glacier melted (Fig. 8). As the glacier retreated, a large moraine formed in Connecticut, creating an enormous glacial lake (Lake Hitchcock) that stretched from Connecticut to northern Vermont. This glacial lake persisted until approximately 2,500 years ago. Within the project area, Lake Hitchcock extended as far as the Village of Groton. Since the draining of this lake, lake sediments have been partially washed out of the Wells River valley, often exposing the bedrock below. Many areas have now been overlain by younger alluvium. Further evidence of past glaciation can be seen in the presence of kame and moraine deposits. Most notable in this watershed is the presence of extensive deposits of the vast Danville Moraine, the largest moraine deposit in New England.

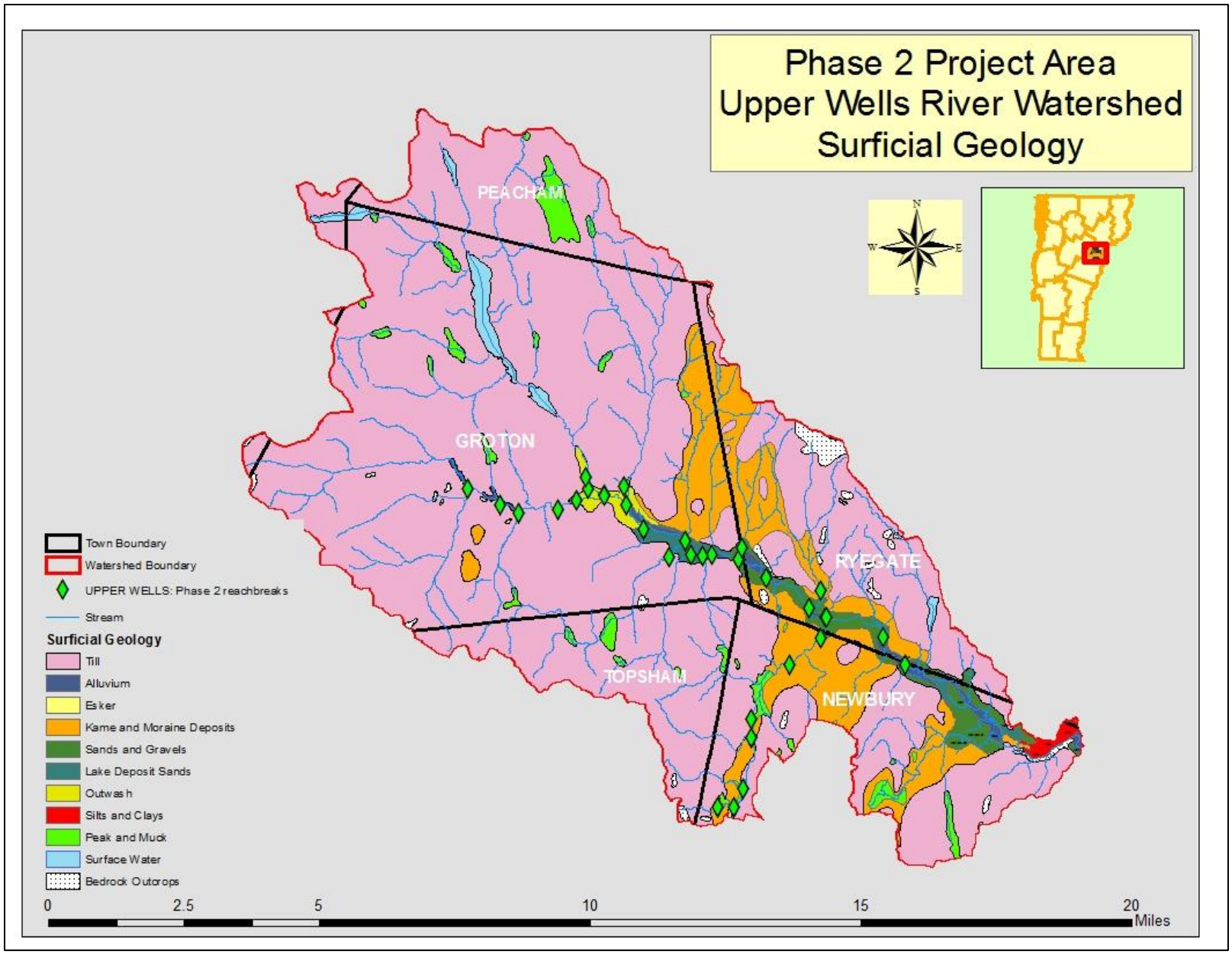


Figure 8.Surficial Geology in the Wells River Watershed

Glaciofluvial deposits at the edges of historical Lake Hitchcock, along with alluvial soils that have deposited within the mainstem valley and just upstream of the lake edges over time, have left some of the more highly erodible sediments in the Wells River basin. Finer silts and clays settled in deeper waters of Lake Hitchcock to form the glaciolacustrine deposits found in the lower reaches of the watershed (Fig. 8). Pebbly sand and gravel particles carried by meltwater tributaries were and are often deposited in small, localized deltaic or alluvial fan formations at the mouths of steep tributaries lining the valley walls. Above approximately 600 feet in elevation (the elevation of Glacial Lake Hitchcock), areas not covered by moraine deposit are covered by glacial till, a mixed up combination of many different kinds of rock compacted and crushed under the weight of the glacier.

3.2.2 Soils

The Wells River watershed has two main soil groups. The valley bottoms are dominated by silt and fine to very fine sandy loams of glaciolacustrine, glaciofluvial, or fluvial origin. Hillsides and headwaters are dominated by glacial till soils, such as the well to moderately well-drained Tunbridge-Vershire and Vershire-Glover complexes, or by somewhat poorly drained hardpan soils such as Cabot silt loam (NRCS, 2003). Soil formation is dependent on both the bedrock and the surficial geology. The calcium-rich waters of the ancient ocean left soils that support maple trees and rich woods on the Gile Mountain and Waits River Formations. There is a wide mix of hydrologic soil groups within the project area (NRCS, 2003). NRCS hydrologic groups A and B are most common, together dominating most of the thirty-eight study reaches (Fig. 9). Hydrologic group A soils have high permeability with high infiltration and low runoff potential. Hydrologic Group B soils have a moderate infiltration rate and moderate runoff potential. Group A soils tend to be deep and sandy. Group B soils are moderately deep and have moderately fine texture to moderately coarse texture. Hydrologic Group C is also fairly common in the project area, occurring in M10, M11, M13, M14, M18, M21, and M22. These soils have a slow infiltration rate and consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. Hydrologic Group D is less common overall but is found in the Scott Brook section of the project area; specifically in M11.T1-03, 05, 06, 07, and 08. This group has a very slow infiltration rate and high run-off potential. These soils consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a clay pan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. Reach-level watershed and corridor geologic and soils details can be found in Table 2.

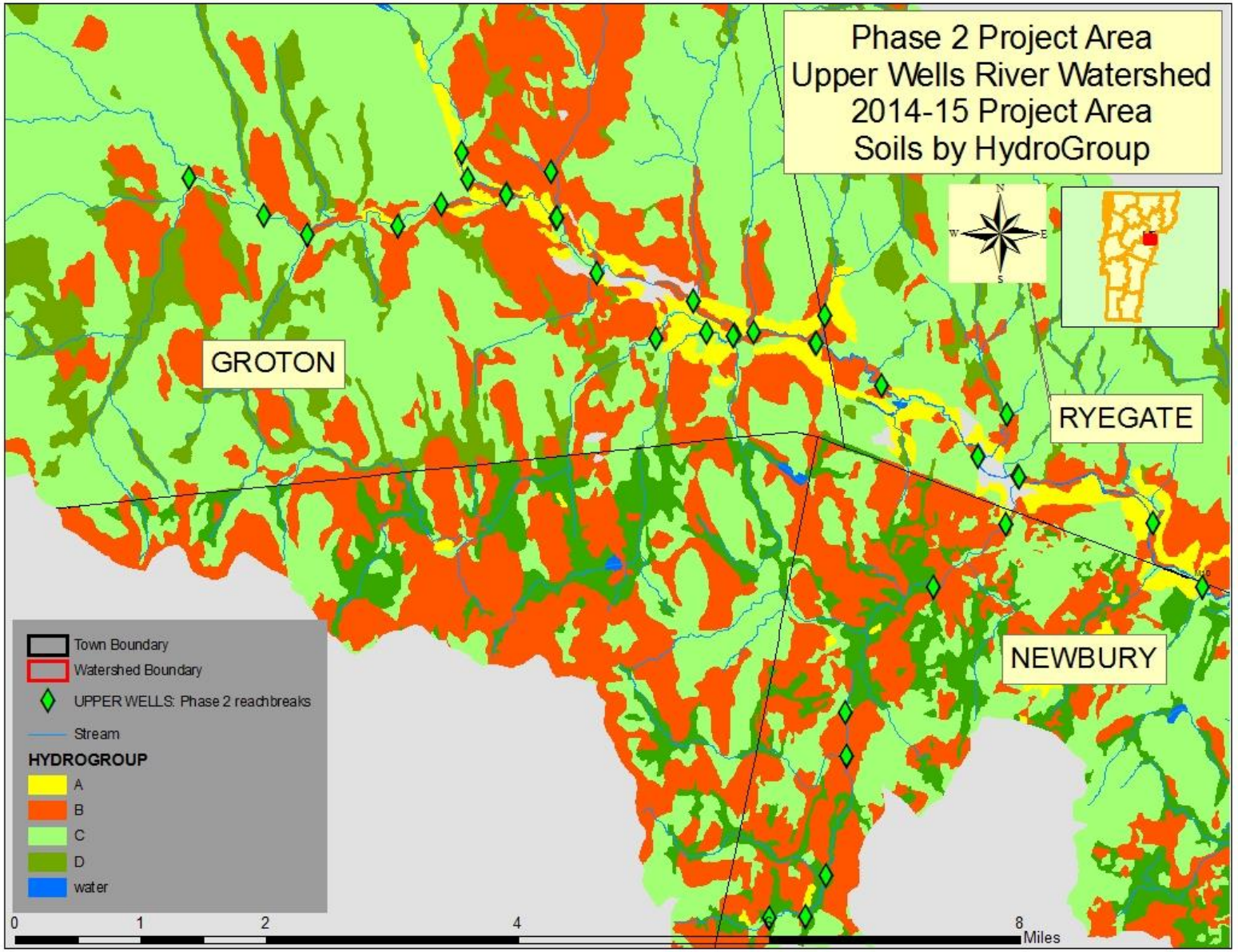


Figure 9. Soils by Hydro Group in Upper Wells 2015 project area.

Table 1. Wells River watershed geology and soils for 2015 Phase 2 reaches (excerpted and combined from Phase 1, Step 3 (geology) and Step 3.5 (soils) analyses. "%" indicates the dominant portion of a soil complex characterized by the stated rating. Blanks indicate the parameter was not assessed in Phase 1 for that reach.

	Geologic Materials			Valley Sideslope		Soils	
Reach ID	**Dominant**	**%**	**Subdominant**	**Left**	**Right**	**Erodibility***	**%**
M10	Alluvial	49.0	Ice-Contact	Steep	Steep	Moderate	26.0
M11	Ice-Contact	43.0	Alluvial	Extremely Steep	Extremely Steep	Severe	55.0
M12	Glacial Lake	88.0	Alluvial	Steep	Very Steep	Slight	5.0
M13	Ice-Contact	62.0	Alluvial	Extremely Steep	Steep	Severe	58.0
M14	Alluvial	77.0	Ice-Contact	Extremely Steep	Extremely Steep	Slight	5.0
M15	Alluvial	55.0	Ice-Contact	Steep	Extremely Steep	Moderate	35.0
M16	Ice-Contact	52.0	Alluvial	Very Steep	Hilly	Slight	19.0
M17	Alluvial	48.0	Glacial Lake	Steep	Hilly	Slight	15.0
M18	Alluvial	60.0	Ice-Contact	Steep	Hilly	Slight	6.0
M19	Ice-Contact	69.0	Alluvial	Steep	Hilly	Very Severe	82.0
M20	Ice-Contact	61.0	Alluvial	Very Steep	Extremely Steep	Slight	21.0
M21	Ice-Contact	67.0	Alluvial	Very Steep	Extremely Steep	Severe	75.0

	Geologic Materials			Valley Sideslope		Soils	
Reach ID	**Dominant**	**%**	**Subdominant**	**Left**	**Right**	**Erodibility***	**%**
M22	Ice-Contact	34.0	Alluvial	Very Steep	Extremely Steep	Severe	61.0
M11T1.01	Glacial Lake	60.0	Ice-Contact	Very Steep	Steep	Moderate	32.0
M11T1.02	Till	66.0	Alluvial	Extremely Steep	Extremely Steep	Severe	66.0
M11T1.03**							
M11T1.04	Till	87.0	Alluvial	Very Steep	Very Steep	Very Severe	87.0
M11T1.05	Till	84.0	Other	Very Steep	Very Steep	Very Severe	78.0
M11T1.06**							
M11T1.07	Till	99.0		Very Steep	Very Steep	Moderate	48.0
M11T1.08	Till	99.0	Ice-Contact	Hilly	Steep	Very Severe	85.0
M12S2.01	Till	44.0	Glacial Lake			Severe	62.0
M12S2.02	Till	76.0	Alluvial			Very Severe	76.0
M14S2.01	Ice-Contact	90.0	Till			Slight	21.0
M14S2.02	Till	75.0	Ice-Contact			Very Severe	99.0
M15S1.01***							
M15T2.01	Alluvial	61.0	Ice-Contact	Hilly	Steep		
M15T2.02	Alluvial	55.0	Ice-Contact	Hilly	Steep	Moderate	33.0
M15T2.03	Till	74.0	Ice-Contact	Hilly	Hilly	Severe	74.0

	Geologic Materials			Valley Sideslope		Soils	
Reach ID	**Dominant**	**%**	**Subdominant**	**Left**	**Right**	**Erodibility***	**%**
M16S1.01	Till	86.0	Alluvial			Very Severe	86.0
M18T3.01	Alluvial	67.0	Till	Very Steep	Steep	Moderate	31.0
M18T3.02	Till	67.0	Ice-Contact	Very Steep	Extremely Steep	Very Severe	94.0
M19T4.01	Ice-Contact	43.0	Alluvial	Very Steep	Very Steep	Moderate	29.0
M19T4.02	Till	88.0	Ice-Contact	Extremely Steep	Extremely Steep	Very Severe	96.0
M19T4.03	Till	38.0	Ice-Contact	Steep	Very Steep	Severe	71.0
M19T4.04	Till	99.0		Steep	Steep	Very Severe	99.0
M19T4.05	Ice-Contact	88.0	Till	Hilly	Steep	Slight	10.0
M19T4.06	Ice-Contact	90.0	Till	Very Steep	Very Steep	Slight	9.0

*Erodibility ratings are based on soil unit. In several instances (M06, M07, M08, M09, and M04S3.01), the erodibility rating of "slight" does not seem to correspond with valley slopes that are steep and soils that are alluvial. This discrepancy has to do with the soil being rated for the area within the corridor, and the valley slopes being calculated using topographic maps for the valley walls that were frequently outside of the corridor delineation.

** Reaches not assessed due to beaver activity

*** Reach not assessed due to small size.

3.3 GEOMORPHIC SETTING

For the purpose of geomorphic assessment and corridor planning, streams in the study area were divided into "reaches," thirty-eight of which are included in this report. A reach is a relatively homogenous section of stream, based primarily on physical attributes such as valley confinement, slope, sinuosity, dominant bed material, and bed form, as well as predicted morphology based on hydrologic characteristics and drainage basin size. Thirteen mainstem reaches and twenty-five tributary reaches were chosen for inclusion. Table 3 outlines stream and valley details for the Phase 2 reaches.

3.3.1 Location of assessed reaches

The assessment includes: thirteen reaches on the Wells mainstem (from upstream of the Boltonville impoundment to just downstream of Ricker Pond (M10-M22); six reaches on the South Branch of the Wells (from its intersection with the Mainstem to close to the end of South Branch Road); two reaches on the North Branch of the Wells; one reach on Darius James Brook, three reaches on Keenan Brook, two reaches on Stone Brook, and six reaches on Scott Brook,

3.3.2 Longitudinal profile, alluvial fans, and natural grade controls

A longitudinal profile of the mainstem indicates gentle gradients along most of the study reaches, with increasing slopes noticeable in upstream of reach M19 and into M22, as well as a more moderate drop along reach M11 in the lower portion of the study area (Fig. 10).

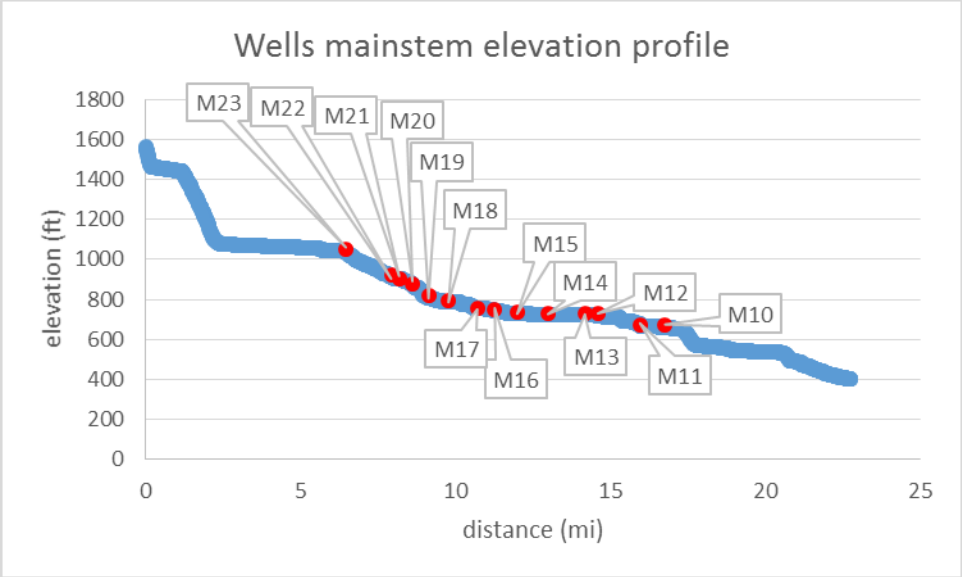


Figure 10. Wells mainstem longitudinal profile

Of twenty-five tributary reaches included in 2015 Phase 2 work, only five have gradients greater than 4% (Table 3). Interestingly, however, the complex geology of the Upper Wells basin impacts slope distributions along the tributaries such that steeper slopes are relatively unbroken for the North and South Branches, but Scott and Keenan Brooks have gentler gradient reaches interspersed along their length (Fig. 11). Though the profiles are not shown here, smaller tributaries Stone Rd Brook (M12S2) and Darius James Brook (M14S2) shared the characteristic

of interspersed gentler gradients while Clark Hatch Brook M15S2 and Tannery Brook M16S1have relatively steep gradients unbroken through their length.

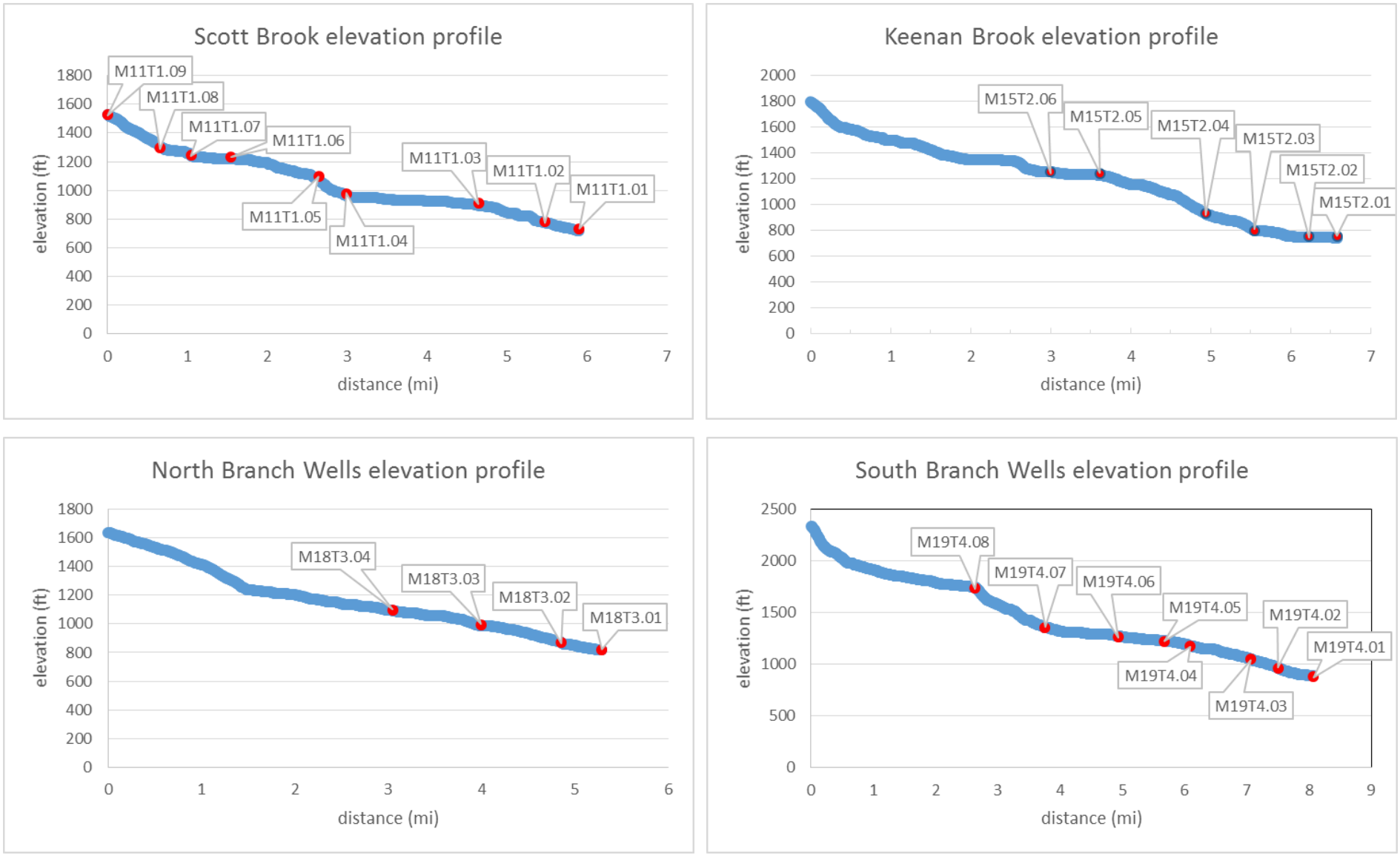


Figure 11. Elevation profiles for four largest tributaries included in 2015 Phase 2 assessments.

Grade controls are frequently present and were found in 17 of the 38 reaches. Ledge is the most frequent grade control found, but two reaches listed multiple grade controls and one listed a weir. Four reach segments contained numerous grade controls: M11T1.08-A, M16S1.01-B, M18T3.02-0, and M22-0. Alluvial fans were mapped for three reach segments: M15S1.01-A, M18T3.01-0, and M19T4.01-A. Alluvial fans frequently develop where tributaries on steep slopes reach the flatter valley floor of the mainstem.

3.3.3 Valley and reference stream types

A reach is a relatively homogenous section of stream, based primarily on physical attributes such as valley confinement, slope, sinuosity, dominant bed material, and bed form, as well as predicted morphology based on hydrologic characteristics and drainage basin size (methods are further discussed in Section 4.0 of this report). The Phase I process assigned "reference stream types" to each reach. The Phase 2 field-assessment process either confirms or corrects Phase 1 information, frequently dividing reaches into smaller parts (segments) to allow for more detailed analysis of geomorphic processes. Primary classification parameters pertinent to establishing these reference stream types are listed in Table 2, and Phase 1 "reference" stream information is found in Table 3.

Table 2. Reference stream type summary indicating classification parameters pertinent to Wells River watershed reaches included for 2014-2015 fluvial geomorphic assessments (VT-RMP 2009, Phase 1 Protocols, p. 28).

Reference stream type	Confinement (Valley Type)	Slope
A	Confined (NC)	Very Steep: 4.0–6.5%
B	Confined or Semiconfined (NC, SC)	Steep: 3.0–4.0%
B	Confined, Semiconfined, or Narrow (NC, SC, NW)	Moderate–Steep: 2.0–3.0%
C or E	Unconfined (NW, BD, VB)	Moderate–Gentle: <2.0%

NC: Narrowly Confined; SC: Semi-Confined; NW: Narrow; BD: Broad; VB: Very Broad

Streams may diverge somewhat from these broad classifications, particularly in the area of slope. A "subslope class" (denoted by a lower case letter for the same slope classifications associated with capital letter Reference stream types in Table 2 above) is assigned to a reach that has a higher or lower slope than that typically associated with a reach of that type.

A and B type streams (steeper slopes) are primarily expected to be sediment Transport reaches, as will be further discussed in Section 5.1.4 of this report.

Stream reaches with C and E reference types utilize their floodplains extensively in stream processes and would be expected to store sediment, high flows and nutrients within the watershed under reference conditions. "Stream Type Departures" in these types of streams, such as when incision processes (from straightening or dredging) have led to loss of access to historic

floodplains, can convert the stream processes from "storage" to "transport". Stream type departures were found in seven reaches within the Upper Wells River project area:

- M11-0 (C to B)
- M11.T1.03-C (E to C)
- M11.T1.07-B (E to C)
- M12.S2.01-A (C to B)
- M13-0 (E to C)
- M17-A (C to B)
- M19.T4.03-A (C to B)

An overview of the project area stream types, as found during the Phase 2 assessment (i.e. including "Stream Type Departures" and separation of reaches into segments) is as follows:

- A type streams were not found in the project area.
- B type streams are found in portions of 11 reaches (all or part of the reach).
- C type streams dominate the project area and included portions of 30 reaches.
- E type streams were found in parts of M06 and M09, only.

Table 3. Reference stream types and geomorphic characteristics for the Wells River and tributary reaches included in 2015-16 corridor planning Project area. Blank cells indicate no Phase 1 data was assigned. (Reach not assessed due to beaver activity;*** Reach not assessed in Phase 1)**

Reach Number	Stream Type/ Bed Form	Confinement (Valley Type)	Channel Slope (%)	Channel Length (ft)	Grade Controls
M10	C4/Riffle-Pool	Narrow	0.02	4217	None
M11	C4/Riffle-Pool	Narrow	0.74	7123	Ledge
M12	C5/Riffle-Pool	Narrow	0.04	2266	None
M13	E5/Dune-Ripple	Broad	0.02	6361	None
M14	C5/Riffle-Pool	Very Broad	0.08	5138	None
M15	C4/Riffle-Pool	Broad	0.38	3938	None
M16	C3/Riffle-Pool	Broad	0.18	2852	None
M17	C3/Riffle-Pool	Broad	0.79	5062	None
M18	C3/Riffle-Pool	Very Broad	0.75	3334	Ledge
M19	Cb3/Riffle-Pool	Broad	2.11	2839	Ledge
M20	C3/Riffle-Pool	Very Broad	1.18	2113	None
M21	C3/Riffle-Pool	Narrow	1.09	1374	Multiple
M22	Cb3/Plane Bed	Narrow	1.69	7713	Ledge

Reach Number	Stream Type/ Bed Form	Confinement (Valley Type)	Channel Slope (%)	Channel Length (ft)	Grade Controls
M11T1.01	Cb3/Riffle-Pool	Very Broad	2.22	2250	Weir
M11T1.02	Cb3/Step-Pool	Semi-confined	2.95	4406	None
M11T1.03**					
M11T1.04	Ba3/Step-Pool	Semi-confined	6.83	1831	Ledge
M11T1.05	Cb4/Riffle-Pool	Very Broad	2.25	5787	None
M11T1.06**					
M11T1.07	E5/Riffle-Pool	Very Broad	2.45	2037	Ledge
M11T1.08	Cb3/Step-Pool	Semi-confined	7.08	4589	None
M12S2.01	Cb3/Riffle-Pool	Very Broad	2.28	3291	None
M12S2.02	Cb3/Riffle-Pool	Very Broad	2.50	7206	Ledge
M14S2.01	Cb4/Riffle-Pool	Very Broad	2.81	1423	None
M14S2.02		Semi-confined	4.96	1915	Multiple
M15S1.01***					
M15T2.01	E5/Riffle-Pool	Very Broad	0.05	1869	None
M15T2.02	C4/Riffle-Pool	Very Broad	1.23	3579	None
M15T2.03	Cb3/Step-Pool	Semi-confined	4.19	3220	Ledge
M16S1.01	Cb3/Step-Pool		3.31	11344	None
M18T3.01	Cb3/Riffle-Pool	Very Broad	2.16	2316	Ledge
M18T3.02	Cb3/Step-Pool	Semi-confined	2.77	4518	Ledge
M19T4.01	Cb3/Riffle-Pool	Very Broad	2.83	3005	None
M19T4.02	Cb3/Step-Pool	Narrowly Confined	8.12	2340	Ledge
M19T4.03	Cb3/Riffle-Pool	Broad	0.39	5085	Ledge
M19T4.04	B3/Step-Pool	Semi-confined	2.03	2216	Ledge
M19T4.05	C3/Riffle-Pool	Broad	1.28	3913	Ledge
M19T4.06	C3/Riffle-Pool	Very Broad	1.37	6205	None

3.4 HYDROLOGY

Hydrology describes the movement and storage of water in and around the earth, which is subject to both natural fluctuations and human modification (Dunne and Leopold 1978). The information presented in this section deals briefly with the basis and interplay of natural fluctuations, while human modifications are discussed further in section 5.1.1, *Watershed-scale hydrologic regime stressors.*

Hydrology is a function of how much rain falls, how much becomes surface flow that reaches the rivers, how much soaks into the ground to become groundwater, how much is taken up by plants through evapo-transpiration, and how much is evaporated into the air.

3.4.1 Wells River Watershed StreamStats

The United States Geological Survey administers a *StreamStats in Vermont* website (USGS 2016), which was used for streamflow and drainage basin characteristics and to help delineate stream profiles as noted below.

The Wells River area is fortunate to have a relatively long-term USGS stream gage in the vicinity, near the base of the basin a short distance upstream of the impoundment behind the Adams Paper Mill dam upstream of the village of Wells River (NWIS 2016; USGS 2016). This site does not have records for the 1927 flood, the primary flood of record for most of the state of Vermont, and is affected to a small degree by flow regulation a good distance upstream at the dams for Lake Groton and Ricker Pond. With these caveats, the gage does offer useful information for understanding the basic hydrology of the basin and some sense of flood history; basic station data is excerpted below.

StreamStats Data-Collection Station Report

USGS Station Number	**01139000**
Station Name	**WELLS RIVER AT WELLS RIVER, VT**

Descriptive Information

Station Type	Streamgage, continuous record
Regulated?	False
Period of Record	1941-2000

Characteristic Name	**Value**	**Units**
24_Hour_2_Year_Precipitation	2.3000	inches
Mean_Annual_Precipitation	40.7	inches
Mean_Annual_Precip_PRISM_1981_2010	43.3	inches
Mean_Annual_Snowfall	70.000	inches
Mean_Min_January_Temperature	4.0000	degrees F
Mean_Basin_Elevation	1420.00	feet

Percentage_of_Basin_Above_1200_ft	0.64496666	percent
Geographic_Factor_for_VT	2.9105746875	dimensionless
Percent_Forest	75.000	percent
Percent_Lakes_and_Ponds	1.4116443697	percent
Percent_Storage	3.0200	percent
Percent_Storage_from_NLCD2006	3.31	percent
Soil_Infiltration	4.9000	inches
Main_Channel_Length	17.800	miles
Stream_Slope_10_and_85_Method	89.800	feet per mi
Contributing_Drainage_Area	98.400	square miles
Drainage_Area	98.9	square miles

StreamStats Data-Collection Station Report

USGS Station Number 1139000

Station Name WELLS RIVER AT WELLS RIVER, VT

(all values in cubic feet per second)

Statistic Name	**Value**	**Years of Record**
Mean_Annual_Flood	1100	71
2_Year_Peak_Flood	1730	71
5_Year_Peak_Flood	2560	71
10_Year_Peak_Flood	3170	71
25_Year_Peak_Flood	4030	71
50_Year_Peak_Flood	4740	71
100_Year_Peak_Flood	5500	71
500_Year_Peak_Flood	7510	71
Weighted_2_Year_Peak_Flood	1730	72.4
Weighted_5_Year_Peak_Flood	2560	73.3
Weighted_10_Year_Peak_Flood	3180	74.2
Weighted_25_Year_Peak_Flood	4040	75.6
Weighted_50_Year_Peak_Flood	4760	76.5
Weighted_100_Year_Peak_Flood	5530	77.3
Weighted_500_Year_Peak_Flood	7550	78.6

Bankfull flows typically occur every 1.25 - 2 years (2_Year_Peak_Flood above). These are the flows that move the most sediment, and are also known as “channel forming flows” (Leopold, 1973).

Attenuation of flood flows is provided by lakes, ponds, and valley flood plains. Areas with wetland soils that can absorb and store large amounts of water for more gradual release are particularly important. Although basin characteristics for the Wells River indicate a relatively small percentage of lakes and ponds in the basin (1.4%, above), adding in hydric soils, which can also serve to provide storage and attenuation of flows within the watershed, includes an additional nearly 26% of the overall land in the Wells basin (Fig. 12). Not all hydric soils indicate good attenuation, but those within the stream valleys frequently have wetland characteristics; 31% of the land area within stream corridors of the Wells basin is situated on hydric soils.

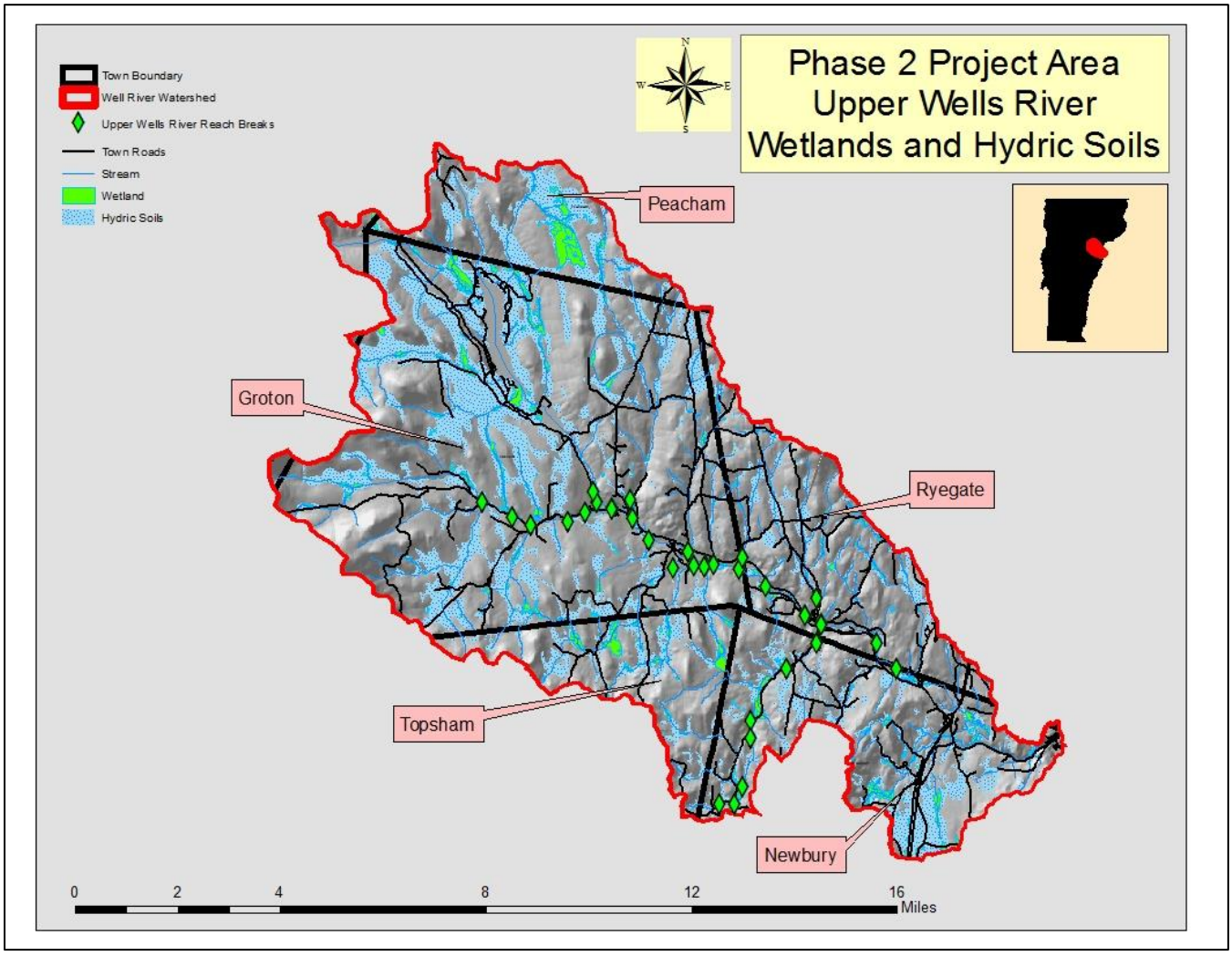


Figure 12. Wetlands and Hydric Soils within the Wells River Watershed

3.4.2 Wells River watershed flood history

The largest flood events in the Wells River basin were in 1927, 1869 and 1973 (listed in descending order of magnitude; USGS-VT 1989). Flooding in 1936 and 1938 was generally worse further south of this area.

Pertinent to the 2015-2016 work presented here, Tropical Storm Irene in 2011 was the fourth largest flood in the basin overall, second largest flood on record at the Wells River gage (i.e., since 1940; second to 1973). Irene did not exceed the 100-year flood recurrence interval peak flow statistics (Fig. 13).

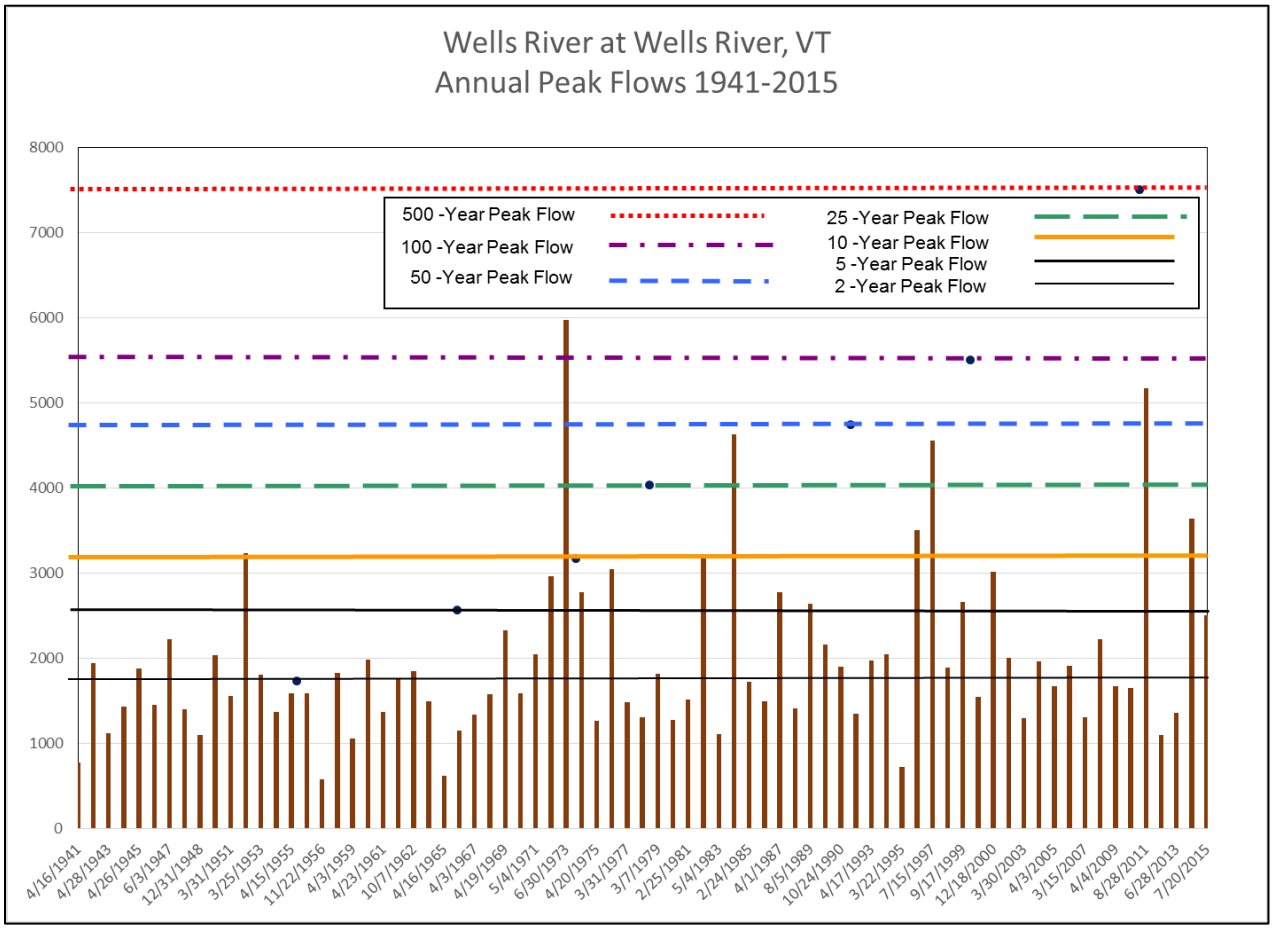


Figure 13. Annual peak flows at the Wells River gage in relation to 2 to 500 year recurrence interval statistics. (*100-year floods can happen 2 years in a row*; a flood of that magnitude has a 1 percent chance of happening in any year)

Peak flow statistics used in Figure 13 were derived from the USGS StreamStats application as seen above.

Pertinent to the work presented here was April 2014 flooding, sixth highest on record at the Wells gage, which resulted from a rapid heavy snow melt accompanied by warm rains (Hanson 2014). Impacts from this flood were quite evident in the study area.

The National Weather Service's Advanced Hydrologic Prediction Site (NWS-AHPS 2016) indicates flood dangers in relationship to Wells River gage height as follows:

Flood Categories (gage height in feet, flow in cubic feet per second)

Major Flood Stage:	9	5100
Moderate Flood Stage:	8	4100
Flood Stage:	6	2200
Action Stage:	5	1400

Historic and recent crests for the Wells area follow.

Historic Crests
(1) 9.82 ft. on 06/30/1973
(2) 9.00 ft. on 08/29/2011
(3) 8.68 ft. on 06/07/1984
(4) 8.54 ft. on 07/15/1997
(5) 8.12 ft. on 06/02/1952
(6) 7.54 ft. on 04/16/2014
(7) 7.52 ft. on 01/20/1996
(8) 7.39 ft. on 05/27/2011

Recent Crests
(1) 6.30 ft. on 07/20/2015
(2) 7.54 ft. on 04/16/2014
(3) 9.00 ft. on 08/29/2011
(4) 7.39 ft. on 05/27/2011
(5) 6.40 ft. on 04/11/2011
(6) 6.71 ft. on 10/01/2010

9 ft. The villages of Wells River, South Ryegate, and Groton become isolated due to flooded roadways. Water reaches a depth of about 2 feet in downtown Wells River. Low lying buildings and roads along the Wells River in Groton, South Ryegate, and Wells River take on water, with significant flooding along route 302. Flooding is similar to Irene in 2011.

8.5 ft. Flooding occurs in the town of Wells River beginning at the fire station at the intersection of Routes 302 and 5 and continuing down Route 5 until the Happy Hour restaurant. Buildings on the east side of Route 5 flood. Low lying roads and buildings along the Wells River may take on water in Groton and South Ryegate.

6 ft. Water approaches US Highway 302 along the Wells River in Groton, South Ryegate, and Wells River. (NWS-AHPS 2016)

3.5 ECOLOGICAL SETTING

The Wells River watershed lies within the Northern and Southern Vermont Piedmont biophysical regions (Thompson and Sorenson 2001), with Southern Vermont Piedmont limited to the Connecticut River valley environs in downstream portions of the overall basin. The "Upper Wells" basin lies within the Northern Piedmont. This landscape is hilly and dissected by many streams. Downstream portions of the basin include good agricultural land (especially along the Wells mainstem) on "sweet soils" (i.e., calcium-rich) that also support rich forests and other natural communities that thrive on these soils. These communities include remarkable expanses of cedar swamps and forests along Scott and Keenan Brooks in particular, where glacial processes deposited and/or carved out some unusual "transverse" valleys that have contributed to the presence of swamps, beaver-controlled wetlands, and fertile lands which support many homesteads and small farms. Typical forest lands are dominated by northern hardwood species,

with hemlock-hardwood forests occurring on shallow soils. Rich hardwood forests, as well as intermediate and rich fens, are common here, all responding to soils rich in calcium and other nutrients. Climate in this area is moderate; not as warm or dry as the Connecticut and Champlain Valleys, but warmer and drier than the Green Mountains or the Northeast Highlands.

Although also located within the Northern Vermont Piedmont biophysical region, the upstream portions of the Upper Wells basin are located on granitic bedrock and thin soils derived from that basis. These soils, and the cooler climate found at higher elevations in the headwaters region, lead to the establishment of natural communities more characteristic of the Northeastern Highlands biophysical region (Thompson and Sorenson 2000), including boreal forest types with a heavier presence of spruce and fir.

3.5.1 Distribution of instream, riparian and wetland habitats

There are six large lakes and ponds in the Upper Wells basin, including Lake Groton (422 acres), Kettle Pond (109 acres), Ricker Pond (95 acres), Osmore Pond (48 acres), Noyes Pond (39 acres), and Levi Pond (20 acres). There are numerous large and significant wetlands in the basin as well. The largest wetland, Peacham Bog, is entirely within the Groton State Forest and is protected, but there are many smaller wetlands on private property that also provide important functions and values. Beaver-influenced wetlands were prevalent in the study area along Wells mainstem reaches M20-22 downstream of Ricker Pond and along much of Scott Brook (M11T1), as well as smaller areas along Stone Road Brook (M12S2), Tannery Brook (M16S1.01), and South Branch reaches M19T4.03 and M19T4.06. North Branch reach M18T3.01 also had indications of likely beaver influences upstream, but none were observed in assessed portions of the North Branch.

Riparian habitat has been heavily influenced by human habitation in the last 200 years, with agriculture and development frequently occupying what would likely be floodplain forest habitats. Wetland habitats are fairly common in the watershed and soil maps indicate that many riparian zones might have been classified as wetlands (hydric soils) before conversion to use for agriculture and development (Fig. 12; Fig. 5). Hydric soils occupy roughly 25.8% of the overall land area in the basin, and more than a quarter of this (~6.9% of the overall land area) is now in “urban” (typically road infrastructure and residential) or agricultural use.

3.5.2 Aquatic Life

The Wells River watershed is home to a variety of aquatic species. A fisheries reference station is located approximately 1 mile upstream of the Boltonville Dam, near the Creamery Road bridge in South Ryegate (reach M11 as reported in this corridor plan). The upper Wells River watershed (particularly the South Branch) contains habitat that supports naturally reproducing (i.e., wild) trout populations (pers. comm., Jud Kratzer, Vermont Department of Fish & Wildlife Fisheries Biologist, April 2009). The State stocks the river with brook trout from the confluence of the South Branch downstream to South Ryegate village, and with rainbow trout (previously brown trout) from the outlet of Ricker Pond to the confluence with the South Branch of the Wells River and again from South Ryegate Village almost to the confluence with the Connecticut River.

An excellent summary of the most recent fisheries status for the Wells basin can be found in the Basin 14 Tactical Plan (VT-ANR WMD 2015) Appendix D, Wells River Watershed. The Tactical Plan itself (pp 32-34) also gives a good overview of macroinvertebrate assessments, biodiversity levels and high quality waters in the basin along with excellent suggestions for extending biomonitoring. The Upper Wells basin has a concentration of high value habitat with generally excellent to very good biomonitoring assessments, although Levi Pond is impaired due to acid deposition.

The Wells River is warm at the start, because of large ponds and lakes upstream, but tributaries help to cool it as it flows downstream. The majority of the Wells mainstem is too warm for trout during the summer months, but trout can survive in cold water refugia in portions of the Wells and its tributaries. Dartmouth graduate student Keith Fritschie, in coordination with Jud Kratzer, was actively engaged in temperature monitoring studies (particularly in relation to fisheries biology and management) along portions of the North Branch and other sections of the Upper Wells basin at the time of the Phase 2 study reported here, with work continuing beyond the scope of this project.

In addition to stocked fish, the reference station data indicate that natural populations of dace species are abundant, and that slimy sculpin, common shiner, and lake chub are common. Rarely occurring species include largemouth bass, yellow perch, brook and brown trout, white sucker, pumpkinseed, longnose sucker, bluntnose minnow, and creek chub. Flows provided in the bypassed reach at Boltonville Dam are insufficient to support aquatic biota in accordance with the levels set in Vermont Water Quality Standards, an issue that has been highlighted for remediation (VT DEC MAPP 2008; VT-ANR WMD 2015).

3.5.3 Unique plant and animal communities

The headwaters of the Upper Wells basin has a high degree of area mapped as “Greatest” or “Very High” contribution to biodiversity (BioFinder 2016), in part due to relatively intact forest cover along riparian areas and a combination of geology, climate and management that help comprise its designation as a high quality rare representative landscape (VT-ANR Atlas 2016; VT-ANR WMD 2015). Peacham Bog, in the headwaters of Red Brook and the North Branch (M18T3), is the second largest peatland in the state of Vermont, and the granitic soils of the headwaters contribute to other uncommon and rare species and uncommon Significant Natural Communities. Although many of these features are upstream of the project area reported here, the South and North Branches include or are contiguous to a number of these features.

Scott and Keenan Brooks also have a number of notable features due to location along unusual geologic formations along the longest glacial moraine in New England (see sec. 3.2.1, *Surficial Geology*), along with sweeter soils due to very different underlying bedrock than the Upper Wells headwaters. Northern white cedar swamps and associated plant communities are interspersed with flora and fauna associated with the more acidic nature of peat inclusions in some of the long-standing beaver ponds and swamps in kettle-hole formations in this portion of the basin. In addition, interspersion with frequent hemlock forest components indicate an unusual mix of boreal and temperate forest communities and an ecotone at that juncture.

4.0 METHODS

4.1 STREAM GEOMORPHIC ASSESSMENT

In an effort to provide a sound basis for decision-making and project prioritization and implementation, the Vermont Agency of Natural Resources River Management Program (VT-RMP) has developed protocols for conducting geomorphic assessments of rivers. The results of these assessments provide the scientific background to inform planning in a manner that incorporates an overall view of watershed dynamics as well as reach-scale, or localized, dynamics. Incorporating upstream and downstream dynamics in the planning process can help increase the effectiveness of projects by addressing the sources of river instability that are largely responsible for erosion conflicts, increased sediment and nutrient loading, and reduced river habitat quality (Kline 2010, p.1). Trainings have been held to provide consultants, regional planning commissions, and watershed groups with the knowledge and tools necessary to make accurate and consistent assessments of Vermont's rivers.

The stream geomorphic assessments are divided into phases. A Phase 1 assessment is a preliminary analysis of the condition of the stream through remotely sensed data such as aerial photographs, maps, and 'windshield survey' data collection. This phase of work identifies a 'reference' stream type for each reach assessed. A reach is a similar section of stream, primarily in terms of physical attributes such as valley confinement, slope, sinuosity, dominant bed material, and bed form, as well as predicted morphology based on hydrologic characteristics and drainage basin size.

Phase 2 involves rapid assessment fieldwork to inform a more detailed analysis of adjustment processes that may be taking place, whether the stream has departed from its reference conditions, and how the river might continue to evolve in the future. This sometimes requires further division of 'reaches' into 'segments' of stream, based on such field-identified parameters as presence of grade controls, change in channel dimensions or substrate size, bank and buffer conditions, or significant corridor encroachments. The data collected in Phase 2 also help identify the inherent sensitivity to changes in watershed inputs of a given stream segment, and these data can be used to map and classify Fluvial Erosion Hazard zones (VT-RMP FEH 2010; VT-RMP RCProtect 2008). River Corridor Plans analyze the data from the Phase 1 and 2 assessments to inform project prioritization and methodology. Phase 3 involves detailed fieldwork for projects requiring survey and engineering-level data for identification and implementation of management and restoration alternatives.

All Phase 1 and Phase 2 data were entered into the most current version of the VTANR Stream Geomorphic Assessment (SGA) Data Management System (https://anrweb.vt.gov/DEC/SGA/Default.aspx), where they are available for public review. Phase 1 data were updated, where appropriate, using the field data from Phase 2 assessments; these changes were tracked and documented within the DMS. Spatial data for bank erosion, grade control structures, bank revetments, beaver dams, debris jams, depositional features, and other important features were documented within field-assessed segments and entered into the spatial component of the statewide data base using the Feature Indexing Tool of the Stream Geomorphic Assessment Tools (SGAT) ArcView extension, which permits geographic information systems implementation of the data. Using data from both Phase 1 and 2 assessments, maps displaying this information are being made available for public use as well, through the Vermont ANR Natural Resource Atlas (http://anrmaps.vermont.gov/websites/anra/).

4.2 QUALITY ASSURANCE, QUALITY CONTROL, AND DATA QUALIFICATIONS

VT-RMP is committed to providing watershed groups, towns, regional planning commissions, consultants and other interested parties with technical assistance and shares responsibility for a thorough quality assurance/quality control (QA/QC) procedure for data collected in geomorphic assessments. Checks were initially conducted by Redstart personnel utilizing the QA/QC tools developed by VTANR and implemented through the online Data Management System. Documentation of these quality control checks is maintained within the DMS as well. Further review by both RMP and Redstart personnel were cross-checked to verify integrity of the data, and this iterative process was completed in April 2016; further documentation of that process can be found in Appendix 5. General questions about data collection methods can be answered by referencing the SGA Protocols (VT-RMP 2009).

Primary data qualifications for the Upper Wells Phase 2work and River Corridor Plan include:

Lack of Phase 1 data for three reaches that were not included in the 2008-2009 Phase 1 work for the overall Wells basin: Scott Brook reaches M11T1.03 and M11T1.06 (beaver and wetland influences) and Clark Hatch Brook reach M15S1.01 (excluded from Phase 1 due to limitations on the scope of work at that time). A limited number of Phase 1 parameters (e.g., steepness of valley wall side slopes) were also not fully assessed in Phase 1 for a limited number of reaches; these parameters are noted as blanks in applicable tables in Chapter 3 of this report as well as in the online VTANR Stream Geomorphic Assessment (SGA) Data Management System (DMS) (https://anrweb.vt.gov/DEC/SGA/Default.aspx).

Three segments (portions of reaches) were excluded from full geomorphic assessment in Phase 2 due to beaver (and human in M11T1.08B) impoundments and wetland influences, all on Scott Brook: M11T1.03B, M11T1.06A, and M11T1.08B. M11T1.03B also had several hundred linear feet on the upstream end that were excluded from assessment due to access issues at a fenced dog run, but the stream in this area was largely beaver-influenced cedar swamp as well. Qualitative rather than quantitative assessments in these areas indicate important flood, sediment and nutrient attenuation values for all of these segments.

During Phase 2 assessment, South Branch reach M19T4.06 was walked for its entire length but property access was denied for conducting cross-section measurements within a nearly one mile stretch of stream under single ownership on the downstream end. Based on the information and photos collected for that mile, the reach was split into four segments. Phase 2 Step 6 Rapid Habitat Assessment and Step 7 Rapid Geomorphic Assessment scoring was based on qualitative observations for channel dimensions in downstream segments A, B, and C; upstream segment M19T4.06D is located on Groton State Forest land and the typical cross-section measurements were recorded and used to inform the usual quantitative assessments.

5.0 RESULTS

The following sections summarize pertinent results of Phase 1 and 2 SGA data collection in the Upper Wells River basin. Stressor, departure, and sensitivity maps are presented as a means to integrate data that have been collected and show the interplay of watershed and reach-scale dynamics. These maps should help identify practical restoration and protection actions that can move the river toward a healthy equilibrium (Kline 2010). Single page maps are included with the text for ease of reference in regards to the text; larger maps can be found in Appendix 7.

Alterations to watershed-scale hydrologic and sediment regimes can profoundly influence reach-scale dynamics, and greater understanding of these processes is vital to increasing the effectiveness of protection and restoration efforts at a reach level (Kline 2010). Section 5.1 presents an analysis of stream departure from reference conditions. Sections 5.1.1 and 5.1.2 summarize watershed-scale stressors contributing to current stream conditions. Two points are important to keep in mind in using these maps:

1) The watershed-scale maps attempt to convey patterns rather than details; more detailed impacts appear in the reach maps in section 6.0, *Project identification.*
2) A "zoomed in" map (such as the reach maps in section 6) is easier to read in some respects, but does not fully capture indications of watershed-scale alterations. Because fluvial geomorphic processes often unfold over decades, the "bigger picture" relationships are critical to understanding how upstream processes (either historic or current) affect what may be happening further upstream and/or downstream.

Sections 5.1.3–5.1.6 characterize reach-scale stressors. Section 5.1.7 characterizes the hydrologic and sediment regime departures for reaches included in Phase 2 assessment. Section 5.2 presents a sensitivity analysis of these reaches, indicating the likelihood that a stream will respond to a watershed or local disturbance or stressor as well as an indication of the potential rate of subsequent channel evolution (VT-RMP 2009, Phase 2, Step 7.7; Kline 2010, Section 5.2).

Data used for the analyses can be found in the appendices. Reach/segment summary statistics and channel geometry data are found in Appendix 1. Phase 1 observations, assembled at a reach scale, are summarized in Appendix 2. Reach/segment scale data from Phase 2 fieldwork are provided as summary sheets in Appendix 3. Plots of channel cross sections are found in Appendix 4. Appendix 5 includes Quality Assurance review notes. Appendix 6 is a consolidated list of projects identified in Chapter 6. Appendix 7 contains 11x17 in. reach maps and maps used for analysis (Chapter 5 maps). Appendix 8 contains the results of bridge and culvert assessments for structures located on Phase 2 reaches.

5.1 DEPARTURE ANALYSIS

5.1.1 Hydrologic regime stressors

Precipitation patterns and hydrologic regime stressors in the Upper Wells basin particularly exacerbate high volumes, rates and intensity of water discharges in heavy precipitation events along steeper streams with few slope breaks: upstream portions of the Wells mainstem from reach M19 (upstream of Branch Brook (aka Fred Hayes) Rd. and Power House Rd. to Ricker Pond, plus tributary streams North (M18T3) and South (M19T4) Branches of the Wells, Tannery Brook (M16S1) and Clark Hatch Brook (M15S2; see section 3.3.2 of this report, *Longitudinal profile, alluvial fans, and natural grade controls*). Flood impacts are thus amplified at the downstream ends of these areas, as well as the downstream end of Scott Brook (M11T1) in South Ryegate village where increased slopes in reaches M11T1.02 and M11T1.01 are exacerbated by old a semi-confined valley and old mill remains in M11T1.02 as well as a series of undersized structures in M11T1.01. Orographic effects contributing to heavy localized downpours seem to affect most of the Upper Wells basin, but straightening and encroachment that has contributed to floodplain loss intensify flood impacts along small streams sharing narrow valleys with streams (Tannery Brook and Minard Hill Rd., Clark Hatch Brook and Glover Rd.) as well as portions of larger streams especially encroached upon by the bed of the old Montpelier-Wells River railroad bed (South Branch M19T4.01, Wells mainstem reaches M16-M15, M13-M10) and/or Rte. 302 and other roads (Rte. 302 along much of South Branch M19T4, Wells mainstem M13, M10, Swamp Rd. along much of Scott Brook).

The hydrologic regime involves the timing, volume, and duration of flow events throughout the year and over time; as addressed in this section, the regime is characterized by the input and manipulation of water at the watershed scale. When the hydrologic regime has been significantly changed, stream channels will respond by undergoing a series of channel adjustments. Where hydrologic modifications are persistent, an impacted stream will adjust morphologically (e.g., enlarging through either downcutting or widening when stormwater peaks are consistently higher) and often result in significant changes in sediment loading and channel adjustments in downstream reaches (Kline 2010). The primary morphologic change noted in the Upper Wells basin is a moderate degree of channel incision (downcutting), with current adjustments including widening and lateral adjustments in most of the assessment area.

Historic deforestation that occurred throughout much of Vermont starting in the late 18th century provides a "backdrop stressor" on the hydrologic regime, exacerbated by large scale forest fires in late 19th and early 20th century in the upstream portions of the Upper Wells basin. As noted in section 3.1.3 of this report, Land use and general characteristics, the early 21st century finds the Upper Wells basin roughly 75% forested, with much of this being relatively young second, third or even fourth and fifth growth (Wells 1902). Young forests and longstanding channel management practices that have removed large woody debris from the channel have combined with other factors that contribute to a high degree of "flashiness" in the basin.

Historical clearing initially contributed to higher runoff of both water and sediment (Marsh 1848, p. 253). While this situation tended to diminish with reforestation, it is likely that the initial downcutting and transport of sediment out of uplands extended the stream network, initiating or

furthering channel formation in areas that formerly had a broader absorptive base, and deposited thick layers of sediment in the valleys. Streams have cut back down through these sediments over time, restricting access to historic floodplains and requiring widening and planform adjustments to establish new floodplains at a lower elevation.

Due in large part to the geologic legacy of glacial Lake Hitchcock (see Sec. 3.2, *Geologic setting*, of this report), portions of the Upper Wells mainstem exhibit deep soils with few grade controls to limit downcutting. Recent impacts from Tropical Storm Irene as well as the recent removal of dams (Franconia Paper Mill Dam in reach M19, 2014; Groton #9 Dam in reach M17, 2016) appear to have offset some historic incision with more recent aggradation and sediment redistribution, but overall incision ratios (indicating restriction or loss of floodplain access) were moderate to high through much of the study area. A number of historically disconnected oxbows along the Wells mainstem reaches on the "back side" of the railroad tracks from the current channel location (visible in aerial photography and on topographic maps), as well as high embankments along much the mainstem running alongside the old railbed, indicate that high flows are currently contained within significantly reduced floodplains, but high level floods such as Irene do appear to be able to access many of these somewhat restricted floodplains. The net effect at the current time is an overall pattern of moderately entrenched streams, with stream flows typically eroding banks in areas of reduced floodplains or undergoing rapid lateral migrations including channel avulsions or major sediment dumps at high level flood flows.

While much of the current entrenchment of streams is due to historic incision through highly erodible geologic materials in the Upper Wells basin, mill history in the area has clearly played a role in contributing to channel incision. Flow regulation is a relatively minor contemporary contributor to changes in water inputs in the Upper Wells basin, mainly due to the dams at Ricker Pond and Lake Groton which are managed primarily for recreational use and not to power mills. The Boltonville power dam also impounds the Wells mainstem just downstream of the project area and does appear to affect sedimentation and water fluctuations in reach M10 of the Upper Wells basin.

Historic mill sites appear more connected with channel downcutting in streams of the Upper Wells basin, and are indicated on Beers Atlas (1875) in numerous locations spread along the Wells mainstem from Ricker Pond (M22) downstream to South Ryegate village and Boltonville (M09), as well as on portions of Scott Brook (M11T1.02, M11T1.01) Tannery Brook (M16S1.01A) and the South Branch (several locations spread along M19T4). Fieldwork indicated smaller mill structures were also likely present at some point along upstream portions of Tannery Brook (M16S1.01), Keenan Brook (M15T2.03) and Scott Brook (M11T1.05) and possibly on North Branch reach M18T3.02, though none of these locations appear on Beers Atlas (1875) or other historic maps. Flow regulation at mills usually included water storage and release for mill use that contributed to "pulse" flows. The combination of an intermittent increase in stream power and "sediment starving" at dams contributes to "hungry water", a phenomenon that may help explain some of the historic channel incision (also referred to as downcutting or degradation of the channel) and/or channel widening in these areas.

In addition to straightening (road and railbed encroachments) and restriction of access to historic floodplains in the Upper Wells basin, the Hydrologic Alterations map (Fig. 14) indicates primary stressors commonly associated with stream channel adjustments (Kline 2010, pp. 26-27).

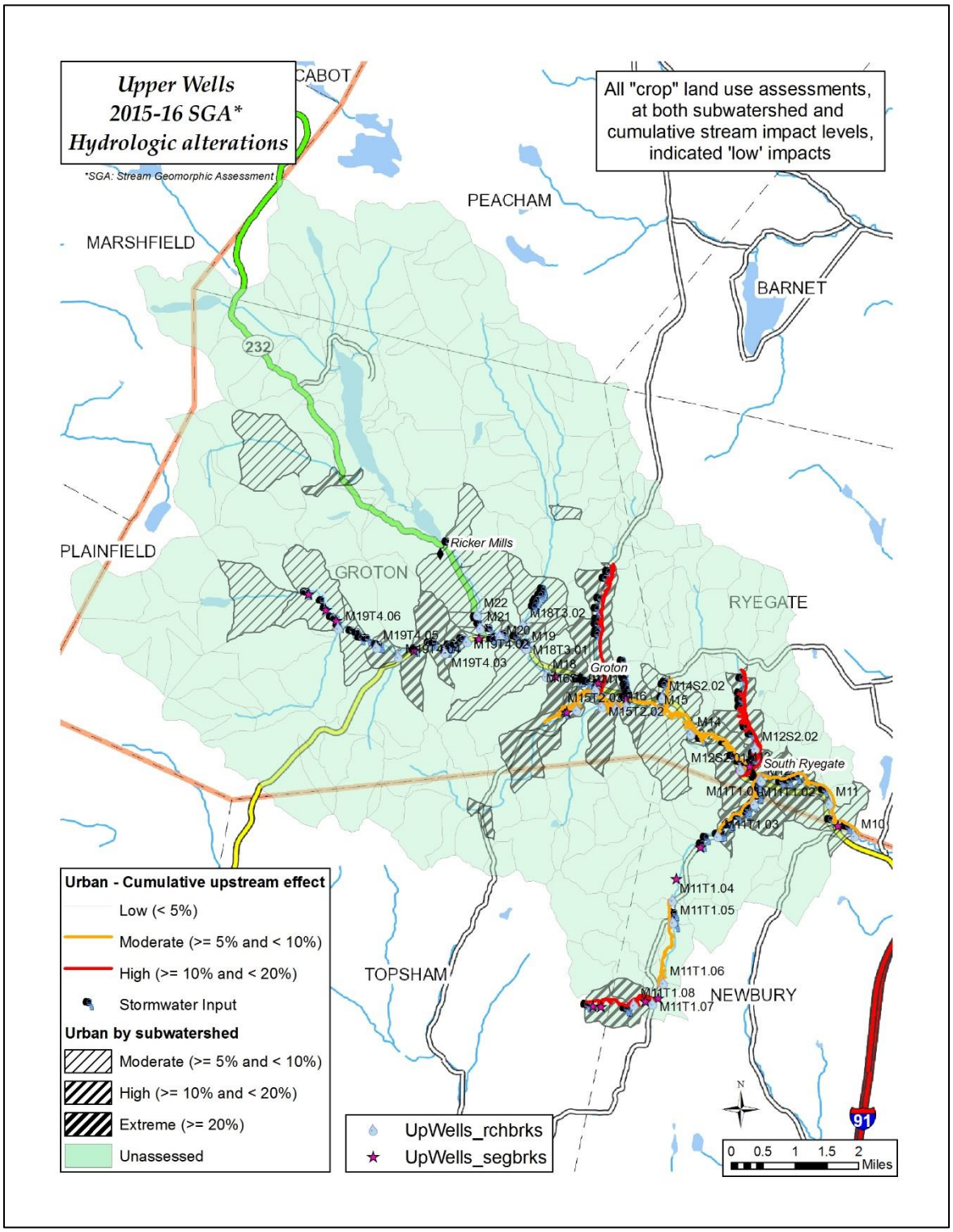


Figure 14. Hydrologic Alterations map for the Upper Wells 2015 Phase 2 study area.

Many of the fields, roads and "urban" land uses in the stream corridors of the Upper Wells basin area are accompanied by ditches. Evolving best management practices for stormwater along roads often entails stone lining ditches to limit erosion (VT Better Roads 2016), and recommendations for program manual updates (VT BBR 2015) clearly recognize the potential impacts this can have on hydrology. With increasing ubiquity of heavy equipment it has become more cost-effective to expand road ditching rather than continually repair roads from the damages of heavy frost heaving and washouts. While this is extremely helpful in limiting elevated sediment discharges to the stream network, expanded ditching can also exacerbate "flashiness" by increasing the rate and intensity of water delivery to the streams. Careful attention to directing these surface water inputs to well vegetated surfaces can help mitigate the effects of direct surface water inputs to streams, and increasing retention and opportunities for water to percolate through uncompacted soils before entering streams addresses observations penned by George Perkins Marsh in 1864:

> "…the accumulation of water in the channel of a river depends far less upon the quantity of precipitation in its valley, than upon the rapidity with which it is conducted, on or under the surface of the ground, to the central artery that drains the basin." (Marsh 1864, p. 182)

Stormwater inputs exceed "high" levels of >5 inputs/stream mile on more than a third (19 of 55) of the stream segments walked in 2015, and "moderate" levels of 2-5 inputs/stream mile were found on 14 additional segments to total sixty percent of the assessed stream segments with significant stormwater influences. These inputs were primarily road inputs, although there were some indications of historic ditching along agricultural fields on the South Branch, Keenan Brook and portions of the Wells mainstem. "Crop" land use does not exceed "low" levels of impacts at a subwatershed level in any of the study area, but cumulative watershed "urban" land impacts are rated "high" in the upstream portion of Scott Brook along Topsham Rd. (M11T1.07 and M11T1.08), as well as on Stone Rd. Brook (M12S2.01 and M12S2.02) and Tannery Brook (M16S1.01). While "urban" impacts may seem surprising in a relatively rural area such as this, the impacts are largely related to a relatively dense road network and cumulative development, both of which tend to increase impervious surfaces that shed water more quickly to the stream network than the more absorptive surfaces previously in place.

At a subwatershed level, eight subwatersheds indicate "very high" urban impacts: Wells M11, Scott Brook M11T1.02 and Stone Rd. Brook M12S2.01 (South Ryegate); Wells M16 and M17 and Keenan Brook M15T2.02 (Groton village); M19 (Groton from Branch Brook Rd. to Puffer ballfield); and Darius James Brook M14S2.01 along the downstream end of Witherspoon Road. An additional 13 of the 38 subwatersheds in the 2015 Phase 2 study area were rated with "high" urban impacts, and 10 more were rated with "moderate" urban impacts.

5.1.2 Sediment regime stressors

With the impacts of Irene (2011) in the not-so-distant past and more recent flooding in April 2014, Phase 2 fieldwork in 2015 found the streams of the Upper Wells basin typically characterized by evolving redistribution of "sediment slugs" in the stream channel. Sediments that were deposited on floodplains were occasionally visible along some of the smaller streams, but agricultural use, revegetation and occasional active management to remove heavy deposition (especially on impacted fields) had obscured some of the more visible indicators of the sediment regime in the basin. Despite lack of clear visible signs of floodplain deposition however, only 8 of 52 fully assessed stream segments in the 2015 study area lacked significant presence of "sediment slugs" (steep riffles, delta bars and other heavy deposition), and all but one of these were Wells mainstem reaches that had clear signs of floodplain access in 2012 orthoimagery following Irene (VCGI 2012). Keenan Brook reach M15T2.03, where the channel had split in Irene, was the only non-mainstem reach and this stream segment was lacking further sediment slugs in the newer channel.

While floodplain deposition had reduced sediment slugs in the limited number of reaches noted, the finer sediments along these reaches (legacy of glacial Lake Hitchcock) also showed signs of elevated erosion and depositional instability in the channel (which can be detrimental to habitat). Concentration of heavy deposition on tributary reaches and in upstream portions of the mainstem (Fig. 15) indicate that coarser sediments will take time to redistribute, and their continued distribution through the stream network provides the raw materials for more stable bed features and rebuilding of floodplain access (and attendant reduction of erosion in incised channels).

Tributary rejuvenation, a process that elevates sediment loads when stream beds incise and the base elevation of tributary streams down-cut to match the receiving stream, was evident primarily in the more confined valley reaches of the 2015 study area (Scott Brook M11T1.02, Stone Rd. Brook M12S2.02, North Branch M18T3.02, South Branch M19T4.03A, M19T4.05, M19T4.06D). The exceptions to the rule of tributary rejuvenation in the more confined valleys occurred in areas of localized dredging and channelization (South Branch M19T4.06B, Scott Brook M11T1.03C).

The following description of issues related to the sediment regime is taken from the most current version of the VT ANR River Corridor Planning Guide (VT ANR 2010):

> The sediment regime may be defined as the quantity, size, transport, sorting, and distribution of sediments….sediment erosion and deposition patterns, unique to the equilibrium conditions of a stream reach, create habitat. In all but the most dynamic areas (e.g., alluvial fans), they provide for relatively stable bed forms and bank conditions…
>
> ….During high flows, when sediment transport typically takes place, small sediments become suspended in the water column. These wash load materials are easily transported and typically deposit under the lowest velocity conditions, which exist on floodplains and the inside of meander bendways at the recession of a flood. When these features are missing or disconnected from the active channel, wash load materials may stay in transport until the low velocity conditions are encountered….This…

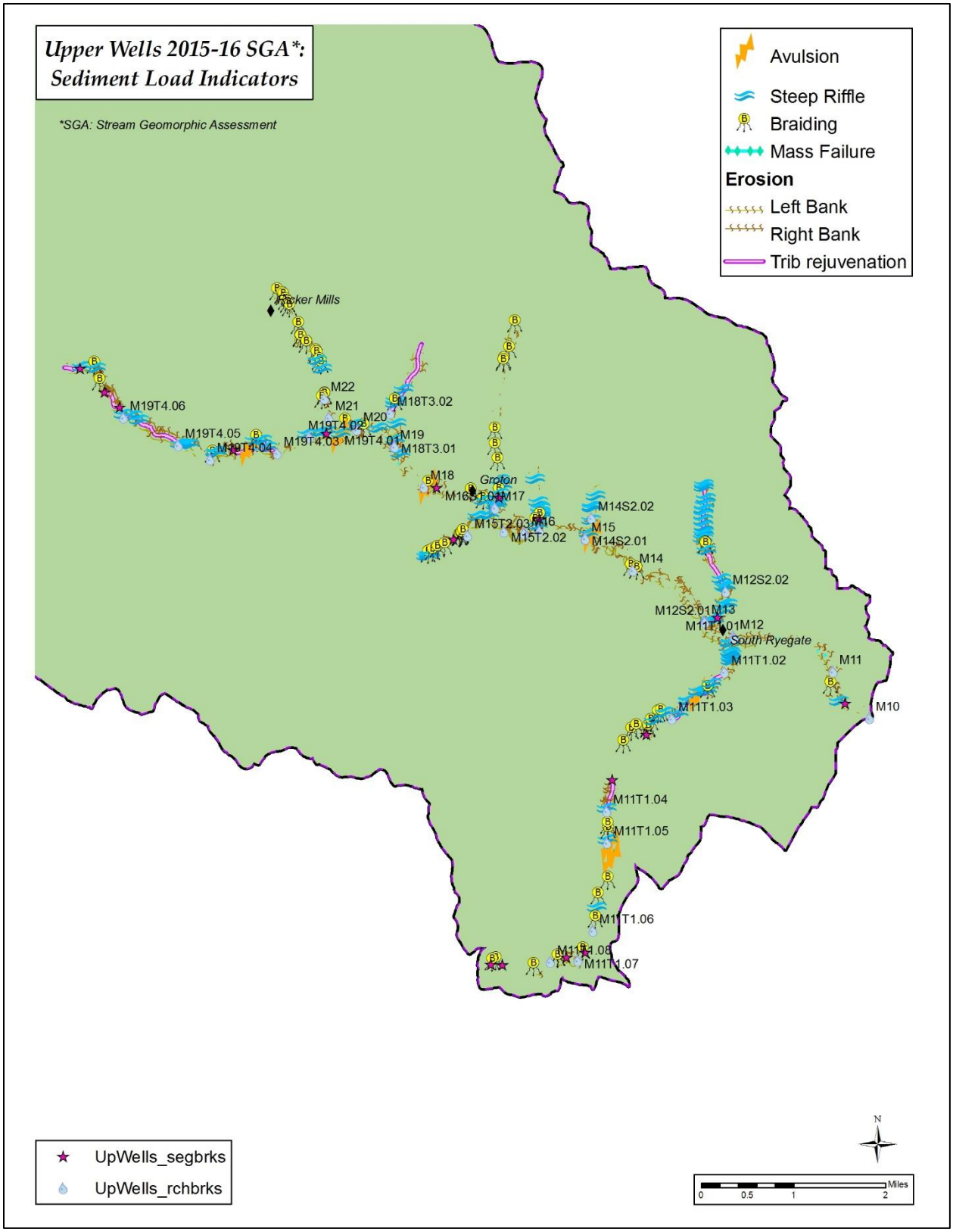


Figure 15. Sediment load indicators map for the Upper Wells 2015 Phase 2 study area.

> …unequal distribution of fine sediment has a profound effect on aquatic plant and animal life. Fine-grained wash load materials typically have the highest concentrations of organic material and nutrients.
>
> Bed load is comprised of larger sediments, which move and roll along the bed of the stream during floods…. The fact that it takes greater energy or stream power to move different sized sediment particles results in the differential transport and sorting of bed materials….When these patterns are disrupted, there are direct impacts to existing aquatic habitat, and the lack of equal distribution and sorting may result in abrupt changes in depth and slope leading to vertical instability, channel evolution processes, and a host of undesirable erosion hazard and water quality impacts.

Many of these processes typically unfold over a time period of decades, with the "channel-forming" flows necessary to continue re-distribution of sediments (and other channel adjustments contributing to channel evolution toward greater stability) only occurring at 1.5 – 2-year intervals or even longer. During Irene numerous areas in the Upper Wells 2015 study area underwent rapid scour, particularly in upland areas and confined valleys, followed by deposition further downstream (with sediments being recruited from mass failures and scoured uplands). Channel elevations actually rose toward historically abandoned floodplains in this single event, and high flows in April 2014 accelerated redistribution of these sediments.

Where large woody debris and coarse sediments have remained within the channel or adjacent accessible floodplains, adjustments such as rebuilding of floodplain access and establishment or extension of channel meanders (increasing channel sinuosity and thus decreasing channel slope; Fig. 16) escalated in Irene and have continued to evolve with subsequent high flows. The vast majority (50 of 52 fully assessed segments) of streams in the study area are currently in "Fair" geomorphic condition with "major reducing to minor" stream adjustments primarily including widening and lateral adjustments tied to patterns of sediment deposition. Many of these adjustments are in response to a relatively high degree of channel straightening, further discussed in regards to channel slope modifiers (*sec. 5.1.2a*) below.



Figure 16. Large woody debris and coarse sediments play a critical role in rebuilding floodplain access, particularly on small streams (M12S2.02, left) while sediment deposition also contributes to meander development and sinuosity (M16, right) that decreases stream slope. Sediment continuity allows coarser bed load sediments to establish more stable features in situations such as the point bar forming in reach M16 (right).

The hydrologic and sediment load watershed-scale stressors described above form a hierarchical pretext for understanding the timing and degree to which reach-scale modifications are contributing to field-observed channel adjustments (Kline 2010). Modifications to the valley, floodplain, and channel, as well as boundary (bank and bed) conditions, can change the hydraulic geometry, and thus change the way sediment is transported, sorted, and distributed (Table 4). Phase 1 and Phase 2 assessments provide semi-quantitative datasets for examining stressors and their effects on sediment regime when channel hydraulic geometry is modified.

Table 4. Reach level stressors: relationship of energy grade and boundary conditions in sediment transport regime (Kline 2010).

		Sediment Transport Increases	Sediment Transport Decreases
Energy Grade	**Stream power as a function of:**	**Stressors that lead to an increase in power**	**Stressors that lead to a decrease in power**
	Slope	• Channel straightening, • River corridor encroachments, • Localized reduction of sediment supply below grade controls or channel constrictions	• Upstream of dams, weirs, • Upstream of channel/floodplain constrictions, such as bridges and culverts
	Depth	• Dredging and berming, • Localized flow increases below stormwater and other outfalls	• Gravel mining, bar scalping, • Localized increases of sediment supply occurring at confluences and backwater areas
Boundary Conditions	**Resistance to power by the:**	**Stressors that lead to a decrease in resistance**	**Stressors that lead to an increase in resistance**
	Channel bed	Snagging, dredging, windrowing	Grade controls and bed armoring
	Stream bank and riparian	Removal of bank and riparian vegetation (influences sediment supply more directly than transport processes)	Bank armoring (influences sediment supply more directly than transport processes)

Channel Slope and Depth Modifier Maps (Sections 5.1.2a and b, respectively) are used to determine whether stream power has been significantly increased or decreased. A Channel Boundary and Riparian Modifiers Map (Section 5.1.2c) helps explain whether resistance to stream power has been increased or decreased. The analysis here attempts to portray general trends in contributions these various features contribute to stream dynamics; primary reach-scale stressors in each reach are noted in section 6 for Project Identification.

5.1.2a Channel slope modifiers

Analysis of channel slope modifiers in the Upper Wells 2015 Phase 2 study area indicates that channel straightening is the predominant stressor in the area, with indications of straightening (largely associated with road and development encroachments and the effects of undersized

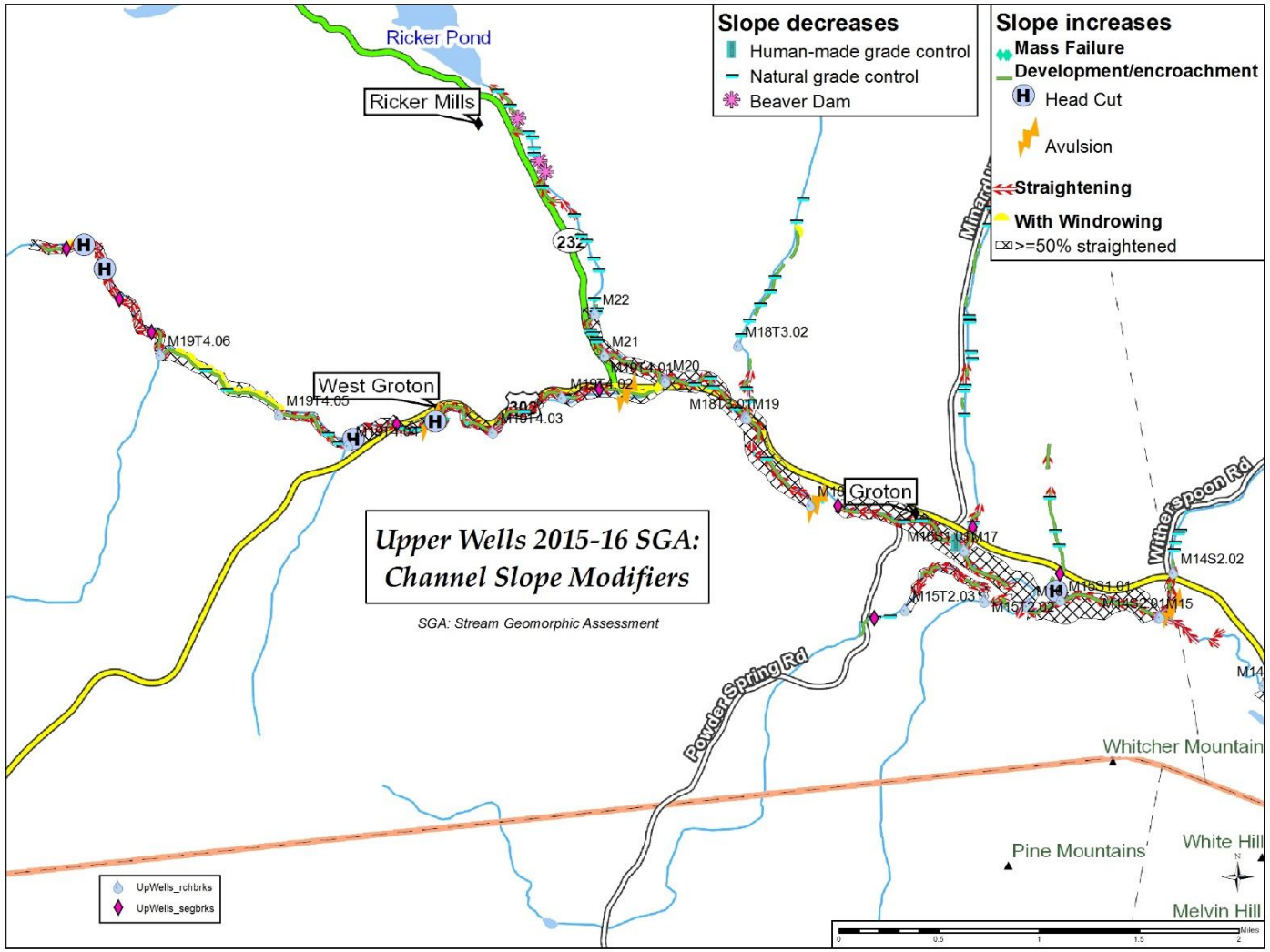


Figure 17. Channel Slope Modifiers map for the Upper Wells 2015 Phase 2 study area.

bridges and culverts) observed in 35 of 38 reaches (44 of 52 fully assessed segments) in Phase 2 (Fig. 17). "High" levels (>20% of the segment length) were observed in 39 of the 52 fully assessed segments, with 32 of these more than half (>50%) straightened.

Channel straightening can heighten stream power when slope increases occur as a stream loses its meanders (similar to putting a driveway straight up a steep slope rather than installing switchbacks; Figs. 18 and 19). In areas with erodible bed materials (surprisingly true through much of the Upper Wells 2015 study area, despite large substrates left by glacial processes along many of the tributary reaches), elevated stream power may contribute to bed downcutting (channel incision) that further enhances stream power and sediment transport capacity as a result of the increased slope and depth at flood stage.

Figure 18. While meandering streams typically exhibit much lower slopes than mountain trails, the meanders provide a critical function of decreasing slope (and thus energy in high flows) similar to trail switchbacks. "Trails that go straight up and down steep hills don't stay nice trails for long. Erosion turns those trails into gullies because water moves faster down steep straight-aways…" (Conway 1998). *Graphic credit: Steven Hill*.



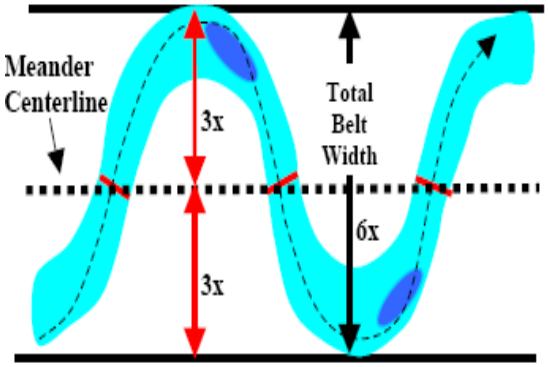


Figure 19. Studies on hundreds of streams worldwide indicate that a meandering stream will naturally migrate through a fairly predictable belt-width over time, providing the critical function of reducing slope (and thus stream power) (VT-RMP_ApxH 2009)

5.1.2b Channel depth modifiers

Deep historic incision leading to loss of access to historic floodplains (incision ratio ≥2.0) occurs almost exclusively on tributary reaches or segments in the 2015 Phase 2 study area (M11T1.05, M11T1.08C, M16S1.01B, M12S2.01A). The only exception along the mainstem was segment M17A where the Wells remains deeply entrenched at the former site of a log cribbing dam just upstream of the Powder Spring Rd. bridge in Groton village. While this is relatively good news for flood impacts in major floods (streams are able to diffuse stream power by accessing floodplains in major events), moderate stage flooding is largely contained within more than half of the stream channels in the basin (27 of 52 fully assessed segments have an incision ratio≥1.4). Grade controls, which limit further downcutting (bed incision) when stream power is enhanced, are surprisingly infrequent in the Upper Wells basin (Fig. 20). This fact means that large woody debris plays an extremely important role in contributing to stream stability in this basin.

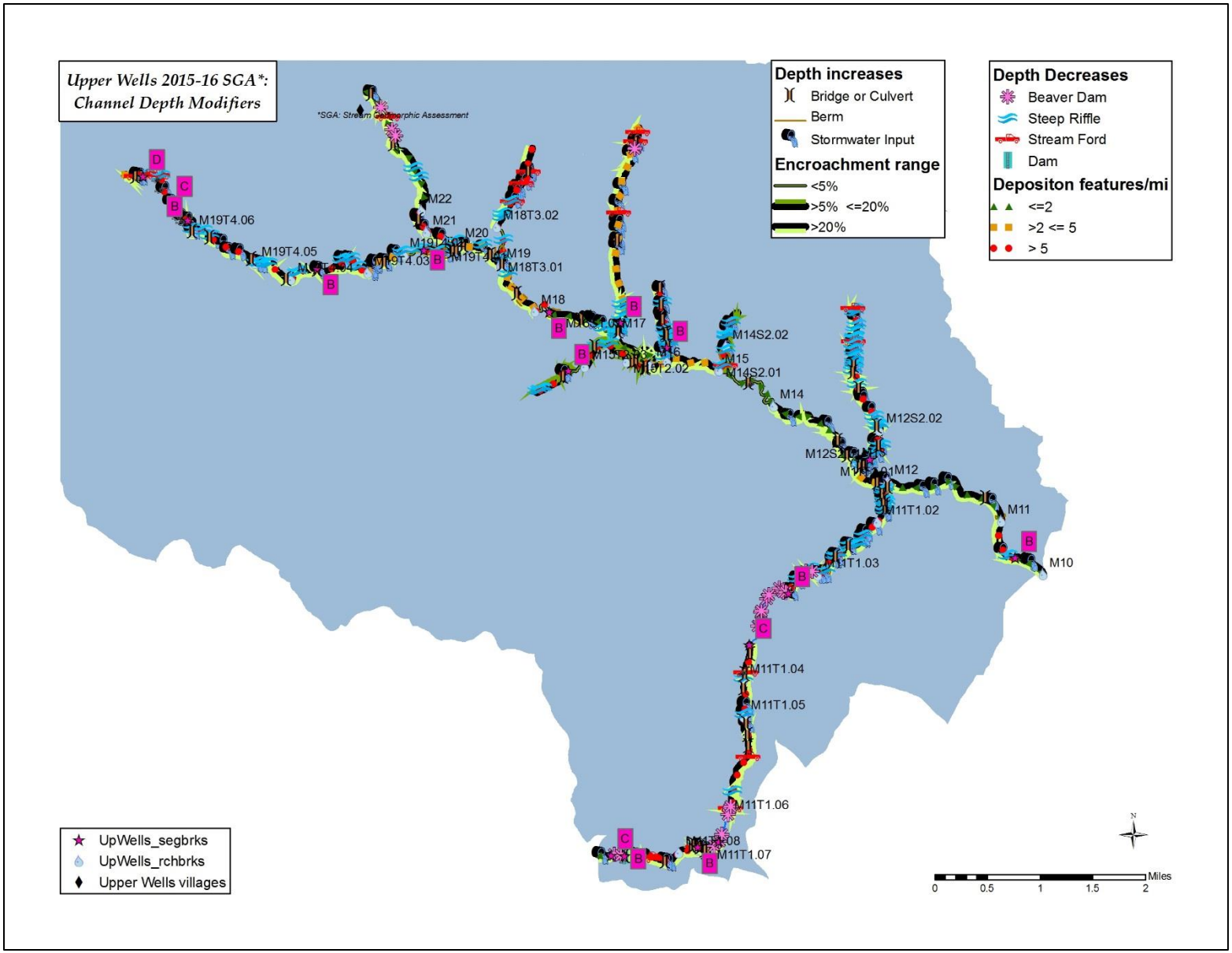


Figure 20. Channel depth modifiers map for the Upper Wells 2015 Phase 2 study area.

In areas of the Upper Wells basin where large wood exists in close proximity to stream channels, commonly narrow valleys of the basin frequently feature deposition combined with large woody debris falling into the stream in a dynamic whereby the stream may actually rebuild access to abandoned floodplains and extend or re-establish meanders. In areas where the channel has incised deeply, the process often initiates with mass failures contributing large sediment inputs, which are then trapped behind trees that have fallen into the stream, and may include plugged channels followed by avulsions or similar rapid channel relocations. This issue bears close attention in areas where high levels of encroachments along the stream corridor (often with attendant bank armoring) further contribute to heightened channel depths in flood flows. Diversion of high flows around large sediment plugs or deposits can quickly lead to escalated damage to encroachments in the corridor. Given widespread current level of moderate to high stream incision and the importance of these dynamics in mitigating the effects of increased flood depths, a strong case is presented for limiting further development in these areas and leveraging opportunities to reduce current levels of encroachment on these streams.

Stream encroachments (primarily roads and development) comprise the largest contribution to depth increases in the Upper Wells basin, with nearly three-quarters (38 of 52 fully assessed segments, 72%) of the stream segments in the 2015 Phase 2 study area indicating "High" levels of >20% of the length of the stream segments having such encroachments. These impacts are exacerbated by more rapid discharges to the channel network in areas of concentrated stormwater inputs, and further heightened by funneling through widespread undersized bridges and culverts in the basin. Roughly 89% of the assessed stream crossing structures in the basin were channel constrictions (some due to effective width reduced by angle of alignment to the stream), and 60% were floodplain constrictions as well. Structures that are channel constrictions but not floodplain constrictions will elevate moderate flood impacts (elevated stream power contained in a narrower, deeper channel) until water is able to access the floodplain. Recent flood impacts were most evident in areas downstream of these type of channel and floodplain constrictions combined with elevated flood depths (e.g., M19T4.01A, M19T4.03, M11T1.01 and M11T1.02, M18 and M17).

5.1.2c Boundary condition and riparian modifiers

Stream boundaries include bed and banks, and are strongly affected by the underlying geology and the state of buffer vegetation in the riparian corridor. Root systems from woody vegetation (and, to a lesser extent, herbaceous vegetation) help bind stream bank soils and diffuse stream power.

Although very large boulder and cobble sediments in glacial outwash areas (e.g., along the South Branch) give a substantial degree of channel roughness that helps dissipate stream power, stream beds of the Upper Wells basin have surprisingly few ledge grade controls overall. Ledge is concentrated along tributary stream north of the Wells mainstem and along the South Branch (Fig. 21), while throughout much of the rest of the basin elevated stream power (largely due to intermittent confined valleys, significant road encroachments, and the historical impacts of pulse flows related to substantial use for mills) has demonstrated the capacity to erode and incise stream beds.

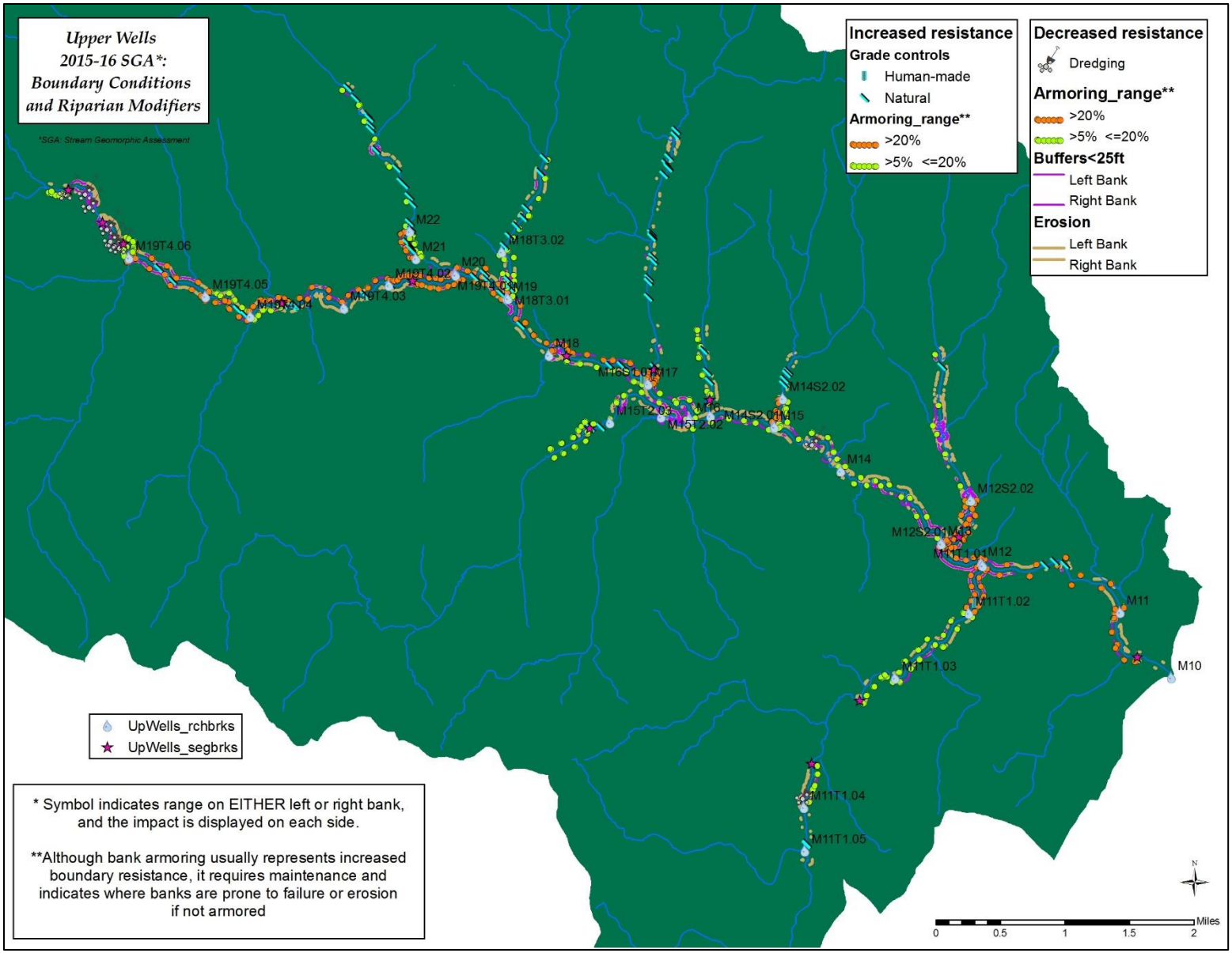


Figure 21. Boundary Conditions and Riparian Modifiers map for the Upper Wells 2015 Phase 2 study area

Recent aggradation (particularly in Irene) and subsequent redistribution of sediments has offset some historic incision and transferred primary current impacts to stream banks. The high erodibility of stream beds in the Upper Wells basin is accompanied by similar erodibility along the banks, but erodibility of banks is mitigated by decent (though often young) buffers throughout much of the 2015 study area. Expanses lacking substantial streamside buffers are primarily along roadsides, as well as some agricultural areas concentrated along the Wells mainstem, South Branch, Stone Rd. Brook, and to a lesser degree along Keenan Brook (Fig. 21).

With highly erodible soils throughout the study area, increased bank armoring is widely used to offset elevated erosion in areas lacking buffers (diminishing bank roughness and the effects of intertwined roots that might otherwise provide some dissipation of stream energy in high flows). This effectively transfers additional erosive power to erodible stream beds where ledge grade controls are lacking, or passes heightened stream power downstream when bank armoring is combined with grade controls (notable along the South Branch and Wells mainstem reaches M17-M19). Frequently armored development encroachments and intermittent longer lengths of road encroachments thus represent a significant modifier of bank boundary conditions, highlighting significant benefits to limiting further corridor encroachments as well as maintaining channel roughness and possibilities for incorporating woody vegetation in areas where armoring is hard to avoid (Schiff et al 2014).

5.1.3 Sediment regime departure, constraints to sediment transport, and attenuation assets

Within a reach, the principals of stream equilibrium dictate that stream power and sediment will tend to distribute evenly over time (Leopold 1994). Changes or modifications to watershed inputs and hydraulic geometry create disequilibrium in the balance of these forces and lead to uneven distribution of power and sediment (Fig. 22). Whether a project works with or against the physical processes at play in a watershed is primarily determined by examining the source, volumes, and attenuation of flood flows and sediment loads from one reach to the next within the stream network. If increasing loads are transported through the network to a sensitive reach, where conflicts with human investments are creating a management expectation, little success can be expected unless the restoration design accommodates the increased load or finds a way to attenuate the loads upstream (Kline 2010).

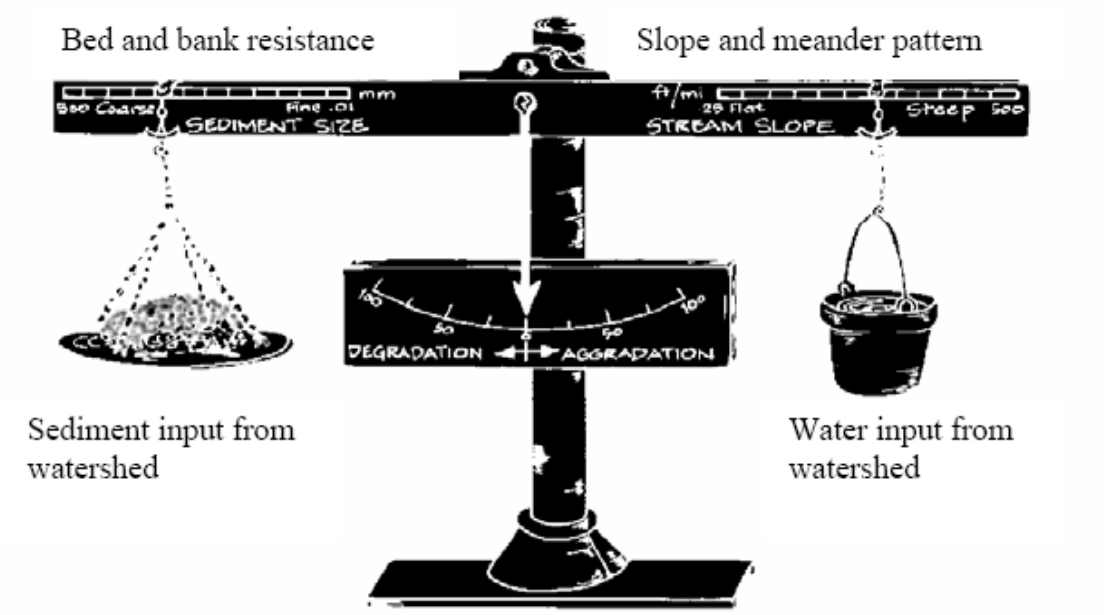


Figure 22. The channel balance indicates how changes in watershed inputs influence channel adjustment processes (Lane 1955)

When stream power and sediment are relatively balanced, the streams located in narrower valleys on steeper gradients in a watershed (primarily A- and some B-type streams) tend to exhibit a "Transport" sediment regime, contributing minor amounts of various sized sediments to downstream reaches but not storing many sediments. Streams in wider valleys with lower slope gradients (primarily C- and E- type streams) provide for sediment storage in a dynamic balance with water moving through the system (in = out: i.e., stream power, which is produced as a result of channel gradient and hydraulic radius, is balanced by the sediment load, sediment size, and channel boundary resistance). Under reference conditions, these streams would provide for coarse particle equilibrium and fine sediment deposition at annual flood flows, largely on the floodplains and at bendways and meanders (Coarse Equilibrium and Fine Deposition sediment regime, Fig. 23; Kline 2010, p.43).

Sediment Regime	Narrative Description
Transport	Steeper bedrock and boulder/cobble cascade and step-pool stream types; typically in more confined valleys, do not supply appreciable quantities of sediments to downstream reaches on an annual basis; little or no mass wasting; storage of fine sediment is negligible due to high transport capacity derived from both the high gradient and/or natural entrenchment of the channel.
Coarse Equilibrium (in = out) & Fine Deposition	Sand, gravel, or cobble streams with equilibrium bed forms; at least one side of the channel is unconfined by valley walls; these streams transport and deposit coarse sediment in equilibrium (stream power—produce as a result of channel gradient and hydraulic radius—is balanced by the sediment load, sediment size, and channel boundary resistance); and store a relatively large volume of fine sediment due to the access of high frequency (annual) floods to the floodplain. Look for unconfined streams, which are not incised or entrenched, have boundary resistance (woody buffers), minimal bank erosion, and vegetated bars. These streams are Stage I, late Stage IV, and Stage V.

Figure 23. Pertinent characteristics for Phase 1 classification of reference sediment regimes in Upper Wells 2015 Phase 2 study area reaches.

Based primarily on valley slope and confinement, Phase 1 assessments in the Upper Wells area classified just 2 of the 38 reaches assessed with Transport sediment regimes under reference conditions (Fig. 25), including Scott Brook M11T1.04 and South Branch M19T4.04. The remaining 36 reaches would be expected to have Coarse Equilibrium and Fine Deposition (CEFD) sediment regimes under reference conditions.

Sediment regime departure

Phase 2 sediment regimes (which help identify current departures from reference conditions) are determined based on a number of parameters measured in rapid field assessments (Kline 2010, p. 44). These include signs of active adjustment processes indicating that streams are in a state of disequilibrium, including a likely stage of channel evolution (Fig. 24; criteria listed left to right in order of relative importance).

Sediment Regime	Delimiting criteria related to sediment supply, transport, and storage	Stage of Channel Evolution Geomorphic Condition	Common Existing Stream Type	Natural Valley Type
Confined Source and Transport	Incision ratio > 1.3	Stage II-IV Fair-Good	A3, B3*	NC, SC, NW
	Incision ratio > 1.3	Stage II-IV Fair-Good	A4, A5 B4*, B5*	Any Type
Unconfined Source & Transport	Bank armor > 50% Straightening > 50% W/d < 30 Incision ratio > 1.3	Stage II - III Poor-Fair	G3, G4, G5 F3, F4, F5	NW, BD, VB
		Stage II - III Poor-Fair	E3, E4, E5 C3, C4, C5 B3c, B4c, B5c	NW, BD, VB
Fine Source & Transport and Coarse Deposition	Bank armor < 50% W/d > 30** Incision ratio > 1.3	Stage II-IV Poor-Fair	E3, E4, E5 C3, C4, C5 B3c, B4c, B5c F3, F4, F5	NW, BD, VB
	Bank armor < 50% Incision ratio > 1.3	Stage II-IV Poor-Fair	D3, D4, D5	NW, BD, VB
Coarse Equilibrium (in = out) & Fine Deposition	Incision ratio < 1.3	Stage I -V Fair-Good-Ref	D3, D4, D5	NW, BD, VB
	W/d < 30 Incision ratio < 1.3	Stage I -V Fair-Good-Ref	C2, C3, E3	NW, BD, VB
	W/d < 30 Incision ratio < 1.3	Stage I -V Fair-Good-Ref	C4, C5 E4, E5	NW, BD, VB

Figure 24. Pertinent parameters for characterizing existing sediment regime using Phase 2 data.

*B streams with the slope of a C stream, or a Bc stream type, in an unconfined valley setting (NW, BD, VB) may be classed as either "unconfined source and transport" or "fine source and transport & coarse deposition" depending on other delimiting criteria.

** Depositional Features may include multiple channel avulsions and multiple chute cut-offs

The only stream segments noted in relatively stable stages (IV and V) of channel evolution during 2015 field assessments were Scott Brook M11T1.06B and M11T1.07A, Wells mainstem M17B, and South Branch M19T4.06A. M11T1.06B and M17B appeared to be in a state of dynamic equilibrium due in large part to significant aggradation that had rebuilt floodplain access in both of these segments. M11T1.07A and M19T4.06A, on the other hand, appeared to be relatively stable due to location downstream of relatively large high value attenuation assets that had dissipated and absorbed stream power and sediment discharges in recent floods.

Once a stream has entered a state of disequilibrium, it will begin a series of channel adjustments or evolutions to fulfill the physical mandates of restoring equilibrium. Schumm (1977 and 1984) has described five stages of channel evolution for reaches where the stream has a bed and banks that are sufficiently erodible to be shaped by the stream over time ("F-model" evolution). The five stages of channel evolution for F-model evolution are paraphrased from the SGA protocols (VT-RMP_ApxC 2007) as follows:

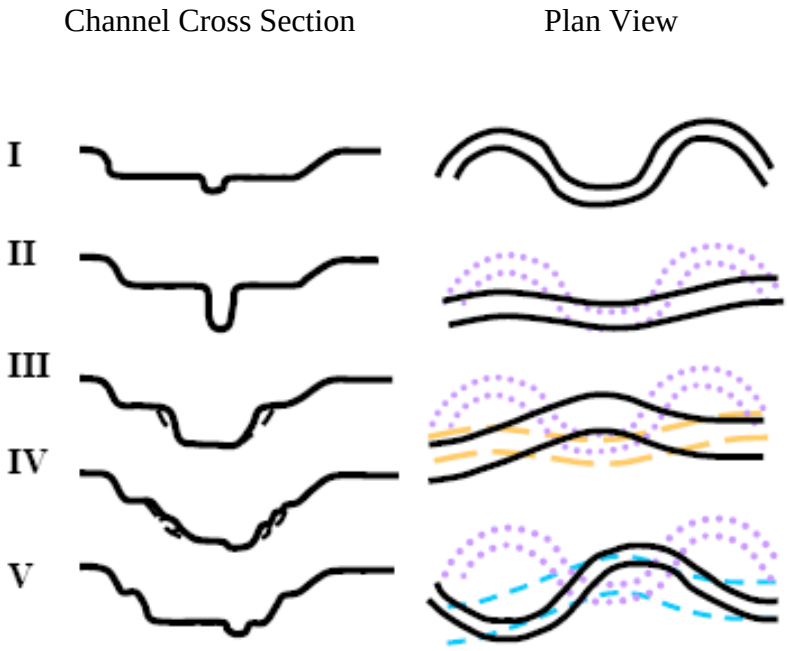
I. Stable — In regime, reference to good condition. Insignificant to minimal adjustment; planform is moderately to highly sinuous.

II. Incision — Fair to poor condition, major to extreme channel degradation. High flow events are contained in the channel, and channel slope is typically increased.

III. Widening/Migration — Fair to poor condition, major to extreme widening and aggradation. (An incised, entrenched and widened channel is an "F-type stream", hence F-model evolution)

IV. Stabilizing — Fair to good condition, major reducing to minor aggradation, widening and planform adjustments

V. Stable — In regime, reference to good condition. Insignificant to minimal adjustment.



Five stream segments in the Upper Wells 2015 Phase 2 study area exhibit a second model of channel evolution ("D-model" evolution) that is more typical in areas where stream banks are more erodible than the bed. Wells mainstem M21 and Keenan Brook M15T.03A had ledge grade controls and/or very coarse boulder substrates. Keenan Brook M15T2.01 and Scott Brook M11T1.03C and M11T1.07B were located in wetlands that have had significant agricultural use, with relatively cohesive high silt or muck components in the bed and diminished buffers along the banks.

Under conditions where the banks are more erodible than the bed, the stream does not significantly incise and instead evolves primarily through widening and/or lateral movement. The three stages for D-model channel evolution are paraphrased from the SGA protocols (VT-RMP geoassesspro 2007, Appendix C) as follows:

I. Stable — in regime, reference to good condition. Insignificant to minimal adjustment; planform is moderately to highly sinuous.

Then either of the following Stage II scenarios may occur:

> **Stage IIc. Widening/Migration** — Widening and migrating laterally through bank erosion caused by increased stream power. The balance between stream power and boundary materials is re-established when the slope flattens after a process of channel lengthening and increased sinuosity.
>
> **Stage IId. Braiding** — Extreme deposition and braiding, with water flowing in multiple channels at low flow stage ("D" stream type). Channel width narrows through aggradation and the development of bar features. Main channel may shift back and forth through different channels and chute cut-offs, continuing to erode banks or terraces.

Stage III. Stable — Channel adjustment process is complete (back to a B, C or E stream type).

With field-assessed measures such as bank armoring, straightening, channel incision, and stage of channel evolution accounted, Phase 2 assessment helps identify an existing sediment regime for each stream segment. Comparing reference sediment regimes (Phase 1 assessments) side by side with field-assessed existing sediment regimes (Fig. 25) gives a sense of sediment regime departure within the watershed.

Phase 2 assessments in the Upper Wells area during 2015 indicated that, in contrast to 36 Phase 1 reaches that would function as Coarse Equilibrium and Fine Deposition (CEFD) areas under reference conditions, CEFD sediment regimes exist in 14 reaches (39% of the reaches). Accounting for additional impacts to portions of reaches, 18 of 52 fully assessed stream segments (34% of the segments) have CEFD sediment regimes.

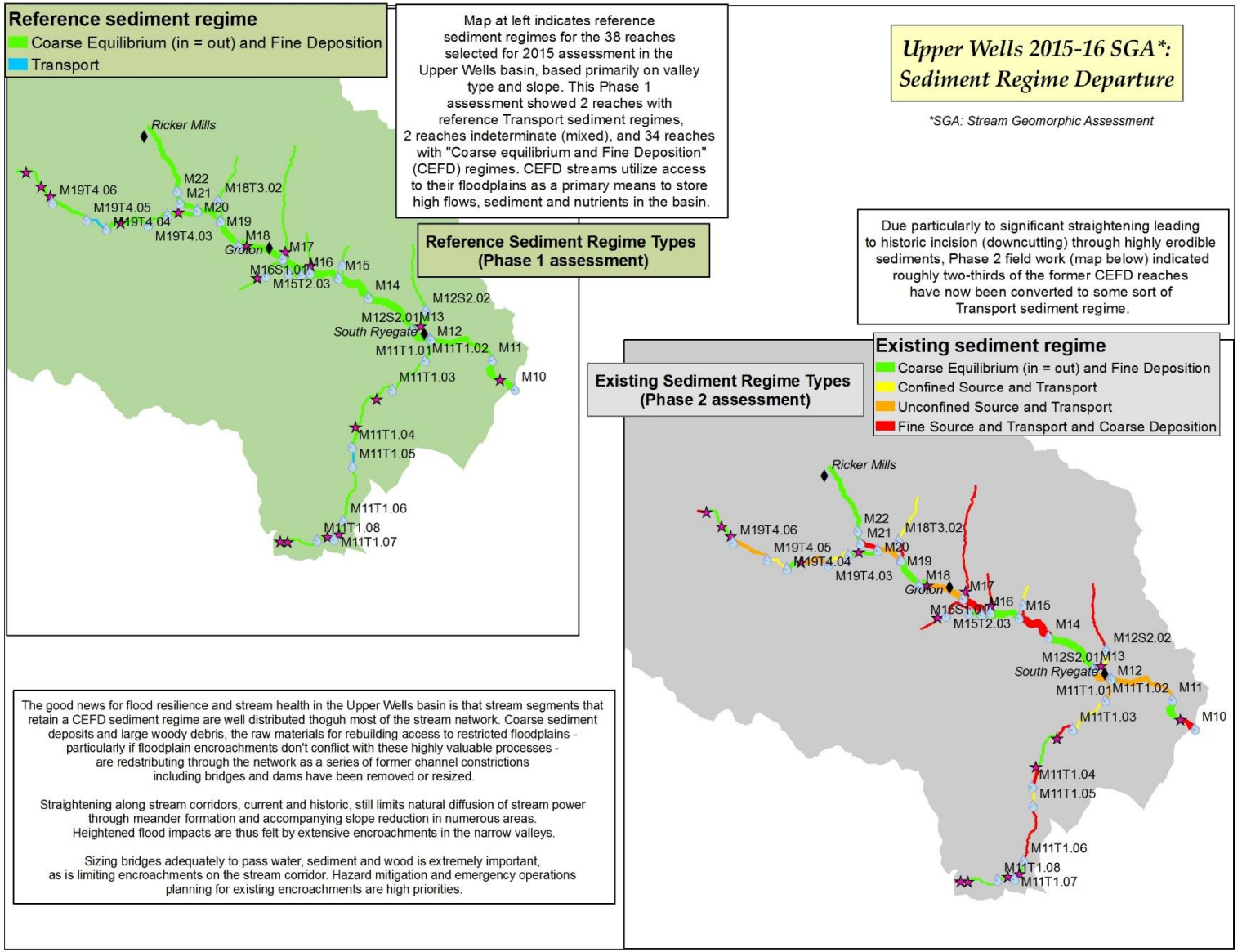


Figure 25. Sediment regime departure map for the Upper Wells 2015 Phase 2 study area.

With two-thirds of the stream segments assessed in 2015 Phase 2 work now functioning as transport reaches of some sort, soil and nutrients are being exported through the stream network of the Upper Wells basin. High flows and fine sediment in particular are being transferred downstream, often to the detriment of streamside properties and instream habitats.

Fine Source and Transport and Coarse Deposition regimes (coded red in Fig. 25) now exist in 18 (of 52 assessed) stream segments that lack extensive bank armoring and are characterized by channel widening, elevated levels of erosion and concentrated deposition at channel constrictions (including upstream of undersized bridges and culverts and old abutments), tributary mouths, and over widened sections of the stream. These segments are widely distributed throughout the basin on both mainstem and tributary reaches but are noticeably absent along the South Branch (with the exception of the most upstream segment, M19T4.06D on Groton State Forest land.

Unconfined Source and Transport sediment regimes (coded orange in Fig. 25) currently exist in 9 segments: 4 intermittent along the Wells mainstem, 2 on the South Branch, plus the downstream ends of Tannery Brook, Stone Rd. Brook and Scott Brook – all in the village settings of West Groton, Groton and South Ryegate. These areas include a relatively high percentage of bank armoring, have often had large stone removed from the channel to line the banks through either windrowing or more deliberate riprapping and bank toe stabilization, and frequently have repeat dredging or "clean-out" areas upstream of undersized structures and valley/floodplain pinch points. While these areas would have better floodplain access and storage under reference conditions, historic and current channel management practices leave little ability to store sediments or high flows and thus transfer impacts to downstream reaches.

Confined Source and Transport sediment regimes (coded yellow in Fig. 25) currently exist in 7 segments situated in Semi-confined valleys, with 2 each along Scott Brook (M11T1.02 and M11T1.04) and the South Branch (M19T4.02 and M19T4.04) plus portions of Stone Rd. Brook (M12S2.02), Darius James Brook (M14S2.02) and the North Branch (M18T3.02). All of these segments had significant flood damages, channel avulsions or temporary occupation of large flood chutes in areas immediately downstream during Irene. Flood damages were particularly evident to corridor encroachments in South Branch M19T4.01 and Scott Brook M11T.101.

Channel adjustments due to increased flows can be difficult to remediate in downstream reaches (Booth and Jackson 1997; Doyle et al. 2000; Fitzgerald 2007), potentially prolonging instability in these streams and leaving them open to heightened flood impacts in future events. This places a premium on attenuation of high flows and sediment discharges in the shortest distance downstream possible, and increases the importance of:

a) limiting development and encroachments within stream corridors;

b) restoring, protecting and maintaining floodplain access even on small streams high in the watershed, including current beaver-controlled areas;

c) establishing and maintaining woody buffers in riparian corridors and

d) managing stormwater inputs to minimize direct discharges to streams.

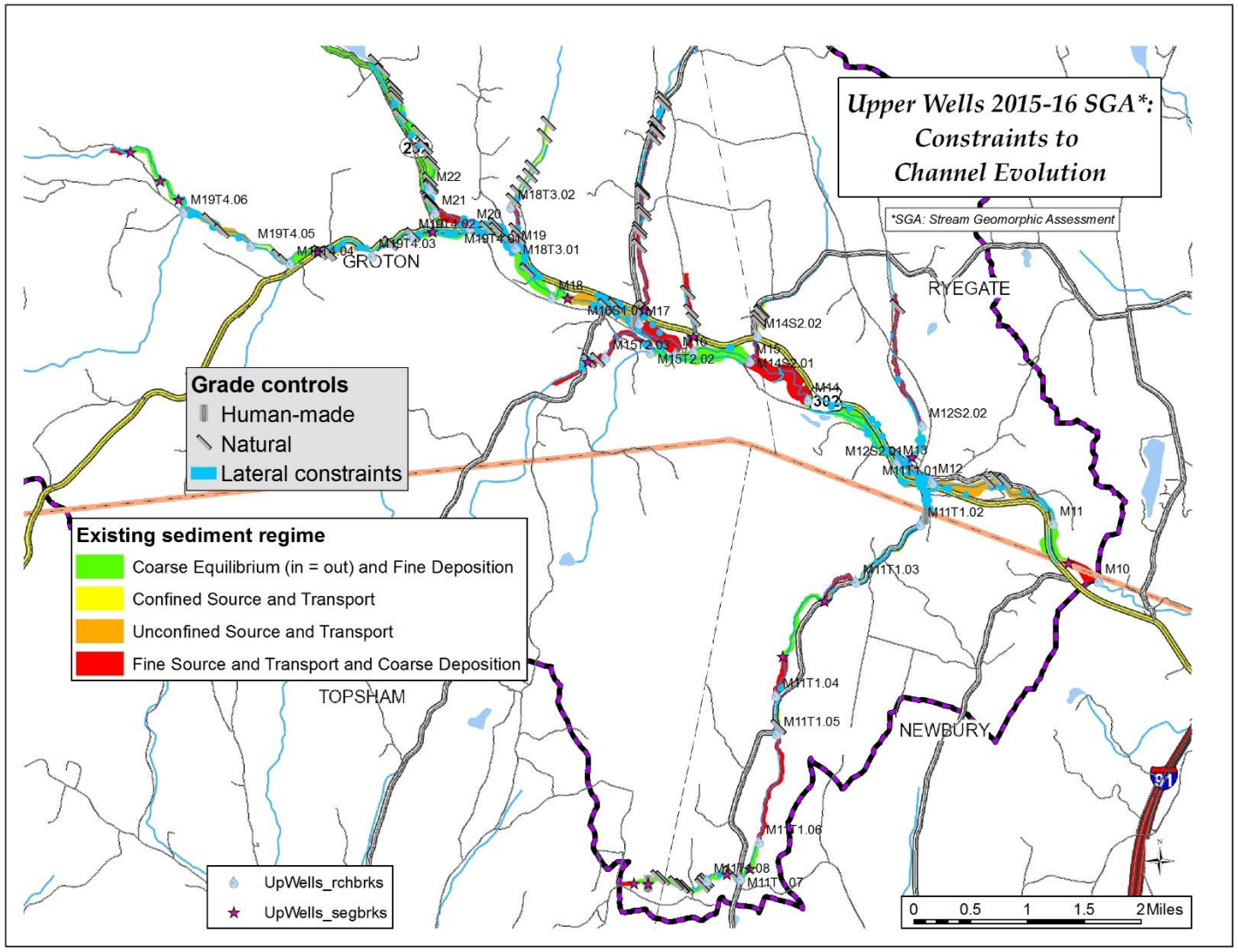


Figure 26. Map of existing sediment regime in conjunction with vertical and lateral constraints to channel evolution in the Upper Wells 2015 Phase 2 study area.

Constraints to channel evolution

Constraints to vertical channel evolution include such features as ledge, waterfalls, and dams that limit a stream from cutting down further into its bed. Ledge grade controls are present in 23 of 52 fully assessed stream segments in the Upper Wells 2015 Phase 2 study area but 6 of these 23 segments contain just a single grade control, and 6 more have just 2 grade controls (leaving a total of 11 of 52 segments with more than 2 grade controls; Fig. 26).

Small waterfalls are located on Darius James Brook reach M14S2.02 and Wells mainstem reach M22, but with the removal of the Groton #9 dam in September 2016 the only remaining dam in the Upper Wells 2015 Phase 2 study area is on a small 0.5 acre pond in Scott Brook segment M11T1.08B. Dams on Ricker Pond, Lake Groton (both Wells mainstem) and Seyon Pond (South Branch) are within the Upper Wells basin but upstream of the extent of the Phase 2 study.

A small poured concrete weir at the upstream end of Scott Brook reach M11T1.01 as it enters South Ryegate village represents the only grade control on a highly straightened and armored reach that is otherwise susceptible to significant downcutting.

None of the streams assessed in the 2013 study area have the natural lateral constraint of dominantly cohesive banks (with the lone exception of a 300 foot long partially bedrock-controlled gorge that comprises only a small portion of reach M19T4.02 upstream of the old rail abutments at Rte. 302 and Wilson Rd. in West Groton. As is visible in the lateral constraints denoted in the Constraints to Channel Evolution Map (Fig. 26), however, road and development encroachments are common and present a primary lateral constraint to channel evolution (human constructed and maintained), thus increasing risks for these structures and infrastructure in the course of lateral channel evolution (planform changes) or further bed degradation when banks are armored to protect these encroachments. In areas lacking bedrock to limit downcutting, further bed degradation amplifies stream power (more erosive power contained within the channel and increasingly limited floodplain) and eventually poses risks for undermining even well-constructed lateral constraints, feeding into a progressively expensive cycle of damage and repairs.

Under reference conditions for most of the streams in the Upper Wells 2015 Phase 2 study area large woody debris and coarse sediments would present some natural checks to bed erosion and channel evolution would lead to pool formation alternating with runs and riffles or steps so that these streams would undulate both vertically and laterally, balancing sediment transport and stream power.

Attenuation assets

Given a significant degree of lateral constraints in the Upper Wells basin, particularly along roadsides in tributary valleys and between road and railbed sides along much of the Wells mainstem, protection of existing floodplains as "attenuation assets" is challenging but plays a critical role in mitigating flood impacts by accommodating and diffusing high flows and storing sediments and nutrients. Although attenuation assets would be widely distributed (though frequently limited in extent due to narrow valleys) under reference conditions, the current configuration of lateral and vertical constraints severely curtails the value of many stream segments as attenuation assets except in high-level floods such as Irene (Fig. 26; Table 5).

Table 5. Departure Analysis Table for the Upper Wells and some of its tributaries, indicating where river segments are constrained from adjustment, converted to transport streams, and/or have existing or future potential as a place to attenuate sediment load and high flows.

	Constraints		Transport		Attenuation (storage)		
River Segment	**Vertical**	**Lateral**	**Natural**	**Converted**	**Natural**	**Increased**	**Asset**
Upper Wells Mainstem (M) - Ryegate, Newbury, Groton							
M10-A	none	human		x	x		limited
M10-B	none	human			x		limited
M11-0	natural- human	human		x	limited		limited
M12-0	none	human		x			
M13-0	none	human			x		x
M14-0	none	human (limited)		x	x		x
M15-0	none	human			x		x
M16-0	none	human		x	x		limited
M17-A	natural	human		x	x		limited
M17-B	none	human (limited)			x	x	x
M18-0	natural	human		x	x	x	x
M19-0	natural	human		x	x		limited
M20-0	none	human (limited)		x	x		x
M21-0	natural	human		x	x		x
M22-0	natural	human		x	x		x
Tributaries to the Upper Wells River							
Scott Brook (M11T1) - Ryegate (M11T1.01), Newbury, Topsham (portion M11T1.08)							
M11T1.01-0	human (1 weir)	human		x	x		
M11T1.02-0	none	human		x	limited	x	
M11T1.03-A	none	human		x	x		x
M11T1.03-B	none	none			x	x	x
M11T1.03-C	none	human (limited)		x	x		x
M11T1.04-0	natural (limited)	human (limited)	x				
M11T1.05-0	none	human (limited)		x	x	x	x
M11T1.06-A	none	none			x	x	x
M11T1.06-B	none	human (limited)			x	x	x
M11T1.07-A	natural	human		x	x		limited
M11T1.07-B	none	human			x	x	x
M11T1.08-A	natural	human			x	x	x
M11T1.08-B	human	human (limited)			x		x
M11T1.08-C	none	none		x	limited		limited
Stone Road Brook (M12S2) - Ryegate							
M12S2.01-A	none	human		x	x		limited
M12S2.01-B	none	human		x	x		limited
M12S2.02-0	natural (limited)	human		x	x	x	x

	Constraints		Transport		Attenuation (storage)		
River Segment	**Vertical**	**Lateral**	**Natural**	**Converted**	**Natural**	**Increased**	**Asset**
Darius James Brook (M14S2) - Ryegate, Groton (portion M14S2.01)							
M14S2.01-0	none	human (limited)		x	x	x	limited
M14S2.02-0	natural	human (limited)		x	x		limited
Clark Hatch Brook (M15S1) - Groton							
M15S1.01-A	none	human (limited)		x	x		x
M15S1.01-B	natural	human		x	limited		limited
Keenan Brook - Groton							
M15T2.01-0	none	human			x		x
M15T2.02-0	none	human		x	x		x
M15T2.03-A	natural	human (limited)		x	limited		limited
M15T2.03-B	none	human		x	x		x
Tannery Brook - Groton							
M16S1.01-A	none	human		x	x		
M16S1.01-B	natural	human		x	x		x
North Branch Wells River - Groton							
M18T3.01-0	natural	human		x	x		limited
M18T3.02-0	natural	human		x	limited	x	limited
South Branch Wells River - Groton							
M19T4.01-A	none	human		x	limited	x	limited
M19T4.01-B	natural	human (limited)			limited	x	limited
M19T4.02-0	natural	human		x	limited	x	limited
M19T4.03-A	natural	human		x	limited	x	limited
M19T4.03-B	none	human (limited)			x	x	x
M19T4.04-0	natural	human	x	x			
M19T4.05-0	natural	human			x		limited
M19T4.06-A	none	human (limited)		x	limited		limited
M19T4.06-B	none	none		x	x	x	x
M19T4.06-C	none	none		x	x		x
M19T4.06-D	none	human		x	limited		limited

5.2 SENSITIVITY ANALYSIS

The preceding departure analysis identifies the watershed and reach-scale stressors that help explain current sediment regime departure in the Upper Wells Phase 2 assessment area. Designing stream corridor protection and restoration projects that are compatible with channel evolution processes, and prioritizing them at the watershed scale, also requires an understanding of stream sensitivity.

Sensitivity refers to the likelihood that a stream will respond to a watershed or local disturbance or stressor, and an indication as to the potential rate of channel evolution (VT-RMP 2009, Phase 2, Step 7.7; Kline 2010, Section 5.1.3). While every stream changes in time, a sensitivity rating indicates that some streams, due to their setting and location within the watershed, are more likely to be in an episodic, rapid, and/or measurable state of change or adjustment.

Due primarily to the strong geologic influence of glacial Lake Hitchcock along the Wells mainstem, a glacial outwash spillway along the South Branch, and the Danville moraine through much of the remainder of the study area, only one of the stream segments assessed in the Upper Wells area in 2015 was rated with Moderate sensitivity (Wells main stem reach M20, which is largely bordered by beaver-controlled wetlands off the left bank). All other fully assessed stream segments in the Upper Wells 2015 Phase 2 study area were Highly to Extremely sensitive to disturbance and stressors, and thus also capable of a relatively rapid response (channel evolution to reestablish equilibrium conditions) if stressors are addressed (Table 6; Fig. 27).

Table 6. Stream sensitivity and current adjustments for stream segments in the Upper Wells 2015 Phase 2 study area.

Sensitivity	Count	Current Adjustments	Count
Extreme	6	Lateral	30
Very High	16	Lateral and aggradation	14
High	29	Degradation	1
Moderate	1	Lateral and degradation	5
		Stable	2

The widespread extent of lateral adjustments along with High to Extreme Sensitivity on all of the assessed streams places a high priority on preventing new and/ or reducing current corridor encroachments as both a safety measure and means to reducing long-term costs in living with streams that are highly responsive to indications of a changing climate. High to Extreme Sensitivity on the large majority of these streams also suggests that the streams of the Upper Wells basin have the capacity and resources to stabilize if impediments to channel evolution are addressed, lending a preference for primarily passive project implementation with active components focused primarily on addressing issues such as reducing or removing channel and floodplain encroachments and constrictions.

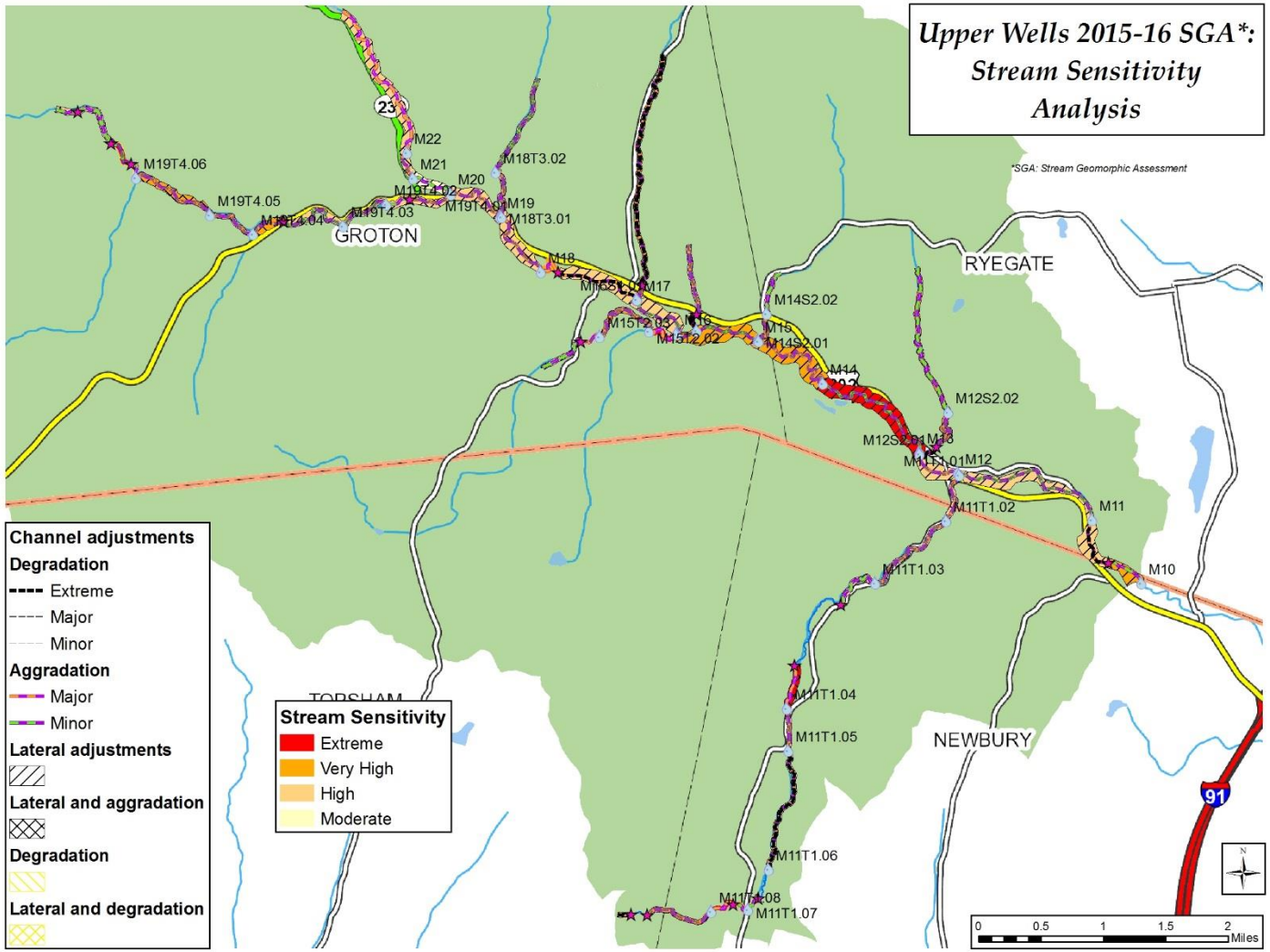


Figure 27. Stream sensitivity and channel adjustments map for the Upper Wells Phase 2 study area.

6.0 PROJECT IDENTIFICATION

6.1 REACH DESCRIPTIONS — PRELIMINARY PROJECT IDENTIFICATION

Within the context of the overarching considerations discussed in previous sections of this report, reach descriptions highlighting factors leading to preliminary project identification are presented on a reach-by-reach basis in the following pages.

"Left bank" and "right bank" in the reach descriptions are referenced looking downstream. Reach maps include a "belt width corridor" drawn on either side of the stream. The width of this corridor (generally a minimum of 3-4 times the stream channel width) is based on over 30 years of research and data collected from hundreds of streams around the world, and approximates the extent of lateral adjustments likely to occur over time in a meandering stream type (VT ANR 2009 Protocols, Appendix H). "Human investments within the belt width inevitably result in structural constraints placed on the channel adjustment process to protect those investments and address associated threats to public safety. These threats will be largely avoided by recognizing the hazards created by development, incompatible with channel adjustments, within the critical belt width" (VT ANR 2009 Phase 2 Protocols, p.17).

Background imagery for the reach maps is from natural color orthoimagery with a source scale of 1:5000 (VCGI orthos 2012). The scale of these maps can make it difficult to read in a single-page format as in this report, so readers with high-speed internet access are strongly encouraged to further reference the Vermont Agency of Natural Resources Atlas to access the data from these assessments in an interactive format (VT-ANR Atlas 2016).

6.1 Reach M10 - Wells mainstem upstream of Boltonville dam backwater wetlands to ~0.1 mi downstream of easterly Creamery Rd-Scott Hwy (Rte. 302) junction

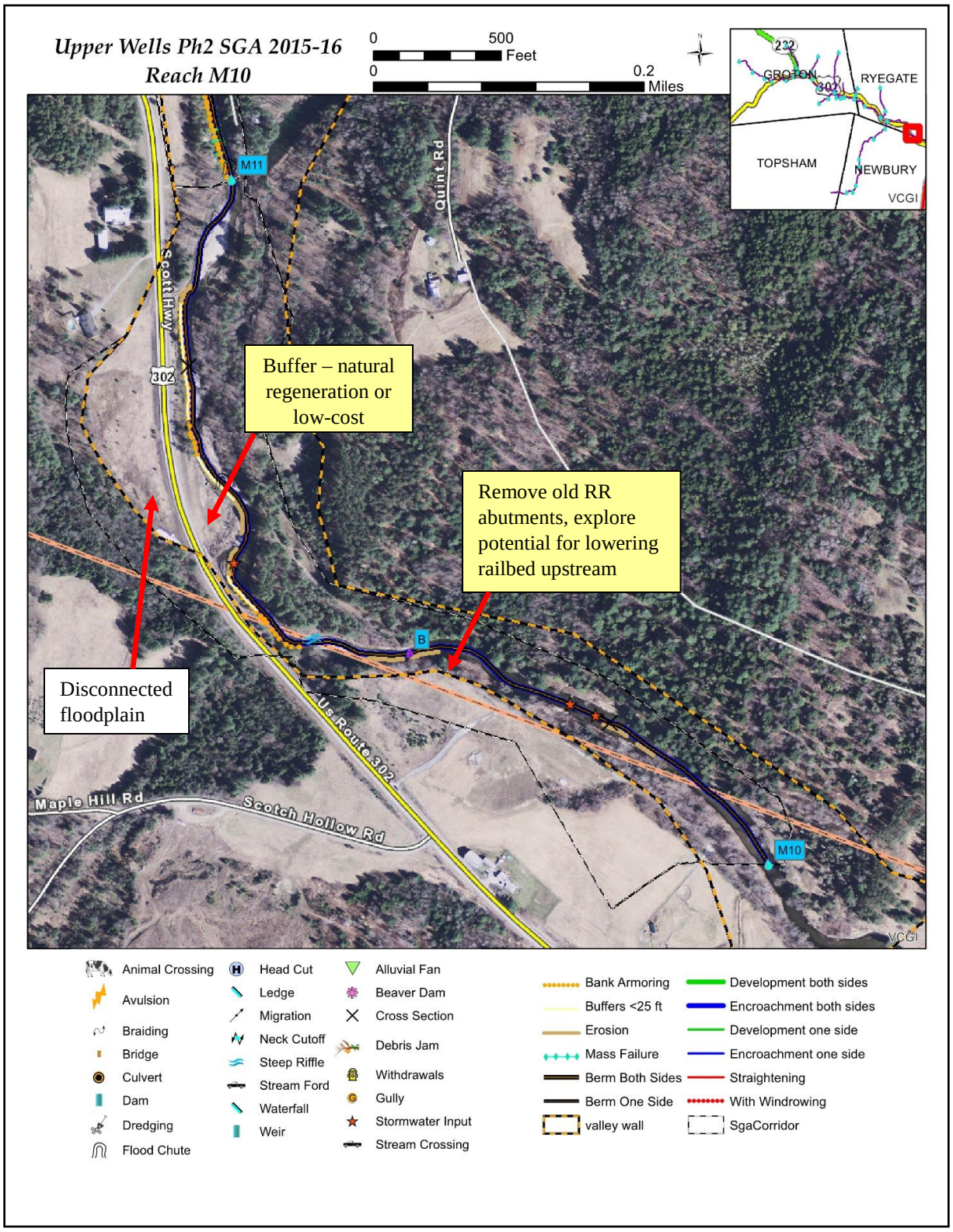


Figure 28. M10 Reach map - Wells mainstem.

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M10	4,217	C	none	Gravel	Riffle-pool	Broad

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M10-A	1,710	C	none	Gravel	Riffle-pool	Broad
M10-B	2,507	C	none	Cobble	Riffle-pool	Broad

	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
M10-A	Fair	Very High	1.3	III	F	none
M10-B	Fair	Very High	1.3	III	F	none

Reach M10 marks the downstream extent of the Wells mainstem included in the 2015-16 assessment reported here. The reach was split into two segments primarily due to changes in substrate size as the stream approaches a complex of backwater wetlands behind the Boltonville dam in reach M09, which was the upstream extent of a 2007 assessment of the lower Wells mainstem (Redstart 2009).

Segment M10A is located downstream of old abutments from a former bridge of the Montpelier-Wells River Railroad. After entering from a gated access on Scott Hwy (Rte. 302) near the downstream end of the reach and passing along farm fields and alder wetlands, the old railbed increasingly encroaches upon the stream along river right before crossing at the segment break. Although soil maps indicate the same alluvium and lake sands present in upstream segment B, the substrate in segment M10A was notably finer and lacking depositional features, and may be influenced by the backwater effects of the Boltonville Dam in reach M09 as well as possible historic gravel mining for construction of the railbed (soil maps indicate sand and/or gravel pits on river right adjacent to the old rail crossing abutments, and a small farm pit is evident on the high terraces at the north end of the fields there). The landowners of the farm along much of reach M10 noted anecdotally that the permits at the dam had been changed sometime in the last 10 years to allow an increase in the water levels retained behind the dam, and they felt there had

been an increase in bank erosion. This information has not been verified for this report; the banks in segment M10A were notably steeper than upstream but there were not distinctive differences in levels of erosion.

With similar confinement from natural valley walls in conjunction with road and railroad encroachments in both segments, and similar soil profiles along these areas, it appears that the primary differences in substrate size were largely related to sediment distribution following recent flood discharges. It should be noted, however, that Scott Highway (Rte. 302) is higher in segment B and both Rte. 302 and the old railbed in segment A are of sufficient height that they are confining at all but the highest level floods and are likely acting as the effective valley wall at lower discharge levels, increasing the force of flood flows due to lack of floodplain access.



Figure 29. Old bridge abutments from the Montpelier-Wells River Railroad (barely visible at center of picture at right, on river right bank) at the break between segments M10A and M10B are high enough that only high level floods will access the terraces on which the old railbed runs.

Landowner preferences and the gated access off Rte. 302 at the downstream end of this reach allow pedestrian and non-motorized access to the old Montpelier-Wells River railbed, but the Cross-Vermont recreational trail runs along Rte. 302 here rather than the old railbed and there is no access across the Wells River since the old rail bridge is gone. Due to distance from the stream and the amount of vegetation, it was not clear how elevated the old railbed is in segment M10B and how much floodplain access might be gained by lowering the elevation or removing the old railbed.

Primary Stressors:

- Rte. 302 (Scott Hwy.) encroachment in M10B cuts off floodplain access in all but the highest level floods, old railbed reduces floodplain access in both segments
- Straightening (>50% of segment length) largely related to extensive encroachment from both road and railbed

- Legacy of dam presence: sedimentation upstream of Boltonville dam heightens influence of glacial Lake Hitchcock fines (lake sands), possibly exacerbated by historic gravel mining
- Restriction of access to historic floodplains (incision ratio 1.3), additional older incision evident in presence of high terraces

Table 7. M10 Projects and Practices Table – Wells mainstem

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M10-A	Protect River Corridors	Next Highest	Medium	Y	Attenuation asset for watershed (stormwater and urban) changes upstream. Previous contacts made; follow up. Full benefit only if old RR abutments removed
M10-A	Remove/ Replace Structures	Very High	Very High	Y	Would open floodplain access; important to keep buffers intact as could also increase erosion possibilities due to incision and high terraces
M10-B	Protect River Corridors	Next Highest	Next Highest	Y	Passive to start - unclear of elevation of old railbed off left bank; explore opportunities for removal or lowering, may reduce pressure on Rte. 302
M10-B	Stream Buffers	Medium	Low	Y	Create set-aside for natural regeneration, or low-cost planting along Rte. 302 upstream of segment break (old RR abutments)
M10-B	Remove/ Replace Structures	Very High	Very High	Y	Possibly lower railbed approach as well, would open floodplain access; important to keep buffers intact

6.1 Reach M11 - Wells mainstem from ~0.1 mi downstream of easterly Creamery Rd.-Scott Hwy. (Rte. 302) junction to confluence with Scott Brook, just downstream of Church St. bridge in South Ryegate village

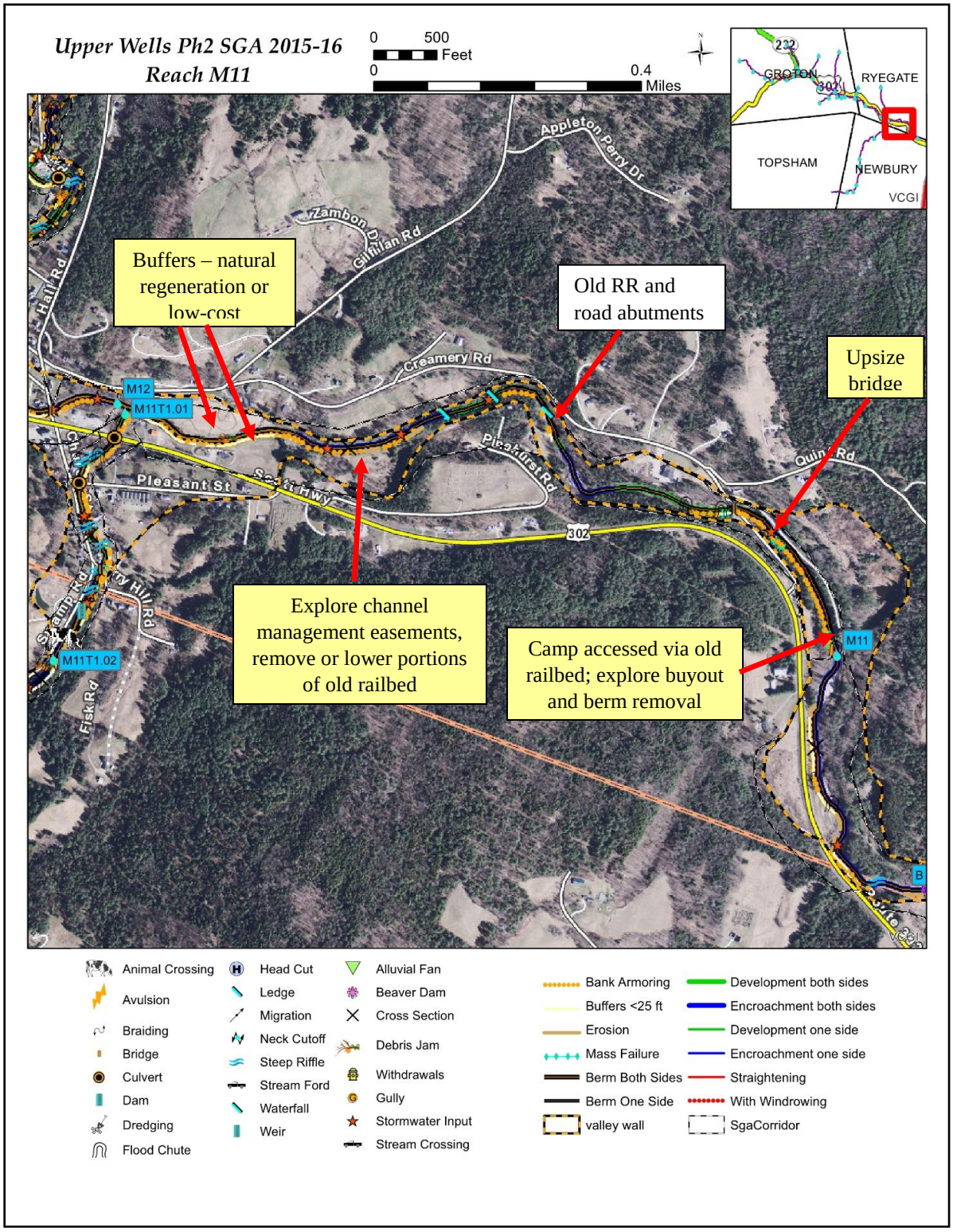


Figure 30. M11 Reach map - Wells mainstem

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M11	7,123	C	none	Gravel	Riffle-Pool	Narrow

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M11-0	7,123	B	c	Gravel	Riffle-Pool	Narrow
	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
	Fair	High	1.8	III	F	C to B

Reach M11 is a relatively confined reach flowing from South Ryegate village below the Pinehurst Cemetery and through the downstream Creamery Rd. bridge. These factors and the presence of the old railbed that formerly crossed the Wells mainstem in the middle of this reach (Fig. 31), as well as a former road whose bridge abutments also remain along the stream very close to the old rail bridge abutments, all add to the confinement of the valley in lower level floods, though the height of most of the encroachments may be overtopped in highest level floods.



Figure 31. Old railroad bridge abutment and development encroaching on the river corridor in reach M11

A large mass failure just upstream of the Creamery Rd. bridge (Fig. 32) is indicative of the increased stream power generated as the river gets squeezed through this reach and

likely contributed some of the coarser sediments being distributed though segment M10B in recent floods. Valley wall collapses such as this are a vivid illustration of the reasons for keeping development out of harm's way along the river corridor.



Figure 32. Mass failure just upstream of the Creamery Rd. bridge east of South Ryegate village indicates elevated stream power in reach M11 and contributes sediments being distributed downstream into segment M10B.

Primary Stressors:

- Straightening primarily by virtue of extensive encroachment: old railbed, roads, development
- Old abutments from both railroad and a discontinued road, Creamery Rd. bridge constriction at DS end of reach
- Restriction of access to historic floodplains (incision ratio 1.8)

Table 8. M11 Projects and Practices Table – Wells mainstem

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M11-0	Protect River Corridors	Very High	Medium	Y	Primary assets upstream of Pinehurst Cemetery and downstream of Creamery Rd bridge, but incision means floodplains are difficult to access at this point.
M11-0	Stream Buffers	Medium	Medium	Y	Create set-aside for natural regeneration downstream of Scott Brook confluence, downstream of old RR abutments mid-reach; planting better in conjunction with addressing old RR bed
M11-0	Remove/ Replace Structures	Medium	Medium	Y	Creamery Rd bridge 70 pct. bankfull width, biggest gains. Old RR and road abutments gain limited floodplain without addressing old railbed, and even then most of this reach is relatively confined naturally
M11-0	Restore Incised Reach	Next Highest	Low	N	Low priority due especially to hydrologic (stormwater) changes. May be opportunities to address lowering old railbed, primary foci upstream of Pinehurst Cemetery and downstream of Creamery Rd bridge. Downstream of Creamery Rd bridge a short berm adds to railbed height by seasonal camp.
M11-0	Watershed Strategies	Next Highest	Very High	Y	Municipal corridor protection, bridge and culvert prioritization and capital planning

6.1 Reach M12 - Wells mainstem from confluence with Scott Brook, just downstream of Church St. bridge in South Ryegate village, to old railroad bridge abutments near stonesheds at west end of South Ryegate village

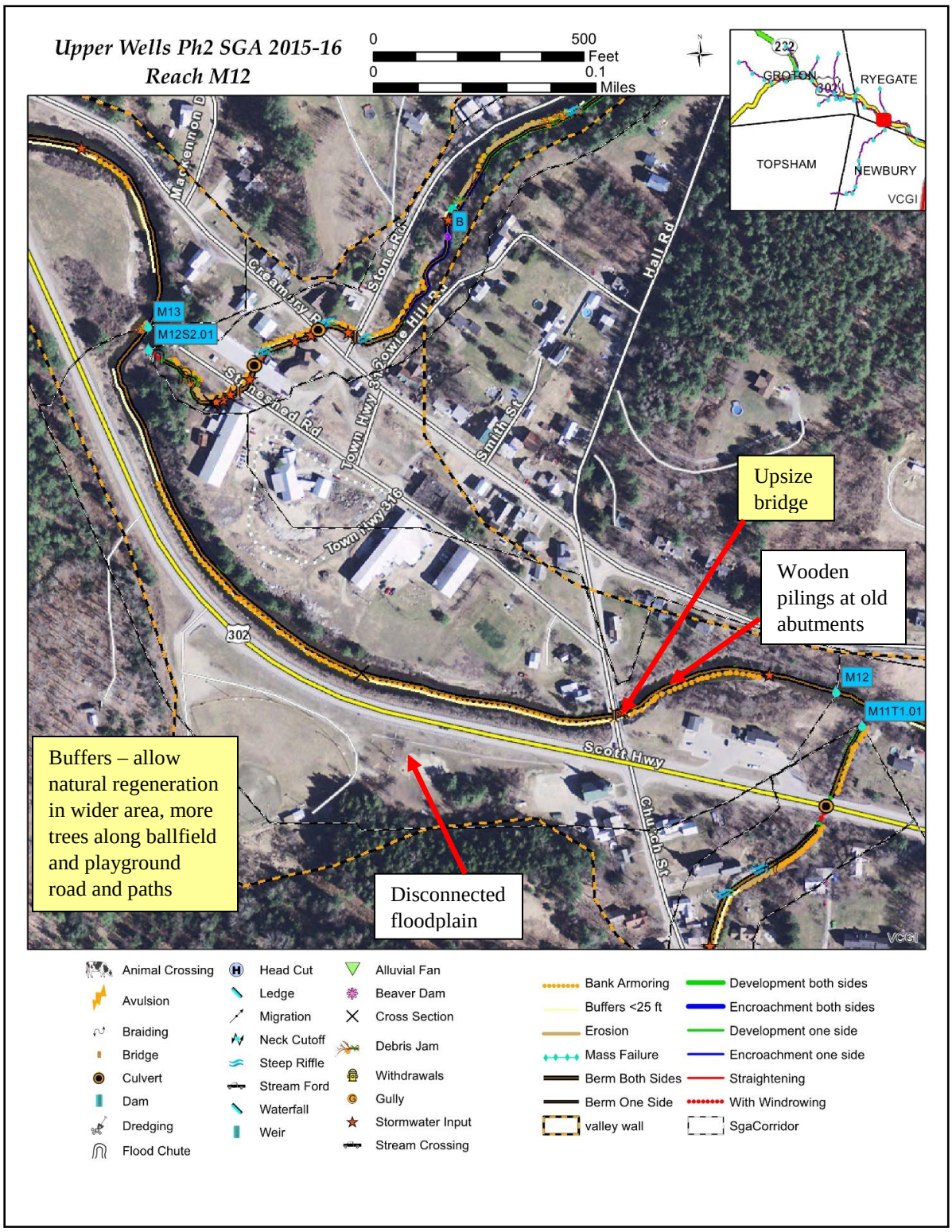


Figure 33. M12 Reach map - Wells mainstem

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M12	2,266	C	none	Gravel	Riffle-Pool	Broad

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M12-0	2,266	C	none	Gravel	Plane-bed	Narrow
	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
	Fair	Very High	1.4	III	F	none

Reach M12 in South Ryegate village is a highly visible example of the degree to which Rte. 302 (Scott Hwy.) and the old Montpelier-Wells River railroad bed restrict access to the historic floodplains of the Wells River. While the right valley wall technically lies behind the ball fields on the south side of Rte. 302 (additionally excavated for sand and gravel), the highway is 8-9 feet height above water throughout the reach and makes it nearly impossible for the river to access these historic floodplains except in the highest level floods (which did not include Tropical Storm Irene in 2011). The old railbed is now Stoneshed Rd. and old railroad bridge abutments are prominent at the upstream end of this road (and reach M12) near the stonesheds, and visible but less prominent behind the Post Office just downstream of the Church St. bridge. The terraces along the old railbed (on which the stonesheds, post office and Alley's Market are located) are at a similar elevation to Rte. 302, and both banks of the river are almost entirely lined with waste granite and other stone in reach M12. This combination of confinement and straightening serves to greatly increase impacts passed downstream in high water events.




Figure 34. Rte. 302 (left) and stonesheds along the old railbed (right) are high enough above the river that historic floodplains in reach M12 are only accessed in highest level floods.

Primary Stressors:

- Straightening by virtue of extensive encroachment (old railbed, roads, development) and near continuous heavy bank armoring
- Old railroad bridge abutments (two sets – upstream Stoneshed Rd., downstream Church St. bridge); Church St. bridge constriction at DS end of reach
- Restriction of access to historic floodplains (incision ratio 1.4)

Table 9. M12 Projects and Practices Table – Wells mainstem

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M12-0	Stream Buffers	Next Highest	Low	Y	Protect wider set-aside for natural regeneration, low-cost plantings thru much of reach; narrow buffers present, parent sources exist
M12-0	Remove/ Replace Structures	Next Highest	Low	Y	Wooden pilings on left bank below Church St. bridge non-functional but limited gains from removal; Church St. bridge 88 pct. bankfull width, also limited gains
M12-0	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, stormwater management (from Stone Rd Brook)

6.1 Reach M13 - Wells mainstem from old railroad bridge abutments near stonesheds at west end of South Ryegate village to ~0.1 mi upstream of disconnected oxbow beaver wetlands along Brown Dr.

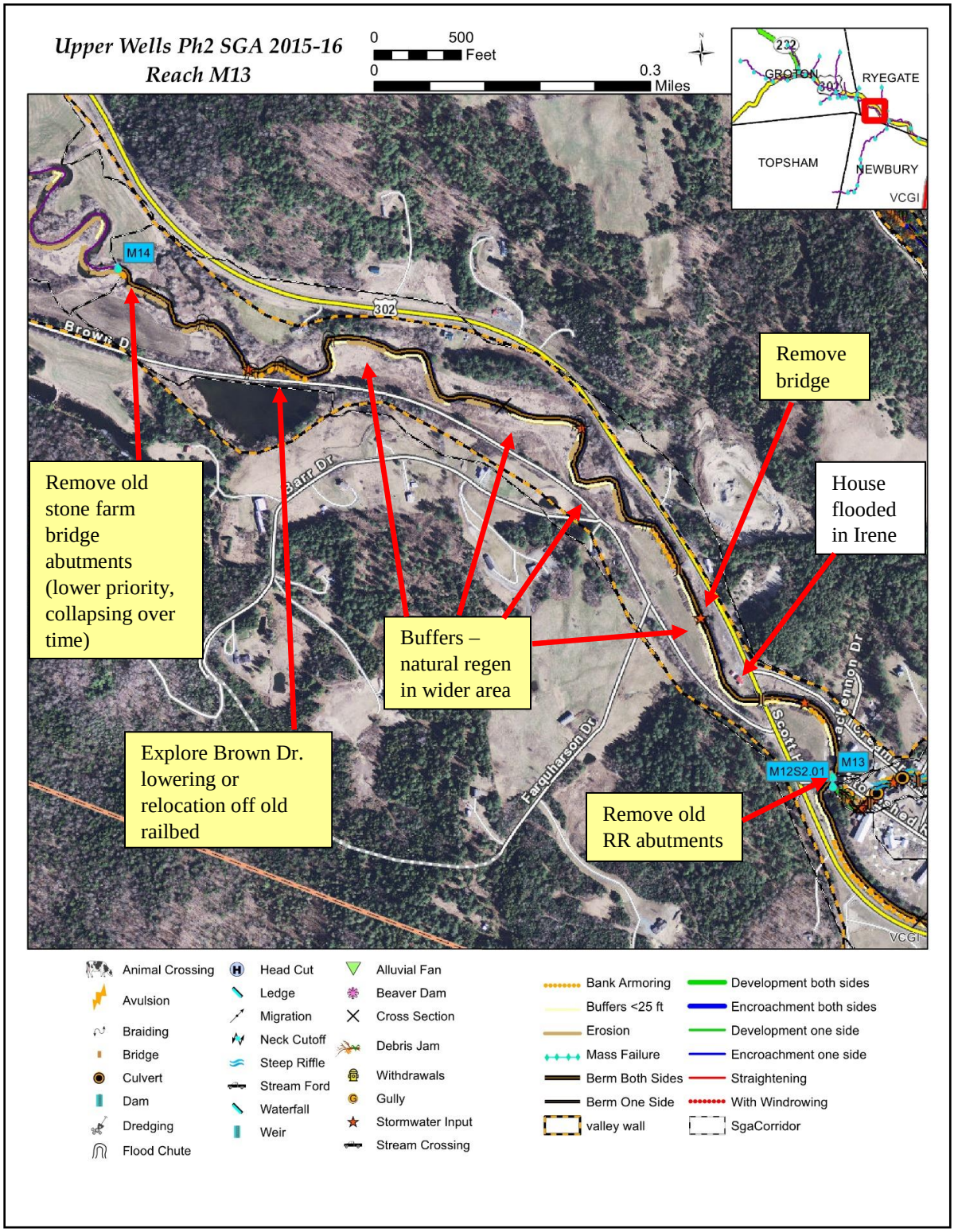


Figure 35. M13 Reach map - Wells mainstem

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M13	6,361	E	none	Sand	Dune-Ripple	Broad

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M13-0	6,361	C	none	Sand	Dune-Ripple	Narrow
	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
	Fair	Extreme	1.1	III	F	E to C

Wells mainstem reach M13 is situated in a portion of the valley that grows increasingly constricted from upstream to downstream, pinched between Rte. 302 (Scott Hwy.) along the left valley wall and the old railroad bed (now Brown Dr.) that restricts access to historic floodplains off the right bank in lower level floods. The stream here flows through agricultural fields with alder-lined banks and interspersed scrub-shrub wetlands that may indicate conversion of formerly more widespread wetlands to agriculture, but there were no indications of field drainage tiles and drainage ditching is not widespread. It is more likely that hayfields are located on well drained glacial Lake Hitchcock legacy sands, with pasture and scrub shrub wetlands located on interspersed finer silty loams.

With fine substrates prevalent throughout the reach, Extreme sensitivity to elevated flows was reflected in both widespread bank erosion and deep but transient scour pools downstream of channel constrictions and flood chute stream entry points. These dynamics were particularly evident at the top of the reach where old stone abutments likely related to a former bridge were toppling into the stream but still creating enough of a constriction to funnel flows and create scour pools upstream and downstream of the constriction (Fig. 36). Although this structure would ideally be removed it was considered low priority due to high likelihood that it will collapse on its own in the relatively near future, and associated stream dynamics do not appear to conflict with evolution toward a more stable planform and depth.



Figure 36. Extreme sensitivity to high flows due to fine substrates was evident at this old bridge abutment at the upstream end of reach M13: scour pools were noted both upstream and downstream of this channel constriction while a mid-channel bar just downstream was growing into an island with further deposition over time.

Downstream of an inactive but intact bridge across the Wells that appears to be a former extension of Farquharson Rd., the floodplain briefly becomes increasingly accessible on both banks before the river passes under the Rte. 302 bridge at the upstream end of Creamery Rd. where the floodplain becomes less accessible again. With better floodplain access there is a striking reduction in erosion along the banks in this area, despite a relatively thin scrub shrub buffer. The house at the downstream end of this stretch, just upstream of the Rte. 302 bridge, appears to have flooded in Irene.

Primary Stressors:

- Reduction of the effective valley width by lengthy corridor encroachments - primarily Rte. 302 and old railbed (now Brown Dr.) as well as more localized channel constrictions at old bridge abutments and two bridges
- Loss of planform (few meanders present) due to channel straightening related to the corridor encroachments and effects of channel constrictions

Table 10. M13 Projects and Practices Table – Wells mainstem

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M13-0	Protect River Corridors	Very High	Very High	N	Extremely sensitive reach, attenuation asset. Full benefit only if old bridge abutments removed. Retain post-Irene guidance for landowners for buyout and elevation options if needed in future.
M13-0	Stream Buffers	Very High	Very High	Y	Protect wider set-aside for natural regeneration; some buffers present, parent sources exist
M13-0	Remove/Replace Structures	Very High	Very High	Y	Bridge below Farquharson Rd. not functional: more substantial, higher priority; old stone abutments at US end of reach are lower priority, collapsing over time but remain a constriction
M13-0	Restore Incised Reach	Next Highest	Next Highest	N	Passive; increases value of buffers and attenuation assets in M10 due to likelihood of erosion as stream evolves. Brown Rd. (built on old RR bed) and Rte. 302 constrain, but more meanders can develop
M13-0	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, stormwater management

6.1 Reach M14 - Wells mainstem from ~0.1 mi upstream of disconnected oxbow beaver wetlands along Brown Dr. to ~0.1 mi upstream of Ryegate-Groton town line (mouth of Darius James Brook that empties downstream of electrical substation on Rte. 302)

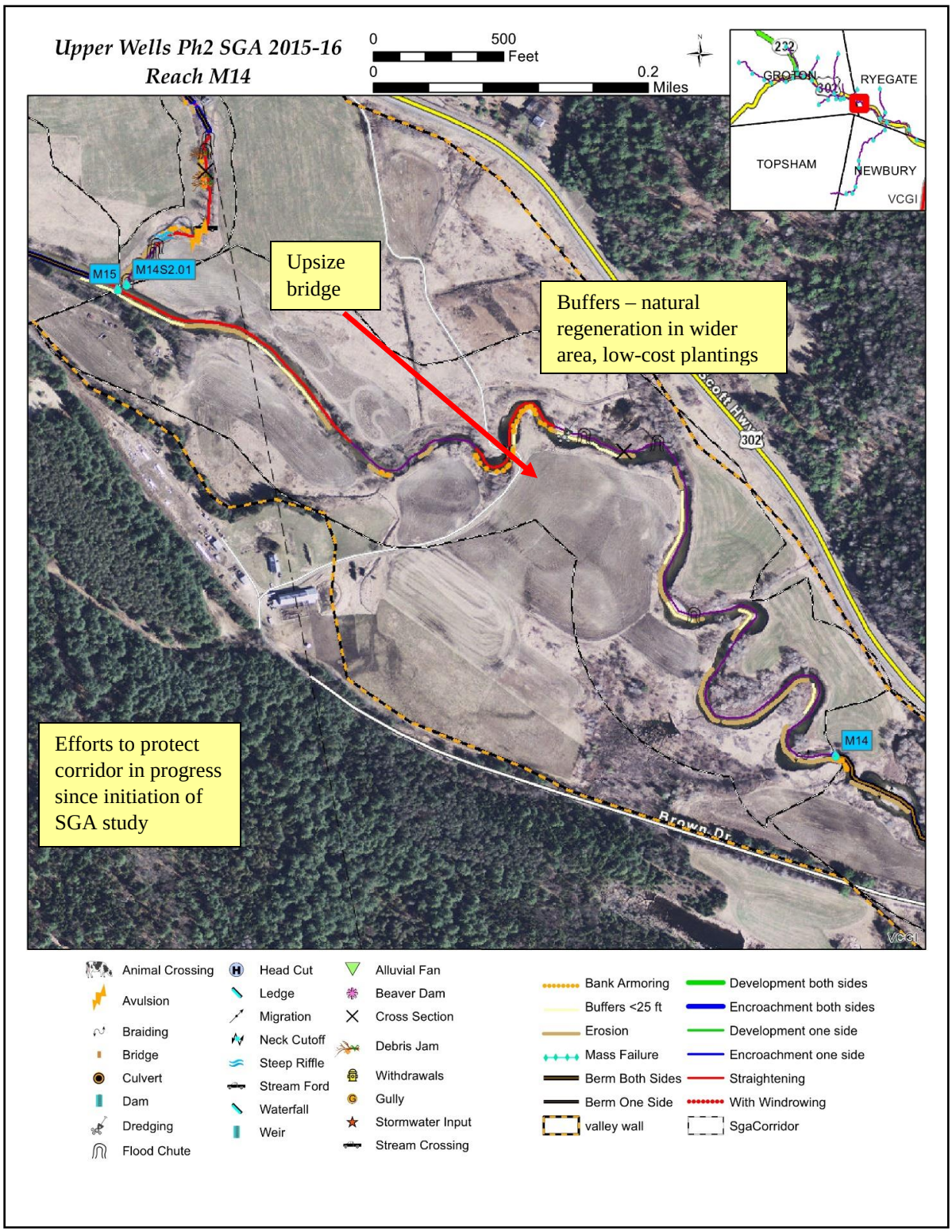


Figure 37. M14 Reach map - Wells mainstem

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M14	5,138	C	none	Gravel	Riffle-pool	Very Broad

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M14-0	5,138	C	none	Gravel	Riffle-pool	Very Broad
	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
	Fair	Very High	1.5	III	F	none

Reach M14 flows through the broadest portion of the Wells mainstem valley assessed in 2015, with Rte. 302 and the old Montpelier-Wells River railbed more distant from the river than in almost any other portion of the mainstem as well. The reach is mostly occupied by a single dairy farm, with one bridge crossing the Wells representing the only development within the river corridor (the farm buildings are located on higher terraces distant from the river channel). The channel is moderately incised (more so than reaches immediately upstream and downstream) and dominated by glacial Lake Hitchcock sediments (fine sands and silty loams), and erosion is common along the banks. The silt component appears to be sufficiently cohesive that the banks typically slump rather than completely collapsing. Buffers almost always meet or exceed 35 ft. minimum widths but are frequently composed of a single row of trees mixed with shrubs, or just shrubs, leaving the banks open to heightened erosion if trees are undercut and tip in. The limited rooting zone of herbs and shrubs in the buffer is often evident in these eroded areas, increasing soil loss, but the slumping banks are currently the primary mechanism for establishing better floodplain access in this area; a notable lack of woody debris throughout the mainstem Wells channel leaves limited other means for rebuilding floodplain access.

The old railbed along the southern valley wall of reach M14 abuts the Pine Mountain Wildlife Management Area, and there were numerous signs and teeming wildlife activity noted along the river corridor during assessment.

After the initiation of the geomorphic assessment documented here and previous to the completion of the report efforts to protect the river corridor along reach M14 and downstream portions of reach M15 were initiated that (if completed) will help to allow the channel to evolve toward a more stable planform and floodplain relationship.

Primary Stressors:

- Channel constriction at farm bridge mid-reach
- Loss of planform (few meanders present) in upstream portion due to historic channel straightening

Table 11. M14 Projects and Practices Table – Wells mainstem

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M14-0	Protect River Corridors	Next Highest	Very High	Y	In process since SGA was undertaken, data used to inform prioritization
M14-0	Stream Buffers	Next Highest	Very High	Y	Protect wider set-aside for natural regeneration, low-cost plantings thru much of reach; narrow buffers present (technically compliant), parent sources exist
M14-0	Remove/Replace Structures	Very High	Medium	Y	Replace farm bridge; undersized and skewed to stream
M14-0	Watershed Strategies	Low	Very High	N	Stormwater management upstream; corridor here being protected

6.1 Reach M15 - Wells mainstem from ~0.1 mi upstream of Ryegate-Groton town line (mouth of Darius James Brook empties near electrical substation on Rte. 302) to mouth of Keenan Brook (between east end Little Italy Rd. and end of Cemetery Rd. off Rte. 302)

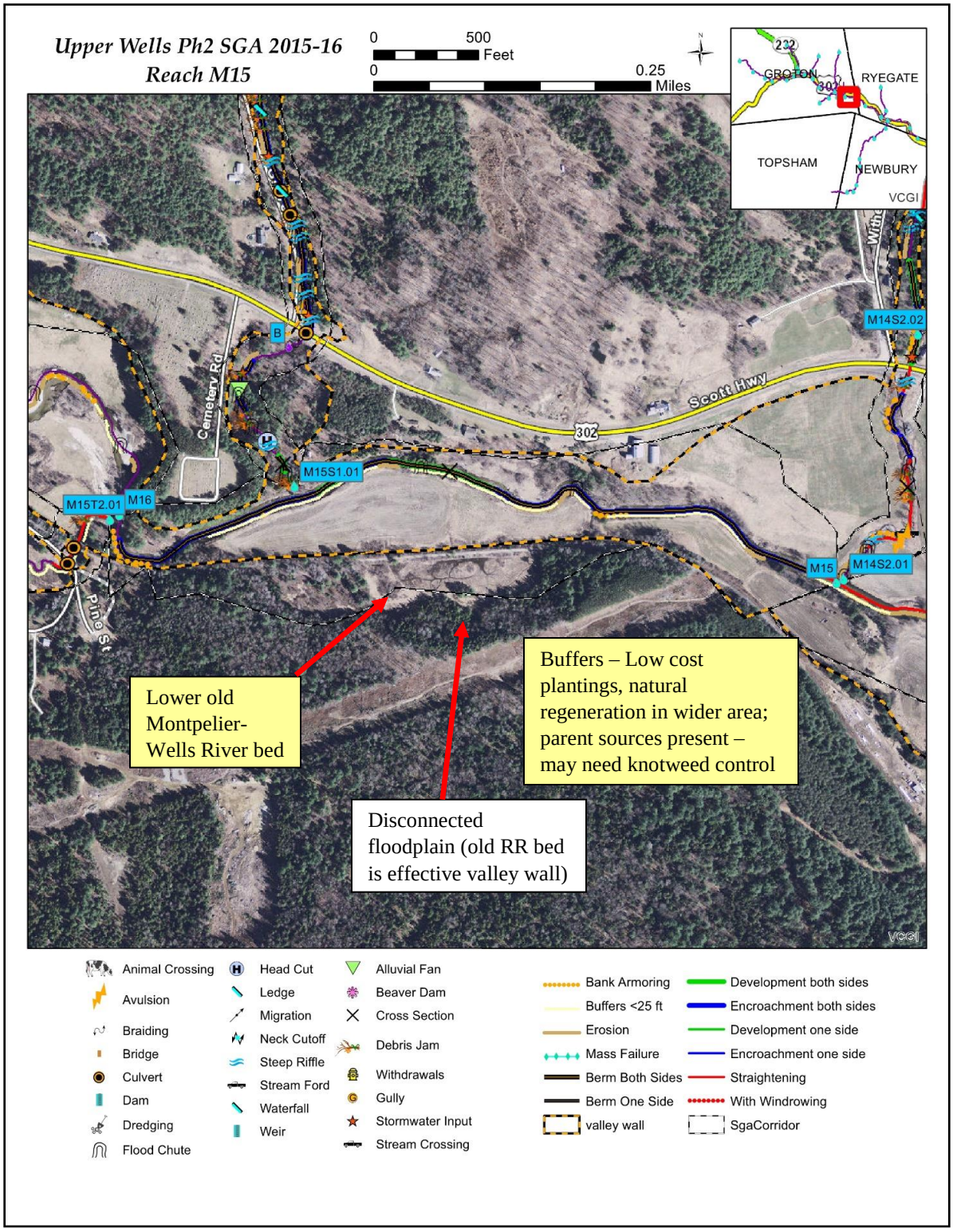


Figure 38. M15 Reach map - Wells mainstem

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M15	3,938	C	none	Gravel	Riffle-Pool	Broad

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M15-0	3,938	C	none	Gravel	Riffle-Pool	Narrow
	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
	Fair	Very High	1.2	III	F	none

Reach M15 is located in a relatively constricted portion of the Wells mainstem valley naturally, and the elevated railbed of the old Montpelier-Wells River further reduces the valley and effective floodplain widths. A disconnected oxbow wetland complex retained behind the railbed along the right valley wall in the mid-section of the reach (Fig. 38) is emblematic of this dynamic, and the channel in this reach shows signs of this straightening contributing to enhanced sediment transport in and through the reach in recent flood events. Significant stretches of featureless plane bed (Fig. 39) were accompanied by occasional sediment slugs at tributary mouths, transient mid-channel and side bars, and large point bars at pronounced bends.



Figure 39. Typical stretch of relatively featureless plane bed in reach M15, indicative of elevated sediment transport in and through this straightened reach disconnected from much of its former floodplain by the elevated railbed of the old Montpelier-Wells River Railroad.

The Groton Village Cemetery (Cemetery Rd. off Rte. 302) is located on a high lake sediment terrace along the left valley wall at the head of the reach, and this glacial legacy formation combines with the railbed that separates the Wells mainstem from the formerly shared floodplain at the mouth of Keenan Brook along the right valley wall to create a valley pinch point that funnels flows into the remainder of the reach.

In fact, the railbed (and now parts of Little Italy Rd.) appears to disconnect the Wells mainstem from part of a large floodplain shared with the confluences of several streams (Keenan Brook, East Brook, Tannery Brook, Clark Hatch Brook, and an unnamed tributary) that converged in an enlarged portion of one of the upper arms of glacial Lake Hitchcock (Fig. 40). This disconnection from former floodplain contributes to a marked increase in stream power and elevated sediment transport.

Primary Stressors:

- Straightening and planform loss due to extensive encroachment of elevated railbed along right valley wall and historic channel management practices
- Fine sediments due to legacy of glacial Lake Hitchcock

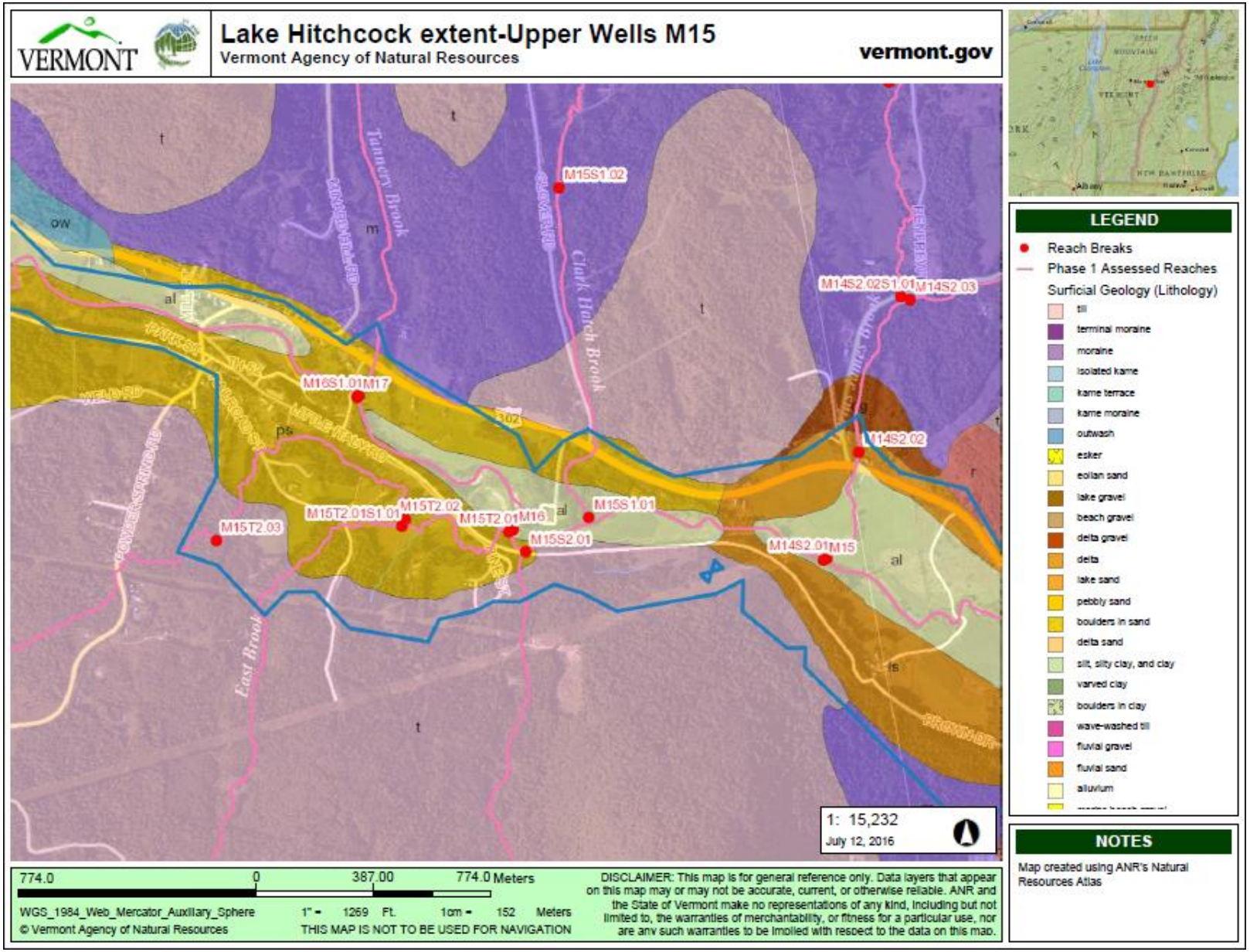


Figure 40. Approximate extent of glacial Lake Hitchcock (blue line) and lake-related sediments (pebbly sands-ps, lake sands-ls) indicate that the railroad bed has disconnected the Wells mainstem from much of its former floodplain in the vicinity of reach M15 confluence with the mouths of Keenan, East, and Tannery Brooks.

Table 12. M15 Projects and Practices Table – Wells mainstem

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M15-0	Protect River Corridors	Very High	Very High	Y	In progress since SGA was undertaken, corridor here in motion toward being protected
M15-0	Stream Buffers	Next Highest	Very High	Y	Protect wider set-aside for natural regen thru much of reach; narrow buffers present (technically compliant), parent sources exist; active adjustments reduce reach priority
M15-0	Remove Berms	Very High	Medium	N	Lower old railbed to reconnect floodplain behind it; efforts to protect corridor in progress
M15-0	Restore Incised Reach	Very High	Medium	N	Passive with active component of railbed lowering; not deeply incised

6.1 Reach M16 - Wells mainstem from mouth of Keenan Brook (between east end of Little Italy Rd. and end of Cemetery Rd. off Rte. 302) to mouth of Tannery Brook at end of Tannery Brook Rd.

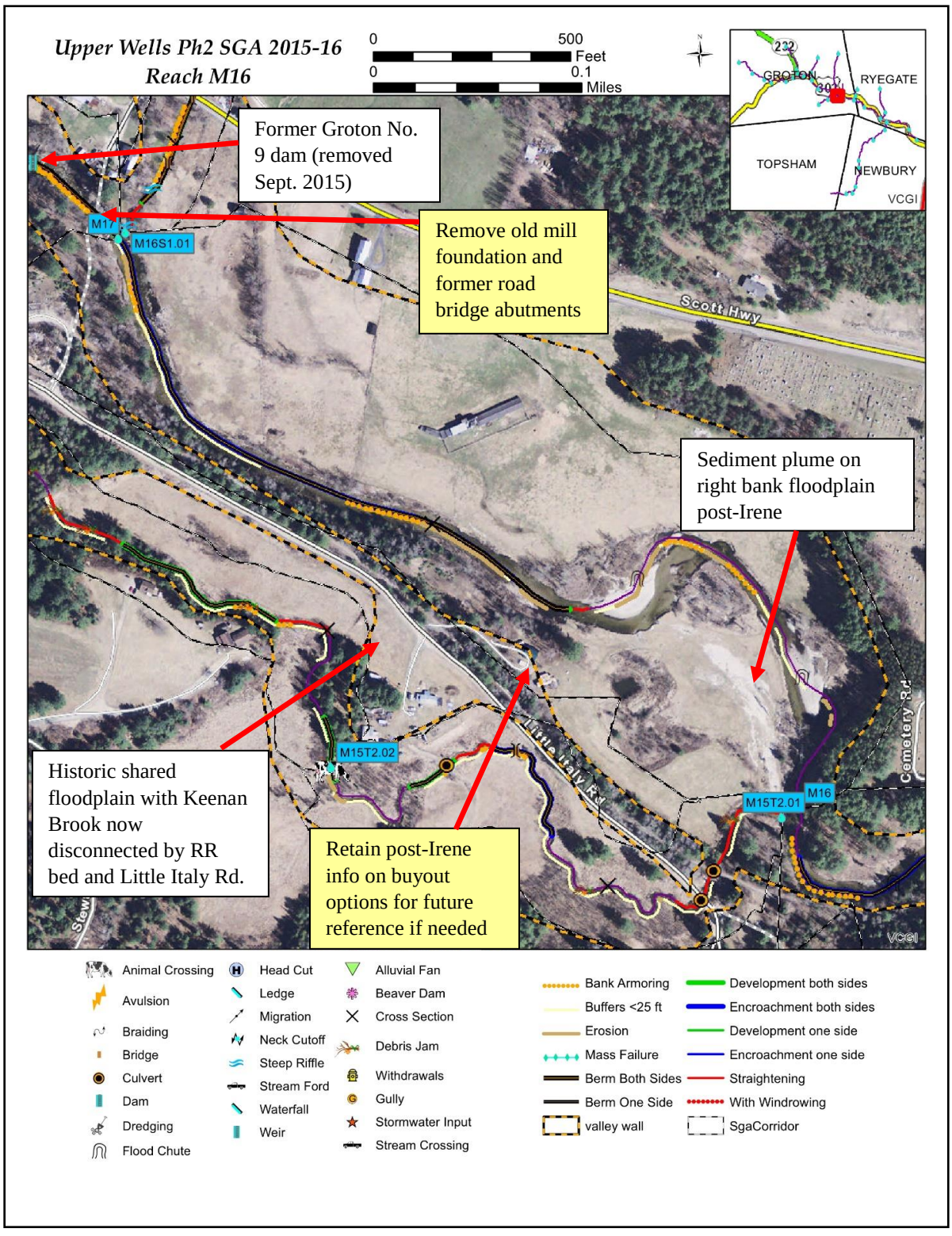


Figure 41. M16 Reach map - Wells mainstem

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M16	2,852	C	none	Cobble	Riffle-Pool	Broad

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M16-0	2,852	C	none	Cobble	Riffle-Pool	Broad
	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
	Fair	High	1.4	III	F	none

Wells mainstem reach M16 is located downstream of historically dammed and industrialized portions of the Wells River in Groton village and exhibits ongoing channel adjustments related to funneled flows redistributing formerly impounded sediments downstream. The Groton No. 9 dam, formerly located immediately upstream in reach M17 and removed in September 2015, was a substantial contributor to the funneling of flows and its removal is likely to contribute further sediments for redistribution for some years to come. Significant stretches of featureless plane bed, interspersed with incipient riffle formations and punctuated by sediment slugs in the form of large point and midchannel bars (Fig. 42), were found throughout the length of reach M16.

Similar to reach M15, the old Montpelier-Wells River rail bed and Little Italy Rd. form a new right valley wall in this reach, further contributing to funneling of high flows, and cutting off the formerly much wider valley and floodplain shared with portions of Keenan and East Brooks, which now lie behind the rail and road beds. The cumulative straightening of the reach likely contributed to a temporary channel avulsion and sediment dump on the right bank floodplain in Irene, with the sediment plume still evident in May 2012 aerial photography (Fig. 41).



Figure 42. Large point bar typical of sediment redistribution unfolding in reach M16.

In addition to the presence of the former Groton No. 9 dam, flows are funneled into reach M16 through an old carding mill and saw mill that were present historically at the head of the reach, at the confluence with Tannery Brook (reach M16S1.01; Fig. 43). The Groton No. 9 dam was present only from 1909-1927 so does not appear on Beers Atlas 1875 (Fig. 43), and was not repaired after damage in the 1927 flood so does not appear on any historical maps located for this assessment (next topos 1935; UNH Dimond 2016).

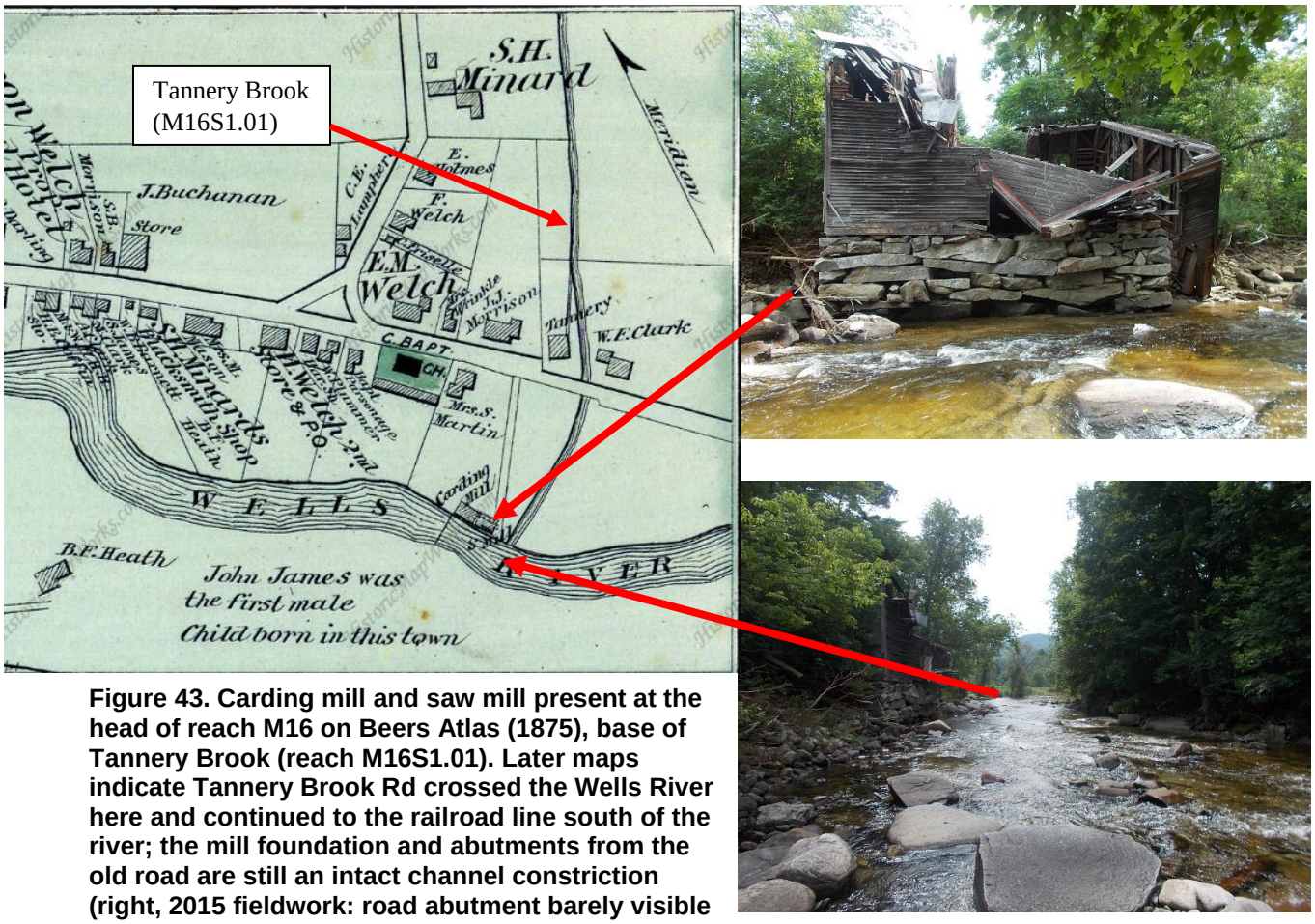


Figure 43. Carding mill and saw mill present at the head of reach M16 on Beers Atlas (1875), base of Tannery Brook (reach M16S1.01). Later maps indicate Tannery Brook Rd crossed the Wells River here and continued to the railroad line south of the river; the mill foundation and abutments from the old road are still an intact channel constriction (right, 2015 fieldwork: road abutment barely visible at right of lower picture).

The extreme degree of straightening in reach M16 and into reach M15 is difficult to remedy at this point in time due to limited development on both sides of the elevated railbed, constraining opportunities that might exist to access historic shared floodplains through lowering of the railbed.

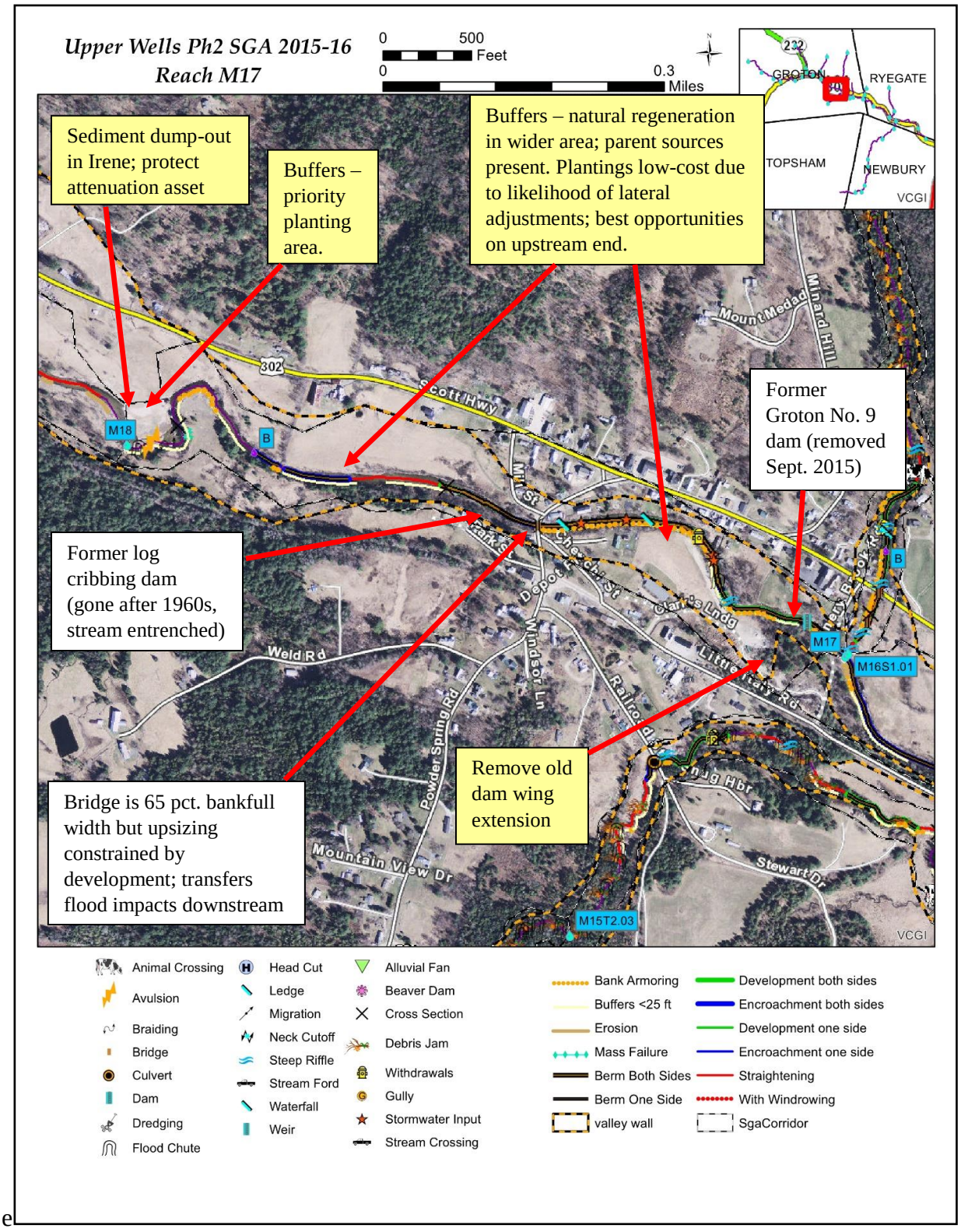
Primary Stressors:

- Straightening and planform loss due to extensive encroachment of elevated railbed along right valley wall
- Historic incision related to channel constriction and former dams at head of reach: pulse flows and "hungry water" with sediment discontinuity due to damming; sediment slugs now being redistributed over time

Table 13. M16 Projects and Practices Table – Wells mainstem

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M16-0	Protect River Corridors	Very High	Medium	N	Retain post-Irene guidance for landowners for buyout options if needed in future (dwelling on riverside of RR bed).
M16-0	Stream Buffers	Next Highest	Medium	Y	Create-protect wider set-aside for natural regen, low-cost plantings if any due to lateral instability; US end in particular
M16-0	Remove/Replace Structures	Very High	Very High	Y	Remove old sawmill foundation and former Tannery Rd bridge abutment (on right bank, side that went to old RR); technically in reach M17 but impacts reach M16
M16-0	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, familiarity with buyout options if-when flooding occurs; occupation of floodplains on both sides of RR bed constrains opportunities for restoring large amount of floodplain thru lowering RR bed elevation

6.1 Reach M17 - Wells mainstem from mouth of Tannery Brook (end of Tannery Brook Rd.) to midway between Weldon Rd. and Powder Spring Rd. (~1800 Scott Hwy.-Rte. 302)



e

Figure 44. M17 Reach map - Wells mainstem

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M17	5062	C	None	Cobble	Riffle-Pool	Broad

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M17A	3800	B	c	Cobble	Riffle-Pool	Narrow
M17B	1262	C	None	Gravel	Riffle-Pool	Very Broad

	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
M17A	Fair	High	2.1	III	F	C to B
M17B	Fair	Very High	1.0	V	F	none

Wells mainstem reach M17 is mostly located in a formerly substantially industrialized portion of Groton village, with at least two dams formerly located within the reach now gone (there may have been additional dams at the old grist and saw mills at the downstream end of the reach-see reach description for M16 above). The reach was segmented primarily due to depositional features related to a major sediment dump-out in the much wider valley present in the upstream (segment M17B) portion of the reach.

The sediment dump-out in M17B lies downstream of a highly straightened portion of the Wells, featuring low berms on both sides of the stream downstream of the formerly undersized Welton Rd. bridge (replaced and upsized 2013). Google Earth historical imagery starting in May 1998 indicates sediment deposition here that likely contributed to a channel avulsion initiated in 1996 and 1997 floods, which continued to unfold over a series of subsequent floods. May 2012 aerial imagery indicates that floodwaters in Irene deposited sediment across a broad portion of the floodplain in this segment. This area represents a high-value attenuation asset with few encroachments, located upstream of a relatively densely developed portion of Groton village and downstream of a highly

straightened portion of the river that emphasize benefits of protection for both flood resiliency and stream stability.

Downstream of the channel avulsion area comprising segment M17B, a high berm off the right bank combines with the naturally encroaching right valley wall approaching the village, contributing to a significantly narrower valley that funnels the Wells River into the formerly industrialized portion of Groton village. Soil maps indicate gravel pits behind this berm, although there do not appear to be any active pits at this time. It may be this area was mined for material for the old railroad bed and surrounding roads; during fieldwork we questioned whether there may have been a railroad spur line in close proximity to the river along Park St, but found no evidence of this with clear enough resolution on historical maps to back this conjecture. Regardless of whether there was a spur line here, the right bank is very high along Park St. and effectively forms a valley pinch point just upstream of the Powder Spring Rd. bridge where a log cribbing dam was in place at least as late as the mid-1960s (Fig. 45).



Figure 45. Log cribbing dam upstream of the Powder Spring Rd. bridge in segment M17A was present into at least the 1960s (photo courtesy UVM Landscape Change Program).

With the log cribbing dam gone, the stream is quite entrenched in this area. Although removal of the berm on the upstream end of this area might permit meander redevelopment and eventually allow for floodplain access to redevelop at a lower elevation, this alternative requires careful analysis: the berm is relatively vegetated at this point and may in fact be keeping the stream from accessing an old sand or gravel pit.

Remains of the former Groton No. 9 dam in the downstream portion of reach M17 (segment M17A) were removed in late summer 2015 after the geomorphic assessment reported here had been conducted. Historic researcher Hugh Henry was compiling impressive documentation of the area including the large impoundment that extended across much of Clark's Landing when the dam (including a side wing extension) was

intact (1908-1927). Removal of this side wing extension would permit greater floodplain access but would also entail impacting a well-established buffer (Fig. 46).



Figure 46. Earthen dam now largely covered with trees was part of a dam wing extension that appears to have impounded the Wells River across much of Clark's Landing when the Groton No. 9 dam was intact. In conjunction with preparations for dam removal in 2015, historian Hugh Henry was documenting much of this history for Green Mountain Power Company during fieldwork for this project; the layout was hard to recognize without his pictures and background.

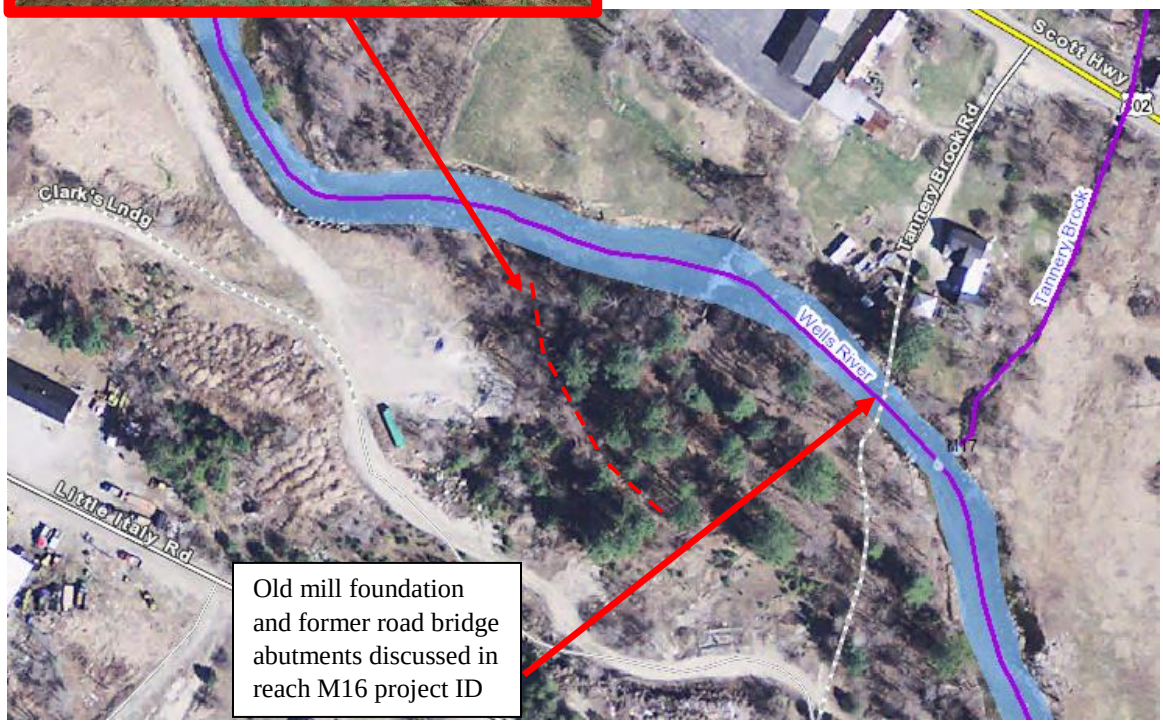


Table 14. M17 Projects and Practices Table – Wells mainstem

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M17-A	Stream Buffers	Next Highest	Medium	Y	create-protect wider set-aside for natural regeneration, low-cost plantings if any due to lateral instability; upstream end in particular
M17-A	Remove Berms	Very High	Very High	N	Remove old dam wing extension by Groton No. 9 (may have issues connected with dam removal permitting). Berm on upstream end of segment may restrict stream access to former gravel pit, needs further analysis; lower priority
M17-A	Remove/Replace Structures	Medium	Medium	N	Powder Spring Rd bridge is 65 pct. bankfull width but replacement is severely constrained by surrounding development; currently increases flood impacts downstream
M17-A	Restore Incised Reach	Very High	Very High	N	Further analysis of berm removal projects and constraints. High priority corridor protection for attenuation downstream, now in process in M14 and M15
M17-A	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, stormwater management
M17-B	Protect River Corridors	Very High	Very High	Y	High value attenuation asset upstream of village and downstream of straightened area
M17-B	Stream Buffers	Very High	Very High	Y	Priority planting area

6.1 Reach M18 - Wells mainstem from midway between Weldon Rd. bridge and Powder Spring Rd. bridge (~1800 Scott Hwy.-Rte. 302) to mouth of North Branch at Branch Brook Rd. (aka Fred Hayes Rd.)

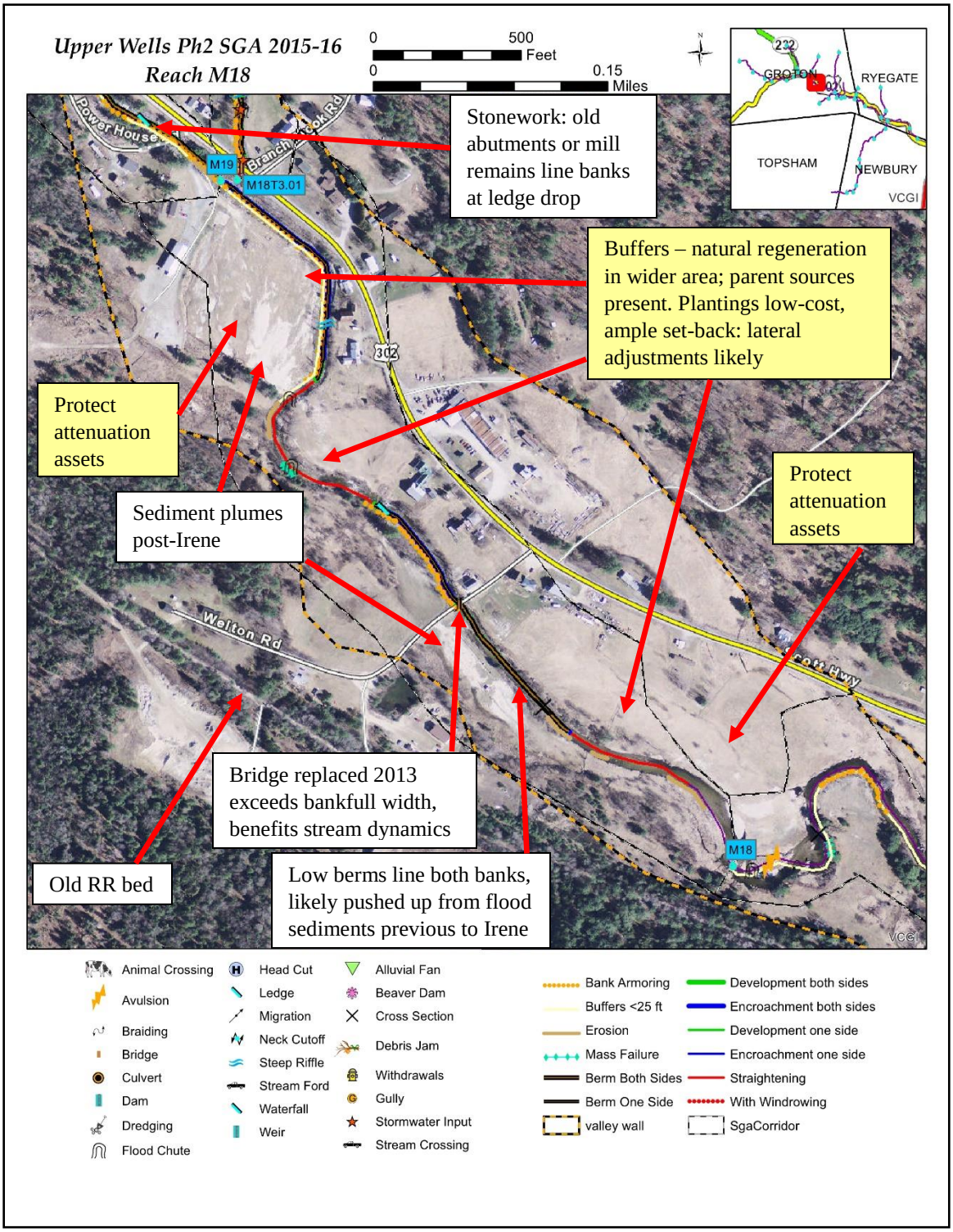


Figure 47. M18 Reach map - Wells mainstem

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M18-0	3334	C	None	Cobble	Riffle-Pool	Very Broad

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M18-0	3334	C	None	Cobble	Riffle-Pool	Broad
	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
M18-0	Fair	High	1.0	III	F	none

Reach M18 is situated in a relatively broad portion of the Wells mainstem valley and marks the upstream extent of glacial Lake Hitchcock in the Wells basin. The attendant soils associated with the legacy of Lake Hitchcock provide the foundation for significant agricultural use in this reach, which diminishes in extent and intensity upstream of this reach. Although Scott Hwy. (Rte. 302) is directly alongside the Wells mainstem at the head of the reach, the majority of reach M18 is situated much further from the highway; the highway often effectively forms the left valley wall more by virtue of distance from the stream than by absolute elevation.

With a ledge grade control (and stonework that indicates an old road crossing, remains of mill infrastructure, or both; Fig. 48) located just upstream, as well as a pinch point in the Wells mainstem valley, reach M18 appears to have borne the brunt of a "firehose effect" in tropical Storm Irene. Red Brook (M18T3.03S1) and the North Branch of the Wells (M18T3), two of the three largest tributaries of the Wells, also join the mainstem at the head of this reach and appear to have contributed to a large sediment dump being spread across the floodplain pasture below Power House Rd in Irene (Fig. 47).





Figure 48. Three photos of stonework and ledge grade controls (at an old road crossing, mill site, or both) that contributed to a "fire hose effect" that supplemented the discharge from the North Branch to spread a sediment dump across the floodplain pasture at Power House Rd in Irene.



Downstream of the pasture at Power House Rd, the stream flows over another ledge grade control and the elevation of both banks begins to climb toward the Welton Rd. bridge, again serving to funnel flows. The Welton Rd. bridge was replaced in 2013 (and sized a bit above bankfull width, greatly helping stream dynamics and flood resiliency), but aerial imagery indicates the formerly significantly undersized bridge was outflanked and likely contributed to another "fire hose effect" in distributing sediment downstream of the bridge. It is not clear if this had happened historically as well, but low berms along both banks downstream of the bridge appeared to be pushed up from flood materials in fields on either side of channel (not easily seen through tall grass). These berms are likely to still be overtopped in higher level floods (and are not continuous through the reach) but limit access to the floodplain in lower level floods.

Primary Stressors:

- Abutments and/or mill remains at head of reach create "fire-hose effect"
- Straightening (>50% of segment length) related to road encroachment, bank armoring, bridge constriction and berms
- Restriction of access to floodplain (incision ratio 1.2 due to berm presence, not continuous through reach)

Table 15. M18 Projects and Practices Table – Wells mainstem

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M18-0	Protect River Corridors	Very High	Very High	Y	Intermittent attenuation assets at Power House Rd and downstream of Welton Rd bridge, important for mitigating effects of highly straightened reaches upstream
M18-0	Stream Buffers	Very High	Very High	Y	Create-protect wider set-aside for natural regen, low-cost plantings due to likely lateral adjustments
M18-0	Remove Berms	Very High	Very High	Y	Will impact existing buffer but gains likely outweigh impacts
M18-0	Restore Incised Reach	Very High	Very High	Y	High priority corridor protection DS end of reach and into M17B, berm removal; development US in M18 currently constrains possibilities for reducing impacts of extensive straightening
M18-0	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, stormwater management

6.1 Reach M19 - Wells mainstem from mouth of North Branch at Branch Brook Rd (aka Fred Hayes Rd) to mouth of South Branch at L.H. Puffer baseball field

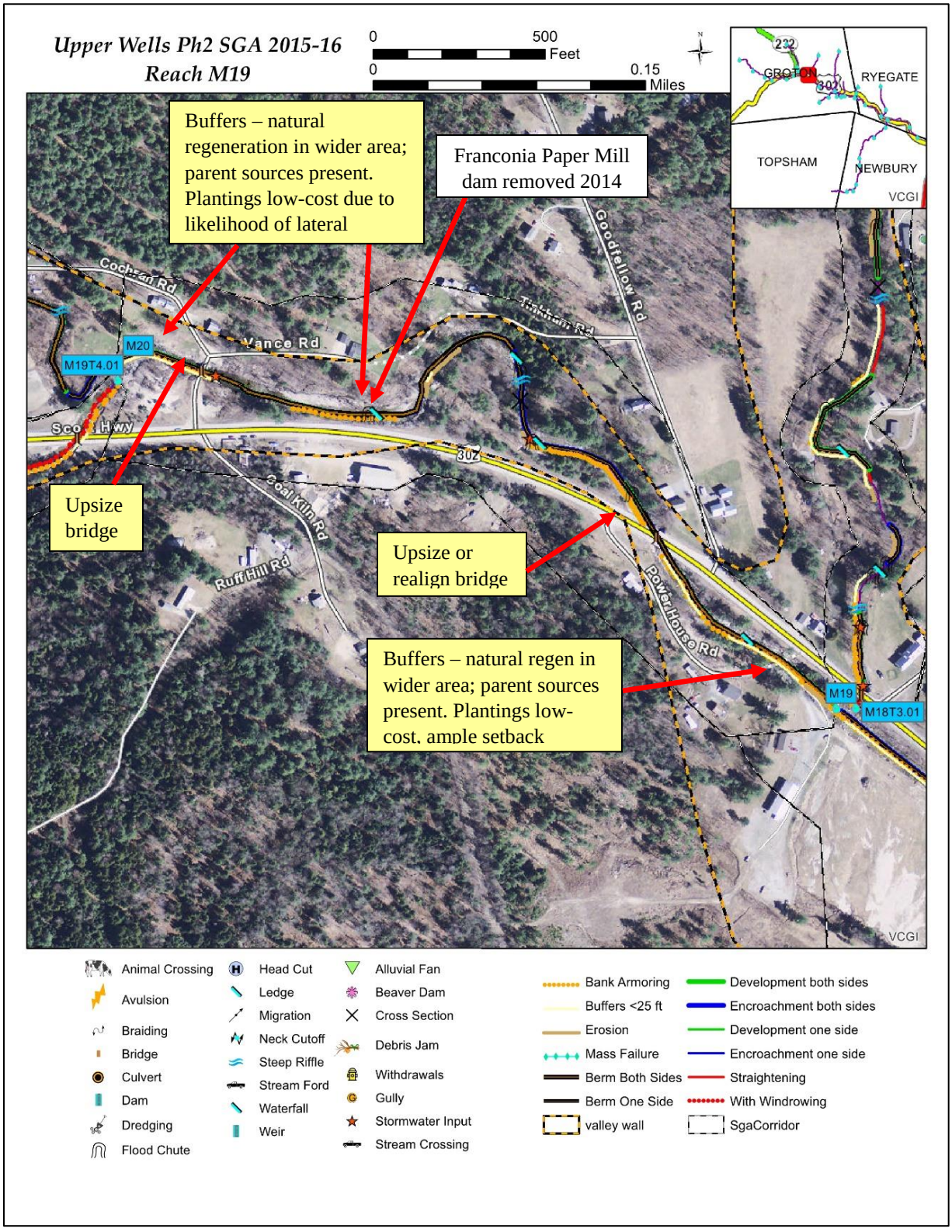


Figure 49. M19 Reach map - Wells mainstem.

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M19-0	2839	C	b	Cobble	Riffle-Pool	Broad

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M19-0	2839	C	b	Cobble	Riffle-Pool	Narrow
	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
M19-0	Fair	High	1.6	III	F	none

Reach M19 may be a disorganized plane bed stream type under reference conditions, with neither steps nor riffles setting up well, ~2.1 pct. channel slope, and long stretches of ledge grade controls. Current conditions show well-formed riffles and occasional steps as well, however. These appear to be primarily due to active adjustments, with sediments being distributed in high flows after removal of the former Franconia Paper Mill dam across from the Groton Town Garage (removal completed in 2014; video at https://www.youtube.com/watch?v=G_Vi6ikMbqk), plus significant sediment discharges from the South Branch (M19T4) following Irene. Substantial straightening appears likely shortly following European settlement, with historic impacts including both a saw mill at the top end of the reach near the confluence with the South Branch and a starch factory in the vicinity of the dam later used by Franconia Paper Company, across from the current Town Garage location (Beers 1875). As noted in the Reach M18 narrative above, there also appear to be old bridge abutments and/or other infrastructure at the downstream end of M19 near Power House Rd. (Fig. 48); water funneling through the Rte. 302 bridge (Fig. 50) and over a considerable ledge drop at Power House Rd. appears to have contributed to a large sediment dump in the upstream end of reach M18 in Irene.



Figure 50. The Wells mainstem is funneled through this Rte. 302 bridge near the downstream end of reach M19, then through old stone bridge abutments and/or old mill infrastructure near Power House Rd. before joining the flow from Red Brook and the North Branch at the top of reach M18.

The state bridge on Rte. 302 (Scott Hwy.) is sized above bankfull, but the angle to the stream reduces the effective width to roughly half of the actual span. The degree of straightening upstream of this structure further contributes to impacts passed downstream. While redistribution of coarse sediments following the 2014 dam removal in this reach is helping re-establish a more stable planform, the amount of historic incision and the slope of this stream segment under reference conditions would likely require the dynamics of large woody debris in the stream to be able to rebuild access to historic floodplains. Sizing structures at an effective width above bankfull width would reduce the chances of these structures plugging in flood situations while accommodating large wood in the stream, a critical piece of establishing long term stream stability and flood resiliency in this section of the Upper Wells basin.

Primary Stressors:

- Undersized bridge at Cochran Rd., significantly reduced effective width at Rte. 302 bridge (angle of alignment to stream)
- Abutments and/or mill remains at downstream end of reach, in combination with funneling through Rte. 302 bridge, create “fire-hose effect” at top of reach M18 where two major tributaries also join
- Straightening (>50% of segment length) related to road encroachment, bank armoring, bridge constriction
- Restriction of access to historic floodplains (incision ratio 1.6)

Table 16. M19 Projects and Practices Table – Wells mainstem

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M19-0	Stream Buffers	Next Highest	Medium	Y	Low-cost plantings upstream and downstream ends; upstream end a good buffer would create more of a physical flood break for house at mouth of South Branch, otherwise natural regeneration for a wider buffer
M19-0	Remove/Replace Structures	Very High	Medium	Y	Replace Cochran Rd. bridge-57 pct. bankfull width; substantial concrete structure makes it likely that road will bear brunt of damage in a flood
M19-0	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, capital budget planning with eye to bridge replacement

6.1 Reach M20 - Wells mainstem from mouth of South Branch at Puffer baseball field to downstream end of large pool downstream of waterfalls on State Forest Rd. (Rte. 232), 0.15 mi. north of Rte. 302

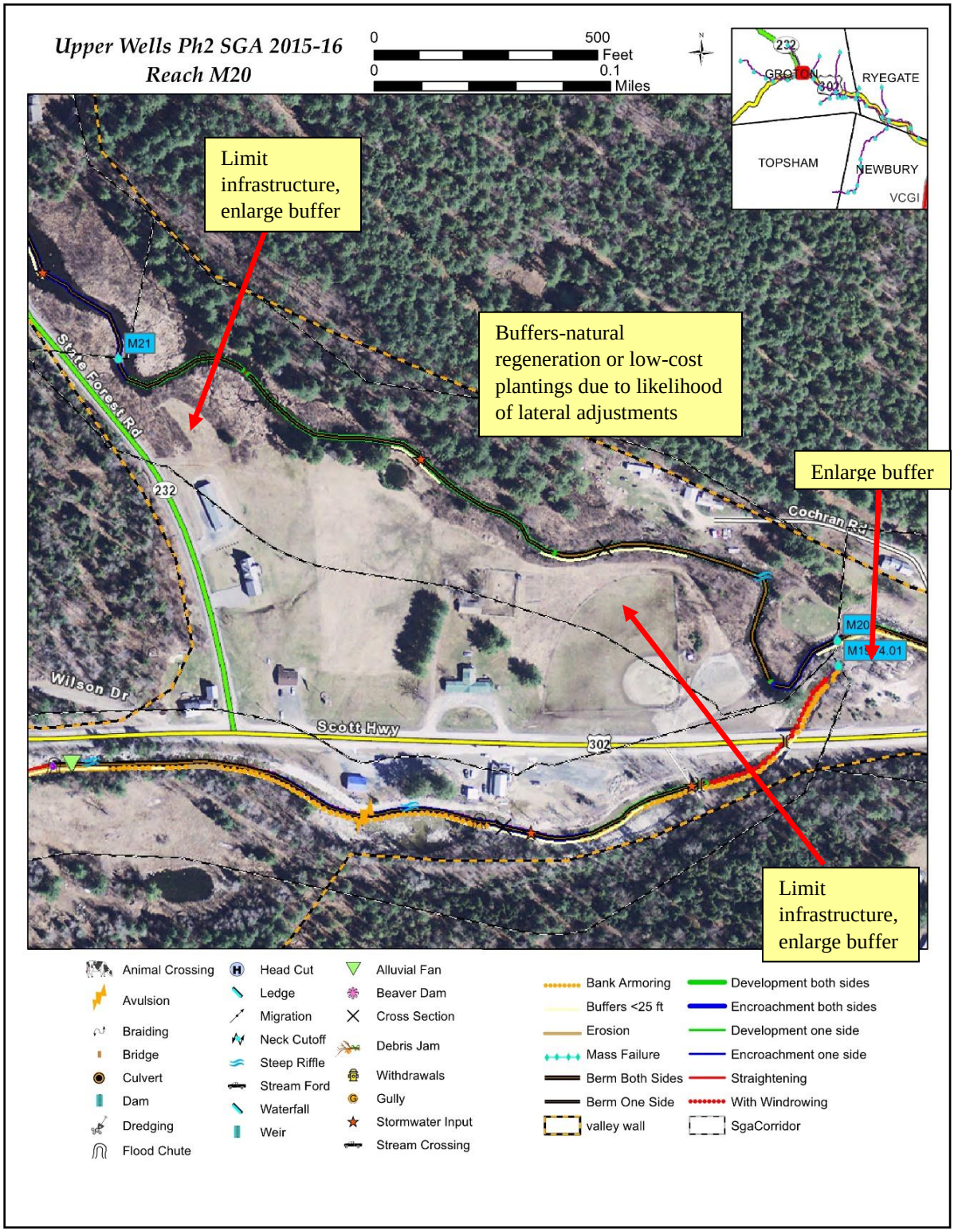


Figure 51. M20 Reach map - Wells mainstem.

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M20	2113	C	None	Cobble	Riffle-Pool	Very Broad

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M20-0	2117	C	None	Cobble	Riffle-Pool	Very Broad
	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
M20-0	Good	Moderate	1.3	III	F	none

Reach M20 is beaver influenced, with alder-willow wetlands on both sides of the channel in the upstream portion of the reach and off the left bank of much of the reach evidencing multiple beaver chutes and access channels. Although there is a narrow buffer of alder off the right bank in many areas, it appears that much of the right bank floodplain may have been converted from wetland to residential and recreational use (may have been more agricultural historically). Soils are better drained than in the beaver occupied left bank floodplain and may have been stream terrace. The ballfield has relatively little infrastructure in the stream corridor at this time and it would be highly beneficial to resist the temptation to increase this.

Reach M20 had a strange feel to it overall, and we wondered more than once if it had been dam influenced (backwater). The Franconia Paper Mill Dam removal (2014) was further downstream in reach M19 (by Groton Town Garage), but Beers Atlas 1875 also indicates a saw mill just downstream of the South Branch confluence (downstream end of reach M20) that may have influenced this reach historically. The forest on the hillside northeast of reaches M20 and M21 appeared to have been cut relatively heavily within a year or two previous to the assessment reported here, but there were no apparent impacts to the stream in the intervening period. Vegetation along the stream corridor is primarily scrub-shrub wetland and unlikely to contribute large wood to stream dynamics even under reference conditions. Construction of Rte. 232 (State Forest Rd.) likely altered wetlands on the upstream end of the reach, further contributing to alterations in this reach

that have diminished but not eliminated the capacity of this reach to attenuate flows from the next two reaches upstream, which have a much greater extent of ledge grade controls.

Primary Stressors:

- Straightening (>50% of segment length) related to road encroachment, bank armoring
- Loss of attenuation value of altered wetlands
- Restriction of access to historic floodplains (incision ratio 1.3), lack of large woody debris to rebuild access

Table 17. M20 Projects and Practices Table – Wells mainstem

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M20-0	Protect River Corridors	Medium	Medium	Y	Beaver wetlands deter encroachment LB, but RB more at risk. Lateral adjustments likely; limit structure encroachments, including rec area
M20-0	Stream Buffers	Very High	Medium	Y	Create-protect wider set-aside for natural regen, low-cost plantings due to likely lateral adjustments
M20-0	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, stormwater management

6.1 Reach M21 - Wells mainstem from downstream end of large pool downstream of waterfalls on State Forest Rd. (Rte. 232), 0.15 mi north of Rte. 302, to ledge grade controls upstream of house at 304 State Forest Rd. (Rte. 232)

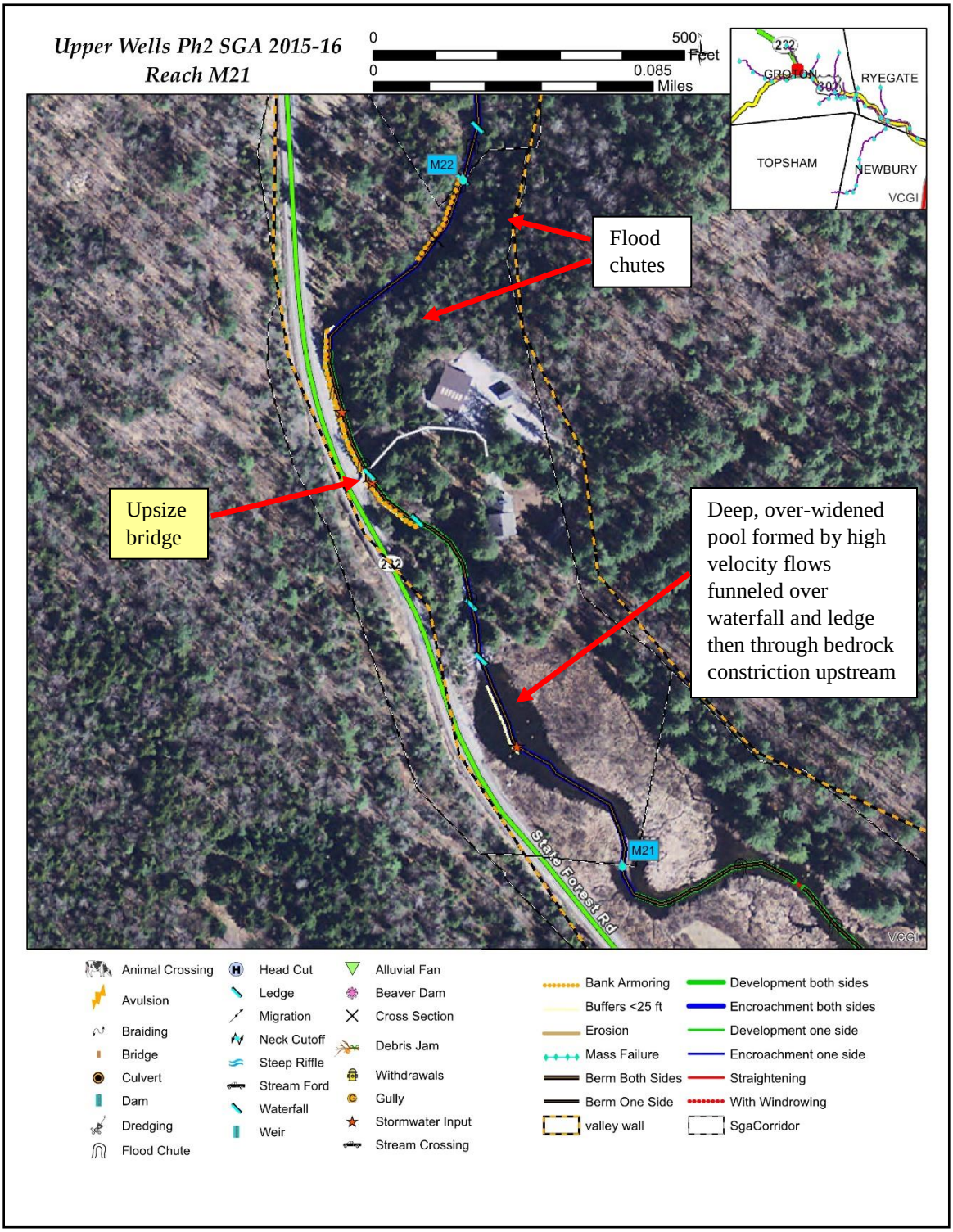


Figure 52. M21 Reach map - Wells mainstem.

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M21	1374	C	None	Cobble	Riffle-Pool	Narrow

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M21-0	1374	C	None	Cobble	Riffle-Pool	Narrow
	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
M21-0	Fair	High	1.0	IId	D	none

Reach M21 lies in close proximity to Rte. 232 (State Forest Rd.) for more than half its length on the downstream end, and two ledge grade controls at the downstream end create both a significant drop and a bedrock constriction that funnels flows into a deep and over-widened pool that is prominently visible from the road near a pull-out on Rte. 232 at the head of the beaver-influenced area on the upstream end of reach M20 (Fig. 53).



Figure 53. Ledge grade controls at downstream end of reach M21 include a small waterfall and bedrock constriction that funnels high velocity flows into a deep and over-widened pool visible alongside Rte. 232 (State Forest Rd.).

The reach also has a run of ledge on the upstream end, which appear to have helped the stream migrate rapidly across the valley in flood events in the past; prominent flood

chutes (possibly old channels) are visible on both sides of the stream. Despite these indications, straightening along Rte. 232 includes substantial stretches of rip rap and a large flood chute off the left bank in the upstream portion of the reach has been turned into a home work lane, with a close by driveway leading to a garage that appears to be located in a historic channel or flood chute (Fig. 54). Buildings off the left bank appear to be at risk in future flood events.



Figure 54. Garage or shop off left bank in upstream portion of reach M21 appears to be located in a flood chute or old channel.

Primary Stressors:

- Development encroachments
- Straightening (>50% of segment length) related to road encroachment, bank armoring, bridge constriction
- Undersized bridge at 304 State Forest Rd.

Table 18. M21 Projects and Practices Table – Wells mainstem

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M21-0	Stream Buffers	Medium	Medium	N	Missing buffers important but primarily along roadside, would require additional considerations for anything besides natural regeneration
M21-0	Remove/Replace Structures	Next Highest	Medium	Y	Replace bridge at 304 State Forest Rd. (Rte. 232) with longer span
M21-0	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, develop info on bridge and culvert options for private landowners

6.1 Reach M22 - Wells mainstem from ledge grade controls upstream of house at 304 State Forest Rd. (Rte. 232) to remains of Rickers Mills and dam at downstream end of Ricker Pond

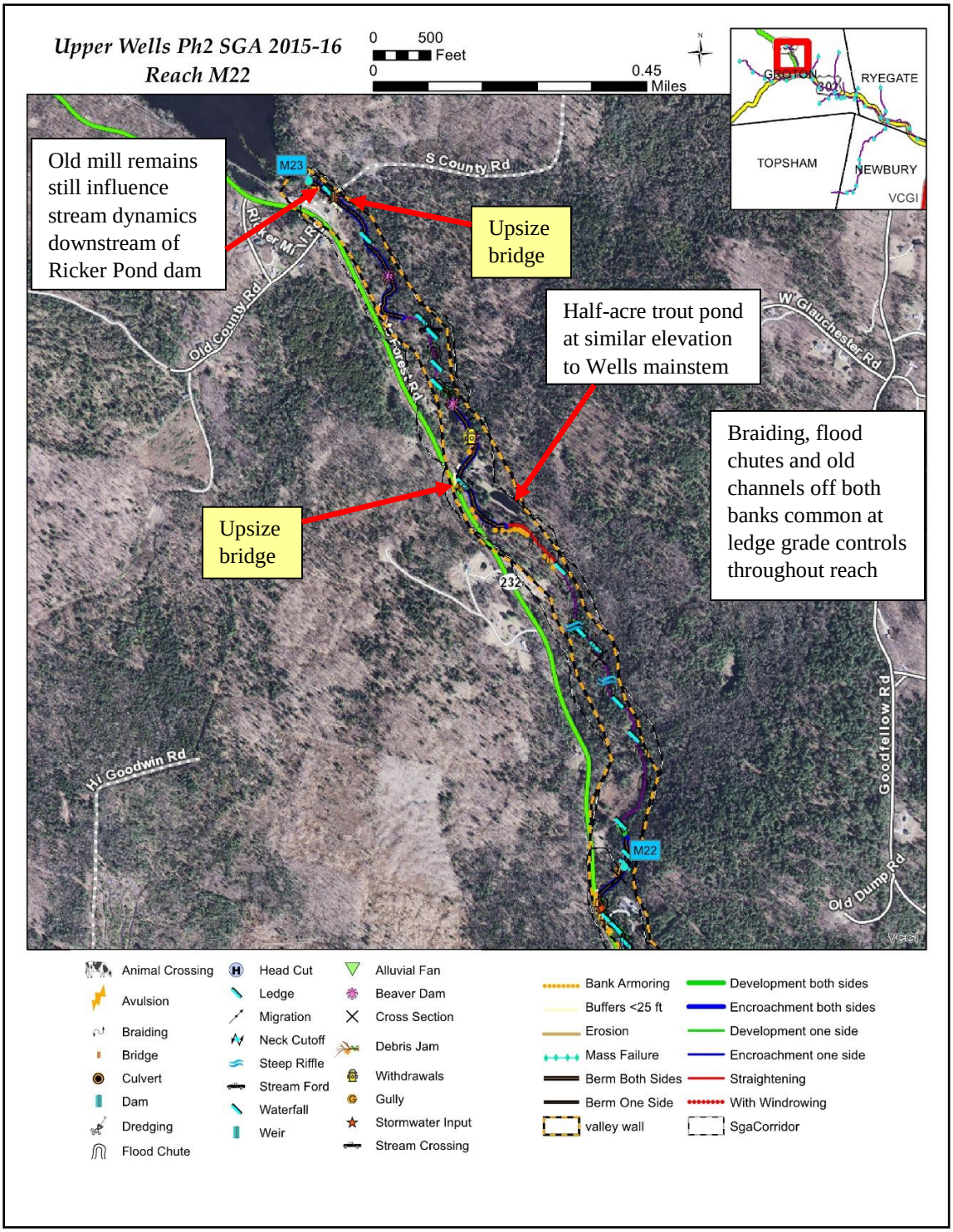


Figure 55. M22 Reach map - Wells mainstem.

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M22	7713	C	b	Cobble	Plane Bed	Narrow

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M22-	7713	C	b	Cobble	Plane Bed	Narrow
	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
M22-	Fair		1.3	III	F	none

Reach M22 comprises roughly 1.5 miles downstream of the dam that impounds Ricker Pond, a 0.373 sq. km. (92 ac.) pond that was purchased by the State of Vermont in 1970 and now is part of the Groton Management Unit and includes a campground along one shore of the pond. State managed land includes roughly 0.44 mi. of corridor along the stream downstream of the dam, an area that includes substantial remains of concrete and stonework infrastructure from the Ricker Mills complex (Fig. x). This area housed Groton's first grist and saw mills in 1783, and a saw mill was in operation on the site until the 1960s (Hollowell and Snyderman 2008).

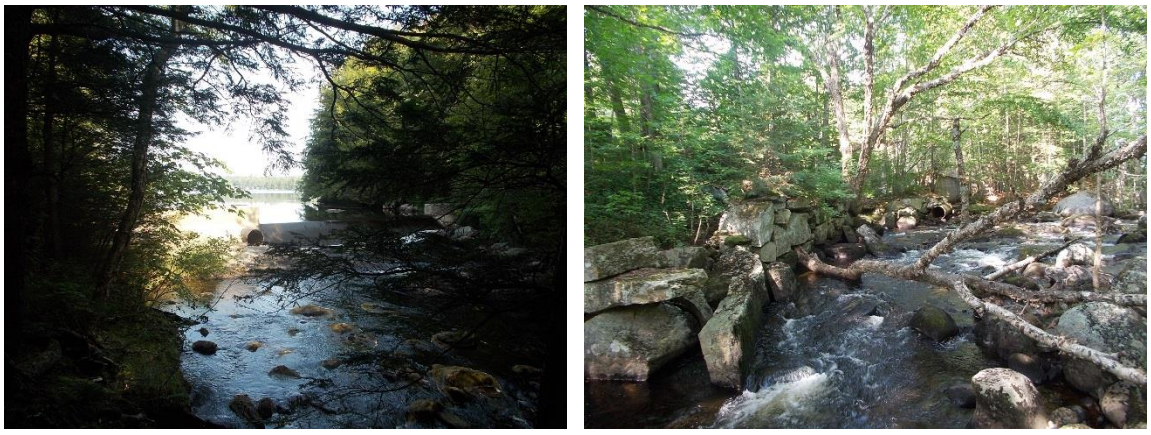


Figure 56. Stonework and concrete infrastructure from the former mill complex at Ricker Mills (right), in operation until the 1960s, lies just downstream of the dam (left) that impounds Ricker Pond at the head of reach M22.

With the exception of the most upstream portion of the reach, Rte. 232 (State Forest Rd.) was constructed outside the stream corridor off the right bank, but closer to the stream than the old railbed. Intermittent development has been placed in five or six locations throughout the reach off the stream side of Rte. 232 however, inside the stream corridor. A house and half-acre pond occupy part of the river corridor at 1076 State Forest Rd., and though the pond does not appear to draw water from the Wells River it is at a similar elevation to the stream. No dam information for this pond is available through the VT ANR Atlas; the owner indicated that they raise trout in the pond. Two bridges cross the stream and are sized at roughly half the bankfull width of the stream, one that hosts a snowmobile trail (South County Rd.) on the state managed portion of the corridor and one private driveway bridge.

The reach is largely bedrock controlled with numerous ledge grade controls spread through its length. Flood impacts were evident in numerous braided areas, though large woody debris and current debris jams were surprisingly few. Old channels were evident on both sides of the valley and many are active as flood chutes in high flows. It is not clear if there are seasonal releases from the dam at Ricker Pond, and numerous questions arose as to whether the reach is affected by such releases or just other recent flooding (including high flows from combined snow pack release and rain in April 2014; NWS-BTV 2014).

One small beaver pond currently occupies a portion in the middle of the reach and appears to be leveraged for water for human use, and beaver influences were observed in other relatively level portions of the valley – particularly in association with channel spanning bedrock outcrops. These influences further contribute to stream dynamics that can include rapid lateral migrations across much of the valley floor.

Primary Stressors:

- Flow regulation upstream (currently dammed, historically managed and funneled)
- Recent flooding (are there seasonal dam releases?)
- Undersized bridges
- Development encroachments
- Straightening (20%< and <50% of segment length) largely related to upstream end road encroachment, undersized bridges, and intermittent development in corridor
- Restriction of access to historic floodplains (incision ratio 1.3), additional older incision evident in presence of high terraces

Table 19. M22 Projects and Practices Table – Wells mainstem

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M22-0	Stream Buffers	Next Highest	Medium	Y	Localized buffers missing - lawn settings and roadside (roadside requires additional considerations for anything besides natural regeneration)
M22-0	Remove/Replace Structures	Very High	Very High	Y	South County Rd. bridge and private driveway 1076 State Forest Rd. both ~60 pct. bankfull width; not class 3 town roads, may be able to be placed on waste block on tops of banks outside bankfull width
M22-0	Restore Incised Reach	Next Highest	Next Highest	N	Bridge replacements important piece (whose domain is South County Rd.), otherwise primarily passive. Need to understand impacts of damming upstream; seasonal releases?
M22-0	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, capital budget planning with eye to bridge replacement (may include state and private)

6.1 Reach M11T1.01 – Scott Brook from junction with Wells mainstem (downstream Alley's Market and Church St. bridge in South Ryegate) to ~650 ft. upstream of Ryegate-Newbury town line (Church St. becomes Swamp Rd.)

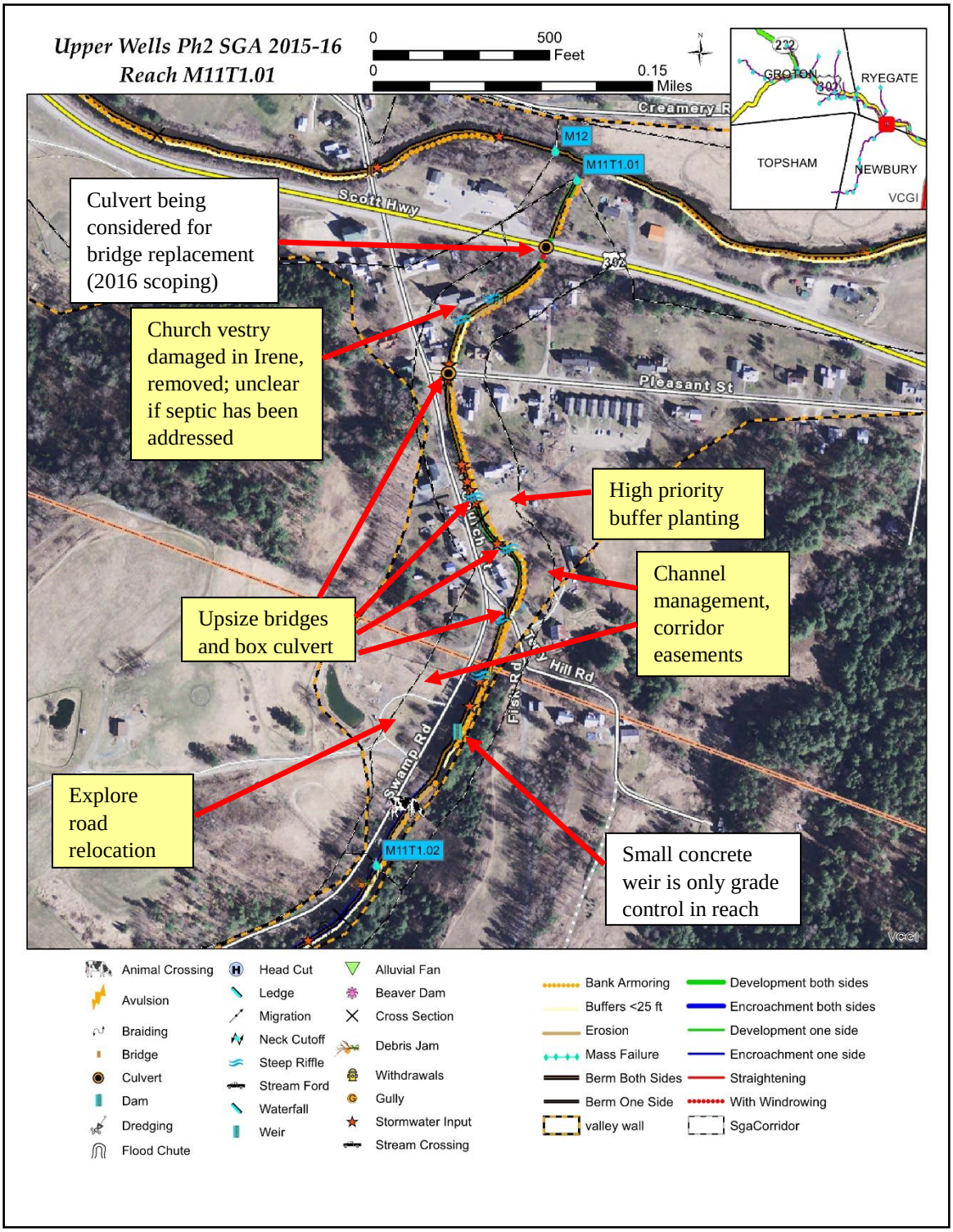


Figure 57. M11T1.01 Reach map – Scott Brook.

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M11T1.01	2250	C	b	Cobble	Riffle-Pool	Very Broad

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M11T1.01-0	2250	C	b	Cobble	Riffle-Pool	Very Broad
	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
M11T1.01-0	Fair	High	1.9	III	F	none

M11T1.01, the most downstream reach of Scott Brook, is situated in a densely developed portion of South Ryegate village. On its upstream end the reach is just over the Ryegate-Newbury town line and is jammed in against the side of Swamp Rd.; the road name changes to Church St. in Ryegate but the stream remains wedged in against the side of the road for much of its length before heading east along Rte. 302 where it is funneled through an undersized culvert before joining the Wells mainstem just downstream of Alley's Market.

This is a highly straightened reach (nearly continuous riprap-windrow lines left bank and significant portions of the right bank) with flood impacts amplified by being funneled through a series of undersized bridges. A streamside ell (vestry/parsonage) off the back side of the former First Presbyterian Church was damaged and removed after Irene, and the septic exposed by scour (it was not known if there are plans for dealing with this structure). The building appears to have been sold in January 2016; at the time of this writing it was not known what the future plans for this structure are.

Flood impacts in this reach are highly amplified by water being funneled through a semi-confined valley in the next reach upstream, plus old mill works that are still relatively intact, as well as through the series of undersized bridges in the village. All of these structures were repaired after recent flooding but all remain undersized. The state culvert

under Rte. 302 at the base of the reach was being scoped in 2016 for possible replacement with a bridge, and the Terry Hill Rd. bridge is a high priority for replacement by the Town of Ryegate (confirmed at public meeting July 25, 2016).

Stream force in this reach is also amplified by lack of floodplain access. Situated on lake sands at the edges of former glacial Lake Hitchcock, and lacking any ledge grade controls, the stream has cut deeply into its bed over time and now access the floodplain in only the highest level floods.

Primary Stressors:

- Extensive straightening (>50% of segment length) and loss of planform largely related to extensive road encroachment and bank armoring, five undersized structures
- Heavily restricted floodplain access in all but the highest level floods (incision ratio 1.9)
- Legacy of glacial Lake Hitchcock: underlain by highly erodible glacial Lake Hitchcock fines (lake sands), incision likely exacerbated by historic dredging and windrowing
- Stormwater inputs contribute to rapid delivery of water to stream

Table 20. M11T1.01 Projects and Practices Table – Scott Brook

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M11T1.01-0	Stream Buffers	Very High	Very High	Y	Highest priority only for 311-259 Church St., others Medium priority (or higher if part in reach restoration; lawn areas might be planted but many missing buffers due to road encroachment and need additional considerations for a buffer to establish
M11T1.01-0	Remove/Replace Structures	Very High	Next Highest	Y	Highest priority Terry Hill Rd. bridge. Rte. 302 culvert being scoped (2016) for replacement with a bridge. Private bridges might be able to be placed on waste block outside channel width.
M11T1.01-0	Watershed Strategies	Very High	Very High	Y	Remove upstream mill infrastructure. Municipal corridor protection, stormwater management, capital planning with eye to moving road, bridge replacements, develop info on bridge and culvert options for private landowners

6.1 Reach M11T1.02 – Scott Brook from ~650 ft. upstream of Ryegate-Newbury town line (Church St. becomes Swamp Rd.) Rd to ~0.2 mi upstream of Jefferson Hill Rd. on Swamp Rd. (stream comes to road edge)

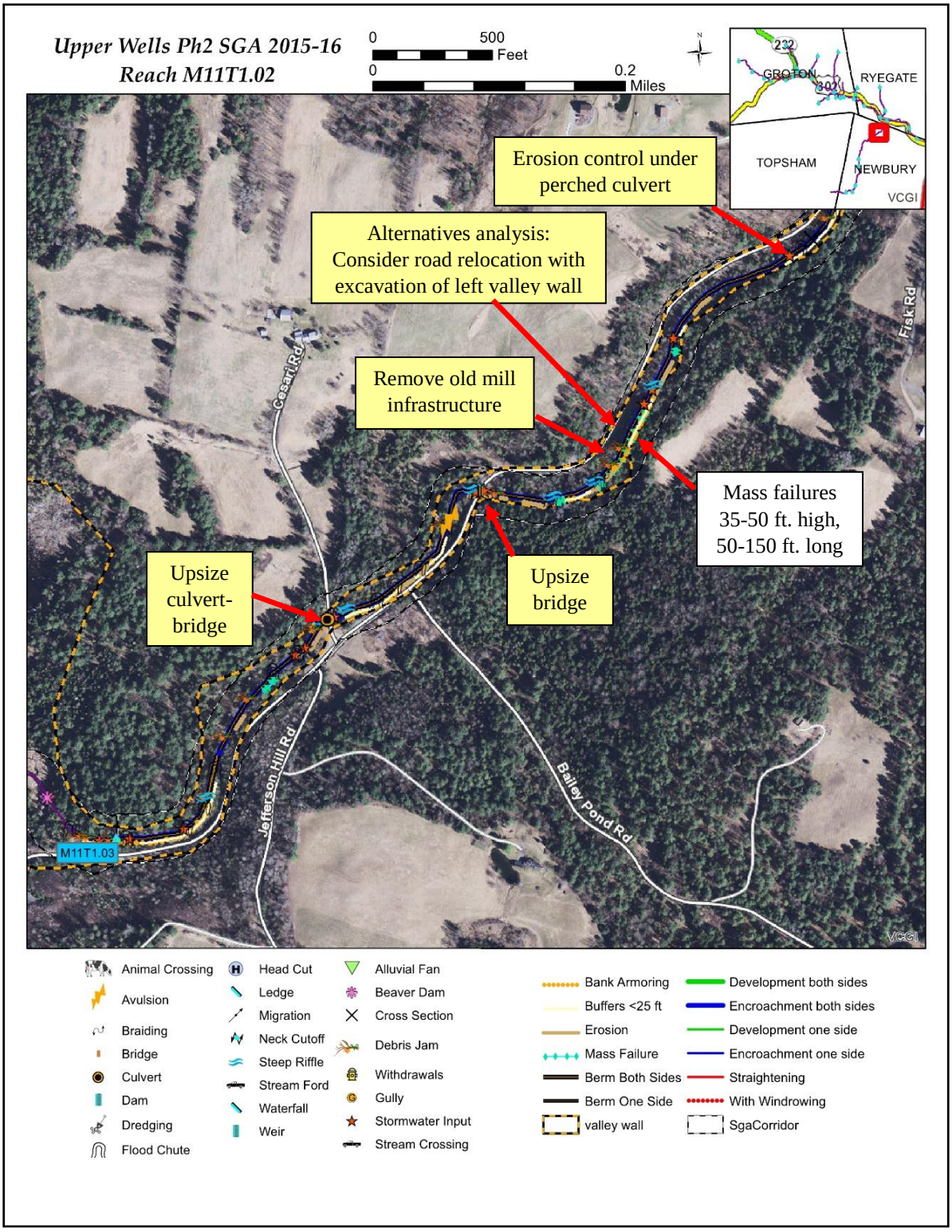


Figure 58. M11T1.02 Reach map – Scott Brook.

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M11T1.02	4406	C	b	Cobble	Step-Pool	Semi-Confined

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M11T1.02-0	4406	C	b	Cobble	Step-Pool	Semi-Confined
	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
M11T1.02-0	Fair	High	1.4	III	F	none

Scott Brook reach M11T1.02 lies close to Swamp Rd. throughout almost its entire length. This road has been relocated, probably more than once and likely due at least in part to road-stream conflicts. Mid-reach the road splits the valley in half, leaving a disconnected portion of the historic channel outside of the current road off the left bank. Although the valley would probably be Semi-confined even under reference conditions, the extensive road encroachment exacerbates the confinement and contributed to multiple mass failures along the extremely steep right valley wall in recent flood events. In addition, old mill site remains were in evidence mid-reach near large (35-50 ft. high, 50-150 ft. long) right bank mass failures (Fig. 59). Beers Atlas (1875) indicates a Rake Factory near this location, but the stonework still in place in 2015 was challenging to decipher as to whether it comprised old foundations, mill races, or other infrastructure. Regardless of its historical use, the stonework is still intact enough to create a floodplain and channel constriction that contributed substantially to triggering the mass failures off the right bank as well as contributing to substantial damage on the left bank along Swamp Rd. a short distance downstream.



Figure 59. Old mill infrastructure mid-reach of Scott Brook M11T1.02 looking from left bank (left) and at left bank (right). Note mass failure in background of photo at left, heavy riprap downstream along Swamp Rd. in background of photo at right.



Figure 60. Looking upstream at heavy riprap along Swamp Rd., same section as that visible in background downstream of mill infrastructure in Fig. 59.

The mass failures off the right bank downstream of the old Rake Factory infrastructure are likely to continue pushing the stream to the left bank along Swamp Rd. at the next downstream curve, an area that was windrowed and heavily riprapped following Irene (Fig. 60). Although the valley wall pinches the left side of the road (looking downstream) by the old mill infrastructure, the underlying geology appears to be largely very stony fine sandy loam (VT-ANR Atlas 2016, field observation) and it may be cheaper in the long run to try to excavate and relocate the road further against this left valley wall. This pinch point is likely to remain a road-stream conflict point as currently configured and the heavy bank armoring now in place will amplify the force of water impacting downstream areas in future floods. This area is highly recommended for a more in-depth alternatives analysis including removal of some of the old mill infrastructure and potential road relocation.

Stream power is further amplified along Scott Brook by a series of undersized, substantial concrete bridges that appear to have been mostly constructed in the same era (late 1920s). One of these structures is located in reach M11T1.02, as well as an additional granite block bridge with a concrete apron installed to check bed scour within the structure entailed by the undersized opening (Fig. 61).



Figure 61. Concrete apron installed to limit bed scour in undersized bridge at Cesari Rd. (left) and undersized, substantial concrete bridge that is characteristic of a series of bridges along Swamp Rd. (right).

Riprap along the upstream end of reach M11T1.02, roughly 0.2 miles upstream of the Jefferson Hill Rd.-Swamp Rd. intersection, marks the upstream extent of Japanese knotweed observed along the stream corridor during 2015 Phase 2 fieldwork. From this point, proceeding along Scott Brook downstream into South Ryegate, Japanese knotweed becomes common and often extremely dense.

Primary Stressors:

- Extreme road encroachment and relatively intact mill infrastructure cut off extensive areas of historic floodplain and old channel meanders
- Straightening (>50% of segment length) largely related to road encroachment and mill infrastructure, extensive bank armoring
- Legacy of location on glacial moraine: highly erodible soils
- Restriction of access to historic floodplains (incision ratio 1.4), additional older incision evident in presence of high terraces
- Undersized substantial bridges amplify stream power and risks to roads (bridges likely to be outflanked and instead wash out road)

Table 21. M11T1.02 Projects and Practices Table – Scott Brook

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M11T1.02-0	Remove/Replace Structures	Very High	Very High	Y	Remove mill infrastructure to increase LB floodplain access and meander formation, replace bridges to reduce stream power and scour
M11T1.02-0	Watershed Strategies	Very High	Very High	Y	Stormwater and drainage management (including erosion control under perched culvert in this reach)

6.1 Reach M11T1.03 – Scott Brook from ~0.2 mi upstream of Jefferson Hill Rd on Swamp Rd (stream comes to road edge) to just upstream of 2310 Swamp Rd

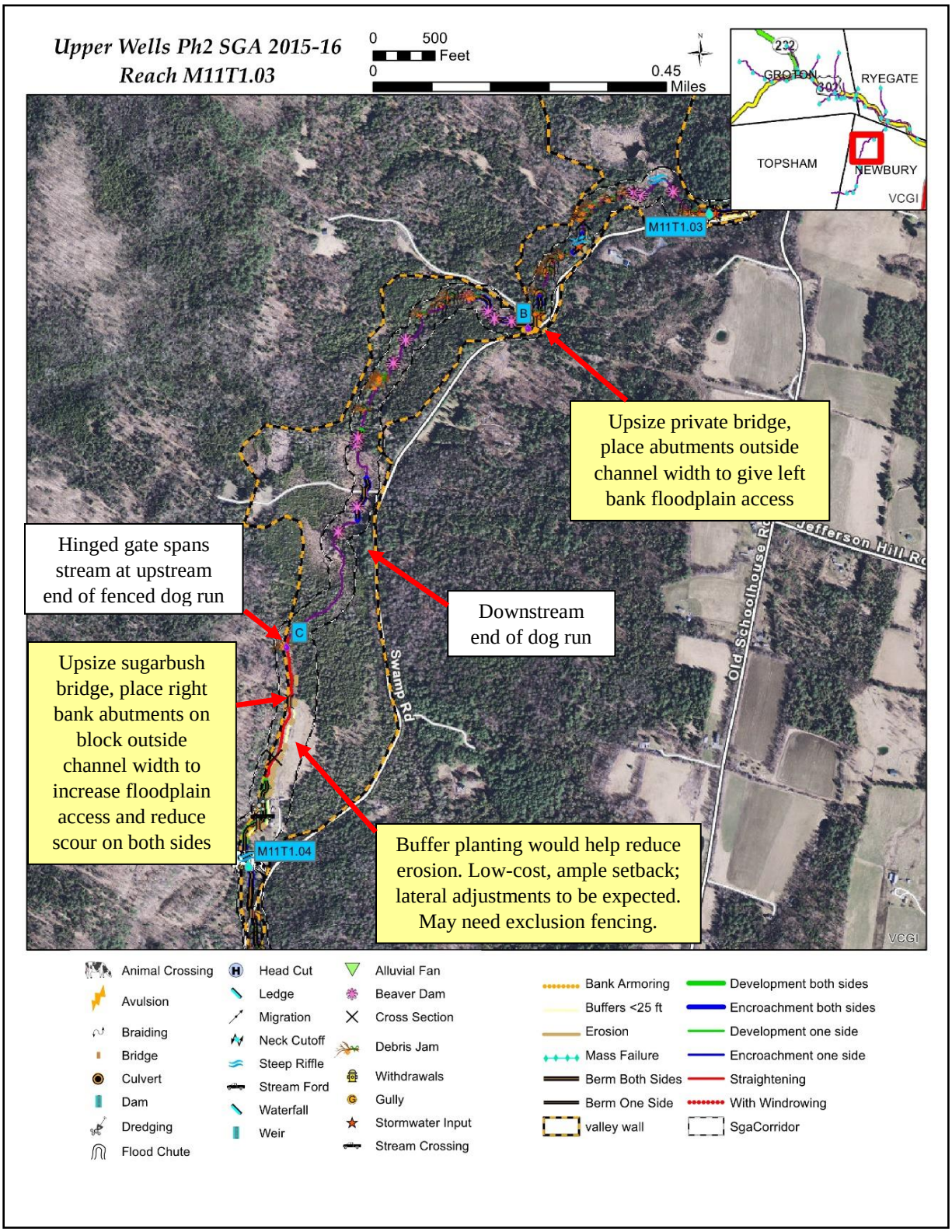


Figure 62. M11T1.03 Reach map – Scott Brook.

Phase 1 (reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M11T1.03		Excluded from Phase 1 (Beaver Wetlands)				

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M11T1.03A	2370	C	None	Cobble	Plane Bed	Broad
M11T1.03B	4413	Excluded (beaver controlled, lacks defined channel)	None	Sand	Ripple-dune	Very Broad
M11T1.03C	1940	C	None	Gravel	Riffle-Pool	Very Broad

	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
M11T1.03A	Fair	High	1.7	III	F	None
M11T1.03B	Excluded					
M11T1.03C	Fair	Extreme	1.8	IIc	D	E To C

Scott Brook reach M11T1.03 runs along the western side of Swamp Rd. and borders on some remarkable, relatively undisturbed northern white cedar swamps that represent statewide-significant natural community occurrences in Vermont (VT-ANR Atlas 2016). This reach itself, while closer to roads and somewhat fragmented by development, also contains some notable northern white cedar swamp (more recently logged than those to the west) as well as a relatively unusual juxtaposition with hemlock indicating position on an ecotone between temperate and boreal forest types. The reach was broken into three segments for Phase 2 assessment, with mid-reach segment B excluded from full



geomorphic assessment due to the predominance of beaver ponds (and frequent lack of a defined channel) as well as property access (the majority of this segment is fenced, likely for a beagle run or similar enclosure; Fig. 63).

Figure 63. This downstream-swinging gate entirely spans the channel of Scott Brook M11T1.03 as it enters what appears to be a private dog run at the upstream end of segment B.

The break between segments M11T1.03A and B was placed at a bridge entering a long private driveway at 1198 Swamp Rd., and downstream segment A beyond this point is still clearly beaver influenced but not dominated by current active beaver ponds. The driveway entering at this point runs along a transition point from swamp to uplands created by a moraine formation transverse to overall valley orientation (Fig. 64).

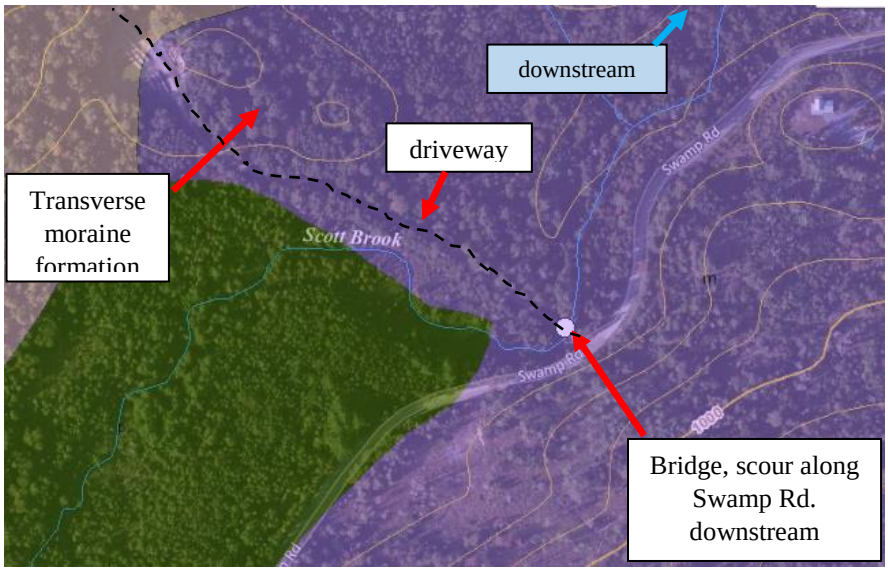


Figure 64. Driveway to 1198 Swamp Rd. enters along a cut and fill bench terraced at the transition from swamp (green) to moraine uplands (purple); contours indicate the transverse orientation of this moraine formation to the general valley axis of Scott Brook.

Straightening by this bridge at the upstream end of segment A only slightly increases the effects of this natural valley pinch point, but the undersized bridge had clear signs of scour along Swamp Rd. and stream braiding downstream following recent flood events (Fig. 65).



Figure 65. Bridge and cut and fill driveway at 1198 Swamp Rd. (left) seems to only slightly constrict the natural valley pinch point here (bridge is 78 pct.. measured bankfull width) but significantly restricts left bank floodplain access downstream, increasing stream power effects along Swamp Rd. on the right bank (right).

M11T1.03A was assessed as a reference planebed subreach due to small cobble substrate combined with ~2 percent overall slope, with sediment storage primarily at debris jams and inactive channels; the combination leaves neither riffles nor steps well-formed. Frequent signs of intermittent or transient beaver influences were observed, with impacts from episodic flood discharges and transient beaver dam blow-outs; these have likely contributed to the heightened scour along Swamp Rd. as well, amplified by the floodplain constriction at the bridge. Although flood related incision (nickpoints) appears quickly offset by subsequent aggradation, increased confinement of the floodplain contributes to greater sediment transport in high flows, especially fines. This increases the value of downstream portions of M11T1.03A as an attenuation asset, as the valley and floodplain become much more confined moving downstream from here into reach M11T1.02.

Segment M11T1.03B was Excluded from full geomorphic assessment due to multiple active beaver ponds and wetlands as well as the access issues (dog run fencing and gate) noted above, but habitat data was collected while trying to determine the extent of possible full assessment. This habitat data indicated good attenuation benefits in this segment due to the presence of multiple debris jams and snags that provide an important role in sediment retention and diffusion of stream power. While active beaver dams often provide similar benefits, storm surges can also occur when transient beaver dams blow (this appeared to have happened in several areas in recent floods). An undersized bridge in this segment creates localized scour and erosion impacts from the channel confinement but the structure is not a floodplain constriction and is virtually surrounded by beaver pond.

Upstream segment M11T1.03C is largely dominated by homestead and agricultural use. Located on Muck soils (VT0ANR Atlas 2016), it appears likely this would be an E type stream through adjacent altered wetlands (now hayfield) under reference conditions. Scott Brook has been maintained against the left valley wall here, with clear signs of

minor dredging and major snagging following recent flood events (plus at least one former small bridge damaged and removed; Fig. 66).



Figure 66. This eroded bank appeared likely to have been the location of a former bridge damaged in recent flooding in M11T1.03C. Muck soils in the hayfields-pastures off the right bank appear more erodible than the bed of the stream in this segment.

Because of the highly erodible muck soils off the right bank in this segment, as well as recent manipulation of the channel, the stream appears to be in arrested Stage IIc of a D-model channel evolution:

> "Steeper gradient may be imposed through activities such as channelization, but due to the resistance of the bed material, the stream has not incised significantly or lost access to its floodplain (remaining a "C" Stream Type). Channel is widening and migrating laterally through bank erosion caused by the increased stream power. The balance between stream power and boundary materials is re-established when the slope flattens after a process of channel lengthening and increased sinuosity. Stream bed may be a combination of poorly defined riffle-pool and plane bed features." (VT-RMP_ApxC 2007)

Further evidence of high erodibility was present through much of this segment, and an undersized sugarbush access bridge at the downstream end of the segment appeared to be at some risk of having the banks collapse underneath it (Fig. 67).



Figure 67. High bank erodibility was evident through much of segment M11T1.03C (left), and an undersized sugarbush access bridge at the downstream end of the segment had significant erosion on the supporting banks underneath it (right).

Aggradation is quickly offsetting incision in M11T1.03C, and the stream is likely to begin to braid or meander further as it continues to evolve. Corridor protection through channel management easements would greatly benefit this section of stream, but the value of the attenuation asset is diminished to some degree by the extensive presence of low gradient, less disturbed swamp and wetlands that also function as valuable attenuation assets in the next segment downstream.

Primary Stressors:

- Floodplain and/or channel constrictions at stream crossings
- Straightening (>50% of segment C length, plus important juncture at segment B break point-bridge at 1198 Swamp Rd.) largely related to bank armoring, channel manipulation and undersized structures
- Extensive presence of muck soils means high erodibility of banks; upland moraine soils also highly erodible

Table 22. M11T1.03 Projects and Practices Table – Scott Brook

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M11T1.03-A	Protect River Corridors	Next Highest	Next Highest	Y	ensure any crossings meet general permit at minimum; wooded corridor does not seem at high risk for development, but additional stream crossing mid-reach could impact already diminished attenuation assets; downstream becomes more confined
M11T1.03-A	Remove/ Replace Structures	Very High	Next Highest	Y	ideally structure would exceed bank full to ensure access to left bank floodplain downstream; Swamp Rd. likely to continue being undercut with current configuration
M11T1.03-A	Restore Incised Reach	Very High	Next Highest	N	primary issue is replacement of bridge to allow left bank floodplain access, remainder is passive-corridor protection to ensure long-term viability
M11T1.03-B	Excluded				EXCLUDED SEGMENT (active beaver ponds and wetlands, access issues on upstream end)

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M11T1.03-C	Protect River Corridors	Very High	Medium	N	Channel management easement would greatly benefit reach, lend stability and reduce erosion in long term; significant attenuation assets also in close proximity downstream
M11T1.03-C	Stream Buffers	Very High	Next Highest	Y	Ideally accompanied by corridor protection for passive meander restoration, but beneficial in reducing erosion regardless. May need exclusion fencing.
M11T1.03-C	Remove/ Replace Structures	Next Highest	Medium	Y	Sugarbush access bridge could be placed on waste block outside channel width off right bank to increase floodplain access and reduce scour on both banks
M11T1.03-C	Restore Incised Reach	Very High	Medium	N	Passive meander restoration through corridor protection (channel management easement possibility). Animal crossings may need gated access and off stream watering set-up. Size any bridge replacements to bank full width plus, preferably on block outside channel width. Priority only reduced by presence of downstream attenuation assets.

6.1 Reach M11T1.04 – Scott Brook from just upstream of 2310 Swamp Rd. to tributary mouth at hard bend of Swamp Rd. just downstream of Grapes Rd.

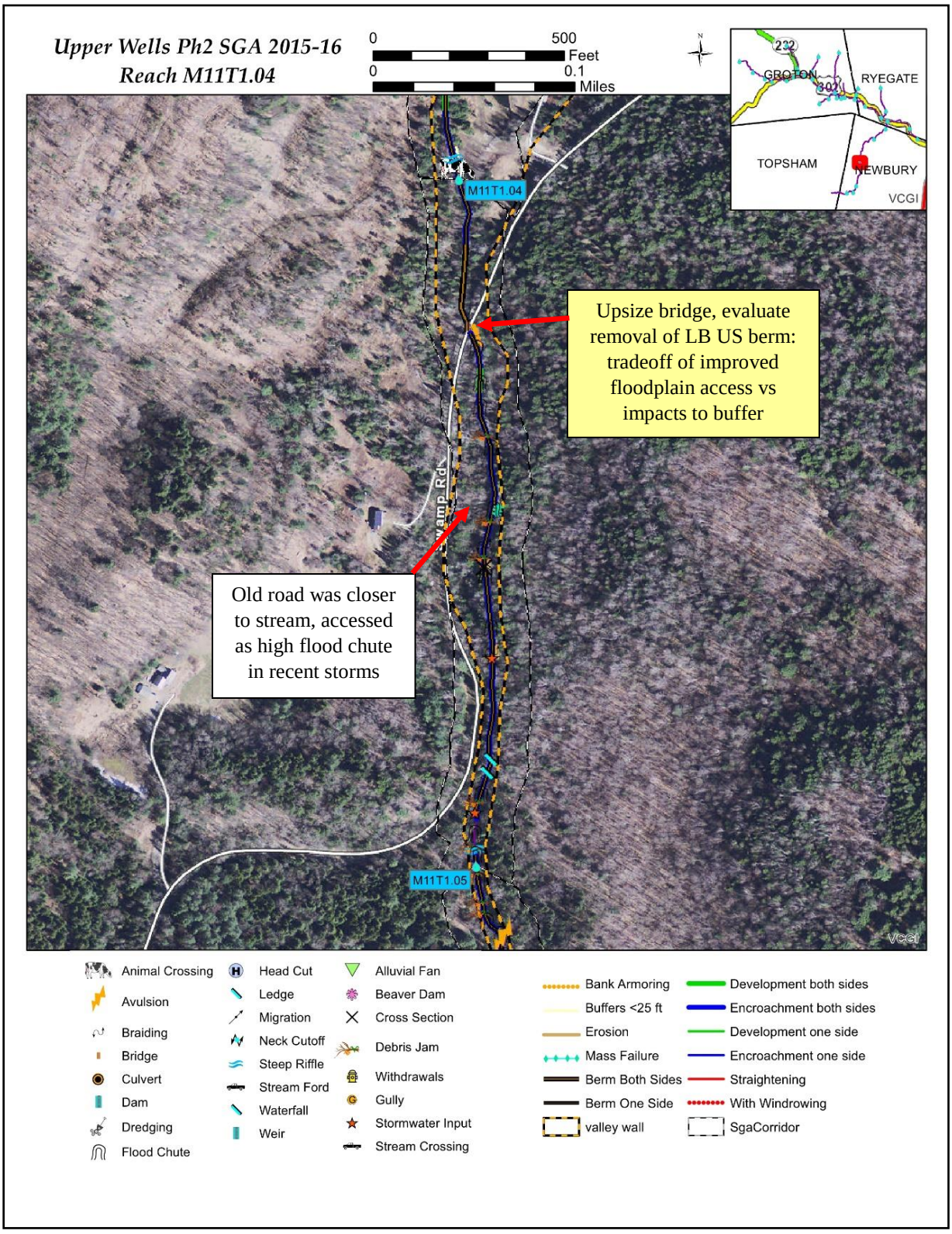


Figure 68. M11T1.04 Reach map – Scott Brook.

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M11T1.04	1831	B	a	Cobble	Step-Pool	Semi-Confined

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M11T1.04-0	1831	B	a	Cobble	Step-Pool	Semi-Confined
	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
M11T1.04-0	Fair	High	1.9	III	F	none

Scott Brook reach M11T1.04 is a Semi-confined reach between broader portions of the valley, sharing this tighter valley with Swamp Rd. below a tributary that follows a large bend in Swamp Rd. downstream of the junction with Grapes Road. Swamp Rd. appears to have been relocated along much of this reach, and the old road was much closer to stream; stone walls along it encroach on M11T1.04 but flood chutes along the old road were very recently accessed despite appearing high above the current channel location (Fig. 69). This recent high water event left very clear bankfull indicators that demonstrate the intensity of intermittent channel enlargement in downpours in this steep, confined valley. Old channel avulsions, abandoned channels and large flood chutes outside the current floodplain all gave further testament of a propensity to rapid channel relocations.



Figure 69. Swamp Rd. has been relocated along portions of reach M11T1.04, and the old road (closer to Scott Brook) had been recently accessed as a flood chute despite appearing high above the current channel location.

As with much of Scott Brook, this reach is located on a long glacial moraine (interspersed with pockets of swamp) extending toward South Ryegate and further north into Peacham, Barnet, and Danville. Complex topography due to this glacial legacy includes varied but loose and erodible sediments ranging from fines to boulders. Multiple ledge grade controls interspersed through the reach limit downcutting, and old channels and flood chutes were in evidence on both sides of the stream. One long ledge grade control and one large massive boulder step (apparent glacial boulder train; Fig. 70) account for the majority of slope in the reach, but despite intermittent slope breaks and floodplain pockets overall slope is still likely greater than six percent.

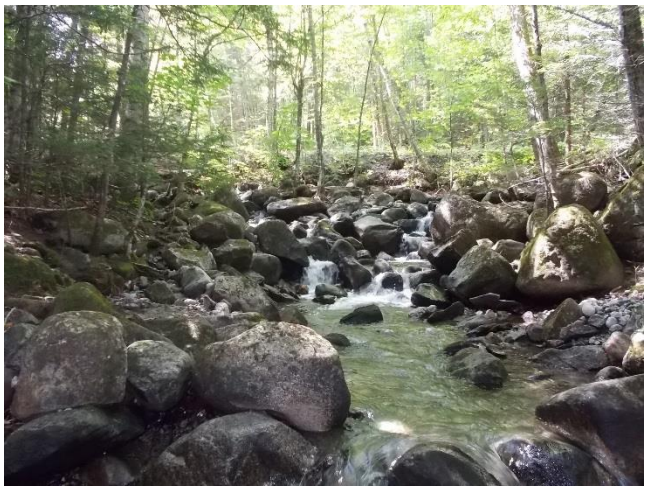


Figure 70. Location on a glacial moraine that extends along much of Scott Brook gives reach M11T1.04 complex topography and varied sediment sizes ranging from fines to features such as this apparent boulder train.

Straightening by the old road and stone wall remains have contributed to lack of meanders, increased slope and consequent incision in this reach. Incision was likely amplified historically by pulse flows below a mill dam in upstream reach M11T.105. There is a relatively dense sapling understory on both side of the streams, but subdominant buffer cover off the left bank is bare ground due to road encroachment and this forest is not yet mature enough to contribute ample amounts of truly large wood to channel dynamics. Lack of large wood in channel dynamics means that stream power is amplified through this reach, diffused by the presence of relatively few debris jams, and storage of fine sediments is primarily occurring only in the limited pockets of floodplain along the margins of the stream.

A substantial concrete bridge on Swamp Rd. is sized at roughly 67 percent of the measured representative bankfull width for the reach (31 ft.., wider than the hydraulic

curve indicated 23 ft.. due to channel dynamics as noted).The effective width of the bridge is reduce d by the angle of alignment to the stream. This is a low clearance bridge built in 1928, likely to pass water but not large volumes of sediment or large wood, with a cracked parapet wall on the downstream end. The parapet wall reduces effective road width from 20 to 18 feet, making it difficult to accommodate two lane traffic across the bridge. Two hundred feet of berm on the left bank upstream of the bridge could be removed with bridge replacement but would substantially impact the buffer; improved floodplain access should be evaluated in light of this tradeoff.

Primary Stressors:

- Straightening (20-50% of reach length) primarily related to road encroachment, both from the current road and the old road that was located closer to the stream
- Highly erodible (though often large) sediments due to location on glacial moraine
- Pronounced restriction of access to floodplains in all but high level floods (incision ratio 1.9), additional older incision evident in presence of high terraces
- Stormwater, drainage and tributary inputs increase flashiness
- Undersized bridge likely to accommodate water but not sediment and large wood; substantial concrete structure increases risk of road damage while structure holds

Table 23. M11T1.04 Projects and Practices Table –Scott Brook

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M11T1.04-0	Remove/Replace Structures	Very High	Medium	Y	Low clearance 1928 bridge with cracked parapet wall; structure likely to pass water but not sediment and wood, substantial concrete increases risk of outflanking
M11T1.04-0	Restore Incised Reach	Next Highest	Medium	N	Primarily passive restoration: large woody debris currently at diminished levels, likely to change with time; important to size bridge replacement to accommodate wood and sediment as well as water - consider removal of berm just upstream of bridge at same time as replacement

6.1 Reach M11T1.05 – Scott Brook from tributary mouth at hard bend of Swamp Rd. just downstream of Grapes Rd. to downstream end of beaver wetlands east of Swamp Rd. between Topsham Rd. and Saxie Welch Trail

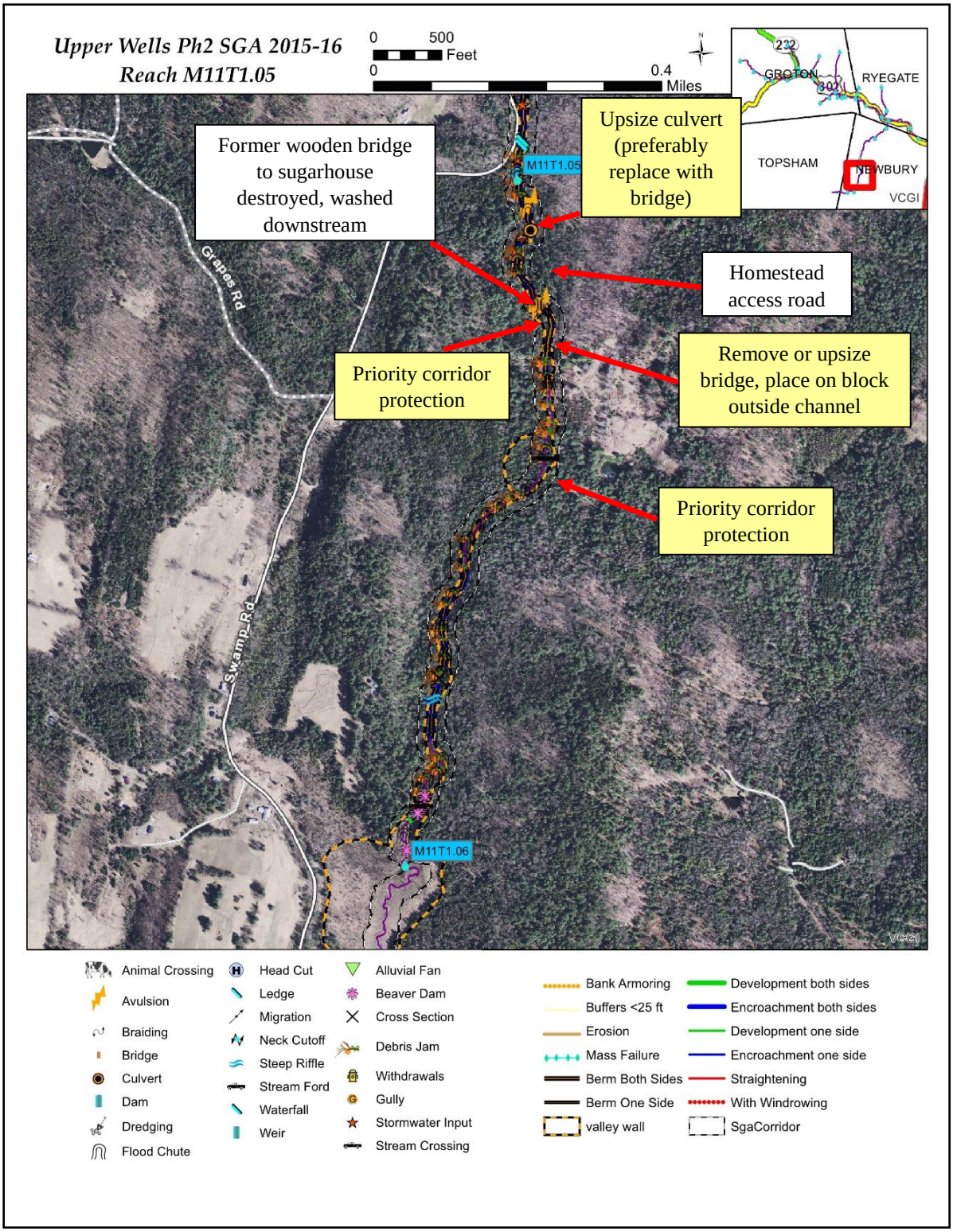


Figure 71. M11T1.05 Reach map – Scott Brook.

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M11T1.05	5787	C	b	Gravel	Riffle-Pool	Very Broad

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M11T1.05-0	5787	C	b	Cobble	Step-Pool	Narrow
	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
M11T1.05-0	Fair	High	2.1	III	F	none

Scott Brook reach M11T1.05 is deeply incised in a narrow valley that is more distant from roads than many other portions of Scott Brook. Although Phase 1 analysis characterized the valley as Very Broad, the phase 2 assessment as a Narrow valley appears to be largely a glacial legacy and alternates with intermittent pockets of much wider valley. Although the stream has lost access to historic floodplains through much of its length, even in the narrower portions of the valley it retains sufficient (though diminished) floodplain access to function as a C type stream and hence was not considered a stream type departure.

The most upstream portion of reach M11T1.05 is impounded by beavers and is functionally more consistent with the excluded segment M11T1.06A just upstream; it was not segmented out due to the very short distance of impoundment. Beavers had placed a dam on top of old stonework from what appears to be a former mill in the upstream portion of the reach (Fig. 72), which may have contributed to hungry water-pulse flow dynamics that contributed to amplified historic incision.



Figure 72. Beaver dam built on top of stonework from what appears to be old mill infrastructure near the top of reach M11T1.05.

The current channel is situated in a vastly reduced floodplain with meanders out of sync in relation to glacial stream valley meanders, leaving alternating pockets of floodplain on opposite sides of current channel, but is able to access high flood plains and alternate channels (through avulsions) in major floods.

An unusual transverse valley mid-reach in M11T1.05 (Fig. x; likely a legacy of a glacial recessional moraine) appears to have been the location of a road leading from Swamp Rd. to a homestead off the current right bank that appears on the 1875 Beers Atlas, and a major flood chute captured and followed a large portion of the old road bed in recent flooding (now dry again, channel is single thread). This area is recommended as a priority corridor protection area due to the apparent value of this attenuation asset, but it is critical that any easements in this area include a wide buffer and channel management rights due to stream dynamics that are likely to impact encroachments. This road does not appear on current VTrans mileage maps (VTrans 2016) or the ANR Atlas (VT-ANR Atlas 2016), and it is assumed the road has been discontinued.

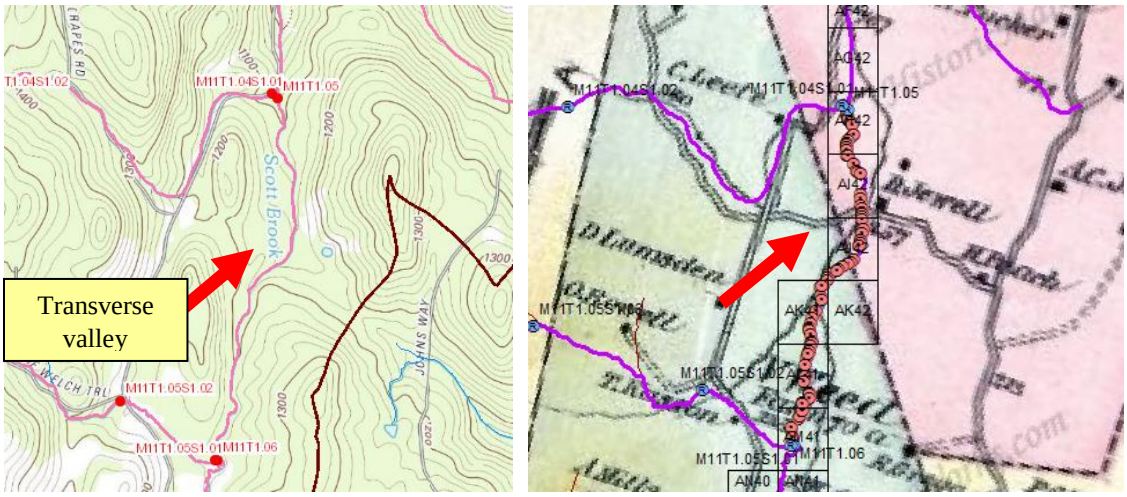


Figure 73. Unusual transverse valley mid-reach in M11T1.05 (topo, left) was the location of a former road that appears on the 1875 Beers Atlas (Phase 2 field map grid and GPS waypoints overlaid, right), which was captured as a flood chute in recent flooding (below).



Downstream of this old road is a homestead that is now accessed from a long woods road that comes in from the M11T1.05 reach break. It was unclear if this homestead is currently occupied; a bridge formerly used for equipment access to a sugarhouse off the left bank appears to have been more recently used as a footbridge,

then fallen into disrepair (Fig. 74). This bridge represents a channel constriction, but the floodplain off the left bank in the vicinity of the sugarhouse appears accessible. A second wooden bridge that accessed this floodplain-sugarhouse area was destroyed in recent floods and remains lodged at the next sharp bend downstream along the stream (Fig. 75). The sugarhouse appeared to have been in use fairly recently if not currently.



Figure 74. Wooden bridge from homestead off right bank of M11T1.05 to sugarhouse in broad pocket of floodplain off left bank is a channel constriction but does not appear to block access to the left bank floodplain (left, looking downstream); the bridge has fallen into disrepair (right).



Figure 75. Second wooden bridge to sugarhouse in M11T1.05 was destroyed in recent floods; remains were lodged at the next bend downstream.

The long woods road that travels upstream from the M11T1.05 reach break into this homestead includes an undersized and poorly aligned culvert that is highly prone to failure (Fig. 76). The woods road as currently laid out does not appear to be the same as a road that appears further east on Beers Atlas (1875; Fig. 73 above), but the homestead could conceivably occupy the same area as one attributed to D. Jewell on that atlas.

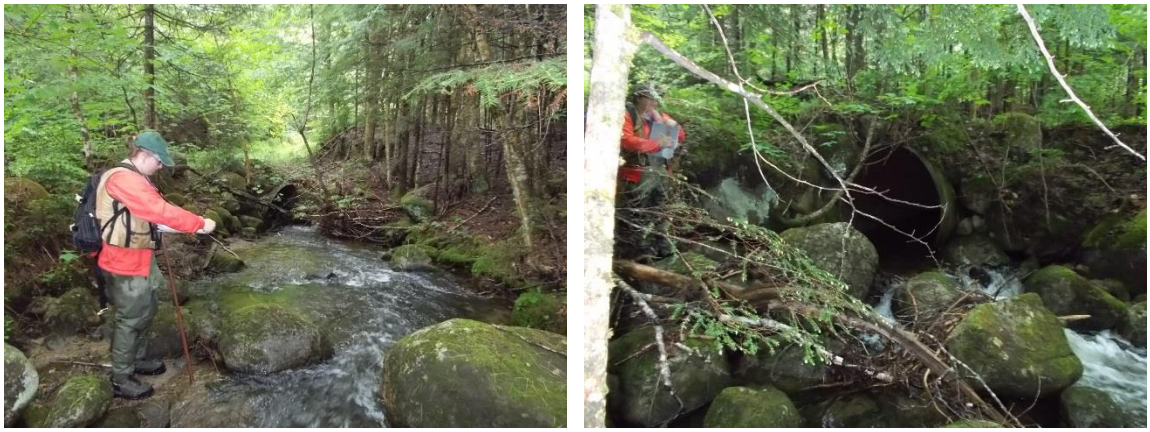


Figure 76. Undersized culvert on long woods road that accesses homestead off right bank of M11T1.05 creates hard bends in the stream on both upstream (left) and downstream (right) ends.

Primary Stressors:

- Loss of historic floodplain access through most of reach (intermittent pockets much broader)
- Highly erodible, variably sized sediments due to location on glacial moraine
- Undersized and poorly aligned culvert at downstream end of reach, undersized bridge in apparent disuse, third bridge destroyed and remains lodged with debris jam
- Development encroachment

Table 24. M11T1.05 Projects and Practices Table – Scott Brook

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M11T1.05-0	Protect River Corridors	Very High	Medium	Y	Homestead off right bank in downstream half of reach had multiple undersized structures and development encroachments. Critical that any easements in this area include a wide buffer and channel management rights due to stream dynamics that are likely to impact encroachments.
M11T1.05-0	Remove/Replace Structures	Next Highest	Medium	Y	Culvert on woods road highly prone to failure, if replaced a bridge would be better and alignment should be addressed. If sugarhouse bridges need to be replaced, place on block outside channel width; portable modular would be even better
M11T1.05-0	Restore Incised Reach	Very High	Medium	N	Remove encroachments (bridges, outbuildings), pursue corridor protection

6.1 Reach M11T1.06 – Scott Brook from downstream end of beaver wetlands east of Swamp Rd. between Topsham Rd. and Saxie Welch Trail to corner of Topsham Rd. and Swamp Rd.

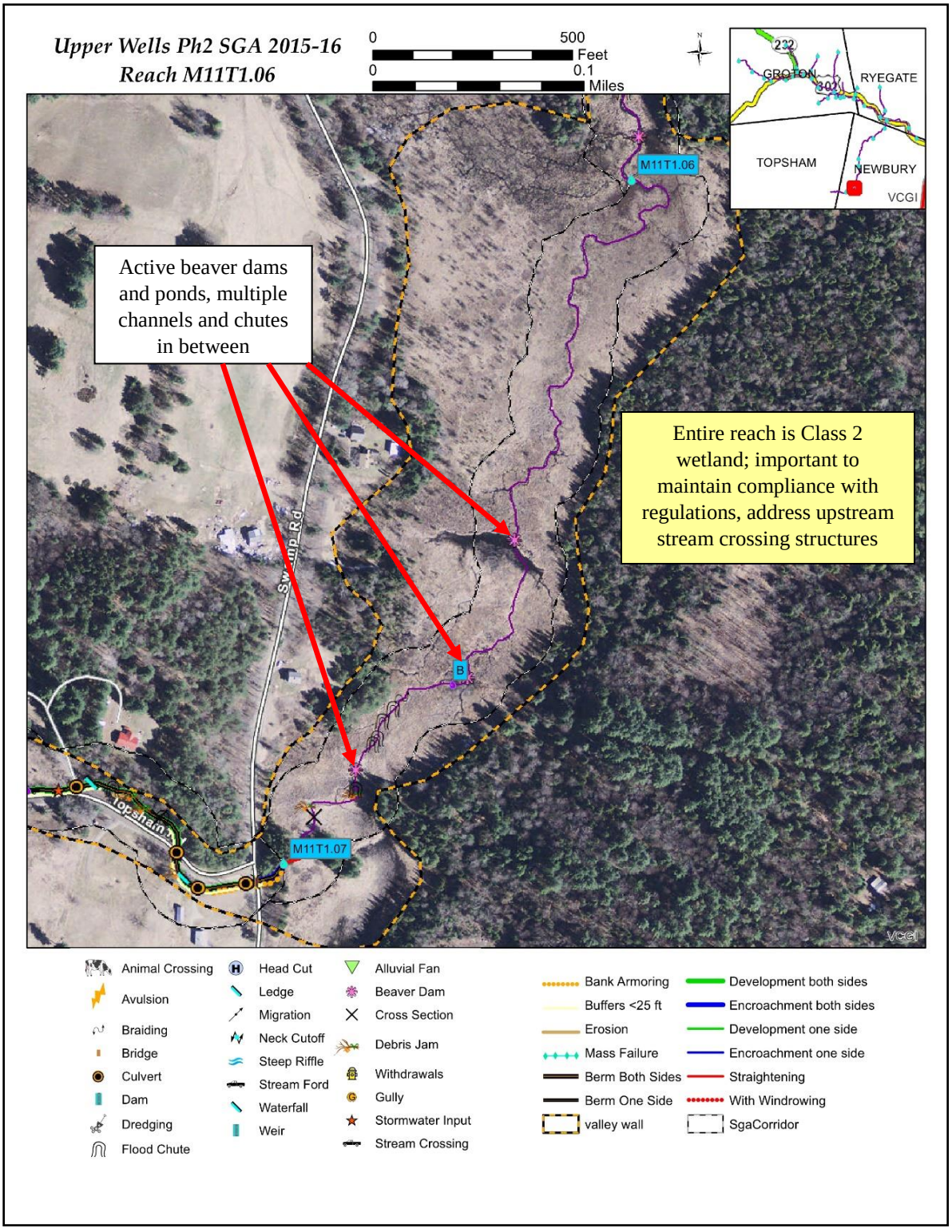


Figure 77. M11T1.06 Reach map – Scott Brook.

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M11T1.06	Excluded from Phase 1 (Beaver Wetlands)					

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M11T1.06A	1875					Very Broad
M11T1.06B	759	E	None	Sand	Riffle-Pool	Very Broad
	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
M11T1.06A			0			
M11T1.06B	Good	High	1.1	IV	F	None

Scott Brook reach M11T1.06 crosses under Swamp Rd.at the corner of Topsham Rd. and flows into a Very Broad valley largely occupied by active beaver ponds and wetlands. The reach was segmented due to these influences, with downstream segment A being excluded from full geomorphic assessment (per Phase 2 protocols) due to several active beaver ponds and frequent lack of a defined channel. The entire reach is situated in a Class 2 wetland area that was likely in former agricultural use, now dominated by a mix of reed canary grass and native wetland herbaceous vegetation that limits erosion but contributes little to stream shading. Beaver activity and the persistent nature of the reed canary grass are likely to inhibit establishment of trees and shrubs, but cattails and other tall herbaceous vegetation do provide some shading.

Segment M11T1.06B comprises roughly 800 feet at the upstream end of the reach, which has a single thread channel probably in part due to limited incision (frequently offset by

aggradation that “washes out” streambed nickpoints) related to enhanced stream power as water is funneled into the top of the reach by a series of road ditches and undersized stream crossing structures in upstream reach M11T1.07. Elevated sediment discharges through the box culvert at Swamp Rd. (base of reach M11T1.07) appear to have offset minor incision in recent flood events.

Primary Stressors:

- Limited incision due to elevated stream power funneled through road ditches and series of undersized stream crossing structures in upstream reach M11 T1.07
- Elevated sediment transport from upstream appears to frequently offset limited incision but likely also contributes to elevated sediment and nutrient loading in this reach
- Tree and shrub establishment inhibited by beaver presence and presence of reed canary grass
- Restriction of access to historic floodplains (incision ratio 1.3), additional older incision evident in presence of high terraces

Table 25. M11T1.06 Projects and Practices Table – Scott Brook

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M11T1.06-A	EXCLUDED				EXCLUDED SEGMENT (active beaver ponds and wetlands, frequent lack of defined channel)
M11T1.06-B	Protect River Corridors	Medium	Medium	Y	important attenuation asset for upstream impacts, should technically already have some protections-Class 2 wetland-maintain compliance
M11T1.06-B	Stream Buffers	Low	Low	Y	reed canary grass well established and likely to inhibit tree establishment, as well as beavers; does not appear to be in active ag use, may establish woody veg eventually on its own and has herbaceous wetland vegetation present currently
M11T1.06-B	Watershed Strategies	Medium	Next Highest	Y	culvert replacements, drainage management to increase infiltration and filtering through vegetation upstream should reduce sediment and nutrient loading here

6.1 Reach M11T1.07 – Scott Brook from corner of Topsham Rd. and Swamp Rd. to corner of Topsham Rd. and Swift Rd.

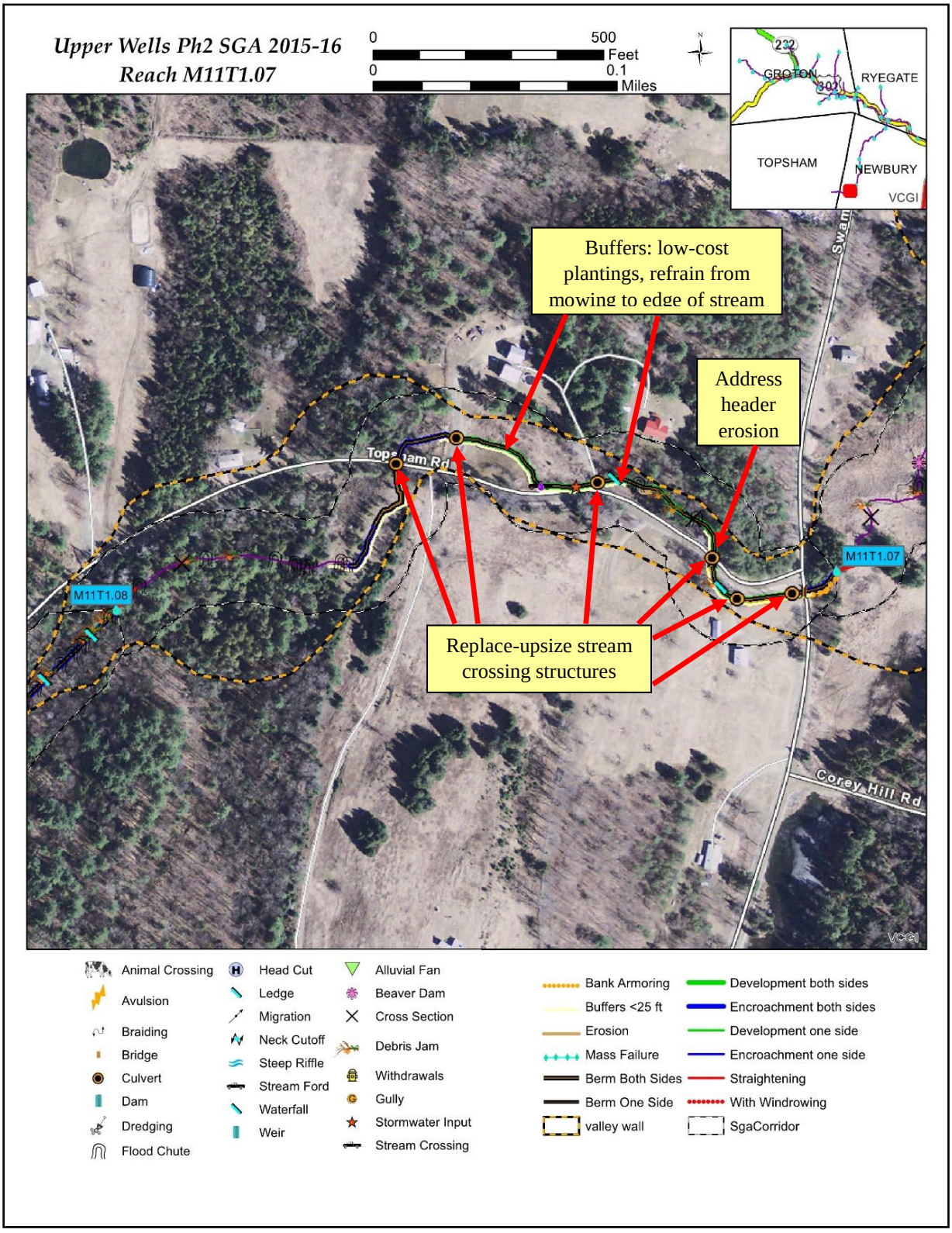


Figure 78. M11T1.07 Reach map – Scott Brook.

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M11T1.07	2037	E	None	Sand	Riffle-Pool	Very Broad

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M11T1.07A	818	C	b	Gravel	Step-Pool	Broad
M11T1.07B	1219	C	None	Sand	Riffle-Pool	Very Broad

	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
M11T1.07A	Fair	Very High	1.0	V	F	none
M11T1.07B	Fair	Extreme	1	IId	D	none

Scott Brook reach M11T1.07 flows west to east in relatively close proximity to Topsham Rd. in Newbury throughout most of the reach, and the downstream extent of the reach crosses under a box culvert under Swamp Rd. from whence Scott Brook parallels Swamp Rd. flowing north into the village of South Ryegate and the confluence with the Wells mainstem. The reach was broken into two segments for Phase 2 assessment primarily based on the presence of ledge grade controls in downstream segment A versus the lack of grade controls in upstream segment B, but also due to differences in planform and slope (segment A largely straightened and steeper).

Although upstream wetland and hydric soils greatly buffer storm discharges, lack of incision in downstream segment M11T1.07A was offset by a significant amount of straightening largely due to road encroachment and multiple undersized stream crossing structures (Fig. 79).



Figure 79. A series of undersized culverts along Topsham Rd., including the concrete box culvert under Swamp Rd. at the base of segment M11T1.07A (lower right), intensify sediment transport and the force of water being channeled through this segment and increase the risk of flood impacts.

Much of the development along M11T1.07A appears relatively recent, and the addition of further stream crossings and significant ditching increases the intensity and rapidity of water delivery to the stream network, thus increasing the value of upstream and downstream wetlands in tempering the effects of these hydrologic changes. Multiple ledge grade controls clearly contribute to lack of downcutting and lend some stability to the stream despite the high degree of encroachment, but will also increase the likelihood of lateral adjustments (widening and rapid planform changes). Sizing stream crossing structures adequately (at least 120 percent bankfull width in a reach with these type of stream dynamics; Schiff et al. 2014) will greatly reduce the prospects for elevated flood impacts in this reach. A gravel substrate was not expected in M11T1.07A, anticipated to be a cobble substrate under reference conditions, and the difference is likely related to the impacts of straightening and undersized structures and indicative of elevated sediment transport into the wetland area in the next reach downstream.

In upstream segment M11T1.07B, Peacham mucky peat soils appear to occupy more of the reach than indicated on soil maps (VT-ANR Atlas 2016). This segment was classified with an E type to C type stream type departure due to sedimentation and widening. The

channel splits upstream of a meadow above the most upstream culvert under Topsham Rd. in segment M11T1.07B, and rejoins just above that culvert, with some braiding in between. With substantial amounts of Peacham soils present there appeared to be sufficient cohesion to make the bed resistant to erosion, and the channel easily braids - especially when woody debris is also playing a role (Fig. 80).



Figure 80. Peacham soils present in much of M11T.07B lend sufficient cohesion to make the bed resistant to erosion, with braiding and floodplain access common on this section of small stream.

This segment was classed with Extreme sensitivity to changes in water and sediment inputs due to the current channel dynamics and dominance of Peacham soils, stressing the value of this segment as an attenuation asset and increasing the importance of protecting the corridor by limiting encroachments on the stream channel and floodplain in this segment.

Although the meadow in M11T1.07B is dominated by reed canary grass from likely past agricultural use, woody vegetation appears to already be taking hold through much of the segment. Buffers are missing in the vicinity of the driveway culvert to 162 Topsham Rd. however, where the stream is mowed to the banks.

Primary Stressors:

- Straightening (>50% of segment length) largely related to road encroachment, bank armoring and undersized stream crossing structures
- Muck and hydric soils contribute to Extreme sensitivity to changes in water and sediment inputs in upstream portions of the reach, channel currently split
- Development encroachments and clearing, missing buffers

Table 26. M11T1.07 Projects and Practices Table – Scott Brook

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M11T1.07-A	Stream Buffers	Next Highest	Next Highest	Y	low-cost plantings, refrain from mowing to edge of stream
M11T1.07-A	Remove/ Replace Structures	Very High	Next Highest	Y	private culverts all significantly undersized; box culvert under Swamp Rd. is lowest priority but is also undersized, especially for passage of wood and sediment
M11T1.07-A	Watershed Strategies	Very High	Medium	Y	Address undersized structures, stormwater management to increase infiltration and filtration through vegetation
M11T1.07-B	Protect River Corridors	Very High	Next Highest	Y	Attenuation asset upstream of rapidly developing area with significant encroachments
M11T1.07-B	Stream Buffers	Next Highest	Next Highest	Y	Stream mowed to banks in vicinity of driveway culvert to 162 Topsham Rd
M11T1.07-B	Remove/ Replace Structures	Very High	Next Highest	Y	Undersized culverts (under road and private driveway) increase straightening and force of water moving downstream, limiting floodplain access and increasing risk of impacts downstream
M11T1.07-B	Watershed Strategies	Very High	Very High	Y	Address undersized structures

6.1 Reach M11T1.08 – Scott Brook from corner of Topsham Rd. and Swift Rd. to downslope of cemetery on Emerson Rd. at Lime Kiln and James Downing Rds.

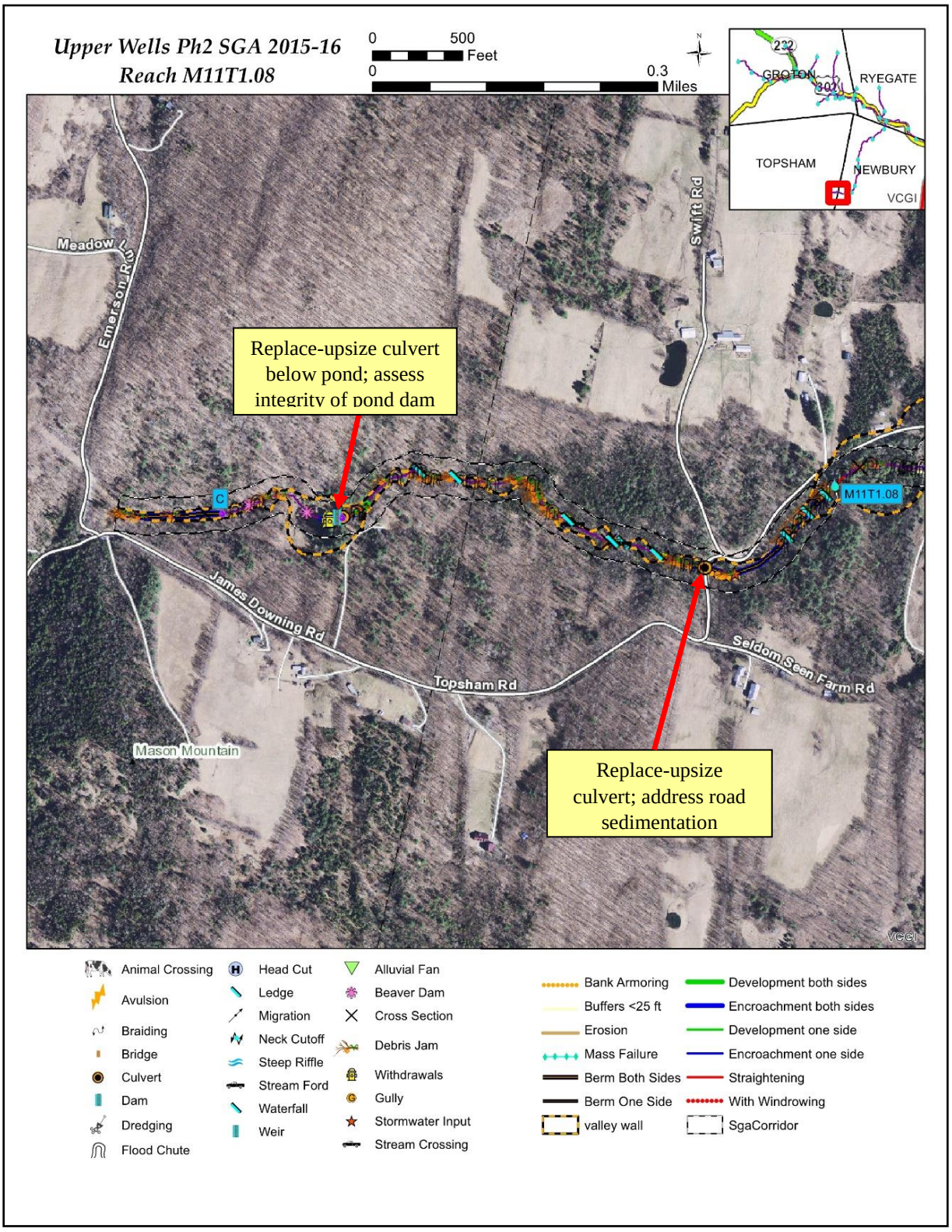


Figure 81. M11T1.08 Reach map – Scott Brook.

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M11T1.08	4589	C	b	Cobble	Step-Pool	Semi-Confined

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M11T1.08A	3256	C	b	Gravel	Step-Pool	Narrow
M11T1.08B	740	C	b	Gravel	Step-Pool	Very Broad
M11T1.08C	593	C	b	Gravel	Step-Pool	Narrow

	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
M11T1.08A	Fair	Very High	1.4	III	F	none
M11T1.08B	EXCLUDED					
M11T1.08C	Fair	Very High	2.3	III	F	none

Scott Brook reach M11T1.08 comprises the headwaters of Scott Brook and flows parallel to (though frequently at a distance and out of sight from) Topsham Rd. in Newbury, which becomes James Downing Rd. in Topsham at the town line in the mid-section of this reach. Although the stream is similar in slope and planform throughout much of this area, the reach was broken into three segments for Phase 2 assessment due to a beaver-human impounded pond (plus recently blown-out smaller, transient beaver ponds upstream) in a broader portion of the valley in segment M11T1.08B. That segment was excluded from full geomorphic assessment (per Phase 2 protocols) due to the impoundment lack of channel definition in the upstream beaver-influenced area.

In downstream segment M11T1.08A overall segment slope calculates to roughly six percent, but most of this occurs over a short stretch of ledge grade controls and the majority of the segment was field estimated at 2-4 percent slope. Current logging was in progress along roughly 40 percent of the segment, with occasional cutting extending to the edge of the stream bank and several brush corduroys (Fig. 82) in place at ledge grade controls that were used as stream fords; these corduroys were retaining a good deal of fine sediments. Fines appeared to be coming from breached upstream beaver dams and other stream bank erosion, and were being retained by natural debris jams as well as these log job brush corduroys; there was little evidence of sediment inputs from the logging.



Figure 82. Brush corduroy on top of a ledge grade control in the background of this picture was typical of several temporary stream crossings used for logging in progress along segment M11T1.08A during assessment; these corduroys were retaining a good deal of fine sediments.

At the downstream end of M11T1.08A Scott Brook is currently directly against Topsham Rd. on the left valley wall downstream of a perched culvert (with coarse stone cascade installed; Fig. 83) by Swift Road. Fresh bank armoring indicated possible reconfiguration of the road intersection in this area; it was not clear whether this was related to impacts of recent floods. Although this culvert is clearly problematic for aquatic organism passage, multiple ledge grade controls upstream are as well.



Figure 83. Culvert under Topsham Rd. at Swift Rd. was accompanied by fresh bank armoring downstream that appeared to indicate possible reconfiguration of the road intersection in this area; it was not clear if this was related to impacts from recent floods.

A one foot wide culvert in segment A just below the instream pond in M11T1.08B appeared to have plugged in recent floods, with resulting erosion and trail damage as well as some sort of pond overflow (did not appear to be a full breach, but more an outflanking) contributing an abundance of fine sediments to the channel (Fig. 84).



Figure 84. One foot culvert underneath trail (left) downstream of instream pond in M11T1.08B (dam in background of photo at right) appeared to have plugged in recent floods; dam did not appear fully breached, but rather overtopped or outflanked.

As noted, segment M11T1.08B was excluded due to impoundment of an instream pond (~0.74 acres) that appears to be shared by humans and beavers (Fig. 85). The excluded segment also included several hundred feet upstream where a couple smaller beaver ponds had been breached and were dry; the channel was frequently subsurface in this area.



Figure 85. Beaver lodge (center left of photo) on the upstream left bank of the shared human-beaver instream pond in segment M11T1.08B.

Upstream of the blown beaver dams segment M11T1.08C comprises the headwaters of Scott Brook, including a small well at the head of the reach and downslope of a small cemetery on Emerson Road. The slope gets much steeper at the head of the reach. It appears the stream bed in M11T1.08C may have been used as skid road in the past; a woods road now runs higher up along the right valley but does not appear to have been in recent use (this may have been an equipment access road for construction of the pond downstream). Despite significant historic incision the channel is small and retains sufficient floodplain access to remain a Cb stream type (‘a’ subslope, i.e. 4 percent plus, in most upstream portion).

Primary Stressors:

- Undersized culverts at Topsham Rd. and downstream of instream pond in M11T1.08B
- Road encroachment (Topsham Rd.) on downstream end of reach
- Recent flood impacts in vicinity of pond, breached beaver pond dams (temporary)

Table 27. M11T1.08 Projects and Practices Table – Scott Brook

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M11T1.08-A	Protect River Corridors	Medium	Medium	Y	Low probability of further development (distant from road) but municipal corridor protection including small stream setbacks would help
M11T1.08-A	Remove/Replace Structures	Next Highest	Medium	Y	Topsham Rd culvert undersized, prone to fail, header open to erosion; culvert on trail beneath pond extremely undersized, perched, plugged in recent floods
M11T1.08-A	Restore Incised Reach	Very High	Medium	Y	Passive; allow wood to play critical role in retaining sediments and rebuilding floodplain access
M11T1.08-A	Watershed Strategies	Very High	Very High	Y	municipal corridor protection including small stream setbacks; assess dam integrity at pond in upstream segment B
M11T1.08-B	EXCLUDED				EXCLUDED SEGMENT (active beaver-human pond, blown ponds upstream with subsurface channel)
M11T1.08-C	Watershed Strategies	Very High	Very High	Y	municipal corridor protection including small stream setbacks; assess dam integrity at pond in upstream segment B

6.1 Reach M12S2.01 – Stone Rd Brook from old railroad abutments at South Ryegate stonesheds to tributary confluence at field-woods edge east of 411 Stone Rd

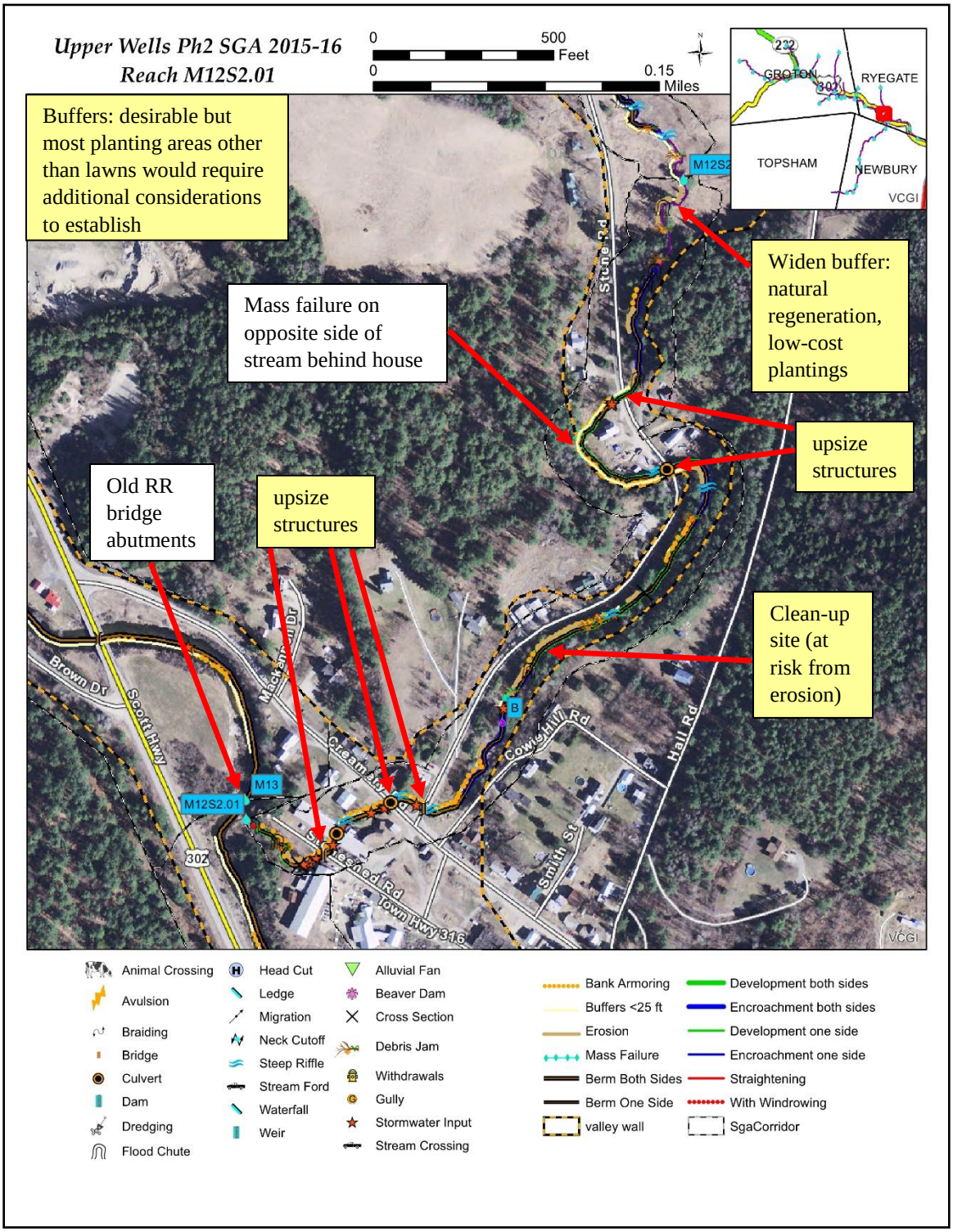


Figure 86. M12S2.01 Reach map – Stone Rd Brook.

Phase 1 (reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M12S2.01	3291	C	b	Cobble	Riffle-Pool	Very Broad

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M12S2.01A	1033	C	None	Gravel	Riffle-Pool	Very Broad
M12S2.01B	2258	C	b	Gravel	Riffle-Pool	Semi-Confined

	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
M12S2.01A	Fair	Very High	3.3	III	F	C to B
M12S2.01B	Fair	Very High	1.8	III	F	none

Stone Rd. Brook is a name assigned to a small tributary to the Wells that is actually unnamed on topographic maps. This tributary does in fact parallel Stone Rd. in Ryegate for almost its entire 3-plus mile length, draining forest and farm fields into relatively densely settled portions of South Ryegate village and joining the Wells mainstem at the old railroad bridge abutments at the former stonesheds that are highly visible from Rte. 302 (Scott Hwy.). Downstream reach M12S2.01 (0.62 mi. total) is strongly influenced by the underlying geology, with the reach being segmented for Phase 2 assessment based on the depth of historic incision (downcutting) through highly erodible sediments that appear to be a legacy of glacial Lake Hitchcock (Fig. 87).

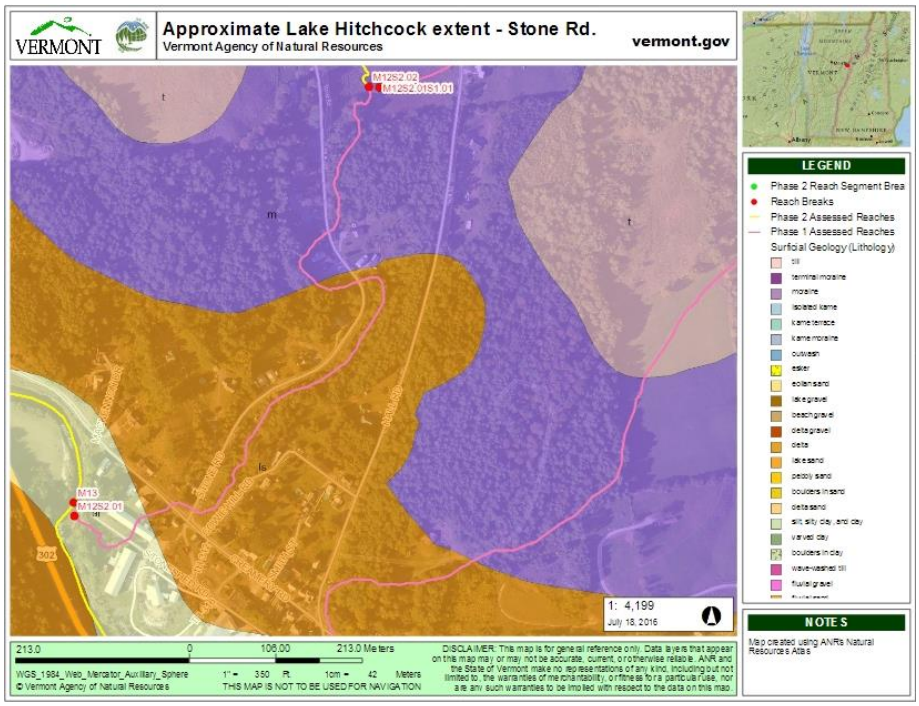


Figure 87. Approximate glacial Lake Hitchcock extent indicated by surficial geology of reach M12S2.01, which is largely located on former lake sands (orange) in the downstream half (segment A) and on a recessional moraine (purple) in the upstream portion (segment B).

Downstream segment A is largely riprapped and/or walled in, and passes through four undersized structures including two bridges, a box culvert and a long poured concrete structure that passes under one of the former stonesheds (Fig. 88).

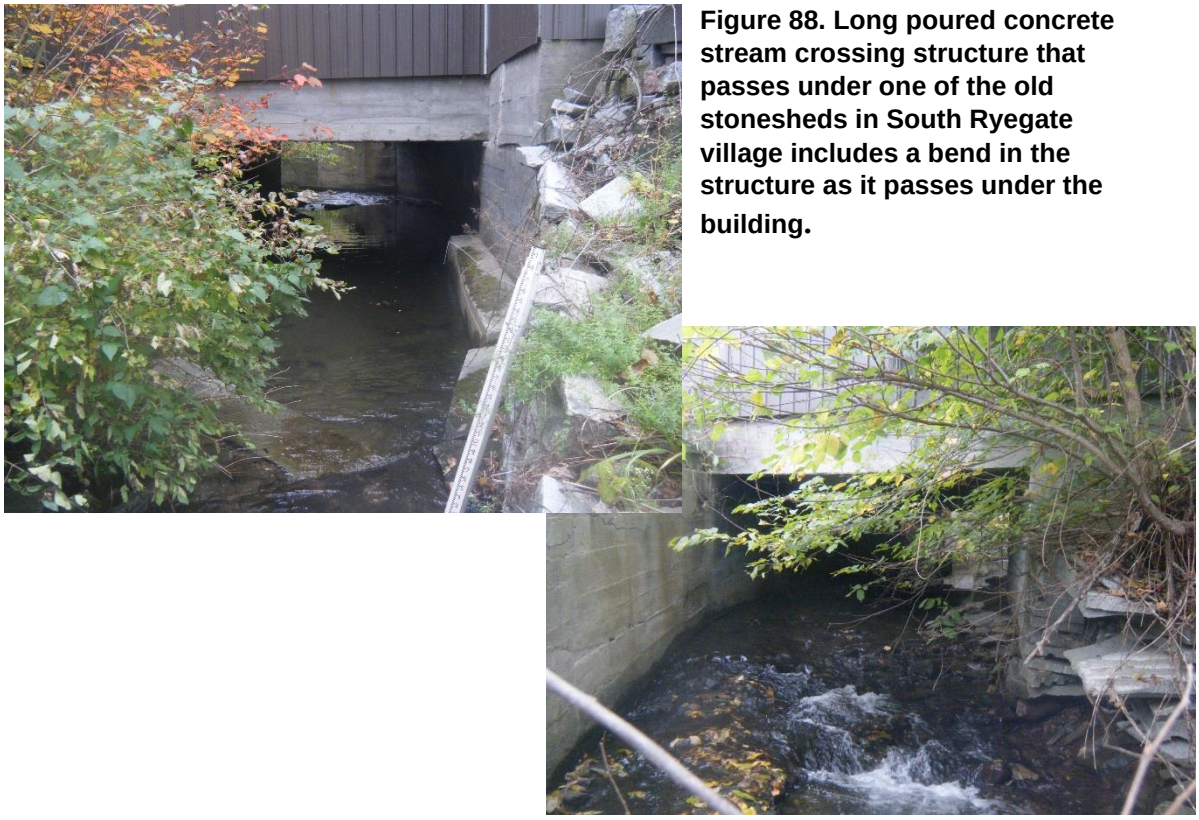


Figure 88. Long poured concrete stream crossing structure that passes under one of the old stonesheds in South Ryegate village includes a bend in the structure as it passes under the building.

The stream is deeply incised historically through most of segment A, and local residents reported that it never overtopped its banks in the vicinity of the bridge (Stone Rd.) and box culvert (Creamery Rd.) that funnel the stream through a right angle bend before it passes under and past the stonesheds on its way to the old rail abutments that line the banks at the Wells mainstem reach break between reaches M12 and M13 (Fig. 89). Sediments deposited at the mouth of the stream are indicative of the enhanced sediment transport in this highly straightened portion of stream, but the structures themselves are difficult to address at this point in time due to pervasive development encroachments.



Figure 89. Partially eroded delta bar at the mouth of Stone Rd. Brook as it empties into the Wells mainstem at the old rail abutments near the South Ryegate stonesheds, at the break between reaches M12 and M13.

Segment M12S2.01B is situated on a recessional moraine with high sand content, and lots of fines were moving as we walked the stream. A significant degree of historic downcutting is likely partially related to glacial legacy but is also amplified by road encroachment that significantly reduces the valley and available floodplain width. While the stream in this upstream segment is generally less incised than in downstream segment A, localized entrenchment is clear in the vicinity of a pair of stream crossings (one culvert and one bridge) in the midsection of the segment that block access to the floodplain on either side of the stream (Fig. 90). The enhanced stream power from this funneling has helped trigger a mass failure along the right valley wall behind a house located inside a stream meander at 273 Stone Rd., scoured below the culvert on the upstream end so that the culvert is starting to become perched, and toppled much of the bank armoring that formerly lined the majority of this meander.





Figure 90. Culvert (left) and bridge (right) that help funnel flow around a house located inside a meander bend both block access to the floodplain on either side of the stream and appear to have helped trigger a mass failure and erosion leading to bank armoring a short distance downstream of each of these structures.

The downstream of these two structures, a substantial concrete bridge, was replaced around 2006 and is sized at ~84 pct. bankfull width, a figure that does not account the reduction of effective width due to the angle of alignment. Much of the bank armoring immediately downstream of this structure has been toppled, and the majority of the stream below the two of structures has been armored (much toppled) or significantly eroded. Various stockpiled or discarded materials along the right bank of the stream immediately across Stone Rd. from a garage near 159 Stone Rd. appear to be at risk due to undercutting of the banks (Fig. 91).



Figure 91. Various stockpiled or discarded materials along right bank of M12S2.01B appear to be at risk due to undercutting of the banks

Primary Stressors:

- Straightening (>50% of each segment length) largely related to extensive road encroachment, bank armoring and undersized structures
- Significant historical downcutting through highly erodible sediments (loss of historic floodplain access - incision ratio 3.3 - in segment A; substantial restriction of access to historic floodplains – incision ratio 1.8 - in segment B)

Table 28. M12S2.01 Projects and Practices Table – Stone Rd. Brook

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M12S2.01-A	Stream Buffers	Medium	Medium	Y	Lawn areas might be planted but many missing buffers due to road encroachment and need additional considerations for a buffer to establish
M12S2.01-A	Remove/Replace Structures	Low	Low	N	Four structures all significantly undersized but currently difficult to remedy due to pervasive development encroachments. Creamery Rd. box culvert headers washing out but limited in extent of potential sediment contribution
M12S2.01-A	Restore Incised Reach	Low	Low	N	High priority corridor protection downstream, likely in reach M10 at this point in time, to attenuate elevated flows and sediment discharges through channelized reach
M12S2.01-A	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, stormwater management, capital planning with eye to structure replacements-identify problem structures and target replacement sizes for when opportunities arise to replace damaged structures

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M12S2.01-B	Protect River Corridors	Very High	Medium	Y	Limited but important possibility for corridor protection on upstream end
M12S2.01-B	Stream Buffers	Medium	Medium	Y	Possibility for wider natural regen and low cost planting (with ample setback) on upstream end; lawn areas might be planted but many missing buffers due to road encroachment and need additional considerations for a buffer to establish
M12S2.01-B	Remove/Replace Structures	Next Highest	Next Highest	Y	Upstream culvert more undersized, higher priority but more constrained by nearby development; downstream bridge replaced 2006, substantial concrete (places road at higher risk), undersized and effective width reduced by angle of alignment
M12S2.01-B	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, stormwater management, capital planning with eye to structure replacements

6.1 Reach M12S2.02 – Stone Rd. Brook tributary confluence at field-woods edge east of 411 Stone Rd. to temporary skidder bridge crossing east of hayfields just upstream of 1557 Stone Rd.

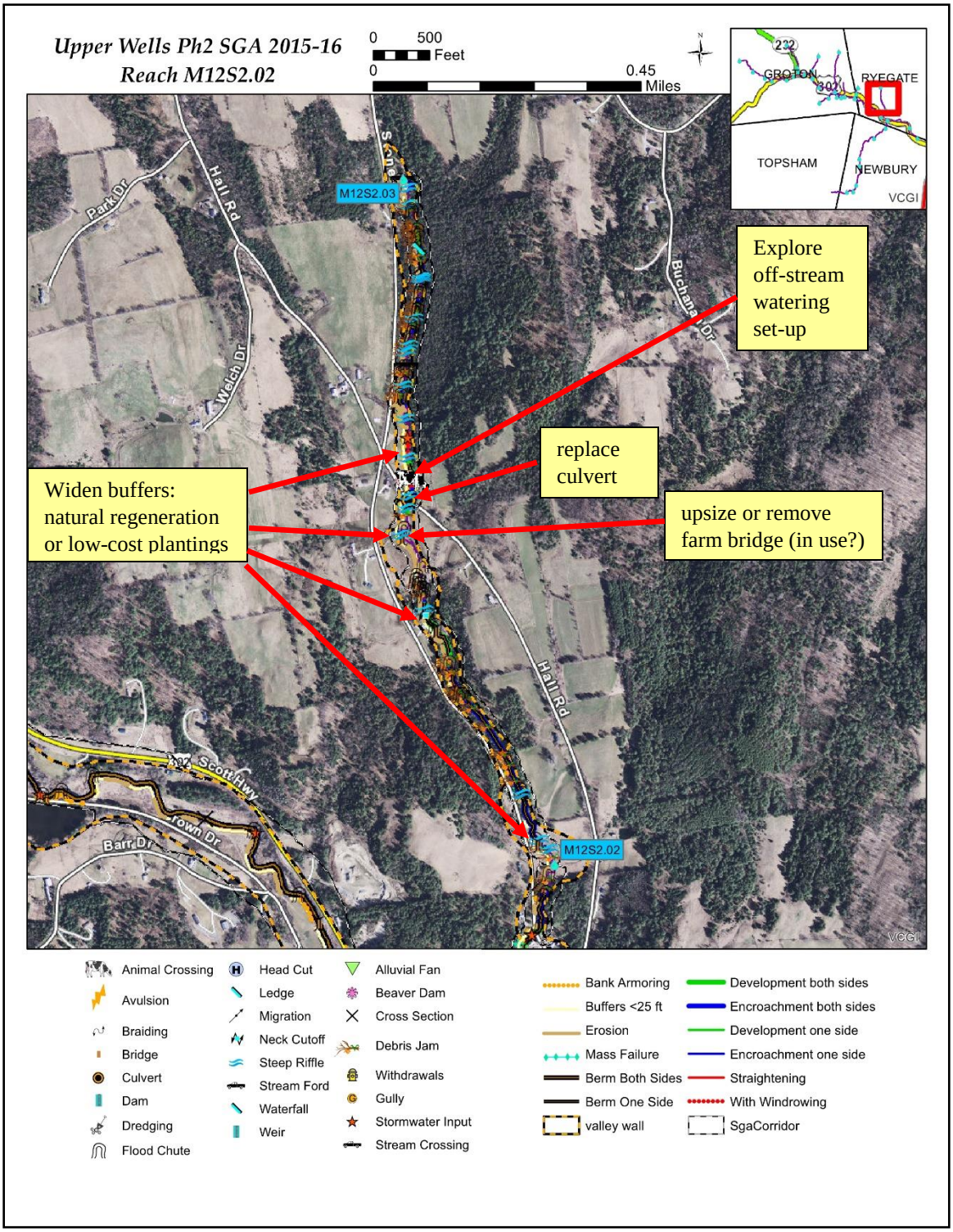


Figure 92. M12S2.02 Reach map – Stone Rd Brook.

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M12S2.02	7206	C	b	Cobble	Riffle-Pool	Very Broad

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M12S2.02-0	7206	C	b	Gravel	Riffle-Pool	Very Broad
	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
M12S2.02-0	Fair	Very High	1.4	III	F	none

Reach M12S2.02 is located on part of the Danville Moraine, a large “glacial frontal moraine assumed to be recessional”, indicating an unsorted mix of soil particles and stone left behind during glacial retreat as the Laurentide Ice Sheet melted and receded from its maximum southerly advance roughly 12,000-15,000 years ago. These glacial influences and subsequent erosion and deposition patterns have left complex topography in this stream reach that is highly variable both vertically (stream bed-floodplain relationship) and horizontally (valley and floodplain width). High terraces inside the true valley walls often lead to localized channel constrictions and incision, with alternating pockets of aggradation in wider portions of the valley where older terraces are more distant from the stream. Only one ledge grade control was located in the reach, so large wood is the primary check to stream incision or downcutting. Incision was notable in straightened areas and at stream constrictions (Hall Rd. culvert significantly undersized (Fig. 93), farm bridge a short distance downstream may not be in use any longer).

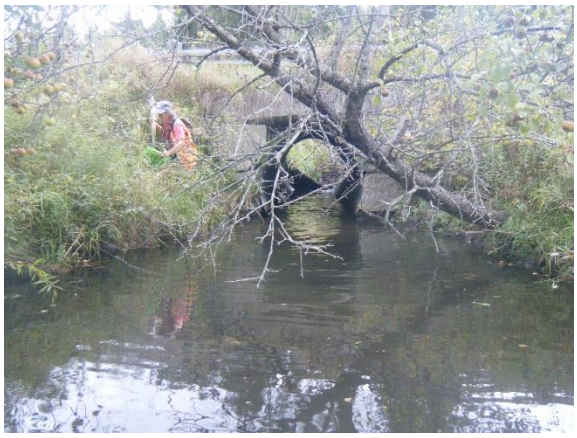


Figure 93. Scour pool downstream of the significantly undersized Hall Rd. culvert in reach M12S2.02 indicates the erodible nature of the stream bed, which generally lacks any ledge grade controls in this reach.

Debris jams play a large role in stream dynamics in reach M12S2.02 (Fig. 94) but post-Irene snagging (large wood removal) appears relatively common along this small stream, leaving the stream moderately entrenched and more erosive.



Figure 94. Sediment retention behind a large tree tip-in in reach M12S2.02 demonstrates the important role of large woody debris in small stream dynamics, attenuating sediment discharges and diffusing high flows while also providing a means to rebuild access to historically abandoned floodplains.

Primary Stressors:

- Restriction of access to historic floodplains (incision ratio 1.4), frequent additional older incision evident in presence of high terraces
- Lack of grade controls, localized incision in areas of straightening and undersized structures
- Snagging (removal of large wood from channel dynamics)
- Elevated erosion in areas lacking woody stream buffers

Table 29. M12S2.02 Projects and Practices Table –Stone Rd. Brook

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M12S2.02-0	Protect River Corridors	Very High	Medium	Y	Channel management easements might allow large wood to play appropriate important role in establishing more stability, encourage better buffers
M12S2.02-0	Stream Buffers	Very High	Next Highest	Y	Protect wider set-aside for natural regeneration and low-cost plantings (with ample setback) thru portions of reach; narrow buffers present, parent sources exist. Exclusion fencing and off-stream watering near Hall Rd.
M12S2.02-0	Remove/ Replace Structures	Next Highest	Medium	Y	Hall Rd. culvert significantly undersized; scour currently localized but road also at risk. Farm bridge short distance downstream may not be in use, best option removal; if replaced, consider design on waste blocks outside channel width
M12S2.02-0	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, stormwater management, capital planning with eye to bridge replacements, develop info on bridge and culvert options for private landowners. Significant loss of wetland attenuation upstream, hydrologic loads may well shift with stormwater management

6.1 Reach M14S2.01 – Darius James Brook from confluence with Wells mainstem to Scott Hwy. (Rte. 302) bridge by electric substation at Witherspoon Rd.

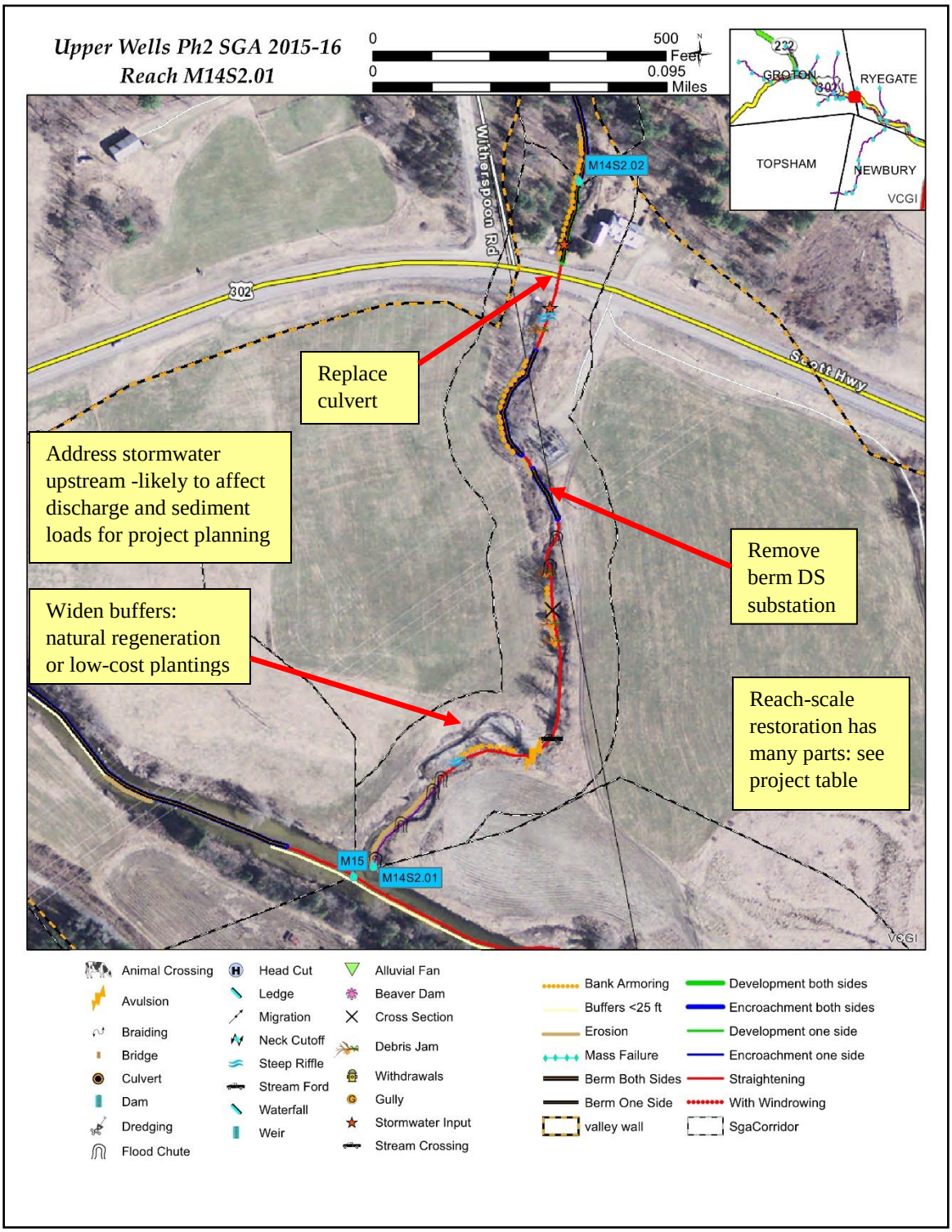


Figure 95. M14S2.01 Reach map – Darius James Brook.

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M14S2.01	1423	C	b	Gravel	Riffle-Pool	Very Broad

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M14S2.01-0	1423	C	b	Gravel	Riffle-Pool	Very Broad
	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
M14S2.01-0	Fair	Very High	1.7	III	F	none

Reach M14S2.01 is the most downstream portion of Darius James Brook, a tributary to the Wells that runs alongside Witherspoon Rd. for much of its length. This is a significantly channelized reach located on an alluvial fan and deltaic formations (delta gravel and lake sands) at the edge of glacial Lake Hitchcock. The upstream end of this reach is located just upstream of a 14 ft. squash tube culvert (roughly 75 pct. bankfull width) under Rte. 302 (Scott Hwy.), and a house and barn occupy the left bank floodplain and stream corridor upstream of the culvert as well (Fig. 96). The house and barn appear old and may be buildings that have been at this site since the 1800s, as the Beers Atlas for Caledonia County (1875) indicates a residence at roughly this same location.



Figure 96. House and barn occupy the left bank corridor and floodplain upstream of the undersized Rte. 302 culvert in reach M14S2.01, near the base of Witherspoon Rd.

Downstream of the Rte. 302 culvert the stream remains channelized and has a berm along much of the left bank; the berm restricts floodplain access in the vicinity of an electrical substation placed close to the stream off the left bank (Fig. 97).



Figure 97. Downstream of the Rte. 302 culvert in reach M14S2.01 a berm appears to limit floodplain access in the vicinity of an electrical substation.

The valley downstream of Rte. 302 joins a shared valley with the Wells mainstem, running transverse to the flow of Darius James Brook and offering a vast floodplain, but due to the combination of channelization, berming, and deep historical incision the stream does not appear to be able to access this floodplain until a very short distance (~350 ft.) upstream of the confluence with the Wells mainstem.

Primary Stressors:

- Straightening (>50% of segment length) largely related to development encroachments, bank armoring, funneling through an underside culvert, deep historic incision, and berming
- Geologic legacy of glacial Lake Hitchcock and glacial retreat (delta gravels, lake sands in this reach, mix of sediments including strong proportion of fines on recessional moraine upstream)
- Restriction of access to historic floodplains (incision ratio 1.7)

Table 30. M14S2.01 Projects and Practices Table – Darius James Brook

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M14S2.01-0	Stream Buffers	Next Highest	Medium	Y	Create-protect wider buffer. Natural regeneration may be possible, some parent sources present. Ideally part of restoration of incised reach, but low-cost plantings would still be a benefit and could establish due to armoring
M14S2.01-0	Remove/Replace Structures	Next Highest	Medium	Y	Minimal gains unless other restoration of incised reach occurs
M14S2.01-0	Watershed Strategies	Very High	Next Highest	N	Municipal corridor protection: corridor adoption to raise level of Emergency Relief Assistance Funds cost shares (house at risk). Stormwater management upstream likely to affect discharge and sediment loads. Reach-scale restoration: address undersized structure, remove portion of berm downstream of substation, channel management easement in downstream portions

6.1 Reach M14S2.02 – Darius James Brook from Scott Hwy. (Rte. 302) bridge by electric substation at Witherspoon Rd. to tributary just west of Renfrew Rd. junction with Witherspoon Rd.

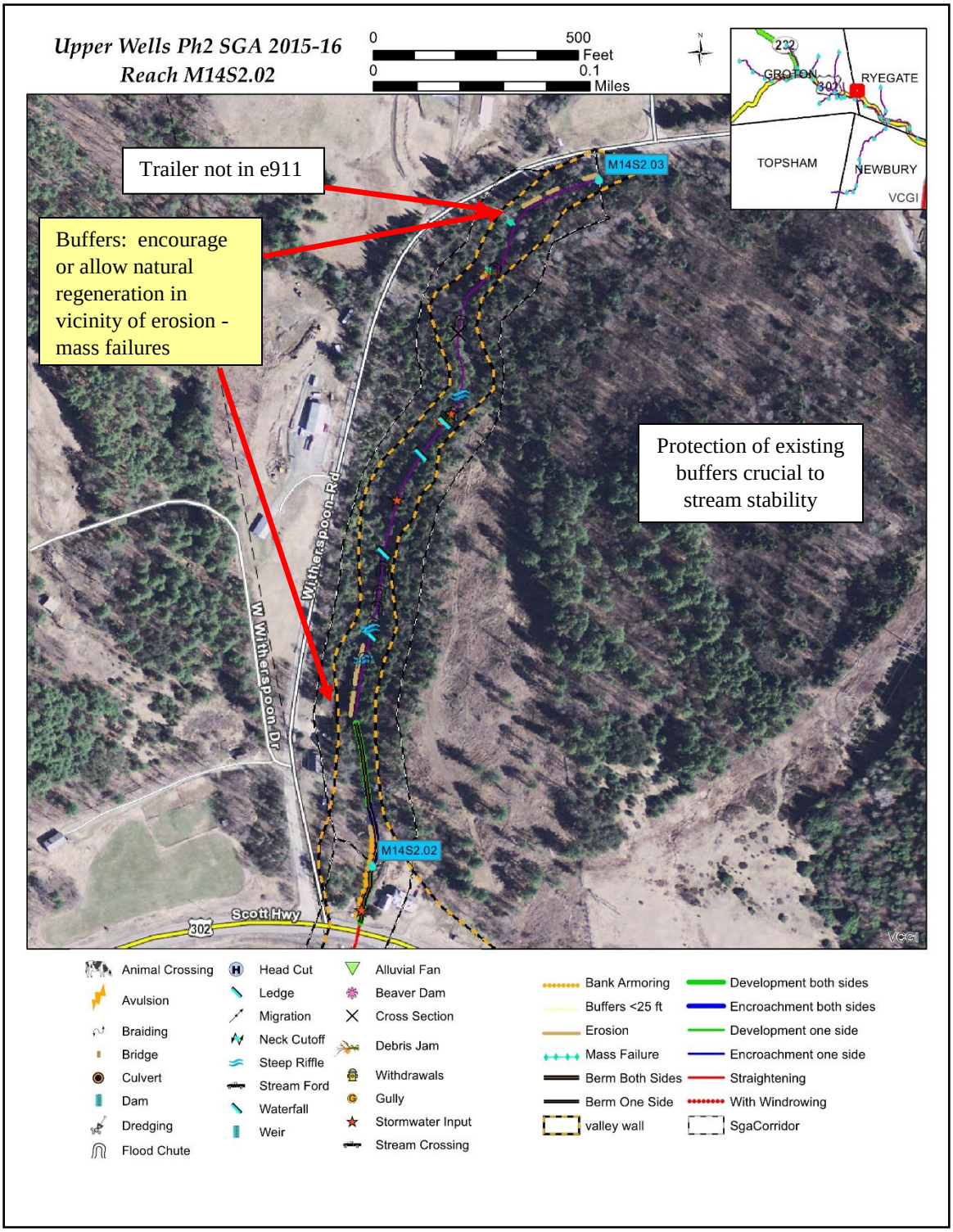


Figure 98. M14S2.02 Reach map – Darius James Brook.

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M14S2.02	1915	B	None	Cobble	Step-Pool	Semi-Confined

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M14S2.02-0	1915	B	None	Cobble	Step-Pool	Semi-Confined
	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
M14S2.02-0	Fair	High	1.4	III	F	None

Reach M14S2.02 of Darius James Brook is located on a glacial moraine (assumed to be recessional) upstream of the former glacial lake edge delta and alluvial fan that occupy much of M14S2.01.The stream is entrenched in a semi-confined valley below Witherspoon Rd., with small pockets of floodplain on alternating sides of the stream interspersed with areas where the stream valley slopes upward directly from the stream on both sides, typically in more of a “U” shape than a steeper “V” (Fig. 99).

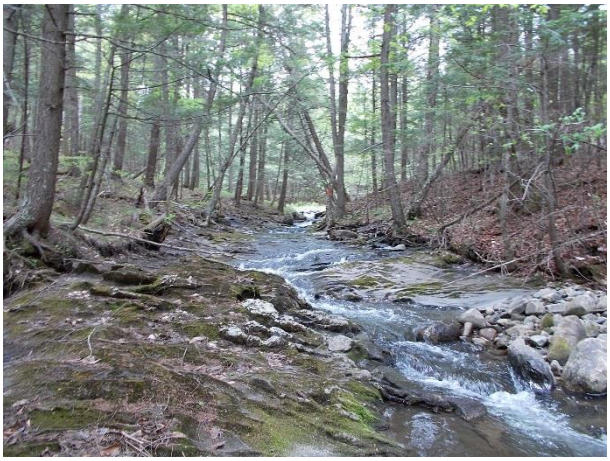


Figure 99. Ledge grade controls limiting further downcutting, gently sloping valley sides when the slopes depart directly from the stream on both sides (foreground), and alternating pockets of floodplain on one side or the other (background) when valley sides are steeper are all emblematic of Darius James Brook reach M14S2.02.

Good buffers are present along much of the reach and are critical, currently limiting what could be much more erosion to just scour and mass failures in this semi-confined valley. Large woody debris and significant sediment contributions from the mass failures, including a good bit of coarse sediments, contribute to a combination of step and meander formation that give this reach a much more diverse planform than is apparent from the Vermont Hydrography Dataset, which indicates a relatively straight stream along the roadside.

Although it is unclear whether development was placed near old mass failures where a view to the stream was present, or mass failures occurred where buffers were cut, two areas of heightened erosion/mass failures in the reach were located fairly close to existing development (including 4313 Witherspoon Rd.); a camp or small trailer and associated shed near the head of the reach do not appear to be present in the e911 database (Fig. 100). Large woody debris associated with mass failures plays an important role in trapping and storing sediment and rebuilding floodplain access in a stream of this type, and sizing bridges and culverts to bankfull width or larger can help prevent plugging of these structure in floods.



Figure 100. Heightened erosion/mass failures near a trailer and shed near the top of reach M14S2.02 (left) and house further downstream (right) have some of the few areas of reduced buffers in this reach.

Primary Stressors:

- Stormwater inputs (moderate) due to location alongside road; no gullies, but quicker and more intense delivery of water to the stream in heavy events
- Historic incision (incision ratio 1.4)
- Development encroachments
- Highly erodible geology along sides (bed has ledge grade controls) due to legacy of recessional moraine

Table 31. M14S2.02 Projects and Practices Table – Darius James Brook

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M14S2.02-0	Protect River Corridors	Very High	Very High	Y	Municipal corridor protection
M14S2.02-0	Stream Buffers	Next Highest	Low	Y	Encourage revegetation of areas near erosion-mass failures; could be passive, but refrain from impacting buffers
M14S2.02-0	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, stormwater management, capital planning with eye to bridge replacements, develop info on bridge and culvert options for private landowners. Significant loss of wetland attenuation upstream, hydrologic loads may well shift with stormwater management.

6.1 Reach M15S1.01 – Clark Hatch Brook from confluence with Wells mainstem by Cemetery Rd. (Groton Village Cemetery) to just downstream of driveway to 432 Glover Rd.

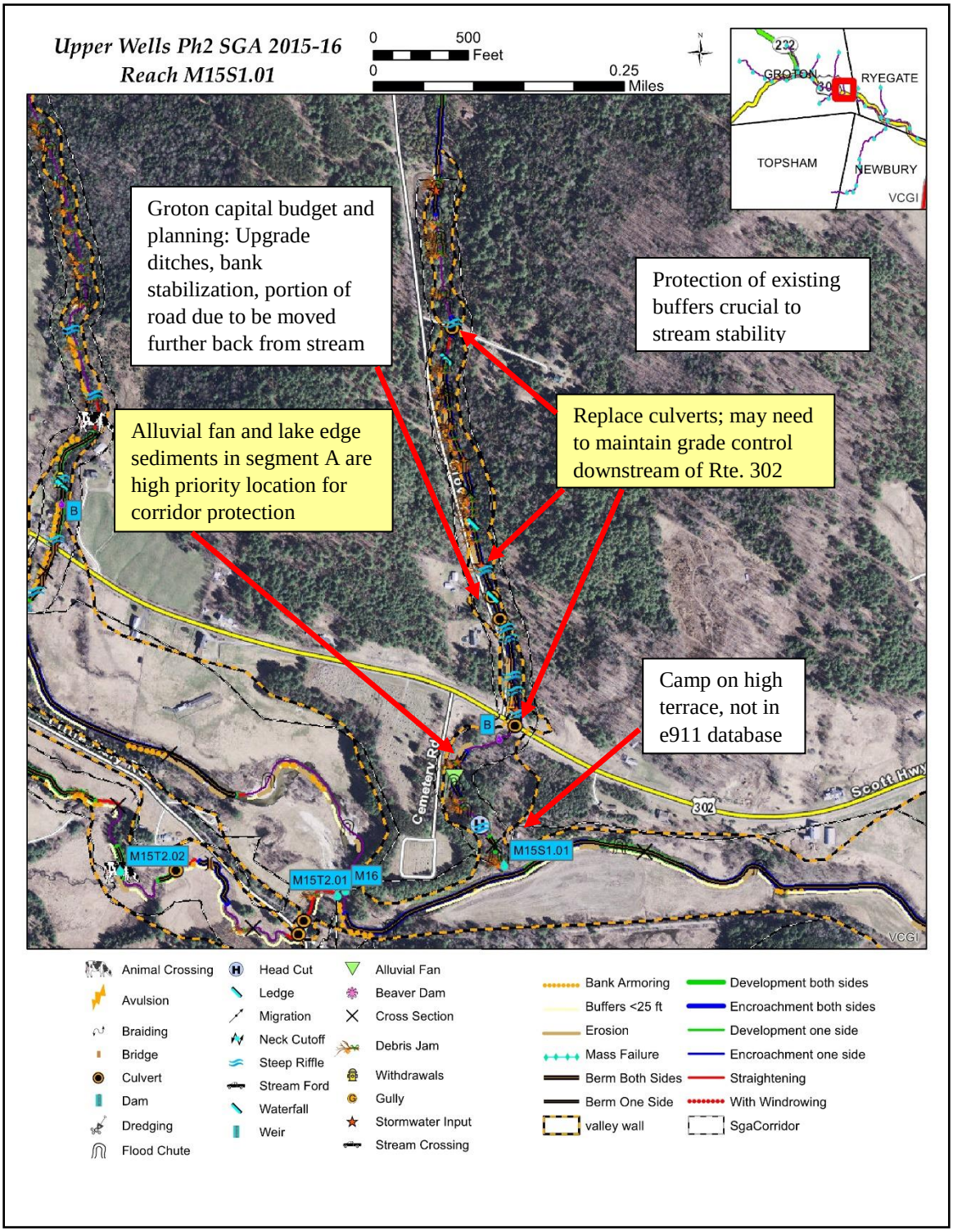


Figure 101. M15S1.01 Reach map – Clark Hatch Brook.

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M15S1.01	4006	Not Assessed in Phase 1 - small stream				

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M15S1.01A	917	C	None	Gravel	Riffle-Pool	Narrow
M15S1.01B	3089	C	b	Cobble	Step-Pool	Narrow
	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
M15S1.01A	Fair	Extreme	1.6	III	F	none
M15S1.01B	Fair	High	1.7	III	F	none

Reach M15S1.01 on Clark Hatch Brook is part of a small stream that runs along Glover Rd. a short distance west of the Ryegate-Groton town line, and was not included in Phase 1 assessment of the overall Wells basin in 2008 due primarily to its size. The stream is emblematic of numerous other tributaries on the north side of the Wells mainstem however, laid out in close proximity to a road and situated on highly erodible soils that are a legacy of the presence of glacial Lake Hitchcock. The reach was segmented primarily due to differences in underlying geology related to that legacy; downstream of the Rte. 302 culvert segment A is located on pebbly sands and an alluvial fan in the vicinity of the former glacial Lake Hitchcock shoreline. (The Groton Village Cemetery immediately west of segment M15S1.01A is also located on this combination of lake edge sediments and alluvial fan). Upstream segment B is situated in part atop denser till, but upstream portions are located on less consolidated, mixed size sediments likely left behind as a recessional moraine during glacial retreat (Fig. 102).

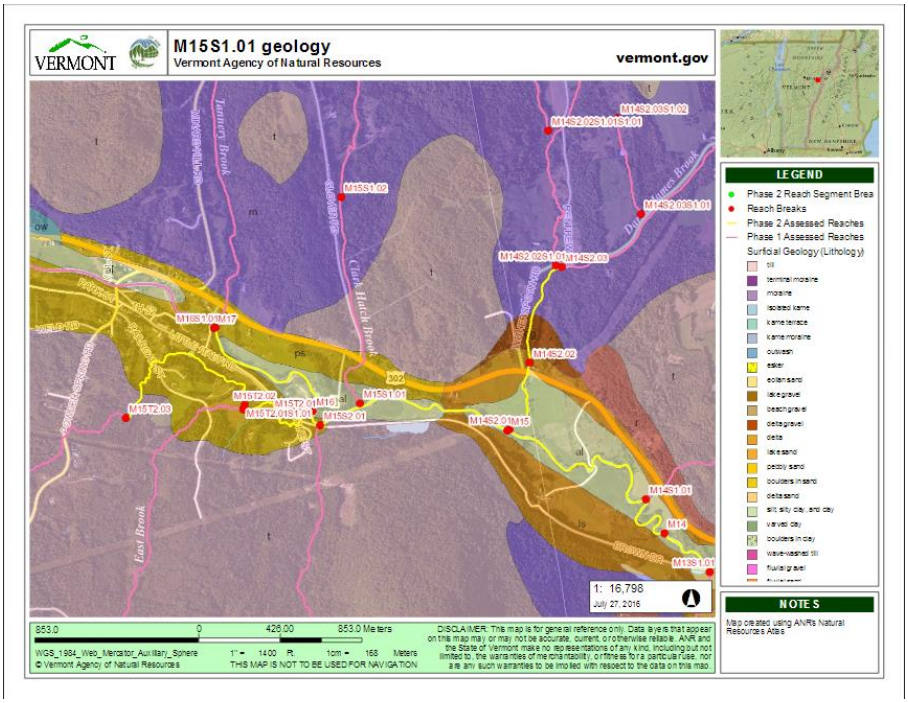


Figure 102. Glacial influences on surficial geology of reach M15S1.01: segment A, downstream of the Rte. 302 culvert, is located on pebbly sands (orange) and an alluvial fan at the edge of the former Lake Hitchcock while upstream segment B is located on till and a recessional moraine (purple).

In segment A, deep historical erosion through the former lake edge sediments leaves the current stream entrenched in a "valley" (high terraces) of meanders reflective of glacial stream planform (Fig. 103).



Figure 103. High terraces left by deep incision through lake edge sediments leaves the current stream in M15S1.01A in a tight "valley" reflecting old stream meanders.

A single headcut in M15S1.01A (Fig. 104) is at a "valley wall" (high terraces) pinch point broken through transverse lake edge formations parallel to the valley of the Wells mainstem. With no other apparent outlet to the mainstem it appears likely that this point periodically builds up sediments, and nickpoints or headcuts then chew back through these deposits.



Figure 104. Headcut in M15S1.01A cuts through a transverse wall of old lake edge sediments before Clark Hatch Brook joins the Wells.

A camp on the left valley wall of segment A is located on a higher terrace, but the stream dynamics and highly erodible nature of the sediments in this segment indicate a high priority for corridor protection, ensuring encroachments remain well back from the stream.

There are a number of ledge grade controls in upstream segment M15S1.01B that limit incision, but their presence has transferred erosive stream power to the channel banks and lateral boundaries, and stream-road conflicts have been repetitive in portions.

Due to repeat damages and escalating repair costs, Glover Rd. was identified as a high priority project area in a model 'Municipal Road Erosion and Stream Crossing Inventory and Capital Planning Budget' developed by the Town of Groton and other cooperators (Smith et al 2015) that serves as an excellent example for project development incorporating many of the considerations highlighted here in this geomorphic assessment report. Clark Hatch Brook already included an innovative double culvert system to drain high flows (amplified by one of the ledge grade controls) under the road and into an old flood chute or abandoned channel before returning the water to the stream further downslope (Fig. 105). Plans developed in conjunction with the capital budget planning (Smith et al 2015) include relocating a portion of Glover Rd. further back from Clark Hatch Brook to allow the stream room for adjustments without repeatedly damaging the road, as well as implementing state of the art ditches that are part of the stormwater management in this area.



Figure 105. Historically incised stream in downstream portion of M15S1.01B leaves very little room for the stream to move, and with ledge now exposed in the bottom the primary erosion has occurred along Glover Rd. (left). Innovative culvert system (right) was installed to carry high flows off the top of a ledge run, under the road, and into a disconnected meander, returning high flows to the stream through another culvert downstream; longer-term capital budget now includes planning for a portion of the road to be relocated further back from the stream to reduce recurrent conflicts.

Beyond the two small culverts used to divert high flows into the old channel meander, three other culverts in M15S1.01B are also undersized and contributing to straightening and amplification of stream power; two appear to be private structures, and the state structure under Rte. 302 is significantly sloped (Figs. 106 and 107).

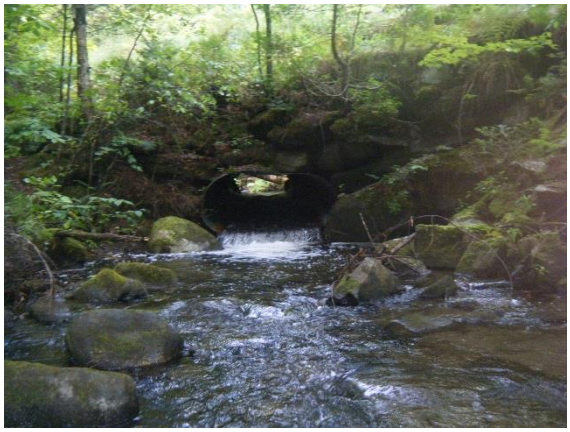



Figure 106. Two undersized private culverts in segment M15S1.01B.



Figure 107. Culvert under Rte. 302 has a significant downhill slope to it that heavily amplifies stream power through the structure (left). With highly erodible sediments downstream and lack of natural ledge or other grade controls, efforts have been required to keep headcuts from migrating upstream and undermining this structure (right).



Primary Stressors:

- Heavy road encroachment, particularly in downstream 600 feet of M15S1.01B (upstream of Rte. 302 culvert); ledge grade controls limit downcutting but increase erosive force on stream banks-road edge
- Straightening largely related to undersized culverts and road encroachment
- Legacy of glacial retreat and Lake Hitchcock presence: erodible mixed sediments upstream; alluvial fan, deep historic incision and transverse terraces at entrance to Wells mainstem valley downstream
- Restricted access to historic floodplains (incision ratio 1.6 in downstream segment A, 1.7 in upstream segment B), additional older incision evident in presence of high terraces – especially downstream of Rte. 302 culvert (segment A)

Table 32. M15S1.01 Projects and Practices Table – Clark Hatch Brook

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M15S1.01-A	Protect River Corridors	Very High	Next Highest	Y	Reach priority elevated by difficulty in addressing upstream conflicts; watershed priority only reduced by relatively small size of drainage and inaccessibility to mainstem dynamics - but appears susceptible to development and encroachment as well
M15S1.01-A	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, stormwater management, capital planning with eye to culvert replacements upstream, develop info on bridge and culvert options for private landowners.

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M15S1.01-B	Stream Buffers	Next Highest	Medium	N	Lawn areas might be planted but most missing buffers due to road encroachment and need additional considerations for a buffer to establish; ideally part of incised reach restoration
M15S1.01-B	Remove/Replace Structures	Very High	Very High	Y	Undersized structures amplify stream power in this road-encroached segment; adequate sizing would help reduce erosive impacts and help allow large wood to play its critical role in a stream setting like this
M15S1.01-B	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, stormwater management, capital planning with eye to culvert replacements, develop info on bridge and culvert options for private landowners. Groton road erosion inventory, capital planning and stormwater management planning are great model for starting point

6.1 Reach M15T2.01 – Keenan Brook from confluence with Wells mainstem downstream of railroad culverts at Little Italy Rd. and Pine St. to confluence with East Brook near 556 Little Italy Rd.

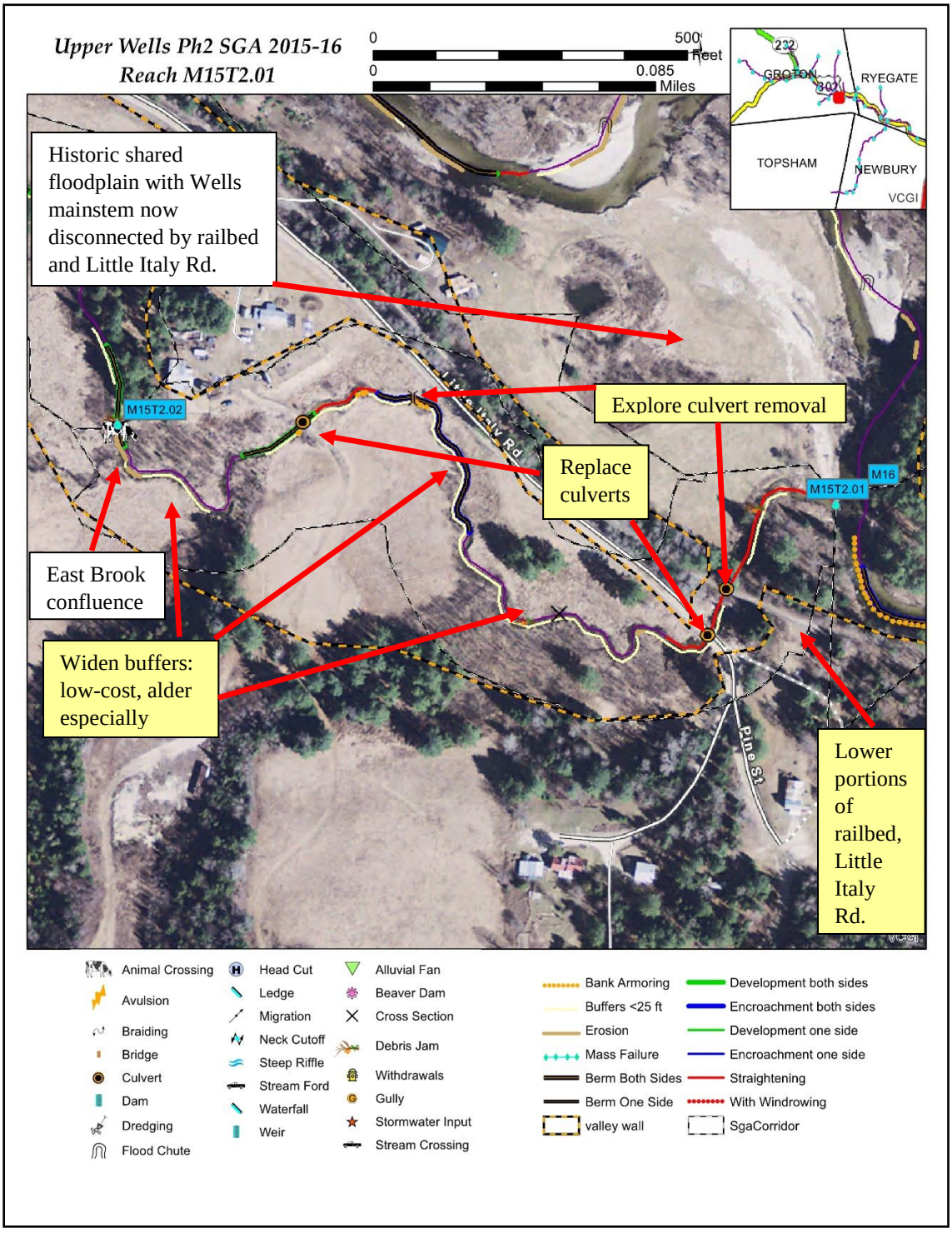


Figure 108. M15T2.01 Reach map – Keenan Brook.

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M15T2.01	1869	E	None	Sand	Riffle-Pool	Very Broad

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M15T2.01-0	1869	E	None	Sand	Riffle-Pool	Very Broad
	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
M15T2.01-0	Fair	Extreme	1.0	IIc	D	none

Reach M15T2.01 is the most downstream of three reaches on Keenan Brook included in the 2015-2016 Phase 2 assessment and corridor planning reported here. The reach was not segmented for assessment, and appears to be largely located on wetlands altered for agricultural and residential use. Alder-dominated buffers ranging from single trees to more extensive scrub-shrub wetland line the banks through much of the reach. The very broad valley and floodplain in this reach are vastly diminished from their former extent, as the former Montpelier-Wells River railbed and Little Italy Rd. have disconnected the majority of the reach from a former shared floodplain with the mainstem Wells (Fig. 108). Even with its current diminished extent the floodplain in this reach represents a high-value attenuation asset at the downstream end of a stream with significant straightening, road and development encroachments that are likely to contribute to channel instability and adjustments for some time to come. A primary constraint to achieving long-term stability within this reach derive primarily from four stream crossing structures: two private structures including a very undersized stone culvert and a farm bridge side by side double culvert partially dammed by beavers, and side by side double culverts at Little Italy Rd. and under the old railroad bed (Fig. 109). All of these structures had downstream scour pools associated with them and many signs of classic "hourglass" impacts due to undersized structures (Fig. 110). Impacts from flooding, or changes in hydrology or sediment loading upstream of this Extremely sensitive reach, are likely to primarily affect land use and road infrastructure in the vicinity of these structures as development is currently located further away from these structures.



Figure 109. Four stream crossing structures in Keenan Brook reach M15T2.01 all have associated scour pools and exhibit many of the classic "hourglass" signs of undersized structures.

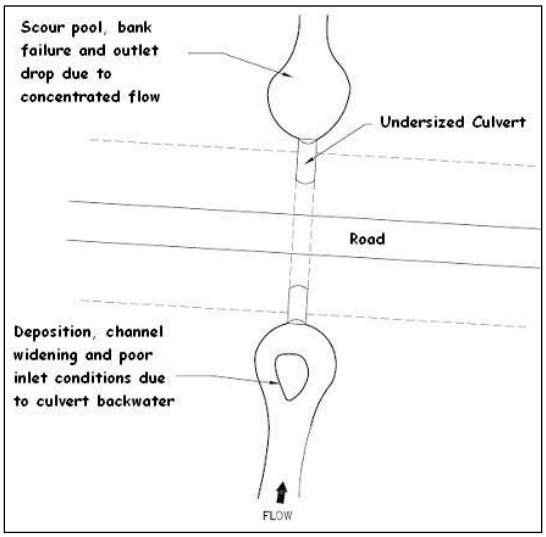


Figure 110. Hourglass effect at undersized stream crossing structures.

Primary Stressors:

- Elevated railbed and Little Italy Rd. disconnect much of historic floodplain shared with Wells mainstem
- Straightening largely related to road and railbed encroachment
- Four undersized and-or suboptimally configured culverts
- Impacts to wetland attenuation value through conversion to ag and residential use
- Diminished buffers

Table 33. M15T2.01 Projects and Practices Table – Keenan Brook

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M15T2.01-0	Protect River Corridors	Very High	Medium	Y	Attenuation asset with Extreme sensitivity, possible development pressure; crucial to prevent encroachment if railbed is ever to be addressed
M15T2.01-0	Stream Buffers	Very High	Very High	Y	Widen buffers by hayfields, residential area; alder-dominated naturally, critical to bank stability and soil retention as widening is primary adjustment
M15T2.01-0	Remove/Replace Structures	Very High	Medium	N	Important to watershed dynamics (loss of soils, but fines contribute to wash load not bed load, not beneficial to stability); complicated by property impacts, ideally part of reach restoration
M15T2.01-0	Watershed Strategies	Very High	Very High	Y	Evaluate pond embankment upstream. Municipal corridor protection, stormwater management, capital planning with eye to culvert replacements, develop info on bridge and culvert options for private landowners. Groton planning is great model for starting point

6.1 Reach M15T2.02 – Keenan Brook from confluence with East Brook near 556 Little Italy Rd. to ~1000 feet upstream of Snug Harbor and Railroad St. intersection (downstream of waterfalls and ledge below old mill site at 607 Powder Spring Rd.)

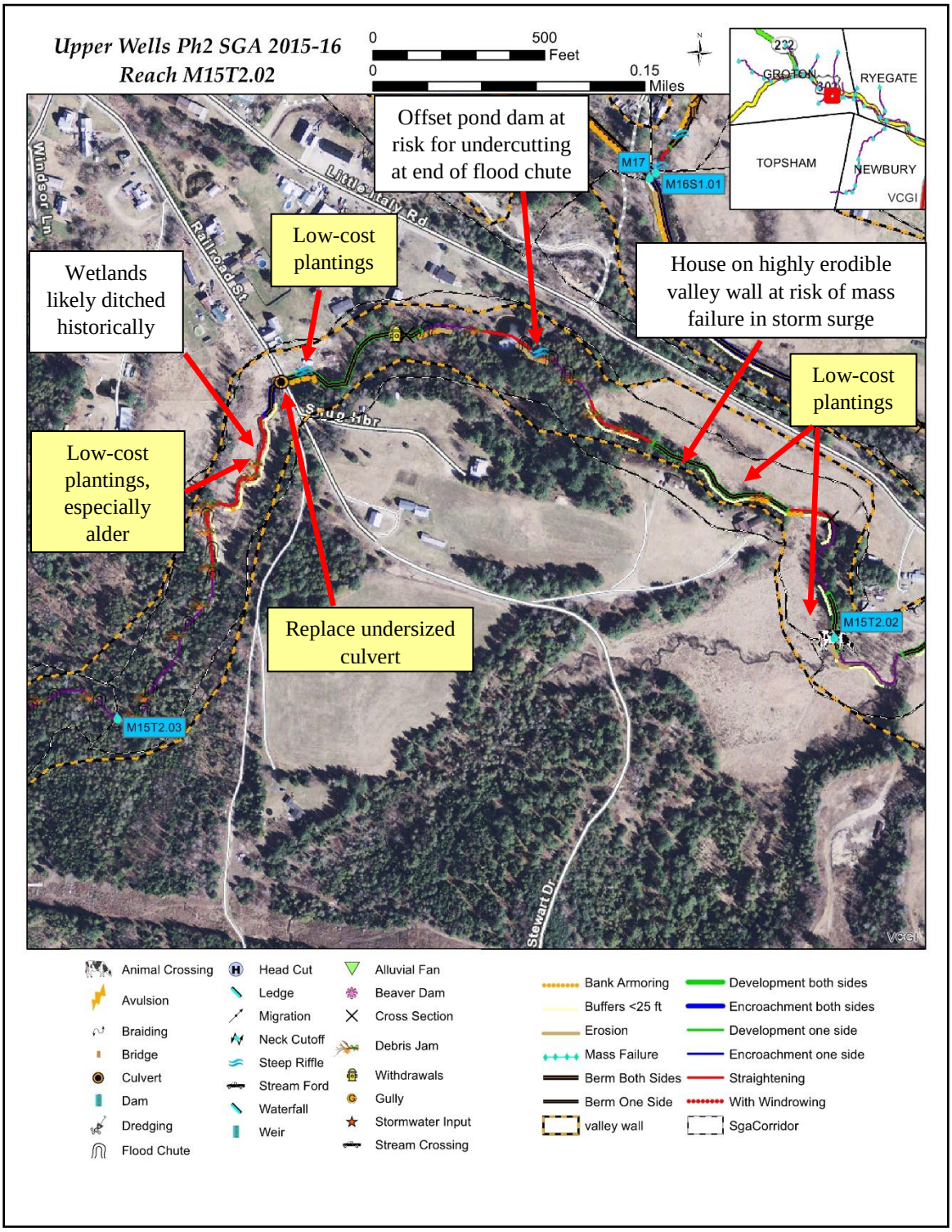


Figure 111. M15T2.02 Reach map – Keenan Brook.

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M15T2.02	3579	C	None	Gravel	Riffle-Pool	Very Broad

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M15T2.02-0	3578	C	None	Gravel	Riffle-Pool	Broad
	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
M15T2.02-0	Fair	Very High	1.9	III	F	none

Although Keenan Brook reach M15T2.02 was classed as a C-type stream for Phase 1 purposes, altered wetland inclusions in upstream and downstream sections as well as a significant degree of straightening and historic incision with subsequent major aggradation, widening and planform change could indicate a possible E-type stream under reference conditions. This reach is heavily influenced by the legacy of glacial lake Hitchcock, located almost entirely on pebbly sands along the margins of that former lake (see map in Fig. 40 in discussion of Wells mainstem reach M15). Subsequent disconnection (by the Montpelier-Wells River railbed and roads built on or beside the railbed) from former floodplains shared with the Wells River mainstem leaves the current stream functioning in a vastly reduced floodplain.

Pronounced historic incision may also be related to pulse flows from a former mill dam upstream in segment M15T2.03A as well as wetland ditching upstream of Railroad Street. Recent flood impacts in M15T2.02 were quite evident during 2015 fieldwork. Channel enlargement did not appear dramatic but flood debris was common along the stream corridor downstream of Railroad St., and some flood chute scour was evident underneath an offset pond dam off the left bank below Snug Harbor (Fig. 112). This pond is offset and not instream as indicated by the Vermont Hydrography Dataset, but may be at risk for undercutting. A house placed at the top of an extremely erodible right valley wall at the downstream end of the reach (89 Stewart Dr.) would be highly susceptible to mass failure in a storm surge if this embankment failed.



Figure 112. Scour at the end of this flood chute (center) has potential to undermine an offset pond dam off the left bank of reach M15T2.02 (pond in background at right of photo).

Primary Stressors:

- Old railbed and roads built on or alongside it cut off access to historic floodplain shared with Wells mainstem
- Straightening (>50% of segment length) related to railbed, road and pond encroachment, undersized culvert, wetland ditching
- Highly erodible sediments due to glacial Lake Hitchcock legacy
- Restriction of access to historic floodplains (incision ratio 1.9)

Table 34. M15T2.02 Projects and Practices Table – Keenan Brook

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M15T2.02-0	Stream Buffers	Next Highest	Next Highest	Y	Deeply incised, erodible; wood important to stream dynamics and rebuilding floodplain access
M15T2.02-0	Remove/Replace Structures	Very High	Very High	Y	Railroad St. culvert is ~26 pct. bankfull width, amplifies flood impacts downstream
M15T2.02-0	Watershed Strategies	Very High	Very High	Y	Structure replacements, municipal corridor protection, stormwater and drainage (increase infiltration, vegetative filters) ,establish-ensure buffer integrity - large wood plays critical role in sediment retention and rebuilding floodplain access

6.1 Reach M15T2.03 – Keenan Brook from ~1000 feet upstream of Snug Harbor and Railroad St. intersection (downstream of waterfalls and ledge below old mill site at 607 Powder Spring Rd.) to woods edge downstream of wetlands 600 ft. downstream of bridge near 1308 Powder Spring Rd.

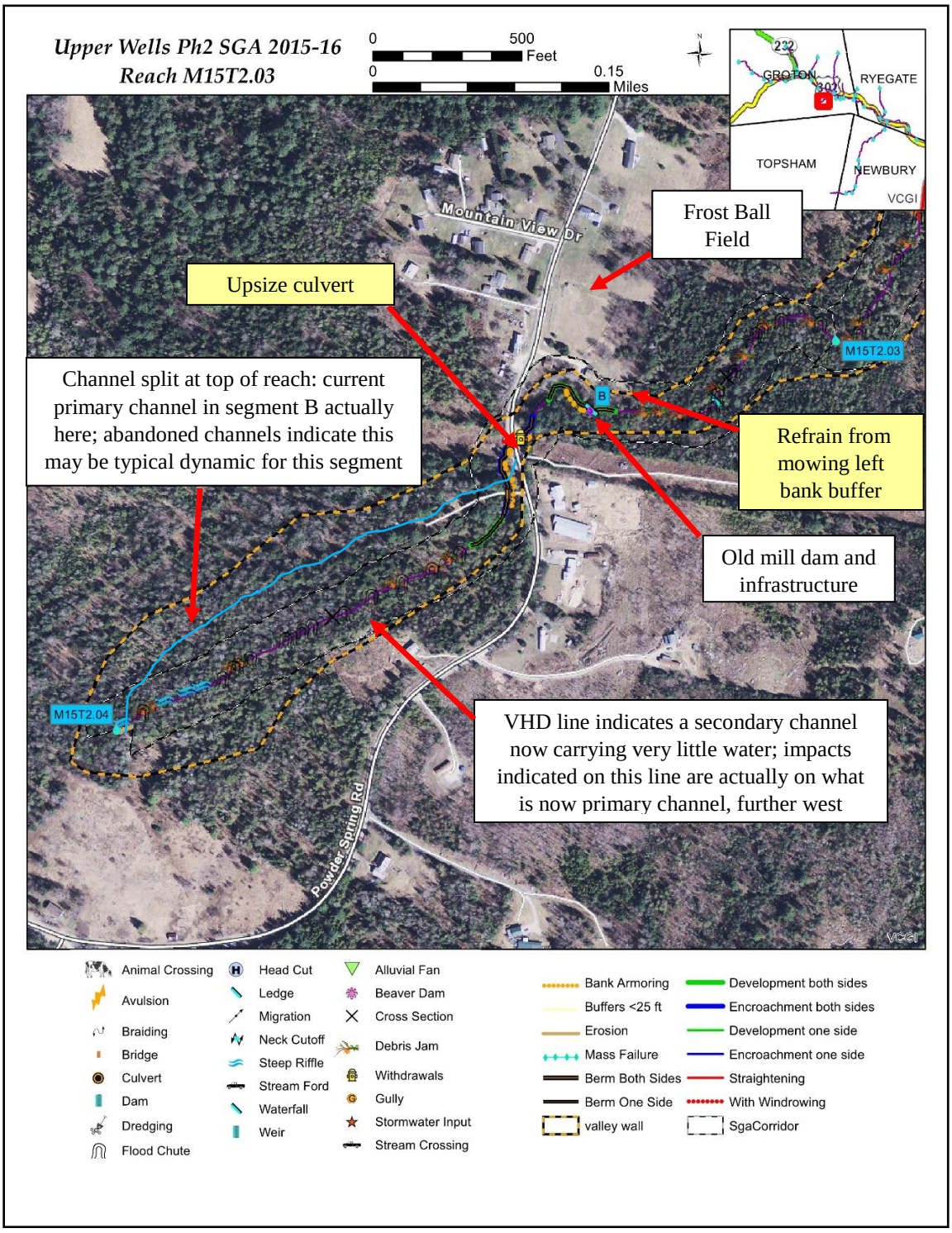


Figure 113. M15T2.03 Reach map – Keenan Brook.

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M15T2.03	3220	C	b	Cobble	Step-Pool	Semi-Confined

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M15T2.03A	1033	B	a	Cobble	Step-Pool	Broad
M15T2.03B	2188	C	b	Cobble	Step-Pool	Very Broad

	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
M15T2.03A	Fair	High	1.5	IId	D	none
M15T2.03B	Fair	High	1.7	III	F	none

Keenan Brook reach M15T2.03 spans both sides of Powder Spring Rd. at a major power line cut a short distance south (upstream) of the Frost Ball Field. The reach was segmented due to lack of grade controls upstream vs. multiple ledge outcrops downstream, as well as differences in planform and slope. The segment break was located at the remains of an old mill dam and infrastructure alongside a house at 607 Powder Spring Rd., a short distance downstream of a recent dry hydrant installation beneath the culvert at the power line cut on Powder Spring Road.

Downstream segment M15T2.03A winds past the old mill site with portions of the mostly breached dam still intact (mostly wing walls) then drops steeply, spilling over ledge grade controls and large boulders before flattening out for a short distance before the reach break marking the transition to reach M15T2.02. The main dam may have been log cribbing; currently a peeled log and a single timber (8x8) are fastened to the top of the natural ledge grade controls (Fig. 114). Neither Beers Atlas (1875) nor USGS topographic maps from 1935 (UNH Dimond 2016) indicate the presence of this mill dam.

Large cut granite blocks off the right bank downstream may be the remains of an old foundation.

While intact buffers providing large woody debris clearly play an important role in diffusing stream power in this setting, diminished buffers off the left bank in the vicinity of the old mill site showed little signs of erosion, likely due to the extensive ledge presence.



Figure 114. A peeled log (left) and 8x8 timber (right) are currently fastened to the ledge grade controls at the remains of an old mill dam off Powder Spring Rd. in segment M15T2.03A.

In upstream segment M15T2.03B of Keenan Brook the channel splits at the top of the reach; the Vermont Hydrography Dataset shows the location of a secondary channel, while the primary channel is currently 200-225 ft. further west. The split channel does not rejoin until near the segment break, just upstream of the culvert at the power cut on Powder Spring Road. Fieldwork noted evidence of multiple historic abandoned channels, indicating this portion of the stream is prone to rapid channel migrations including channel avulsions and braiding, with frequent debris jams but little erosion due to excellent buffers. Recent flood dynamics appeared to have initiated headcuts in newly cut channels that were rapidly being "washed out" by subsequent aggradation (Fig. 115).



Figure 115. Split channel, braiding, and recent headcut now "washing out" with subsequent aggradation all appear to be parts of common stream dynamics in Keenan Brook segment M15T2.03B.

Although road and development encroachments, parcelization and the nearby utility line cut lend to a more fragmented landscape than upstream portions of this basin, the diverse and interesting plant and animal communities along Keenan Brook in M15T2.03B bear many of the same hallmarks as white cedar swamp-related statewide significant natural communities found in the headwaters areas of Keenan and East Brooks (VT-ANR Atlas 2016). This diversity includes a significant hemlock component beside black spruce and northern white cedar, indicating location in an ecotone between temperate and boreal forests. This portion of the stream represents a valuable attenuation asset for mitigating impacts of flooding on downstream reaches, but channelization, straightening and hydrologic changes ("urbanization") have contributed (and can contribute) to incision now being offset by aggradation.

Primary Stressors:

- Road and development encroachment, "urbanization" at watershed scale (current primary channel has migrated further away from road and development but historic evidence indicates rapid channel migrations and relocations are common)
- Undersized culvert at Powder Spring Rd.
- Restriction of access to historic floodplains (incision ratio 1.5 in M15T2.03A, 1.7 in M15T2.03B)

Table 35. M15T2.03 Projects and Practices Table – Keenan Brook

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M15T2.03-A	Protect River Corridors	Medium	Low	Y	appears likely mostly under single ownership, but limited access reduces development pressure
M15T2.03-A	Stream Buffers	Medium	Low	Y	left bank mowed in vicinity of old mill site; large wood plays important role in stream dynamics, but other wood is making it to stream and erosion is limited
M15T2.03-A	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, stormwater and drainage (increase infiltration, vegetative filters, prevent gullies), ensure buffer integrity - large wood plays critical role in sediment retention and rebuilding floodplain access

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M15T2.03-B	Protect River Corridors	Very High	Very High	Y	important attenuation asset but parcelized; municipal corridor protection recommended - corridor in this segment needs to accommodate rapid planform changes
M15T2.03-B	Remove/Replace Structures	Very High	Medium	Y	undersized Powder Spring Rd culvert increases risk to road
M15T2.03-B	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, stormwater and drainage (increase infiltration, vegetative filters, prevent gullies), ensure buffer integrity - large wood plays critical role in sediment retention and rebuilding floodplain access

6.1 Reach M16S1.01 – Tannery Brook from confluence with Wells mainstem at Tannery Brook Rd. upstream to junction of Minard Hill Rd. and Glover Rd.

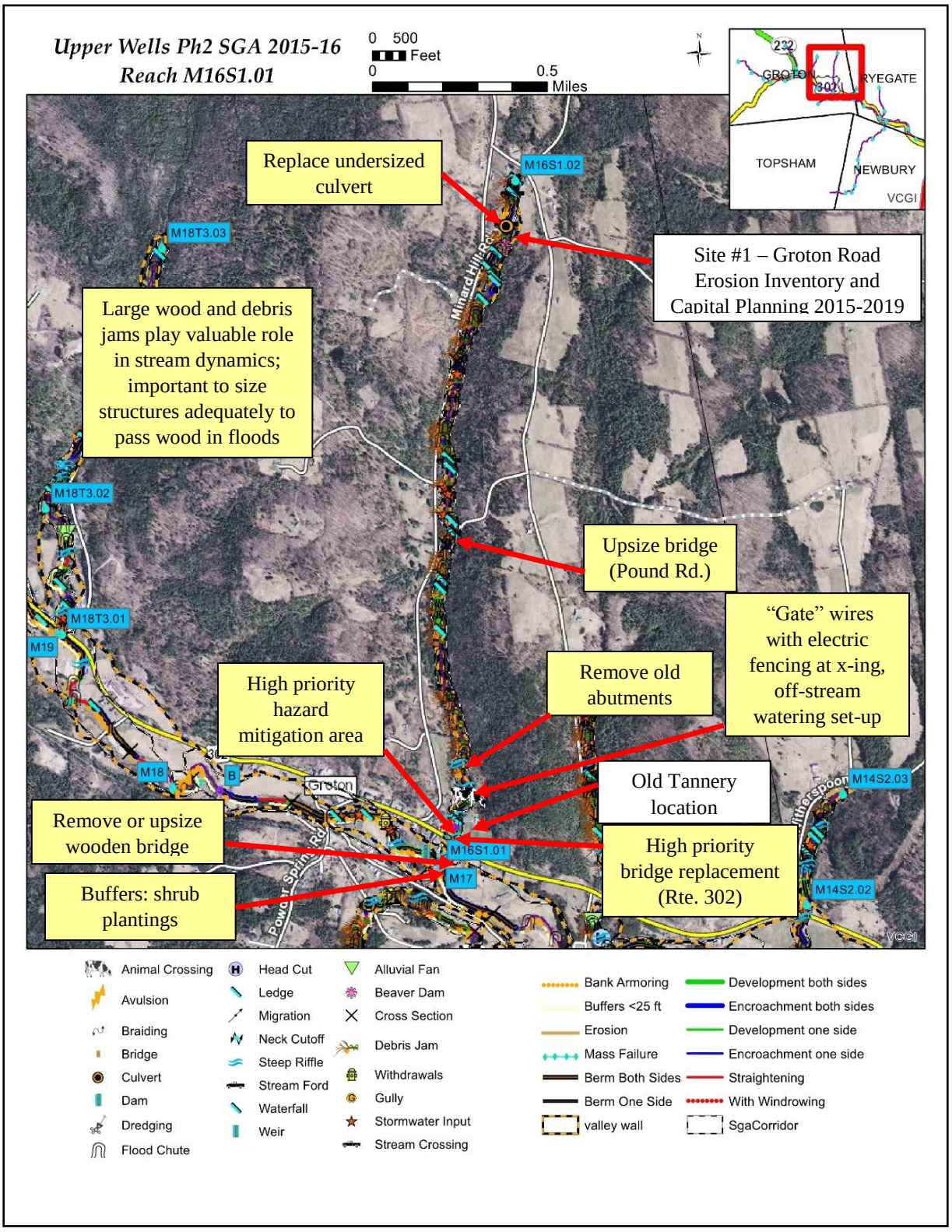


Figure 116. M16S1.01 Reach Map – Tannery Brook

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M16S1.01	11344	C	b	Cobble	Step-Pool	

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M16S1.01A	634	C	b	Cobble	Step-Pool	Very Broad
M16S1.01B	10708	C	b	Gravel	Step-Pool	Narrow

	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
M16S1.01A	Fair	Very High	1.4	III	F	none
M16S1.01B	Fair	Very High	2.2	III	F	none

Tannery Brook reach M16S1.01 was the longest stream reach assessed in 2015 Phase 2 work in the Upper Wells basin, spanning a bit over 2 miles along the side of Minard Hill Rd., then passing through an extremely undersized Rte. 302 bridge and alongside Tannery Brook Rd. before joining the Wells mainstem at what is now the end of Tannery Brook Rd. (historically the road continued over a bridge across the Wells mainstem and up to the old railroad near the current location of the Groton stump dump off Little Italy Rd.). The reach was segmented for Phase 2 assessment, based primarily on bank and buffer conditions; the downstream 600 plus feet of Tannery Brook (segment A) has minimal buffers and banks are extensively armored, a stark contrast with the upstream portions of the stream (segment B). Segment A also appears to be located on pebbly sands that are a legacy of glacial Lake Hitchcock lake edge sediments, in contrast with mixed size loose sediments (boulders, cobbles, gravels and fines) deposited on the moraine left behind during glacial retreat along upstream portions of the reach.

Segment M16S1.01A has been extensively straightened historically, with both riprap and foundations present along the banks of the stream. Beers Atlas (1875) indicates the Tannery (Fig. 117) was upstream of Rte. 302 (Scott Hwy.), while a carding mill and

sawmill were located at the mouth of Tannery Brook along the Wells mainstem (Fig. 43 in reach description for M16). The old Tannery does not appear to be currently identified as a brownfields site (VT-ANR Atlas 2016), but it is unclear if any assessment has been done. There is currently additional development in the right bank floodplain of this area, which is located just upstream of an extremely undersized bridge in rough shape under Rte. 302 (Fig. 117). This appears to be a potential high priority hazard mitigation site.







Figure 117. Old Tannery foundation (left above) and house (right above) lie in the floodplain of Tannery Brook just upstream of an extremely undersized, considerably scoured bridge under Rte. 302 (looking downstream, left; looking upstream, below right). The bridge cannot easily pass two cars side by side on Rte. 302.



Downstream of the Rte. 302 bridge Tannery Brook is largely channelized between development off the right bank and farm fields off the left bank. A community solar array was recently installed off the left bank, and the undersized wooden equipment and footbridge that spans the stream between the two banks now appears to be minimally used (Fig. 118).



Figure 118. Undersized wooden foot and equipment bridge in M16S1.01A appears to be minimally used since installation of a community solar array off the left bank in farm fields connected by this bridge to the house off the right bank.

Most riprap downstream past the footbridge-equipment bridge has failed and commonly forms steps in the stream, and the old carding mill and sawmill buildings at the mouth are falling in on themselves (sawmill mostly gone). The solar array off the left bank appears to be partially within the stream corridor but the panels are slightly elevated on ground mounts. It appears the buildings off the right bank are largely high enough in elevation to avoid impacts if the stream starts to re-establish meanders in this area, but this development off the right bank likely needs further analysis of potential risks if the Rte. 302 bridge and footbridge are addressed. A sediment dump-out and delta bar at the mouth of Tannery Brook indicate elevated sediment transport through M16S1.01A in recent flooding (contributing to current step-pool rather than riffle-pool bedform), and possible implementation of a passive floodplain restoration in this area would offer significant attenuation benefits.

In upstream segment M16S1.01B good buffers are clearly playing an important role in limiting erosion and rebuilding access to abandoned floodplains. Recent flood impacts (many appear related to April 2014 flooding as much as Irene in 2011) were mostly seen in braiding, channel splits, and debris jams building floodplain access and stream meanders. Frequent ledge grade controls limit current incision in many areas, and overall incision appears historic (largely glacier-related and augmented by transitory beaver occupation). Although there are no indications of mills on Beers Atlas (1875), foundation remains near one of the upstream breached beaver ponds suggest there may have been one at some point (lending to hungry water-pulse flow dynamics that would also contribute to incision).

Alternating periods of beaver occupation and effects of debris jams contribute to both rapid planform change and new localized incision following channel migrations/splits, and there is some road encroachment that contributes to straightening that can amplify incision. Groton capital planning 2015-2019 (Smith et al 2015) has identified an upstream portion of segment M16S1.10B road embankment erosion as a priority for a short term fix in the near future (Minard Hill Rd project - upper; Site #1), and further noted that replacement of an undersized and poorly aligned culvert (as well as allowing buffers to regenerate) will further mitigate ongoing road-stream conflicts for the long run in this area. Phase 2 fieldwork in 205 indicated that a separate section of Minard Hill Rd.

(between Mt. Ara Rd. on the downstream end and Heath Hill Rd. on the upstream end) is an encroachment on the current stream location and likely to have road-stream conflict issues as well, but much of Tannery Brook in segment B is more distant from the road and meanders a lot more than indicated by the Vermont Hydrography Dataset.

Given the important, valuable role that good buffers are playing in segment M16S1.10B it is important that bridges and culverts be sized adequately to accommodate large wood and sediment as well as water in flood situations, preferably at least 120 percent bankfull width for this type of stream setting (Schiff et al 2014, p. 11). In addition to the culvert at the Minard Hill Site #1 identified in the Groton road erosion inventory (Smith et al 2015), this would also apply to the bridge at Pound Rd. in this stream segment (Fig. 119).



Figure 119. Effective width of bridge at Pound Rd. is reduced by angle of alignment. Ideally bridges and culverts in this type of stream setting would be sized at 120 pct. bankfull width, increasing the ability to pass large wood and sediments in a flood and thus reducing risk to the road and structure.

Although it was not clear how permanent a cattle crossing in M16 S1.01B was (Fig. 120), installation of an off-stream watering system and "gate" wires added to electric fencing on both sides of the stream could allow stream access exclusion and allow some buffer regeneration.



Figure 120. "Gate" wires added to electric fencing at cattle crossing in M16S1.01B could allow stream access exclusion and permit some buffer regeneration

Primary Stressors:

- Undersized structures, particularly given valuable role of good buffers and thus need to accommodate large wood and sediment transport
- Straightening (>50% of segment length M16S1.01A, 20-50% of segment length M16S1.01B) largely related to bank armoring in segment A and road encroachment in segment B
- Development encroachment in M16S1.10A
- Restriction or loss of access to historic floodplains (incision ratio 1.4 segment A, 2.2 segment B

Table 36. M16S1.01 Projects and Practices Table – Tannery Brook

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M16S1.01-A	Stream Buffers	Medium	Medium	Y	create-protect buffer, low-cost plantings need ample setback - preference to shrubs near solar array; ideally part of passive floodplain and meander restoration
M16S1.01-A	Remove/ Replace Structures	Very High	Very High	Y	highest priority to Rte. 302 bridge at Tannery Brook, high priority hazard mitigation area; remove or upsize wooden bridge by solar array
M16S1.01-A	Restore Incised Reach	Very High	Medium	N	needs to include addressing structures (Rte. 302 and private wooden bridge), corridor protection to accommodate passive floodplain access and meander development, addressing potential conflicts with development in corridor
M16S1.01-A	Watershed Strategies	Very High	Very High	Y	High priority hazard mitigation site includes replacement of extremely undersized Rte. 302 bridge at Tannery Brook Rd, brownfields assessment and potential clean-up at old Tannery just upstream; keep properties upstream of this bridge in mind for potential buy-outs if opportunities arise

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M16S1.01-B	Protect River Corridors	Next Highest	Medium	Y	corridor relatively undeveloped, limited attenuation asset-small pockets over multiple parcels-municipal corridor protection high value for risk reduction
M16S1.01-B	Stream Buffers	Medium	Medium	Y	natural regeneration or low-cost planting upstream in vicinity of Minard Hill Site # 1 (road erosion inventory and capital planning 2015-2019)
M16S1.01-B	Remove/ Replace Structures	Very High	Next Highest	Y	culvert at upstream end of reach (Minard Hill Site #1 in Groton capital planning) priority due to road impacts, Pound Road needs to pass large wood, old abutments by farm at downstream end of reach lower priority
M16S1.01-B	Watershed Strategies	Very High	Very High	N	address hazard mitigation downstream first (addressing structures and floodplain reconnection here may increase sediment transport into segment A), protect corridor (municipal protection recommended), stormwater management
M16S1.01-B	Watershed Strategies	Very High	Very High	Y	Minard Hill Rd project top priority in Groton road erosion planning 2015-19 (short term fix in near future). Municipal corridor protection, stormwater management, capital planning with eye to culvert replacements, develop info on bridge and culvert options for private landowners. Groton road erosion inventory, capital planning and stormwater management planning are great model for starting point

6.1 Reach M18T3.01 – North Branch Wells River, Wells mainstem at Branch Brook Rd. and Rte. 302 to tributary west of log landing 0.4 mi up Branch Brook Rd.

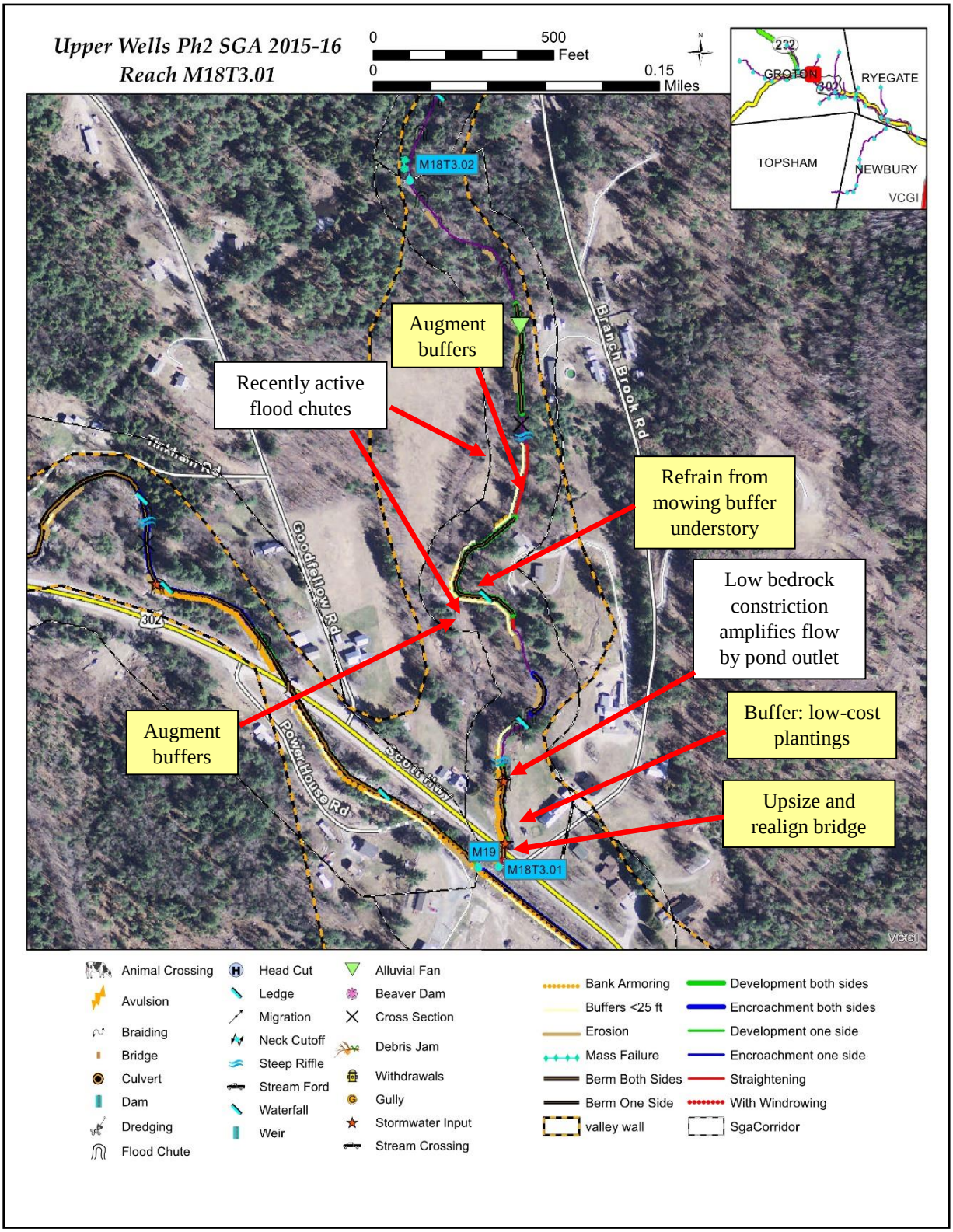


Figure 121. M18T3.01 Reach map – North Branch Wells River

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M18T3.01	2316	C	b	Cobble	Riffle-Pool	Very Broad

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M18T3.01-0	2316	C	b	Cobble	Riffle-Pool	Very Broad
	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
M18T3.01-0	Fair	High	1.5	III	F	none

North Branch of the Wells reach M18T3.01 joins the Wells mainstem at the junction of Rte. 302 (Scott Hwy.) and Branch Brook Rd. (aka Fred Hayes Rd.), and aerial imagery following Irene in 2011 indicates that flooding from the North Branch contributed to a sediment dump that spread across fields below Power House Rd., at the downstream end of reach M19 (break between Wells mainstem reaches M18 and M19; Fig. 122).

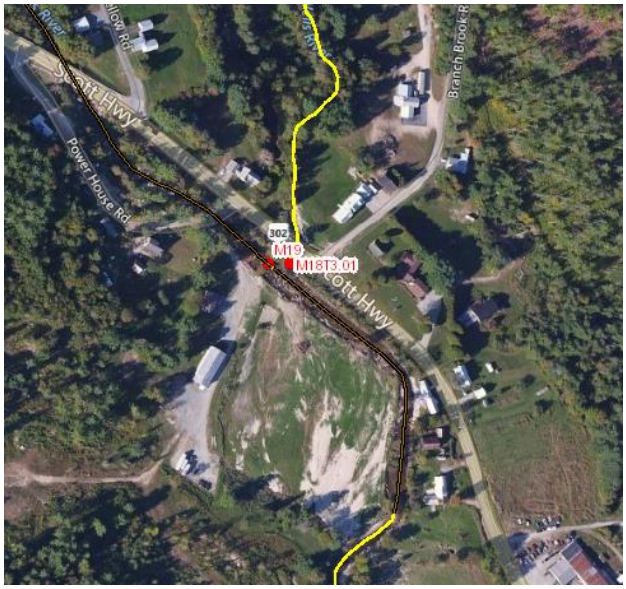


Figure 122. Apparent alluvial fan or deltaic flooding at the downstream end of North Branch Wells reach M18T3.01, with sediment dump in fields below Powerhouse Rd. and downstream end of mainstem reach M19.

With upstream portions of reach M18T3.01 located on a glacial outwash spillway, the steeper portions of M19 and M18T3.01 empty into a broader, flatter floodplain that is a valuable attenuation asset and likely alluvial fan. Old channels and large flood chutes were common across the broad valley of M18T3.01, indicating changed

channel locations and meanders over time. The channel of M18T3.01 also appears aggraded, with flood intolerant trees along both banks not very high above current bankfull depths.

Given these channel adjustment dynamics (rapid changes in channel location, high deposition zones), buildings and other development in close proximity to the stream in this reach appear at risk in flood situations (Fig. 123), and potential exists for capture of a pond off the right bank at the downstream end of the reach by one of the recently active flood chutes in the right bank floodplain. Elevated erosion and mass failures in other portions of this reach indicate the effects of heightened stream power when the floodplain is not able to be accessed.



Figure 123. Given apparent history of changed channel locations and meanders as well as active flood chutes in M18T3.01, buildings off left bank appear to be at some risk in floods. Note location of flood intolerant trees at current water level, likely indicating aggradation that has raised level of stream bed.

At the downstream end of reach M18T3.01 the stream passes through a low bedrock constriction before being funneled through the undersized, substantial concrete bridge on Rte. 302 at the mouth of the reach (Fig. 124). The effective width of this bridge is significantly reduced by the angle of alignment to the stream, and it appears the effect of both the bedrock constriction and the bridge contributed to a large increase in stream power before the bridge was overtopped.



Figure 124. Low bedrock channel constriction at pond outlet (left) and Rte. 302 bridge by Branch Brook Rd. (effective width vastly reduced by angle of alignment, right) a short distance downstream appear to have helped amplify stream power significantly before the bridge was likely overtopped in flooding.

Primary Stressors:

- Development encroachments and undersized bridge (effective width reduced by angle of alignment) necessitating bank armoring; substantial concrete bridge increases risks to road
- Moderate straightening largely related to bank armoring
- Restriction of access to historic floodplains (incision ratio 1.5)

Table 37. M18T3.01 Projects and Practices Table – North Branch Wells River

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M18T3.01-0	Stream Buffers	Medium	Medium	Y	Ample setbacks for low-cost plantings as missing buffers are often in vicinity of active erosion; existing armoring might be leveraged for time for buffer establishment before it fails - buffers far better for long term dynamics and stability; natural regeneration also
M18T3.01-0	Remove/ Replace Structures	Very High	Very High	Y	Rte. 302 bridge undersized, effective width reduced by angle of alignment; substantial concrete structure increases risk of repeat damage to road
M18T3.01-0	Watershed Strategies	Very High	Very High	Y	Hazard mitigation and emergency operations planning, municipal corridor protection, stormwater management

6.1 Reach M18T3.02 – North Branch Wells River, tributary west of log landing 0.4 mi up Branch Brook Rd. to tributary ~1200 ft. upstream of end of Branch Brook Rd.

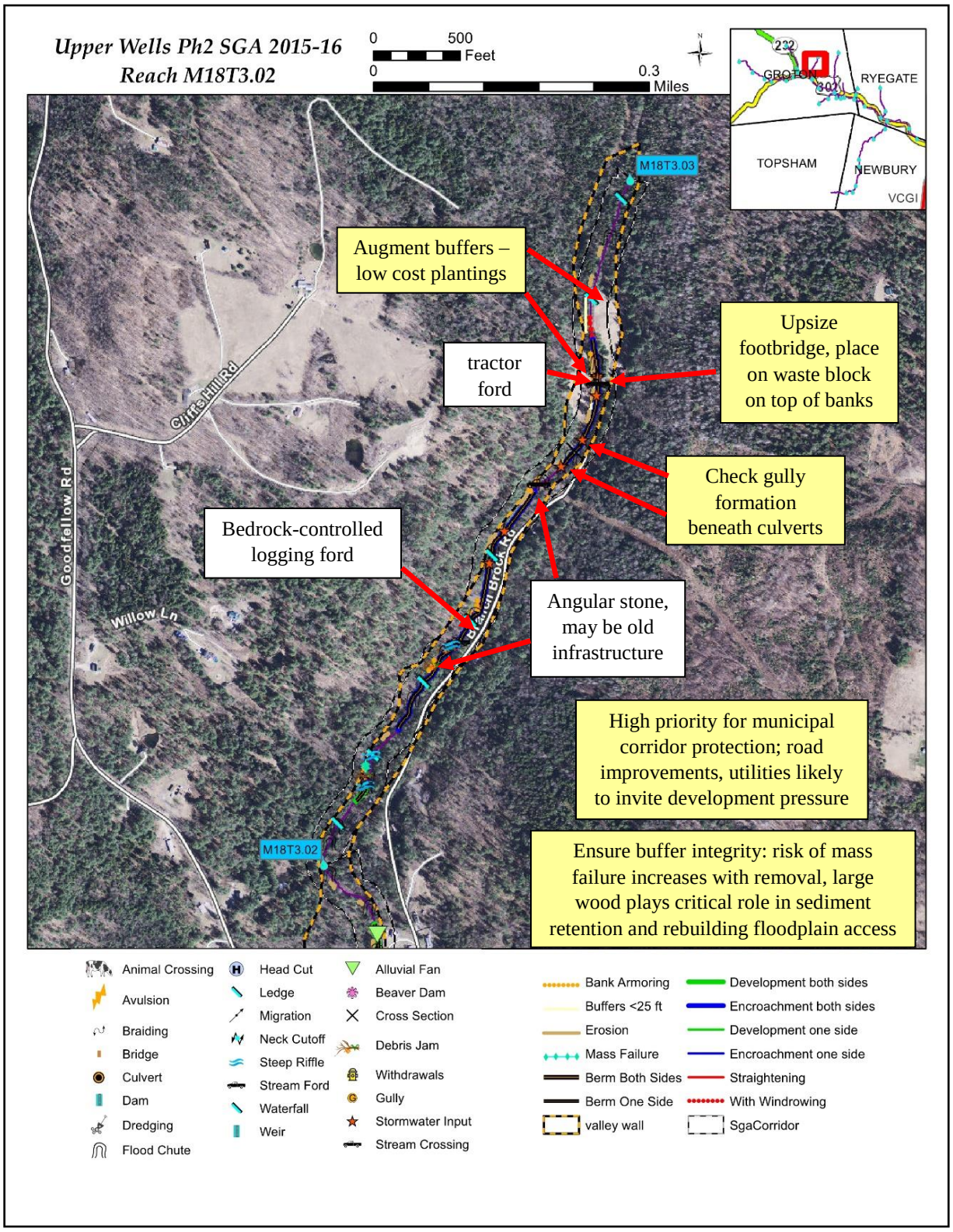


Figure 125. M18T3.02 Reach map – North Branch Wells River

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M18T3.02	4518	C	b	Cobble	Step-Pool	Semi-Confined

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M18T3.02-0	4518	C	b	Cobble	Step-Pool	Semi-Confined
	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
M18T3.02-0	Fair	High	1.8	III	F	none

North Branch of the Wells reach M18T3.02 is a relatively undeveloped stream reach, though recent road improvements and utility infrastructure appear likely to increase development pressure. The stream is deeply incised historically, probably in part due to glacial legacy but also likely amplified by pulse flows and snagging (removal of large wood) associated with sawmills historically located in this drainage (Beers Atlas (1875) indicates the Welch saw and planing mill a good distance upstream near Red Brook Rd., and 2015 fieldwork included observations of angular stone likely associated with other small mills or similar infrastructure at two locations in a narrow portion of the valley in mid-sections of reach M18T3.02).

Multiple terraces along both sides of this variable width valley indicate successive stages of incision and floodplain abandonment, but the bed is scoured to bedrock in numerous locations at this point in time so that current adjustments manifest as widening and lateral adjustments. Erosion is relatively limited due to largely intact wooded buffers, but localized heightened erosion was notable in the vicinity of an undersized foot bridge in upstream portions of the reach as well as a few areas of diminished buffers along the reach. Recent culvert installations along Branch Brook (aka Fred Hayes) Rd. appear to have the potential for gully formation along the valley side walls (Fig. 126).



Figure 126. Recent culvert installations along Branch Brook Rd. appear to have the potential for gully formation along the left valley wall of North Branch reach M18T3.02.

With limited erosion evident within the reach it was somewhat surprising to note frequent heavy deposition of fine sediments. In combination with an observed dearth of large wood this fact suggested possible beaver influences upstream, with the possibility of recent beaver dam breaches in flood events contributing fines and presence of wetlands contributing to lack of large wood recruitment. Alternatively, there was at least one location along the reach where the stream had clearly been recently snagged, with large cut wood piled along both banks. Large wood typically plays an important role in retaining fine sediments and rebuilding access to abandoned floodplains in a stream setting like this, and the minor role currently played by large wood in this reach was notable. A recent logging job was not by any means extreme in cutting along the stream corridor but certainly removed a good number of trees close to the stream, limiting future wood recruitment for this important stream dynamic.

Primary Stressors:

- Restriction of access to historic floodplains (incision ratio 1.8), additional older incision evident in presence of high terraces
- Road encroachment with numerous stormwater inputs
- Undersized footbridge contributing to localized erosion

Table 38. M18T3.02 Projects and Practices Table – North Branch Wells River

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M18T3.02-0	Protect River Corridors	Very High	Very High	Y	road and utility upgrades increase development pressure; municipal corridor protection important due to risks, semi-confined valley limits value as attenuation asset
M18T3.02-0	Stream Buffers	Next Highest	Medium	Y	limited planting opportunity on upstream end of reach, augmenting existing; primarily ensuring integrity of existing buffers as impacts greatly increase risk of mass failures
M18T3.02-0	Remove/ Replace Structures	Medium	Medium	Y	placing footbridge on upstream end of reach on waste block on top of banks outside channel would reduce erosion; structure is wood, not a significant floodplain constriction
M18T3.02-0	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, stormwater and drainage (increase infiltration, vegetative filters, prevent gullies), ensure buffer integrity - large wood plays critical role in sediment retention and rebuilding floodplain access

6.1 Reach M19T4.01 – South Branch Wells River, from Wells mainstem by Puffer ballfield upstream ~0.5 mi along Rte. 302 (Scott Hwy.)

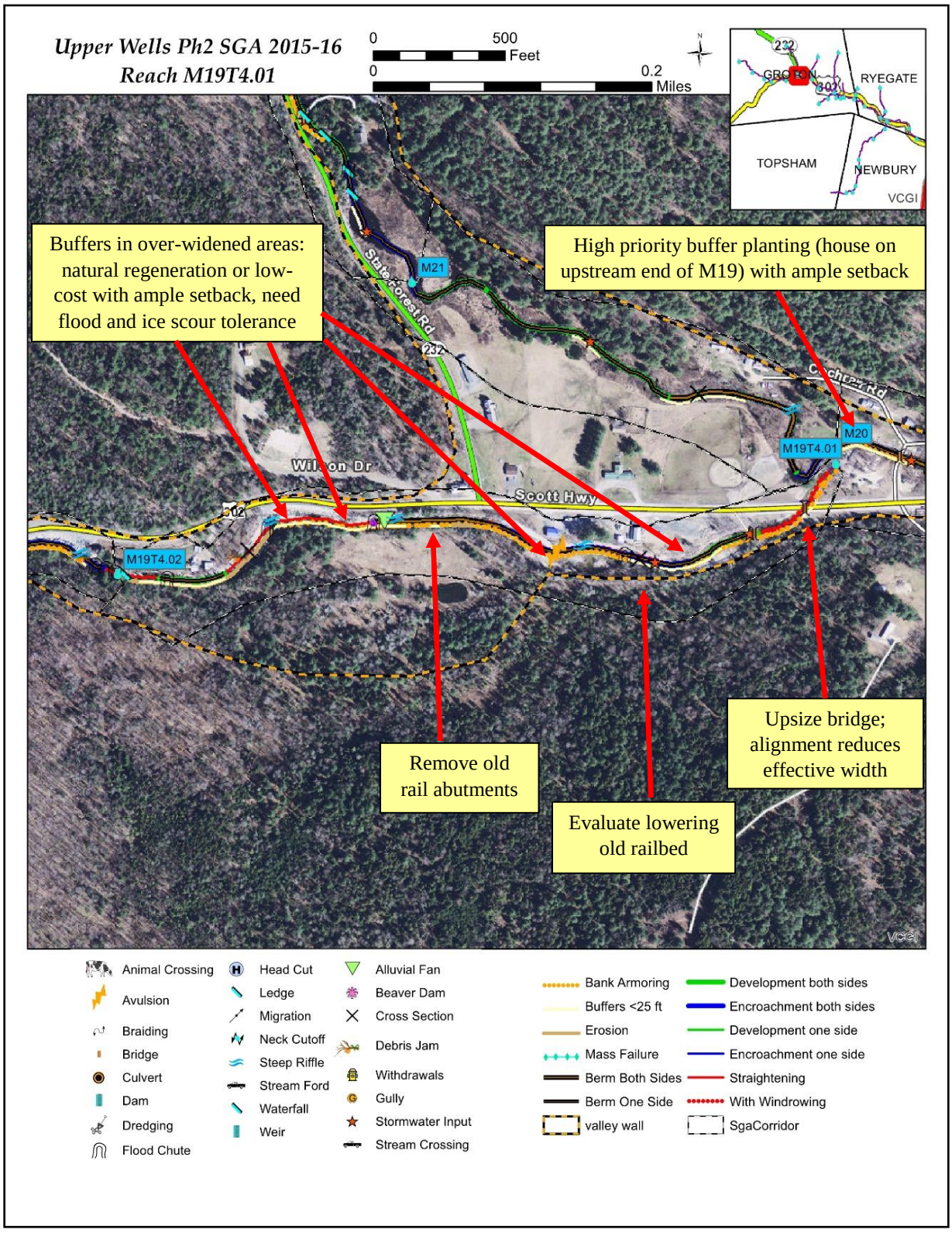


Figure 127. M19T4.01 Reach map – South Branch Wells River

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M19T4.01	3005	C	b	Cobble	Riffle-Pool	Very Broad

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M19T4.01A	1938	C	b	Cobble	Step-Pool	Very Broad
M19T4.01B	1067	C	b	Cobble	Step-Pool	Broad

	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
M19T4.01A	Fair	High	1.2 1.8-berm area	III	F	None
M19T4.01B	Fair	High	1.2	III	F	None

South Branch reach M19T4.01 is in a relatively densely developed portion of the Upper Wells basin today, a stark contrast with Beers Atlas (1875) which indicates a relatively undeveloped floodplain with a single sawmill located at the confluence of the South Branch and the Wells mainstem (this despite similar overall population levels in the two time periods). The mid-section of the reach is notable as the location of a significant change in direction of the old Montpelier-Wells River railbed, which formerly crossed the South Branch at a set of old rail bridge abutments to swing from an east-west orientation to a north-south axis (following the Wells mainstem toward Ricker's Mills and Lake Groton) near what is today the junction of Wilson Rd. and Rte. 302.

Reach M19T4.01 was segmented near the location of the old rail bridge abutments, primarily due to a difference in slope; upstream segment B is considered a subreach as it would be a steeper portion of the stream even under reference conditions (i.e., without the major degree of

straightening due to road encroachment) while the slope flattens significantly in downstream segment A.

M19T4.01A appears to be on an alluvial fan, although the slope upstream is not dramatically steeper (~4 pct. grade). If not a classic alluvial fan, this stream segment is still on the downstream end of a glacial outwash spillway with remarkably large boulder and cobble material, and the short stretch of bedrock gorge, old railroad abutments (Fig. 128) and degree of straightening and channelization upstream helped mobilize much of this material in Irene.



Figure 128. Old rail abutments at the segment break between M19T4.01 A and B are a channel constriction of less than half the bankfull width (1.5-2 year high flow) of the stream and greatly amplify the force of water funneled downstream.

With a garage, shed and general store all in close proximity to the stream in M19T4.01A, post-Irene response included heavy channelization, substantial windrowing and creation of a berm off the left bank (berm restricts left bank floodplain access and increases incision ratio from 1.2 to 1.8; Fig. 129). Fieldwork in 2015 found steps and riffles rapidly "washing out" erosional features and nickpoints, but these depositional features were broken and clearly mobile; the stream included significant stretches of over-widened plane bed with few habitat features.



Figure 129. Substantial windrowing and berm in segment M19T4.01A post-Irene.

The Rte. 302 bridge at the downstream end of M19T4.01A is sized at 100 pct. bankfull width, but the angle of alignment to the South Branch reduces the effective width and a large point bar extending though the structure occupies a noteworthy portion of the opening following

significant aggradation (Fig. 130). This substantial concrete structure increases the risk that the road will be damaged before the bridge if plugged in a flood situation, and efforts to "clean out" the structure are likely to increase flood risks to the house at the downstream end of the South Branch (accessed from Cochran Rd.; Fig. 130). Buffer plantings at this house, actually on the upstream end of Wells mainstem reach M19, are highly recommended. Other buffers in reach M19T4.01 would be highly beneficial for this shallow, over-widened portion of stream but will be challenging to establish without additional considerations for species tolerant of periodic flooding and ice scour.



Figure 130. Angle of alignment of the Rte. 302 bridge at the downstream end of South Branch segment M19T4.01A reduces the effective width of the structure, and a large point bar occupying a substantial portion of the opening indicates the need for the structure to be able to pass sediment and wood as well as water. Efforts to "clean out" the structure may increase flood risks to a house at the downstream end of the South Branch (right).

While segment M19T4.01B is steeper than segment A, the glacial outwash spillway evident in segment A is present in this segment as well, and coarse sediment (boulder/cobble) transport was enhanced in Irene (and likely April 2014 flooding as well) as flow got funneled through the short bedrock gorge in upstream reach M19T4.02 and into M19T4.01. It appears likely that initial downcutting in both of these segments in Irene was offset by subsequent aggradation. Aggradation just upstream of the old rail abutments appears to have been "cleaned out" from building toward the level of the historic floodplain behind the railbed off the right bank near the segment break (Fig. 131).

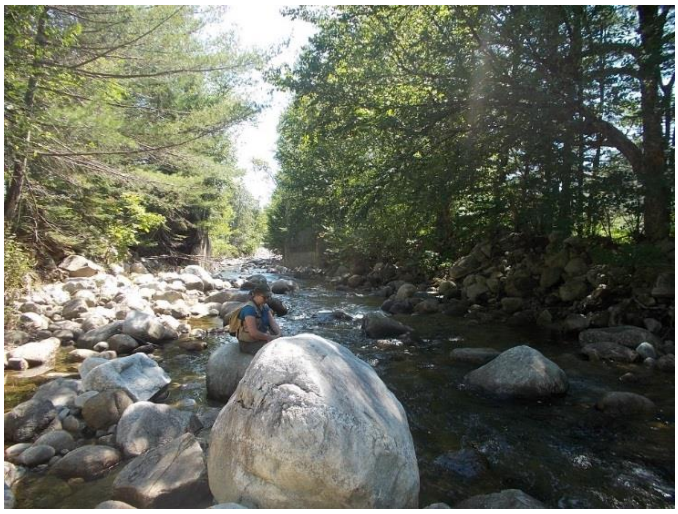


Figure 131. Cobbles and boulders piled on the right bank upstream of the old rail bridge abutments at the M19T4.01A-B segment break appeared to have been "cleaned out" from the stream bed, effectively restricting access to the historic floodplain visible in background at right of photo.

Heightened erosion on the opposite bank downstream of armored banks by a house in upstream segment M19T4.01B (Fig. 132) are indicative of ongoing channel adjustments in this reach. While it is unclear how many of the structures along reach M19T4.01 have sustained flood damage over time, incorporating these elements into hazard mitigation planning and retaining knowledge of buyout and relocation options that emerged after Irene may be important if not popular.



Figure 132. Heightened erosion (right) downstream of and on the opposite bank from upstream bank armoring (left) in M19T4.01B are indicative of ongoing channel adjustments.

Primary Stressors:

- Old rail abutments at segment break contribute to “fire hose effect”, elevated flood impacts in segment M19T4.01A
- Old railbed cuts off access to historic floodplain off right bank
- Straightening (>50% of segment length) largely related to extensive encroachments, windrowing and berms, undersized or poorly aligned structures
- Location on glacial outwash spillway
- Heavy development encroachment

Table 39. M19T4.01 Projects and Practices Table – South Branch Wells River

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M19T4.01-A	Stream Buffers	Medium	Medium	Y	Missing buffers primarily in areas of over-widened stream, windrowing, riprap; buffers important but limited planting (ample setback, natural regeneration with focus on flood and ice scour tolerant species due to over-widened state)
M19T4.01-A	Remove Berms	Very High	Next Highest	N	Potential for lowering old railbed off right bank; evaluate for cost-effectiveness, potential for impacts to developed areas
M19T4.01-A	Watershed Strategies	Very High	Very High	Y	Hazard mitigation and emergency operations planning, municipal corridor protection, stormwater management
M19T4.01-A	Remove/ Replace Structures	Very High	Very High	Y	Rte. 302 bridge effective width reduced by alignment and aggradation; "clean-out" increases flood risk to house at end of South Branch
M19T4.01-A	Potential restoration/ protection project	Very High	Very High	N	Information gathering for possibility of lowering or removing old railbed off right bank to restore floodplain access, then removing old rail abutments
M19T4.01-A	Watershed Strategies	Very High	Very High	Y	Hazard mitigation and emergency operations planning, municipal corridor protection, stormwater management, capital planning for replacing key structures

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M19T4.01-B	Stream Buffers	Medium	Medium	Y	Missing buffers primarily in areas of over-widened stream, windrowing, riprap; buffers important but limited planting (ample setback, natural regen with focus on flood and ice scour tolerant species due to over-widened state)
M19T4.01-B	Watershed Strategies	Very High	Very High	N	Priority to addressing headcut in flood chute in M19T4.02, protection of attenuation assets in M19T4.03

6.1 Reach M19T4.02 – South Branch Wells River, ~0.5 mi up Rte. 302 (Scott Hwy.) to ~0.2 mi. upstream of private driveway bridge at 3507 Scott Hwy.

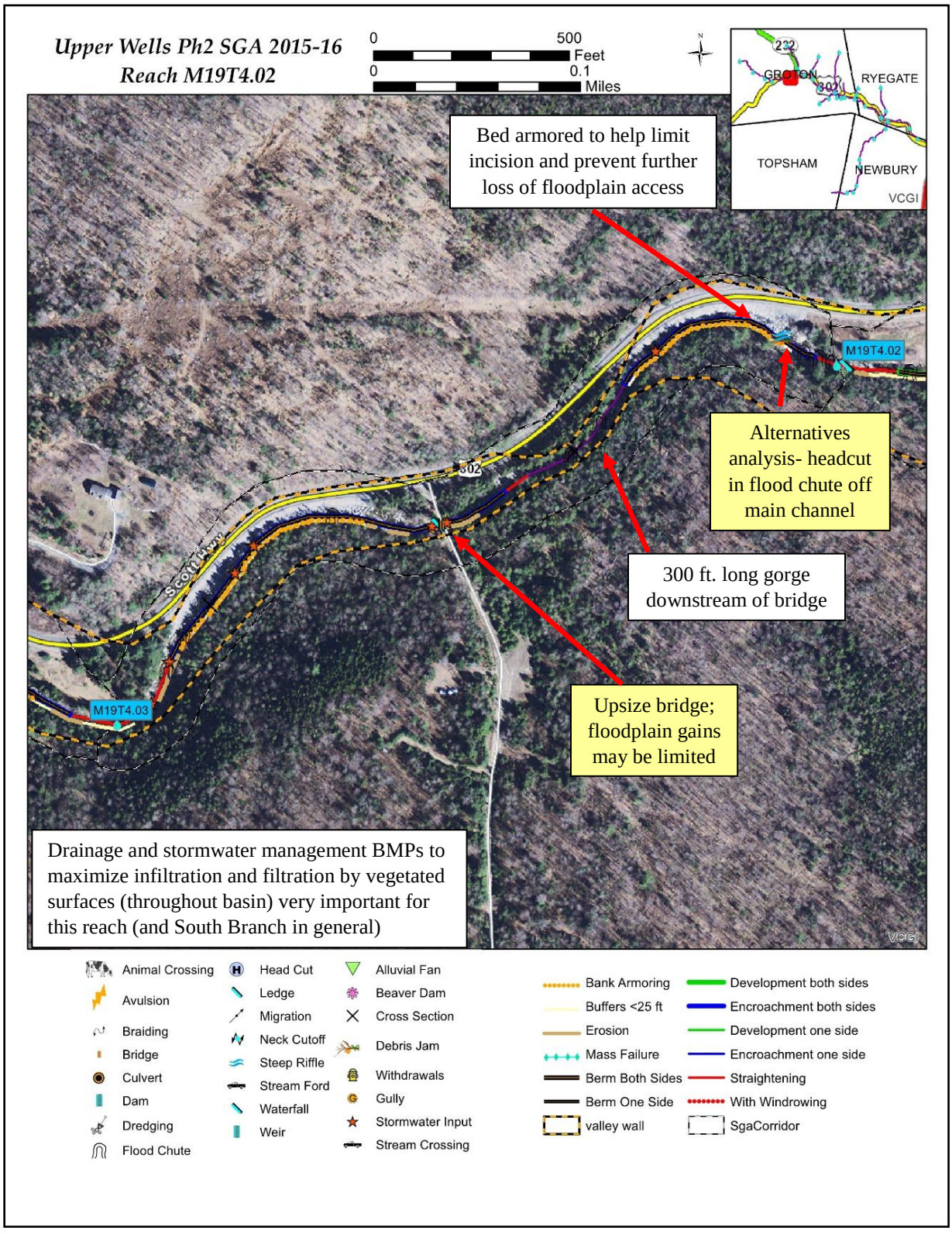


Figure 133. M19T4.02 Reach map – South Branch Wells River

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M19T4.02	2340	C	b	Cobble	Step-Pool	Narrowly Confined

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M19T4.02-0	2340	C	b	Cobble	Step-Pool	Semi-Confined
	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
M19T4.02-0	Fair	High	1.6	III	F	none

Reach M19T4.02 is situated in one of the narrowest portions of the valley of the South Branch of the Wells, and Rte. 302 (Scott Hwy.) occupies significant portions of former floodplain along the left bank through much of the reach. Heavy bank armoring along Rte. 302 significantly encroaches on the current channel location in several locations, and portions of the stream bed have actually been armored in the past in an attempt to limit bed incision due to the extreme degree of straightening and confinement (Fig. 134).



Figure 134. Portions of the stream bed in M19T4.02 have been armored to try to limit bed incision (downcutting) and maintain at least some floodplain access off the right bank in this highly straightened section of stream.

Aggradation is apparent upstream of an undersized private bridge mid-reach (effective width reduced by the angle of alignment to the stream and armoring inside the structure, ~55 pct. bankfull width; Fig. 135) where ledge grade controls limit downcutting, and it appears the bridge has likely been "cleaned out" to prevent plugging. This dynamic limits floodplain access off the left bank by and downstream of the bridge in particular, but it's questionable how much floodplain would be gained by increasing the span of the bridge because the stream starts to drop into a small gorge a short distance downstream; the historic floodplain

off the left bank is largely occupied by Rte. 302. Glacial outwash including remarkably large boulders downstream of the bridge indicate this gorge is largely a glacial legacy that has been further carved by the enormous force of water channeled through this opening. Sediment discontinuity at this structure limits rebuilding of floodplain access downstream further amplifying stream power.

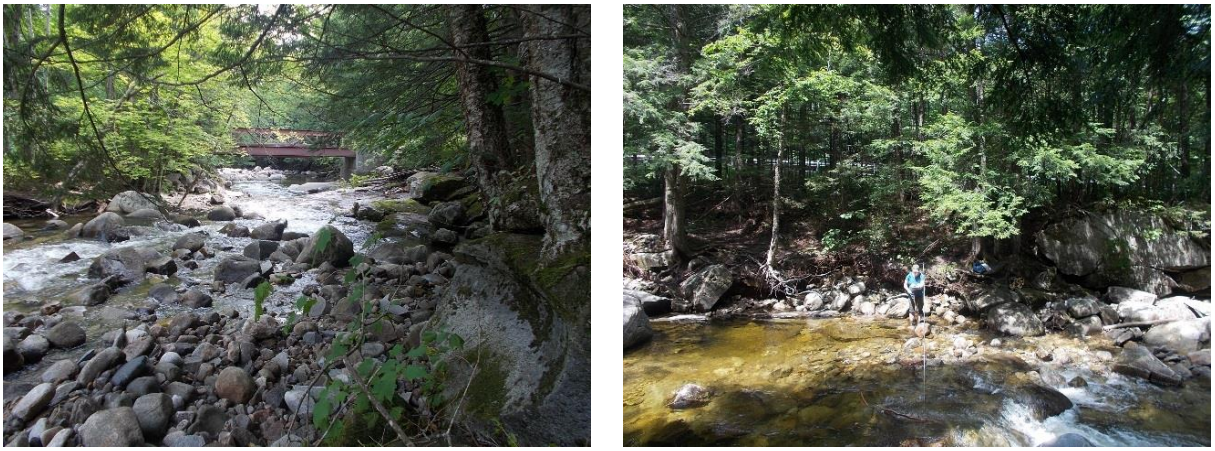


Figure 135. Sediment drops out upstream of an undersized bridge (left) placed on ledge in the mid-section of reach M19T4.02. With no access to historic floodplain off the left bank downstream of the bridge (Rte. 302 visible occupying much of the historic floodplain in photo at right) the South Branch is funneled through a small gorge, enormously increasing the force of water channeled through this opening.

Downstream of the bridge water is funneled through a 300 ft. long partially bedrock-controlled gorge before entering a broader portion of the valley along another heavily armored portion of Rte. 302 (Fig. 136). In this portion of the valley attempts have been made to armor the bed so that the stream would not continue incising and losing access to a wooded, undeveloped floodplain off the right bank.



Figure 136. Downstream end of 300 ft. long gorge (left photo; mid-reach bridge barely visible in center background) lies just upstream of a heavily armored portion of Rte. 302 (right) where bed armoring has also been installed to keep the stream from incising further and losing access to an wooded, undeveloped floodplain off the right bank.

Fieldwork documented that the wooded floodplain off the right bank was in fact accessed during Irene and more recent flooding in April 2014 (Fig. 137), but a large flood chute off the right bank was scoured 5 ft. BELOW the elevation of the current channel; a debris jam and sediment wedge appear to be the only thing keeping the South Branch from dropping into this headcut and potentially losing a significant degree of floodplain accessibility. This area is highly recommended for an alternatives analysis for potential restoration projects that might help move toward greater stream stability, as this area lies upstream of further channel constrictions that greatly escalated flood damages in recent storms.

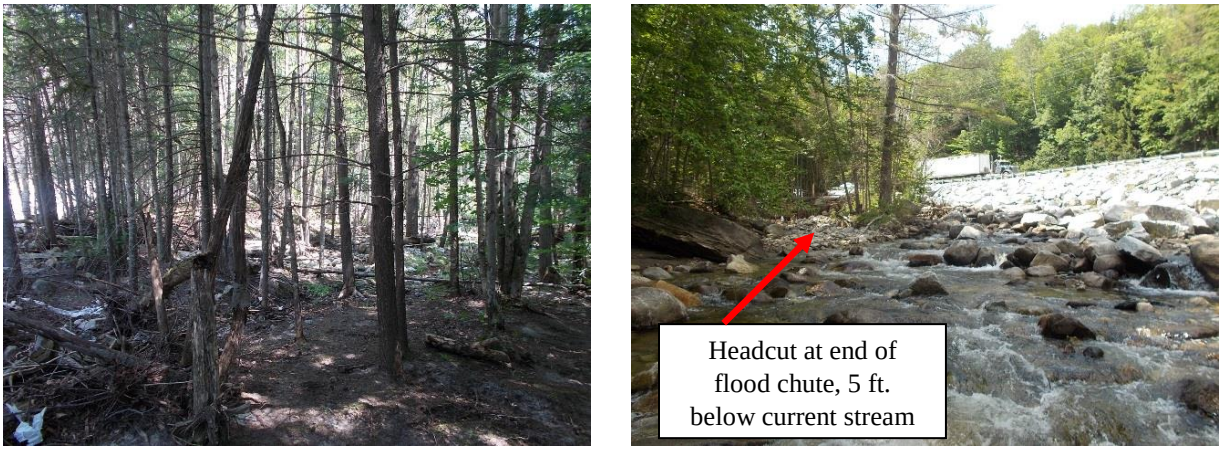


Figure 137. Undeveloped, wooded floodplain accessed in recent floods off right bank in vicinity of bed-armored stream along Rte. 302 in reach M19T4.02 (left) lies just upstream of a 5 ft. deep headcut in the end of a flood chute plugged by a debris jam and sediment wedge (right).

Primary Stressors:

- Heavy road encroachment and bank armoring
- Undersized bridge likely "cleaned out" after flooding
- Glacial carving and loss of historic floodplain access leading to greatly amplified stream power
- Straightening (>50% of segment length) largely related to extensive road encroachment, further exacerbating amplified stream power

Table 40. M19T4.02 Projects and Practices Table – South Branch Wells River

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M19T4.02-0	Stream Buffers	Medium	Low	N	missing buffers important but primarily along roadside, would likely require additional considerations for anything besides natural regeneration
M19T4.02-0	Remove/Replace Structures	Next Highest	Medium	Y	Private bridge restricts floodplain access at a critical juncture where grade controls give some possibility of retaining it, but floodplain gains may be limited even in best of scenarios
M19T4.02-0	Restore Incised Reach	Very High	Very High	N	Potential project: alternatives analysis for 5 ft. headcut plugged by debris jam-sediment wedge at end of flood chute on DS end of reach, consider opportunities for habitat restoration in bed armored area; ensure watershed strategies for stormwater management BMPs are being pursued
M19T4.02-0	Watershed Strategies	Very High	Very High	Y	drainage and stormwater management BMPs

6.1 Reach M19T4.03 – South Branch Wells River, Westville (~0.2 mi. upstream of bridge at 3507 Scott Hwy. upstream to junction of Seyon Pond and Beck Rds.

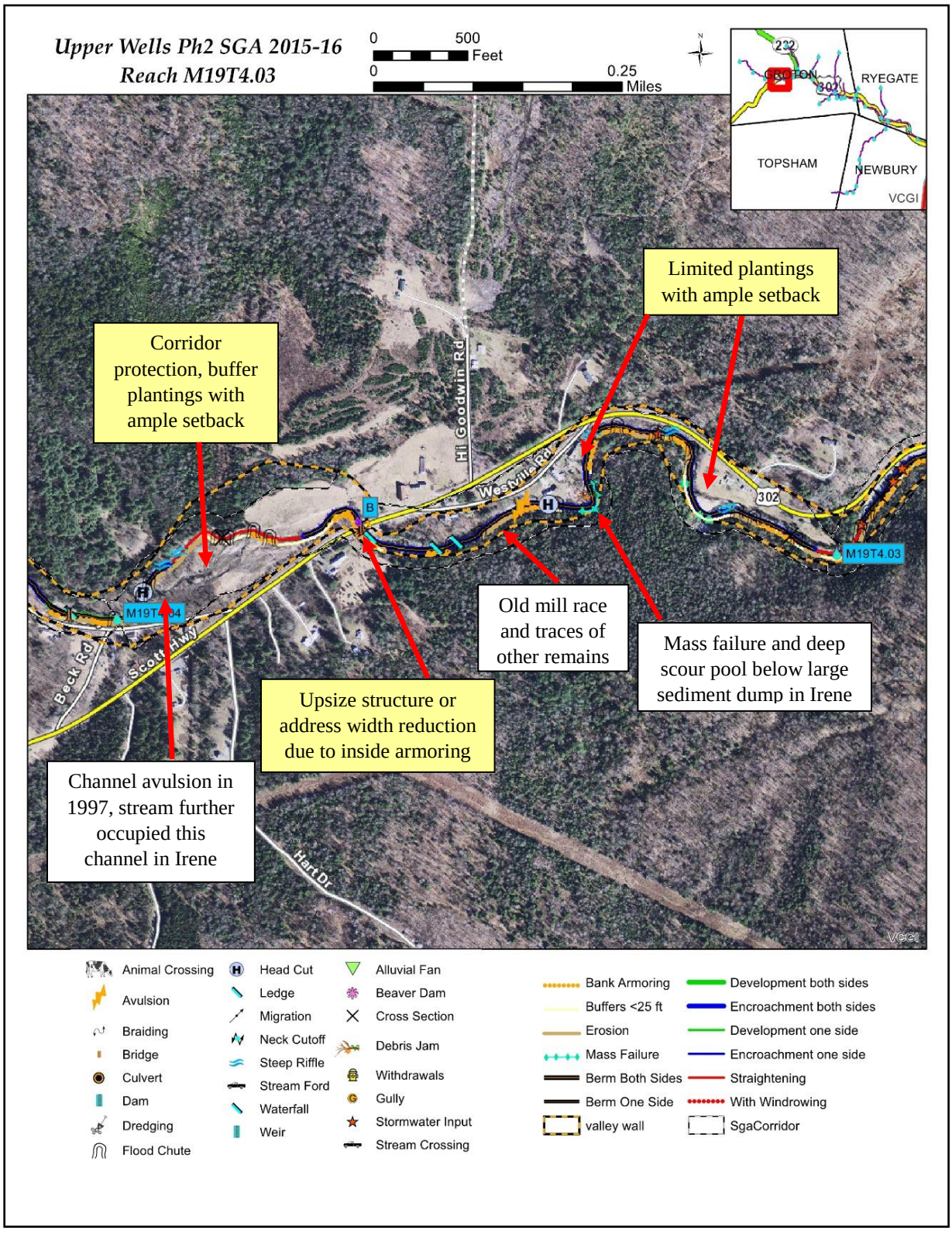


Figure 138. M19T4.03 Reach map – South Branch Wells River

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M19T4.03	5085	C	b	Cobble	Riffle-Pool	Broad

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M19T4.03A	3478	B	None	Cobble	Step-Pool	Narrow
M19T4.03B	1607	C	None	Gravel	Riffle-Pool	Broad

	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
M19T4.03A	Fair	High	1.5	III	F	C to B
M19T4.03B	Fair	Very High	1.1	III	F	none

South Branch of the Wells reach M19T4.03 is visible from Rte. 302 (Scott Hwy.) through much of its length, particularly since a channel avulsion at the upstream end of the reach has routed substantial portions of the reach closer to that thoroughfare than its former location along the left valley wall away from the junction of Seyon Pond Rd. and Rte. 302 at the upstream end of the reach. The reach was segmented for Phase 2 assessment, primarily due to differences in planform and slope: downstream segment A is steeper and straighter due to its confinement in a narrower valley and floodplain, while upstream segment B has a gentler slope and is in a broader valley largely occupied by farm fields.

A small settlement (indicated as part of West Groton on topographic maps) lies along Westville Rd. in close proximity to the stream in segment M19T4.03A, and Beers Atlas (1875) indicates this as the location of the Heath & Welch Saw & Planing Mill. The mill was likely situated here due to the temporary narrowing of the valley, an apparent glacial legacy related to a stream outwash spillway; additional human influences on the degree of confinement were not clear in the field. The valley pinch point lies just upstream of a sediment dump and large scour pool that contributed to a large mass failure in Irene (Fig. 139), and houses located near the stream appeared to have substantial bank scour impacts to bank armoring and channel flood flows around massive boulders that cut much closer to the structures than the pre-flood channel.

Upstream of this area stream power escalates as water is funneled through an undersized opening created by substantial bank armoring inside the Rte. 302 bridge at the segment break between M19T4.03A and B (Fig. 140). Traces of an old millrace and other remains were also observed in this area, though the contribution of these remnants to stream dynamics ("fire-hose effect" on downstream areas) beyond the general effects of the valley pinch point were not clear.





Figure 139. Possible remains of an old dam below Westville Rd. (left) are part of a valley pinch point a short distance upstream of a sediment dump and scour pool beneath a mass failure (right). Traces of an old millrace and other remains were observed a short distance upstream.





Figure 140. Massive stone that reduces the effective width of the Rte. 302 bridge at the break between M19T4.03A and B (left) is characteristic of the glacial outwash spillway in downstream segment A; the stone has been used to armor banks near several buildings in segment A (right).



Figure 141. High flows in Irene (2011) and again in April 2014 spread widely over the glacial outwash in M19T4.03A, scouring banks, dumping sediment, and carving out vegetation much closer to buildings than pre-flood flows.

Segment M19T4.03B extends upstream of the Rte. 302 bridge at the upstream end of Westville Rd., and is located in a much broader portion of the valley. Just upstream in reach M19T4.04, near the junction of Seyon Pond Rd. and Beck Rd., a high degree of straightening associated with the road, a former mill site, and old bridge abutments (evident on 1875 Beers Atlas, old foundations noted during field assessment) appear to have contributed to a channel avulsion in M19T4.03B. Historic orthos (April 1998) indicate this same path had been accessed to a lesser degree previously (4th highest peak flow at Wells gage July 1997).

The current primary channel of the South Branch in this area cut through a beaver influenced scrub-shrub wetland (likely used for hay and pasture over the years) in the middle of the valley and now carries roughly three-quarters of the flow. The remaining one-quarter flows weakly through what is now a mostly dry, somewhat incised channel (partially offset on the upstream end by sedimentation during recent floods) along the left valley wall where the channel had been maintained previously (Fig. 142). The old channel was not completely dry at the time of assessment (driest stretch of a wet summer) but may likely be at low flows.



Figure 142. Upstream (left) and downstream (right) ends of a channel avulsion that has carved a new primary channel in M19T4.03B. The current primary channel flows right in the picture of the upstream end, comes in at left of the downstream end photo.

It appears likely that further sedimentation and/or debris jams will contribute to channel evolution that will take some time to reach a new equilibrium in this area, but that both of these channels will play an important role in attenuating flood discharges in the future. These dynamics will make continued farming difficult but offer large benefits to downstream flood mitigation. The stream corridor in this area (occupying much of the valley floor) is highly recommended for protection through channel easements or similar mechanisms.

Primary Stressors:

- Increased stream power due to high degree of straightening and old mill remains in upstream reach M19T4.04
- Diminished buffers

Table 41. M19T4.03 Projects and Practices Table – South Branch Wells River

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M19T4.03-A	Stream Buffers	Medium	Low	Y	primarily by dwellings along banks - reestablish or plant to widen-ample setbacks
M19T4.03-A	Remove/ Replace Structures	Very High	Next Highest	Y	Rte. 302 bridge upstream of Westville has 60 ft. span at road level but only 40 ft. effective width due to armoring inside structure
M19T4.03-A	Watershed Strategies	Very High	Very High	Y	Hazard mitigation and emergency operations planning, municipal corridor protection, stormwater management
M19T4.03-B	Protect River Corridors	Very High	Very High	Y	Corridor easement: high value attenuation asset downstream of highly straightened area (long-term challenges) and upstream of Westville and major infrastructure issues along Rte. 302
M19T4.03-B	Stream Buffers	Next Highest	Next Highest	Y	ideally in conjunction with corridor protection-channel management easement
M19T4.03-B	Restore Incised Reach	Very High	Very High	N	corridor protection and removal of encroachments upstream in M19T4.04 - old abutments and possibly old mill infrastructure

6.1 Reach M19T4.04 – South Branch Wells River, jct. of Seyon Pond and Beck Rds. upstream to riprapped corner of Seyon Pond Rd. ~200 ft. downstream farm bridge

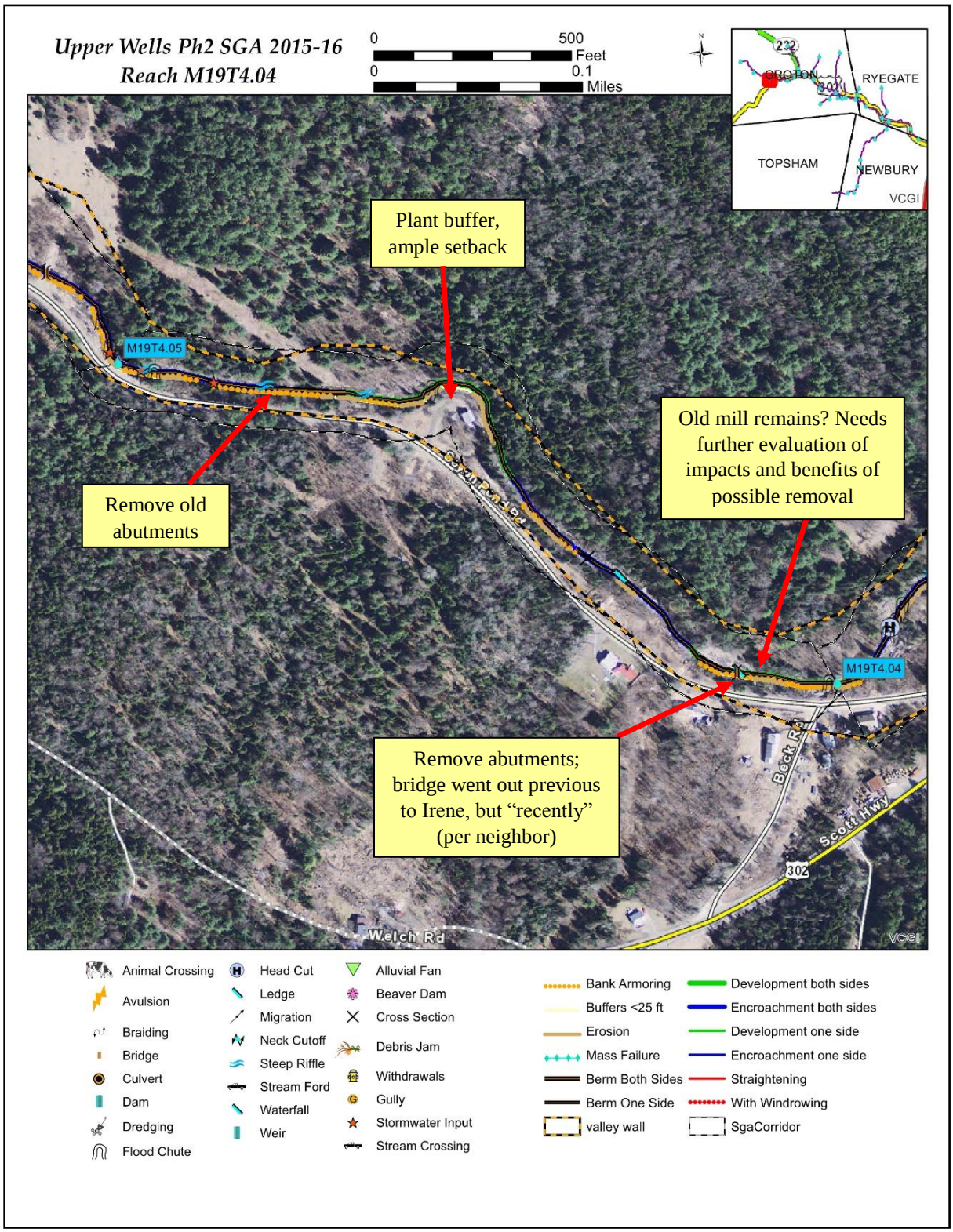


Figure 143. M19T4.04 Reach map – South Branch Wells River

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M19T4.04	2216	B	None	Cobble	Step-Pool	Semi-Confined

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M19T4.04-0	2216	B	None	Cobble	Step-Pool	Semi-Confined
	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
M19T4.04-0	Fair	High	2.0	III	F	none

Reach M19T4.04 is in a more confined valley than adjacent upstream and downstream reaches along the South Branch of the Wells, but includes similar levels of development and road encroachments as upstream reach M19T4.05. Beers Atlas (1875) indicates a relatively high level of development along this stream historically, including a church and sawmill located at the downstream end of the reach.

There appear to be at least two sets of old bridge abutments in this reach (possibly 3 or 4, but hard to tell due to significant erosion/failure), one near a current utility line crossing on the upstream end of the reach and a second at the downstream end near the junction of Seyon Pond and Beck Roads. A high degree of straightening including these abutments and significant road encroachment appears to have amplified the effects of the valley confinement and slope of this reach, thus contributing to a channel avulsion in the next reach downstream; this appears to have also occurred (to a lesser degree) in 1997.

A neighborhood resident said that the bridge at the downstream abutments went out recently, but previous to Irene; Bing 2010 aerial maps (ANR Atlas) seem to show the bridge still in place. Beers Atlas (1875) indicates a sawmill close to these downstream abutments near Beck Rd., and there are old foundations and likely mill races evident off the left bank in this area (Fig. 144).



Figure 144. Laid stone off left bank near Beck Rd., downstream end of reach M19T4.04, may be part of the remains of an old sawmill; note flattened vegetation and sediment from recent high water access at lower right. Laid stone on the right bank just upstream is also substantial and may have been part of an old foundation, but may have served solely as a bridge abutment.

A relatively low number of depositional features in reach M19T4.04 may be due in part to elevated sediment transport due to the confinement and straightening, but is also likely related to sediment discontinuities due to historic dredging upstream where a majority of large cobbles and boulders appear to have been used as bank toe armoring.

Primary Stressors:

- Heightened stream power due to valley confinement, straightening (>50% of segment length, largely related to extensive road encroachment and bank armoring), and constrictions at old abutments and mill works
- Loss of access to historic floodplains (incision ratio 1.97)

Table 42. M19T4.04 Projects and Practices Table – South Branch Wells River

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M19T4.04-0	Stream Buffers	Medium	Medium	Y	Flood resiliency benefits for camp off right bank in addition to general benefits of buffers; other reduced buffers primarily roadside - important to protect but difficult to augment without additional considerations
M19T4.04-0	Remove/Replace Structures	Very High	Next Highest	Y	remove 2 sets old abutments (highest priority downstream set); 2 possible other sets largely failed, not affecting channel dynamics as greatly
M19T4.04-0	Restore Incised Reach	Medium	Next Highest	Y	high priority river corridor protection at downstream reach M19T4.03 to attenuate flow and sediment transported through channelized reaches M19T4.05 and M19T4.04
M19T4.04-0	Watershed Strategies	Very High	Very High	Y	Hazard mitigation and emergency operations planning, municipal corridor protection, stormwater management, develop info on bridge and culvert options for private landowners

6.1 Reach M19T4.05 – South Branch Wells River, riprapped corner of Seyon Pond Rd. ~200 ft. downstream farm bridge upstream to Heath Brook at Buzzy's Rd.

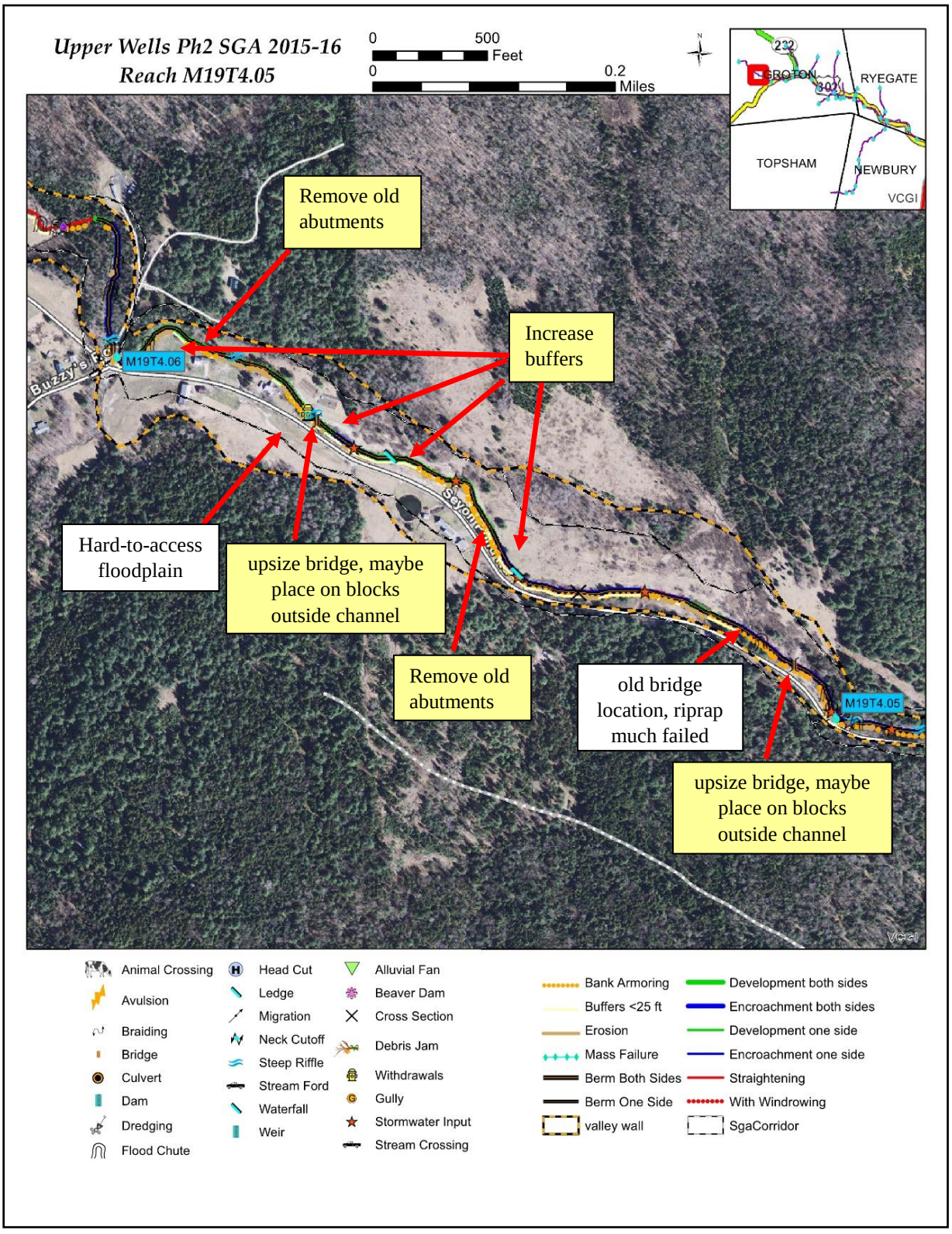


Figure 145. M19T4.05 reach map – South Branch Wells River

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub-slope	Bed material	Bed-form	Valley type
M19T4.05	3913	C		Cobble	Riffle-Pool	Broad

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M19T4.05-0	3913	C	None	Gravel	Riffle-Pool	Broad
	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
M19T4.05-0	Fair	Very High	1.5	III	F	none

South Branch of the Wells reach M19T4.05 is located downstream of the confluence with Heath Brook, and channel bankfull width expands from roughly 30 to 40 ft. with the additional drainage (hydraulic curve width 29.5 ft. in M19T4.06, field measured at 34 ft.; curve and field both 40 ft. in M19T4.05). M19T4.05 is relatively densely settled, and Beers Atlas (1875) indicates a schoolhouse in the reach that appears on the 1948 East Barre quadrangle topographic maps as the Westville Schoolhouse (UNH Dimond 2016).

With long-standing development along the banks in this reach, and old mills located further downstream, it appears the stream has been historically managed in a manner that can intensify flood impacts. Very little large woody debris was observed in the stream (indicating likely historic and/or more recent snagging), and a majority of large cobbles and boulders appear to have been removed from the bed over time, often placed as bank toe armoring. Much of this bank armoring is now failing, but it appears the stream has likely been dredged for stone in the vicinity of current bridges as well as old abutments that no longer have stream crossings.



Figure 146. Much of the large stone appears to have been removed from the stream bed and placed as bank armoring along reach M19T4.05 over time, particularly in the vicinity of stream crossings.

Current bridges in M19T4.05 are private structures that are not required to have the full width of town roads. Although both of these structures appear to have been recently replaced, they remain channel constrictions primarily due to the placement of the abutments and associated armoring (Fig. 146). Placement of modular structures on waste block or similar, on top of the banks and outside the channel width, has been used elsewhere as a cost-effective means of accommodating stream processes more effectively and reducing long-term repair and replacement costs as well as permitting the stream more room for inevitable adjustment processes.

Removal of coarse sediments in this reach appears to have led to a progressive fining due to windrowing or use of the boulders and cobbles for riprap. This section of stream would likely have a cobble substrate under reference conditions but is currently dominated by gravel substrate, and downstream reaches are dominated by alluvium that has been augmented by sediments transported out of this straightened reach. Two sets of ledge grade controls are located in the middle of the reach, helping to limit further downcutting and leading to widening and deposition as primary current adjustments. Recent floods have impacted existing buffers, particularly in the vicinity of several houses and associated openings in the reach, and indicate the benefits of widening existing buffers and establishing missing ones.

Primary Stressors:

- Straightening (>50% of segment length) largely related to extensive road and development encroachments and stream crossing constrictions
- Dredging and snagging, collapsed bank armoring now starting to replenish coarse sediments
- Restriction of access to historic floodplains (incision ratio 1.5)

Table 43. M19T4.05 Projects and Practices Table – South Branch Wells River

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M19T4.05-0	Stream Buffers	Very High	Medium	Y	passive or low cost due to lateral instability, existing armoring may buy some time for buffer establishment that will be more beneficial in long term; set-back important, ideally part of corridor protection-passive restoration
M19T4.05-0	Remove/ Replace Structures	Very High	Next Highest	Y	old abutments on US end increase hazard to house off RB; private bridges constrict due to abutments, may be candidates for modulars on waste block outside channel
M19T4.05-0	Restore Incised Reach	Medium	Next Highest	Y	high priority river corridor protection at downstream reach M19T4.03 to attenuate flow and sediment transported through channelized reaches
M19T4.05-0	Watershed Strategies	Very High	Very High	Y	Hazard mitigation and emergency operations planning, municipal corridor protection, stormwater management, develop info on bridge and culvert options for private landowners

6.1 Reach M19T4.06 – South Branch Wells River, Heath Brook at Buzzy's Rd. upstream to ~600 ft. upstream of South Branch Rd. bridge entry to Groton State Forest

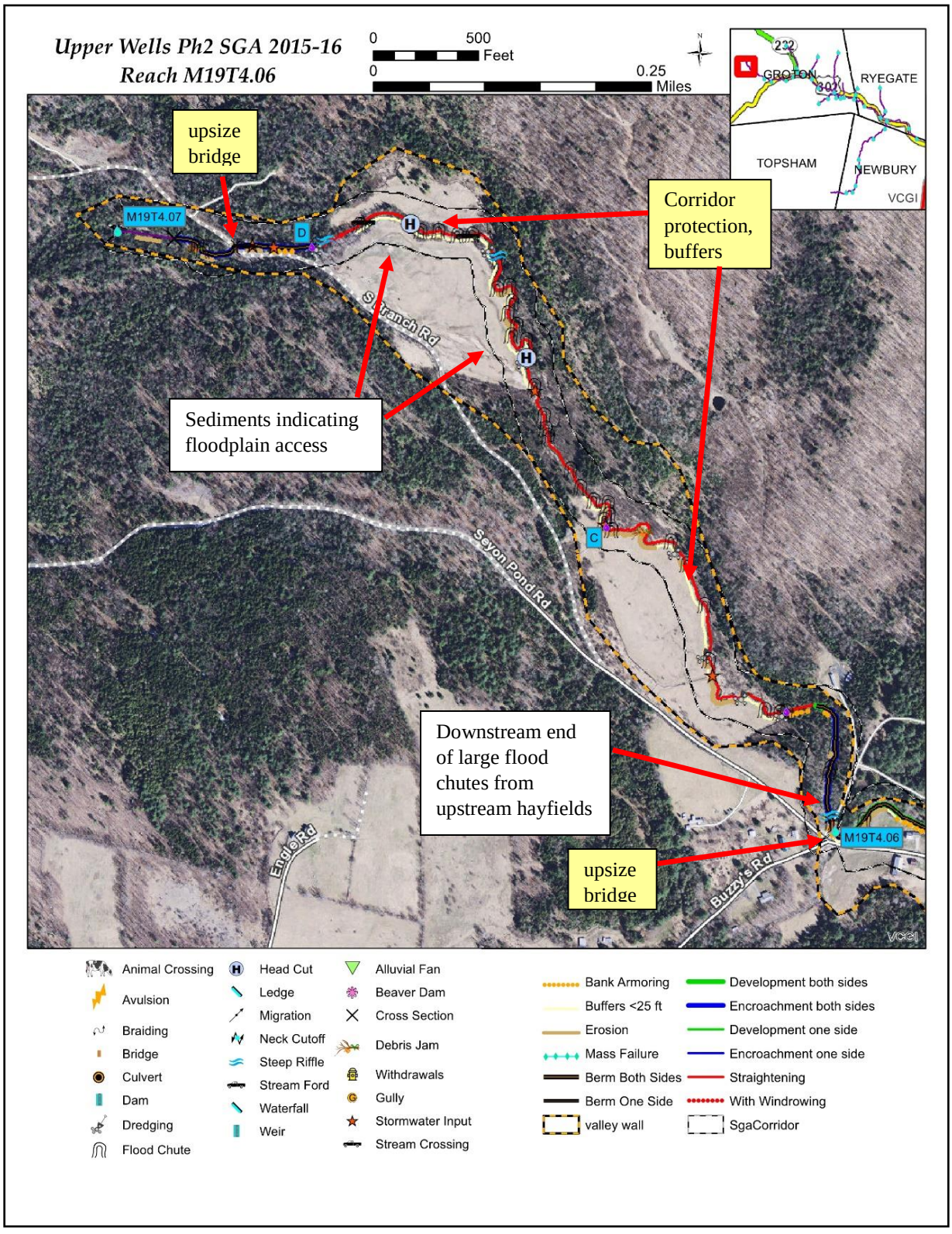


Figure 147. M19T4.06 Reach map - South Branch Wells River

Phase 1
(reference)

Reach ID	Channel length (ft)	Stream type (reference)	Sub- slope	Bed material	Bed-form	Valley type
M19T4.06	6205	C	None	Cobble	Riffle-Pool	Very Broad

Phase 2

Segment ID	Channel length (ft)	Stream type (existing)	Sub-slope	Bed material	Bed-form	Valley type
M19T4.06A	816	C	b	Cobble	Step-Pool	Very Broad
M19T4.06B	1640	E	None	Gravel	Riffle-Pool	Very Broad
M19T4.06C	2781	C	None	Cobble	Riffle-Pool	Very Broad
M19T4.06D	968	C	b	Cobble	Step-Pool	Very Broad

	Geomorphic condition	Stream sensitivity	Incision ratio	Channel evolution stage	Channel evolution model	Stream Type Departure
M19T4.06A	Fair	High	NA*	IV	F	none
M19T4.06B	Fair	Extreme	NA*	II	F	none
M19T4.06C	Fair	High	NA*	III	F	none
M19T4.06D	Fair	High	1.3	III	F	none

*Typical x-sections were not measured for downstream segments A-C due to property access restrictions.

Reach M19T4.06 marks the upstream extent of the South Branch of the Wells included in the 2015-16 assessment reported here, and upstream of this reach the stream is located on State of Vermont lands (Groton State Forest). The reach was split into four segments for phase 2 assessment, with downstream and upstream segments M19T4.06A and D located in narrower portions of the valley than mid-reach segments B and C. Segment B was classed as a subreach

due to characteristics of an E-type stream (in contrast with the C-type stream of the other three segments), with much finer sediments present in segment B. Alder-dominated buffers ranging from single trees to more extensive scrub-shrub wetland line the banks through much of the mid-portion of the reach (segments B and C), and substantial ditching in combination with the scrub-shrub vegetation indicate that the extensive hayfields along these two segments are likely located on altered wetlands. The very broad valley and wide floodplain in this central portion of the reach represent a high-value attenuation asset located relatively high in the watershed.

The majority of reach M19T4.06 appears to be under single ownership. The reach was walked in its entirety and field notes and photos were recorded, but property access was denied for cross-sections on segments M19T4.06A-C. (Step 6 Rapid Habitat and Step 7 Rapid Geomorphic Assessment scoring was based on qualitative observations for channel dimensions). Segment D is on state forest land, and the typical cross-section was measured.

Upstream segment M19T4.06D has irregular topography with multiple flood chutes and likely old channels on both sides, with clear signs of recent stream access to these. This section of the stream is steeper and a bit more confined than the much wider valley in the next two segments downstream, but large boulders and cobbles scattered through the wooded buffers in between flood chutes indicate a depositional zone in recent floods. It appears the South Branch Rd bridge at the downstream end of this segment may have plugged or at least been outflanked (likely replaced or repaired after Irene), and the current channel is split around an island just upstream of the bridge (Fig. 148). Deposition in this segment is likely related to this constriction, and deposition is much more pronounced in segments C and B downstream.

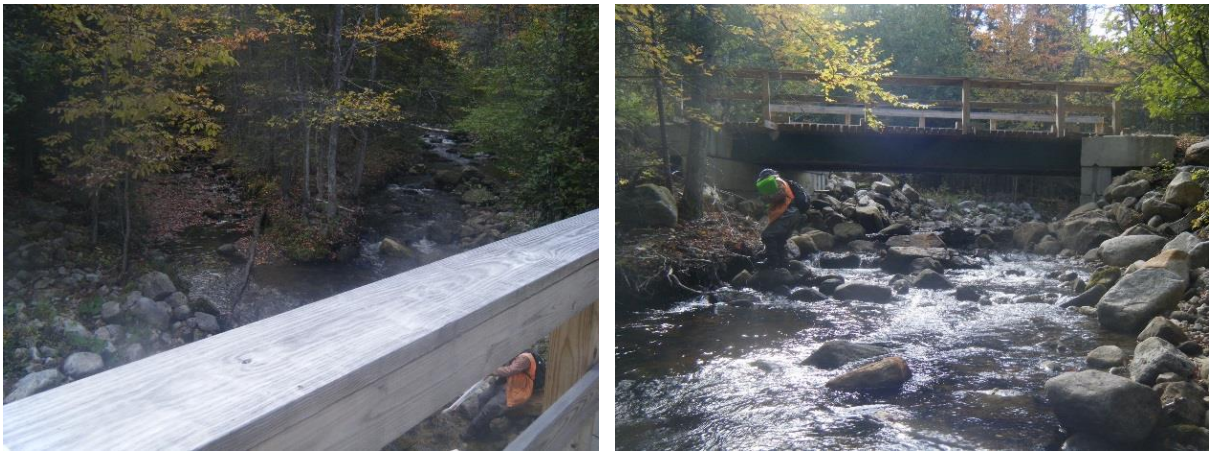


Figure 148. South Branch Rd bridge at the downstream end of segment M19T4.06D likely plugged in Irene (and was "cleaned out" of large sediments post-flood, right), and the current channel splits around an island just upstream of the bridge (left).

Signs of localized dredging and snagging downstream of the bridge indicate possible efforts to return the stream to a single thread flowing toward the left valley wall near the upstream end of segment C, where post-Irene aerial photography indicates the stream spread widely across the floodplain during flooding (Fig. 147). Headcuts and nickpoints noted in this segment were

working back up through aggraded sediments at debris jams and in areas where sediments were removed in post-flood clean-out, as this segment was clearly a depositional zone in recent flooding (Fig. 149).



Figure 149. Headcut working up through aggraded sediments in M19T4.06C; snagged wood on left bank.

Numerous small-scale dredging locations were also noted in segment B, and relatively deep scour pools were notable in the fine sediments at these sites (Fig. 150). Scour pools were also common at the downstream end of field ditches and several relatively large flood chutes, an apparent response to high flows in flooding.



Figure 150. Equipment access point at localized dredging site in M19T4.06B; point bar scalped, enlarged scour pool just upstream.

Though the floodplain access in hayfields off the right bank of segment M19T4.06B is not as evident in aerial photography as in the segment C hayfields upstream (Fig. 147), sediment and water discharge at the downstream end of a pair of large flood chutes were clearly evident in the wooded buffer of segment A, just upstream of the bridge installed at the valley pinch point at the downstream end of reach M19T4.06 (Fig. 151).



Figure 151. Nickpoint and large boulders at the field edge in background at center of this photo mark the downstream end of one of a pair of large flood chutes activated in Irene in M19T4.06B hayfields.

The stream enters a wooded corridor with steeper gradient and coarser sediments in downstream segment M9T4.06A, and the naturally pinching valley at the base of the reach is exacerbated by fill and bank armoring placed by the bridge abutments, road and driveway located along the top of the valley walls in this area. This effectively serves to funnel high flows through the private bridge situated at a valley pinch point at the base of the reach (Fig. 152) and into a more densely settled area downstream in reach M19T4.05.



Figure 152. Bridge at the base of reach M19T4.06 funnels flows through a valley pinch point where they join the confluence of Heath Brook upon entering a more densely developed reach M19T.05.

Primary Stressors:

- Straightening (>50% of reach length) largely related to snagging, dredging, windrowing, bank armoring and effects of undersized bridges
- Bridges on upstream (South Branch Rd.) and downstream (private drive off Seyon Pond Rd. at Buzzy's Rd.) ends undersized and restrict access to floodplain, contributing to fire hose effects
- Restriction of access to historic floodplains (incision ratio 1.3 on measured segment), additional older incision evident in presence of high terraces

Table 44. M19T4.06 Projects and Practices Table – South Branch Wells River

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*
M19T4.06-A	Remove/Replace Structures	Medium	Medium	Y	Consider impacts to land use, structures downstream
M19T4.06-A	Watershed Strategies	Very High	Very High	Y	River corridors in town planning
M19T4.06-B	Protect River Corridors	Very High	Very High	Y	Landowner outreach - corridor easement
M19T4.06-B	Stream Buffers	Next Highest	Next Highest	Y	Passive or low cost due to lateral instability; set-aside important
M19T4.06-C	Protect River Corridors	Very High	Very High	Y	Landowner outreach: corridor easement
M19T4.06-C	Stream Buffers	Next Highest	Next Highest	Y	Passive or low cost due to lateral instability; set-aside important
M19T4.06-D	Protect River Corridors	Medium	Low	Y	State land; bridge is larger issue
M19T4.06-D	Remove/Replace Structures	Very High	Medium	Y	Likely recently replaced or repaired, still undersized; road may be at risk from avulsion

6.2 PROJECT PRIORITIZATION

Project prioritization focuses on efforts that will potentially move streams most quickly toward stable or equilibrium conditions. A river is considered stable, or in a state of "dynamic equilibrium," if it can adjust its channel geometry (width, depth, and slope) to efficiently discharge, transport, and store water, sediment, and debris (Leopold, 1994, Rosgen, 1996). Primary current channel adjustments on the vast majority of streams in the assessed area involve widening and lateral adjustments, increasing the importance of reducing or limiting stream corridor encroachments, reducing road-stream conflicts, and sizing stream crossing structures (bridges and culverts) adequately to accommodate efficient transport of sediment and woody debris in addition to water.

Based on 2015-2016 fieldwork and analysis, project prioritization for this 2016 River Corridor Plan for the Upper Wells and associated tributaries features (in order of descending priority):

- Watershed (largely municipal) strategies, especially hazard mitigation planning plus capital planning and prioritization for addressing undersized stream crossing structures
- Buffer protection and establishment, primarily in conjunction with corridor protection and/or integrated restoration projects
- Reach-scale corridor protection projects: Wells mainstem segment M17B, reaches M14 and M15, South Branch reach M19T4.06, segment M19T4.03B; Wells mainstem reach M09 (identified in previous corridor plan but priority reconfirmed by value of attenuation for current lack of floodplain access in reach M10)
- Reach-scale restoration projects: Tannery Brook segment M16S1.01A Rte. 302 bridge replacement, information gathering for addressing old Tannery structure just upstream; Scott Brook reach M11T1.02 old mill remains removal and road relocation at downstream end into top of reach M11T1.01; information gathering for potential of lowering railbed and removing old abutments in South Branch reach M19T4.01A; Wells mainstem reach M13 corridor protection and buffer plantings, evaluate bridge removal and Brown Rd. floodplain reconnection; information gathering for removing old abutments in segment Wells mainstem segment M10B and potential of lowering railbed there and into downstream end of reach M11; remove channel constrictions at downstream end of South Branch reach M19T4.04

Watershed strategies

The highest priority project recommendations include the following watershed strategies (listed in order of descending priority but understood to be strongly interconnected and interdependent):

1) Floodplain and River Corridor Planning and Protection

- River Corridor overlay in conjunction with updated Flood Hazard Bylaws (the river corridor includes space for both the meander belt and a 50 ft.. riparian buffer; VT DEC 2014, pp. 8-11). Draft model ordinances and regulations are available as a starting point (Kline 2010, pp. 66-67; VT WMD 2014).

- Local Emergency Operations and Local Hazard Mitigation Plans. All of the towns in the 2015 study area have up-to-date Emergency Operations Plans, but all have expired Hazard Mitigation Plans (FloodReadyVT 2016). Addressing road encroachments will be especially important, and Hazard Mitigation Plans may benefit from incorporating guidance from the Vermont Standard River Management Principles and Practices (Schiff et al 2014).

It would be difficult to overemphasize the importance of the role that encroachments on small streams play in narrow valleys and restricted floodplains (which is the case in much of the Upper Wells basin). Emergency operations and large costs associated with road repair are challenging for small towns to accommodate. River Corridor overlays provide not only flood protection and /or hazard identification for land and structures adjacent to the stream, but an idea of the room needed to accommodate stream processes in a manner that will help break a cycle of impacts being amplified and passed to downstream reaches.

2) Drainage and Stormwater Management

- Management of overland flow and keeping entry points well vegetated
- Seek opportunities to increase on-site infiltration and retention times; this is not just a municipal issue, but applies to landowners and developers as well. Vermont League of Cities and Towns is an excellent starting point for information on a wide range of options (VLCT 2016)
- Priority areas (due to more notable cumulative impacts) on tributaries

3) Road-Stream Crossing Retrofits and Replacements

- All of the towns in the 2015 study area (Groton, Ryegate, Newbury and Topsham) have adopted Vermont Agency of Transportation 2013 Bridge and Culvert Standards (VTrans 2014), an important step that will help leverage funding for adequately sized structures damaged in flood events (Emergency Relief Assistance Fund).

- Undersized private stream crossing structures are widespread and frequently problematic both for flood damages to the structures and their owners' properties as well as stream dynamics and impacts (especially downstream) of these structures. High recommendations are offered here for development of a brochure that would briefly cover potential funding options for landowners (and development of better resources on this front) as well as necessary stream alteration permits and considerations. Recent flood damages along Church St. in South Ryegate are a prime example that such structures can take a toll on municipal, state and private assets. Proactive measures to fund, size and install structures adequately and properly could amount to significant economic benefits and greater flood resiliency in the long term.

  Funding options for replacement of private bridges will be a challenging issue for long-term reach-scale restorations (including M11T1.01 along Church St. in South Ryegate, M19T4.02 along Rte. 302 in Groton, and M19T4.05 along Seyon Pond Rd. in Groton), and it is highly recommended that an effort be made to contact structure owners and compile information on how such replacements were funded post-Irene (if such a document does not now exist). It is

further recommended that a summary report of the compiled information be provided to the Road Commissioners, Selectboards and Planning Commission members in the four towns of the study area.

4) Buffers

Although much of the Upper Wells basin is currently forested, buffer protection (especially) and/or establishment is an important part of any efforts in the basin. In part due to large-scale fires in this basin during the height of steam-powered railroad engine use, plus land use history and long-standing channel management practices (see Chapter 3 background in this report), large woody debris does not currently (but would under reference conditions) play a prominent role in channel dynamics in many of the assessed streams. Buffer protection and establishment projects can certainly be recommended as a stand-alone project if opportunities arise (with adequate planning to account for bank instability, potential for rapid lateral stream migrations, and their potential impacts on plantings), but the primary recommendations for this report are for buffer projects as part of integrated projects with other components as well. Selecting areas for prioritization favors areas where reach-scale corridor protection or restoration activities will help move streams more quickly toward equilibrium conditions, and priority buffer establishment and/or protection is thus highlighted as part of integrated projects listed in Table 45 below.

Notwithstanding the emphasis on buffers being integrated with larger projects, stand-alone buffer projects could be implemented to good benefit on Darius James reach M14S2.01; Scott Brook segment M11T1.03C; South Branch segment M19T4.03B; and Wells mainstem reaches M17, M18 and M19.

In addition to the “projects” noted above (watershed strategies largely contingent upon municipal actions), the highest priority projects identified in the creation of this River Corridor Plan are listed below in a Project and Strategy Summary Table (Table 45) intended as a quick reference for those wishing to assess project status and/or plan further project activities.

Table 45. Prioritized Project and Strategy Summary Table for top 11 projects identified in Upper Wells Corridor Planning 2015-2016.

Project #	Reach/ Segment Condition	Site Description including Stressors and Constraints	Project or Strategy Description	Technical Feasibility & Priority	Other Social Benefits	Costs	Land Use Conversion & Landowner Commitments	Potential Partner Commitments
1	M17B: Fair, CEFD sediment regime, Very High Sensitivity M18: Fair, CEFD sediment regime, High Sensitivity	High value attenuation assets upstream of village and highly straightened section of stream. Welton Rd. bridge upsized to bankfull width at upstream end of this area 2014, major sediment dump in M18 into M17B in Irene. Previous sediment dump pushed into low berms (likely intermittent) along either side of channel in M18, now partially vegetated with shrubs-small trees along pasture-hayfields; evaluate berms after vegetation has died back.	Corridor easements, buffer plantings, possibly breach holes in berms to increase floodplain access. Also evaluate right bank downstream and whether this is an old gravel pit needing protection from channel capture.	High feasibility for corridor protection and plantings; addressing berms and potential for gravel pit channel capture needs further evaluation. Berms low, likely overtopped in higher level floods; priority to corridor protection	Appears to be repeat flood impact area; engaged community members; increased flood resilience for village area downstream; water quality (heavy sediment contributions)	Corridor easement purchases and transaction costs, buffer plantings, possible excavation costs for berm breaches	High value hayfields-pasture to buffer plantings	CT River Watershed Council; Caledonia County Natural Resource Conservation District; FSA-CREP; US Partners for Fish & Wildlife; CT River Mitigation and Enhancement Fund; Vermont Land Trust; Vermont River Conservancy
2	M14: Fair, FSTCD sediment regime, Very High Sensitivity M15: Fair, CEFD sediment regime, Very High Sensitivity	High value attenuation assets for straightened reaches upstream, addressing upstream issues likely to take time. Moderately incised, most of historic floodplain in M16-M15 cut off by railroad bed and old dam wing extension, upstream end M15 historically straightened by railbed. Groton #9 dam upstream removed summer 2016, active adjustments likely. Further analysis of lowering railbed downstream of Keenan Brook at upstream end of M15. Mostly under single ownership.	Corridor easement, buffer plantings, further analysis of lowering railbed downstream of Keenan Brook	High feasibility and priority for corridor protection, buffer plantings (project in process as corridor plan is completed); further analysis needed for possibility of lowering railbed downstream of Keenan Brook		Corridor easement purchases and transaction costs, buffer plantings, consulting engineering fees to evaluate possibilities for lowering railbed on upstream end of M15	High value hayfields-pasture to buffer plantings; may need exclusion fencing	Ecosystem Restoration Program; FSA-CREP; US Partners for Fish & Wildlife; CT River Watershed Council; Caledonia County Natural Resource Conservation District; Vermont Land Trust; Vermont River Conservancy

Project #	Reach/ Segment Condition	Site Description including Stressors and Constraints	Project or Strategy Description	Technical Feasibility & Priority	Other Social Benefits	Costs	Land Use Conversion & Landowner Commitments	Potential Partner Commitments
3	M19T4.06B: Fair, FSTCD* sediment regime, Extreme Sensitivity M19T4.06C: Fair, FSTCD* sediment regime, High Sensitivity (*sediment regime based on qualitative observations - no measured x-sections to determine incision ratio)	High value attenuation asset high in watershed upstream of more channelized, developed area. Converted wetlands ditched, localized dredging to maintain stream against one side of valley. Sediment fan downstream of state forest road bridge deposited large amounts of sediment on hayfields in Irene, flood chutes captured and amplified field ditches, also resulting in large sediment dumps in ends of flood chutes. Single ownership.	Corridor easement, buffer plantings, bridge replacement preferably 120 pct. bankfull or placed on top of banks outside channel width	High feasibility and priority for corridor protection, buffer plantings with landowner buy-in. Bridge is on state forest road, may be possible to use modular or similar if full town road width is not required; design for floodplain access around structure. Priority to corridor protection.	Increasingly difficult to farm with growing frequency of heavy downpours. Increased flood resiliency in more developed downstream areas. Fisheries benefits with more shaded stream, habitat benefits due to extension of contiguous forest anchor block.	Corridor easement purchase and transaction costs, buffer plantings, bridge replacement	High value hayfields to buffer plantings	FSA-CREP; Trout Unlimited; US Partners for Fish & Wildlife; State of Vermont (Groton State Forest); CT River Watershed Council; Caledonia County Natural Resource Conservation District; Vermont Land Trust; Vermont River Conservancy

Project #	Reach/ Segment Condition	Site Description including Stressors and Constraints	Project or Strategy Description	Technical Feasibility & Priority	Other Social Benefits	Costs	Land Use Conversion & Landowner Commitments	Potential Partner Commitments
4	M19T4.03B: Fair, CEFD sediment regime, Very High Sensitivity	High degree of straightening associated with road, former mill site, and old bridge abutments upstream contributed to a channel avulsion here; same path had been accessed to a lesser degree previously (4th highest peak flow at Wells gage July 1997). Current primary channel of the South Branch in this area cut through a beaver influenced scrub-shrub wetland (likely used for hay and pasture over the years), sediment fan spread across floodplain Further sedimentation and/or debris jams will contribute to channel evolution that will take some time to reach a new equilibrium in this area, but both of these channels (and the broad floodplain in between) will play an important role in attenuating flood discharges in the future. These dynamics will make continued farming difficult but offer large benefits to downstream flood mitigation	Corridor easement, buffer plantings	High feasibility and priority for corridor protection, buffer plantings	Increased flood resilience in more densely settled areas downstream; fisheries benefits with more shaded stream; contiguous to 17-ac Class 2 wetland on tributary	Corridor easement purchase and transaction costs, buffer plantings, bridge replacement	Hayfields-pasture to buffer plantings; ideally a wide portion of this valley out of active production	FSA-CREP; Caledonia County Natural Resource Conservation District; CT River Watershed Council

Project #	Reach/ Segment Condition	Site Description including Stressors and Constraints	Project or Strategy Description	Technical Feasibility & Priority	Other Social Benefits	Costs	Land Use Conversion & Landowner Commitments	Potential Partner Commitments
5	M09 (2009 assessment): Good, CEFD sediment regime, High Sensitivity M10A: Fair, FSTCD sediment regime, Very High Sensitivity	M09 identified as attenuation asset in previous corridor plan; farm includes a good bit of reach M10 as well, but the old railbed restricts right bank floodplain access in that reach. M09 is the primary attenuation asset for now because the impacts are passed downstream due to this. Whether the old railbed can be lowered to increase floodplain access needs another level of analysis (listed as separate project below), but single ownership of M09 and M10A suggests important consideration here	Channel easement and buffer plantings for important attenuation asset (M09) with elevated upstream impacts being passed here; further analysis of potential for lowering railbed and removing old bridge abutments in M10A (see separate project below both segments A and B); should include M11 downstream of Creamery Rd. bridge in alternatives analysis for lowering railbed as well	High feasibility and priority for corridor protection, buffer plantings. Possibilities for lowering railbed need further analysis	Adjacent to Boltonville dam area which is highlighted for remediation (VT-ANR WMD 2015)	Corridor easement purchases and transaction costs, buffer plantings, consulting engineering fees to evaluate possibilities for removing abutments, lowering railbed	High value hayfields to buffer plantings, potentially further floodplain access	Essex Hydro Associates; CT River Mitigation and Enhancement Fund; Ducks Unlimited; CT River Watershed Council; Caledonia County Natural Resource Conservation District; FSA-CREP; US Partners for Fish & Wildlife; Vermont Land Trust; Vermont River Conservancy
6	M16S1.01A: Fair, UST sediment regime, Very High Sensitivity	Extremely undersized bridge with significant scour and escalating wear, high risk for plugging and too narrow for two cars to pass on roads. Old Tannery remains just upstream on RB, house in floodplain off LB. Delta bar downstream at mouth indicates high sediment transport through channelized reach, dumps out coarse materials at mainstem (fines transported downstream)	Rte. 302 bridge replacement, information gathering for addressing old Tannery structure just upstream, explore buyout options on both banks if circumstances arise	Feasible but detour route for bridge replacement is challenging. Unclear about opportunities (or needs) for brownfields remediation, buyouts, easements upstream. High priority due to potential impacts.	Transportation safety, water quality, flood resiliency	Bridge replacement, brownfields assessment and potential clean-up, corridor easements and/ or buyouts	Explore potential for buyouts, relocations	VTrans; Northern VT Development Association; Community Development Block Grants; CT River Watershed Council; Caledonia County Natural Resource Conservation District; CT River Mitigation and Enhancement Fund

Project #	Reach/ Segment Condition	Site Description including Stressors and Constraints	Project or Strategy Description	Technical Feasibility & Priority	Other Social Benefits	Costs	Land Use Conversion & Landowner Commitments	Potential Partner Commitments
7	M11T1.02: Fair, CST sediment regime, High Sensitivity M11T1.01: Fair, UST sediment regime, High Sensitivity	Extensive road encroachment exacerbates confinement and contributed to multiple mass failures along x-steep right valley wall in recent flood events; further settling likely to increase pressure on left bank (Swamp Rd.) in future. Old mill site remains even closer to stream than road near largest (35-50 ft.. high, 50-150 ft. long) mass failures; stonework still intact, contributed to triggering mass failures and substantial damage on left bank (along Swamp Rd.) a short distance downstream. Driveway entrance off left bank at top of M11T1.01 is last opportunity for road relocation before entering densely developed portion of South Ryegate village	old mill remains removal and road relocation at downstream end of M11T1.02 into top of reach M11T1.01	Feasibility unclear, would need landowner buy-in. High priority as road is going to be at increasing risk for repeat damage.	Reduced long-term road maintenance costs, downstream flood resilience, water quality	Significant. Engineering designs, stone removal from old mill site, road relocation, stream alteration permitting	Road relocation would require land from abutter(s).	VTrans, Towns of Ryegate and Newbury

Project #	Reach/ Segment Condition	Site Description including Stressors and Constraints	Project or Strategy Description	Technical Feasibility & Priority	Other Social Benefits	Costs	Land Use Conversion & Landowner Commitments	Potential Partner Commitments
8	M10B: Fair, CEFD sediment regime, High Sensitivity M11: Fair, UST sediment regime, High Sensitivity	Old Montpelier-Wells River railbed and bridge abutment constrict left bank floodplain to uncertain degree (not entirely clear where railbed is located in M10B). M11 downstream of Creamery Rd. bridge has low-lying wetlands behind railbed off left bank, but may have development constraints; short length of berm is placed on top of rail embankment near camp (190 Creamery Rd.) accessed via the old railbed	Alternatives analysis for removing old abutments in segment M10B and potential of lowering railbed there and reach M11 downstream of Creamery Rd bridge in South Ryegate Corridor protection important; may or may not be tied to analysis of potential for lowering railbed and removing old bridge abutments in M10A (see separate project above for M09 and M10A)	Feasible but floodplain gains for different sections need better analysis; not entirely clear where railbed is located in M10B. Highest priority is likely railbed lowering in M11 downstream of Creamery Rd. bridge, but may have development constraints. Removal of left bank abutment at M10A-B segment break likely limited in amount of floodplain gain but could aid meander development	Risk reduction for flood damage and maintenance needs along Rte. 302 and in vicinity of Creamery Rd. bridge	Consulting engineering costs for alternatives analysis, possible excavation work to lower railbed and/or remove abutments, potential buyout or corridor easement costs	Explore potential for camp buyout	VTrans; Town of Ryegate; CT River Mitigation and Enhancement Fund; CT River Watershed Council; Caledonia County Natural Resource Conservation District
9	M19T4.04: Fair, CST sediment regime, Very High Sensitivity	High degree of straightening including two set of old abutments and significant road encroachment amplified effects of valley confinement and slope of this reach, contributing to a channel avulsion in the next reach downstream (M19T4.03); also occurred (to a lesser degree) in 1997. Neighbor reported most downstream bridge went out recently but previous to Irene. Left bank infrastructure by Beck Rd. has stone foundations at a minimum, possibly old mill race remains; laid stone on right bank may be tied to Seyon Pond Rd. support	remove channel constrictions (bridge abutments, old mill remains) at downstream end of South Branch reach M19T4.04	Feasible. High priority due in large part to likelihood of repeat damage along road	Risk reduction for flood damage and maintenance needs along Seyon Pond Rd., water quality	Abutment removal and attendant stream alteration permitting, design work to ensure stability of Seyon Pond Rd.	Reduced access to left bank property. Corridor protection may require use of temporary bridges or other access	Town of Groton; CT River Watershed Council; Caledonia County Natural Resource Conservation District

Project #	Reach/ Segment Condition	Site Description including Stressors and Constraints	Project or Strategy Description	Technical Feasibility & Priority	Other Social Benefits	Costs	Land Use Conversion & Landowner Commitments	Potential Partner Commitments
10	M13: Fair, CEFD sediment regime, Extreme Sensitivity	Bridge spanning Wells mainstem below Farquharson Rd. no longer in use, upstream hayfield access at Barr Rd. and bridge limit meander redevelopment and access to floodplain; Brown Rd. (former railbed) disconnects oxbow wetland. Monitor old stone bridge abutments at upstream end of reach; appear likely to collapse on their own, but river dynamics may benefit from removal if they are persistent (current dynamics do not appear inconsistent with evolution toward greater stability)	Corridor protection and buffer plantings; evaluate potential for bridge removal (and monitor upstream abutment for potential removal if not collapsed soon), lowering Brown Rd. to reconnect floodplain	High feasibility and priority for corridor protection, buffer plantings. Further evaluation needed for downstream bridge removal and lowering Brown Rd.; constraint by Rte. 302 and Brown Rd. limit possibilities for greater floodplain access and meander redevelopment	Contiguous Class 2 wetlands have high habitat value for waterfowl, aquatic organisms; greater flood resilience in downstream village	Corridor easement and transaction costs; consulting engineering to evaluate lowering upstream hayfield access at Barr Rd and Brown Rd. at oxbow wetlands, possibilities for bridge removal	Floodplain access to hayfields, wider buffers; potentially some high value cropland	Ducks Unlimited; Ecosystem Restoration Program; FSA-CREP; CT River Watershed Council; Caledonia County Natural Resource Conservation District
11	M19T4.01A: Fair, CEFD sediment regime, High Sensitivity	Old rail abutments at segment break contribute to “fire hose effect”, elevated flood impacts in segment M19T4.01A; old railbed cuts off access to historic floodplain off right bank	information gathering for potential of lowering railbed and removing one or both old abutments at Wilson Rd. by Rte. 232	Feasible but needs better analysis of potential floodplain gains from lowering railbed, possible impacts of abutment removal on downstream development and willingness of landowners to ensure corridor protection	Increased flood resilience downstream, reduction of risk to Rte. 302, potential engagement with recreation community (VAST, Cross Vermont Trail)	Consulting engineering costs for alternatives analysis, possible excavation work to remove abutments and/or lower railbed, explore options for other types of trail crossings	Corridor protection, reduction or limiting of encroachments	VTrans, Forests, Parks and Recreation,VAST, Cross Vermont Trail

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– Appendix 1 –

Reach/Segment Phase 2 Summary Reports*:
Channel geometry data
Rapid Geomorphic Assessment scores
Rapid Habitat Assessment scores

*Datasets include reaches beyond the scope of the 2015 Upper Wells Phase 2 study area reported in this Corridor Plan. For scores and summary data pages the relevant reaches reported in this Corridor Plan are as follows:

Wells mainstem: M10-M22
Scott Brook: M11T1.01-M11T1.08
Stone Rd. Brook: M12S2.01-M12S2.02
Darius James Brook: M14S2.01-M14S2.02
Clark Hatch Brook: M15S1.01
Keenan Brook: M15T2.01-M15T2.03
Tannery Brook: M16S1.01
North Branch Wells: M18T3.01-M18T3.02
South Branch Wells: M19T4.01-M19T4.06

VERMONT

Stream Geomorphic Assessment

Agency of Natural Resouces

VT DEC

Vermont.gov

September, 12

Phase 2 - Stream Geometry Data

Wells River

		Phase 2 Stream Type					Phase 1 Data			Phase 2 Channel Data												
Reach	Seg-ment	Stream Type	Bed Material	Bedform	Subcl. Slope	Sub Rch?	Channel Slope	Channel Width	Bankfull Width	Max Depth	Mean Depth	Floodpr Width	Recnt Abandn Fldpln	Width Depth Ratio	Entrench-ment Ratio	Incision Ratio	Channel Evolution Stage	Channel Evolution Model	Geo Assess Condition	Hab Assess Condition	QC Staff	QC Auto
M01	0	C	Cobble	Riffle-Pool	None	No	0.71		56.8	6.3	4.49	763	7.75	12.65	13.43	1.23	II	F	Fair	Fair	P	P
M02	0	B	Cobble	Riffle-Pool	c	No	1.52		108.6	4	2.52	170.6	6.2	43.10	1.57	1.55	II	F	Fair	Fair	P	P
M04	A	B	Boulder	Step-Pool	None	No	1.29	51	50.8	6.1	3.76	70.6	6.1	13.51	1.39	1.00	I	F	Reference	Good	P	P
M04	B	C	Sand	Plane Bed	None	Yes	1.29	51	68.4	6.55	5.14	165.2	7.5	13.31	2.42	1.15	II	F	Fair	Fair	P	P
M05	0	C	Sand	Dune-Ripple	None	No	0.04		74.1	6.7	5.77	151.6	9.3	12.84	2.05	1.39	IV	F	Fair	Good	P	P
M06	A	E	Sand	Dune-Ripple	None	No	0.06	67	66.6	6.6	5.52	718.6	6.6	12.07	10.79	1.00	IIc	D	Fair	Fair	P	P
M06	B	C	Gravel	Plane Bed	None	No	0.06	67	79.2	6.9	5.19	680.2	9.05	15.26	8.59	1.31	II	F	Fair	Fair	P	P
M07	A	C	Gravel	Plane Bed	None	No	0.64	63	62.6	6.8	5.35	601.1	10.05	11.70	9.60	1.48	II	F	Good	Fair	P	P
M07	B	F	Cobble	Plane Bed	None	Yes	0.64	63	102.6	4.7	3.35	122.65	10.05	30.63	1.20	2.14	III	F	Fair	Fair	P	P
M08	A	B	Cobble	Step-Pool	None	No	3.24	74	74.3	6.4	4	107.6	6.4	18.58	1.45	1.00	I	F	Reference	Reference	P	P
M08	B	C	Sand	Plane Bed	None	Yes	3.24	74	93.5	6.3	4.99	245.6	7.95	18.74	2.63	1.26	III	F	Fair	Fair	P	P
M08	C					No	3.24	74						0.00	0.00	0.00					P	F
M09	A					No	0.38	71						0.00	0.00	0.00					P	F
M09	B	E	Gravel	Dune-Ripple	None	No	0.38	71	70.9	8.35	6.37	1140.9	8.35	11.13	16.09	1.00	I	F	Good	Fair	P	P
M10	A	C	Gravel	Riffle-Pool	None	No	0.02		93.5	5.6	4.3	483.5	7.3	21.74	5.17	1.30	III	F	Fair		F	P
M10	B	C	Cobble	Riffle-Pool	None	No	0.02		99.8	5.3	4.01	281.8	6.7	24.89	2.82	1.26	III	F	Fair		F	P
M11	0	B	Cobble	Riffle-Pool	c	No	0.74		70.7	6.5	4.96	89.2	11.5	14.25	1.26	1.77	III	F	Fair		F	P
M12	0	C	Gravel	Plane Bed	None	No	0.04		76	6.45	5.12	471.2	8.75	14.84	6.20	1.36	III	F	Fair		F	P
M12S2.01	A	C	Gravel	Riffle-Pool	None	Yes	2.28		19.3	2.2	1.4	28.3	7.2	13.79	1.47	3.27	III	F	Fair		F	P
M12S2.01	B	C	Gravel	Riffle-Pool	b	No	2.28		23	2.4	1.4	65	4.2	16.43	2.83	1.75	III	F	Fair		F	P
M12S2.02	0	C	Gravel	Riffle-Pool	b	No	2.50		17	2	1.3	174	2.8	13.08	10.24	1.40	III	F	Fair		F	P
M13	0	C	Sand	Dune-Ripple	None	No	0.02		71	7.1	5.45	321	7.8	13.03	4.52	1.10	III	F	Fair		F	P
M14	0	C	Gravel	Riffle-Pool	None	No	0.08		92	5.2	3.06	642	8	30.07	6.98	1.54	III	F	Fair		F	P
M14S2.01	0	C	Gravel	Riffle-Pool	b	No	2.81		19	2.8	1.72	639	4.7	11.05	33.63	1.68	III	F	Fair		F	P

VERMONT

Stream Geomorphic Assessment

Agency of Natural Resouces

VT DEC

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September, 12

Reach	Segment	Stream Type	Bed Material	Bedform	Subcl. Slope	Sub Rch?	Channel Slope	Channel Width	Bankfull Width	Max Depth	Mean Depth	Floodpr Width	Recnt Abandn Fldpln	Width Depth Ratio	Entrench-ment Ratio	Incision Ratio	Channel Evolution Stage	Channel Evolution Model	Geo Assess Condition	Hab Assess Condition	QC Staff	QC Auto
M14S2.02	0	B	Cobble	Step-Pool	None	No	4.96		23	2	1.3	39.5	2.8	17.69	1.72	1.40	III		Fair		F	P
M15	0	C	Gravel	Riffle-Pool	None	No	0.38		87.2	4.8	3.47	454.2	5.6	25.13	5.21	1.17	III	F	Fair		F	P
	A	C	Gravel	Riffle-Pool	None	Yes			19.3	1.3	0.8	104.3	2.1	24.12	5.40	1.62	III	F	Fair		F	P
	B	C	Cobble	Step-Pool	b	No			18.1	1.7	1.1	99.1	2.9	16.45	5.48	1.71	III	F	Fair		F	P
M16	0	C	Cobble	Riffle-Pool	None	No	0.18		78	4.8	3.36	252	6.5	23.21	3.23	1.35	III	F	Fair		F	P
M16S1.01	A	C	Cobble	Step-Pool	b	No	3.31		16.3	2.4	1.75	55.1	3.3	9.31	3.38	1.37	III	F	Fair		F	P
M16S1.01	B	C	Gravel	Step-Pool	b	No	3.31		17.7	2.1	1.6	43.1	4.6	11.06	2.44	2.19	III	F	Fair		F	P
M17	A	B	Cobble	Riffle-Pool	c	No	0.79		80.5	4.85	3.5	128.5	10.15	23.00	1.60	2.09	III	F	Fair		F	P
M17	B	C	Gravel	Riffle-Pool	None	No	0.79		62.8	6.25	4.34	670.3	6.25	14.47	10.67	1.00	V	F	Fair		F	P
M18	0	C	Cobble	Riffle-Pool	None	No	0.75		54.1	5.7	4.44	839.1	5.7	12.18	15.51	1.00	III	F	Fair		F	P
M18T3.01	0	C	Cobble	Riffle-Pool	b	No	2.16		50.7	2.8	1.91	133.7	4.1	26.54	2.64	1.46	III	F	Fair		F	P
M18T3.02	0	C	Cobble	Step-Pool	b	No	2.77		38	3.45	2.03	134.5	6.35	18.72	3.54	1.84	III	F	Fair		F	P
M19	0	C	Cobble	Riffle-Pool	b	No	2.11		69.5	5.1	3.4	294.5	8.1	20.44	4.24	1.59	III		Fair		F	P
M20	0	C	Cobble	Riffle-Pool	None	No	1.18		60.2	4.4	1.85	620.2	5.75	32.54	10.30	1.31	III	F	Good		F	P
M21	0	C	Cobble	Riffle-Pool	None	No	1.09		85.4	2.7	1.7	217.4	2.7	50.24	2.55	1.00	IId	D	Fair		F	P
M22	0	C	Cobble	Plane Bed	b	No	1.69		61.2	3.1	1.85	311.2	4.1	33.08	5.08	1.32	III	F	Fair		F	P
M19T4.01	A	C	Cobble	Step-Pool	b	No	2.83		53.7	4.9	2.7	804	5.9	19.89	14.97	1.20	III	F	Fair		F	P
M19T4.01	B	C	Cobble	Step-Pool	b	Yes	2.83		52.5	5.2	3.07	362.5	6.1	17.10	6.90	1.17	III	F	Fair		F	P
M19T4.02	0	C	Cobble	Step-Pool	b	No	8.12		64.9	3.7	2.5	223	5.9	25.96	3.44	1.59	III	F	Fair		F	P
M19T4.03	A	B	Cobble	Step-Pool	None	No	0.39		45	5	3.33	84	7.6	13.51	1.87	1.52	III	F	Fair		F	P
M19T4.03	B	C	Gravel	Riffle-Pool	None	Yes	0.39		33.3	3.7	1.94	373.3	4.2	17.16	11.21	1.14	III	F	Fair		F	P
M19T4.04	0	B	Cobble	Step-Pool	None	No	2.03		57.9	3.5	2.32	105.9	6.9	24.96	1.83	1.97	III	F	Fair		F	P
M19T4.05	0	C	Gravel	Riffle-Pool	None	No	1.28		40	4.4	2.98	150	6.4	13.42	3.75	1.45	III	F	Fair		F	P
M19T4.06	A	C	Cobble	Step-Pool	b	Yes	1.37							0.00	0.00	0.00	IV	F	Fair		F	P
M19T4.06	B	E	Gravel	Riffle-Pool	None	Yes	1.37							0.00	0.00	0.00	II	F	Fair		F	P
M19T4.06	C	C	Cobble	Riffle-Pool	None	No	1.37							0.00	0.00	0.00	III	F	Fair		F	P
M19T4.06	D	C	Cobble	Step-Pool	b	Yes	1.37		33.5	2.8	1.7	118.5	3.75	19.71	3.54	1.34	III	F	Fair		F	P
M15T2.01	0	E	Sand	Riffle-Pool	None	No	0.05		11.9	3.3	1.85	279.7	3.3	6.43	23.50	1.00	IIc	D	Fair		F	P
M15T2.02	0	C	Gravel	Riffle-Pool	None	No	1.23		27	2.7	1.56	189	5	17.31	7.00	1.85	III	F	Fair		F	P
M15T2.03	A	B	Cobble	Step-Pool	a	Yes	4.19		54	2.6	2.15	113	3.9	25.12	2.09	1.50	IId	D	Fair		F	P

Reach	Segment	Stream Type	Bed Material	Bedform	Subcl. Slope	Sub Rch?	Channel Slope	Channel Width	Bankfull Width	Max Depth	Mean Depth	Floodpr Width	Recnt Abandn Fldpln	Width Depth Ratio	Entrench-ment Ratio	Incision Ratio	Channel Evolution Stage	Channel Evolution Model	Geo Assess Condition	Hab Assess Condition	QC Staff	QC Auto
M15T2.03	B	C	Cobble	Step-Pool	b	No	4.19		27.3	2.8	1.6	120.3	4.7	17.06	4.41	1.68	III	F	Fair		F	P
M11T1.01	0	C	Cobble	Riffle-Pool	b	No	2.22		26.8	3.55	2.1	237	6.65	12.76	8.84	1.87	III	F	Fair		F	P
M11T1.02	0	C	Cobble	Step-Pool	b	No	2.95		28.5	3.25	2.25	84	4.45	12.67	2.95	1.37	III	F	Fair		F	P
	A	C	Cobble	Plane Bed	None	Yes			31.5	3	2.24	171.5	5	14.06	5.44	1.67	III	F	Fair		F	P
	B					No								0.00	0.00	0.00					F	F
	C	C	Gravel	Riffle-Pool	None	No			35.2	3.3	1.96	390.7	6	17.96	11.10	1.82	IIc	D	Fair		F	P
M11T1.04	0	B	Cobble	Step-Pool	a	No	6.83		31.7	3.45	2.33	67.7	6.7	13.61	2.14	1.94	III	F	Fair		F	P
M11T1.05	0	C	Cobble	Step-Pool	b	No	2.25		15	2.4	1.4	33.5	5	10.71	2.23	2.08	III	F	Fair		F	P
	A					No								0.00	0.00	0.00					F	F
	B	E	Sand	Riffle-Pool	None	No			7	1.4	0.49	247	1.6	14.29	35.29	1.14	IV	F	Good		F	P
M11T1.07	A	C	Gravel	Step-Pool	b	Yes	2.45		9.5	1.6	0.95	80.8	1.6	10.00	8.51	1.00	V	F	Fair		F	P
M11T1.07	B	C	Sand	Riffle-Pool	None	No	2.45		11.8	1.3	1.01	291.8	1.3	11.68	24.73	1.00	IId	D	Fair		F	P
M11T1.08	A	C	Gravel	Step-Pool	b	No	7.08		8.65	1	0.73	22.4	1.4	11.85	2.59	1.40	III	F	Fair		F	P
M11T1.08	B	C	Gravel	Step-Pool	b	No	7.08							0.00	0.00	0.00					F	F
M11T1.08	C	C	Gravel	Step-Pool	b	No	7.08		10.2	0.8	0.38	42.4	1.8	26.84	4.16	2.25	III	F	Fair		F	P
M04S3.01	A	E	Sand	Dune-Ripple	None	No	1.34	26	25.5	3.95	2.27	229.5	3.95	11.23	9.00	1.00	IIc	D	Fair	Fair	P	P
M04S3.01	B					No	1.34	26						0.00	0.00	0.00					P	F
M04S3.01	C					No	1.34	26						0.00	0.00	0.00					P	F
M04S3.01	D	B	Cobble	Step-Pool	a	Yes	1.34	26	19	2.45	1.73	35.3	2.45	10.98	1.86	1.00	I	F	Reference	Reference	P	P

Phase 2 - Rapid Geomorphic Assessment

Wells River

			Degradation			Aggradation			Widening		Planform								
Reach	Seg-ment	Sub Rch?	Score	STD	Historic	Score	STD	Historic	Score	Historic	Score	Historic	Geo Score	Geo Condition	Evol. Stage	Confin. Type	Sensitivity	QC Staff	QC Auto
M01	0	No	5	None	No	10	None	No	12	No	10	Yes	0.46	Fair	II	BD	High	P	P
M02	0	No	6	None	Yes	12	None	No	8	No	12	Yes	0.48	Fair	II	NC	High	P	P
M04	A	No	19	None	No	18	None	No	16	No	17	No	0.88	Reference	I	NC	Very Low	P	P
M04	B	Yes	5	None	Yes	11	None	No	10	No	11	No	0.46	Fair	II	NW	Very High	P	P
M04S3.01	A	No	16	None	No	11	None	No	11	No	10	No	0.60	Fair	IIc	VB	Very High	P	P
M04S3.01	B	No											0.00					P	F
M04S3.01	C	No											0.00					P	F
M04S3.01	D	Yes	19	None	No	18	None	No	19	No	20	No	0.95	Reference	I	NC	Moderate	P	P
M05	0	No	12	None	No	9	None	No	13	No	15	No	0.61	Fair	IV	NW	Very High	P	P
M06	A	No	12	None	No	12	None	No	9	No	11	No	0.55	Fair	IIc	VB	Extreme	P	P
M06	B	No	8	None	No	8	None	No	11	Yes	10	No	0.46	Fair	II	BD	Very High	P	P
M07	A	No	9	None	No	11	None	No	13	No	12	No	0.56	Good	II	BD	High	P	P
M07	B	Yes	5	B to F	Yes	10	None	No	11	No	12	Yes	0.48	Fair	III	SC	Extreme	P	P
M08	A	No	19	None	No	17	None	No	18	No	19	No	0.91	Reference	I	NC	Moderate	P	P
M08	B	Yes	11	None	No	13	None	No	13	No	14	No	0.64	Fair	III	NW	Very High	P	P
M08	C	No											0.00					P	F
M09	A	No											0.00					P	F
M09	B	No	16	None	No	13	None	No	13	No	14	No	0.70	Good	I	VB	High	P	P
M10	A	No	12			11			14		14		0.64	Fair	III	NW	Very High	F	P
M10	B	No	5	None		10			7		9		0.39	Fair	III	SC	High	F	P
M11	0	No	7	C to B	Yes	11			12		10		0.50	Fair	III	NW	High	F	P
M11T1.01	0	No	7	None	Yes	10	None	No	8	No	5	No	0.38	Fair	III	VB	High	F	P
M11T1.02	0	No	8	None	Yes	10	None	No	10	No	5	No	0.41	Fair	III	SC	High	F	P
M11T1.03	A	Yes	11	None	Yes	11	None	No	11	No	10	No	0.54	Fair	III	BD	High	F	P
M11T1.03	B	No											0.00			VB		F	F
M11T1.03	C	No	12	E To C	No	8	E To C	No	9	No	8	No	0.46	Fair	IIc	VB	Extreme	F	P
M11T1.04	0	No	7	None	Yes	9	None	No	9	No	6	No	0.39	Fair	III	SC	High	F	P

VERMONT

Stream Geomorphic Assessment

Agency of Natural Resouces

VT DEC

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Reach	Seg-ment	Sub Rch?	Score	STD	Historic	Score	STD	Historic	Score	Historic	Score	Historic	Geo Score	Geo Condition	Evol. Stage	Confin. Type	Sensitivity	QC Staff	QC Auto
M11T1.05	0	No	5		Yes	10			8		7		0.38	Fair	III	NW	High	F	P
M11T1.06	A	No											0.00			VB		F	F
M11T1.06	B	No	14	None	No	13	None	No	13	No	14	No	0.68	Good	IV	VB	High	F	P
M11T1.07	A	Yes	12			13			14		12		0.64	Fair	V	BD	Very High	F	P
M11T1.07	B	No	14			7	E To C		10		7		0.48	Fair	IId	VB	Extreme	F	P
M11T1.08	A	No	10		Yes	10			11		9		0.50	Fair	III	NW	Very High	F	P
M11T1.08	B	No											0.00			VB		F	F
M11T1.08	C	No	5	None	Yes	10			9		10	Yes	0.43	Fair	III	NW	Very High	F	P
M12	0	No	9		Yes	10			12		10		0.51	Fair	III	NW	High	F	P
M12S2.01	A	Yes	5	C to B	Yes	10	None	No	8	No	6	No	0.36	Fair	III	VB	Very High	F	P
M12S2.01	B	No	8	None	Yes	10	None	No	9	No	8	No	0.44	Fair	III	SC	Very High	F	P
M12S2.02	0	No	12	None	Yes	11	None	No	11	No	9	No	0.54	Fair	III	VB	Very High	F	P
M13	0	No	9			11			11	No	8		0.49	Fair	III	NW	Extreme	F	P
M14	0	No	10			10			10		9		0.49	Fair	III	VB	Very High	F	P
M14S2.01	0	No	7	None		10			9		7		0.41	Fair	III	VB	Very High	F	P
M14S2.02	0	No	13		Yes	13			10		13		0.61	Fair	III	SC	High	F	P
M15	0	No	10	None		13			13		10		0.58	Fair	III	NW	Very High	F	P
M15S1.01	A	Yes	5	None	No	12	None	No	11	No	13	No	0.51	Fair	III	NW	Extreme	F	P
M15S1.01	B	No	8	None	Yes	10	None	No	8	No	6	No	0.40	Fair	III	NW	High	F	P
M15T2.01	0	No	12			10			12		11		0.56	Fair	IIc	VB	Extreme	F	P
M15T2.02	0	No	9		Yes	9			10		9		0.46	Fair	III	BD	Very High	F	P
M15T2.03	A	Yes	10		Yes	9			9		10		0.48	Fair	IId	BD	High	F	P
M15T2.03	B	No	11			11			12		10		0.55	Fair	III	VB	High	F	P
M16	0	No	10			13			11		12		0.58	Fair	III	BD	High	F	P
M16S1.01	A	No	7		Yes	10			9		7		0.41	Fair	III	VB	Very High	F	P
M16S1.01	B	No	5	None	Yes	10			10		8		0.41	Fair	III	NW	Very High	F	P
M17	A	No	5	C to B	Yes	9			9		9		0.40	Fair	III	NW	High	F	P
M17	B	No	11			8			11		5		0.44	Fair	V	VB	Very High	F	P
M18	0	No	10	None	Yes	10	None	No	10	No	7	No	0.46	Fair	III	BD	High	F	P
M18T3.01	0	No	10	None	Yes	10	None	No	10	No	8	No	0.48	Fair	III	VB	High	F	P

Agency of Natural Resouces

September, 12 201

Reach	Seg-ment	Sub Rch?	Score	STD	Historic	Score	STD	Historic	Score	Historic	Score	Historic	Geo Score	Geo Condition	Evol. Stage	Confin. Type	Sensitivity	QC Staff	QC Auto
M18T3.02	0	No	9	None	Yes	11	None	No	10	No	9	No	0.49	Fair	III	SC	High	F	P
M19	0	No	8		Yes	10			11		9		0.48	Fair	III	NW	High	F	P
M19T4.01	A	No	7	None	No	9	None	No	9	No	5	No	0.38	Fair	III	VB	High	F	P
M19T4.01	B	Yes	12	None	No	11	None	No	9	No	7	No	0.49	Fair	III	BD	High	F	P
M19T4.02	0	No	8	None	No	11	None	No	10	No	7	No	0.45	Fair	III	SC	High	F	P
M19T4.03	A	No	8	C to B		11			8		5		0.40	Fair	III	NW	High	F	P
M19T4.03	B	Yes	10	None	No	9	None	No	8	No	5	No	0.40	Fair	III	BD	Very High	F	P
M19T4.04	0	No	7	None	Yes	9	None	No	7	No	7	No	0.38	Fair	III	SC	High	F	P
M19T4.05	0	No	10	None	Yes	10	None	No	9	No	7	No	0.45	Fair	III	BD	Very High	F	P
M19T4.06	A	Yes	11	None	Yes	12	None	No	12	No	13	No	0.60	Fair	IV	BD	High	F	P
M19T4.06	B	Yes	9	None	No	12	None	No	11	No	10	No	0.53	Fair	II	VB	Extreme	F	P
M19T4.06	C	No	11	None	No	11	None	No	10	No	9	No	0.51	Fair	III	VB	High	F	P
M19T4.06	D	Yes	12	None	No	11	None	No	11	No	9	No	0.54	Fair	III	VB	High	F	P
M20	0	No	11		Yes	12			11		15		0.61	Good	III	VB	Moderate	F	P
M21	0	No	10	None	No	8	None	No	8	No	6	No	0.40	Fair	IId	NW	High	F	P
M22	0	No	11		Yes	8			8		9		0.45	Fair	III	NW	High	F	P

Phase 2 - Rapid Habitat Assessment Scores

Wells River

Explanation of codes used in table header

6.1	Woody Debris Cover	**6.5**	Hydrologic Characteristics
6.2	Bed Substrate Cover	**6.6**	Connectivity
6.3	Scour and Deposition Features	**6.7**	River Banks
6.4	Channel Morphology	**6.8**	Riparian Area

Reach	Reference Stream Type	Bed-form	Habitat Departure	Reach Length	6.1	6.2	6.3	6.4	6.5	6.6	6.7 Left	6.7 Right	6.8 Left	6.8 Right	Total Score	Percent-age	Habitat Condition
M01-0		Riffle-Pool	None	2,806											0	0	Poor (Severe Departure)
M02-0		Riffle-Pool	None	1,977											0	0	Poor (Severe Departure)
M04-A		Step-Pool	None	3,913											0	0	Poor (Severe Departure)
M04-B		Step-Pool	None	2,308											0	0	Poor (Severe Departure)
M04S3.01-A		Dune-Ripple	None	1,024											0	0	Poor (Severe Departure)
M04S3.01-B		Dune-Ripple	None	1,200											0	0	Poor (Severe Departure)
M04S3.01-C		Dune-Ripple	None	860											0	0	Poor (Severe Departure)
M04S3.01-D		Dune-Ripple	None	277											0	0	Poor (Severe Departure)
M05-0		Dune-Ripple	None	2,824											0	0	Poor (Severe Departure)
M06-A		Dune-Ripple	None	5,779											0	0	Poor (Severe Departure)
M06-B		Dune-Ripple	None	1,177											0	0	Poor (Severe Departure)
M07-A		Riffle-Pool	None	1,551											0	0	Poor (Severe Departure)
M07-B		Riffle-Pool	None	798											0	0	Poor (Severe Departure)
M08-A		Step-Pool	None	819											0	0	Poor (Severe Departure)
M08-B		Step-Pool	None	746											0	0	Poor (Severe Departure)
M08-C		Step-Pool	None	1,213											0	0	Poor (Severe Departure)
M09-A		Dune-Ripple	None	1,679											0	0	Poor (Severe Departure)
M09-B		Dune-Ripple	None	2,257											0	0	Poor (Severe Departure)
M10-A	Riffle-Pool	Riffle-Pool	None	1,710	10	11	8	13	14	10	6	6	7	7	92	58	Fair (Major Departure)
M10-B	Riffle-Pool	Riffle-Pool	None	2,507	11	13	12	9	11	10	6	5	9	3	89	56	Fair (Major Departure)
M11-0	Riffle-Pool	Riffle-Pool	None	7,123	8	14	9	7	12	7	6	5	6	4	78	49	Fair (Major Departure)
M11T1.01-0	Riffle-Pool	Riffle-Pool	None	2,250	9	11	9	8	8	10	2	4	1	1	63	39	Fair (Major Departure)

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Stream Geomorphic Assessment

Agency of Natural Resouces

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Reach	Reference Stream Type	Bed-form	Habitat Departure	Reach Length	6.1	6.2	6.3	6.4	6.5	6.6	6.7 Left	6.7 Right	6.8 Left	6.8 Right	Total Score	Percent-age	Habitat Condition
M11T1.02-0	Step-Pool	Step-Pool	None	4,406	9	11	11	10	10	13	6	5	2	7	84	53	Fair (Major Departure)
M11T1.03-A	Plane Bed	Riffle-Pool	None	2,370	18	13	17	12	14	12	8	8			102	64	Fair (Major Departure)
M11T1.03-B	Riffle-Pool	Riffle-Pool	None	4,413											0	0	Poor (Severe Departure)
M11T1.03-C	Riffle-Pool	Riffle-Pool	None	1,940	6	12	12	14	9	7	7	5	9	5	86	54	Fair (Major Departure)
M11T1.04-0	Step-Pool	Step-Pool	None	1,831	12	14	13	8	7	8	8	6	2	7	85	53	Fair (Major Departure)
M11T1.05-0	Step-Pool	Riffle-Pool	None	5,787	14	11	11	12	13	10	8	8	8	8	103	64	Fair (Major Departure)
M11T1.06-A		Riffle-Pool	None	1,875											0	0	Poor (Severe Departure)
M11T1.06-B	Riffle-Pool	Riffle-Pool	None	759	10	12	8	16	15	5	7	7	7	7	94	59	Fair (Major Departure)
M11T1.07-A	Step-Pool	Riffle-Pool	None	818	14	12	10	13	10	8	5	4	5	4	85	53	Fair (Major Departure)
M11T1.07-B	Riffle-Pool	Riffle-Pool	None	1,219	13	11	11	13	15	11	8	8	8	8	106	66	Good (Minor Departure)
M11T1.08-A	Step-Pool	Step-Pool	None	3,256	14	12	10	11	13	7					67	42	Fair (Major Departure)
M11T1.08-B		Step-Pool	None	740											0	0	Poor (Severe Departure)
M11T1.08-C	Step-Pool	Step-Pool	None	593	15	7	6	4	7	5	5	5	9	9	72	45	Fair (Major Departure)
M12-0	Riffle-Pool	Riffle-Pool	Plane Bed	2,266	5	10	5	8	10	8	6	5	3	1	61	38	Fair (Major Departure)
M12S2.01-A	Riffle-Pool	Riffle-Pool	None	1,033	13	9	11	5	9	13	3	5	2	2	72	45	Fair (Major Departure)
M12S2.01-B	Riffle-Pool	Riffle-Pool	None	2,258	16	12	14	7	9	14	7	7	5	2	93	58	Fair (Major Departure)
M12S2.02-0	Riffle-Pool	Riffle-Pool	None	7,206	16	11	10	11	12	14	8	8	7	3	100	63	Fair (Major Departure)
M13-0	Dune-Ripple	Dune-Ripple	None	6,361	8	17	11	16	14	9	5	5	4	4	93	58	Fair (Major Departure)
M14-0	Riffle-Pool	Riffle-Pool	None	5,138	9	12	11	8	12	11	5	4	4	3	79	49	Fair (Major Departure)
M14S2.01-0	Riffle-Pool	Riffle-Pool	None	1,423	12	10	9	8	9	10	4	5	3	4	74	46	Fair (Major Departure)
M14S2.02-0	Step-Pool		None	1,915	11	11	12	10	13	6	8	8	6	5	90	56	Fair (Major Departure)
M15-0	Riffle-Pool	Riffle-Pool	None	3,938	7	12	12	12	14	10	5	5	3	2	82	51	Fair (Major Departure)
M15S1.01-A	Riffle-Pool	Step-Pool	None	917	16	8	12	8	10	10	8	8	9	8	97	61	Fair (Major Departure)
M15S1.01-B	Step-Pool	Step-Pool	None	3,089	14	12	12	7	11	9	8	5	8	3	89	56	Fair (Major Departure)
M15T2.01-0	Riffle-Pool	Riffle-Pool	None	1,869	9	10	12	12	13	8	9	9	5	7	94	59	Fair (Major Departure)
M15T2.02-0	Riffle-Pool	Riffle-Pool	None	3,578	17	11	11	11	11	8	4	7	4	7	91	57	Fair (Major Departure)
M15T2.03-A	Step-Pool	Step-Pool	None	1,033	12	15	8	7	14	7	7	8	9	9	96	60	Fair (Major Departure)
M15T2.03-B	Riffle-Pool	Step-Pool	None	2,188	18	14	11	10	11	13	8	6	9	9	109	68	Good (Minor Departure)
M16-0	Riffle-Pool	Riffle-Pool	None	2,852	9	15	12	10	12	11	3	3	4	4	83	52	Fair (Major Departure)
M16S1.01-A	Riffle-Pool	Step-Pool	None	634	8	15	10	8	9	6	4	4			64	40	Fair (Major Departure)

Reach	Reference Stream Type	Bed-form	Habitat Departure	Reach Length	6.1	6.2	6.3	6.4	6.5	6.6	6.7 Left	6.7 Right	6.8 Left	6.8 Right	Total Score	Percent-age	Habitat Condition
M16S1.01-B	Step-Pool	Step-Pool	None	10,708	16	14	11	12	14	7	8	8	8	8	106	66	Good (Minor Departure)
M17-A	Riffle-Pool	Riffle-Pool	None	3,800	6	11	10	7	10	3	4	4	2	3	60	38	Fair (Major Departure)
M17-B	Riffle-Pool	Riffle-Pool	None	1,262	10	14	11	13	14	13	5	5	3	4	92	58	Fair (Major Departure)
M18-0	Riffle-Pool	Riffle-Pool	None	3,334	5	15	13	10	11	7	3	3	3	4	74	46	Fair (Major Departure)
M18T3.01-0	Riffle-Pool	Riffle-Pool	None	2,316	10	10	14	7	13	15	8	8	4	5	94	59	Fair (Major Departure)
M18T3.02-0	Step-Pool	Step-Pool	None	4,518	10	13	14	7	12	15	8	7	4	8	98	61	Fair (Major Departure)
M19-0	Riffle-Pool	Riffle-Pool	None	2,839	10	15	10	8	10	8	6	6	5	2	80	50	Fair (Major Departure)
M19T4.01-A	Riffle-Pool	Riffle-Pool	Step-Pool	1,938	4	15	7	7	5	11	3	3	1	6	62	39	Fair (Major Departure)
M19T4.01-B	Step-Pool	Riffle-Pool	None	1,067	7	17	12	9	5	12	3	5	2	8	80	50	Fair (Major Departure)
M19T4.02-0	Step-Pool	Step-Pool	None	2,340	8	17	14	5	8	13	4	6	1	7	83	52	Fair (Major Departure)
M19T4.03-A	Step-Pool	Riffle-Pool	None	3,478	10	17	14	8	10	12	2	4	2	9	88	55	Fair (Major Departure)
M19T4.03-B	Riffle-Pool	Riffle-Pool	None	1,607	9	13	12	14	12	12	6	6	6	3	93	58	Fair (Major Departure)
M19T4.04-0	Step-Pool	Step-Pool	None	2,216	7	13	12	6	12	12	7	3	8	3	83	52	Fair (Major Departure)
M19T4.05-0	Riffle-Pool	Riffle-Pool	None	3,913	4	10	10	9	11	12	5	3	4	2	70	44	Fair (Major Departure)
M19T4.06-A	Step-Pool	Riffle-Pool	None	816	10	14	13	11	13	15	6	8	4	6	100	63	Fair (Major Departure)
M19T4.06-B	Riffle-Pool	Riffle-Pool	None	1,640	8	9	10	11	10	16	7	5	5	3	84	53	Fair (Major Departure)
M19T4.06-C	Riffle-Pool	Riffle-Pool	None	2,781	10	13	12	11	10	17	8	8	6	3	98	61	Fair (Major Departure)
M19T4.06-D	Step-Pool	Riffle-Pool	None	968	11	14	12	9	13	15	9	8	6	8	105	66	Good (Minor Departure)
M20-0	Riffle-Pool	Riffle-Pool	None	2,117	13	13	11	9	14	10	8	7	8	3	96	60	Fair (Major Departure)
M21-0	Riffle-Pool	Riffle-Pool	None	1,374	9	15	10	7	11	8	6	6	7	2	81	51	Fair (Major Departure)
M22-0	Plane Bed	Plane Bed	None	7,713	11	11	14	13	9	8	7	7	8	8	96	60	Fair (Major Departure)

– Appendix 2 –

Phase I Reach Summary Reports*

*Reaches M11T1.03, M11T1.06, and M15S1.01 were not assessed in Phase 1

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **Wells River**
Topo Maps: **WOODSVILLE**
Watershed:
Sub-watershed:

Reach ID: **M10**
SGAT Version: **4.56**
Date Last Edited: **April, 03 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location

1.1 Reach Description: **From approximately 3900 upstream of Boltonville Road crossing upstream approximately 4200 feet to tributary confluence.**

1.2 Towns: **Newbury, Ryegate**

1.3 Downstream Latitude: **44.1744709065**

1.3 Downstream Longitude: **-72.109063918**

Step 2. Stream Type

2.1 Elevation Upstream: **676**
2.1 Elevation Downstream: **675**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **4,162.0** ft. **0.79** Miles
2.3 Valley Slope: **0.0**
2.4 Channel Length: **4,217.0** ft. **0.80** Miles
2.5 Channel Slope: **0.02 %**
2.6 Sinuosity: **1.01**
2.7 Watershed Area: **87.1** Square Miles
2.8 Channel Width: **93.5** feet
2.9 Valley Width: **504.0** feet
2.10 Confinement Ratio: **5.4**
2.10 Confinement Type: **Narrow**
2.11 Reference Stream Type: **C**
Bedform: **Riffle-Pool**
Sub-Class Slope: **None**
Bed Material: **Gravel**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geological Mat.: **Alluvial** **49.0** %
3.3 Sub-dom. Geological Mat.: **Ice-Contact**
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: **B** **42.0** %
Flooding: **None/Rare** **89.0** %
Water Table Deep: **6.0** **44.0** %
Water Table Shallow: **6.0** **44.0** %
Erodibility: **Moderate** **26.0** %

7.4 Comments:

Jam potential is due to meander bends, though these bends are not very significant. There is road encroachment for almost the entire length, and the river appears to have been straightened for much of its length as well.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover:
Current Dominant Land Cover: **Forest** **87.0** %
Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor
Historic Land Cover::
Current Dominant Land Cover: **Forest** **56.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**0-25**
Sub-dominant:	**None**	**51-100**
Length w / less than 25 ft.:	**0.0** ft.	**921.0** ft.

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **0** **0.0** %
5.3 Bank Armoring: **1,078.0** **25.6** %
Left: **0.0** ft. Right: **1,078.0** ft.
5.4 Channel Straightening: **4,216.9** **100.0** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **4,217.0** ft. **100.0**

	One Side	Both Sides
Road:	**2,163.1** ft.	**0.0** ft.
Railroad:	**4,217.0** ft.	**0.0** ft.
Berm:	**0.0** ft.	**0.0** ft.
Improved Path:	**700.5** ft.	**0.0** ft.

6.2 Development: **113.0** ft. **0.0** ft.
6.3 Channel Bars: **Mid-channel**
6.4 Meander Migration: **Multiple**
6.5 Meander Width: **93 ft.** Rato: **1.0**
6.6 Wavelength: **93 ft.** Ratio: **1.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **1010.17** ft
7.2 Bank Height: **4** ft
7.3 Ice/Debris Jam Potential: **Bend**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1 Low	2 High	2 High	0 N.S.	0 N.S.	2 High	2 High	0 N.S.	2 High	0 N.S.	2 High	0 N.S.	2 High	2 High	2 High	1 Low	20

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **Wells River**
Topo Maps: **GROTON, WOODSVILLE**
Watershed:
Sub-watershed:

Reach ID: **M11**
SGAT Version: **4.56**
Date Last Edited: **April, 17 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location

1.1 Reach Description: **Beginning approximately 1400 feet downstream of Creamery Road crossing and continuing to 560 feet downstream of Hall Road Crossing in Ryegate.**

1.2 Towns: **Ryegate**

1.3 Downstream Latitude: **44.1818362876**

1.3 Downstream Longitude: **-72.1170136005**

Step 2. Stream Type

2.1 Elevation Upstream: **729**
2.1 Elevation Downstream: **676**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **6,697.0** ft. **1.27** Miles
2.3 Valley Slope: **0.8**
2.4 Channel Length: **7,123.0** ft. **1.35** Miles
2.5 Channel Slope: **0.74 %**
2.6 Sinuosity: **1.06**
2.7 Watershed Area: **83.9** Square Miles
2.8 Channel Width: **92.0** feet
2.9 Valley Width: **384.0** feet
2.10 Confinement Ratio: **4.2**
2.10 Confinement Type: **Narrow**
2.11 Reference Stream Type: **C**
Bedform: **Riffle-Pool**
Sub-Class Slope: **None**
Bed Material: **Gravel**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **Ledge**
3.3 Dominant Geological Mat.: **Ice-Contact** **43.0** %
3.3 Sub-dom. Geological Mat.: **Alluvial**
3.4 Valley Slope Left: **Ext. Steep**
3.4 Valley Slope Right: **Ext. Steep**
3.5 Soils
Hydrologic Group: **B** **45.0** %
Flooding: **None/Rare** **99.0** %
Water Table Deep: **6.0** **55.0** %
Water Table Shallow: **6.0** **55.0** %
Erodibility: **Severe** **55.0** %
7.4 Comments:

Jam potential is due to a bridge and some meander bends. Most of this reach has been straightened. Road encroachment, and lack of buffers are also common features for this reach.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover:
Current Dominant Land Cover: **Forest** **87.0** %
Current Sub-Dominant Land Cover: **Urban**
4.2 Corridor
Historic Land Cover::
Current Dominant Land Cover: **Urban** **29.0** %
Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**0-25**
Sub-dominant:	**26-50**	**>100**
Length w / less than 25 ft.:	**1,129.0** ft.	**1,170.0** ft.

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **1** **8.4** %
5.3 Bank Armoring: **4,348.8** **61.1** %
Left: **1,825.4** ft. Right: **2,523.5** ft.
5.4 Channel Straightening: **7,122.1** **100.0** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **6,102.1** ft. **85.7**

	One Side	Both Sides
Road:	**510.4** ft.	**2,511.2** ft.
Railroad:	**6,102.1** ft.	**0.0** ft.
Berm:	**142.6** ft.	**0.0** ft.
Improved Path:	**0.0** ft.	**0.0** ft.

6.2 Development: **2,429.3** ft. **1,478.0** ft.
6.3 Channel Bars: **Multiple**
6.4 Meander Migration: **Flood Chute**
6.5 Meander Width: **92 ft.** Rato: **1.0**
6.6 Wavelength: **92 ft.** Ratio: **1.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **321.213** ft
7.2 Bank Height: **2** ft
7.3 Ice/Debris Jam Potential: **Bridge**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1 Low	2 High	2 High	0 N.S.	1 Low	2 High	2 High	0 N.S.	2 High	2 High	2 High	1 Low	2 High	2 High	0 N.S.	1 Low	22

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **Scott Brook**
Topo Maps: **GROTON**
Watershed:
Sub-watershed:

Reach ID: **M11T1.01**
SGAT Version: **4.56**
Date Last Edited: **April, 13 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **From confluence with Wells River upstream approximately 2200 feet to where valley narrows and steepens.**

1.1 Reach Description:

1.2 Towns: **Newbury, Ryegate**

1.3 Downstream Latitude: **44.1871392836**

1.3 Downstream Longitude: **-72.138409824**

Step 2. Stream Type

2.1 Elevation Upstream: **780**
2.1 Elevation Downstream: **730**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **2,081.0** ft. **0.39** Miles
2.3 Valley Slope: **2.4**
2.4 Channel Length: **2,250.0** ft. **0.43** Miles
2.5 Channel Slope: **2.22 %**
2.6 Sinuosity: **1.08**
2.7 Watershed Area: **8.2** Square Miles
2.8 Channel Width: **33.1** feet
2.9 Valley Width: **451.0** feet
2.10 Confinement Ratio: **13.6**
2.10 Confinement Type: **Very Broad**
2.11 Reference Stream Type: **C**
Bedform: **Riffle-Pool**
Sub-Class Slope: **b**
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **Weir**
3.3 Dominant Geological Mat.: **Glacial Lake** **60.0** %
3.3 Sub-dom. Geological Mat.: **Ice-Contact**
3.4 Valley Slope Left: **Very Steep**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: **Not Rated** **60.0** %
Flooding: **None/Rare** **99.0** %
Water Table Deep: **6.0** **32.0** %
Water Table Shallow: **6.0** **32.0** %
Erodibility: **Moderate** **32.0** %

7.4 Comments:

Jam potential is due to many bridges. This reach is highly impacted by development. Buffers are also frequently lacking. Riprap and berming are also common.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover:
Current Dominant Land Cover: **Forest** **88.0** %
Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor
Historic Land Cover::
Current Dominant Land Cover: **Urban** **77.0** %
Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**0-25**	**0-25**
Sub-dominant:	**51-100**	**51-100**
Length w / less than 25 ft.:	**1,724.0** ft.	**1,283.0** ft.

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **5** **75.6** %
5.3 Bank Armoring: **2,250.0** **1.0** %
Left: **1,690.6** ft. Right: **1,324.9** ft.
5.4 Channel Straightening: **2,235.2** **99.3** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **1,626.9** ft. **72.3**

	One Side	Both Sides
Road:	**1,515.4** ft.	**111.4** ft.
Railroad:	**0.0** ft.	**0.0** ft.
Berm:	**184.2** ft.	**158.3** ft.
Improved Path:	**0.0** ft.	**0.0** ft.

6.2 Development: **493.8** ft. **1,171.8** ft.
6.3 Channel Bars: **Multiple**
6.4 Meander Migration: **Flood Chute**
6.5 Meander Width: **33 ft.** Rato: **1.0**
6.6 Wavelength: **33 ft.** Ratio: **1.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **787.771** ft
7.2 Bank Height: **3** ft
7.3 Ice/Debris Jam Potential: **Bridge**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1 Low	2 High	2 High	0 N.S.	2 High	2 High	2 High	0 N.S.	2 High	2 High	2 High	0 N.S.	2 High	2 High	2 High	2 High	25

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **Scott Brook**
Topo Maps: **GROTON**
Watershed:
Sub-watershed:

Reach ID: **M11T1.02**
SGAT Version: **4.56**
Date Last Edited: **April, 13 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location

1.1 Reach Description: **From 2200 feet upstream of confluence with Wells River to approximately 1400 feet upstream of Cesari Road crossing.**

1.2 Towns: **Newbury**

1.3 Downstream Latitude: **44.1818090482**

1.3 Downstream Longitude: **-72.1406120074**

Step 2. Stream Type

2.1 Elevation Upstream: **910**
2.1 Elevation Downstream: **780**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **4,219.0** ft. **0.80** Miles
2.3 Valley Slope: **3.1**
2.4 Channel Length: **4,406.0** ft. **0.83** Miles
2.5 Channel Slope: **2.95 %**
2.6 Sinuosity: **1.04**
2.7 Watershed Area: **7.9** Square Miles
2.8 Channel Width: **32.5** feet
2.9 Valley Width: feet
2.10 Confinement Ratio: **0.0**
2.10 Confinement Type: **Semi-confined**
2.11 Reference Stream Type: **C**
Bedform: **Step-Pool**
Sub-Class Slope: **b**
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geological Mat.: **Till** **66.0** %
3.3 Sub-dom. Geological Mat.: **Alluvial**
3.4 Valley Slope Left: **Ext. Steep**
3.4 Valley Slope Right: **Ext. Steep**
3.5 Soils
Hydrologic Group: **B** **65.0** %
Flooding: **None/Rare** **67.0** %
Water Table Deep: **6.0** **65.0** %
Water Table Shallow: **6.0** **65.0** %
Erodibility: **Severe** **66.0** %
7.4 Comments:
Jam potential is due to bridges and abundant woody material.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover:
Current Dominant Land Cover: **Forest** **89.0** %
Current Sub-Dominant Land Cover: **Urban**
4.2 Corridor
Historic Land Cover::
Current Dominant Land Cover: **Urban** **57.0** %
Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**51-100**	**51-100**
Length w / less than 25 ft.:	**722.0** ft.	**1,006.0** ft.

4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **2** **9.1** %
5.3 Bank Armoring: **1,121.5** **25.5** %
Left: **450.9** ft. Right: **670.6** ft.
5.4 Channel Straightening: **241.9** **5.5** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **4,135.4** ft. **93.9**

	One Side	Both Sides
Road:	**4,135.4** ft.	**0.0** ft.
Railroad:	**0.0** ft.	**0.0** ft.
Berm:	**0.0** ft.	**253.4** ft.
Improved Path:	**0.0** ft.	**0.0** ft.

6.2 Development: **0.0** ft. **0.0** ft.
6.3 Channel Bars: **Multiple**
6.4 Meander Migration: **Multiple**
6.5 Meander Width: **N/A** Rato: **0.0**
6.6 Wavelength: **N/A** Ratio: **0.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **1329.83** ft
7.2 Bank Height: **4** ft
7.3 Ice/Debris Jam Potential: **Bridge**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1 Low	2 High	2 High	0 N.S.	1 Low	2 High	1 Low	0 N.S.	2 High	0 N.S.	2 High	0 N.S.	0 N/A	0 N/A	2 High	2 High	17

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **Scott Brook**
Topo Maps: **GROTON**
Watershed:
Sub-watershed:

Reach ID: **M11T1.04**
SGAT Version: **4.56**
Date Last Edited: **April, 13 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **From 280 feet downstream of Swamp Road crossing to 1400 upstream of Swamp road crossing.**

1.1 Reach Description:
1.2 Towns: **Newbury**
1.3 Downstream Latitude: **44.1600858029**
1.3 Downstream Longitude: **-72.1664506978**

Step 2. Stream Type

2.1 Elevation Upstream: **1,100**
2.1 Elevation Downstream: **975**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **1,813.0** ft. **0.34** Miles
2.3 Valley Slope: **6.9**
2.4 Channel Length: **1,831.0** ft. **0.35** Miles
2.5 Channel Slope: **6.83 %**
2.6 Sinuosity: **1.01**
2.7 Watershed Area: **3.6** Square Miles
2.8 Channel Width: **23.0** feet
2.9 Valley Width: feet
2.10 Confinement Ratio: **0.0**
2.10 Confinement Type: **Semi-confined**
2.11 Reference Stream Type: **B**
Bedform: **Step-Pool**
Sub-Class Slope: **a**
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **Ledge**
3.3 Dominant Geological Mat.: **Till** **87.0** %
3.3 Sub-dom. Geological Mat.: **Alluvial**
3.4 Valley Slope Left: **Very Steep**
3.4 Valley Slope Right: **Very Steep**
3.5 Soils
Hydrologic Group: **B** **87.0** %
Flooding: **None/Rare** **87.0** %
Water Table Deep: **6.0** **87.0** %
Water Table Shallow: **6.0** **87.0** %
Erodibility: **Very Severe** **87.0** %
7.4 Comments:

Jam potential is due to one bridge, fairly straight section. There is road encroachment along the whole length of the reach.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover:
Current Dominant Land Cover: **Forest** **88.0** %
Current Sub-Dominant Land Cover: **Urban**
4.2 Corridor
Historic Land Cover::
Current Dominant Land Cover: **Forest** **44.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**None**	**None**
Length w / less than 25 ft.:	**0.0** ft.	**0.0** ft.

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **1** **10.9** %
5.3 Bank Armoring: **67.2** **3.7** %
Left: **14.6** ft. Right: **52.6** ft.
5.4 Channel Straightening: **474.4** **25.9** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old:	**1,534.4** ft.	**83.8**
	One Side	Both Sides
Road:	**1,321.5** ft.	**212.8** ft.
Railroad:	**0.0** ft.	**0.0** ft.
Berm:	**0.0** ft.	**0.0** ft.
Improved Path:	**175.8** ft.	**0.0** ft.

6.2 Development: **59.9** ft. **0.0** ft.
6.3 Channel Bars: **Multiple**
6.4 Meander Migration: **Multiple**
6.5 Meander Width: **N/A** Rato: **0.0**
6.6 Wavelength: **N/A** Ratio: **0.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **44.2125** ft
7.2 Bank Height: **2** ft
7.3 Ice/Debris Jam Potential: **Bridge**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1 Low	2 High	0 N.S.	0 N.S.	1 Low	0 N.S.	2 High	0 N.S.	2 High	0 N.S.	2 High	0 N.S.	0 N/A	0 N/A	0 N.S.	1 Low	11

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **Scott Brook**
Topo Maps: **GROTON**
Watershed:
Sub-watershed:

Reach ID: **M11T1.05**
SGAT Version: **4.56**
Date Last Edited: **February, 22 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location

1.1 Reach Description: **From 1400 feet upstream of Swamp Road crossing and continuing 5400 feet to where valley widens (and is tributary confluence).**

1.2 Towns: **Newbury**

1.3 Downstream Latitude: **44.1551539316**

1.3 Downstream Longitude: **-72.1663071824**

Step 2. Stream Type

2.1 Elevation Upstream:	**1,230**		
2.1 Elevation Downstream:	**1,100**		
2.1 Is Gradient Gentle?:	**No**		
2.2 Valley Length:	**5,400.0** ft.	**1.02**	Miles
2.3 Valley Slope:	**2.4**		
2.4 Channel Length:	**5,787.0** ft.	**1.10**	Miles
2.5 Channel Slope:	**2.25 %**		
2.6 Sinuosity:	**1.07**		
2.7 Watershed Area:	**2.1** Square Miles		
2.8 Channel Width:	**18.3** feet		
2.9 Valley Width:	**369.0** feet		
2.10 Confinement Ratio:	**20.1**		
2.10 Confinement Type:	**Very Broad**		
2.11 Reference Stream Type:	**C**		
Bedform:	**Riffle-Pool**		
Sub-Class Slope:	**b**		
Bed Material:	**Gravel**		

Step 3. Basin Charateristicts

3.1 Alluvial Fan:	**None**	
3.2 Grade Control:	**None**	
3.3 Dominant Geological Mat.:	**Till**	**84.0** %
3.3 Sub-dom. Geological Mat.:	**Other**	
3.4 Valley Slope Left:	**Very Steep**	
3.4 Valley Slope Right:	**Very Steep**	
3.5 Soils		
Hydrologic Group:	**D**	**67.0** %
Flooding:	**None/Rare**	**94.0** %
Water Table Deep:	**1.5**	**52.0** %
Water Table Shallow:	**0.0**	**52.0** %
Erodibility:	**Very Severe**	**78.0** %

7.4 Comments:
No evidence that debris jams would be an issue here. Not enough visible meanders to measure wave lenths.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover:		
Current Dominant Land Cover:	**Forest**	**86.0** %
Current Sub-Dominant Land Cover:	**Urban**	

4.2 Corridor

Historic Land Cover::		
Current Dominant Land Cover:	**Forest**	**77.0** %
Current Sub-Dominant Land Cover:	**Urban**	

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**None**	**0-25**
Length w / less than 25 ft.:	**0.0** ft.	**0.0** ft.

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type:	**None**		
Use:			
5.2 Bridges and Culverts:	**3**		**4.0** %
5.3 Bank Armoring:	**94.3**		**1.6** %
Left:	**53.5** ft.	Right:	**40.9** ft.
5.4 Channel Straightening:	**0.0**		**0.0** %
5.5 Dredging History:	**None**		

Step 6. Floodplain Modifications

6.1 Berms & Roads - old:	**2,278.3** ft.	**39.4**
	One Side	Both Sides
Road:	**532.1** ft.	**0.0** ft.
Railroad:	**0.0** ft.	**0.0** ft.
Berm:	**0.0** ft.	**0.0** ft.
Improved Path:	**1,891.7** ft.	**386.7** ft.
6.2 Development:	**184.4** ft.	**0.0** ft.
6.3 Channel Bars:	**No Data**	
6.4 Meander Migration:	**Multiple**	
6.5 Meander Width:	**N/A** Rato:	**0.0**
6.6 Wavelength:	**N/A** Ratio:	**0.0**

Step 7. Windshield Survey

7.1 Bank Erosion:	**34.2056**	ft
7.2 Bank Height:	**6**	ft
7.3 Ice/Debris Jam Potential:	**None**	

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1 Low	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	2 High	0 N.S.	0 N.S.	0 N.S.	0 N/A	0 N/A	0 N.S.	0 N.S.	3

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **Scott Brook**
Topo Maps: **GROTON**
Watershed:
Sub-watershed:

Reach ID: **M11T1.07**
SGAT Version: **4.56**
Date Last Edited: **April, 18 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **From second Swamp Road crossing continuing along Topsham Road approximately 1780 feet.**

1.1 Reach Description:
1.2 Towns: **Newbury**
1.3 Downstream Latitude: **44.1366756578**
1.3 Downstream Longitude: **-72.1728556633**

Step 2. Stream Type

2.1 Elevation Upstream: **1,295**
2.1 Elevation Downstream: **1,245**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **1,691.0** ft. **0.32** Miles
2.3 Valley Slope: **3.0**
2.4 Channel Length: **2,037.0** ft. **0.39** Miles
2.5 Channel Slope: **2.45 %**
2.6 Sinuosity: **1.20**
2.7 Watershed Area: **0.6** Square Miles
2.8 Channel Width: **10.4** feet
2.9 Valley Width: **355.0** feet
2.10 Confinement Ratio: **34.1**
2.10 Confinement Type: **Very Broad**
2.11 Reference Stream Type: **E**
Bedform: **Riffle-Pool**
Sub-Class Slope: **None**
Bed Material: **Sand**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **Ledge**
3.3 Dominant Geological Mat.: **Till** **99.0** %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Very Steep**
3.4 Valley Slope Right: **Very Steep**
3.5 Soils
Hydrologic Group: **D** **65.0** %
Flooding: **None/Rare** **100.0** %
Water Table Deep: **0.5** **51.0** %
Water Table Shallow: **-1.0** **51.0** %
Erodibility: **Moderate** **48.0** %
7.4 Comments:

Jam potential is due to there being several bridges. There is a significant amount of development, straightening, encroachment, and buffers lacking on this reach.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover:
Current Dominant Land Cover: **Forest** **81.0** %
Current Sub-Dominant Land Cover: **Urban**
4.2 Corridor
Historic Land Cover::
Current Dominant Land Cover: **Urban** **56.0** %
Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**0-25**	**0-25**
Sub-dominant:	**51-100**	**>100**
Length w / less than 25 ft.:	**1,042.0** ft.	**919.0** ft.

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **7** **47.9** %
5.3 Bank Armoring: **389.4** **19.1** %
Left: **191.0** ft. Right: **198.4** ft.
5.4 Channel Straightening: **1,551.0** **76.1** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **1,475.6** ft. **72.4**

	One Side	Both Sides
Road:	**1,306.3** ft.	**169.2** ft.
Railroad:	**0.0** ft.	**0.0** ft.
Berm:	**0.0** ft.	**0.0** ft.
Improved Path:	**0.0** ft.	**0.0** ft.

6.2 Development: **933.3** ft. **0.0** ft.
6.3 Channel Bars: **Point**
6.4 Meander Migration: **Multiple**
6.5 Meander Width: **10 ft.** Rato: **1.0**
6.6 Wavelength: **10 ft.** Ratio: **1.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **46.8516** ft
7.2 Bank Height: **2** ft
7.3 Ice/Debris Jam Potential: **Bridge**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
2 High	2 High	2 High	0 N.S.	2 High	1 Low	2 High	0 N.S.	2 High	2 High	1 Low	0 N.S.	2 High	2 High	0 N.S.	2 High	22

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **Scott Brook**
Topo Maps: **GROTON**
Watershed:
Sub-watershed:

Reach ID: **M11T1.08**
SGAT Version: **4.56**
Date Last Edited: **July, 18 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location

1.1 Reach Description: **From approximately 1780 feet upstream of second Swamp Road crossing to headwaters just shy of Emerson Road.**

1.2 Towns: **Newbury, Topsham**

1.3 Downstream Latitude: **44.1364620489**

1.3 Downstream Longitude: **-72.1788020627**

Step 2. Stream Type

2.1 Elevation Upstream: **1,620**
2.1 Elevation Downstream: **1,295**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **4,383.0** ft. **0.83** Miles
2.3 Valley Slope: **7.4**
2.4 Channel Length: **4,589.0** ft. **0.87** Miles
2.5 Channel Slope: **7.08 %**
2.6 Sinuosity: **1.05**
2.7 Watershed Area: **0.3** Square Miles
2.8 Channel Width: **8.2** feet
2.9 Valley Width: feet
2.10 Confinement Ratio: **0.0**
2.10 Confinement Type: **Semi-confined**
2.11 Reference Stream Type: **C**
Bedform: **Step-Pool**
Sub-Class Slope: **b**
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geological Mat.: **Till** **99.0** %
3.3 Sub-dom. Geological Mat.: **Ice-Contact**
3.4 Valley Slope Left: **Hilly**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: **D** **54.0** %
Flooding: **None/Rare** **100.0** %
Water Table Deep: **1.5** **41.0** %
Water Table Shallow: **0.0** **41.0** %
Erodibility: **Very Severe** **85.0** %
7.4 Comments:
Jam potential is due to only one bridge.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover:
Current Dominant Land Cover: **Forest** **83.0** %
Current Sub-Dominant Land Cover: **Urban**
4.2 Corridor
Historic Land Cover::
Current Dominant Land Cover: **Forest** **79.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**None**	**None**
Length w / less than 25 ft.:	**0.0** ft.	**0.0** ft.

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **0** **0.0** %
5.3 Bank Armoring: **0.0** **0.0** %
Left: **0.0** ft. Right: **0.0** ft.
5.4 Channel Straightening: **0.0** **0.0** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **509.5** ft. **11.1**

	One Side	Both Sides
Road:	**0.0** ft.	**0.0** ft.
Railroad:	**0.0** ft.	**0.0** ft.
Berm:	**0.0** ft.	**0.0** ft.
Improved Path:	**509.5** ft.	**0.0** ft.

6.2 Development: **0.0** ft. **0.0** ft.
6.3 Channel Bars: **No Data**
6.4 Meander Migration: **Flood Chute**
6.5 Meander Width: **N/A** Rato: **0.0**
6.6 Wavelength: **N/A** Ratio: **0.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **29.5248** ft
7.2 Bank Height: **2** ft
7.3 Ice/Debris Jam Potential: **Bridge**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
2 High	2 High	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	1 Low	0 N.S.	0 N.S.	0 N.S.	0 N/A	0 N/A	0 N.S.	1 Low	6

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **Wells River**
Topo Maps: **GROTON**
Watershed:
Sub-watershed:

Reach ID: **M12**
SGAT Version: **4.56**
Date Last Edited: **April, 10 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location

1.1 Reach Description: **From 565 feet downstream of Church Street crossing to 750 feet downstream of Scott Hwy crossing (302) (also is trib confluence)**

1.2 Towns: **Ryegate**

1.3 Downstream Latitude: **44.1873626153**

1.3 Downstream Longitude: **-72.1386448565**

Step 2. Stream Type

2.1 Elevation Upstream: **730**
2.1 Elevation Downstream: **729**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **2,206.0** ft. **0.42** Miles
2.3 Valley Slope: **0.0**
2.4 Channel Length: **2,266.0** ft. **0.43** Miles
2.5 Channel Slope: **0.04 %**
2.6 Sinuosity: **1.03**
2.7 Watershed Area: **75.1** Square Miles
2.8 Channel Width: **87.6** feet
2.9 Valley Width: **468.0** feet
2.10 Confinement Ratio: **5.3**
2.10 Confinement Type: **Narrow**
2.11 Reference Stream Type: **C**
Bedform: **Riffle-Pool**
Sub-Class Slope: **None**
Bed Material: **Gravel**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geological Mat.: **Glacial Lake** **88.0** %
3.3 Sub-dom. Geological Mat.: **Alluvial**
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Very Steep**
3.5 Soils
Hydrologic Group: **Not Rated** **88.0** %
Flooding: **None/Rare** **99.0** %
Water Table Deep: **6.0** **5.0** %
Water Table Shallow: **6.0** **5.0** %
Erodibility: **slight** **5.0** %
7.4 Comments:

One bridge, straightened through here. This reach has been highly impacted by development and road encroachment.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover:
Current Dominant Land Cover: **Forest** **87.0** %
Current Sub-Dominant Land Cover: **Urban**
4.2 Corridor
Historic Land Cover::
Current Dominant Land Cover: **Urban** **74.0** %
Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**0-25**	**0-25**
Sub-dominant:	**51-100**	**None**
Length w / less than 25 ft.:	**640.0** ft.	**1,670.0** ft.

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **1** **3.1** %
5.3 Bank Armoring: **1,711.5** **75.5** %
Left: **1,674.1** ft. Right: **37.5** ft.
5.4 Channel Straightening: **2,264.4** **99.9** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **2,251.8** ft. **99.4**

	One Side	Both Sides
Road:	**0.0** ft.	**2,251.8** ft.
Railroad:	**0.0** ft.	**0.0** ft.
Berm:	**0.0** ft.	**0.0** ft.
Improved Path:	**0.0** ft.	**0.0** ft.

6.2 Development: **905.0** ft. **1,333.6** ft.
6.3 Channel Bars: **Multiple**
6.4 Meander Migration:
6.5 Meander Width: **87 ft.** Rato: **1.0**
6.6 Wavelength: **87 ft.** Ratio: **1.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **0** ft
7.2 Bank Height: **No Data** ft
7.3 Ice/Debris Jam Potential: **Bridge**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1 Low	2 High	2 High	0 N.S.	0 N.S.	2 High	2 High	0 N.S.	2 High	2 High	1 Low	0 N.S.	2 High	2 High	0 N.S.	1 Low	19

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **Stone Road Brook**
Topo Maps: **GROTON**
Watershed:
Sub-watershed:

Reach ID: **M12S2.01**
SGAT Version: **4.56**
Date Last Edited: **April, 20 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location

1.1 Reach Description:
1.2 Towns: **Ryegate**
1.3 Downstream Latitude: **44.1896133251**
1.3 Downstream Longitude: **-72.1448556671**

Step 2. Stream Type

2.1 Elevation Upstream: **810**
2.1 Elevation Downstream: **735**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **2,743.0** ft. **0.52** Miles
2.3 Valley Slope: **2.7**
2.4 Channel Length: **3,291.0** ft. **0.62** Miles
2.5 Channel Slope: **2.28 %**
2.6 Sinuosity: **1.20**
2.7 Watershed Area: **2.6** Square Miles
2.8 Channel Width: **20.0** feet
2.9 Valley Width: **268.0** feet
2.10 Confinement Ratio: **13.4**
2.10 Confinement Type: **Very Broad**
2.11 Reference Stream Type: **C**
Bedform: **Riffle-Pool**
Sub-Class Slope: **b**
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geological Mat.: **Till** **44.0** %
3.3 Sub-dom. Geological Mat.: **Glacial Lake**
3.4 Valley Slope Left:
3.4 Valley Slope Right:
3.5 Soils
Hydrologic Group: **B** **44.0** %
Flooding: **None/Rare** **84.0** %
Water Table Deep: **6.0** **63.0** %
Water Table Shallow: **6.0** **63.0** %
Erodibility: **Severe** **62.0** %
7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover:
Current Dominant Land Cover: **Forest** **72.0** %
Current Sub-Dominant Land Cover: **Urban**
4.2 Corridor
Historic Land Cover::
Current Dominant Land Cover: **Urban** **76.0** %
Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:		
Sub-dominant:		
Length w / less than 25 ft.:	**585.0** ft.	**556.0** ft.

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **4** **13.7** %
5.3 Bank Armoring: **1,122.8** **34.1** %
Left: **589.9** ft. Right: **532.9** ft.
5.4 Channel Straightening: **1,033.0** **31.4** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **693.3** ft. **21.1**

	One Side	Both Sides
Road:	**580.0** ft.	**113.3** ft.
Railroad:	**0.0** ft.	**0.0** ft.
Berm:	**0.0** ft.	**0.0** ft.
Improved Path:	**0.0** ft.	**0.0** ft.

6.2 Development: **146.0** ft. **589.5** ft.
6.3 Channel Bars: **Multiple**
6.4 Meander Migration: **Flood Chute**
6.5 Meander Width: **ft.** Rato: **0.0**
6.6 Wavelength: **ft.** Ratio: **0.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **105.619** ft
7.2 Bank Height: **7** ft
7.3 Ice/Debris Jam Potential:

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
2 High	2 High	2 High	0 N.S.	1 Low	2 High	2 High	0 N.S.	2 High	2 High	1 Low	0 N.S.	0 N.D.	0 N.D.	0 N.S.	0 N.S.	16

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **Stone Road Brook**
Topo Maps: **GROTON**
Watershed:
Sub-watershed:

Reach ID: **M12S2.02**
SGAT Version: **4.56**
Date Last Edited: **April, 20 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location

1.1 Reach Description:
1.2 Towns: **Ryegate**
1.3 Downstream Latitude: **44.1944552288**
1.3 Downstream Longitude: **-72.140205902**

Step 2. Stream Type

2.1 Elevation Upstream: **990**
2.1 Elevation Downstream: **810**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **6,551.0** ft. **1.24** Miles
2.3 Valley Slope: **2.7**
2.4 Channel Length: **7,206.0** ft. **1.36** Miles
2.5 Channel Slope: **2.50 %**
2.6 Sinuosity: **1.10**
2.7 Watershed Area: **2.4** Square Miles
2.8 Channel Width: **19.2** feet
2.9 Valley Width: **399.0** feet
2.10 Confinement Ratio: **20.8**
2.10 Confinement Type: **Very Broad**
2.11 Reference Stream Type: **C**
Bedform: **Riffle-Pool**
Sub-Class Slope: **b**
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **Ledge**
3.3 Dominant Geological Mat.: **Till** **76.0** %
3.3 Sub-dom. Geological Mat.: **Alluvial**
3.4 Valley Slope Left:
3.4 Valley Slope Right:
3.5 Soils
Hydrologic Group: **D** **61.0** %
Flooding: **None/Rare** **77.0** %
Water Table Deep: **1.5** **61.0** %
Water Table Shallow: **0.0** **84.0** %
Erodibility: **Very Severe** **76.0** %
7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover:
Current Dominant Land Cover: **Forest** **72.0** %
Current Sub-Dominant Land Cover: **Urban**
4.2 Corridor
Historic Land Cover::
Current Dominant Land Cover: **Forest** **35.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:		
Sub-dominant:		
Length w / less than 25 ft.:	**1,181.0** ft.	**2,451.0** ft.

4.4 Ground Water Inputs:

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **4** **9.7** %
5.3 Bank Armoring: **1,258.0** **17.5** %
Left: **42.0** ft. Right: **1,215.9** ft.
5.4 Channel Straightening: **600.4** **8.3** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **3,018.4** ft. **41.9**

	One Side	Both Sides
Road:	**3,018.4** ft.	**0.0** ft.
Railroad:	**0.0** ft.	**0.0** ft.
Berm:	**41.1** ft.	**0.0** ft.
Improved Path:	**30.1** ft.	**0.0** ft.

6.2 Development: **696.9** ft. **0.0** ft.
6.3 Channel Bars: **Multiple**
6.4 Meander Migration: **Multiple**
6.5 Meander Width: **ft.** Rato: **0.0**
6.6 Wavelength: **ft.** Ratio: **0.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **2815.12** ft
7.2 Bank Height: **2** ft
7.3 Ice/Debris Jam Potential:

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
2 High	2 High	2 High	0 N.S.	1 Low	1 Low	1 Low	0 N.S.	2 High	1 Low	2 High	0 N.S.	0 N.D.	0 N.D.	2 High	0 N.S.	16

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **Wells River**
Topo Maps: **GROTON**
Watershed:
Sub-watershed:

Reach ID: **M13**
SGAT Version: **4.56**
Date Last Edited: **April, 10 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location

1.1 Reach Description: **From 750 feet downstream of Scott Hwy Crossing by Creamery Road, continuing upstream from crossing 5680 feet to where valley really broadens.**

1.2 Towns: **Ryegate**

1.3 Downstream Latitude: **44.1897617011**

1.3 Downstream Longitude: **-72.144861953**

Step 2. Stream Type

2.1 Elevation Upstream: **731**
2.1 Elevation Downstream: **730**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **5,341.0** ft. **1.01** Miles
2.3 Valley Slope: **0.0**
2.4 Channel Length: **6,361.0** ft. **1.20** Miles
2.5 Channel Slope: **0.02 %**
2.6 Sinuosity: **1.19**
2.7 Watershed Area: **72.2** Square Miles
2.8 Channel Width: **86.1** feet
2.9 Valley Width: **678.0** feet
2.10 Confinement Ratio: **7.9**
2.10 Confinement Type: **Broad**
2.11 Reference Stream Type: **E**
Bedform: **Dune-Ripple**
Sub-Class Slope: **None**
Bed Material: **Sand**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geological Mat.: **Ice-Contact** **62.0** %
3.3 Sub-dom. Geological Mat.: **Alluvial**
3.4 Valley Slope Left: **Ext. Steep**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: **A** **51.0** %
Flooding: **None/Rare** **85.0** %
Water Table Deep: **6.0** **66.0** %
Water Table Shallow: **6.0** **66.0** %
Erodibility: **Severe** **58.0** %
7.4 Comments:

Jam potential is due to bridges and bends. This reach has been highly impacted. There are significant amounts of straightening, road encroachment, and lack of buffers.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover:
Current Dominant Land Cover: **Forest** **87.0** %
Current Sub-Dominant Land Cover: **Urban**
4.2 Corridor
Historic Land Cover::
Current Dominant Land Cover: **Urban** **41.0** %
Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**0-25**	**0-25**
Sub-dominant:	**51-100**	**>100**
Length w / less than 25 ft.:	**1,138.0** ft.	**3,543.0** ft.

4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **2** **17.3** %
5.3 Bank Armoring: **1,021.1** **16.1** %
Left: **501.0** ft. Right: **520.1** ft.
5.4 Channel Straightening: **6,361.4** **100.0** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **6,361.1** ft. **100.0**

	One Side	Both Sides
Road:	**0.0** ft.	**6,361.1** ft.
Railroad:	**0.0** ft.	**0.0** ft.
Berm:	**0.0** ft.	**0.0** ft.
Improved Path:	**0.0** ft.	**0.0** ft.

6.2 Development: **0.0** ft. **0.0** ft.
6.3 Channel Bars: **Point**
6.4 Meander Migration: **Multiple**
6.5 Meander Width: **86 ft.** Rato: **1.0**
6.6 Wavelength: **86 ft.** Ratio: **1.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **1958.35** ft
7.2 Bank Height: **2** ft
7.3 Ice/Debris Jam Potential: **Multiple**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1 Low	2 High	2 High	0 N.S.	1 Low	1 Low	2 High	0 N.S.	2 High	0 N.S.	0 N.S.	1 Low	2 High	2 High	2 High	2 High	20

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **Wells River**
Topo Maps: **GROTON**
Watershed:
Sub-watershed:

Reach ID: **M14**
SGAT Version: **4.56**
Date Last Edited: **April, 10 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Beginning 5680 upstream of Scott Hwy crossing and continuing 4900 feet along very broad valley**

1.1 Reach Description:

1.2 Towns: **Groton, Ryegate**

1.3 Downstream Latitude: **44.1978236883**

1.3 Downstream Longitude: **-72.1604505378**

Step 2. Stream Type

2.1 Elevation Upstream: **735**
2.1 Elevation Downstream: **731**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **3,389.0** ft. **0.64** Miles
2.3 Valley Slope: **0.1**
2.4 Channel Length: **5,138.0** ft. **0.97** Miles
2.5 Channel Slope: **0.08 %**
2.6 Sinuosity: **1.52**
2.7 Watershed Area: **71.2** Square Miles
2.8 Channel Width: **85.6** feet
2.9 Valley Width: **1,546.0** feet
2.10 Confinement Ratio: **18.1**
2.10 Confinement Type: **Very Broad**
2.11 Reference Stream Type: **C**
Bedform: **Riffle-Pool**
Sub-Class Slope: **None**
Bed Material: **Gravel**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geological Mat.: **Alluvial** **77.0** %
3.3 Sub-dom. Geological Mat.: **Ice-Contact**
3.4 Valley Slope Left: **Ext. Steep**
3.4 Valley Slope Right: **Ext. Steep**
3.5 Soils
Hydrologic Group: **B** **50.0** %
Flooding: **None/Rare** **63.0** %
Water Table Deep: **1.0** **36.0** %
Water Table Shallow: **1.5** **36.0** %
Erodibility: **slight** **5.0** %

7.4 Comments:

Jam potential is due to bridges and many meanders. This reach is mostly impacted by farming activity. There are no buffers for it's length, and the upstream part looks to have been straightened. It is in this area where the farmer has (or has had) a permit to remove gravel from the river.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover:
Current Dominant Land Cover: **Forest** **87.0** %
Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor
Historic Land Cover::
Current Dominant Land Cover: **Forest** **33.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**0-25**	**0-25**
Sub-dominant:	**26-50**	**51-100**
Length w / less than 25 ft.:	**1,394.0** ft.	**830.0** ft.

4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **1** **11.7** %
5.3 Bank Armoring: **606.6** **11.8** %
Left: **510.2** ft. Right: **96.4** ft.
5.4 Channel Straightening: **1,672.5** **32.6** %
5.5 Dredging History: **Dredging**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **7.3** ft. **0.1**

	One Side	Both Sides
Road:	**0.0** ft.	**7.3** ft.
Railroad:	**0.0** ft.	**0.0** ft.
Berm:	**0.0** ft.	**0.0** ft.
Improved Path:	**0.0** ft.	**0.0** ft.

6.2 Development: **0.0** ft. **0.0** ft.
6.3 Channel Bars: **Point**
6.4 Meander Migration: **Multiple**
6.5 Meander Width: **376 ft.** Rato: **4.4**
6.6 Wavelength: **417 ft.** Ratio: **4.9**

Step 7. Windshield Survey

7.1 Bank Erosion: **3099.96** ft
7.2 Bank Height: **2** ft
7.3 Ice/Debris Jam Potential: **Multiple**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1 Low	2 High	2 High	0 N.S.	1 Low	1 Low	2 High	2 High	0 N.S.	0 N.S.	1 Low	0 N.S.	1 Low	2 High	2 High	2 High	19

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **Darius James Brook**
Topo Maps: **GROTON**
Watershed:
Sub-watershed:

Reach ID: **M14S2.01**
SGAT Version: **4.56**
Date Last Edited: **April, 21 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location

1.1 Reach Description:
1.2 Towns: **Groton, Ryegate**
1.3 Downstream Latitude: **44.2028151458**
1.3 Downstream Longitude: **-72.1708070596**

Step 2. Stream Type

2.1 Elevation Upstream: **775**
2.1 Elevation Downstream: **735**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **1,332.0** ft. **0.25** Miles
2.3 Valley Slope: **3.0**
2.4 Channel Length: **1,423.0** ft. **0.27** Miles
2.5 Channel Slope: **2.81 %**
2.6 Sinuosity: **1.07**
2.7 Watershed Area: **2.9** Square Miles
2.8 Channel Width: **21.0** feet
2.9 Valley Width: **1,300.0** feet
2.10 Confinement Ratio: **62.0**
2.10 Confinement Type: **Very Broad**
2.11 Reference Stream Type: **C**
Bedform: **Riffle-Pool**
Sub-Class Slope: **b**
Bed Material: **Gravel**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geological Mat.: **Ice-Contact** **90.0** %
3.3 Sub-dom. Geological Mat.: **Till**
3.4 Valley Slope Left:
3.4 Valley Slope Right:
3.5 Soils
Hydrologic Group: **B** **80.0** %
Flooding: **None/Rare** **96.0** %
Water Table Deep: **2.0** **74.0** %
Water Table Shallow: **1.5** **74.0** %
Erodibility: **slight** **21.0** %
7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover:
Current Dominant Land Cover: **Forest** **81.0** %
Current Sub-Dominant Land Cover: **Urban**
4.2 Corridor
Historic Land Cover::
Current Dominant Land Cover: **Urban** **21.0** %
Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:		
Sub-dominant:		
Length w / less than 25 ft.:	**0.0** ft.	**0.0** ft.

4.4 Ground Water Inputs:

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **0** **0.0** %
5.3 Bank Armoring: **511.1** **35.9** %
Left: **140.8** ft. Right: **370.3** ft.
5.4 Channel Straightening: **1,232.9** **86.6** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **298.3** ft. **21.0**

	One Side	Both Sides
Road:	**39.9** ft.	**0.0** ft.
Railroad:	**0.0** ft.	**0.0** ft.
Berm:	**298.3** ft.	**0.0** ft.
Improved Path:	**0.0** ft.	**0.0** ft.

6.2 Development: **138.2** ft. **0.0** ft.
6.3 Channel Bars: **Point**
6.4 Meander Migration: **Multiple**
6.5 Meander Width: **ft.** Rato: **0.0**
6.6 Wavelength: **ft.** Ratio: **0.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **347.362** ft
7.2 Bank Height: **3** ft
7.3 Ice/Debris Jam Potential:

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
2 High	2 High	0 N.S.	0 N.S.	0 N.S.	2 High	2 High	0 N.S.	2 High	1 Low	2 High	0 N.S.	0 N.D.	0 N.D.	2 High	0 N.S.	15

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **Darius James Brook**
Topo Maps: **GROTON**
Watershed:
Sub-watershed:

Reach ID: **M14S2.02**
SGAT Version: **4.56**
Date Last Edited: **April, 22 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location

1.1 Reach Description:
1.2 Towns: **Ryegate**
1.3 Downstream Latitude: **44.2060133938**
1.3 Downstream Longitude: **-72.1694487282**

Step 2. Stream Type

2.1 Elevation Upstream: **870**
2.1 Elevation Downstream: **775**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: ft. **0.00** Miles
2.3 Valley Slope: **0.0**
2.4 Channel Length: **1,915.0** ft. **0.36** Miles
2.5 Channel Slope: **4.96 %**
2.6 Sinuosity: **0.00**
2.7 Watershed Area: **2.9** Square Miles
2.8 Channel Width: **20.8** feet
2.9 Valley Width: **50.0** feet
2.10 Confinement Ratio: **2.4**
2.10 Confinement Type: **Semi-confined**
2.11 Reference Stream Type:
Bedform:
Sub-Class Slope: **None**
Bed Material:

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **Multiple**
3.3 Dominant Geological Mat.: **Till** **75.0** %
3.3 Sub-dom. Geological Mat.: **Ice-Contact**
3.4 Valley Slope Left:
3.4 Valley Slope Right:
3.5 Soils
Hydrologic Group: **B** **75.0** %
Flooding: **None/Rare** **100.0** %
Water Table Deep: **6.0** **100.0** %
Water Table Shallow: **6.0** **100.0** %
Erodibility: **Very Severe** **99.0** %
7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover:
Current Dominant Land Cover: **Forest** **82.0** %
Current Sub-Dominant Land Cover: **Urban**
4.2 Corridor
Historic Land Cover::
Current Dominant Land Cover: **Urban** **42.0** %
Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:		
Sub-dominant:		
Length w / less than 25 ft.:	**0.0** ft.	**0.0** ft.

4.4 Ground Water Inputs:

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **0** **0.0** %
5.3 Bank Armoring: **65.6** **3.4** %
Left: **65.6** ft. Right: **0.0** ft.
5.4 Channel Straightening: **0.0** **0.0** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **187.7** ft. **9.8**

	One Side	Both Sides
Road:	**187.7** ft.	**0.0** ft.
Railroad:	**0.0** ft.	**0.0** ft.
Berm:	**0.0** ft.	**0.0** ft.
Improved Path:	**0.0** ft.	**0.0** ft.

6.2 Development: **200.9** ft. **0.0** ft.
6.3 Channel Bars: **Multiple**
6.4 Meander Migration: **Flood Chute**
6.5 Meander Width: **ft.** Rato: **0.0**
6.6 Wavelength: **ft.** Ratio: **0.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **311.098** ft
7.2 Bank Height: **8** ft
7.3 Ice/Debris Jam Potential:

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1 Low	2 High	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	1 Low	1 Low	2 High	0 N.S.	0 N.D.	0 N.D.	1 Low	0 N.S.	8

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **Wells River**
Topo Maps: **GROTON**
Watershed:
Sub-watershed:

Reach ID: **M15**
SGAT Version: **4.56**
Date Last Edited: **April, 11 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location

1.1 Reach Description: **Beginning 320 downstream of power line crossing and continuing 4000 upstream to the curve near cemetary road.**

1.2 Towns: **Groton**

1.3 Downstream Latitude: **44.2027665139**

1.3 Downstream Longitude: **-72.1709358865**

Step 2. Stream Type

2.1 Elevation Upstream: **750**
2.1 Elevation Downstream: **735**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **3,723.0** ft. **0.71** Miles
2.3 Valley Slope: **0.4**
2.4 Channel Length: **3,938.0** ft. **0.75** Miles
2.5 Channel Slope: **0.38 %**
2.6 Sinuosity: **1.06**
2.7 Watershed Area: **67.2** Square Miles
2.8 Channel Width: **83.4** feet
2.9 Valley Width: **613.0** feet
2.10 Confinement Ratio: **7.3**
2.10 Confinement Type: **Broad**
2.11 Reference Stream Type: **C**
Bedform: **Riffle-Pool**
Sub-Class Slope: **None**
Bed Material: **Gravel**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geological Mat.: **Alluvial** **55.0** %
3.3 Sub-dom. Geological Mat.: **Ice-Contact**
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Ext. Steep**
3.5 Soils
Hydrologic Group: **B** **41.0** %
Flooding: **None/Rare** **81.0** %
Water Table Deep: **6.0** **60.0** %
Water Table Shallow: **6.0** **60.0** %
Erodibility: **Moderate** **35.0** %

7.4 Comments:

Jam potential is due to some bends. This reach looks to have been straightened along it's entire length. There is a fair amount of road encroachment and lack of buffers, as well as a small amount of development.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover:
Current Dominant Land Cover: **Forest** **88.0** %
Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor
Historic Land Cover::
Current Dominant Land Cover: **Forest** **44.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**0-25**
Sub-dominant:	**0-25**	**>100**
Length w / less than 25 ft.:	**151.0** ft.	**2,747.0** ft.

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **0** **0.0** %
5.3 Bank Armoring: **450.3** **11.4** %
Left: **39.5** ft. Right: **410.9** ft.
5.4 Channel Straightening: **3,736.7** **94.9** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **3,681.4** ft. **93.5**

	One Side	Both Sides
Road:	**0.0** ft.	**0.0** ft.
Railroad:	**3,681.4** ft.	**0.0** ft.
Berm:	**0.0** ft.	**0.0** ft.
Improved Path:	**0.0** ft.	**0.0** ft.

6.2 Development: **616.0** ft. **0.0** ft.
6.3 Channel Bars: **Multiple**
6.4 Meander Migration: **Flood Chute**
6.5 Meander Width: **83 ft.** Rato: **1.0**
6.6 Wavelength: **83 ft.** Ratio: **1.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **505.294** ft
7.2 Bank Height: **5** ft
7.3 Ice/Debris Jam Potential: **Bend**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1 Low	2 High	2 High	0 N.S.	0 N.S.	1 Low	2 High	0 N.S.	2 High	1 Low	1 Low	0 N.S.	2 High	2 High	1 Low	1 Low	18

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **Keenan Brook**
Topo Maps: **GROTON**
Watershed:
Sub-watershed:

Reach ID: **M15T2.01**
SGAT Version: **4.56**
Date Last Edited: **April, 22 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **From confluence with Wells River near Cemetary Road curve and continuing 1600 feet to tributary confluence.**

1.1 Reach Description:
1.2 Towns: **Groton**
1.3 Downstream Latitude: **44.2036298065**
1.3 Downstream Longitude: **-72.1841457327**

Step 2. Stream Type

2.1 Elevation Upstream: **756**
2.1 Elevation Downstream: **755**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **1,342.0** ft. **0.25** Miles
2.3 Valley Slope: **0.1**
2.4 Channel Length: **1,869.0** ft. **0.35** Miles
2.5 Channel Slope: **0.05 %**
2.6 Sinuosity: **1.39**
2.7 Watershed Area: **7.6** Square Miles
2.8 Channel Width: **31.9** feet
2.9 Valley Width: **467.0** feet
2.10 Confinement Ratio: **14.6**
2.10 Confinement Type: **Very Broad**
2.11 Reference Stream Type: **E**
Bedform: **Riffle-Pool**
Sub-Class Slope: **None**
Bed Material: **Sand**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geological Mat.: **Alluvial** **61.0** %
3.3 Sub-dom. Geological Mat.: **Ice-Contact**
3.4 Valley Slope Left: **Hilly**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: **C** **57.0** %
Flooding: **Frequent** **57.0** %
Water Table Deep: **1.0** **57.0** %
Water Table Shallow: **0.0** **57.0** %
Erodibility: **0.0** %
7.4 Comments:

Jam potential is due to culverts, a bridge, and meander bends. Some of this reach has been straighted, there is some road encroachment, and buffers are lacking along much of its length.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover:
Current Dominant Land Cover: **Forest** **88.0** %
Current Sub-Dominant Land Cover: **Urban**
4.2 Corridor
Historic Land Cover::
Current Dominant Land Cover: **Forest** **54.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**0-25**	**0-25**
Sub-dominant:	**>100**	**>100**
Length w / less than 25 ft.:	**1,255.0** ft.	**803.0** ft.

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **4** **50.8** %
5.3 Bank Armoring: **96.9** **5.2** %
Left: **66.7** ft. Right: **30.3** ft.
5.4 Channel Straightening: **825.9** **44.2** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **328.2** ft. **17.6**

	One Side	Both Sides
Road:	**328.2** ft.	**0.0** ft.
Railroad:	**0.0** ft.	**0.0** ft.
Berm:	**0.0** ft.	**0.0** ft.
Improved Path:	**0.0** ft.	**0.0** ft.

6.2 Development: **167.9** ft. **0.0** ft.
6.3 Channel Bars: **Point**
6.4 Meander Migration:
6.5 Meander Width: **61 ft.** Rato: **1.9**
6.6 Wavelength: **81 ft.** Ratio: **2.5**

Step 7. Windshield Survey

7.1 Bank Erosion: **91.6712** ft
7.2 Bank Height: **1** ft
7.3 Ice/Debris Jam Potential: **Multiple**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1 Low	2 High	2 High	0 N.S.	2 High	1 Low	2 High	0 N.S.	1 Low	1 Low	1 Low	0 N.S.	2 High	2 High	0 N.S.	2 High	19

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **Keenan Brook**
Topo Maps: **GROTON**
Watershed:
Sub-watershed:

Reach ID: **M15T2.02**
SGAT Version: **4.56**
Date Last Edited: **April, 22 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location

1.1 Reach Description: **From 1600 feet upstream of confluence with Wells River and continuing 3300 feet upstream (past RailRoad street) to where valley narrows before Powder Spring Road.**

1.2 Towns: **Groton**

1.3 Downstream Latitude: **44.2039895548**

1.3 Downstream Longitude: **-72.1885001957**

Step 2. Stream Type

2.1 Elevation Upstream: **800**
2.1 Elevation Downstream: **756**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **3,127.0** ft. **0.59** Miles
2.3 Valley Slope: **1.4**
2.4 Channel Length: **3,579.0** ft. **0.68** Miles
2.5 Channel Slope: **1.23 %**
2.6 Sinuosity: **1.14**
2.7 Watershed Area: **4.8** Square Miles
2.8 Channel Width: **26.2** feet
2.9 Valley Width: **356.0** feet
2.10 Confinement Ratio: **13.6**
2.10 Confinement Type: **Very Broad**
2.11 Reference Stream Type: **C**
Bedform: **Riffle-Pool**
Sub-Class Slope: **None**
Bed Material: **Gravel**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geological Mat.: **Alluvial** **55.0** %
3.3 Sub-dom. Geological Mat.: **Ice-Contact**
3.4 Valley Slope Left: **Hilly**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: **C** **55.0** %
Flooding: **Frequent** **55.0** %
Water Table Deep: **1.0** **55.0** %
Water Table Shallow: **0.0** **55.0** %
Erodibility: **Moderate** **33.0** %
7.4 Comments:

Jam potential is due to a bridge and bends. There has been some straightening and buffers are sometimes lacking.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover:
Current Dominant Land Cover: **Forest** **87.0** %
Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor
Historic Land Cover::
Current Dominant Land Cover: **Forest** **40.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**0-25**	**51-100**
Sub-dominant:	**>100**	**0-25**
Length w / less than 25 ft.:	**1,013.0** ft.	**830.0** ft.

4.4 Ground Water Inputs: **None**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **Small Withdrawal**
Use: **Irrigation**
5.2 Bridges and Culverts: **1** **5.6** %
5.3 Bank Armoring: **289.5** **8.1** %
Left: **236.4** ft. Right: **53.1** ft.
5.4 Channel Straightening: **2,031.8** **56.8** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **376.8** ft. **10.5**

	One Side	Both Sides
Road:	**0.0** ft.	**0.0** ft.
Railroad:	**0.0** ft.	**0.0** ft.
Berm:	**0.0** ft.	**0.0** ft.
Improved Path:	**376.8** ft.	**0.0** ft.

6.2 Development: **1,082.8** ft. **0.0** ft.
6.3 Channel Bars: **Point**
6.4 Meander Migration: **Flood Chute**
6.5 Meander Width: **59 ft.** Rato: **2.2**
6.6 Wavelength: **145 ft.** Ratio: **5.5**

Step 7. Windshield Survey

7.1 Bank Erosion: **187.774** ft
7.2 Bank Height: **2** ft
7.3 Ice/Debris Jam Potential: **Multiple**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1 Low	2 High	2 High	1 Low	1 Low	1 Low	2 High	0 N.S.	1 Low	2 High	1 Low	0 N.S.	2 High	2 High	1 Low	1 Low	20

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **Keenan Brook**
Topo Maps: **GROTON**
Watershed:
Sub-watershed:

Reach ID: **M15T2.03**
SGAT Version: **4.56**
Date Last Edited: **April, 23 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location

1.1 Reach Description: **Beginning 1130 downstream of first Powder Spring Road crossing and continuing to 840 feet downstream of second Powder Spring Road crossing.**

1.2 Towns: **Groton**

1.3 Downstream Latitude: **44.203365932**

1.3 Downstream Longitude: **-72.1964754456**

Step 2. Stream Type

2.1 Elevation Upstream: **935**
2.1 Elevation Downstream: **800**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **2,990.0** ft. **0.57** Miles
2.3 Valley Slope: **4.5**
2.4 Channel Length: **3,220.0** ft. **0.61** Miles
2.5 Channel Slope: **4.19 %**
2.6 Sinuosity: **1.08**
2.7 Watershed Area: **4.7** Square Miles
2.8 Channel Width: **25.9** feet
2.9 Valley Width: feet
2.10 Confinement Ratio: **0.0**
2.10 Confinement Type: **Semi-confined**
2.11 Reference Stream Type: **C**
Bedform: **Step-Pool**
Sub-Class Slope: **b**
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **Ledge**
3.3 Dominant Geological Mat.: **Till** **74.0** %
3.3 Sub-dom. Geological Mat.: **Ice-Contact**
3.4 Valley Slope Left: **Hilly**
3.4 Valley Slope Right: **Hilly**
3.5 Soils
Hydrologic Group: **C** **58.0** %
Flooding: **None/Rare** **100.0** %
Water Table Deep: **1.5** **52.0** %
Water Table Shallow: **0.0** **52.0** %
Erodibility: **Severe** **74.0** %

7.4 Comments:

Jam potential is due to two bridges and meander bends. Debris jams were seen from the road. Most of this reach is forested and has not been highly impacted.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover:
Current Dominant Land Cover: **Forest** **88.0** %
Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor
Historic Land Cover::
Current Dominant Land Cover: **Forest** **68.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**0-25**	**26-50**
Length w / less than 25 ft.:	**0.0** ft.	**0.0** ft.

4.4 Ground Water Inputs: **None**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **Small Withdrawal**
Use: **Other**
5.2 Bridges and Culverts: **1** **6.2** %
5.3 Bank Armoring: **437.8** **13.6** %
Left: **168.6** ft. Right: **269.2** ft.
5.4 Channel Straightening: **0.0** **0.0** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **387.0** ft. **12.0**

	One Side	Both Sides
Road:	**387.0** ft.	**0.0** ft.
Railroad:	**0.0** ft.	**0.0** ft.
Berm:	**0.0** ft.	**0.0** ft.
Improved Path:	**0.0** ft.	**0.0** ft.

6.2 Development: **566.4** ft. **0.0** ft.
6.3 Channel Bars: **Multiple**
6.4 Meander Migration: **Multiple**
6.5 Meander Width: **N/A** Rato: **0.0**
6.6 Wavelength: **N/A** Ratio: **0.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **48.7008** ft
7.2 Bank Height: **2** ft
7.3 Ice/Debris Jam Potential: **Multiple**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1 Low	2 High	0 N.S.	1 Low	1 Low	1 Low	0 N.S.	0 N.S.	1 Low	1 Low	1 Low	0 N.S.	0 N/A	0 N/A	0 N.S.	2 High	11

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **Wells River**
Topo Maps: **GROTON**
Watershed:
Sub-watershed:

Reach ID: **M16**
SGAT Version: **4.56**
Date Last Edited: **April, 11 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location

1.1 Reach Description: **Beginning at curve near Cemetary Road (and confluence with Keenan Brook) and continuing 2830 feet upstream to tributary confluence at Tannery Brook Road.**

1.2 Towns: **Groton**

1.3 Downstream Latitude: **44.203694543**

1.3 Downstream Longitude: **-72.1839827109**

Step 2. Stream Type

2.1 Elevation Upstream: **755**
2.1 Elevation Downstream: **750**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **2,470.0** ft. **0.47** Miles
2.3 Valley Slope: **0.2**
2.4 Channel Length: **2,852.0** ft. **0.54** Miles
2.5 Channel Slope: **0.18 %**
2.6 Sinuosity: **1.15**
2.7 Watershed Area: **57.0** Square Miles
2.8 Channel Width: **77.6** feet
2.9 Valley Width: **685.0** feet
2.10 Confinement Ratio: **8.8**
2.10 Confinement Type: **Broad**
2.11 Reference Stream Type: **C**
Bedform: **Riffle-Pool**
Sub-Class Slope: **None**
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geological Mat.: **Ice-Contact** **52.0** %
3.3 Sub-dom. Geological Mat.: **Alluvial**
3.4 Valley Slope Left: **Very Steep**
3.4 Valley Slope Right: **Hilly**
3.5 Soils
Hydrologic Group: **A** **52.0** %
Flooding: **None/Rare** **99.0** %
Water Table Deep: **6.0** **53.0** %
Water Table Shallow: **6.0** **53.0** %
Erodibility: **slight** **19.0** %

7.4 Comments:

Jam potential is due to some meander curves. This reach has been primarily impacted by farming activity. There has been some straightening and buffers are mostly lacking. There is also some road encroachment.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover:
Current Dominant Land Cover: **Forest** **88.0** %
Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor
Historic Land Cover::
Current Dominant Land Cover: **Forest** **49.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**0-25**	**51-100**
Sub-dominant:	**51-100**	**0-25**
Length w / less than 25 ft.:	**1,377.0** ft.	**325.0** ft.

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **0** **0.0** %
5.3 Bank Armoring: **583.2** **20.5** %
Left: **583.2** ft. Right: **0.0** ft.
5.4 Channel Straightening: **1,627.4** **57.1** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **1,264.0** ft. **44.3**

	One Side	Both Sides
Road:	**311.1** ft.	**0.0** ft.
Railroad:	**1,264.0** ft.	**0.0** ft.
Berm:	**0.0** ft.	**0.0** ft.
Improved Path:	**0.0** ft.	**0.0** ft.

6.2 Development: **0.0** ft. **465.4** ft.
6.3 Channel Bars: **Point**
6.4 Meander Migration: **Flood Chute**
6.5 Meander Width: **77 ft.** Rato: **1.0**
6.6 Wavelength: **77 ft.** Ratio: **1.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **1113.78** ft
7.2 Bank Height: **3** ft
7.3 Ice/Debris Jam Potential: **Bend**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1 Low	2 High	2 High	0 N.S.	0 N.S.	2 High	2 High	0 N.S.	2 High	1 Low	1 Low	0 N.S.	2 High	2 High	2 High	1 Low	20

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **Tannery Brook**
Topo Maps: **GROTON**
Watershed:
Sub-watershed:

Reach ID: **M16S1.01**
SGAT Version: **4.56**
Date Last Edited: **April, 23 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location

1.1 Reach Description:
1.2 Towns: **Groton**
1.3 Downstream Latitude: **44.20770977**
1.3 Downstream Longitude: **-72.1904643949**

Step 2. Stream Type

2.1 Elevation Upstream: **1,130**
2.1 Elevation Downstream: **755**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: ft. **0.00** Miles
2.3 Valley Slope: **0.0**
2.4 Channel Length: **11,344.0** ft. **2.15** Miles
2.5 Channel Slope: **3.31 %**
2.6 Sinuosity: **0.00**
2.7 Watershed Area: **2.5** Square Miles
2.8 Channel Width: **19.6** feet
2.9 Valley Width: feet
2.10 Confinement Ratio: **0.0**
2.10 Confinement Type:
2.11 Reference Stream Type: **C**
Bedform: **Step-Pool**
Sub-Class Slope: **b**
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geological Mat.: **Till** **86.0** %
3.3 Sub-dom. Geological Mat.: **Alluvial**
3.4 Valley Slope Left:
3.4 Valley Slope Right:
3.5 Soils
Hydrologic Group: **C** **47.0** %
Flooding: **None/Rare** **91.0** %
Water Table Deep: **6.0** **87.0** %
Water Table Shallow: **6.0** **87.0** %
Erodibility: **Very Severe** **86.0** %
7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover:
Current Dominant Land Cover: **Forest** **79.0** %
Current Sub-Dominant Land Cover: **Urban**
4.2 Corridor
Historic Land Cover::
Current Dominant Land Cover: **Forest** **30.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:		
Sub-dominant:		
Length w / less than 25 ft.:	**200.0** ft.	**255.0** ft.

4.4 Ground Water Inputs:

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **2** **3.1** %
5.3 Bank Armoring: **622.5** **5.5** %
Left: **257.1** ft. Right: **365.4** ft.
5.4 Channel Straightening: **633.7** **5.6** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **0.0** ft. **0.0**

	One Side	Both Sides
Road:	**0.0** ft.	**0.0** ft.
Railroad:	**0.0** ft.	**0.0** ft.
Berm:	**0.0** ft.	**0.0** ft.
Improved Path:	**0.0** ft.	**0.0** ft.

6.2 Development: **161.0** ft. **377.0** ft.
6.3 Channel Bars: **Multiple**
6.4 Meander Migration: **Multiple**
6.5 Meander Width: **ft.** Rato: **0.0**
6.6 Wavelength: **ft.** Ratio: **0.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **0** ft
7.2 Bank Height: **No Data** ft
7.3 Ice/Debris Jam Potential:

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
2 High	2 High	0 N.S.	0 N.S.	0 N.S.	1 Low	1 Low	0 N.S.	0 Unk.	0 N.S.	1 Low	0 N.S.	0 N.D.	0 N.D.	0 N.S.	0 N.S.	7

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **Wells River**
Topo Maps: **GROTON**
Watershed:
Sub-watershed:

Reach ID: **M17**
SGAT Version: **4.56**
Date Last Edited: **April, 11 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location

1.1 Reach Description: **Beginning at tributary confluence at Tannery Brook Road and continuing to approximately 1300 feet downstream of Welton Road.**

1.2 Towns: **Groton**

1.3 Downstream Latitude: **44.2076667853**

1.3 Downstream Longitude: **-72.1905362495**

Step 2. Stream Type

2.1 Elevation Upstream: **795**
2.1 Elevation Downstream: **755**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **4,477.0** ft. **0.85** Miles
2.3 Valley Slope: **0.9**
2.4 Channel Length: **5,062.0** ft. **0.96** Miles
2.5 Channel Slope: **0.79 %**
2.6 Sinuosity: **1.13**
2.7 Watershed Area: **54.4** Square Miles
2.8 Channel Width: **76.0** feet
2.9 Valley Width: **522.0** feet
2.10 Confinement Ratio: **6.9**
2.10 Confinement Type: **Broad**
2.11 Reference Stream Type: **C**
Bedform: **Riffle-Pool**
Sub-Class Slope: **None**
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geological Mat.: **Alluvial** **48.0** %
3.3 Sub-dom. Geological Mat.: **Glacial Lake**
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Hilly**
3.5 Soils
Hydrologic Group: **B** **40.0** %
Flooding: **None/Rare** **90.0** %
Water Table Deep: **3.0** **39.0** %
Water Table Shallow: **1.5** **39.0** %
Erodibility: **slight** **15.0** %
7.4 Comments:

Jam potential is due to bridges, meander curves, and old dam abuttments. This reach is highly impacted. About half its length is impacted by development and the entire length looks to have been straightened. Buffers are frequently lacking and road encroachment is also common.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover:
Current Dominant Land Cover: **Forest** **87.0** %
Current Sub-Dominant Land Cover: **Urban**
4.2 Corridor
Historic Land Cover::
Current Dominant Land Cover: **Urban** **56.0** %
Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**0-25**	**0-25**
Sub-dominant:	**>100**	**>100**
Length w / less than 25 ft.:	**1,212.0** ft.	**793.0** ft.

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **0** **0.0** %
5.3 Bank Armoring: **365.9** **7.2** %
Left: **365.9** ft. Right: **0.0** ft.
5.4 Channel Straightening: **5.4** **0.1** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **0.0** ft. **0.0**

	One Side	Both Sides
Road:	**0.0** ft.	**0.0** ft.
Railroad:	**0.0** ft.	**0.0** ft.
Berm:	**0.0** ft.	**0.0** ft.
Improved Path:	**0.0** ft.	**0.0** ft.

6.2 Development: **0.0** ft. **0.0** ft.
6.3 Channel Bars: **Multiple**
6.4 Meander Migration: **Multiple**
6.5 Meander Width: **76 ft.** Rato: **1.0**
6.6 Wavelength: **76 ft.** Ratio: **1.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **37.6916** ft
7.2 Bank Height: **3** ft
7.3 Ice/Debris Jam Potential: **Multiple**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1 Low	2 High	2 High	0 N.S.	0 N.S.	1 Low	0 N.S.	0 N.S.	0 Unk.	0 N.S.	2 High	0 N.S.	2 High	2 High	0 N.S.	2 High	14

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **Wells River**
Topo Maps: **GROTON**
Watershed:
Sub-watershed:

Reach ID: **M18**
SGAT Version: **4.56**
Date Last Edited: **January, 31 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location

1.1 Reach Description: **Beginning approximately 1300 feet downstream of Welton Road and continuing to tributary confluence at Branch Brook Road.**

1.2 Towns: **Groton**

1.3 Downstream Latitude: **44.2109796171**

1.3 Downstream Longitude: **-72.205953973**

Step 2. Stream Type

2.1 Elevation Upstream: **820**
2.1 Elevation Downstream: **795**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **2,991.0** ft. **0.57** Miles
2.3 Valley Slope: **0.8**
2.4 Channel Length: **3,334.0** ft. **0.63** Miles
2.5 Channel Slope: **0.75 %**
2.6 Sinuosity: **1.11**
2.7 Watershed Area: **53.0** Square Miles
2.8 Channel Width: **75.2** feet
2.9 Valley Width: **821.0** feet
2.10 Confinement Ratio: **10.9**
2.10 Confinement Type: **Very Broad**
2.11 Reference Stream Type: **C**
Bedform: **Riffle-Pool**
Sub-Class Slope: **None**
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **Ledge**
3.3 Dominant Geological Mat.: **Alluvial** **60.0** %
3.3 Sub-dom. Geological Mat.: **Ice-Contact**
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Hilly**
3.5 Soils
Hydrologic Group: **C** **60.0** %
Flooding: **Frequent** **60.0** %
Water Table Deep: **1.0** **60.0** %
Water Table Shallow: **0.0** **60.0** %
Erodibility: **slight** **6.0** %
7.4 Comments:

Jam potential is due to one bridge and minimal meander curves. Impacts are fairly high for this reach. Straightening, development, encroachment and lack of buffers are all common.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover:
Current Dominant Land Cover: **Forest** **88.0** %
Current Sub-Dominant Land Cover: **Urban**
4.2 Corridor
Historic Land Cover::
Current Dominant Land Cover: **Forest** **33.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**0-25**	**0-25**
Sub-dominant:	**None**	**>100**
Length w / less than 25 ft.:	**921.0** ft.	**1,023.0** ft.

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **1** **30.0** %
5.3 Bank Armoring: **1,475.0** **44.2** %
Left: **1,353.9** ft. Right: **121.1** ft.
5.4 Channel Straightening: **3,000.2** **90.0** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **1,146.1** ft. **34.4**

	One Side	Both Sides
Road:	**1,146.1** ft.	**0.0** ft.
Railroad:	**0.0** ft.	**0.0** ft.
Berm:	**0.0** ft.	**307.3** ft.
Improved Path:	**0.0** ft.	**0.0** ft.

6.2 Development: **1,186.3** ft. **414.8** ft.
6.3 Channel Bars: **Multiple**
6.4 Meander Migration: **Flood Chute**
6.5 Meander Width: **75 ft.** Rato: **1.0**
6.6 Wavelength: **75 ft.** Ratio: **1.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **581.524** ft
7.2 Bank Height: **2** ft
7.3 Ice/Debris Jam Potential: **Bridge**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1 Low	2 High	2 High	0 N.S.	2 High	2 High	2 High	0 N.S.	2 High	2 High	2 High	0 N.S.	2 High	2 High	1 Low	1 Low	23

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **North Branch Wells River**
Topo Maps: **GROTON**
Watershed:
Sub-watershed:

Reach ID: **M18T3.01**
SGAT Version: **4.56**
Date Last Edited: **April, 23 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location

1.1 Reach Description: **Beginning at confluence with Wells River at Branch Brook Road and continuing 2280 feet upstream to where valley narrows.**

1.2 Towns: **Groton**

1.3 Downstream Latitude: **44.2173538255**

1.3 Downstream Longitude: **-72.2123096211**

Step 2. Stream Type

2.1 Elevation Upstream: **870**
2.1 Elevation Downstream: **820**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **2,026.0** ft. **0.38** Miles
2.3 Valley Slope: **2.5**
2.4 Channel Length: **2,316.0** ft. **0.44** Miles
2.5 Channel Slope: **2.16 %**
2.6 Sinuosity: **1.14**
2.7 Watershed Area: **9.6** Square Miles
2.8 Channel Width: **35.5** feet
2.9 Valley Width: **507.0** feet
2.10 Confinement Ratio: **14.3**
2.10 Confinement Type: **Very Broad**
2.11 Reference Stream Type: **C**
Bedform: **Riffle-Pool**
Sub-Class Slope: **b**
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **Yes**
3.2 Grade Control: **Ledge**
3.3 Dominant Geological Mat.: **Alluvial** **67.0** %
3.3 Sub-dom. Geological Mat.: **Till**
3.4 Valley Slope Left: **Very Steep**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: **B** **82.0** %
Flooding: **None/Rare** **88.0** %
Water Table Deep: **3.0** **56.0** %
Water Table Shallow: **1.5** **56.0** %
Erodibility: **Moderate** **31.0** %
7.4 Comments:

Jam potential is due to one bridge. There are not enough meanders to measure meander widths. There is a small amount of development that may be impacting this reach.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover:
Current Dominant Land Cover: **Forest** **88.0** %
Current Sub-Dominant Land Cover: **Urban**
4.2 Corridor
Historic Land Cover::
Current Dominant Land Cover: **Forest** **52.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**51-100**	**>100**
Sub-dominant:	**>100**	**26-50**
Length w / less than 25 ft.:	**775.0** ft.	**455.0** ft.

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **1** **13.0** %
5.3 Bank Armoring: **621.3** **26.8** %
Left: **322.4** ft. Right: **298.9** ft.
5.4 Channel Straightening: **950.5** **41.0** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **133.0** ft. **5.7**

	One Side	Both Sides
Road:	**0.0** ft.	**0.0** ft.
Railroad:	**0.0** ft.	**0.0** ft.
Berm:	**74.8** ft.	**0.0** ft.
Improved Path:	**133.0** ft.	**0.0** ft.

6.2 Development: **764.8** ft. **195.5** ft.
6.3 Channel Bars: **Point**
6.4 Meander Migration: **Flood Chute**
6.5 Meander Width: **N/A** Rato: **0.0**
6.6 Wavelength: **N/A** Ratio: **0.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **652.106** ft
7.2 Bank Height: **3** ft
7.3 Ice/Debris Jam Potential: **Bridge**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1 Low	1 Low	2 High	0 N.S.	1 Low	2 High	2 High	0 N.S.	1 Low	2 High	1 Low	0 N.S.	0 N/A	0 N/A	2 High	1 Low	16

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **North Branch Wells River**
Topo Maps: **GROTON**
Watershed:
Sub-watershed:

Reach ID: **M18T3.02**
SGAT Version: **4.56**
Date Last Edited: **April, 23 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location

1.1 Reach Description: **Beginning 2280 feet upstream from confluence with Wells River (and where valley narrows) and continuing upstream 4400 feet.**

1.2 Towns: **Groton**

1.3 Downstream Latitude: **44.2225655724**

1.3 Downstream Longitude: **-72.213218159**

Step 2. Stream Type

2.1 Elevation Upstream: **995**
2.1 Elevation Downstream: **870**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **4,416.0** ft. **0.84** Miles
2.3 Valley Slope: **2.8**
2.4 Channel Length: **4,518.0** ft. **0.86** Miles
2.5 Channel Slope: **2.77 %**
2.6 Sinuosity: **1.02**
2.7 Watershed Area: **9.3** Square Miles
2.8 Channel Width: **35.0** feet
2.9 Valley Width: feet
2.10 Confinement Ratio: **0.0**
2.10 Confinement Type: **Semi-confined**
2.11 Reference Stream Type: **C**
Bedform: **Step-Pool**
Sub-Class Slope: **b**
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **Ledge**
3.3 Dominant Geological Mat.: **Till** **67.0** %
3.3 Sub-dom. Geological Mat.: **Ice-Contact**
3.4 Valley Slope Left: **Very Steep**
3.4 Valley Slope Right: **Ext. Steep**
3.5 Soils
Hydrologic Group: **B** **94.0** %
Flooding: **None/Rare** **94.0** %
Water Table Deep: **6.0** **67.0** %
Water Table Shallow: **6.0** **67.0** %
Erodibility: **Very Severe** **94.0** %
7.4 Comments:

Road encroachment is high for this reach and there is a short section that lacks a buffer, but generally this reach appears to be only minimally impacted.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover:
Current Dominant Land Cover: **Forest** **90.0** %
Current Sub-Dominant Land Cover: **Urban**
4.2 Corridor
Historic Land Cover::
Current Dominant Land Cover: **Forest** **43.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**0-25**	**0-25**
Length w / less than 25 ft.:	**243.0** ft.	**429.0** ft.

4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **1** **2.2** %
5.3 Bank Armoring: **486.6** **10.8** %
Left: **331.8** ft. Right: **154.8** ft.
5.4 Channel Straightening: **354.1** **7.8** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **2,180.3** ft. **48.3**

	One Side	Both Sides
Road:	**2,180.3** ft.	**0.0** ft.
Railroad:	**0.0** ft.	**0.0** ft.
Berm:	**0.0** ft.	**0.0** ft.
Improved Path:	**544.5** ft.	**0.0** ft.

6.2 Development: **90.3** ft. **0.0** ft.
6.3 Channel Bars: **Point**
6.4 Meander Migration: **Multiple**
6.5 Meander Width: **N/A** Rato: **0.0**
6.6 Wavelength: **N/A** Ratio: **0.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **573.184** ft
7.2 Bank Height: **2** ft
7.3 Ice/Debris Jam Potential: **Not Evaluated**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1 Low	1 Low	1 Low	0 N.S.	0 N.S.	1 Low	1 Low	0 N.S.	2 High	0 N.S.	1 Low	0 N.S.	0 N/A	0 N/A	1 Low	0 N.S.	9

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **Wells River**
Topo Maps: **GROTON**
Watershed:
Sub-watershed:

Reach ID: **M19**
SGAT Version: **4.56**
Date Last Edited: **April, 11 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location

1.1 Reach Description: **Beginning at tributary confluence at Branch Brook Road and continuing approximately 2800 feet to the tributary confluence approximately 230 feet upstream of Coal Kiln Road (crossing?).**

1.2 Towns: **Groton**

1.3 Downstream Latitude: **44.2173489764**

1.3 Downstream Longitude: **-72.212523767**

Step 2. Stream Type

2.1 Elevation Upstream: **880**
2.1 Elevation Downstream: **820**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **2,475.0** ft. **0.47** Miles
2.3 Valley Slope: **2.4**
2.4 Channel Length: **2,839.0** ft. **0.54** Miles
2.5 Channel Slope: **2.11 %**
2.6 Sinuosity: **1.15**
2.7 Watershed Area: **42.6** Square Miles
2.8 Channel Width: **68.3** feet
2.9 Valley Width: **534.0** feet
2.10 Confinement Ratio: **7.8**
2.10 Confinement Type: **Broad**
2.11 Reference Stream Type: **C**
Bedform: **Riffle-Pool**
Sub-Class Slope: **b**
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **Ledge**
3.3 Dominant Geological Mat.: **Ice-Contact** **69.0** %
3.3 Sub-dom. Geological Mat.: **Alluvial**
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Hilly**
3.5 Soils
Hydrologic Group: **A** **69.0** %
Flooding: **None/Rare** **97.0** %
Water Table Deep: **6.0** **82.0** %
Water Table Shallow: **6.0** **82.0** %
Erodibility: **Very Severe** **82.0** %
7.4 Comments:

Jam potential due to bridges and sharp meander bends. Straightening and road encroachment are high for this reach. There is also a significant amount of development impact.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover:
Current Dominant Land Cover: **Forest** **89.0** %
Current Sub-Dominant Land Cover: **Urban**
4.2 Corridor
Historic Land Cover::
Current Dominant Land Cover: **Urban** **62.0** %
Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**0-25**
Sub-dominant:	**0-25**	**51-100**
Length w / less than 25 ft.:	**806.0** ft.	**244.0** ft.

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **2** **42.3** %
5.3 Bank Armoring: **2,664.5** **93.9** %
Left: **1,164.0** ft. Right: **1,500.6** ft.
5.4 Channel Straightening: **2,839.2** **100.0** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **2,711.3** ft. **95.5**

	One Side	Both Sides
Road:	**825.2** ft.	**1,886.1** ft.
Railroad:	**0.0** ft.	**0.0** ft.
Berm:	**0.0** ft.	**0.0** ft.
Improved Path:	**0.0** ft.	**0.0** ft.

6.2 Development: **509.6** ft. **1,298.2** ft.
6.3 Channel Bars: **Multiple**
6.4 Meander Migration: **Multiple**
6.5 Meander Width: **68 ft.** Rato: **1.0**
6.6 Wavelength: **68 ft.** Ratio: **1.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **414.463** ft
7.2 Bank Height: **2** ft
7.3 Ice/Debris Jam Potential: **Multiple**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1 Low	2 High	2 High	0 N.S.	2 High	2 High	2 High	0 N.S.	2 High	2 High	2 High	0 N.S.	2 High	2 High	1 Low	2 High	24

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **South Branch Wells River**
Topo Maps: **GROTON**
Watershed:
Sub-watershed:

Reach ID: **M19T4.01**
SGAT Version: **4.56**
Date Last Edited: **August, 14 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Beginning at confluence with Wells River and continuing 2960 feet upstream to where valley narrows.**

1.1 Reach Description:
1.2 Towns: **Groton**
1.3 Downstream Latitude: **44.2199890795**
1.3 Downstream Longitude: **-72.2204907202**

Step 2. Stream Type

2.1 Elevation Upstream: **965**
2.1 Elevation Downstream: **880**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **2,923.0** ft. **0.55** Miles
2.3 Valley Slope: **2.9**
2.4 Channel Length: **3,005.0** ft. **0.57** Miles
2.5 Channel Slope: **2.83 %**
2.6 Sinuosity: **1.03**
2.7 Watershed Area: **18.3** Square Miles
2.8 Channel Width: **47.0** feet
2.9 Valley Width: **595.0** feet
2.10 Confinement Ratio: **12.6**
2.10 Confinement Type: **Very Broad**
2.11 Reference Stream Type: **C**
Bedform: **Riffle-Pool**
Sub-Class Slope: **b**
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **Yes**
3.2 Grade Control: **None**
3.3 Dominant Geological Mat.: **Ice-Contact** **43.0** %
3.3 Sub-dom. Geological Mat.: **Alluvial**
3.4 Valley Slope Left: **Very Steep**
3.4 Valley Slope Right: **Very Steep**
3.5 Soils
Hydrologic Group: **B** **50.0** %
Flooding: **None/Rare** **99.0** %
Water Table Deep: **6.0** **85.0** %
Water Table Shallow: **6.0** **85.0** %
Erodibility: **Moderate** **29.0** %
7.4 Comments:

Jam potential is from a bridge. Field observations said ice debris jam potential was not significant. This entire reach appears to have been straightened. Road encroachment is high and there is some development. Riprapping is common. Depositional features expected to be High impact under reference conditions; current conditions (2015) include a great deal of windrowing and channelization leading to assessment as Insignificant impacts.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover:
Current Dominant Land Cover: **Forest** **90.0** %
Current Sub-Dominant Land Cover: **Urban**
4.2 Corridor
Historic Land Cover::
Current Dominant Land Cover: **Urban** **43.0** %
Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**26-50**	**>100**
Sub-dominant:	**0-25**	**26-50**
Length w / less than 25 ft.:	**1,565.0** ft.	**455.0** ft.

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **2** **18.3** %
5.3 Bank Armoring: **2,063.9** **68.7** %
Left: **1,278.9** ft. Right: **785.0** ft.
5.4 Channel Straightening: **1,888.8** **62.9** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **1,656.5** ft. **55.1**

	One Side	Both Sides
Road:	**0.0** ft.	**0.0** ft.
Railroad:	**0.0** ft.	**0.0** ft.
Berm:	**1,176.6** ft.	**480.0** ft.
Improved Path:	**0.0** ft.	**0.0** ft.

6.2 Development: **990.2** ft. **0.0** ft.
6.3 Channel Bars: **Point**
6.4 Meander Migration: **Multiple**
6.5 Meander Width: **47 ft.** Rato: **1.0**
6.6 Wavelength: **47 ft.** Ratio: **1.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **158.314** ft
7.2 Bank Height: **3** ft
7.3 Ice/Debris Jam Potential: **Bridge**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1 Low	2 High	2 High	0 N.S.	1 Low	2 High	2 High	0 N.S.	2 High	2 High	2 High	0 N.S.	2 High	2 High	1 Low	1 Low	22

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **South Branch Wells River**
Topo Maps: **GROTON**
Watershed:
Sub-watershed:

Reach ID: **M19T4.02**
SGAT Version: **4.56**
Date Last Edited: **April, 23 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location

1.1 Reach Description: **Beginning 2960 feet upstream from confluence with Wells River and continuing 2325 feet upstream to where valley widens a bit again.**

1.2 Towns: **Groton**

1.3 Downstream Latitude: **44.2188615658**

1.3 Downstream Longitude: **-72.2308964192**

Step 2. Stream Type

2.1 Elevation Upstream: **1,155**
2.1 Elevation Downstream: **965**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **2,217.0** ft. **0.42** Miles
2.3 Valley Slope: **8.6**
2.4 Channel Length: **2,340.0** ft. **0.44** Miles
2.5 Channel Slope: **8.12 %**
2.6 Sinuosity: **1.06**
2.7 Watershed Area: **17.7** Square Miles
2.8 Channel Width: **46.4** feet
2.9 Valley Width: feet
2.10 Confinement Ratio: **0.0**
2.10 Confinement Type: **Narrowly Confined**
2.11 Reference Stream Type: **C**
Bedform: **Step-Pool**
Sub-Class Slope: **b**
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **Ledge**
3.3 Dominant Geological Mat.: **Till** **88.0** %
3.3 Sub-dom. Geological Mat.: **Ice-Contact**
3.4 Valley Slope Left: **Ext. Steep**
3.4 Valley Slope Right: **Ext. Steep**
3.5 Soils
Hydrologic Group: **C** **82.0** %
Flooding: **None/Rare** **99.0** %
Water Table Deep: **2.5** **82.0** %
Water Table Shallow: **1.5** **82.0** %
Erodibility: **Very Severe** **96.0** %
7.4 Comments:

Jam potential is from one bridge. Field observations say jam potential is low to high. Road encroachment is the primary impact here and rip rap is common. Buffers are lacking when the stream is right next to the road.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover:
Current Dominant Land Cover: **Forest** **90.0** %
Current Sub-Dominant Land Cover: **Urban**
4.2 Corridor
Historic Land Cover::
Current Dominant Land Cover: **Urban** **66.0** %
Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**26-50**	**>100**
Sub-dominant:	**0-25**	**None**
Length w / less than 25 ft.:	**1,185.0** ft.	**0.0** ft.

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **1** **6.4** %
5.3 Bank Armoring: **1,091.5** **46.6** %
Left: **1,091.5** ft. Right: **0.0** ft.
5.4 Channel Straightening: **1,978.8** **84.6** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old:	**1,618.1** ft.	**69.2**
	One Side	Both Sides
Road:	**1,618.1** ft.	**0.0** ft.
Railroad:	**0.0** ft.	**0.0** ft.
Berm:	**0.0** ft.	**0.0** ft.
Improved Path:	**0.0** ft.	**0.0** ft.
6.2 Development:	**0.0** ft.	**0.0** ft.

6.3 Channel Bars: **Point**
6.4 Meander Migration: **Flood Chute**
6.5 Meander Width: **N/A** Rato: **0.0**
6.6 Wavelength: **N/A** Ratio: **0.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **392.387** ft
7.2 Bank Height: **2** ft
7.3 Ice/Debris Jam Potential: **Bridge**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1 Low	2 High	2 High	0 N.S.	1 Low	2 High	2 High	0 N.S.	2 High	0 N.S.	1 Low	0 N.S.	0 N/A	0 N/A	1 Low	1 Low	15

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **South Branch Wells River**
Topo Maps: **GROTON, KNOX MOUNTAIN**
Watershed:
Sub-watershed:

Reach ID: **M19T4.03**
SGAT Version: **4.56**
Date Last Edited: **April, 23 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location

1.1 Reach Description: **Beginning 5285 upstream of confluence with Wells River (1640 feet downstream of Westville Road and Scott Hwy intersection) and continuing 2325 feet to the trib confluence at the intersection of Seyon Pond and Beck Roads.**

1.2 Towns: **Groton**

1.3 Downstream Latitude: **44.2163585847**

1.3 Downstream Longitude: **-72.2379137343**

Step 2. Stream Type

2.1 Elevation Upstream: **1,175**
2.1 Elevation Downstream: **1,155**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **4,446.0** ft. **0.84** Miles
2.3 Valley Slope: **0.4**
2.4 Channel Length: **5,085.0** ft. **0.96** Miles
2.5 Channel Slope: **0.39 %**
2.6 Sinuosity: **1.14**
2.7 Watershed Area: **17.5** Square Miles
2.8 Channel Width: **46.2** feet
2.9 Valley Width: **305.0** feet
2.10 Confinement Ratio: **6.6**
2.10 Confinement Type: **Broad**
2.11 Reference Stream Type: **C**
Bedform: **Riffle-Pool**
Sub-Class Slope: **b**
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **Ledge**
3.3 Dominant Geological Mat.: **Till** **38.0** %
3.3 Sub-dom. Geological Mat.: **Ice-Contact**
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Very Steep**
3.5 Soils
Hydrologic Group: **B** **36.0** %
Flooding: **None/Rare** **99.0** %
Water Table Deep: **6.0** **41.0** %
Water Table Shallow: **1.5** **57.0** %
Erodibility: **Severe** **71.0** %

7.4 Comments:

Jam potential is due to lots of bends as well as the bridge. Not enough visible meanders to measure meander width. There are many impacts on this reach. Road encroachment, rip rap, development, and lack of buffers are all fairly common.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover:
Current Dominant Land Cover: **Forest** **90.0** %
Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor
Historic Land Cover::
Current Dominant Land Cover: **Urban** **51.0** %
Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**0-25**	**>100**
Sub-dominant:	**51-100**	**None**
Length w / less than 25 ft.:	**2,935.0** ft.	**962.0** ft.

4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **1** **6.9** %
5.3 Bank Armoring: **2,443.5** **48.1** %
Left: **1,922.3** ft. Right: **521.2** ft.
5.4 Channel Straightening: **5,078.0** **99.9** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **4,137.7** ft. **81.4**

	One Side	Both Sides
Road:	**4,137.7** ft.	**0.0** ft.
Railroad:	**0.0** ft.	**0.0** ft.
Berm:	**0.0** ft.	**0.0** ft.
Improved Path:	**0.0** ft.	**0.0** ft.

6.2 Development: **2,242.3** ft. **0.0** ft.
6.3 Channel Bars: **Point**
6.4 Meander Migration: **Multiple**
6.5 Meander Width: **N/A** Rato: **0.0**
6.6 Wavelength: **N/A** Ratio: **0.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **1765.19** ft
7.2 Bank Height: **3** ft
7.3 Ice/Debris Jam Potential: **Bridge**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1 Low	2 High	2 High	0 N.S.	1 Low	2 High	2 High	0 N.S.	2 High	2 High	2 High	0 N.S.	0 N/A	0 N/A	2 High	2 High	20

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **South Branch Wells River**
Topo Maps: **KNOX MOUNTAIN**
Watershed:
Sub-watershed:

Reach ID: **M19T4.04**
SGAT Version: **4.56**
Date Last Edited: **April, 23 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location

1.1 Reach Description: **Beginning at the tributary confluence at the intersection of Seyon Pond and Beck Roads and continuing 2200 feet to where valley widens.**

1.2 Towns: **Groton**

1.3 Downstream Latitude: **44.2154452687**

1.3 Downstream Longitude: **-72.2525061474**

Step 2. Stream Type

2.1 Elevation Upstream: **1,220**
2.1 Elevation Downstream: **1,175**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **2,178.0** ft. **0.41** Miles
2.3 Valley Slope: **2.1**
2.4 Channel Length: **2,216.0** ft. **0.42** Miles
2.5 Channel Slope: **2.03 %**
2.6 Sinuosity: **1.02**
2.7 Watershed Area: **13.1** Square Miles
2.8 Channel Width: **40.6** feet
2.9 Valley Width: feet
2.10 Confinement Ratio: **0.0**
2.10 Confinement Type: **Semi-confined**
2.11 Reference Stream Type: **B**
Bedform: **Step-Pool**
Sub-Class Slope: **None**
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **Ledge**
3.3 Dominant Geological Mat.: **Till** **99.0** %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: **C** **90.0** %
Flooding: **None/Rare** **100.0** %
Water Table Deep: **2.5** **90.0** %
Water Table Shallow: **1.5** **90.0** %
Erodibility: **Very Severe** **99.0** %
7.4 Comments:

Jam potential is due to some meanders, and abundant source of debris material. Road encroachment is high, but other impacts are absent.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover:
Current Dominant Land Cover: **Forest** **91.0** %
Current Sub-Dominant Land Cover: **Urban**
4.2 Corridor
Historic Land Cover::
Current Dominant Land Cover: **Forest** **52.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**51-100**
Sub-dominant:	**None**	**>100**
Length w / less than 25 ft.:	**0.0** ft.	**921.0** ft.

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **1** **11.3** %
5.3 Bank Armoring: **1,567.3** **70.7** %
Left: **350.6** ft. Right: **1,216.7** ft.
5.4 Channel Straightening: **2,201.8** **99.4** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **1,913.7** ft. **86.4**

	One Side	Both Sides
Road:	**1,622.7** ft.	**291.0** ft.
Railroad:	**0.0** ft.	**0.0** ft.
Berm:	**0.0** ft.	**0.0** ft.
Improved Path:	**0.0** ft.	**0.0** ft.

6.2 Development: **1,113.2** ft. **0.0** ft.
6.3 Channel Bars: **Multiple**
6.4 Meander Migration: **Flood Chute**
6.5 Meander Width: **N/A** Rato: **0.0**
6.6 Wavelength: **N/A** Ratio: **0.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **716.236** ft
7.2 Bank Height: **3** ft
7.3 Ice/Debris Jam Potential: **Culvert**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1 Low	2 High	2 High	0 N.S.	1 Low	2 High	2 High	0 N.S.	2 High	2 High	0 N.S.	0 N.S.	0 N/A	0 N/A	2 High	1 Low	17

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **South Branch Wells River**
Topo Maps: **KNOX MOUNTAIN**
Watershed:
Sub-watershed:

Reach ID: **M19T4.05**
SGAT Version: **4.56**
Date Last Edited: **April, 23 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location

1.1 Reach Description: **Beginning 2200 feet upstream of Seyon Pond and Beck Roads intersection (and where valley widens) and continuing 3850 feet upstream to tributary confluence at Buzzy's Road.**

1.2 Towns: **Groton**

1.3 Downstream Latitude: **44.2176861973**

1.3 Downstream Longitude: **-72.2594535971**

Step 2. Stream Type

2.1 Elevation Upstream: **1,270**
2.1 Elevation Downstream: **1,220**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **3,665.0** ft. **0.69** Miles
2.3 Valley Slope: **1.4**
2.4 Channel Length: **3,913.0** ft. **0.74** Miles
2.5 Channel Slope: **1.28 %**
2.6 Sinuosity: **1.07**
2.7 Watershed Area: **12.9** Square Miles
2.8 Channel Width: **40.4** feet
2.9 Valley Width: **392.0** feet
2.10 Confinement Ratio: **9.7**
2.10 Confinement Type: **Broad**
2.11 Reference Stream Type: **C**
Bedform: **Riffle-Pool**
Sub-Class Slope:
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **Ledge**
3.3 Dominant Geological Mat.: **Ice-Contact** **88.0** %
3.3 Sub-dom. Geological Mat.: **Till**
3.4 Valley Slope Left: **Hilly**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: **C** **92.0** %
Flooding: **None/Rare** **100.0** %
Water Table Deep: **1.5** **88.0** %
Water Table Shallow: **0.0** **88.0** %
Erodibility: **slight** **10.0** %

7.4 Comments:

This reach appears to be highly impacted by farming activity. Almost the entire lenth appears to have been straightened and buffers a mostly lacking. Road encroachment is also high and there is some development.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover:
Current Dominant Land Cover: **Forest** **91.0** %
Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor
Historic Land Cover::
Current Dominant Land Cover: **Forest** **53.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**0-25**	**0-25**
Sub-dominant:	**>100**	**26-50**
Length w / less than 25 ft.:	**2,375.0** ft.	**2,629.0** ft.

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **Small Withdrawal**
Use: **Irrigation**
5.2 Bridges and Culverts: **2** **15.3** %
5.3 Bank Armoring: **3,401.2** **86.9** %
Left: **1,242.8** ft. Right: **2,158.4** ft.
5.4 Channel Straightening: **3,599.8** **92.0** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old:	**3,911.9** ft.	**100.0**
	One Side	Both Sides
Road:	**3,911.9** ft.	**0.0** ft.
Railroad:	**0.0** ft.	**0.0** ft.
Berm:	**0.0** ft.	**0.0** ft.
Improved Path:	**0.0** ft.	**0.0** ft.

6.2 Development: **2,075.2** ft. **0.0** ft.
6.3 Channel Bars: **Multiple**
6.4 Meander Migration: **Flood Chute**
6.5 Meander Width: **40 ft.** Rato: **1.0**
6.6 Wavelength: **40 ft.** Ratio: **1.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **1217.01** ft
7.2 Bank Height: **3** ft
7.3 Ice/Debris Jam Potential: **Bend**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1 Low	2 High	2 High	1 Low	1 Low	2 High	2 High	0 N.S.	2 High	2 High	1 Low	1 Low	2 High	2 High	2 High	1 Low	24

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **South Branch Wells River**
Topo Maps: **KNOX MOUNTAIN**
Watershed:
Sub-watershed:

Reach ID: **M19T4.06**
SGAT Version: **4.56**
Date Last Edited: **April, 23 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location

1.1 Reach Description: **Beginning at tributary confluence at Buzzy's Road and continuing to trib confluence approximately 530 feet downstream of South Branch Road (and the end of the wetland area).**

1.2 Towns: **Groton**

1.3 Downstream Latitude: **44.2220389675**

1.3 Downstream Longitude: **-72.2714033521**

Step 2. Stream Type

2.1 Elevation Upstream: **1,355**
2.1 Elevation Downstream: **1,270**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **4,992.0** ft. **0.95** Miles
2.3 Valley Slope: **1.7**
2.4 Channel Length: **6,205.0** ft. **1.18** Miles
2.5 Channel Slope: **1.37 %**
2.6 Sinuosity: **1.24**
2.7 Watershed Area: **6.4** Square Miles
2.8 Channel Width: **29.5** feet
2.9 Valley Width: **746.0** feet
2.10 Confinement Ratio: **25.2**
2.10 Confinement Type: **Very Broad**
2.11 Reference Stream Type: **C**
Bedform: **Riffle-Pool**
Sub-Class Slope: **None**
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geological Mat.: **Ice-Contact** **90.0** %
3.3 Sub-dom. Geological Mat.: **Till**
3.4 Valley Slope Left: **Very Steep**
3.4 Valley Slope Right: **Very Steep**
3.5 Soils
Hydrologic Group: **C** **98.0** %
Flooding: **None/Rare** **100.0** %
Water Table Deep: **1.5** **94.0** %
Water Table Shallow: **0.0** **94.0** %
Erodibility: **slight** **9.0** %
7.4 Comments:

Jam potential is due to many bends and also a bridge. The primary impact on this reach appears to be agriculture. Straightening and lack of buffer is significant. There appears to be some wetland along much of this reach.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover:
Current Dominant Land Cover: **Forest** **90.0** %
Current Sub-Dominant Land Cover: **Urban**
4.2 Corridor
Historic Land Cover::
Current Dominant Land Cover: **Forest** **53.0** %
Current Sub-Dominant Land Cover: **Wetland**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**0-25**
Sub-dominant:	**26-50**	**>100**
Length w / less than 25 ft.:	**629.0** ft.	**3,486.0** ft.

4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **2** **9.7** %
5.3 Bank Armoring: **323.2** **5.2** %
Left: **68.9** ft. Right: **254.3** ft.
5.4 Channel Straightening: **5,917.1** **95.4** %
5.5 Dredging History: **Dredging**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **1,252.1** ft. **20.2**

	One Side	Both Sides
Road:	**1,215.0** ft.	**37.1** ft.
Railroad:	**0.0** ft.	**0.0** ft.
Berm:	**0.0** ft.	**0.0** ft.
Improved Path:	**0.0** ft.	**0.0** ft.

6.2 Development: **97.8** ft. **0.0** ft.
6.3 Channel Bars: **Multiple**
6.4 Meander Migration: **Multiple**
6.5 Meander Width: **62 ft.** Rato: **2.1**
6.6 Wavelength: **133 ft.** Ratio: **4.5**

Step 7. Windshield Survey

7.1 Bank Erosion: **982.884** ft
7.2 Bank Height: **2** ft
7.3 Ice/Debris Jam Potential: **Bend**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1 Low	2 High	2 High	0 N.S.	1 Low	1 Low	2 High	2 High	2 High	0 N.S.	2 High	0 N.S.	2 High	2 High	1 Low	2 High	22

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **Wells River**
Topo Maps: **GROTON**
Watershed:
Sub-watershed:

Reach ID: **M20**
SGAT Version: **4.56**
Date Last Edited: **April, 11 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location

1.1 Reach Description: **Beginning at tributary confluence approximately 230 feet upstream of Coal Kiln Road (crossing?) and continuing approximately 2030 feet to where valley narrows.**

1.2 Towns: **Groton**

1.3 Downstream Latitude: **44.2201454453**

1.3 Downstream Longitude: **-72.2204998044**

Step 2. Stream Type

2.1 Elevation Upstream: **905**
2.1 Elevation Downstream: **880**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **1,805.0** ft. **0.34** Miles
2.3 Valley Slope: **1.4**
2.4 Channel Length: **2,113.0** ft. **0.40** Miles
2.5 Channel Slope: **1.18 %**
2.6 Sinuosity: **1.17**
2.7 Watershed Area: **24.2** Square Miles
2.8 Channel Width: **53.2** feet
2.9 Valley Width: **633.0** feet
2.10 Confinement Ratio: **11.9**
2.10 Confinement Type: **Very Broad**
2.11 Reference Stream Type: **C**
Bedform: **Riffle-Pool**
Sub-Class Slope: **None**
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geological Mat.: **Ice-Contact** **61.0** %
3.3 Sub-dom. Geological Mat.: **Alluvial**
3.4 Valley Slope Left: **Very Steep**
3.4 Valley Slope Right: **Ext. Steep**
3.5 Soils
Hydrologic Group: **B** **59.0** %
Flooding: **None/Rare** **83.0** %
Water Table Deep: **2.0** **47.0** %
Water Table Shallow: **1.5** **70.0** %
Erodibility: **slight** **21.0** %

7.4 Comments:
Jam potential is due to one major meander bend. This reach appears to have been straightened and buffers are frequently lacking.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover:
Current Dominant Land Cover: **Forest** **87.0** %
Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor
Historic Land Cover::
Current Dominant Land Cover: **Forest** **55.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**0-25**
Sub-dominant:	**51-100**	**26-50**
Length w / less than 25 ft.:	**110.0** ft.	**478.0** ft.

4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **0** **0.0** %
5.3 Bank Armoring: **0.0** **0.0** %
Left: **0.0** ft. Right: **0.0** ft.
5.4 Channel Straightening: **2,112.4** **100.0** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **536.5** ft. **25.4**

	One Side	Both Sides
Road:	**536.5** ft.	**0.0** ft.
Railroad:	**0.0** ft.	**0.0** ft.
Berm:	**0.0** ft.	**0.0** ft.
Improved Path:	**0.0** ft.	**0.0** ft.

6.2 Development: **1,102.5** ft. **720.4** ft.
6.3 Channel Bars: **Multiple**
6.4 Meander Migration: **Multiple**
6.5 Meander Width: **53 ft.** Rato: **1.0**
6.6 Wavelength: **53 ft.** Ratio: **1.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **0** ft
7.2 Bank Height: **No Data** ft
7.3 Ice/Debris Jam Potential: **Bend**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1 Low	2 High	2 High	0 N.S.	0 N.S.	0 N.S.	2 High	0 N.S.	2 High	2 High	1 Low	0 N.S.	2 High	2 High	0 N.S.	1 Low	17

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **Wells River**
Topo Maps: **GROTON**
Watershed:
Sub-watershed:

Reach ID: **M21**
SGAT Version: **4.56**
Date Last Edited: **April, 11 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location

1.1 Reach Description: **Beginning approximately 2260 feet upstream of Coal Kiln Road (crossing?), at a point where the valley narrows, and continuing approximately 1300 feet to where valley widens somewhat again.**

1.2 Towns: **Groton**

1.3 Downstream Latitude: **44.2218889968**

1.3 Downstream Longitude: **-72.2266208583**

Step 2. Stream Type

2.1 Elevation Upstream: **920**
2.1 Elevation Downstream: **905**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **1,202.0** ft. **0.23** Miles
2.3 Valley Slope: **1.2**
2.4 Channel Length: **1,374.0** ft. **0.26** Miles
2.5 Channel Slope: **1.09 %**
2.6 Sinuosity: **1.14**
2.7 Watershed Area: **24.1** Square Miles
2.8 Channel Width: **53.1** feet
2.9 Valley Width: **300.0** feet
2.10 Confinement Ratio: **5.6**
2.10 Confinement Type: **Narrow**
2.11 Reference Stream Type: **C**
Bedform: **Riffle-Pool**
Sub-Class Slope: **None**
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **Multiple**
3.3 Dominant Geological Mat.: **Ice-Contact** **67.0** %
3.3 Sub-dom. Geological Mat.: **Alluvial**
3.4 Valley Slope Left: **Very Steep**
3.4 Valley Slope Right: **Ext. Steep**
3.5 Soils
Hydrologic Group: **A** **67.0** %
Flooding: **None/Rare** **75.0** %
Water Table Deep: **6.0** **67.0** %
Water Table Shallow: **6.0** **67.0** %
Erodibility: **Severe** **75.0** %
7.4 Comments:

Jam potential is due to a few big meanders, and a bridge. Not enough visible meanders to measure meander width. Road encroachment is high for this reach and rip rap occurs where the stream is close to the road. Bedrock grade control provides a stabilizing force.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover:
Current Dominant Land Cover: **Forest** **87.0** %
Current Sub-Dominant Land Cover: **Urban**
4.2 Corridor
Historic Land Cover::
Current Dominant Land Cover: **Urban** **39.0** %
Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**51-100**
Sub-dominant:	**0-25**	**0-25**
Length w / less than 25 ft.:	**0.0** ft.	**464.0** ft.

4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old): **No Data**
Type: **None**
Use:
5.2 Bridges and Culverts: **1** **29.1** %
5.3 Bank Armoring: **541.2** **39.4** %
Left: **206.5** ft. Right: **334.7** ft.
5.4 Channel Straightening: **1,368.1** **99.6** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **1,373.5** ft. **100.0**

	One Side	Both Sides
Road:	**1,373.5** ft.	**0.0** ft.
Railroad:	**0.0** ft.	**0.0** ft.
Berm:	**0.0** ft.	**0.0** ft.
Improved Path:	**524.5** ft.	**0.0** ft.

6.2 Development: **439.7** ft. **0.0** ft.
6.3 Channel Bars: **Multiple**
6.4 Meander Migration: **Multiple**
6.5 Meander Width: **N/A** Rato: **0.0**
6.6 Wavelength: **N/A** Ratio: **0.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **0** ft
7.2 Bank Height: **No Data** ft
7.3 Ice/Debris Jam Potential: **Bridge**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1 Low	2 High	2 High	0 N.S.	2 High	2 High	2 High	0 N.S.	2 High	2 High	1 Low	0 N.S.	0 N/A	0 N/A	0 N.S.	1 Low	17

Wells River

Phase 1 - Reach Summary Report

Basin: **Waits, Ompompanosuc, Stevens, Wells**
Stream Name: **Wells River**
Topo Maps: **GROTON**
Watershed:
Sub-watershed:

Reach ID: **M22**
SGAT Version: **4.56**
Date Last Edited: **July, 17 2016**
QA Status: **Step 7 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location

1.1 Reach Description: **Beginning approximately 3560 feet upstream of Coal Kiln Road (crossing?), where valley widens somewhat, and continuing approximately 7300 feet to just downstream of Ricker Pond.**

1.2 Towns: **Groton**

1.3 Downstream Latitude: **44.2249139221**

1.3 Downstream Longitude: **-72.2275831003**

Step 2. Stream Type

2.1 Elevation Upstream: **1,050**
2.1 Elevation Downstream: **920**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **6,763.0** ft. **1.28** Miles
2.3 Valley Slope: **1.9**
2.4 Channel Length: **7,713.0** ft. **1.46** Miles
2.5 Channel Slope: **1.69 %**
2.6 Sinuosity: **1.14**
2.7 Watershed Area: **23.9** Square Miles
2.8 Channel Width: **53.0** feet
2.9 Valley Width: **300.0** feet
2.10 Confinement Ratio: **5.7**
2.10 Confinement Type: **Narrow**
2.11 Reference Stream Type: **C**
Bedform: **Plane Bed**
Sub-Class Slope: **b**
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **Ledge**
3.3 Dominant Geological Mat.: **Ice-Contact** **34.0** %
3.3 Sub-dom. Geological Mat.: **Alluvial**
3.4 Valley Slope Left: **Very Steep**
3.4 Valley Slope Right: **Ext. Steep**
3.5 Soils
Hydrologic Group: **C** **51.0** %
Flooding: **None/Rare** **70.0** %
Water Table Deep: **6.0** **38.0** %
Water Table Shallow: **0.0** **39.0** %
Erodibility: **Severe** **61.0** %

7.4 Comments:
Jam potential is due to two bridges and multiple bends. There is some road encroachment and a small amount of development in this reach.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover:
Current Dominant Land Cover: **Forest** **87.0** %
Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor
Historic Land Cover::
Current Dominant Land Cover: **Forest** **57.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**None**	**0-25**
Length w / less than 25 ft.:	**146.0** ft.	**205.0** ft.

4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **Small Withdrawal**
Use: **Irrigation**
5.2 Bridges and Culverts: **2** **3.9** %
5.3 Bank Armoring: **998.1** **12.9** %
Left: **298.5** ft. Right: **699.6** ft.
5.4 Channel Straightening: **2,667.3** **34.6** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **3,313.6** ft. **43.0**

	One Side	Both Sides
Road:	**3,313.6** ft.	**0.0** ft.
Railroad:	**0.0** ft.	**0.0** ft.
Berm:	**0.0** ft.	**0.0** ft.
Improved Path:	**494.7** ft.	**0.0** ft.

6.2 Development: **1,205.5** ft. **0.0** ft.
6.3 Channel Bars: **Multiple**
6.4 Meander Migration: **Multiple**
6.5 Meander Width: **170 ft.** Rato: **3.2**
6.6 Wavelength: **531 ft.** Ratio: **10.0**

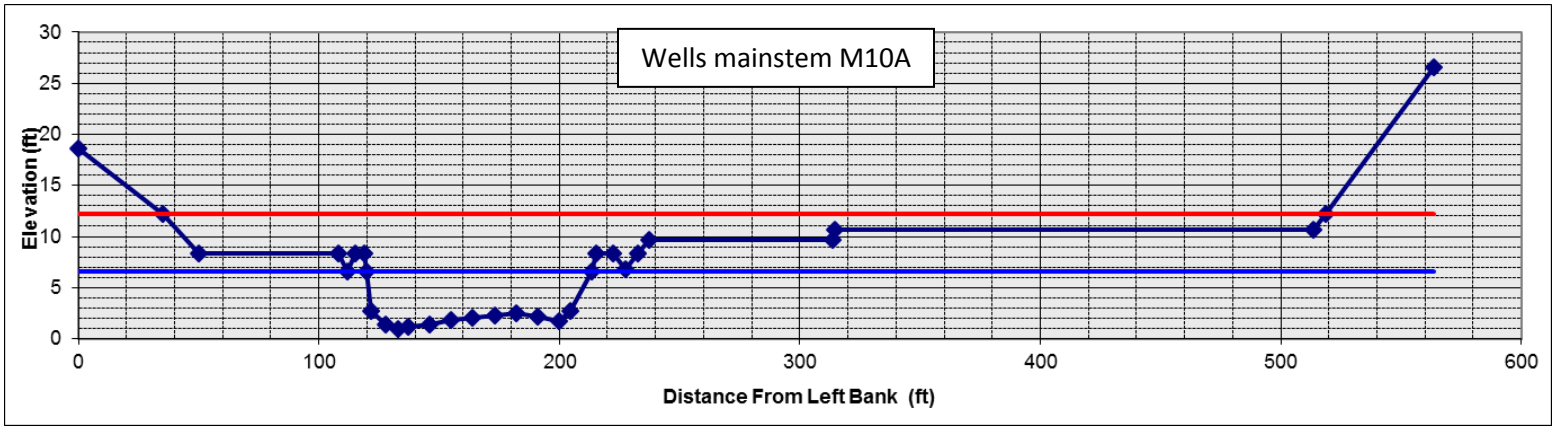
Step 7. Windshield Survey

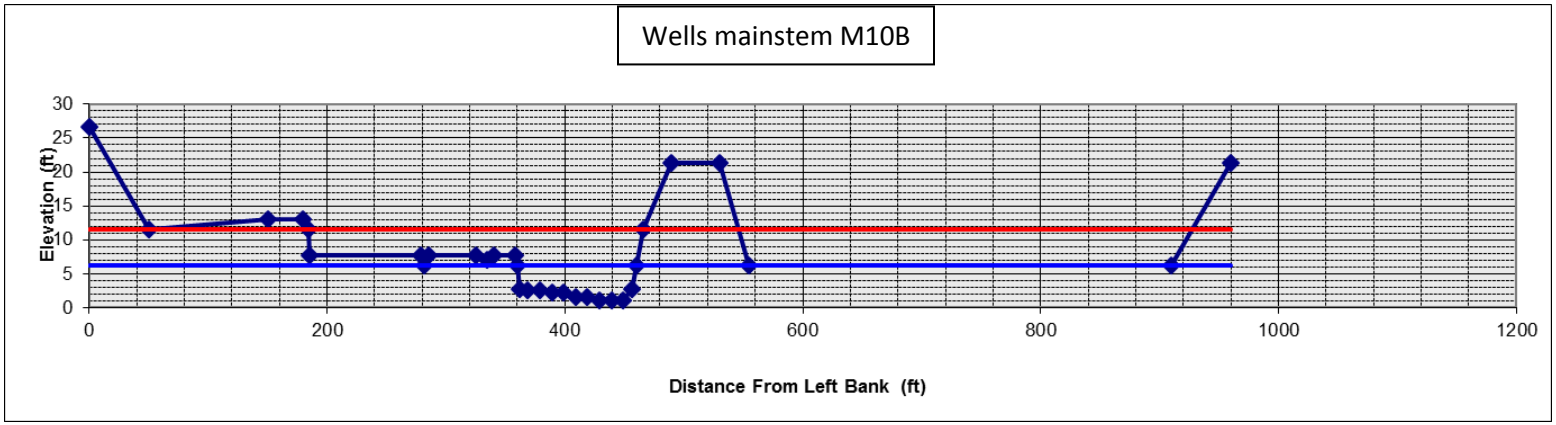
7.1 Bank Erosion: **0** ft
7.2 Bank Height: **No Data** ft
7.3 Ice/Debris Jam Potential: **Multiple**

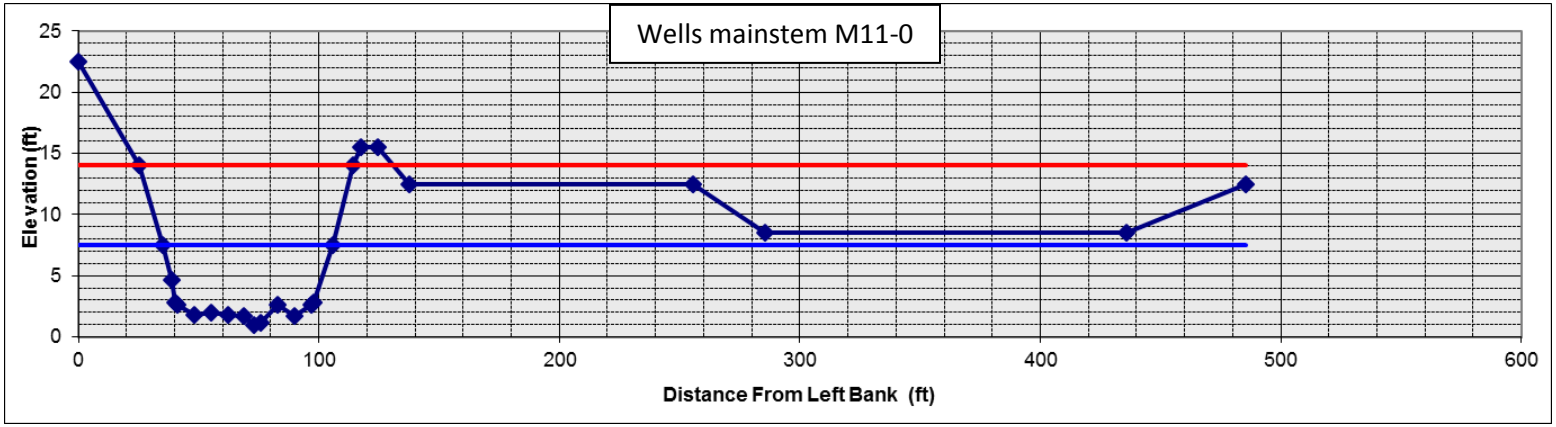
4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1 Low	2 High	0 N.S.	1 Low	0 N.S.	1 Low	2 High	0 N.S.	2 High	1 Low	2 High	0 N.S.	1 Low	0 N.S.	0 N.S.	2 High	15

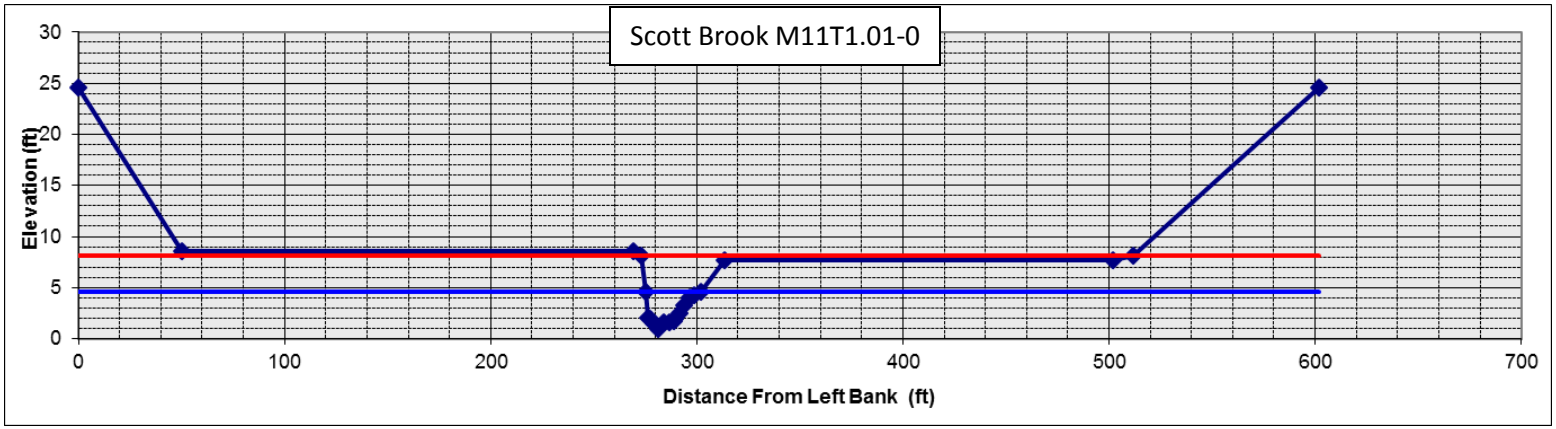
– Appendix 4 –

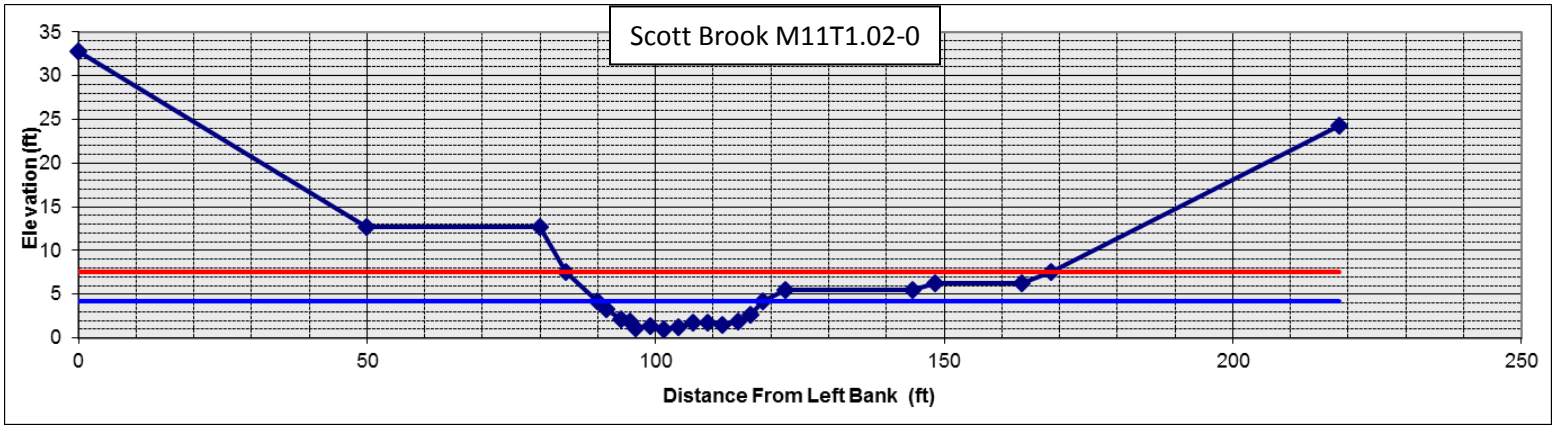
Phase II Cross-section data

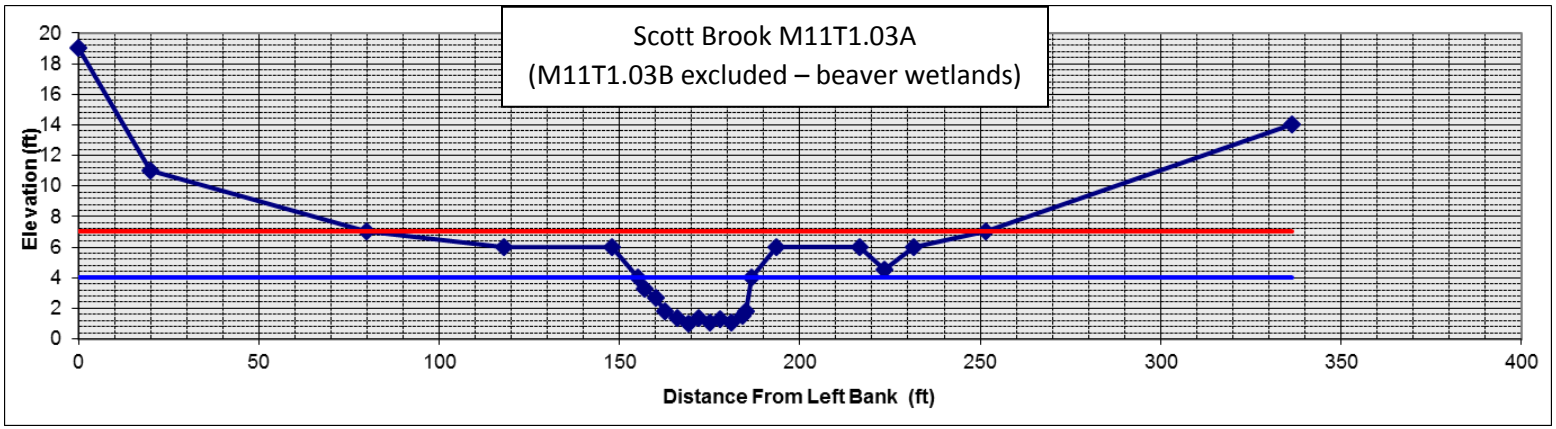

Wells mainstem M10A
Elevation (ft)
30
25
20
15
10
5
0
0
100
200
300
400
500
600
Distance From Left Bank (ft)

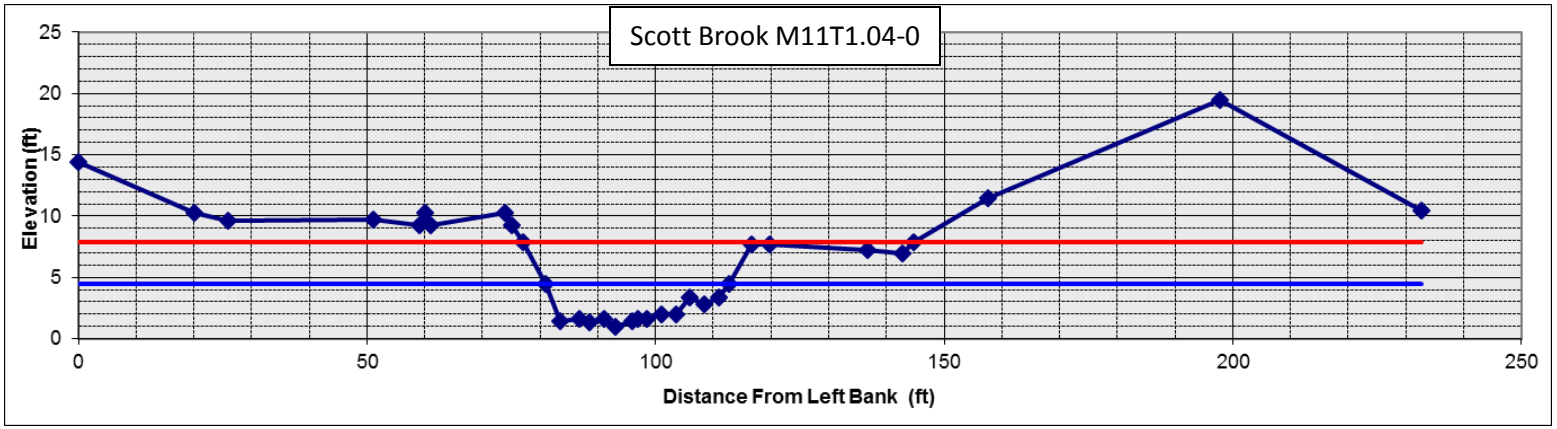

Wells mainstem M10B
Elevation (ft)
30
25
20
15
10
5
0
0
200
400
600
800
1000
1200
Distance From Left Bank (ft)

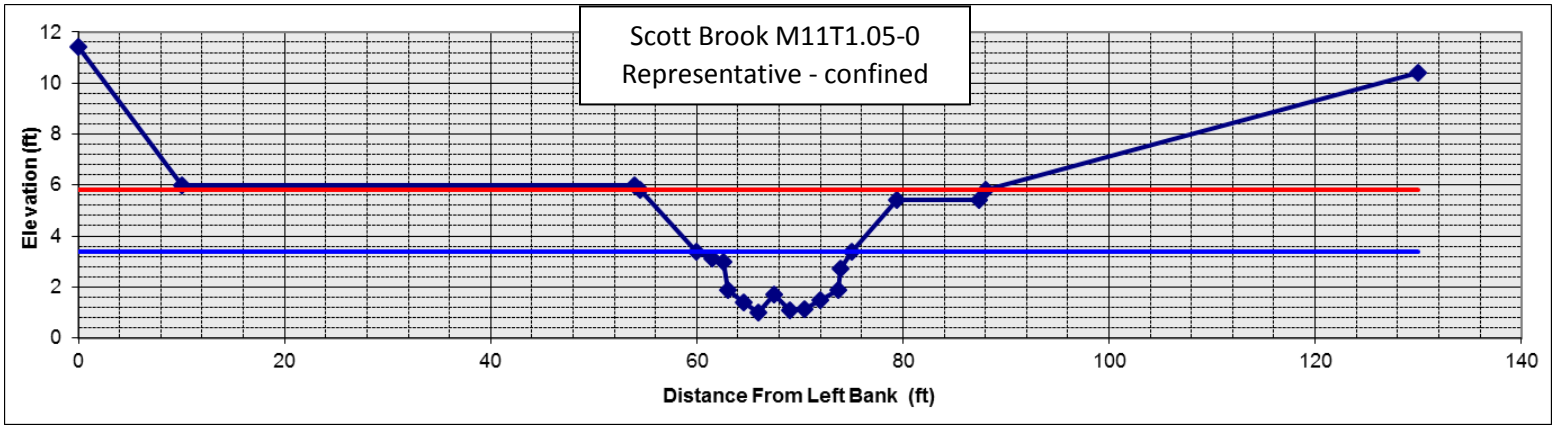

Wells mainstem M11-0
Elevation (ft)
25
20
15
10
5
0
0
100
200
300
400
500
600
Distance From Left Bank (ft)

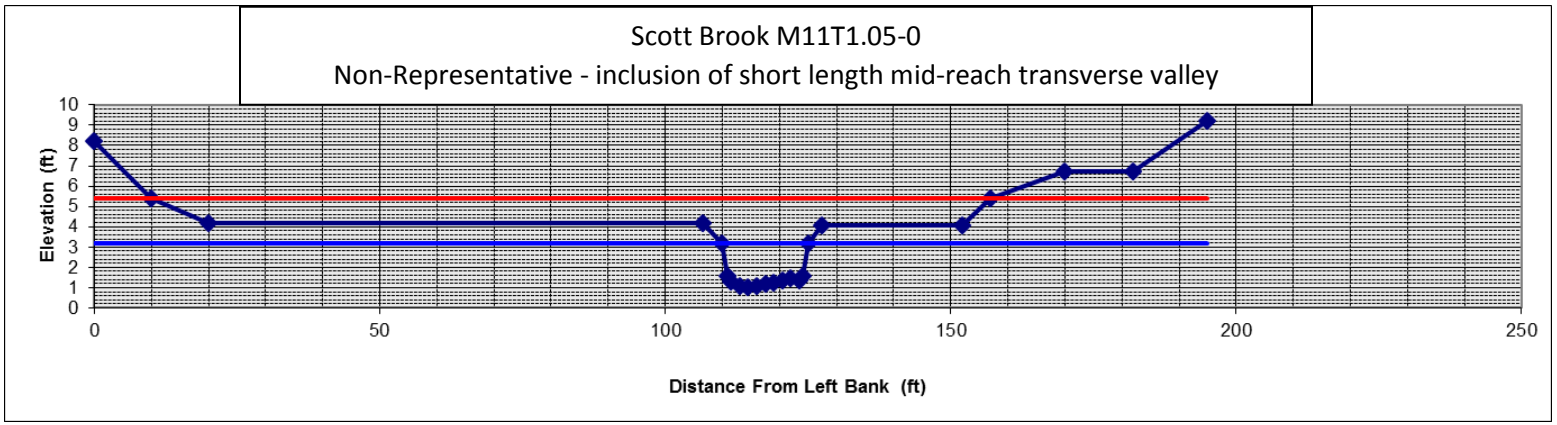

Scott Brook M11T1.01-0
Elevation (ft)
30
25
20
15
10
5
0
0
100
200
300
400
500
600
700
Distance From Left Bank (ft)

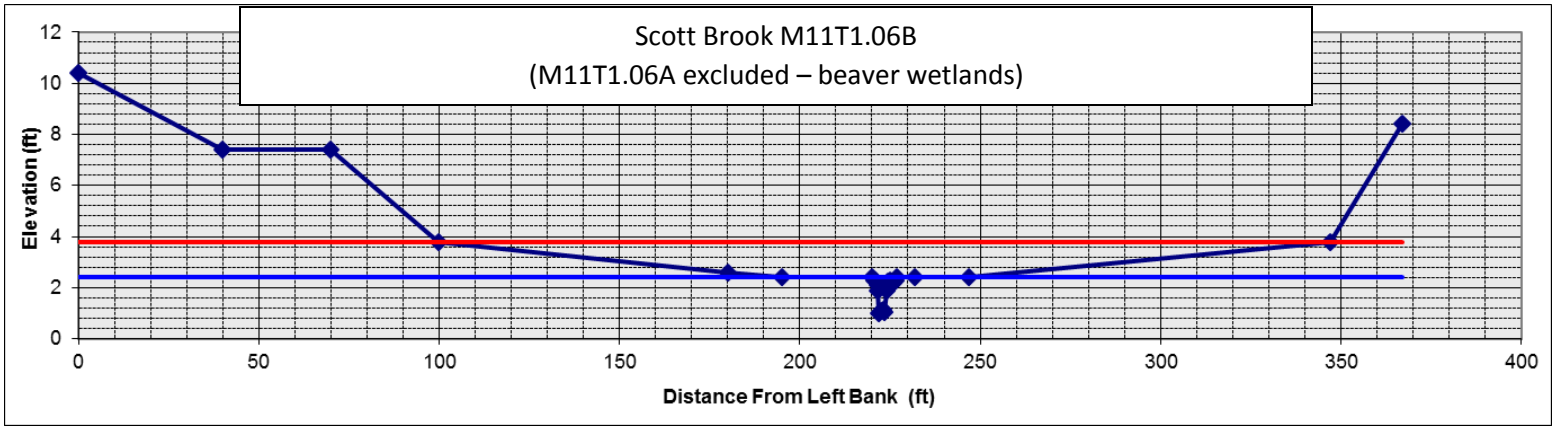

Scott Brook M11T1.02-0
Elevation (ft)
35
30
25
20
15
10
5
0
0
50
100
150
200
250
Distance From Left Bank (ft)

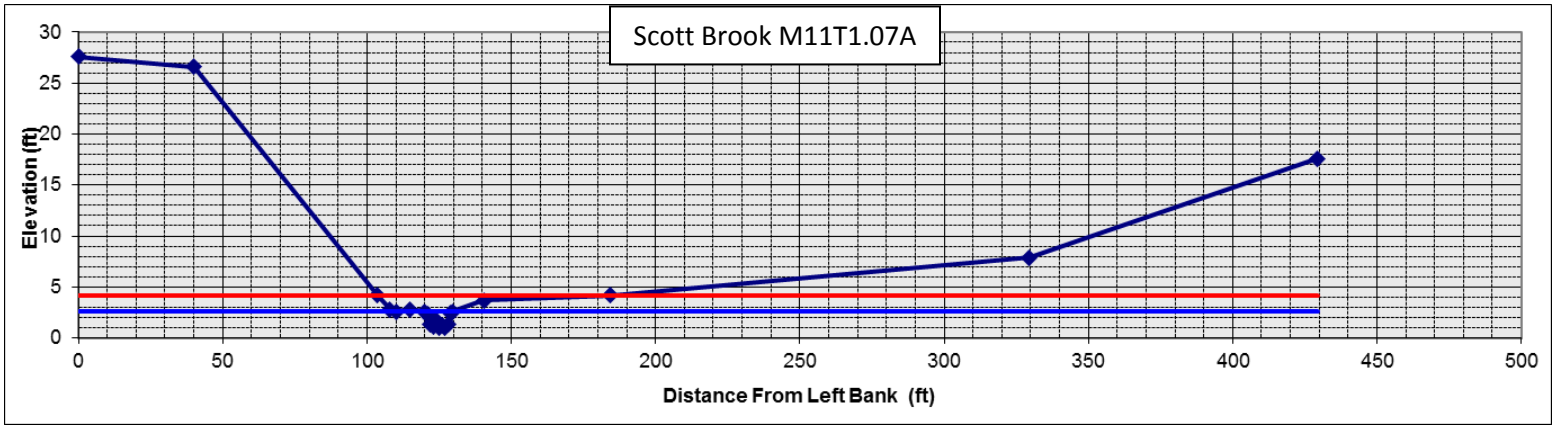

Scott Brook M11T1.03A
(M11T1.03B excluded – beaver wetlands)
Elevation (ft)
20
18
16
14
12
10
8
6
4
2
0
0
50
100
150
200
250
300
350
400
Distance From Left Bank (ft)

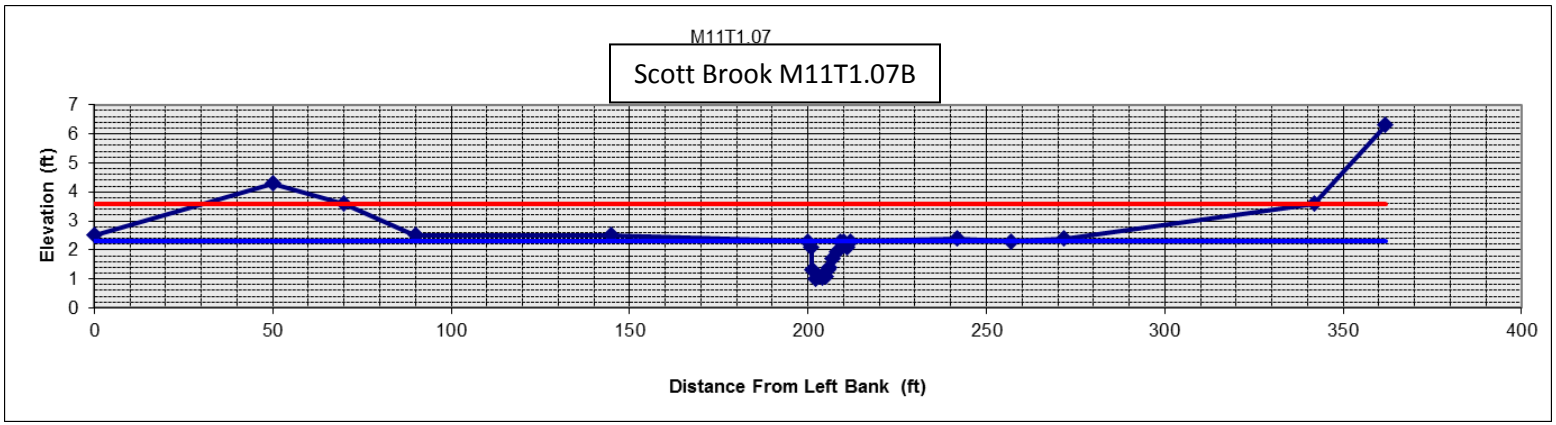

Scott Brook M11T1.04-0
Elevation (ft)
25
20
15
10
5
0
0
50
100
150
200
250
Distance From Left Bank (ft)

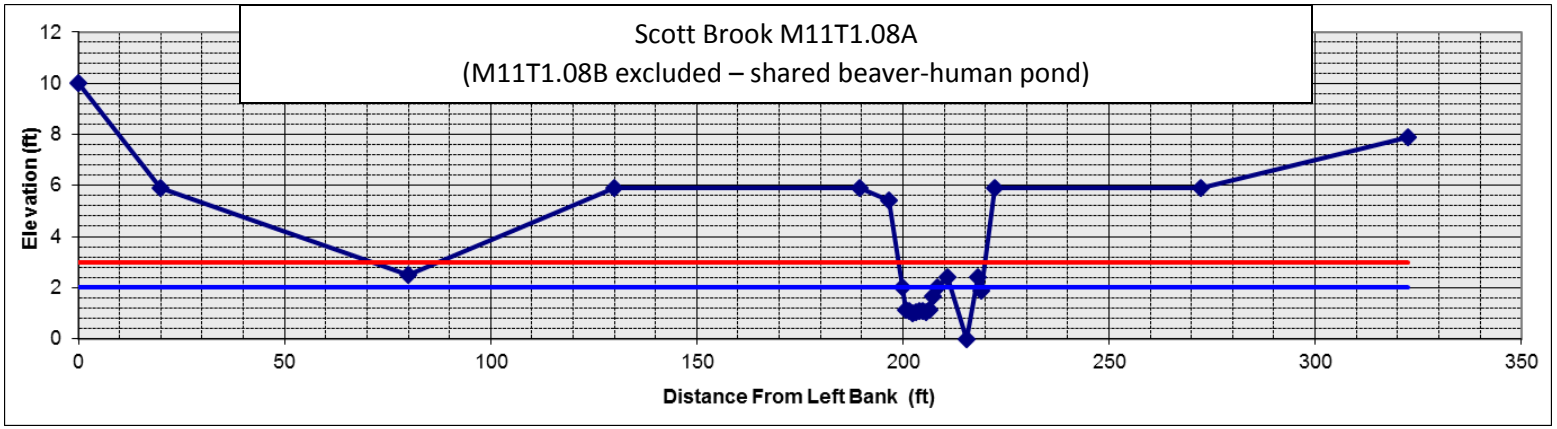

Scott Brook M11T1.05-0
Representative - confined
Elevation (ft)
12
10
8
6
4
2
0
0
20
40
60
80
100
120
140
Distance From Left Bank (ft)

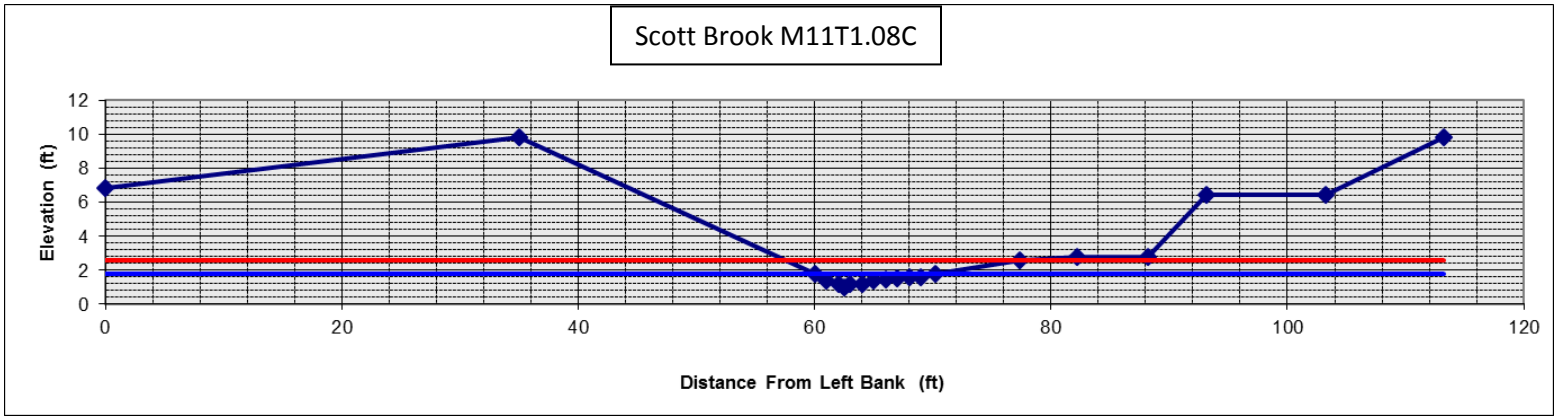

Scott Brook M11T1.05-0
Non-Representative - inclusion of short length mid-reach transverse valley
Elevation (ft)
10
9
8
7
6
5
4
3
2
1
0
0
50
100
150
200
250
Distance From Left Bank (ft)

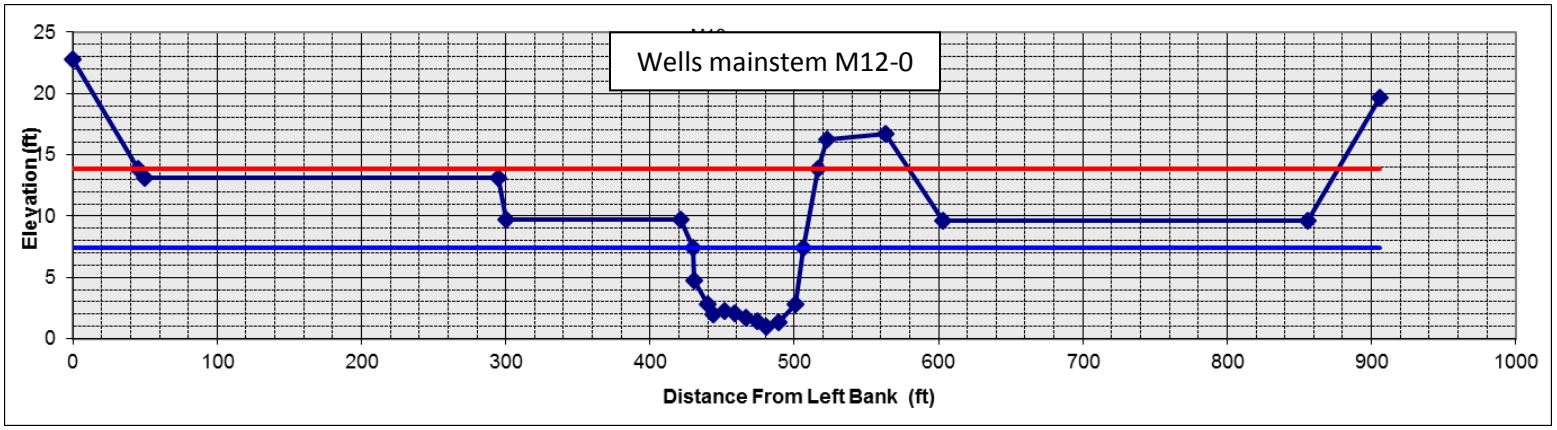

Scott Brook M11T1.06B
(M11T1.06A excluded – beaver wetlands)
Elevation (ft)
Distance From Left Bank (ft)

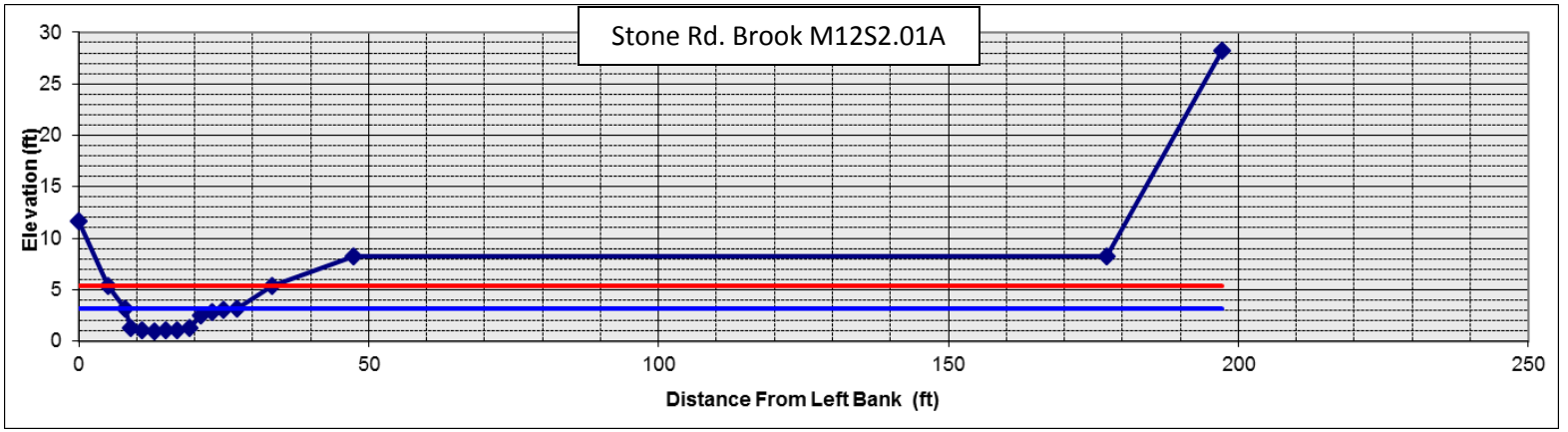

Scott Brook M11T1.07A
Elevation (ft)
Distance From Left Bank (ft)

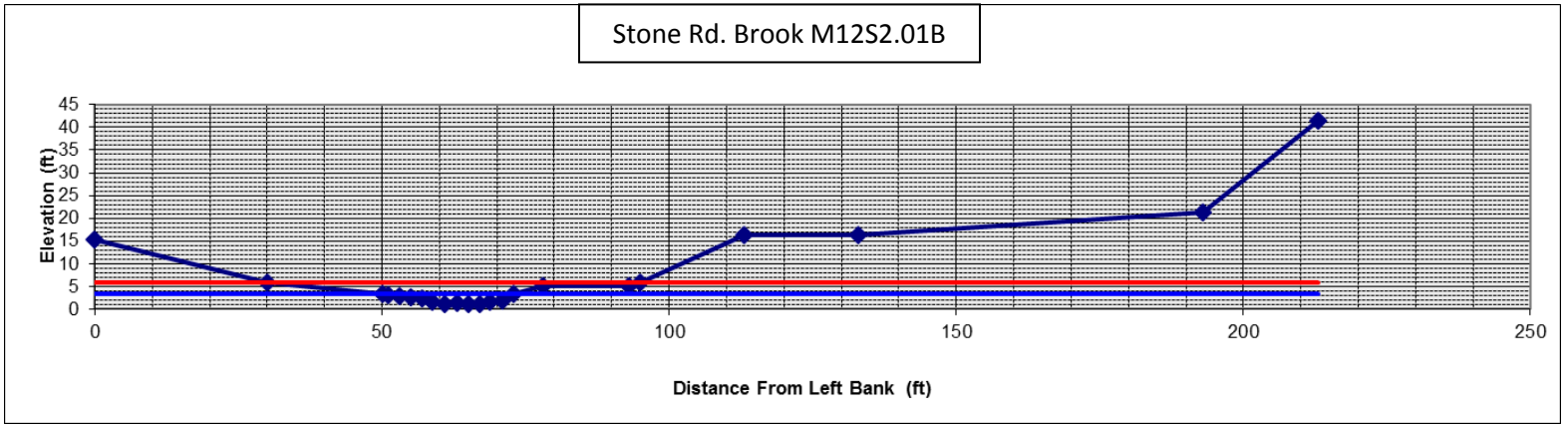

M11T1.07
Scott Brook M11T1.07B
Elevation (ft)
Distance From Left Bank (ft)

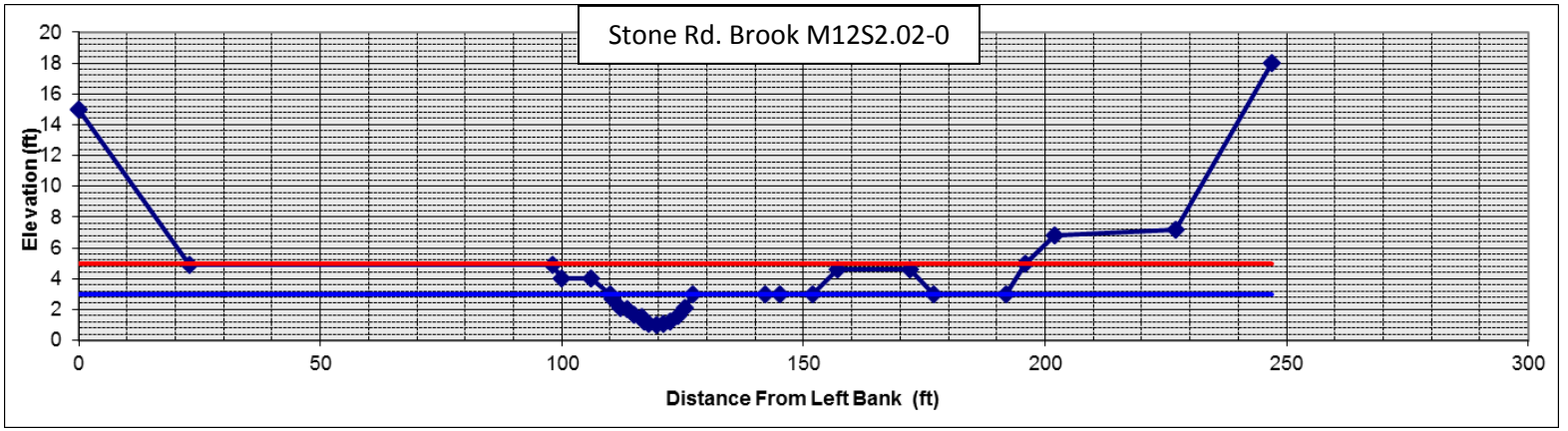

Scott Brook M11T1.08A
(M11T1.08B excluded – shared beaver-human pond)
Elevation (ft)
Distance From Left Bank (ft)

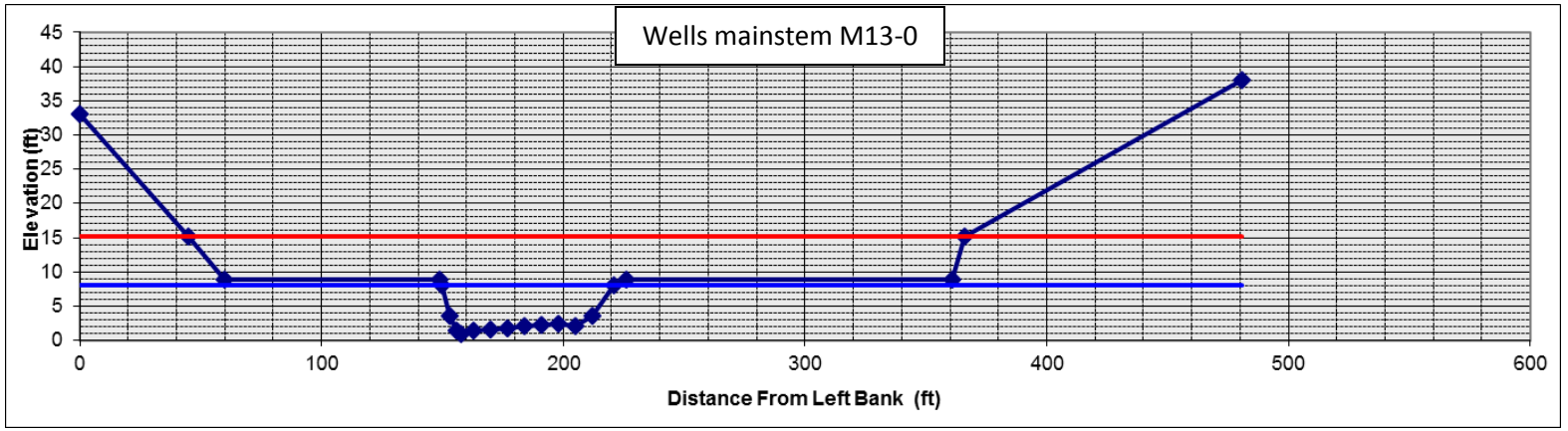

Scott Brook M11T1.08C
Elevation (ft)
Distance From Left Bank (ft)

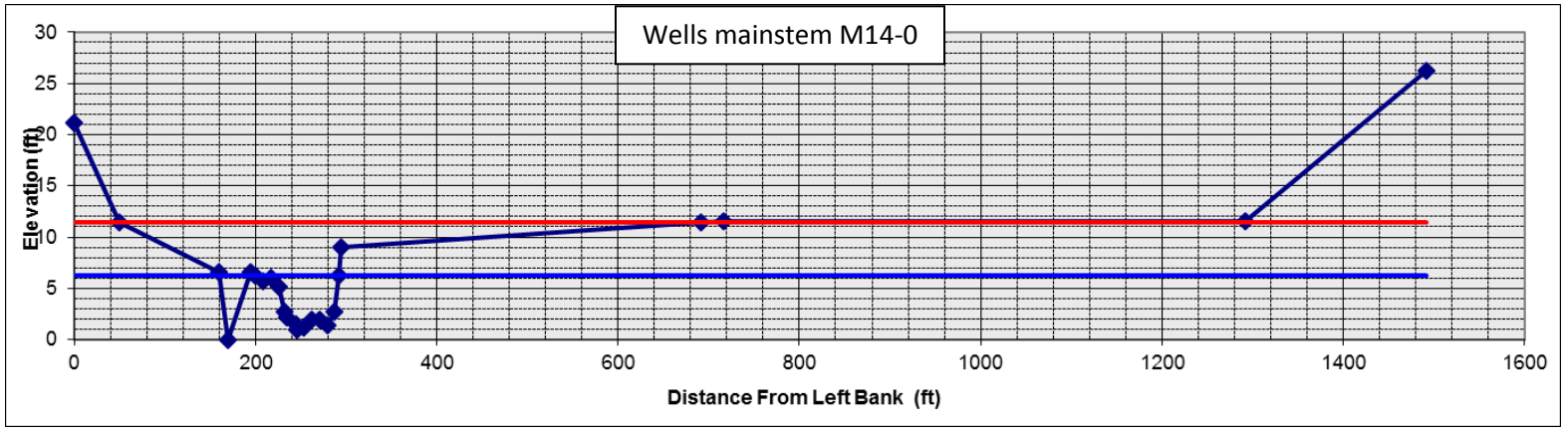

Wells mainstem M12-0
Elevation (ft)
Distance From Left Bank (ft)

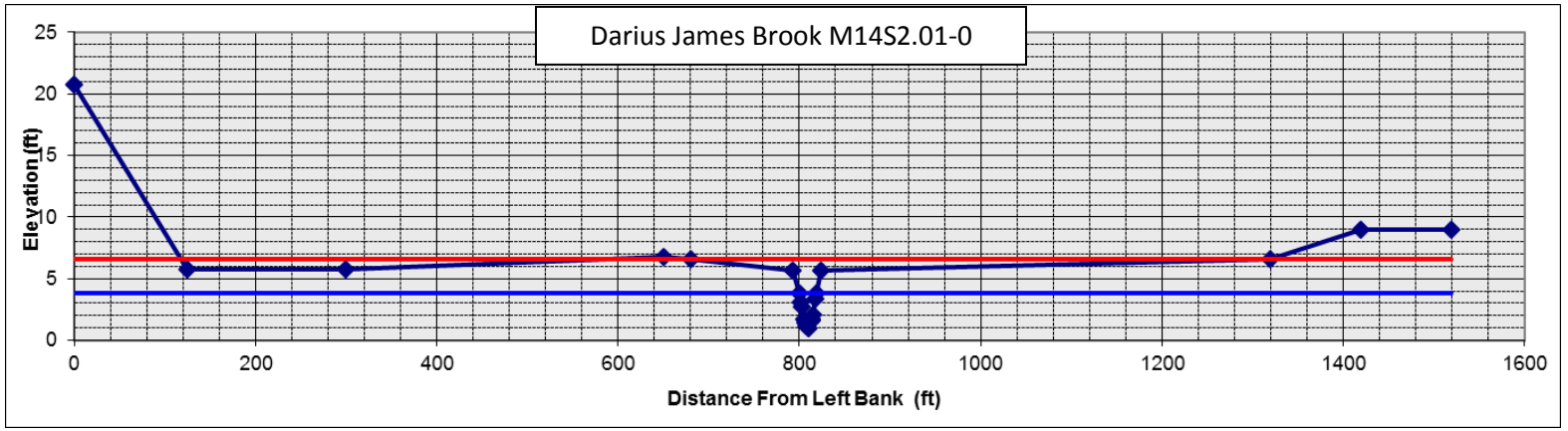

Stone Rd. Brook M12S2.01A
Elevation (ft)
Distance From Left Bank (ft)
0
5
10
15
20
25
30
0
50
100
150
200
250

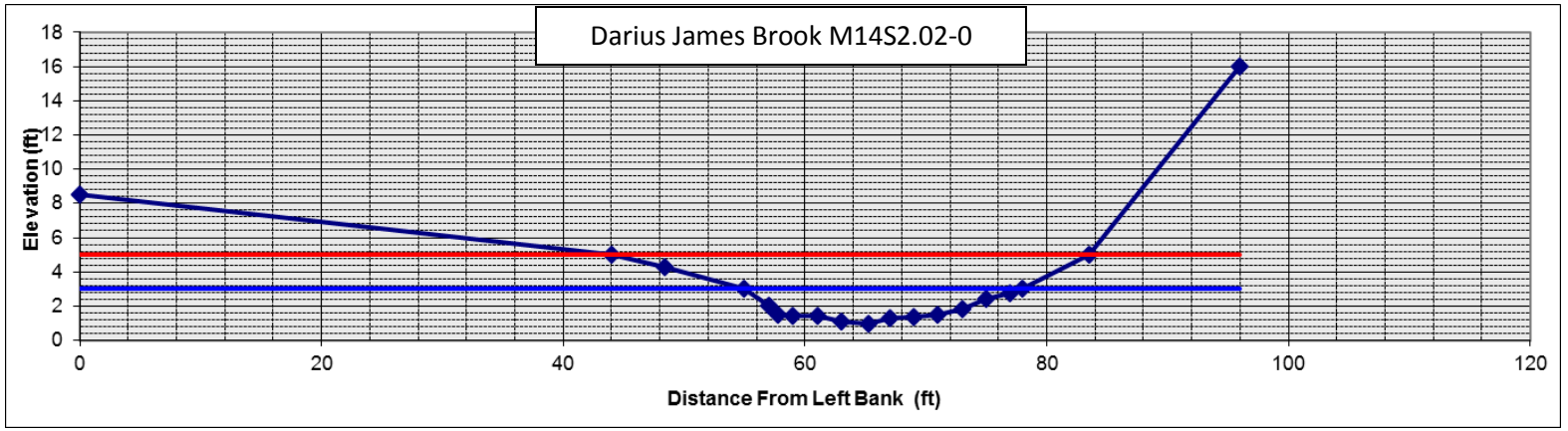

Stone Rd. Brook M12S2.01B
Elevation (ft)
Distance From Left Bank (ft)
0
5
10
15
20
25
30
35
40
45
0
50
100
150
200
250

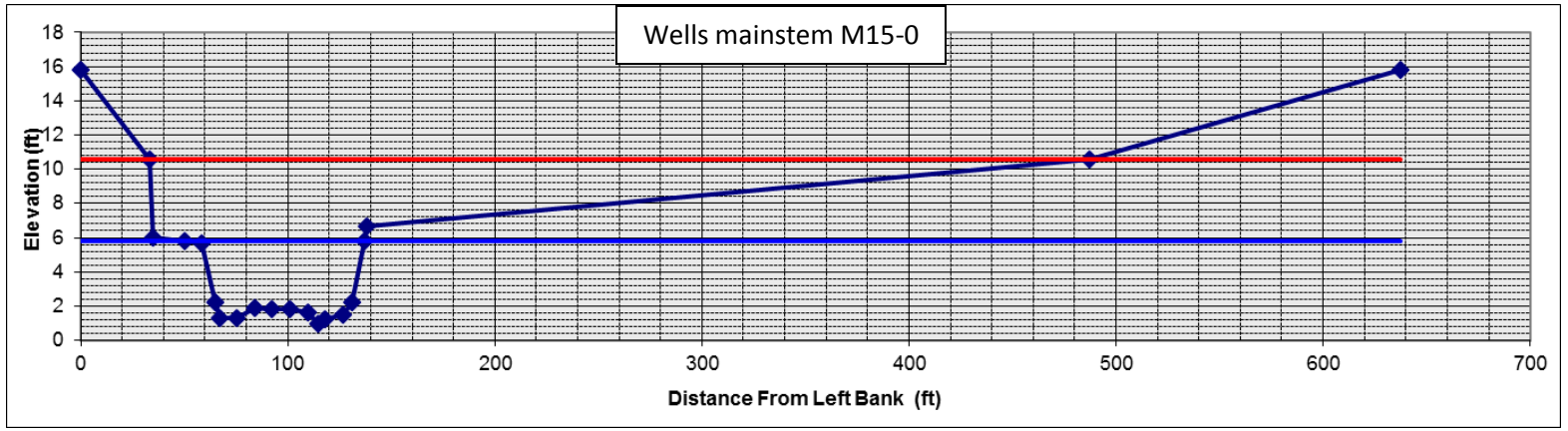

Stone Rd. Brook M12S2.02-0
Elevation (ft)
Distance From Left Bank (ft)
0
2
4
6
8
10
12
14
16
18
20
0
50
100
150
200
250
300

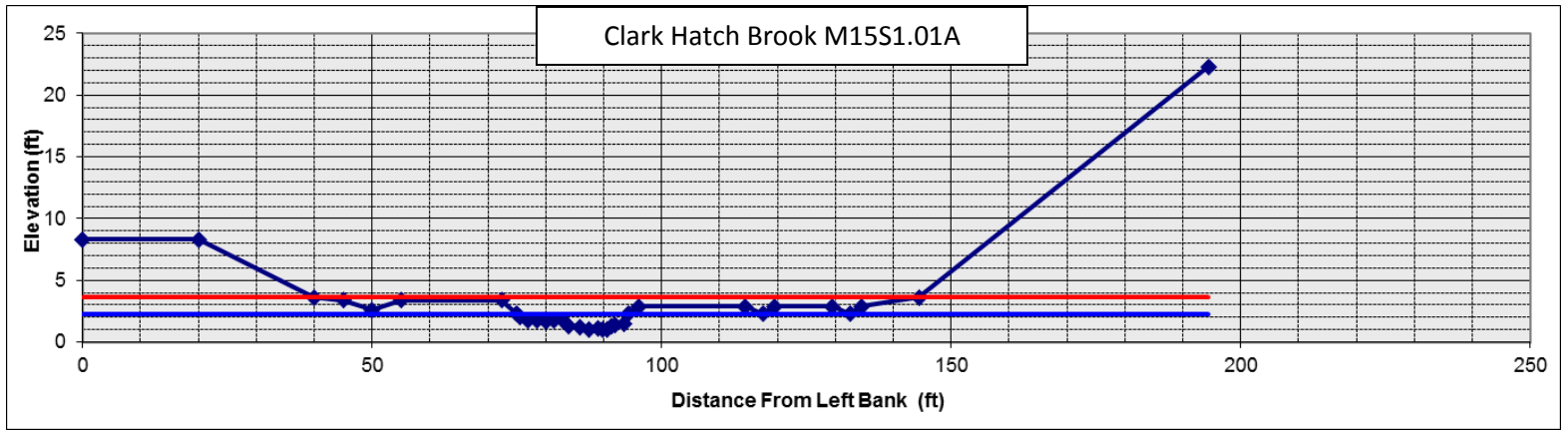

Wells mainstem M13-0
Elevation (ft)
0
5
10
15
20
25
30
35
40
45
0
100
200
300
400
500
600
Distance From Left Bank (ft)

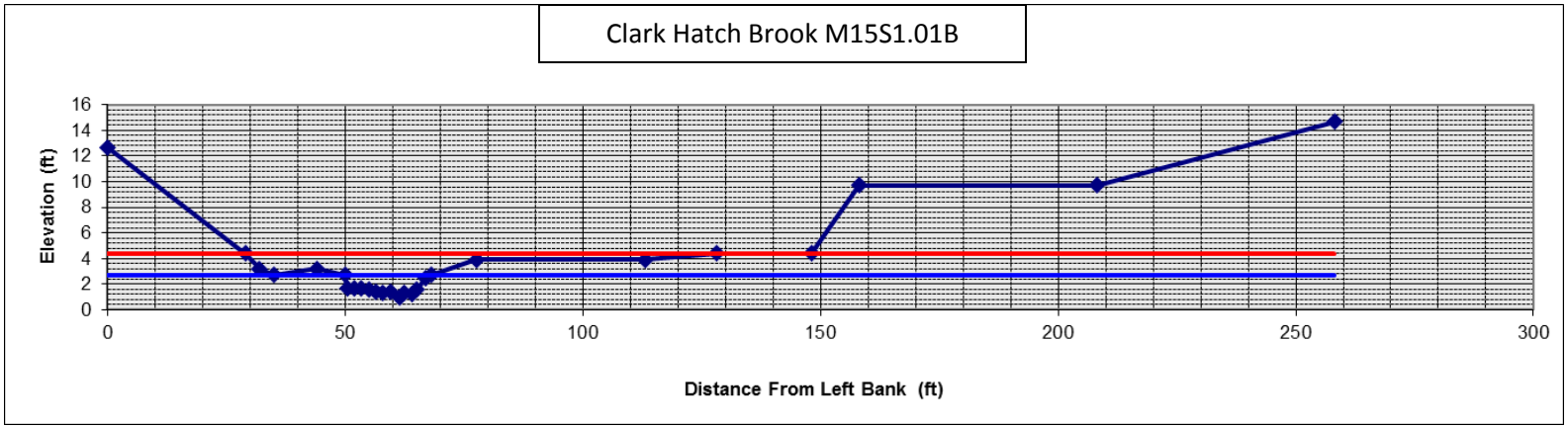

Wells mainstem M14-0
Elevation (ft)
0
5
10
15
20
25
30
0
200
400
600
800
1000
1200
1400
1600
Distance From Left Bank (ft)

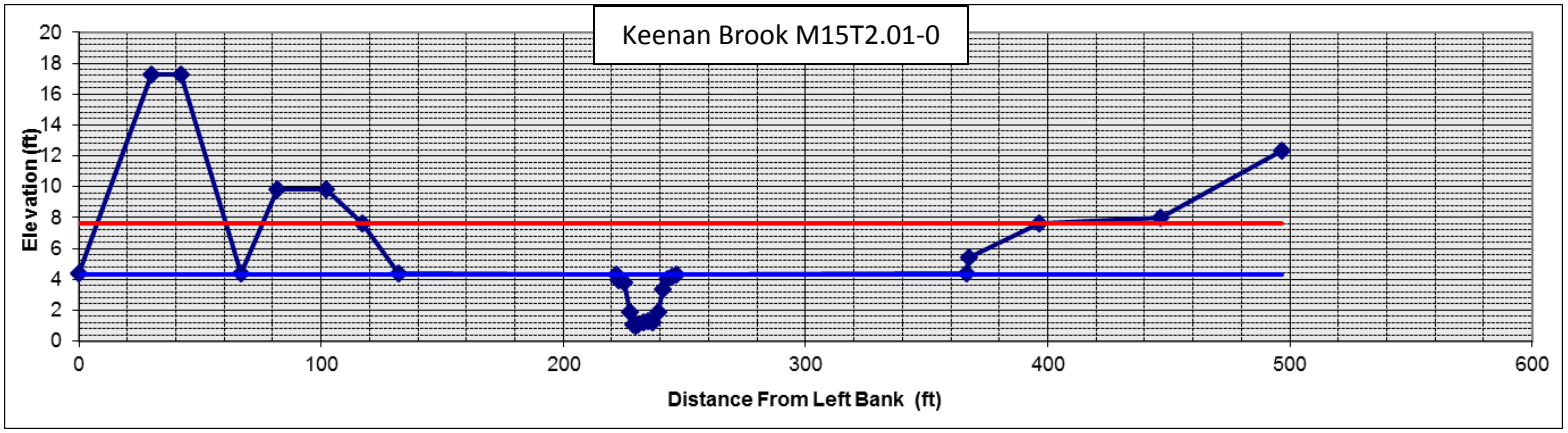

Darius James Brook M14S2.01-0
Elevation (ft)
0
5
10
15
20
25
0
200
400
600
800
1000
1200
1400
1600
Distance From Left Bank (ft)

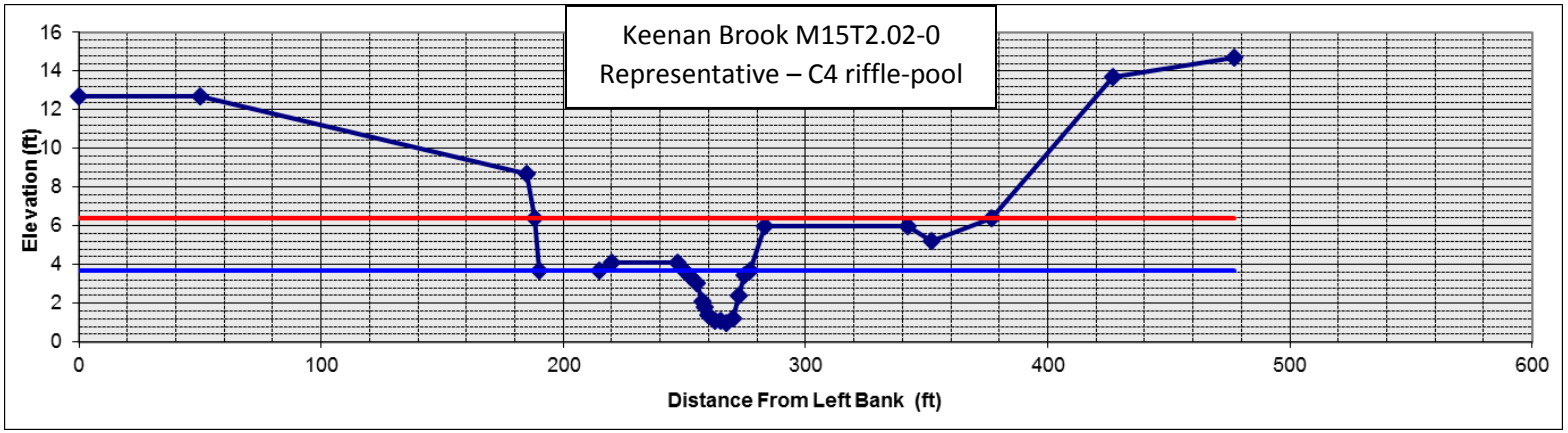

Darius James Brook M14S2.02-0
Elevation (ft)
0
2
4
6
8
10
12
14
16
18
0
20
40
60
80
100
120
Distance From Left Bank (ft)

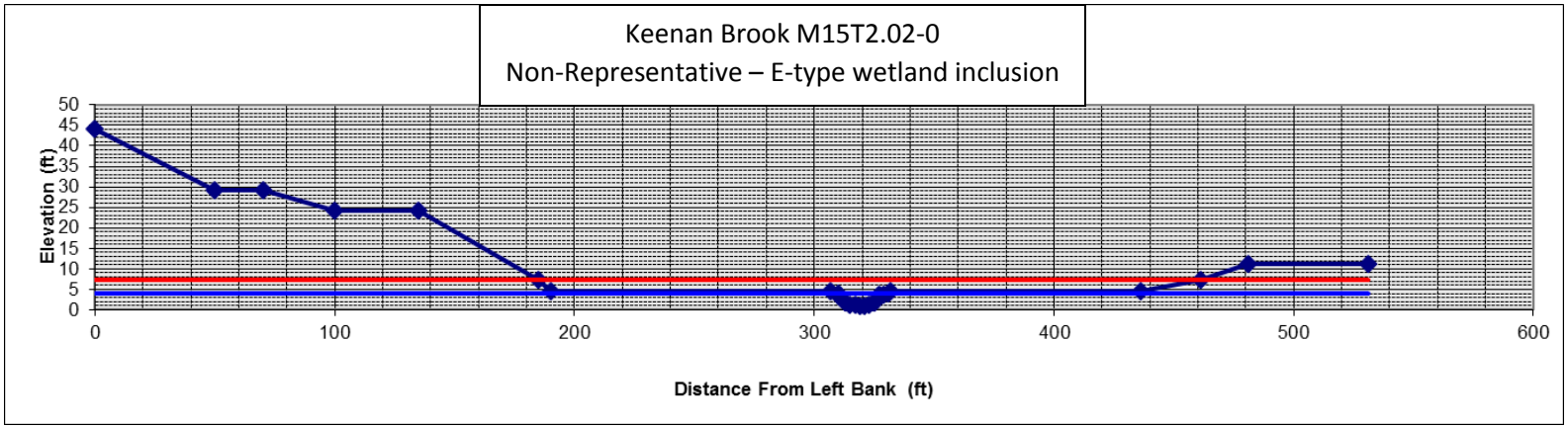

Wells mainstem M15-0
Elevation (ft)
0
2
4
6
8
10
12
14
16
18
0
100
200
300
400
500
600
700
Distance From Left Bank (ft)

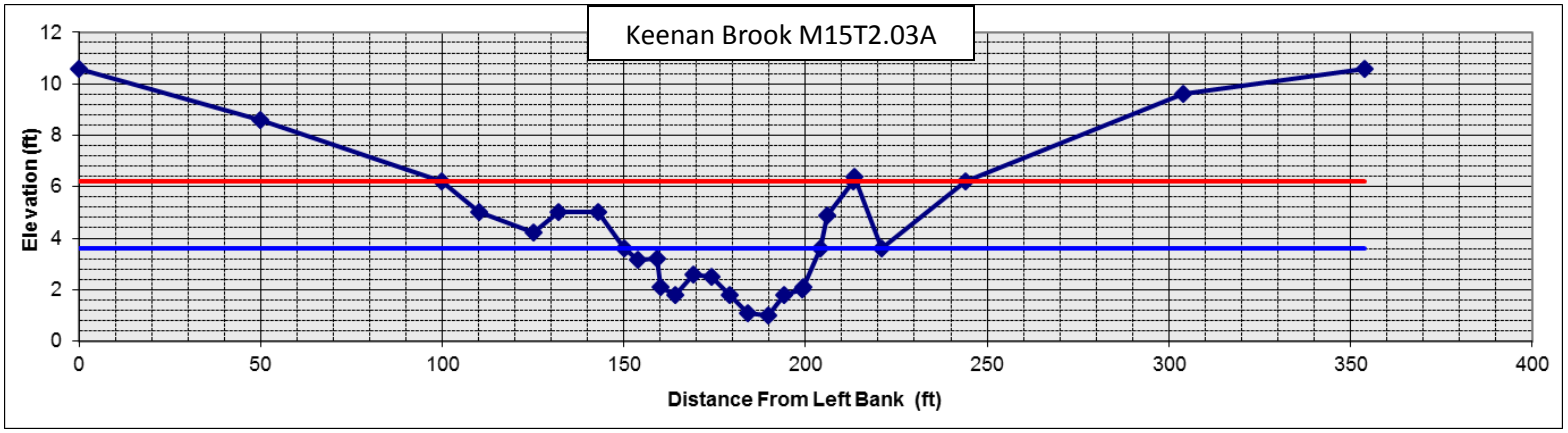

Clark Hatch Brook M15S1.01A
Elevation (ft)
0
5
10
15
20
25
0
50
100
150
200
250
Distance From Left Bank (ft)

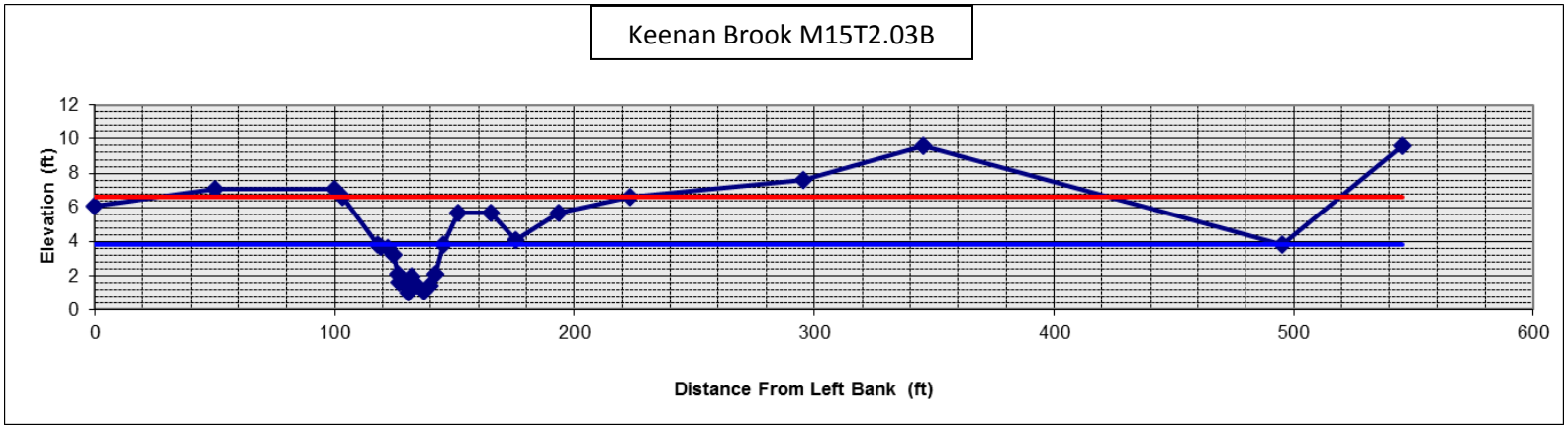

Clark Hatch Brook M15S1.01B
Elevation (ft)
0
2
4
6
8
10
12
14
16
0
50
100
150
200
250
300
Distance From Left Bank (ft)

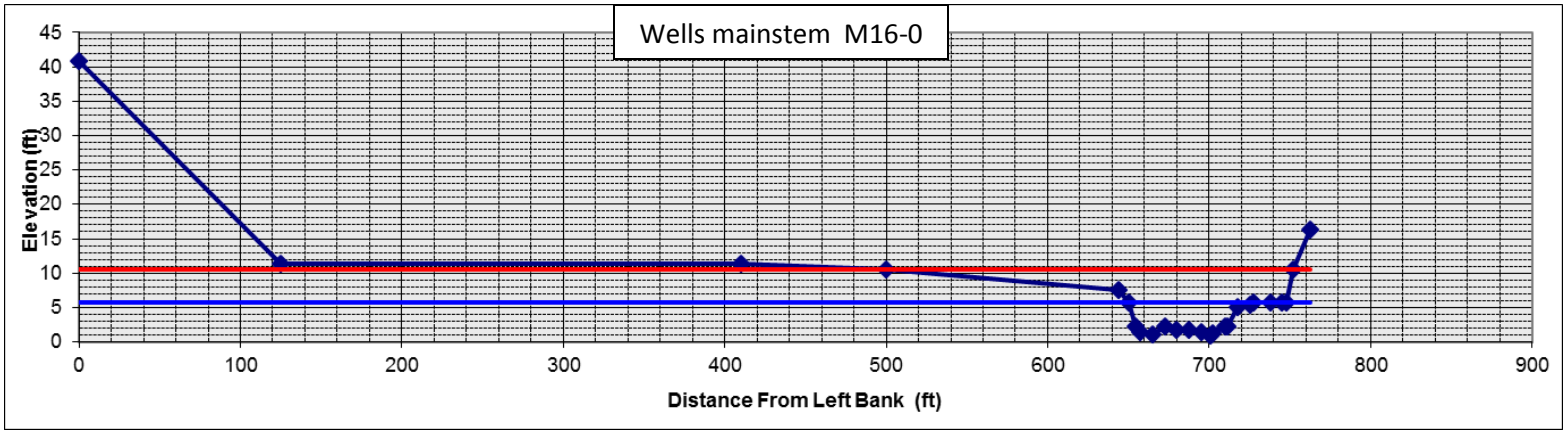

Keenan Brook M15T2.01-0
Elevation (ft)
0
2
4
6
8
10
12
14
16
18
20
0
100
200
300
400
500
600
Distance From Left Bank (ft)

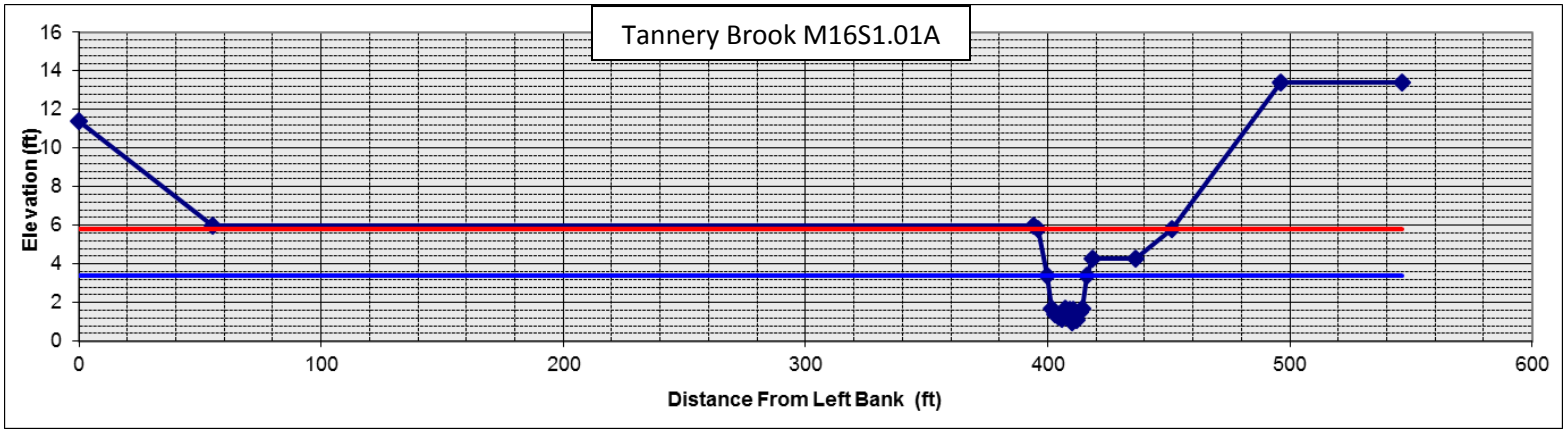

Keenan Brook M15T2.02-0
Representative – C4 riffle-pool
Elevation (ft)
0
2
4
6
8
10
12
14
16
0
100
200
300
400
500
600
Distance From Left Bank (ft)

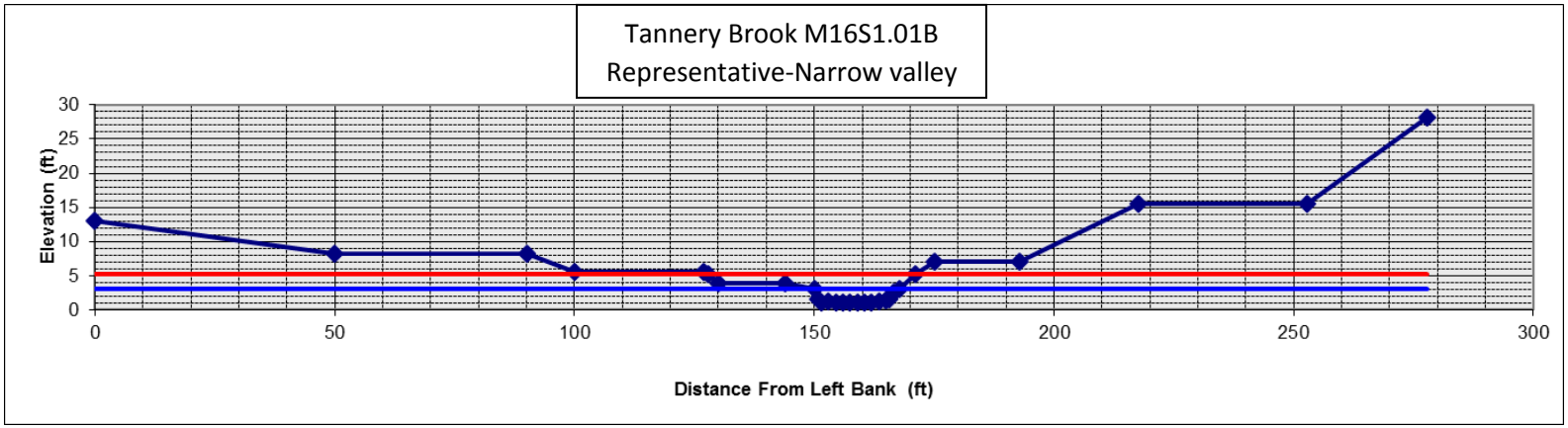

Keenan Brook M15T2.02-0
Non-Representative – E-type wetland inclusion
Elevation (ft)
0
5
10
15
20
25
30
35
40
45
50
0
100
200
300
400
500
600
Distance From Left Bank (ft)

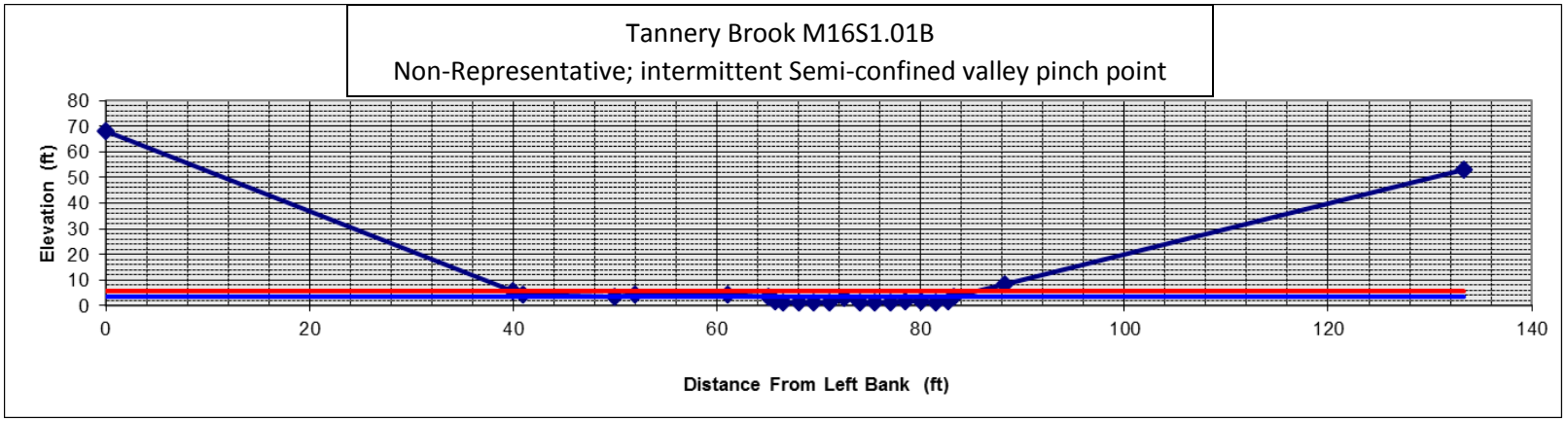

Keenan Brook M15T2.03A
Elevation (ft)
0
2
4
6
8
10
12
0
50
100
150
200
250
300
350
400
Distance From Left Bank (ft)

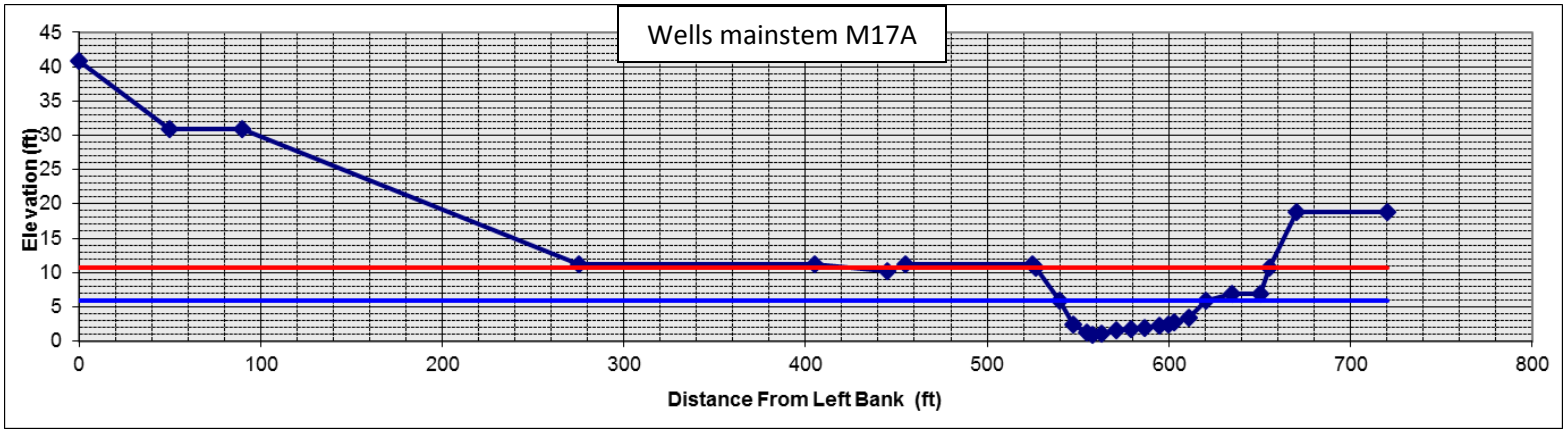

Keenan Brook M15T2.03B
Elevation (ft)
0
2
4
6
8
10
12
0
100
200
300
400
500
600
Distance From Left Bank (ft)

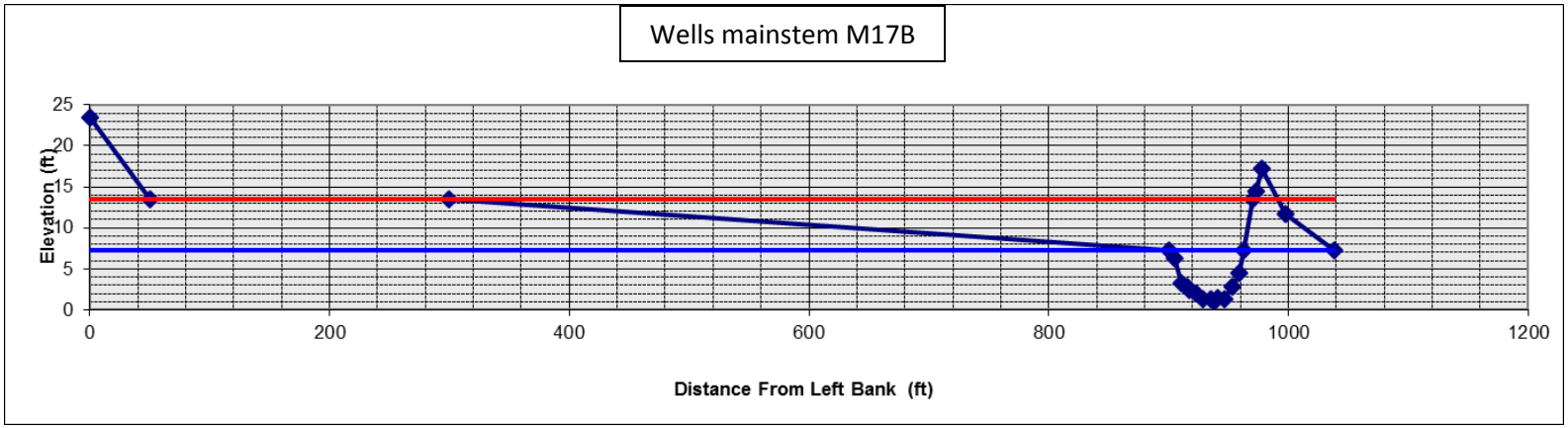

Wells mainstem M16-0
Elevation (ft)
45
40
35
30
25
20
15
10
5
0
0
100
200
300
400
500
600
700
800
900
Distance From Left Bank (ft)

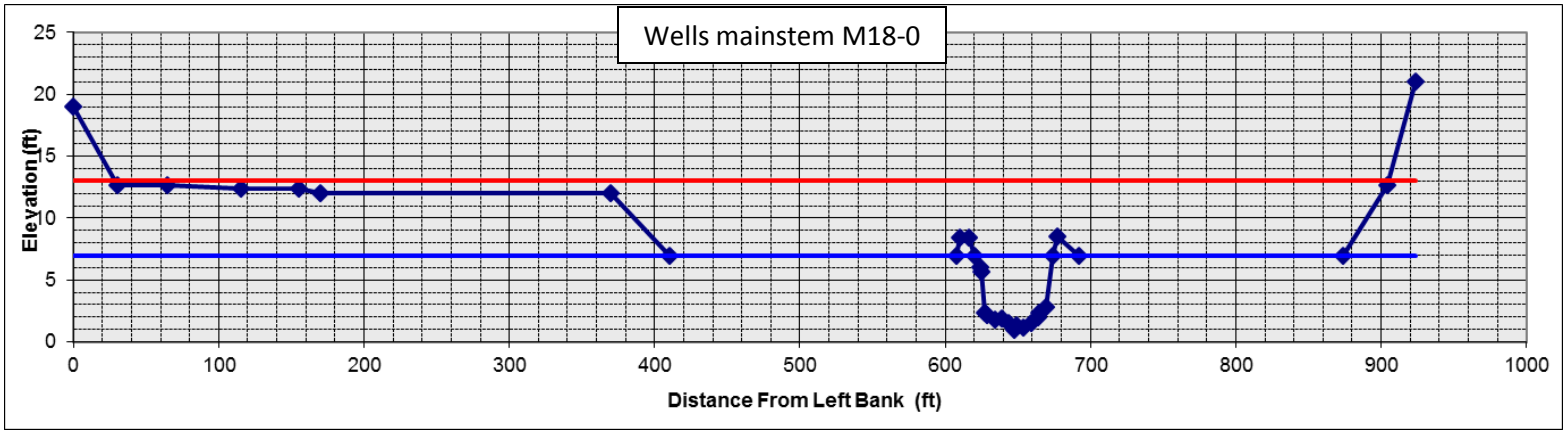

Tannery Brook M16S1.01A
Elevation (ft)
16
14
12
10
8
6
4
2
0
0
100
200
300
400
500
600
Distance From Left Bank (ft)

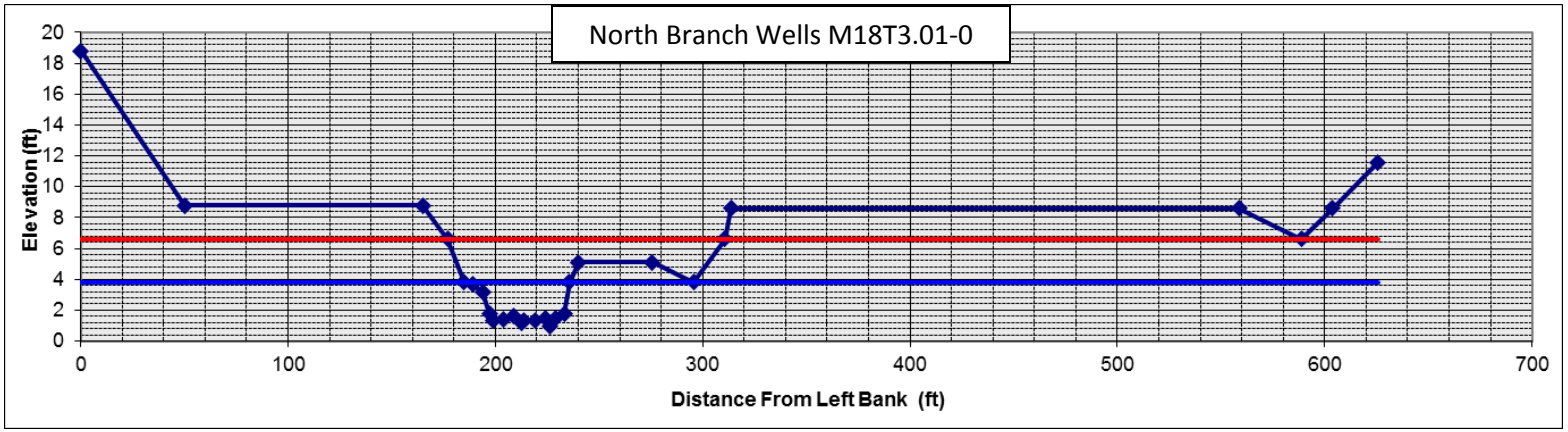

Tannery Brook M16S1.01B
Representative-Narrow valley
Elevation (ft)
30
25
20
15
10
5
0
0
50
100
150
200
250
300
Distance From Left Bank (ft)

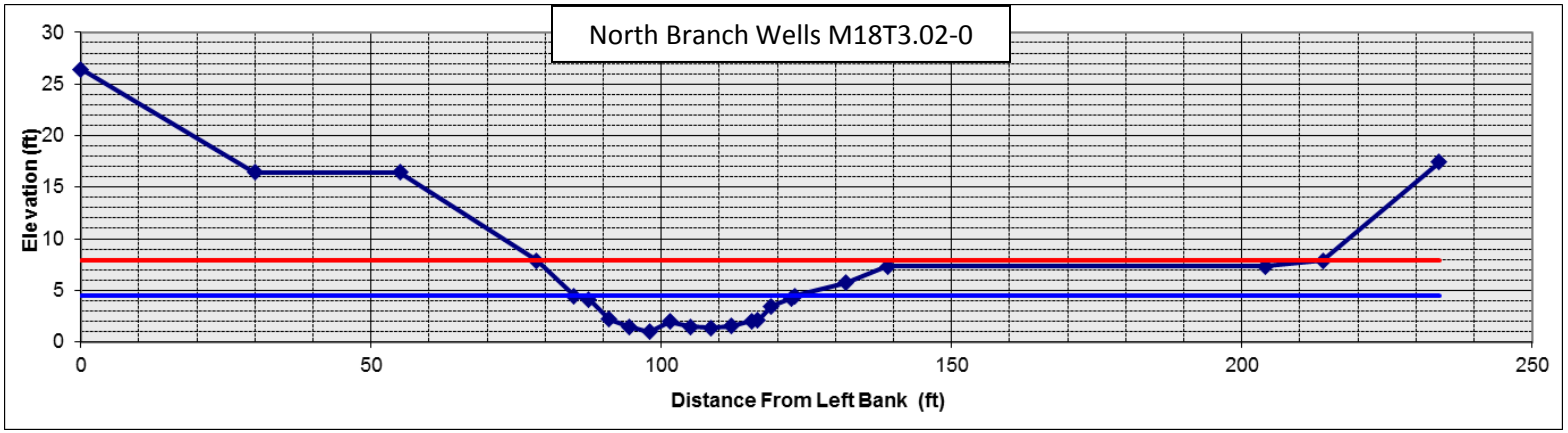

Tannery Brook M16S1.01B
Non-Representative; intermittent Semi-confined valley pinch point
Elevation (ft)
0
10
20
30
40
50
60
70
80
0
20
40
60
80
100
120
140
Distance From Left Bank (ft)

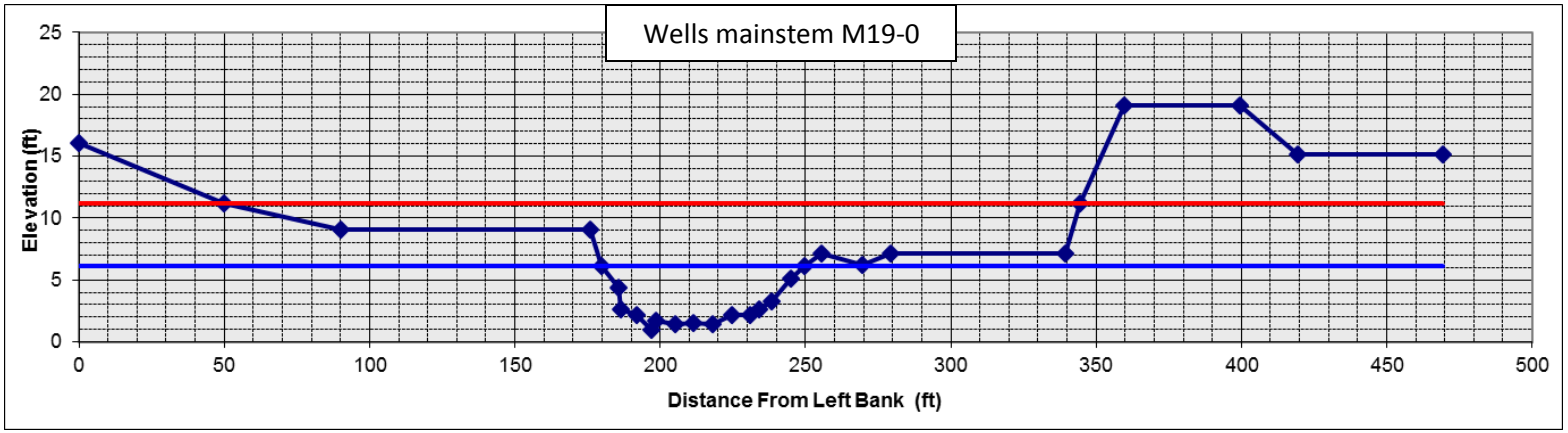

Wells mainstem M17A
Elevation (ft)
0
5
10
15
20
25
30
35
40
45
0
100
200
300
400
500
600
700
800
Distance From Left Bank (ft)

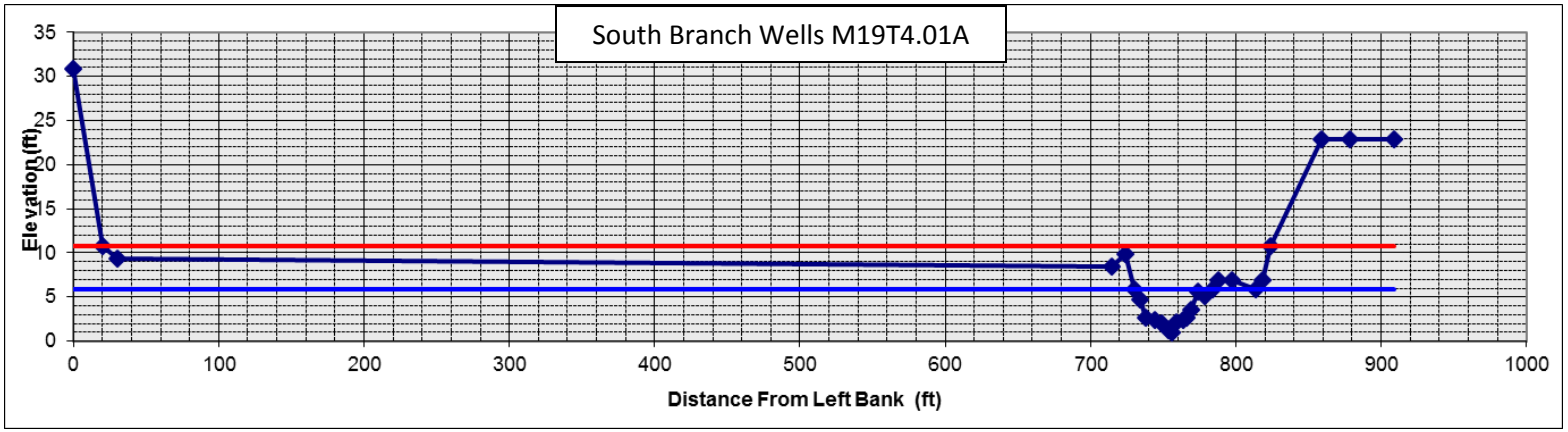

Wells mainstem M17B
Elevation (ft)
0
5
10
15
20
25
0
200
400
600
800
1000
1200
Distance From Left Bank (ft)

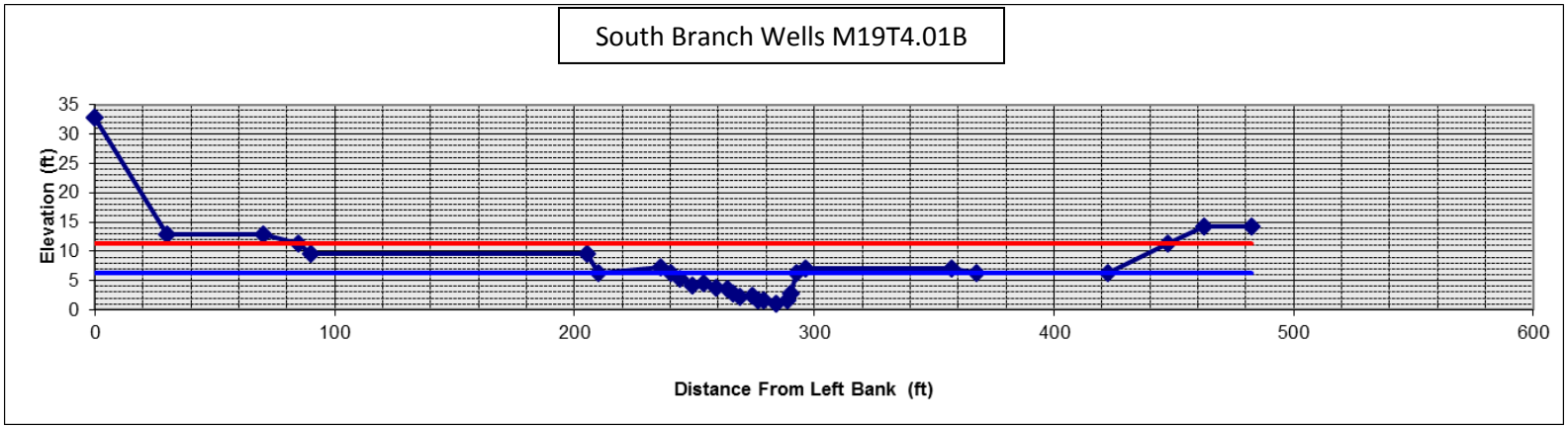

Wells mainstem M18-0
Elevation (ft)
Distance From Left Bank (ft)
0
5
10
15
20
25
0
100
200
300
400
500
600
700
800
900
1000

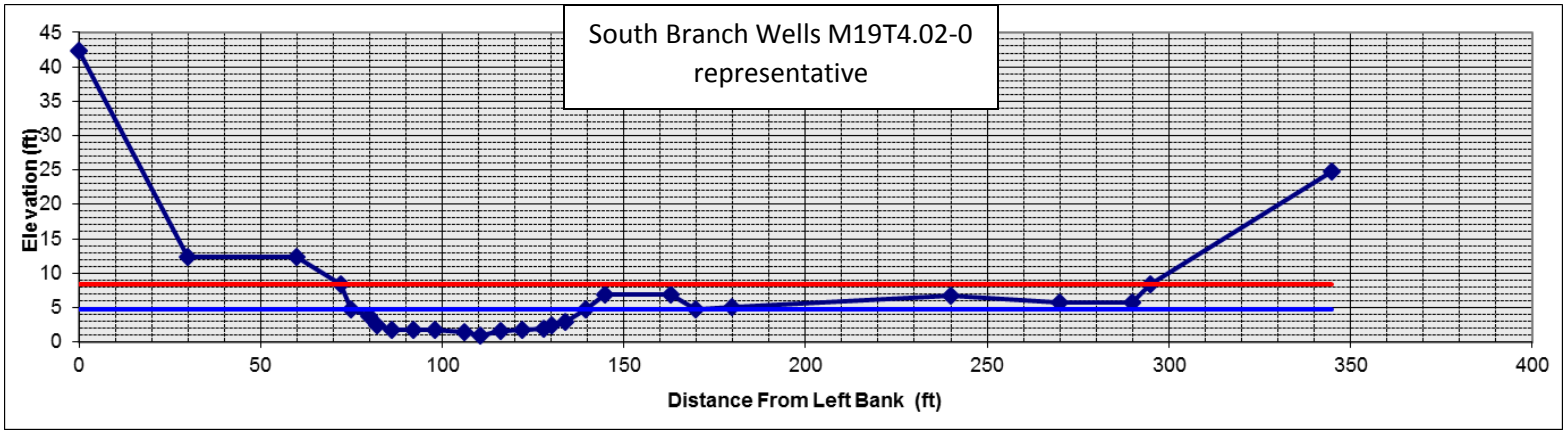

North Branch Wells M18T3.01-0
Elevation (ft)
Distance From Left Bank (ft)
0
2
4
6
8
10
12
14
16
18
20
0
100
200
300
400
500
600
700

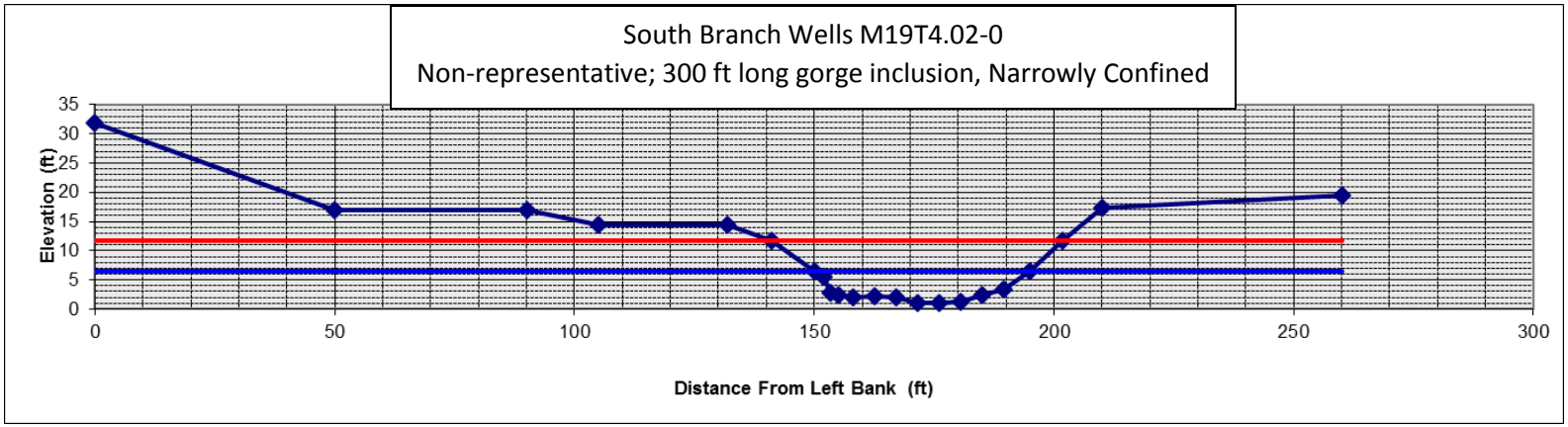

North Branch Wells M18T3.02-0
Elevation (ft)
Distance From Left Bank (ft)
0
5
10
15
20
25
30
0
50
100
150
200
250

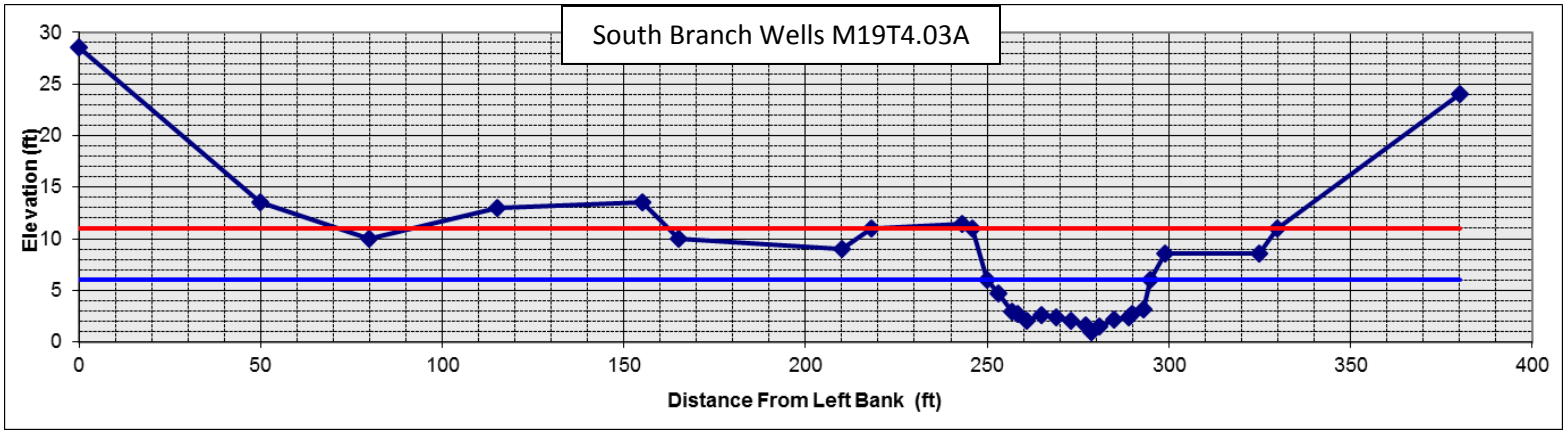

Wells mainstem M19-0
Elevation (ft)
25
20
15
10
5
0
0
50
100
150
200
250
300
350
400
450
500
Distance From Left Bank (ft)

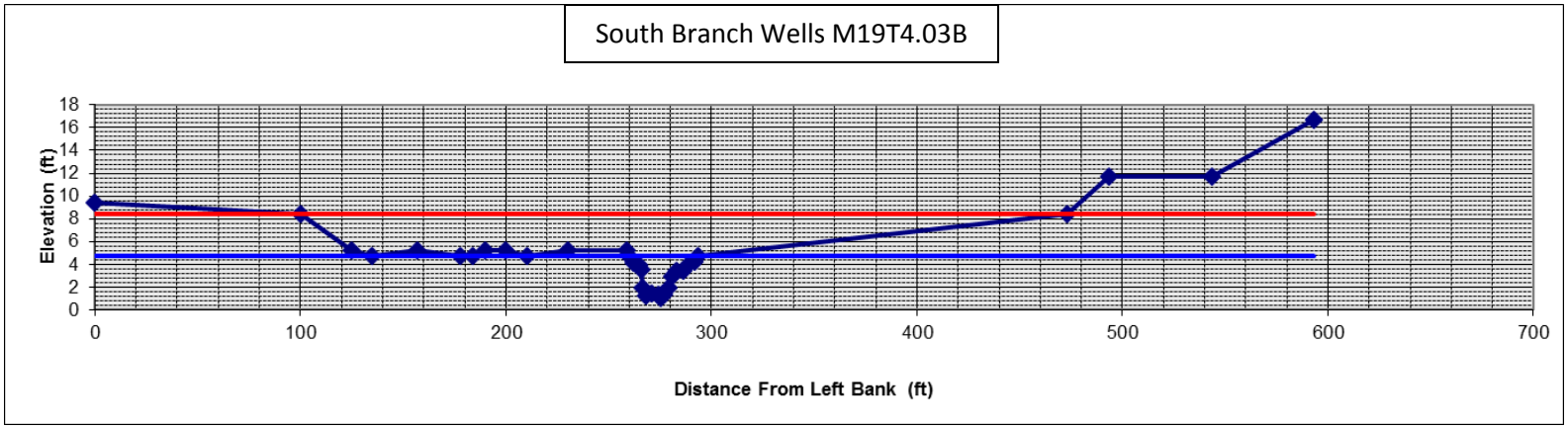

South Branch Wells M19T4.01A
Elevation (ft)
35
30
25
20
15
10
5
0
0
100
200
300
400
500
600
700
800
900
1000
Distance From Left Bank (ft)

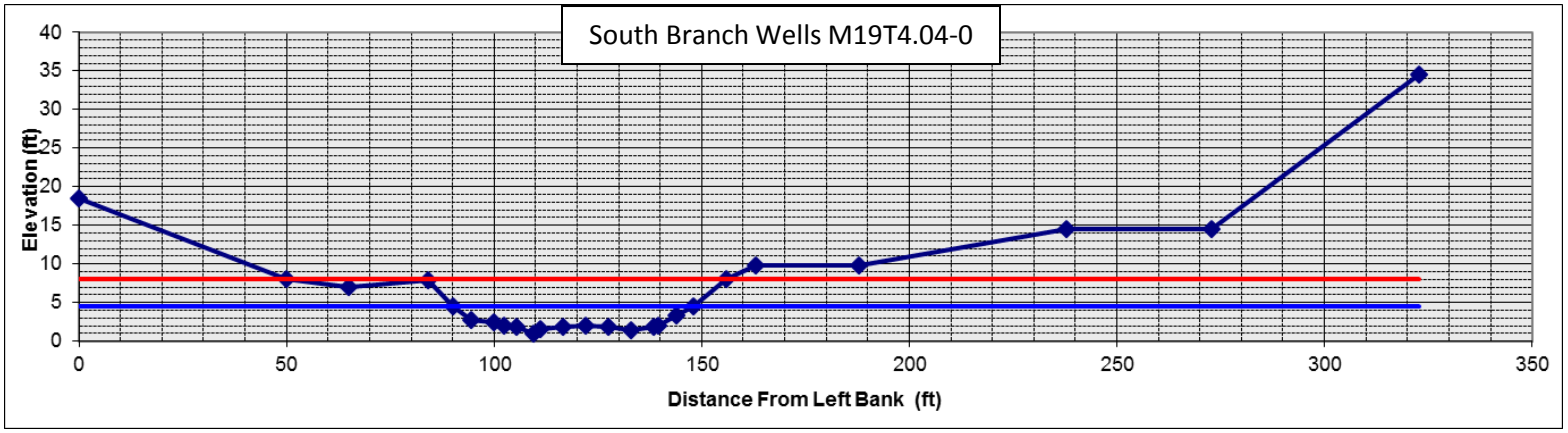

South Branch Wells M19T4.01B
Elevation (ft)
35
30
25
20
15
10
5
0
0
100
200
300
400
500
600
Distance From Left Bank (ft)

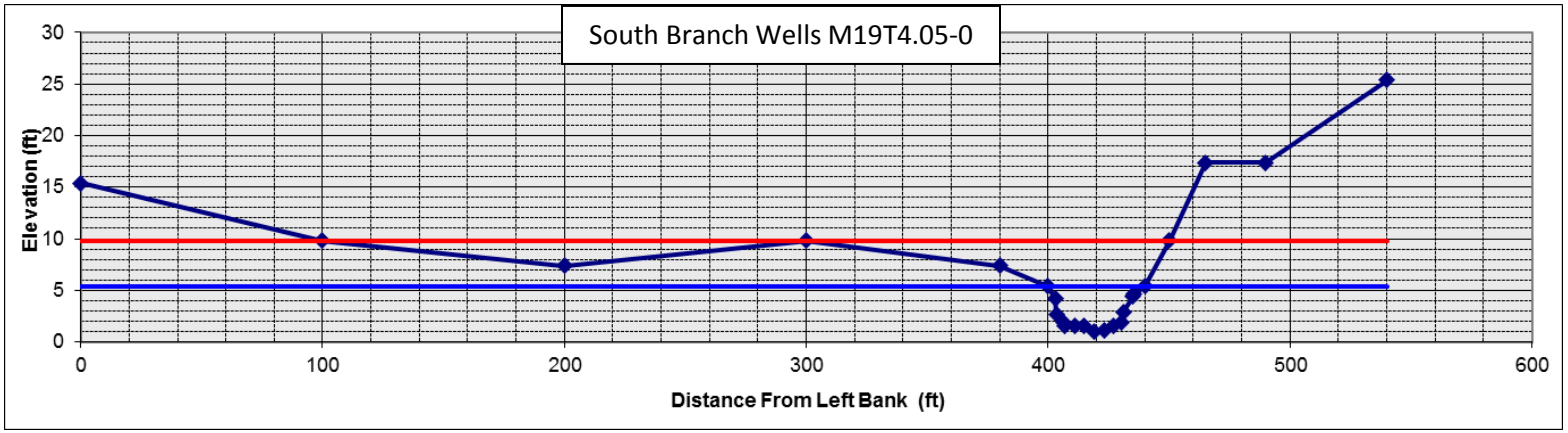

South Branch Wells M19T4.02-0
representative
Elevation (ft)
45
40
35
30
25
20
15
10
5
0
0
50
100
150
200
250
300
350
400
Distance From Left Bank (ft)

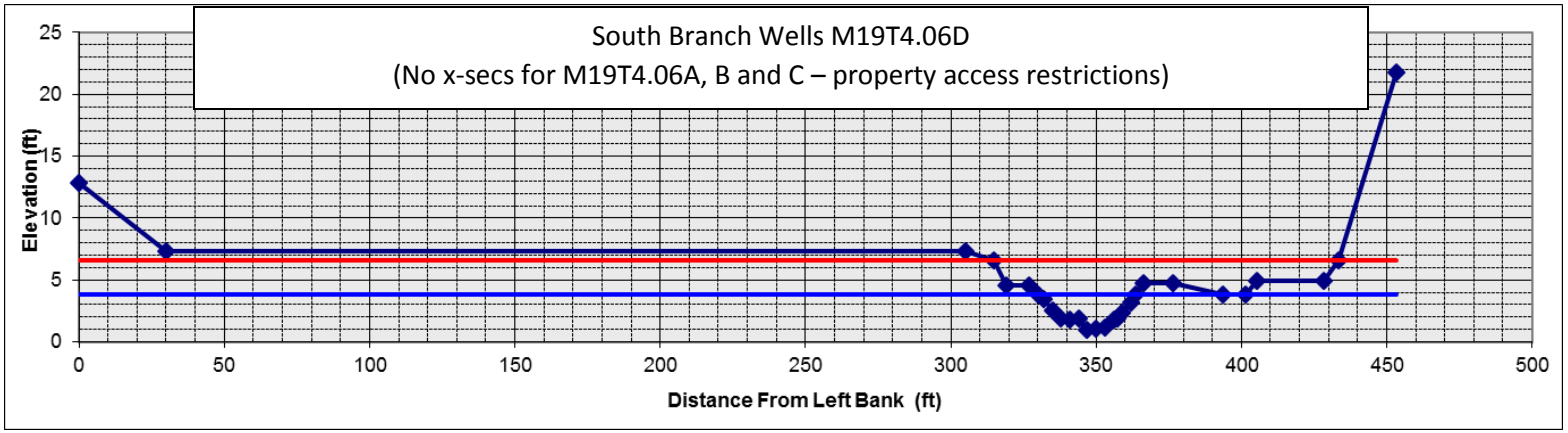

South Branch Wells M19T4.02-0
Non-representative; 300 ft long gorge inclusion, Narrowly Confined
Elevation (ft)
35
30
25
20
15
10
5
0
0
50
100
150
200
250
300
Distance From Left Bank (ft)

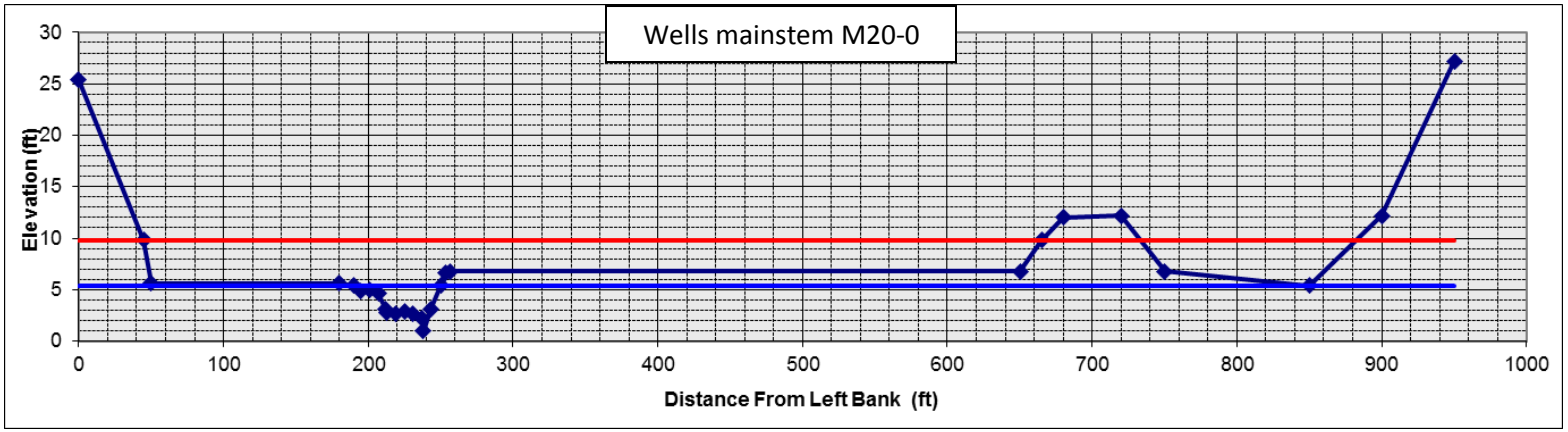

South Branch Wells M19T4.03A
Elevation (ft)
30
25
20
15
10
5
0
0
50
100
150
200
250
300
350
400
Distance From Left Bank (ft)

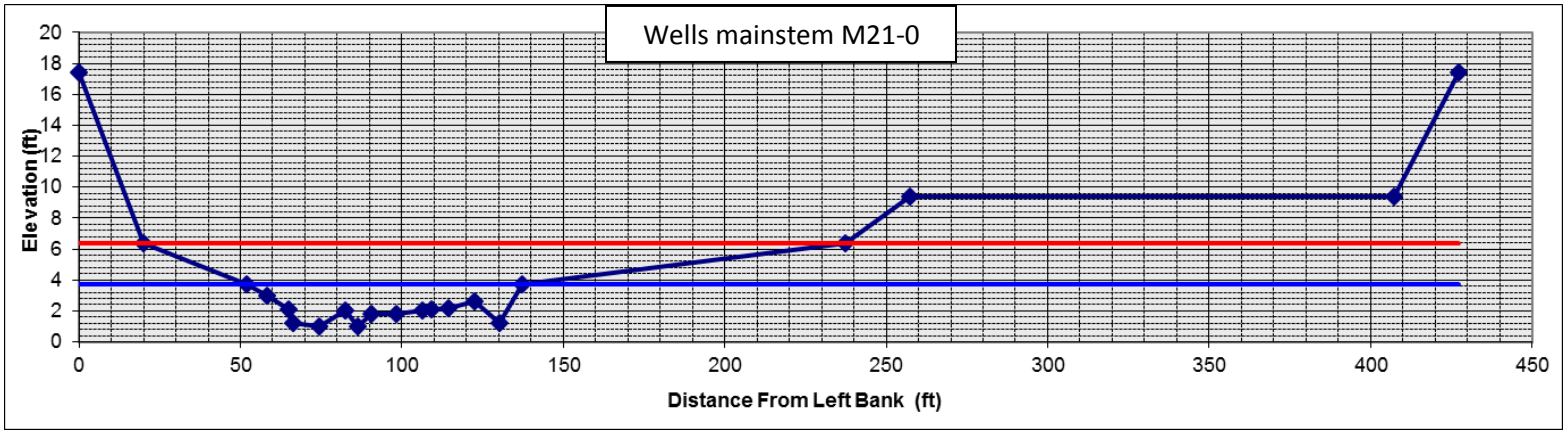

South Branch Wells M19T4.03B
Elevation (ft)
0
2
4
6
8
10
12
14
16
18
0
100
200
300
400
500
600
700
Distance From Left Bank (ft)

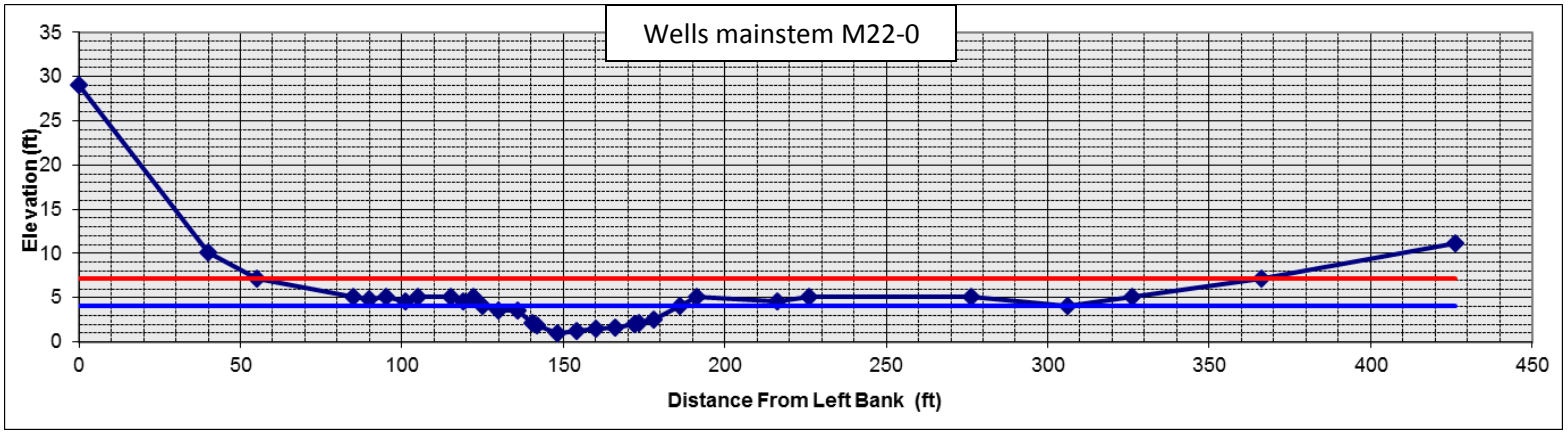

South Branch Wells M19T4.04-0
Elevation (ft)
0
5
10
15
20
25
30
35
40
0
50
100
150
200
250
300
350
Distance From Left Bank (ft)


South Branch Wells M19T4.05-0
Elevation (ft)
0
5
10
15
20
25
30
0
100
200
300
400
500
600
Distance From Left Bank (ft)


South Branch Wells M19T4.06D
(No x-secs for M19T4.06A, B and C – property access restrictions)
Elevation (ft)
Distance From Left Bank (ft)


Wells mainstem M20-0
Elevation (ft)
Distance From Left Bank (ft)


Wells mainstem M21-0
Elevation (ft)
Distance From Left Bank (ft)


Wells mainstem M22-0
Elevation (ft)
35
30
25
20
15
10
5
0
0
50
100
150
200
250
300
350
400
450
Distance From Left Bank (ft)

– Appendix 3 –

Phase II Reach/Segment Summary Reports

Phase 2 Segment Summary Report Wells River

Stream: Wells River
Reach: M10-A
Segment Length(ft): 1,710
Rain: Yes

SGAT Version: 4.56
Organization:
Observers: Redstart_dr, ES
Completion Date: 7/7/2015
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional

Step 0 - Location:

Step 5 - Notes: **Soil maps indicate same alluvium and lake sands present in segments M10A and B, but substrate in segment M10A was notably finer and lacking depositional features; may be influenced by backwater effects of the Boltonville Dam in reach M09 as well as possible historic gravel mining for construction of the railbed (soil maps indicate sand and/or gravel pits on river right adjacent to the old rail crossing abutments, and a small farm pit is evident on the high terraces at the north end of the fields there - but no history or documentation found about river gravel mining). Assumption here is that differences in substrate size were largely related to sediment transport (cobbles into segment B from reach M11) following recent flood discharges. Both Rte. 302 and old railbed in segment A are confining at all but highest level floods, likely acting as effective valley wall at lower discharge levels; increases force of flood flows due to lack of floodplain access.**

Step 7 - Narrative: **Aggradation of fines, localized nickpoints and bank erosion in flood events likely influenced by backwater effects of dam.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Substrate Size**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

	Length (ft)	One Height	Both	Height
Berm:	0		0	
Road:	0		0	
Railroad:	1,710	8	0	
Imp. Path:	700	6	0	
Dev.:	0		0	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Very Steep	Hilly
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	Mixed	Mixed

1.5 Valley Features

Valley Width (ft): 450
Width Determination: Measured
Confinement Type: NW
In Rock Gorge: No
Human Caused Change in Valley Width?: No

1.6 Grade Controls: None

Stream: **Wells River** Reach: **M10-A**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**93.50**	2.11 Riffle/Step Spacing:	**675 ft.**	2.13 Average Largest Particle on			
2.2 Max Depth (ft.):	**5.60**	2.12 Substrate Composition			Bed:	**2.2**	**inches**
2.3 Mean Depth (tf):	**4.30**	Bedrock:	**0.0 %**		Bar:	**1.1**	**inches**
2.4 Floodprone Width (ft.):	**483.50**	Boulder:	**1.0 %**	2.14 Stream Type			
2.5 Aband. Floodpn (ft.):	**7.30**	Cobble:	**2.0 %**	Stream Type:	**C**		
Human Elev FloodPln (ft.):		Coarse Gravel:	**17.0 %**	Bed Material:	**Gravel**		
2.6 Width/Depth Ratio:	**21.74**	Fine Gravel:	**57.0 %**	Subclass Slope:	**None**		
2.7 Entrenchment Ratio:	**5.17**	Sand:	**24.0 %**	Bed Form:	**Riffle-Pool**		
2.8 Incision Ratio:	**1.30**	Silt and Smaller:	**0.0 %**	Field Measured Slope:			
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type			
2.9 Sinuosity:	**Low**	Detritus:	**2.0 %**	Reference Stream Type:			
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**11**	Reference Bed Material:			
				Reference Subclass Slope:			
				Reference Bedform:			

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**135.0**	**149.1**	Dominant:	**Herbaceous**	**Herbaceous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**3.5**	**3.2**	Sub-dominant:	**Coniferous**	**Deciduous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**None**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**0.0**	Canopy %:	**76-100**	**76-100**
Material Type:	**Gravel**	**Gravel**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**26-50**	**51-100**
W less than 25	**0**	**0**
Buffer Vegitation Type		
Dominant	**Coniferous**	**Deciduous**
Sub-Dominant	**Herbaceous**	**Herbaceous**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Forest**	Mass Failures		
Sub-dominant	**Hay**	**Hay**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **Wells River** Reach: **M10-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch: **0**	Road Ditch: **2**
4.3 Flow Status:	**Moderate**	Impoundments:		Other: **0**	Tile Drain: **0**
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow: **0**	Urb Strm Wtr Pipe: **0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Old Abutment	**95**	**Yes**	**Yes**	**No**	**No**	**Scour Below,Alignment**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**0**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**0**	Delta:	**0**	Flood chutes:	**0**	Avulsion:	**0**	5.5 Straightening:		**Straightening**
Point:	**0**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):		**1,710**
Side:	**0**	Braiding:	**0**	Steep Riffles:	**0**	Trib Rejuv.:	**No**	5.5 Dredging:		**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**12**			Geomorphic Rating	**0.64**
7.2 Channel Aggradation		**11**			Channel Evolution Model	**F**
7.3 Widening Channel		**14**			Channel Evolution Stage	**III**
7.4 Change in Planforml		**14**			Geomorphic Condition	**Fair**
Total Score		**51**			Stream Sensitivity	**Very High**

Phase 2 Segment Summary Report Wells River

Stream: **Wells River**
Reach: **M10-B**
Segment Length(ft): **2,507**
Rain: **Yes**

SGAT Version: **4.56**
Organization:
Observers: **Redstart_dr, ES**
Completion Date: **7/2/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location:

Step 5 - Notes: **Soil maps indicate same alluvium and lake sands present in segments M10A and B, but substrate in segment M10A was notably finer and lacking depositional features. Assumption here is that differences in substrate size were largely related to sediment distribution following recent flood discharges; upstream reach M11-0 is confined by old railbed, development encroachments and bridge abutments and appears to be experiencing elevated sediment transport into this segment (M10B); expect these to continue to be redistributed given elevated stream power related to straightening and restriction of floodplain access by elevated road bed of Rte. 302 (this is human elevated floodplain in Step 2.8).**

Step 7 - Narrative: **Major widening and planform change following significant loss of floodplain after Rt. 302 elevation; RR bed already reduced LB floodplain**

Step 1. Valley and Floodplain

1.1 Segmentation: **Substrate Size**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

	Length (ft)	One Height	Both	Height
Berm:	0		0	
Road:	2,163	8	0	
Railroad:	2,507	8	0	
Imp. Path:	0		0	
Dev.:	113		0	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Steep	Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	Sand	Sand

1.5 Valley Features

Valley Width (ft):	300
Width Determination:	Measured
Confinement Type:	SC
In Rock Gorge:	No

Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls: **None**

Stream: **Wells River** Reach: **M10-B**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**99.80**	2.11 Riffle/Step Spacing:	**390 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**5.30**	2.12 Substrate Composition		Bed:	**10.2**	**inches**
2.3 Mean Depth (tf):	**4.01**	Bedrock:	**0.0 %**	Bar:	**4.2**	**inches**
2.4 Floodprone Width (ft.):	**281.80**	Boulder:	**16.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**6.70**	Cobble:	**45.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):	**12.00**	Coarse Gravel:	**15.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**24.89**	Fine Gravel:	**7.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**2.82**	Sand:	**17.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.26**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**2.26**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**10.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**32**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**445.6**	**280.5**	Dominant:	**Coniferous**	**Herbaceous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**5.0**	**4.0**	Sub-dominant:	**Herbaceous**	**Deciduous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**1,078.0**	Canopy %:	**76-100**	**76-100**
Material Type:	**Sand**	**Sand**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**26-50**
Sub-Dominant	**None**	**0-25**
W less than 25	**0**	**921**
Buffer Vegitation Type		
Dominant	**Coniferous**	**Herbaceous**
Sub-Dominant	**Herbaceous**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Forest**	**Residential**
Sub-dominant	**Shrubs/Sapling**	**Shrubs/Sapling**
(Legacy)	Amount	Mean Hieght
Failures	**None**	
Gullies	**None**	

	Left	Right
Mass Failures Height		
Gullies Number	**0**	
Gullies Length	**0**	

Stream: **Wells River** Reach: **M10-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch: **0**	Road Ditch: **1**
4.3 Flow Status:	**Moderate**	Impoundments:		Other: **0**	Tile Drain: **0**
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow: **0**	Urb Strm Wtr Pipe: **0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**0**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**3**	Delta:	**0**	Flood chutes:	**1**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**2**	Island:	**1**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**2,507**
Side:	**2**	Braiding:	**1**	Steep Riffles:	**1**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**5**	**None**		Geomorphic Rating	**0.39**
7.2 Channel Aggradation		**10**			Channel Evolution Model	**F**
7.3 Widening Channel		**7**			Channel Evolution Stage	**III**
7.4 Change in Planforml		**9**			Geomorphic Condition	**Fair**
Total Score		**31**			Stream Sensitivity	**High**

Phase 2 Segment Summary Report Wells River

Stream: Wells River
Reach: M11-0
Segment Length(ft): 7,123
Rain: Yes

SGAT Version: 4.56
Organization:
Observers: Redstart_dr, ES
Completion Date: 7/8/2015
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional

Step 0 - Location:

Step 5 - Notes: **Rte 302 riprap and old rail bed embankments line much of banks (Rte 302 RB, RR embankments alternating portions of both banks). Rte 302 elevated roadbed is basis for calculation of human elevated floodplain; disconnected floodplain is clearly evident off RB approaching Scotch Hollow Rd jct and does not appear to have been accessed in Irene (May 2012 orthos appear to have residual snow rather than sediment). RR embankments are heavily armored and realistically form new valley wall, though may be low enough in a couple short stretches to be overtopped in high-level floods.**

Step 7 - Narrative: **Major planform change following straightening and entrenchment by railroad embankment, with attendant historic incision. Widening somewhat limited by extensive rip-rap, aggradation from mass failures and more limited erosion being rapidly redistributed by recent flood events; few well-established riffles or pools, occasional stretches of coarse plane bed. Heavy armoring of RR embankments was primary reason for using entrenchment ratio +/-0.2 'fudge factor' to class as C-->B STD rather than C-->F, as combination of Rte 302 and RR embankments forms a more confined VW that will be difficult for stream processes to change.**

Step 1. Valley and Floodplain

1.1 Segmentation: None
1.2 Alluvial Fan: None
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	143	9	0	
Road:	510	10	2,511	9
Railroad:	6,102	10	0	
Imp. Path:	0		0	
Dev.:	2,429		1,478	

1.4 Adjacent Side	Left	Right
Hillside Slope:	Very Steep	Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Always	Sometimes
Texture:	Mixed	Mixed

1.5 Valley Features	
Valley Width (ft):	384
Width Determination:	Measured
Confinement Type:	NW
In Rock Gorge:	No
Human Caused Change in Valley Width?:	No

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	2.0	0.2	Yes	
Ledge	Mid-segment	5.1	3.2	Yes	
Ledge	Mid-segment	5.2	3.5	Yes	

Stream: **Wells River** Reach: **M11-0**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**70.70**	2.11 Riffle/Step Spacing:	**311 ft.**	2.13 Average Largest Particle on			
2.2 Max Depth (ft.):	**6.50**	2.12 Substrate Composition			Bed:	**10.8**	**inches**
2.3 Mean Depth (tf):	**4.96**	Bedrock:	**2.0 %**		Bar:	**3.9**	**inches**
2.4 Floodprone Width (ft.):	**89.20**	Boulder:	**14.0 %**	2.14 Stream Type			
2.5 Aband. Floodpn (ft.):	**11.50**	Cobble:	**35.0 %**	Stream Type:	**B**		
Human Elev FloodPln (ft.):	**14.50**	Coarse Gravel:	**23.0 %**	Bed Material:	**Cobble**		
2.6 Width/Depth Ratio:	**14.25**	Fine Gravel:	**13.0 %**	Subclass Slope:	**c**		
2.7 Entrenchment Ratio:	**1.26**	Sand:	**13.0 %**	Bed Form:	**Riffle-Pool**		
2.8 Incision Ratio:	**1.77**	Silt and Smaller:	**0.0 %**	Field Measured Slope:			
Human Elevated Inc. Rat.:	**2.23**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type			
2.9 Sinuosity:	**Moderate**	Detritus:	**2.0 %**	Reference Stream Type:			
2.10 Riffles Type:	**Eroded**	# Large Woody Debris:	**36**	Reference Bed Material:			
				Reference Subclass Slope:			
				Reference Bedform:			

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**40.4**	**280.8**	Dominant:	**Coniferous**	**Coniferous**
Material Type:	**Mix**	**Mix**	Erosion Height (ft.):	**2.0**	**3.0**	Sub-dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Multiple**	**Multiple**	Bank Canopy		
Lower			Revetment Length:	**1,825.4**	**2,523.5**	Canopy %:	**76-100**	**51-75**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**51-100**
Sub-Dominant	**26-50**	**>100**
W less than 25	**1,129**	**1,170**
Buffer Vegitation Type		
Dominant	**Coniferous**	**Herbaceous**
Sub-Dominant	**Herbaceous**	**Coniferous**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Forest**	Mass Failures	**33.39799**	**398.3373**
Sub-dominant	**Residential**	**Residential**	Height	**12.0**	**20.3**
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**Multiple**	**18.5**	Gullies Length		
Gullies	**None**				

Stream: **Wells River** Reach: **M11-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs			
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch:	**0**	Road Ditch:	**1**
4.3 Flow Status:	**Moderate**	Impoundments:		Other:	**2**	Tile Drain:	**0**
4.4 # of Debris Jams:	**1**	Impoundment Loc.:		Overland Flow:	**1**	Urb Strm Wtr Pipe:	**0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:		**0**	
		(old) Upstrm Flow Reg.:		Affected Length (ft):		**0**	

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Old Abutment	**78**	**Yes**	**Yes**	**No**	**No**	**None**
Old Abutment	**96**	**Yes**	**Yes**	**No**	**No**	**None**
Bridge	**65**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Deposition Below,Scour Above**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**0**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**	
Mid:	**0**	Delta:	**0**	Flood chutes:	**3**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**8**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**7,122**
Side:	**3**	Braiding:	**0**	Steep Riffles:	**0**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**7**	**C to B**	**Yes**	Geomorphic Rating	**0.50**
7.2 Channel Aggradation		**11**			Channel Evolution Model	**F**
7.3 Widening Channel		**12**			Channel Evolution Stage	**III**
7.4 Change in Planforml		**10**			Geomorphic Condition	**Fair**
Total Score		**40**			Stream Sensitivity	**High**

Phase 2 Segment Summary Report Wells River

Stream: **Scott Brook**
Reach: **M11T1.01-0**
Segment Length(ft): **2,250**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Caledonia County Conservation District**
Observers: **Redstart_dr, EBM**
Completion Date: **9/23/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **Jct Wells mainstem (DS Alley's Mkt and Church St bridge in S Ryegate) to ~650 ft US Ryegate-Newbury town line (Church St becomes Swamp Rd)**

Step 5 - Notes: **Highly straightened reach (nearly continuous riprap-windrow lines LB) with flood impacts amplified by being funneled through a series of undersized bridges. Streamside ell behind church damaged and removed after Irene, septic exposed; entire building now for sale.**

Step 7 - Narrative: **Extreme loss of planform following extensive straightening and historic incision. Major widening and aggradation currently limited by channelization and extensive revetments.**

Step 1. Valley and Floodplain

1.1 Segmentation: **None**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

	Length (ft)	One	Height	Both	Height
Berm:	184	7		158	5
Road:	1,515	7		111	5
Railroad:	0			0	
Imp. Path:	0			0	
Dev.:	494			1,172	

1.4 Adjacent Side	Left	Right
Hillside Slope:	Flat	Hilly
Continuous w/ Bank:	Always	Sometimes
Within 1 Bankfull W:	Always	Sometimes
Texture:	Gravel	Mixed

1.5 Valley Features
Valley Width (ft): **451**
Width Determination: **Measured**
Confinement Type: **VB**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **No**

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Weir	Mid-segment	2.4	1.2	Yes	

Stream: **Scott Brook** Reach: **M11T1.01-0**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**26.80**	2.11 Riffle/Step Spacing:	**60 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**3.55**	2.12 Substrate Composition		Bed:	**10.3**	**inches**
2.3 Mean Depth (tf):	**2.10**	Bedrock:	**0.0 %**	Bar:	**5.3**	**inches**
2.4 Floodprone Width (ft.):	**237.00**	Boulder:	**3.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**6.65**	Cobble:	**49.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**26.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**12.76**	Fine Gravel:	**8.0 %**	Subclass Slope:	**b**	
2.7 Entrenchment Ratio:	**8.84**	Sand:	**14.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.87**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Moderate**	Detritus:	**2.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**24**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**424.0**	**363.8**	Dominant:	**Invasives**	**Invasives**
Material Type:	**Mix**	**Mix**	Erosion Height (ft.):	**3.5**	**3.6**	Sub-dominant:	**Bare**	**Deciduous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Multiple**	**Multiple**	Bank Canopy		
Lower			Revetment Length:	**1,690.6**	**1,324.9**	Canopy %:	**1-25**	**26-50**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**0-25**	**0-25**
Sub-Dominant	**26-50**	**51-100**
W less than 25	**1,724**	**1,283**
Buffer Vegitation Type		
Dominant	**Herbaceous**	**Herbaceous**
Sub-Dominant	**Mixed Trees**	**Mixed Trees**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Residential**	**Residential**	Mass Failures		
Sub-dominant	**Bare**	**Forest**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **Scott Brook** Reach: **M11T1.01-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs			
4.2 Adjacent Wetlands:	**None**	Flow Reg. Use:		Field Ditch:	**2**	Road Ditch:	**4**
4.3 Flow Status:	**Moderate**	Impoundments:		Other:	**0**	Tile Drain:	**1**
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	**5**	Urb Strm Wtr Pipe:	**0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:		**0**	
		(old) Upstrm Flow Reg.:		Affected Length (ft):		**0**	

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	**8.4**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Scour Above,Alignment**
Bridge	**12**	**Yes**	**Yes**	**Yes**	**No**	**Deposition Above,Deposition Below**
Bridge	**20**	**Yes**	**Yes**	**Yes**	**No**	**Deposition Above,Deposition Below**
Bridge	**18**	**Yes**	**Yes**	**Yes**	**No**	**Deposition Above,Scour Above,Scour Below**
Instream Culvert	**16.9**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Deposition Below**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**2**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**Yes**	
Mid:	**1**	Delta:	**0**	Flood chutes:	**2**	Avulsion:	**0**	5.5 Straightening:	**With Windrowing**
Point:	**9**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**2,235**
Side:	**7**	Braiding:	**0**	Steep Riffles:	**6**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic		
7.1 Channel Degradation	**7**	**None**	**Yes**	Geomorphic Rating	**0.38**
7.2 Channel Aggradation	**10**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel	**8**	**None**	**No**	Channel Evolution Stage	**III**
7.4 Change in Planforml	**5**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score	**30**			Stream Sensitivity	**High**

Phase 2 Segment Summary Report Wells River

Stream: **Scott Brook**
Reach: **M11T1.02-0**
Segment Length(ft): **4,406**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Caledonia County Conservation District**
Observers: **Redstart_dr, EBM**
Completion Date: **9/17/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **~500 ft US Ryegate-Newbury town line (Church St becomes Swamp Rd) to US end of rd encroachment US of Jefferson Hill Rd**

Step 5 - Notes: **Road has been relocated, probably more than once and likely due at least in part to rd-stream conflicts; mid-reach the rd actually splits the valley, leaving a disconnected portion of the historic channel outside of the current rd off the LB. Old mill site remains mid- reach near large RB mass failures.**

Step 7 - Narrative: **Extreme planform change (multiple mass failures off RB) with major aggradation and widening following historic incision. Road and stream have changed positions over time, current rd splits valley mid reach.**

Step 1. Valley and Floodplain

1.1 Segmentation: **None**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		253	7
Road:	4,135	9	0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	0		0	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Extr.Steep	Extr.Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	Mixed	Mixed

1.5 Valley Features

Valley Width (ft):	90
Width Determination:	Estimated
Confinement Type:	SC
In Rock Gorge:	No

Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls: **None**

Stream: **Scott Brook** Reach: **M11T1.02-0**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**28.50**	2.11 Riffle/Step Spacing:	**30 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**3.25**	2.12 Substrate Composition		Bed:	**16.6**	**inches**
2.3 Mean Depth (tf):	**2.25**	Bedrock:	**0.0 %**	Bar:	**5.2**	**inches**
2.4 Floodprone Width (ft.):	**84.00**	Boulder:	**11.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**4.45**	Cobble:	**43.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**13.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**12.67**	Fine Gravel:	**17.0 %**	Subclass Slope:	**b**	
2.7 Entrenchment Ratio:	**2.95**	Sand:	**16.0 %**	Bed Form:	**Step-Pool**	
2.8 Incision Ratio:	**1.37**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Moderate**	Detritus:	**5.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**197**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Undercut**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**549.7**	**780.2**	Dominant:	**Coniferous**	**Coniferous**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**	Erosion Height (ft.):	**4.2**	**4.2**	Sub-dominant:	**Herbaceous**	**Herbaceous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**Multiple**	Bank Canopy		
Lower			Revetment Length:	**450.9**	**670.6**	Canopy %:	**76-100**	**76-100**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Closed**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**26-50**	**>100**
Sub-Dominant	**0-25**	**26-50**
W less than 25	**722**	**1,006**
Buffer Vegitation Type		
Dominant	**Coniferous**	**Coniferous**
Sub-Dominant	**Herbaceous**	**Herbaceous**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Forest**	Mass Failures	**85.94817**	**422.9036**
Sub-dominant	**Bare**	**Bare**	Height	**10.0**	**31.8**
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**Multiple**	**26.4**	Gullies Length	**0**	
Gullies	**None**				

Stream: **Scott Brook** Reach: **M11T1.02-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Abundant**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch: **0**	Road Ditch: **11**
4.3 Flow Status:	**Moderate**	Impoundments:		Other: **0**	Tile Drain: **0**
4.4 # of Debris Jams:	**9**	Impoundment Loc.:		Overland Flow: **1**	Urb Strm Wtr Pipe: **0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	**9.3**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Deposition Below,Scour Below**
Bridge	**12**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Deposition Below,Scour Above,Scour Below,Alignment**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**6**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**	
Mid:	**4**	Delta:	**0**	Flood chutes:	**15**	Avulsion:	**1**	5.5 Straightening:	**With Windrowing**
Point:	**20**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**242**
Side:	**22**	Braiding:	**1**	Steep Riffles:	**7**	Trib Rejuv.:	**Yes**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Confined**	Score	STD	Historic		
7.1 Channel Degradation		**8**	**None**	**Yes**	Geomorphic Rating	**0.41**
7.2 Channel Aggradation		**10**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**10**	**None**	**No**	Channel Evolution Stage	**III**
7.4 Change in Planforml		**5**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**33**			Stream Sensitivity	**High**

Phase 2 Segment Summary Report Wells River

Stream: **Scott Brook**
Reach: **M11T1.03-A**
Segment Length(ft): **2,370**
Rain: **Yes**

SGAT Version: **4.56**
Organization:
Observers: **Redstart_dr, ES**
Completion Date: **8/13/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **~0.2 mi US of Jefferson Hill Rd on Swamp Rd (stream comes to rd edge) to pvt driveway bridge at 1198 Swamp Rd**

Step 5 - Notes: **Assessed this subreach as reference planebed due to small cobble substrate combined with ~2 pct overall slope slope, sediment storage primarily at debris jams and inactive channels; frequent signs of intermittent-transient beaver influences. Straightening by bridge at US end of reach only slightly increases effects of natural valley pinch point created by a terminal moraine transverse to overall valley orientation. Slope leaves neither riffles or steps well-formed, and small inclusion of lower slope cedar swamp/scrub-shrub wetland is impacted by beaver activity.**

Step 7 - Narrative: **Major reducing to minor planform adjustments, aggradation and widening with localized flood related incision (nickpoints) being offset by subsequent aggradation. Primary incision appears historic, with additional impacts from episodic flood discharges and transient beaver dam blow-outs.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Planform and Scope**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	479	9	173	7
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	0		0	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Hilly	Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	Mixed	Mixed

1.5 Valley Features

Valley Width (ft): **230**
Width Determination: **Measured**
Confinement Type: **BD**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls: **None**

Stream: **Scott Brook** Reach: **M11T1.03-A**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**31.50**	2.11 Riffle/Step Spacing:	**72 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**3.00**	2.12 Substrate Composition		Bed:	**5.2**	**inches**
2.3 Mean Depth (tf):	**2.24**	Bedrock:	**0.0 %**	Bar:	**2.4**	**inches**
2.4 Floodprone Width (ft.):	**171.50**	Boulder:	**16.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**5.00**	Cobble:	**41.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**21.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**14.06**	Fine Gravel:	**9.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**5.44**	Sand:	**13.0 %**	Bed Form:	**Plane Bed**	
2.8 Incision Ratio:	**1.67**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Moderate**	Detritus:	**0.0 %**	Reference Stream Type:	**C**	
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**5**	Reference Bed Material:	**Cobble**	
				Reference Subclass Slope:	**None**	
				Reference Bedform:	**Plane Bed**	

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**0.0**	**103.8**	Dominant:	**Coniferous**	**Coniferous**
Material Type:	**Mix**	**Mix**	Erosion Height (ft.):	**0.0**	**3.2**	Sub-dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**78.6**	**287.3**	Canopy %:	**76-100**	**76-100**
Material Type:	**Mix**	**Mix**				Mid-Channel Canopy:	**Closed**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**0-25**	**26-50**
W less than 25	**0**	**137**
Buffer Vegitation Type		
Dominant	**Coniferous**	**Mixed Trees**
Sub-Dominant	**Shrubs/Sapling**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Forest**	**Forest**
Sub-dominant	**Shrubs/Sapling**	**Shrubs/Sapling**
(Legacy)	Amount	Mean Hieght
Failures	**None**	
Gullies	**None**	

	Left	Right
Mass Failures		
Height		
Gullies Number	**0**	
Gullies Length		

Stream: **Scott Brook** Reach: **M11T1.03-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Abundant**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	**Abundant**	Flow Reg. Use:		Field Ditch: **0**	Road Ditch: **3**
4.3 Flow Status:	**Moderate**	Impoundments:		Other: **0**	Tile Drain: **0**
4.4 # of Debris Jams:	**15**	Impoundment Loc.:		Overland Flow: **0**	Urb Strm Wtr Pipe: **0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**3**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**370**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	**25**	**Yes**	**Yes**	**Yes**	**No**	**Deposition Below,Scour Below**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**0**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**1**	Delta:	**0**	Flood chutes:	**5**	Avulsion:	**0**	5.5 Straightening:		**Straightening**
Point:	**6**	Island:	**6**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):		**328**
Side:	**7**	Braiding:	**5**	Steep Riffles:	**2**	Trib Rejuv.:	**No**	5.5 Dredging:		**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Plane Bed**	Score	STD	Historic		
7.1 Channel Degradation		**11**	**None**	**Yes**	Geomorphic Rating	**0.54**
7.2 Channel Aggradation		**11**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**11**	**None**	**No**	Channel Evolution Stage	**III**
7.4 Change in Planforml		**10**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**43**			Stream Sensitivity	**High**

Phase 2 Segment Summary Report Wells River

Stream: **Scott Brook**
Reach: **M11T1.03-B**
Segment Length(ft): **4,413**
Rain: **Yes**

SGAT Version: **4.56**
Organization:
Observers: **Redstart_dr, ES**
Completion Date: **8/13/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**
Why Not Assessed: **wetland**

Step 0 - Location: **Cedar swamp and beaver-impacted wetlands between pvt driveway bridge at 1198 Swamp Rd and dog run fence across valley from driveway at 2107 Swamp Rd; habitat data was collected.**

Step 5 - Notes: **Segment primarily excluded from geomorphic assessment due to multiple beaver dams (5 total documented), impoundment and frequent braiding in this cedar swamp area. Roughly 950 ft of channel length at US end of segment is fenced for a private dog run (beagles?) and was not able to be assessed, but the stream appears to enter the cedar swamp a very short distance from the DS-swinging gate that fully blocks the channel. Very minor reduction of valley width due to Swamp Rd, but this is a relatively intact cedar swamp with high habitat and biodiversity value. Beaver dams were clearly impacted in Irene and other more recent high water events, may be relatively transitory.**

Step 7 - Narrative:

Step 1. Valley and Floodplain

1.1 Segmentation: **Planform and Scope**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

	Length (ft)	One	Height	Both	Height
Berm:		0		0	
Road:		887	5	115	7
Railroad:		0		0	
Imp. Path:		0		0	
Dev.:		146		0	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Flat	Flat
Continuous w/ Bank:	Always	Always
Within 1 Bankfull W:	Always	Always
Texture:	Sand	Sand

1.5 Valley Features

Valley Width (ft): **1,000**
Width Determination: **Estimated**
Confinement Type: **VB**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls: **None**

Stream: **Scott Brook** Reach: **M11T1.03-B**

Step 2. Stream Channel

2.1Bankfull Width (ft.):		2.11 Riffle/Step Spacing:		2.13 Average Largest Particle on	
2.2 Max Depth (ft.):		2.12 Substrate Composition		Bed:	
2.3 Mean Depth (tf):		Bedrock:	%	Bar:	
2.4 Floodprone Width (ft.):		Boulder:	%	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):		Cobble:	%	Stream Type:	
Human Elev FloodPln (ft.):		Coarse Gravel:	%	Bed Material:	
2.6 Width/Depth Ratio:	**0.00**	Fine Gravel:	%	Subclass Slope:	
2.7 Entrenchment Ratio:	**0.00**	Sand:	%	Bed Form:	
2.8 Incision Ratio:	**0.00**	Silt and Smaller:	%	Field Measured Slope:	
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:		2.15 Sub-reach Stream Type	
2.9 Sinuosity:		Detritus:	**0.0 %**	Reference Stream Type:	
2.10 Riffles Type:		# Large Woody Debris:		Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**0.0**	**0.0**	Dominant:	**Coniferous**	**Coniferous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**0.0**	**0.0**	Sub-dominant:	**Herbaceous**	**Herbaceous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**10.7**	Canopy %:	**76-100**	**76-100**
Material Type:	**Sand**	**Sand**				Mid-Channel Canopy:	**Closed**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**None**	**0-25**
W less than 25	**0**	**0**
Buffer Vegitation Type		
Dominant	**Coniferous**	**Coniferous**
Sub-Dominant	**Herbaceous**	**Herbaceous**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Forest**	**Forest**
Sub-dominant	**Shrubs/Sapling**	**Shrubs/Sapling**
(Legacy)	Amount	Mean Hieght
Failures	**None**	
Gullies	**None**	

	Left	Right
Mass Failures		
Height		
Gullies Number	**0**	
Gullies Length	**0**	

Stream: **Scott Brook** Reach: **M11T1.03-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps: **Abundant**
4.2 Adjacent Wetlands: **Abundant**
4.3 Flow Status: **Moderate**
4.4 # of Debris Jams: **10**
4.5 Flow Regulation Type **None**
Flow Reg. Use:
Impoundments:
Impoundment Loc.:
4.6 Up/Down Strm flow reg.: **None**
(old) Upstrm Flow Reg.:
4.7 Stormwater Inputs **None**
Field Ditch: Road Ditch:
Other: Tile Drain:
Overland Flow: Urb Strm Wtr Pipe:
4.9 # of Beaver Dams: **10**
Affected Length (ft): **1800**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	**20**	**Yes**	**Yes**	**Yes**	**No**	**Deposition Below,Scour Below**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types
Diagonal: **0**
Mid: **0** Delta: **0**
Point: **4** Island: **3**
Side: **0** Braiding: **3**
5.2 Other Features
Neck Cutoff: **0**
Flood chutes: **2** Avulsion: **0**
5.3 Steep Riffles and Head Cuts
Head Cuts: **0**
Steep Riffles: **0** Trib Rejuv.: **No**
5.4 Stream Ford or Animal Crossing: **No**
5.5 Straightening: **Straightening**
Straightening Length (ft.): **188**
5.5 Dredging: **None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:
6.2 Pool Substrate:
6.3 Pool Variability:
Total Score:
Habitat Rating:
Habitat Stream Condition:
6.4 Sediment Deposition:
6.5 Channel Flow Status:
6.6 Channel Alteration:
6.7 Channel Sinuosity:
Stream Gradiant Type Left Right
6.8 Bank Stability:
6.9 Bank Vegetation Protection
6.10 Riparian Veg. Zone Width:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Score	STD	Historic
7.1 Channel Degradation			
7.2 Channel Aggradation			
7.3 Widening Channel			
7.4 Change in Planforml			
Total Score			

Geomorphic Rating
Channel Evolution Model
Channel Evolution Stage
Geomorphic Condition
Stream Sensitivity

Phase 2 Segment Summary Report Wells River

Stream: **Scott Brook**
Reach: **M11T1.03-C**
Segment Length(ft): **1,940**
Rain: **Yes**

SGAT Version: **4.56**
Organization:
Observers: **Redstart_dr, ES**
Completion Date: **8/12/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **US of fenced dog run across valley from driveway at 2017 Swamp Rd to reach break M11T1.04, just US of 2310 Swamp Rd**

Step 5 - Notes: **'Other' channel constriction in Step 4 is a DS-swinging gate that entirely spans channel as it enters a pvt dog run at US end of segment.**

Step 7 - Narrative: **Major widening, planform adjustments and aggradation; D model evolution due to greater erodibility of banks than bed, arrested stage IIc due to manipulation of channel. Stream has been maintained against valley wall, clear signs of minor dredging and major snagging following recent flood events (plus at least one former small bridge damaged and removed). Aggradation quickly offsets incision, stream retains good floodplain access; appears likely this would be an E stream through adjacent altered wetlands (now hayfield) under reference conditions.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Planform and Scope**

1.2 Alluvial Fan: **None**

1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	0		0	
Railroad:	0		0	
Imp. Path:	516	4	0	
Dev.:	611		0	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Extr.Steep	Flat
Continuous w/ Bank:	Sometimes	Always
Within 1 Bankfull W:	Always	Always
Texture:	Mixed	Gravel

1.5 Valley Features

Valley Width (ft): **400**
Width Determination: **Estimated**
Confinement Type: **VB**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls: **None**

Stream: **Scott Brook** Reach: **M11T1.03-C**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**35.20**	2.11 Riffle/Step Spacing:	**65 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**3.30**	2.12 Substrate Composition		Bed:	**5**	**inches**
2.3 Mean Depth (tf):	**1.96**	Bedrock:	**2.0 %**	Bar:	**2.35**	**inches**
2.4 Floodprone Width (ft.):	**390.70**	Boulder:	**0.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**6.00**	Cobble:	**6.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**45.0 %**	Bed Material:	**Gravel**	
2.6 Width/Depth Ratio:	**17.96**	Fine Gravel:	**25.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**11.10**	Sand:	**22.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.82**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Moderate**	Detritus:	**1.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**13**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Moderate**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**242.4**	**450.5**	Dominant:	**Coniferous**	**Pasture**
Material Type:	**Mix**	**Gravel**	Erosion Height (ft.):	**3.2**	**2.6**	Sub-dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**212.8**	Canopy %:	**76-100**	**1-25**
Material Type:	**Mix**	**Gravel**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**0-25**
Sub-Dominant	**0-25**	**>100**
W less than 25	**217**	**1,137**
Buffer Vegitation Type		
Dominant	**Coniferous**	**Herbaceous**
Sub-Dominant	**Shrubs/Sapling**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Hay**	Mass Failures	**31.469 71**	
Sub-dominant	**Shrubs/Sapling**	**Shrubs/Sapling**	Height	**12.0**	
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**One**	**12.0**	Gullies Length		
Gullies	**None**				

Stream: **Scott Brook** Reach: **M11T1.03-C**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	**1**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	**20**	**Yes**	**Yes**	**Yes**	**No**	**Deposition Below**
Other	**12**	**Yes**	**Yes**	**Yes**	**No**	**Deposition Below**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**1**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**Yes**
Mid:	**3**	Delta:	**0**	Flood chutes:	**1**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**8**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**1,940**
Side:	**3**	Braiding:	**0**	Steep Riffles:	**1**	Trib Rejuv.:	**Yes**	5.5 Dredging:	**Dredging**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic		
7.1 Channel Degradation	**12**	**E To C**	**No**	Geomorphic Rating	**0.46**
7.2 Channel Aggradation	**8**	**E To C**	**No**	Channel Evolution Model	**D**
7.3 Widening Channel	**9**	**Other**	**No**	Channel Evolution Stage	**IIc**
7.4 Change in Planforml	**8**	**Other**	**No**	Geomorphic Condition	**Fair**
Total Score	**37**			Stream Sensitivity	**Extreme**

Phase 2 Segment Summary Report Wells River

Stream: Scott Brook
Reach: M11T1.04-0
Segment Length(ft): 1,831
Rain: Yes

SGAT Version: 4.56
Organization: Caledonia County Conservation District
Observers: Redstart_dr, ES
Completion Date: 8/10/2015
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional

Step 0 - Location: **~0.1 mi DS of 1928 bridge ~2.6 mi up Swamp Rd out of S. Ryegate to trib confluence 0.35 mi further US (at hard bend of Swamp Rd just DS of Grapes Rd)**

Step 5 - Notes: **Old rd was much closer to stream, stone walls along it act as berms for significant stretches. Complex topography: old channels and flood chutes both sides, some very recently accessed despite appearing high above stream. Long grade control and one large massive boulder step (glacial boulder train) account for majority of slope, but despite intermittent slope breaks and floodplain pockets overall slope still likely >6 pct. Straightening by old rd and stone wall remains have contributed to lack of meanders, increased slope and consequent incision. Relatively dense sapling understory both sides, but subdominant buffer cover off LB is bare ground due to road encroachment and forest is not yet mature enough to contribute truly large wood to channel dynamics.**

Step 7 - Narrative: **Major planform adjustments with aggradation and widening following historic incision related to straightening and confinement by road encroachment, historically amplified by pulse flows below mill dam in US reach. Recent high water event left very clear bankfull indicators that demonstrate intensity of intermittent channel enlargement in downpours in this steep, confined valley; debris jams, old channel avulsions and abandoned channels, large flood chutes outside the current floodplain all in evidence.**

Step 1. Valley and Floodplain

1.1 Segmentation: None
1.2 Alluvial Fan: None
1.3 Corridor Encroachments:

	Length (ft)	One Height	Both	Both Height
Berm:	0		0	
Road:	1,322	9	213	8
Railroad:	0		0	
Imp. Path:	176	4	0	
Dev.:	60		0	

1.4 Adjacent Side	Left	Right
Hillside Slope:	Hilly	Extr.Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Always	Sometimes
Texture:	Boulder	Boulder

1.5 Valley Features
Valley Width (ft): 70
Width Determination: Measured
Confinement Type: SC
In Rock Gorge: No
Human Caused Change in Valley Width?: Yes

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	2.2	1.2	Yes	
Ledge	Mid-segment	14.9	12.9	Yes	

Stream: **Scott Brook** Reach: **M11T1.04-0**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**31.70**	2.11 Riffle/Step Spacing:	**41 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**3.45**	2.12 Substrate Composition		Bed:	**8.8**	**inches**
2.3 Mean Depth (tf):	**2.33**	Bedrock:	**2.0 %**	Bar:	**4.4**	**inches**
2.4 Floodprone Width (ft.):	**67.70**	Boulder:	**45.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**6.70**	Cobble:	**25.0 %**	Stream Type:	**B**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**15.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**13.61**	Fine Gravel:	**7.0 %**	Subclass Slope:	**a**	
2.7 Entrenchment Ratio:	**2.14**	Sand:	**6.0 %**	Bed Form:	**Step-Pool**	
2.8 Incision Ratio:	**1.94**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**5.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**54**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**44.2**	**0.0**	Dominant:	**Coniferous**	**Coniferous**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**	Erosion Height (ft.):	**3.0**	**0.0**	Sub-dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Hard Bank**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**14.6**	**52.6**	Canopy %:	**76-100**	**76-100**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Closed**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**26-50**	**>100**
Sub-Dominant	**>100**	**26-50**
W less than 25	**0**	**0**
Buffer Vegitation Type		
Dominant	**Mixed Trees**	**Coniferous**
Sub-Dominant	**Shrubs/Sapling**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Forest**	Mass Failures		**30.16386**
Sub-dominant	**Bare**	**Shrubs/Sapling**	Height		**10.0**
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**One**	**10.0**	Gullies Length	**0**	
Gullies	**None**				

Stream: **Scott Brook** Reach: **M11T1.04-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Abundant**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch: **0**	Road Ditch: **2**
4.3 Flow Status:	**Moderate**	Impoundments:		Other: **0**	Tile Drain: **0**
4.4 # of Debris Jams:	**5**	Impoundment Loc.:		Overland Flow: **0**	Urb Strm Wtr Pipe: **0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	**20**	**Yes**	**Yes**	**Yes**	**No**	**Deposition Above,Deposition Below,Scour Below,Alignment**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**1**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**	
Mid:	**4**	Delta:	**1**	Flood chutes:	**11**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**4**	Island:	**2**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**474**
Side:	**7**	Braiding:	**2**	Steep Riffles:	**1**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Confined**

	Score	STD	Historic		
7.1 Channel Degradation	**7**	**None**	**Yes**	Geomorphic Rating	**0.39**
7.2 Channel Aggradation	**9**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel	**9**	**None**	**No**	Channel Evolution Stage	**III**
7.4 Change in Planforml	**6**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score	**31**			Stream Sensitivity	**High**

Phase 2 Segment Summary Report Wells River

Stream: **Scott Brook**
Reach: **M11T1.05-0**
Segment Length(ft): **5,787**
Rain: **Yes**

SGAT Version: **4.56**
Organization:
Observers: **Redstart_dr, ES**
Completion Date: **6/15/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location:

Step 5 - Notes: **Former mill in US portion of reach appears to have contributed to historic incision (hungry water-pulse flows); current channel is situated in a vastly reduced floodplain with meanders out of sync in relation to glacial stream valley meanders, leaving alternating pockets of floodplain on opposite sides of current channel. Unusual transverse valley mid-reach (likely legacy of glacial recessional moraine) appears to have been location of a road leading from Swamp Rd to a homestead off current RB that appears on the 1875 Beers Atlas, and a major flood chute captured and followed a large portion of the old road bed in recent flooding (now dry again, channel is single thread). x-section data shows low w/d ratio that technically types out as an E type stream, but felt +/- 2 'fudge factor' was indicated to class as C type stream due to combination of limited floodplain in this relatively narrow valley overall, coarse bed materials, elevated slope, relatively low sinuosity, and preponderance of steps and point bars as depositional features. Likely that beaver influenced area at US end of reach and transverse valley mid-reach represent small inclusions of E-type stream, and 'non-representative' x-section measured mid-reach indicated an even lower w/d ratio.**

Step 7 - Narrative: **Major widening and planform change, major to minor aggradation following historic incision likely related (at least in part) to effects of former mill (hungry water-pulse flows). Current channel is situated in a vastly reduced floodplain with meanders out of sync in relation to glacial stream valley meanders, but is able to access high flood plains and alternate channels (through avulsions) in major floods.**

Step 1. Valley and Floodplain

1.1 Segmentation: **None**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	532	10	0	
Railroad:	0		0	
Imp. Path:	1,892	6	387	6
Dev.:	184		0	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Very Steep	Very Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	Mixed	Mixed

1.5 Valley Features

Valley Width (ft):	70
Width Determination:	Measured
Confinement Type:	NW
In Rock Gorge:	No
Human Caused Change in Valley Width?:	Yes

1.6 Grade Controls: **None**

Stream: **Scott Brook** Reach: **M11T1.05-0**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**15.00**	2.11 Riffle/Step Spacing:	**24 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**2.40**	2.12 Substrate Composition		Bed:	**9.4**	**inches**
2.3 Mean Depth (tf):	**1.40**	Bedrock:	**0.0 %**	Bar:	**5**	**inches**
2.4 Floodprone Width (ft.):	**33.50**	Boulder:	**28.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**5.00**	Cobble:	**33.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**2.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**10.71**	Fine Gravel:	**15.0 %**	Subclass Slope:	**b**	
2.7 Entrenchment Ratio:	**2.23**	Sand:	**22.0 %**	Bed Form:	**Step-Pool**	
2.8 Incision Ratio:	**2.08**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Moderate**	Detritus:	**0.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**188**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Undercut**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**0.0**	**34.2**	Dominant:	**Coniferous**	**Coniferous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**0.0**	**6.0**	Sub-dominant:	**Herbaceous**	**Herbaceous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**53.5**	**40.9**	Canopy %:	**76-100**	**76-100**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Closed**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**51-100**	**51-100**
W less than 25	**0**	**0**
Buffer Vegitation Type		
Dominant	**Coniferous**	**Coniferous**
Sub-Dominant	**Herbaceous**	**Herbaceous**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Forest**	Mass Failures		
Sub-dominant	**Shrubs/Sapling**	**Shrubs/Sapling**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **Scott Brook** Reach: **M11T1.05-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps: **Minimal**
4.2 Adjacent Wetlands: **Minimal**
4.3 Flow Status: **Moderate**
4.4 # of Debris Jams: **39**

4.5 Flow Regulation Type **None**
Flow Reg. Use:
Impoundments:
Impoundment Loc.:
4.6 Up/Down Strm flow reg.: **None**
(old) Upstrm Flow Reg.:

4.7 Stormwater Inputs
Field Ditch: **0** Road Ditch: **1**
Other: **0** Tile Drain: **0**
Overland Flow: **0** Urb Strm Wtr Pipe: **0**
4.9 # of Beaver Dams: **4**
Affected Length (ft): **500**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	**9**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Scour Below**
Instream Culvert	**4.8**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Scour Above,Scour Below**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types
Diagonal: **8**
Mid: **5**
Delta: **1**
Point: **25**
Island: **4**
Side: **16**
Braiding: **3**

5.2 Other Features
Flood chutes: **38**
5.3 Steep Riffles and Head Cuts
Steep Riffles: **1**

Neck Cutoff: **0**
Avulsion: **2**
Head Cuts: **0**
Trib Rejuv.: **No**

5.4 Stream Ford or Animal Crossing: **Yes**
5.5 Straightening: **None**
Straightening Length (ft.): **0**
5.5 Dredging: **None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:
6.2 Pool Substrate:
6.3 Pool Variability:
Total Score: **0**
Habitat Rating: **0.00**
Habitat Stream Condition:

6.4 Sediment Deposition:
6.5 Channel Flow Status:
6.6 Channel Alteration:
6.7 Channel Sinuosity:

Stream Gradiant Type Left Right
6.8 Bank Stability:
6.9 Bank Vegetation Protection
6.10 Riparian Veg. Zone Width:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Confined**

	Score	STD	Historic
7.1 Channel Degradation	**5**		**Yes**
7.2 Channel Aggradation	**10**		
7.3 Widening Channel	**8**		
7.4 Change in Planforml	**7**		
Total Score	**30**		

Geomorphic Rating **0.38**
Channel Evolution Model **F**
Channel Evolution Stage **III**
Geomorphic Condition **Fair**
Stream Sensitivity **High**

Phase 2 Segment Summary Report Wells River

Stream: **Scott Brook**
Reach: **M11T1.06-A**
Segment Length(ft): **1,875**
Rain: **Yes**

SGAT Version: **4.56**
Organization:
Observers: **Redstart_dr, ES**
Completion Date: **6/8/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**
Why Not Assessed: **beaver dam**

Step 0 - Location: **Beaver-impacted wetlands just NE of Swamp Rd-Topsham Rd intersection. Habitat data was collected.**

Step 5 - Notes:

Step 7 - Narrative:

Step 1. Valley and Floodplain

1.1 Segmentation: **Channel Dimensions**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	0		0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	0		0	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Flat	Flat
Continuous w/ Bank:	Always	Always
Within 1 Bankfull W:	Always	Always
Texture:	Sand	Sand

1.5 Valley Features
Valley Width (ft): **400**
Width Determination: **Measured**
Confinement Type: **VB**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **No**

1.6 Grade Controls: **None**

Stream: **Scott Brook** Reach: **M11T1.06-A**

Step 2. Stream Channel

2.1Bankfull Width (ft.):
2.2 Max Depth (ft.):
2.3 Mean Depth (tf):
2.4 Floodprone Width (ft.):
2.5 Aband. Floodpn (ft.):
Human Elev FloodPln (ft.):
2.6 Width/Depth Ratio: **0.00**
2.7 Entrenchment Ratio: **0.00**
2.8 Incision Ratio: **0.00**
Human Elevated Inc. Rat.: **0.00**
2.9 Sinuosity:
2.10 Riffles Type:

2.11 Riffle/Step Spacing:
2.12 Substrate Composition
Bedrock: %
Boulder: %
Cobble: %
Coarse Gravel: %
Fine Gravel: %
Sand: %
Silt and Smaller: %
Silt/Clay Present:
Detritus: %
Large Woody Debris:

2.13 Average Largest Particle on
Bed:
Bar:
2.14 Stream Type
Stream Type:
Bed Material:
Subclass Slope:
Bed Form:
Field Measured Slope:
2.15 Sub-reach Stream Type
Reference Stream Type:
Reference Bed Material:
Reference Subclass Slope:
Reference Bedform:

Step 3. Riparian Features

3.1 Stream Banks

Bank Texture	Left	Right
Upper		
Material Type:	**Sand**	**Sand**
Consistency:	**Non-cohesive**	**Non-cohesive**
Lower		
Material Type:	**Sand**	**Sand**
Consistency:	**Non-cohesive**	**Non-cohesive**

Bank Erosion	Left	Right
Erosion Length (ft.):	**0.0**	**0.0**
Erosion Height (ft.):	**0.0**	**0.0**
Revetment Type:	**None**	**None**
Revetment Length:	**0.0**	**0.0**

Typical Bank Slope:

Near Bank Vegetation Type	Left	Right
Dominant:	**Herbaceous**	**Herbaceous**
Sub-dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Bank Canopy		
Canopy %:	**1-25**	**1-25**
Mid-Channel Canopy:	**Open**	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant		
W less than 25	**0**	**0**
Buffer Vegitation Type		
Dominant	**Herbaceous**	**Herbaceous**
Sub-Dominant	**Shrubs/Sapling**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Shrubs/Sapling**	**Shrubs/Sapling**
Sub-dominant		
(Legacy)	Amount	Mean Hieght
Failures	**None**	
Gullies	**None**	

	Left	Right
Mass Failures		
Height		
Gullies Number	**0**	
Gullies Length	**0**	

Stream: **Scott Brook** Reach: **M11T1.06-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps: **Minimal**
4.2 Adjacent Wetlands: **Abundant**
4.3 Flow Status: **Moderate**
4.4 # of Debris Jams: **0**
4.5 Flow Regulation Type **None**
Flow Reg. Use:
Impoundments:
Impoundment Loc.:
4.6 Up/Down Strm flow reg.: **None**
(old) Upstrm Flow Reg.:
4.7 Stormwater Inputs **None**
Field Ditch: Road Ditch:
Other: Tile Drain:
Overland Flow: Urb Strm Wtr Pipe:
4.9 # of Beaver Dams: **2**
Affected Length (ft): **500**

4.8 Channel Constrictions:

Step 5. Channel Bed and Planform Changes

5.1 Bar Types Diagonal:
Mid: Delta:
Point: Island:
Side: Braiding: **0**
5.2 Other Features
Flood chutes: **0**
5.3 Steep Riffles and Head Cuts
Steep Riffles: **0**
Neck Cutoff: **0**
Avulsion: **0**
Head Cuts: **0**
Trib Rejuv.:
5.4 Stream Ford or Animal Crossing: **No**
5.5 Straightening: **None**
Straightening Length (ft.): **0**
5.5 Dredging: **None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:
6.2 Pool Substrate:
6.3 Pool Variability:
Total Score:
Habitat Rating:
Habitat Stream Condition:
6.4 Sediment Deposition:
6.5 Channel Flow Status:
6.6 Channel Alteration:
6.7 Channel Sinuosity:
Stream Gradiant Type Left Right
6.8 Bank Stability:
6.9 Bank Vegetation Protection
6.10 Riparian Veg. Zone Width:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Score	STD	Historic
7.1 Channel Degradation			
7.2 Channel Aggradation			
7.3 Widening Channel			
7.4 Change in Planforml			
Total Score			

Geomorphic Rating
Channel Evolution Model
Channel Evolution Stage
Geomorphic Condition
Stream Sensitivity

Phase 2 Segment Summary Report Wells River

Stream: **Scott Brook**
Reach: **M11T1.06-B**
Segment Length(ft): **759**
Rain: **Yes**

SGAT Version: **4.56**
Organization:
Observers: **Redstart_dr, ES**
Completion Date: **6/8/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **Segment begins DS of intersection of Swamp Road and Topsham Road.**

Step 5 - Notes: **Wetland area was likely in former ag use, dominated by reed canary grass that limits erosion. Downstream portion of reach is beaver controlled and this US segment receives elevated sediment discharges from box culvert at Swamp Rd (base of reach M11T107), aggradation quickly offsetting minor incision from recent flood events.**

Step 7 - Narrative: **Minor aggradation, widening and planform change related to increased sediment discharges from next reach upstream and beaver dam influences downstream; sediment discharges rapidly offsetting slight incision from recent flood events. Borders on E to C STD based on w/d ratio, but have used +/- 2 'fudge factor' to class as E type stream due to other factors (meadow setting, very broad valley and high entrenchment ratio). Cross-section was difficult to read as floodplain access is good with relatively flat topography; bankfull determined from flattened vegetation in recent high water events likely underestimates cross-sectional area and bankfull width and depth.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Channel Dimensions**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

	Length (ft)	One Height	Both	Height
Berm:	0		0	
Road:	0		0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	0		0	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Flat	Flat
Continuous w/ Bank:	Always	Always
Within 1 Bankfull W:	Always	Always
Texture:	Sand	Sand

1.5 Valley Features

Valley Width (ft): **400**
Width Determination: **Measured**
Confinement Type: **VB**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **No**

1.6 Grade Controls: **None**

Stream: **Scott Brook** Reach: **M11T1.06-B**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**7.00**	2.11 Riffle/Step Spacing:	**24 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**1.40**	2.12 Substrate Composition		Bed:	**1**	**inches**
2.3 Mean Depth (tf):	**0.49**	Bedrock:	**0.0 %**	Bar:	**0.9**	**inches**
2.4 Floodprone Width (ft.):	**247.00**	Boulder:	**0.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**1.60**	Cobble:	**1.0 %**	Stream Type:	**E**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**8.0 %**	Bed Material:	**Sand**	
2.6 Width/Depth Ratio:	**14.29**	Fine Gravel:	**41.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**35.29**	Sand:	**50.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.14**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Moderate**	Detritus:	**0.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**4**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Moderate**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**0.0**	**0.0**	Dominant:	**Herbaceous**	**Herbaceous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**0.0**	**0.0**	Sub-dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**None**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**0.0**	Canopy %:	**1-25**	**1-25**
Material Type:	**Sand**	**Sand**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**None**	**None**
W less than 25	**0**	**0**
Buffer Vegitation Type		
Dominant	**Herbaceous**	**Herbaceous**
Sub-Dominant	**Shrubs/Sapling**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Shrubs/Sapling**	**Shrubs/Sapling**	Mass Failures		
Sub-dominant	**Forest**	**Forest**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length		
Gullies	**None**				

Stream: **Scott Brook** Reach: **M11T1.06-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**Abundant**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:	**None**	Other:	Tile Drain:
4.4 # of Debris Jams:	**2**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**1**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**150**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**0**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**0**	Delta:	**0**	Flood chutes:	**5**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**3**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**52**
Side:	**1**	Braiding:	**1**	Steep Riffles:	**0**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**14**	**None**	**No**	Geomorphic Rating	**0.68**
7.2 Channel Aggradation		**13**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**13**	**None**	**No**	Channel Evolution Stage	**IV**
7.4 Change in Planforml		**14**	**None**	**No**	Geomorphic Condition	**Good**
Total Score		**54**			Stream Sensitivity	**High**

Phase 2 Segment Summary Report Wells River

Stream: Scott Brook
Reach: M11T1.07-A
Segment Length(ft): 818
Rain: Yes

SGAT Version: 4.56
Organization:
Observers: Redstart_dr, ES
Completion Date: 5/27/2015
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional

Step 0 - Location:

Step 5 - Notes: **Upstream wetland (M11T107B) greatly buffers storm discharges; lack of incision was somewhat surprising given length of straightening and multiple undersized stream crossing structures. Private culvert (tank, 60 pct bkfw) at base of reach appears to have been installed when driveway entrance was reconfigured to enter from Topsham Rd instead of former entry off Swamp Rd. Gravel substrate is not expected in this subreach, considered C3b by reference, and may be related to impacts of straightening and undersized structures.**

Step 7 - Narrative: **Minor adjustments in all processes; grade controls and cobble/boulder substrate limit incision. Long-standing boulder rip rap limits widening and may obscure RAF; have used +/- 2 'fudge factor' to class as a C type stream largely due to these factors (w/d technically in range of E type stream). Relatively steep gradient allows large particle movement in high flows, upstream wetland greatly buffers storm discharges**

Step 1. Valley and Floodplain

1.1 Segmentation: **Grade Controls**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

	Length (ft)	One Height	Both	Height
Berm:	0		0	
Road:	817	8	0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	692		0	

1.4 Adjacent Side	Left	Right
Hillside Slope:	Steep	Hilly
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Always	Sometimes
Texture:	Sand	Sand

1.5 Valley Features
Valley Width (ft): 90
Width Determination: Measured
Confinement Type: BD
In Rock Gorge: No
Human Caused Change in Valley Width?: Yes

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	1.7	0.7	No	
Ledge	Mid-segment	2.1	1.9	Yes	

Stream: **Scott Brook** Reach: **M11T1.07-A**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**9.50**	2.11 Riffle/Step Spacing:	**23.4 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**1.60**	2.12 Substrate Composition		Bed:	**10.2**	**inches**
2.3 Mean Depth (tf):	**0.95**	Bedrock:	**1.0 %**	Bar:	**13.2**	**inches**
2.4 Floodprone Width (ft.):	**80.80**	Boulder:	**6.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**1.60**	Cobble:	**39.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**8.0 %**	Bed Material:	**Gravel**	
2.6 Width/Depth Ratio:	**10.00**	Fine Gravel:	**17.0 %**	Subclass Slope:	**b**	
2.7 Entrenchment Ratio:	**8.51**	Sand:	**20.0 %**	Bed Form:	**Step-Pool**	
2.8 Incision Ratio:	**1.00**	Silt and Smaller:	**%**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**0.0 %**	Reference Stream Type:	**C**	
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**3**	Reference Bed Material:	**Cobble**	
				Reference Subclass Slope:	**b**	
				Reference Bedform:	**Step-Pool**	

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**28.3**	**18.5**	Dominant:	**Deciduous**	**Deciduous**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**	Erosion Height (ft.):	**2.0**	**2.0**	Sub-dominant:	**Herbaceous**	**Herbaceous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**191.0**	**198.4**	Canopy %:	**51-75**	**26-50**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Closed**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**0-25**	**0-25**
Sub-Dominant	**>100**	**26-50**
W less than 25	**484**	**394**
Buffer Vegitation Type		
Dominant	**Deciduous**	**Herbaceous**
Sub-Dominant	**Herbaceous**	**Deciduous**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Residential**	**Residential**
Sub-dominant	**Forest**	**Pasture**
(Legacy)	Amount	Mean Hieght
Failures	**None**	
Gullies	**None**	

	Left	Right
Mass Failures		
Height		
Gullies Number	**0**	
Gullies Length	**0**	

Stream: **Scott Brook** Reach: **M11T1.07-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch: **1**	Road Ditch: **3**
4.3 Flow Status:	**Moderate**	Impoundments:	**None**	Other: **0**	Tile Drain: **0**
4.4 # of Debris Jams:	**3**	Impoundment Loc.:		Overland Flow: **0**	Urb Strm Wtr Pipe: **0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Instream Culvert	**4**	**Yes**	**Yes**	**Yes**	**Yes**	**Scour Above,Scour Below**
Instream Culvert	**6**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Scour Above,Scour Below**
Bridge	**9.3**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**0**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**Yes**	
Mid:	**1**	Delta:	**0**	Flood chutes:	**2**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**0**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**818**
Side:	**2**	Braiding:	**0**	Steep Riffles:	**0**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Confined**

	Score	STD	Historic		
7.1 Channel Degradation	**12**			Geomorphic Rating	**0.64**
7.2 Channel Aggradation	**13**			Channel Evolution Model	**F**
7.3 Widening Channel	**14**			Channel Evolution Stage	**V**
7.4 Change in Planforml	**12**			Geomorphic Condition	**Fair**
Total Score	**51**			Stream Sensitivity	**Very High**

Phase 2 Segment Summary Report Wells River

Stream: **Scott Brook**
Reach: **M11T1.07-B**
Segment Length(ft): **1,219**
Rain: **Yes**

SGAT Version: **4.56**
Organization:
Observers: **Redstart_dr, ES**
Completion Date: **5/27/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **Along Topsham Rd**

Step 5 - Notes: **Peacham mucky peat soils appear to occupy more of the reach than indicated on SSURGO soils maps. E-->C STD due to sedimentation and widening, channel splits US of meadow and rejoins just above Topsham Rd culvert with some braiding in between. Sufficient cohesive silt content to make the bed resistant to erosion, and the channel easily braids - especially when woody debris is also playing a role.**

Step 7 - Narrative: **Aggradation at upstream end with minor to major planform change. Some braiding, then channel splits mid-segment through meadow and rejoins at US Topsham Rd culvert. Used +/- 2 'fudge factor' to class as C type stream as w/d ratio borders on 12 even at x-section that was taken in a relatively narrow portion of the channel for the overall segment. Extreme sensitivity assigned due to E to C STD and dominance of Peacham soils.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Grade Controls**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	489	9	169	8
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	241		0	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Flat	Flat
Continuous w/ Bank:	Always	Always
Within 1 Bankfull W:	Always	Always
Texture:	Sand	Sand

1.5 Valley Features

Valley Width (ft): **400**
Width Determination: **Measured**
Confinement Type: **VB**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls: **None**

Stream: **Scott Brook** Reach: **M11T1.07-B**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**11.80**	2.11 Riffle/Step Spacing:	**40 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**1.30**	2.12 Substrate Composition		Bed:	**0.8**	**inches**
2.3 Mean Depth (tf):	**1.01**	Bedrock:	**0.0 %**	Bar:	**0.75**	**inches**
2.4 Floodprone Width (ft.):	**291.80**	Boulder:	**0.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**1.30**	Cobble:	**0.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**1.0 %**	Bed Material:	**Sand**	
2.6 Width/Depth Ratio:	**11.68**	Fine Gravel:	**41.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**24.73**	Sand:	**51.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.00**	Silt and Smaller:	**8.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**Yes**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**High**	Detritus:	**3.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**16**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Undercut**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**0.0**	**0.0**	Dominant:	**Herbaceous**	**Herbaceous**
Material Type:	**Mix**	**Mix**	Erosion Height (ft.):	**0.0**	**0.0**	Sub-dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**None**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**0.0**	Canopy %:	**76-100**	**51-75**
Material Type:	**Gravel**	**Sand**				Mid-Channel Canopy:	**Closed**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**51-100**
Sub-Dominant	**0-25**	**0-25**
W less than 25	**558**	**525**
Buffer Vegitation Type		
Dominant	**Herbaceous**	**Coniferous**
Sub-Dominant	**Coniferous**	**Herbaceous**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Forest**	**Forest**
Sub-dominant	**Residential**	**Residential**
(Legacy)	Amount	Mean Hieght
Failures	**None**	
Gullies	**None**	

	Left	Right
Mass Failures		
Height		
Gullies Number	**0**	
Gullies Length	**0**	

Stream: **Scott Brook** Reach: **M11T1.07-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Abundant**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**Abundant**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	**2**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Instream Culvert	**3.6**	**Yes**	**Yes**	**Yes**	**No**	**Deposition Below**
Instream Culvert	**5**	**Yes**	**Yes**	**Yes**	**No**	**Scour Above,Scour Below,Alignment**
Bridge	**9.3**	**Yes**	**Yes**	**Yes**	**No**	**Deposition Above**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**0**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:	**No**		
Mid:	**2**	Delta:	**0**	Flood chutes:	**7**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**17**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**733**
Side:	**0**	Braiding:	**2**	Steep Riffles:	**0**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**14**			Geomorphic Rating	**0.47**
7.2 Channel Aggradation		**7**	**E To C**		Channel Evolution Model	**D**
7.3 Widening Channel		**10**			Channel Evolution Stage	**IId**
7.4 Change in Planforml		**7**			Geomorphic Condition	**Fair**
Total Score		**38**			Stream Sensitivity	**Extreme**

Phase 2 Segment Summary Report Wells River

Stream: Scott Brook
Reach: M11T1.08-A
Segment Length(ft): 3,256
Rain: Yes

SGAT Version: 4.56
Organization:
Observers: Redstart_dr, ES
Completion Date: 6/5/2015
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional

Step 0 - Location: **DS of intersection of Topsham Road and Swift Road**

Step 5 - Notes: **Though slope is ~6 pct by GIS, most of this occurs over a short stretch of grade controls and the majority of the segment is 2 -4 pct slope. Current logging along ~ 40 pct of the segment, occasionally cut to bank and several corduroys in place at grade controls that were used as stream fords; these corduroys are retaining a good deal of fine sediments. Although w/d ratio at x-section is technically within range of E type stream, used +/- 2 'fudge factor' to class as C type stream based on moderate sinuosity, geologic materials, slope, and common point bar deposition.**

Step 7 - Narrative: **Major to minor aggradation, widening, and planform changes following historic incision; grade controls limit incision. Fines from breached upstream beaver dam being retained by natural debris jams as well as log job brush corduroy stream crossings located at several grade controls. Stream currently directly against Topsham Rd on LVW downstream of perched culvert by Swift Road.**

Step 1. Valley and Floodplain

1.1 Segmentation: Grade Controls
1.2 Alluvial Fan: None
1.3 Corridor Encroachments:

	Length (ft)	One Height	Both	Height
Berm:	0		0	
Road:	1,077	7	0	
Railroad:	0		0	
Imp. Path:	65	3	0	
Dev.:	76		0	

1.4 Adjacent Side	Left	Right
Hillside Slope:	Hilly	Hilly
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	Mixed	Mixed

1.5 Valley Features
Valley Width (ft): 45
Width Determination: Estimated
Confinement Type: NW
In Rock Gorge: No
Human Caused Change in Valley Width?: Yes

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	4.9	4.1	No	Yes
Ledge	Mid-segment	2.6	1.4	No	Yes
Ledge	Mid-segment	5.3	5.0	Yes	Yes
Ledge	Mid-segment	10.2	9.6	Yes	Yes
Ledge	Mid-segment	3.9	3.1	Yes	Yes
Ledge	Mid-segment	2.0	1.2	No	Yes
Ledge	Mid-segment	2.0	1.6	Yes	Yes
Ledge	Mid-segment	15.6	15.1	Yes	Yes
Ledge	Mid-segment	10.3	9.8	Yes	Yes

Stream: **Scott Brook** Reach: **M11T1.08-A**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**8.65**	2.11 Riffle/Step Spacing:	**17 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**1.00**	2.12 Substrate Composition		Bed:	**9.4**	**inches**
2.3 Mean Depth (tf):	**0.73**	Bedrock:	**20.0 %**	Bar:	**6.8**	**inches**
2.4 Floodprone Width (ft.):	**22.40**	Boulder:	**4.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**1.40**	Cobble:	**22.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**12.0 %**	Bed Material:	**Gravel**	
2.6 Width/Depth Ratio:	**11.85**	Fine Gravel:	**15.0 %**	Subclass Slope:	**b**	
2.7 Entrenchment Ratio:	**2.59**	Sand:	**27.0 %**	Bed Form:	**Step-Pool**	
2.8 Incision Ratio:	**1.40**	Silt and Smaller:	**%**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Moderate**	Detritus:	**2.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**104**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**16.4**	**0.0**	Dominant:	**Herbaceous**	**Herbaceous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**3.0**	**0.0**	Sub-dominant:	**Deciduous**	**Deciduous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**None**	Bank Canopy		
Lower			Revetment Length:	**150.5**	**0.0**	Canopy %:	**51-75**	**51-75**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Closed**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**26-50**	**26-50**
W less than 25	**0**	**0**
Buffer Vegitation Type		
Dominant	**Herbaceous**	**Herbaceous**
Sub-Dominant	**Deciduous**	**Deciduous**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Forest**	Mass Failures		
Sub-dominant	**None**	**None**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length		
Gullies	**None**				

Stream: **Scott Brook** Reach: **M11T1.08-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Abundant**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch: **0**	Road Ditch: **3**
4.3 Flow Status:	**Moderate**	Impoundments:		Other: **0**	Tile Drain: **0**
4.4 # of Debris Jams:	**40**	Impoundment Loc.:		Overland Flow: **0**	Urb Strm Wtr Pipe: **0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Instream Culvert	**3**	**Yes**	**Yes**	**Yes**	**No**	**Deposition Above,Deposition Below,Scour Above**
Instream Culvert	**1**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Scour Above**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**4**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:	**Yes**		
Mid:	**5**	Delta:	**0**	Flood chutes:	**24**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**9**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**1,091**
Side:	**10**	Braiding:	**1**	Steep Riffles:	**0**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Confined**	Score	STD	Historic		
7.1 Channel Degradation		**10**		**Yes**	Geomorphic Rating	**0.50**
7.2 Channel Aggradation		**10**			Channel Evolution Model	**F**
7.3 Widening Channel		**11**			Channel Evolution Stage	**III**
7.4 Change in Planforml		**9**			Geomorphic Condition	**Fair**
Total Score		**40**			Stream Sensitivity	**Very High**

Phase 2 Segment Summary Report Wells River

Stream: **Scott Brook**
Reach: **M11T1.08-B**
Segment Length(ft): **740**
Rain: **Yes**

SGAT Version: **4.56**
Organization:
Observers: **Redstart_dr, ES**
Completion Date: **6/5/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**
Why Not Assessed: **impounded**

Step 0 - Location: **Human and beaver pond areas US of 29 James Downing Rd; habitat data was collected.**

Step 5 - Notes: **Upper Beaver pond recently (< 10 years) breached, dry; DS beaver pond is a combo human/beaver. Flood caused damage to DS culverts and partially breached beaver dam. "Losing Stream" (subsurface) through much of old beaver pond area.**

Step 7 - Narrative:

Step 1. Valley and Floodplain

1.1 Segmentation: **Channel Dimensions**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

	Length (ft)	One Height	Both	Height
Berm:	0		0	
Road:	0		0	
Railroad:	0		0	
Imp. Path:	122	3	0	
Dev.:	0		0	

1.4 Adjacent Side	Left	Right
Hillside Slope:	Flat	Hilly
Continuous w/ Bank:	Always	Sometimes
Within 1 Bankfull W:	Always	Always
Texture:	Sand	Mixed

1.5 Valley Features
Valley Width (ft): **250**
Width Determination: **Measured**
Confinement Type: **VB**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **No**

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Dam	Mid-segment	5.5	5.0	Yes	

Stream: **Scott Brook** Reach: **M11T1.08-B**

Step 2. Stream Channel

2.1Bankfull Width (ft.):		2.11 Riffle/Step Spacing:		2.13 Average Largest Particle on Bed:	
2.2 Max Depth (ft.):		2.12 Substrate Composition		Bar:	
2.3 Mean Depth (tf):		Bedrock:	%	2.14 Stream Type	
2.4 Floodprone Width (ft.):		Boulder:	%	Stream Type:	**C**
2.5 Aband. Floodpn (ft.):		Cobble:	%	Bed Material:	**Gravel**
Human Elev FloodPln (ft.):		Coarse Gravel:	%	Subclass Slope:	**b**
2.6 Width/Depth Ratio:	**0.00**	Fine Gravel:	%	Bed Form:	**Step-Pool**
2.7 Entrenchment Ratio:	**0.00**	Sand:	%	Field Measured Slope:	
2.8 Incision Ratio:	**0.00**	Silt and Smaller:	%	2.15 Sub-reach Stream Type	
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:		Reference Stream Type:	
2.9 Sinuosity:		Detritus:	**0.0 %**	Reference Bed Material:	
2.10 Riffles Type:		# Large Woody Debris:		Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Shallow**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**0.0**	**0.0**	Dominant:	**Herbaceous**	**Herbaceous**
Material Type:	**Sand**	**Boulder/Cobble**	Erosion Height (ft.):	**0.0**	**0.0**	Sub-dominant:	**Shrubs/Sapling**	**Deciduous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**None**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**0.0**	Canopy %:	**26-50**	**1-25**
Material Type:	**Sand**	**Sand**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**None**	**None**
W less than 25	**0**	**0**
Buffer Vegitation Type		
Dominant	**Mixed Trees**	**Mixed Trees**
Sub-Dominant	**Shrubs/Sapling**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Forest**	Mass Failures		
Sub-dominant	**Shrubs/Sapling**	**Shrubs/Sapling**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **Scott Brook** Reach: **M11T1.08-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Abundant**	4.5 Flow Regulation Type	**Small Store and Release**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**Abundant**	Flow Reg. Use:	**Recreation**	Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:	**Small**	Other:	Tile Drain:
4.4 # of Debris Jams:	**2**	Impoundment Loc.:	**In Reach**	Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**2**
		(old) Upstrm Flow Reg.:	**Run-of-river Dam**	Affected Length (ft):	**300**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**0**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:	**No**		
Mid:	**0**	Delta:	**0**	Flood chutes:	**2**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**0**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**71**
Side:	**0**	Braiding:	**2**	Steep Riffles:	**0**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradiant Type	Left	Right
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score:	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating:				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Score	STD	Historic		
7.1 Channel Degradation				Geomorphic Rating	
7.2 Channel Aggradation				Channel Evolution Model	
7.3 Widening Channel				Channel Evolution Stage	
7.4 Change in Planforml				Geomorphic Condition	
Total Score				Stream Sensitivity	

Phase 2 Segment Summary Report Wells River

Stream: Scott Brook
Reach: M11T1.08-C
Segment Length(ft): 593
Rain: Yes

SGAT Version: 4.56
Organization:
Observers: Redstart_dr, ES
Completion Date: 6/5/2015
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional

Step 0 - Location:

Step 5 - Notes: **Suspect stream bed may have been used as skid road in past; a skid rd now runs higher up along RVW but does not appear to have been in recent use. Despite significant historic incision channel is small and retains sufficient floodplain access to remain a Cb stream type. Channel begins to braid in next seg DS, loses definition and goes subsurface in vicinity of breached beaver dam, then enters beaver shared human made pond. Well at head of the reach, most US portion borders on 'a' subslope.**

Step 7 - Narrative: **Major aggradation (heavy sedimentation with fines), widening (poorly defined channel), and loss of planform following historic incision. Suspect channel was historically used as a skid or access road to pond area, now replaced by parallel road up RVW. No STD; stream still has sufficient floodplain access at lower elevation to class as C type.**

Step 1. Valley and Floodplain

1.1 Segmentation: Grade Controls
1.2 Alluvial Fan: None
1.3 Corridor Encroachments:

	Length (ft)	One Height	Both	Height
Berm:	0		0	
Road:	0		0	
Railroad:	0		0	
Imp. Path:	510	8	0	
Dev.:	0		0	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Hilly	Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	Sand	Sand

1.5 Valley Features

Valley Width (ft):	40
Width Determination:	Measured
Confinement Type:	NW
In Rock Gorge:	No
Human Caused Change in Valley Width?:	No

1.6 Grade Controls: None

Stream: **Scott Brook** Reach: **M11T1.08-C**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**10.20**	2.11 Riffle/Step Spacing:	**18.9 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**0.80**	2.12 Substrate Composition		Bed:	**11**	**inches**
2.3 Mean Depth (tf):	**0.38**	Bedrock:	**0.0 %**	Bar:	**6.6**	**inches**
2.4 Floodprone Width (ft.):	**42.40**	Boulder:	**9.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**1.80**	Cobble:	**5.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**0.0 %**	Bed Material:	**Gravel**	
2.6 Width/Depth Ratio:	**26.84**	Fine Gravel:	**10.0 %**	Subclass Slope:	**b**	
2.7 Entrenchment Ratio:	**4.16**	Sand:	**76.0 %**	Bed Form:	**Step-Pool**	
2.8 Incision Ratio:	**2.25**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Moderate**	Detritus:	**1.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**19**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Shallow**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**29.5**	**0.0**	Dominant:	**Deciduous**	**Deciduous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**2.0**	**0.0**	Sub-dominant:	**Herbaceous**	**Herbaceous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**None**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**0.0**	Canopy %:	**76-100**	**76-100**
Material Type:	**Sand**	**Sand**				Mid-Channel Canopy:	**Closed**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**None**	**None**
W less than 25	**0**	**0**
Buffer Vegitation Type		
Dominant	**Deciduous**	**Deciduous**
Sub-Dominant	**Shrubs/Sapling**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Forest**	**Forest**
Sub-dominant	**None**	**None**
(Legacy)	Amount	Mean Hieght
Failures	**None**	
Gullies	**None**	

	Left	Right
Mass Failures		
Height		
Gullies Number	**0**	
Gullies Length	**0**	

Stream: **Scott Brook** Reach: **M11T1.08-C**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps: **Abundant**
4.2 Adjacent Wetlands: **Abundant**
4.3 Flow Status: **Moderate**
4.4 # of Debris Jams: **4**

4.5 Flow Regulation Type **None**
Flow Reg. Use:
Impoundments:
Impoundment Loc.:
4.6 Up/Down Strm flow reg.: **None**
(old) Upstrm Flow Reg.:

4.7 Stormwater Inputs
Field Ditch: **0** Road Ditch: **1**
Other: **0** Tile Drain: **0**
Overland Flow: **1** Urb Strm Wtr Pipe: **0**
4.9 # of Beaver Dams: **0**
Affected Length (ft): **0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types
Diagonal: **0**
Mid: **0**
Delta: **0**
Point: **0**
Island: **0**
Side: **0**
Braiding: **0**

5.2 Other Features
Flood chutes: **1**
5.3 Steep Riffles and Head Cuts
Steep Riffles: **0**

Neck Cutoff: **0**
Avulsion: **0**
Head Cuts: **0**
Trib Rejuv.: **No**

5.4 Stream Ford or Animal Crossing: **No**
5.5 Straightening: **None**
Straightening Length (ft.): **0**
5.5 Dredging: **None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:
6.2 Pool Substrate:
6.3 Pool Variability:
Total Score: **0**
Habitat Rating: **0.00**
Habitat Stream Condition:

6.4 Sediment Deposition:
6.5 Channel Flow Status:
6.6 Channel Alteration:
6.7 Channel Sinuosity:

Stream Gradiant Type Left Right
6.8 Bank Stability:
6.9 Bank Vegetation Protection
6.10 Riparian Veg. Zone Width:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Confined**	Score	STD	Historic		
7.1 Channel Degradation		**5**	**None**	**Yes**	Geomorphic Rating	**0.43**
7.2 Channel Aggradation		**10**			Channel Evolution Model	**F**
7.3 Widening Channel		**9**			Channel Evolution Stage	**III**
7.4 Change in Planforml		**10**		**Yes**	Geomorphic Condition	**Fair**
Total Score		**34**			Stream Sensitivity	**Very High**

Phase 2 Segment Summary Report Wells River

Stream: **Wells River**
Reach: **M12-0**
Segment Length(ft): **2,266**
Rain: **Yes**

SGAT Version: **4.56**
Organization:
Observers: **Redstart_dr, ES**
Completion Date: **6/30/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location:

Step 5 - Notes: **Reach is in substantially developed portion of South Ryegate village, dominated by former stonesheds that were served by the railroad; banks extensively armored with granite. Rte 302 bisects former floodplain and ballfields are located in disconnected historic floodplain. Former railroad bed is now occupied by roads in this reach.**

Step 7 - Narrative: **Loss of planform following historic incision and extensive straightening. Although stream still has some access to LB floodplain, valley width and floodplain access significantly reduced by Rt. 302 elevation; extensive rip-rap limits erosion but contributes to cyclic instability of sediment inputs and redistribution. Although protocols would typically assign Very High sensitivity to this reach based on stream type and adjustments, extensive waste granite riprap and relatively intractable nature of Rte 302 and old RR bed (now masked by roads occupying same space) led us to reduce sensitivity to High.**

Step 1. Valley and Floodplain

1.1 Segmentation: **None**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	0		2,252	15
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	905		1,334	

1.4 Adjacent Side	Left	Right
Hillside Slope:	Steep	Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Always	Sometimes
Texture:	Mixed	Mixed

1.5 Valley Features
Valley Width (ft): **350**
Width Determination: **Measured**
Confinement Type: **NW**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls: **None**

Stream: **Wells River** Reach: **M12-0**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**76.00**	2.11 Riffle/Step Spacing:	**750 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**6.45**	2.12 Substrate Composition		Bed:	**3.4**	**inches**
2.3 Mean Depth (tf):	**5.12**	Bedrock:	**0.0 %**	Bar:	**2**	**inches**
2.4 Floodprone Width (ft.):	**471.20**	Boulder:	**1.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**8.75**	Cobble:	**15.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**42.0 %**	Bed Material:	**Gravel**	
2.6 Width/Depth Ratio:	**14.84**	Fine Gravel:	**8.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**6.20**	Sand:	**34.0 %**	Bed Form:	**Plane Bed**	
2.8 Incision Ratio:	**1.36**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**15.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Eroded**	# Large Woody Debris:	**10**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**0.0**	**0.0**	Dominant:	**Herbaceous**	**Shrubs/Sapling**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**0.0**	**0.0**	Sub-dominant:	**Deciduous**	**Herbaceous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Multiple**	**Hard Bank**	Bank Canopy		
Lower			Revetment Length:	**1,674.1**	**37.5**	Canopy %:	**51-75**	**26-50**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**51-100**	**0-25**
Sub-Dominant	**0-25**	**26-50**
W less than 25	**640**	**1,670**
Buffer Vegitation Type		
Dominant	**Shrubs/Sapling**	**Herbaceous**
Sub-Dominant	**Deciduous**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Commercial**	**Commercial**	Mass Failures		
Sub-dominant	**Residential**	**Residential**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **Wells River** Reach: **M12-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	**None**	Flow Reg. Use:		Field Ditch: **0**	Road Ditch: **3**
4.3 Flow Status:	**Moderate**	Impoundments:		Other: **0**	Tile Drain: **0**
4.4 # of Debris Jams:	**1**	Impoundment Loc.:		Overland Flow: **0**	Urb Strm Wtr Pipe: **0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:	**None**	Affected Length (ft):	**0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Old Abutment	**0**	**Yes**	**No**	**Yes**	**No**	**Scour Above,Scour Below**
Bridge	**70**	**Yes**	**Yes**	**Yes**	**Yes**	**Scour Above,Scour Below**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**0**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**1**	Delta:	**1**	Flood chutes:	**0**	Avulsion:	**0**	5.5 Straightening:		**Straightening**
Point:	**1**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):		**2,264**
Side:	**0**	Braiding:	**0**	Steep Riffles:	**0**	Trib Rejuv.:	**No**	5.5 Dredging:		**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic		
7.1 Channel Degradation	**9**		**Yes**	Geomorphic Rating	**0.51**
7.2 Channel Aggradation	**10**			Channel Evolution Model	**F**
7.3 Widening Channel	**12**			Channel Evolution Stage	**III**
7.4 Change in Planforml	**10**			Geomorphic Condition	**Fair**
Total Score	**41**			Stream Sensitivity	**High**

Phase 2 Segment Summary Report Wells River

Stream: **Stone Road Brook**
Reach: **M12S2.01-A**
Segment Length(ft): **1,033**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Caledonia County Conservation District**
Observers: **Redstart_dr, EBM**
Completion Date: **10/7/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **jct with Wells mainstem at Stoneshed Rd (So Ryegate village) to ~350 ft US Stone Rd-Creamery Rd jct**

Step 5 - Notes: **'Other' constriction is Step 4.8 is a stone-lined channel under old stoneshed building. Segment is walled in thru residential and former stoneshed-creamery industrial area.Not clear if totally incised thru sandy sediments (glacial Lake Hitchcock edge legacy) or has extensive fill, as surrounding terrain is mostly altered. According to several local residents, Irene did not quite overtop double right angle corners at Stone Rd-Creamery Rd but did back up some distance above the Stone Rd culvert.**

Step 7 - Narrative: **Loss of planform with major widening and major reducing to minor aggradation following historic incision. Reach is extensively armored and channelized in attempt to limit widening in highly erodible glacial lake edge sediments**

Step 1. Valley and Floodplain

1.1 Segmentation: **Valley Width**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	580	6	113	5
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	146		590	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Extr.Steep	Extr.Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	Sand	Sand

1.5 Valley Features
Valley Width (ft): **900**
Width Determination: **Estimated**
Confinement Type: **VB**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls: **None**

Stream: **Stone Road Brook** Reach: **M12S2.01-A**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**19.30**	2.11 Riffle/Step Spacing:	**60 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**2.20**	2.12 Substrate Composition		Bed:	**9.6**	**inches**
2.3 Mean Depth (tf):	**1.40**	Bedrock:	**0.0 %**	Bar:	**4.8**	**inches**
2.4 Floodprone Width (ft.):	**28.30**	Boulder:	**1.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**7.20**	Cobble:	**21.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**19.0 %**	Bed Material:	**Gravel**	
2.6 Width/Depth Ratio:	**13.79**	Fine Gravel:	**19.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**1.47**	Sand:	**31.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**3.27**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**3.0 %**	Reference Stream Type:	**C**	
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**18**	Reference Bed Material:	**Gravel**	
				Reference Subclass Slope:	**None**	
				Reference Bedform:	**Riffle-Pool**	

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**82.9**	**22.7**	Dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**8.0**	**4.0**	Sub-dominant:	**Herbaceous**	**Herbaceous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Multiple**	**Multiple**	Bank Canopy		
Lower			Revetment Length:	**589.9**	**532.9**	Canopy %:	**1-25**	**1-25**
Material Type:	**Sand**	**Sand**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**0-25**	**0-25**
Sub-Dominant	**>100**	**>100**
W less than 25	**585**	**556**
Buffer Vegitation Type		
Dominant	**Herbaceous**	**Herbaceous**
Sub-Dominant	**Shrubs/Sapling**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Industrial**	**Industrial**
Sub-dominant	**Bare**	**Residential**
(Legacy)	Amount	Mean Hieght
Failures	**None**	
Gullies	**None**	

	Left	Right
Mass Failures		
Height		
Gullies Number	**0**	
Gullies Length	**0**	

Stream: **Stone Road Brook** Reach: **M12S2.01-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps: **None**
4.2 Adjacent Wetlands: **None**
4.3 Flow Status: **Moderate**
4.4 # of Debris Jams: **1**

4.5 Flow Regulation Type **None**
Flow Reg. Use:
Impoundments:
Impoundment Loc.:
4.6 Up/Down Strm flow reg.: **None**
(old) Upstrm Flow Reg.:

4.7 Stormwater Inputs
Field Ditch: **0** Road Ditch: **4**
Other: **0** Tile Drain: **0**
Overland Flow: **1** Urb Strm Wtr Pipe: **0**
4.9 # of Beaver Dams: **0**
Affected Length (ft): **0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	12.5	Yes	Yes	Yes	Yes	Deposition Above,Scour Below
Instream Culvert	12.5	Yes	Yes	Yes	Yes	Deposition Above,Deposition Below,Scour Above,Alignment
Other	10.8	Yes	Yes	Yes	Yes	Deposition Above,Scour Above,Scour Below
Bridge	11.3	Yes	Yes	Yes	Yes	Deposition Above,Deposition Below,Scour Above,Scour Below

Step 5. Channel Bed and Planform Changes

5.1 Bar Types
Diagonal: **1**
Mid: **1**
Delta: **0**
Point: **4**
Island: **0**
Side: **4**
Braiding: **0**

5.2 Other Features
Flood chutes: **2**
5.3 Steep Riffles and Head Cuts
Steep Riffles: **3**

Neck Cutoff: **0**
Avulsion: **0**
Head Cuts: **0**
Trib Rejuv.: **No**

5.4 Stream Ford or Animal Crossing: **No**
5.5 Straightening: **Straightening**
Straightening Length (ft.): **1,033**
5.5 Dredging: **None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:
6.2 Pool Substrate:
6.3 Pool Variability:
Total Score: **0**
Habitat Rating: **0.00**
Habitat Stream Condition:

6.4 Sediment Deposition:
6.5 Channel Flow Status:
6.6 Channel Alteration:
6.7 Channel Sinuosity:

Stream Gradiant Type Left Right
6.8 Bank Stability:
6.9 Bank Vegetation Protection
6.10 Riparian Veg. Zone Width:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	5	C to B	Yes
7.2 Channel Aggradation	10	None	No
7.3 Widening Channel	8	None	No
7.4 Change in Planforml	6	None	No
Total Score	29		

Geomorphic Rating **0.36**
Channel Evolution Model **F**
Channel Evolution Stage **III**
Geomorphic Condition **Fair**
Stream Sensitivity **Very High**

Phase 2 Segment Summary Report Wells River

Stream: **Stone Road Brook**
Reach: **M12S2.01-B**
Segment Length(ft): **2,258**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Caledonia County Conservation District**
Observers: **Redstart_dr, EBM**
Completion Date: **10/6/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **~350 ft US Stone Rd-Creamery Rd jct to rchbrk at trib confluence in DS end of hayfields across from 411 Stone Rd**

Step 5 - Notes: **Segment situated on recessional moraine with high sand content; lots of fines moving. Large degree of downcutting likely partially related to glacial legacy but amplified by road encroachment that significantly reduces valley and available floodplain width.**

Step 7 - Narrative: **Major planform adjustments, widening and aggradation following historic incision related to straightening and significant road encroachment that significantly reduces valley width and available floodplain**

Step 1. Valley and Floodplain

1.1 Segmentation: **Valley Width**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

	Length (ft)	One Height	Both	Height
Berm:	0		0	
Road:	1,932	5	0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	1,162		69	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Extr.Steep	Extr.Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	Mixed	Mixed

1.5 Valley Features
Valley Width (ft): **75**
Width Determination: **Estimated**
Confinement Type: **SC**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls: **None**

Stream: **Stone Road Brook** Reach: **M12S2.01-B**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**23.00**	2.11 Riffle/Step Spacing:	**65 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**2.40**	2.12 Substrate Composition		Bed:	**10.7**	**inches**
2.3 Mean Depth (tf):	**1.40**	Bedrock:	**0.0 %**	Bar:	**6.2**	**inches**
2.4 Floodprone Width (ft.):	**65.00**	Boulder:	**10.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**4.20**	Cobble:	**32.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**12.0 %**	Bed Material:	**Gravel**	
2.6 Width/Depth Ratio:	**16.43**	Fine Gravel:	**17.0 %**	Subclass Slope:	**b**	
2.7 Entrenchment Ratio:	**2.83**	Sand:	**29.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.75**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Moderate**	Detritus:	**5.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**94**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**377.5**	**255.6**	Dominant:	**Coniferous**	**Coniferous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**3.6**	**3.1**	Sub-dominant:	**Deciduous**	**Deciduous**
Consistency:	**Non-cohesive**	**Cohesive**	Revetment Type:	**Rip-Rap**	**Multiple**	Bank Canopy		
Lower			Revetment Length:	**482.8**	**685.6**	Canopy %:	**76-100**	**51-75**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Closed**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**26-50**
Sub-Dominant	**0-25**	**0-25**
W less than 25	**648**	**568**
Buffer Vegitation Type		
Dominant	**Mixed Trees**	**Mixed Trees**
Sub-Dominant	**Shrubs/Sapling**	**Herbaceous**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Residential**	Mass Failures	**49.9511**	**60.73152**
Sub-dominant	**Residential**	**Bare**	Height	**10.0**	**15.0**
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**Multiple**	**12.5**	Gullies Length	**0**	
Gullies	**None**				

Stream: **Stone Road Brook** Reach: **M12S2.01-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Abundant**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs			
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch:	**0**	Road Ditch:	**5**
4.3 Flow Status:	**Moderate**	Impoundments:		Other:	**0**	Tile Drain:	**0**
4.4 # of Debris Jams:	**6**	Impoundment Loc.:		Overland Flow:	**2**	Urb Strm Wtr Pipe:	**0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:		**0**	
		(old) Upstrm Flow Reg.:		Affected Length (ft):		**0**	

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Instream Culvert	**11.3**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Deposition Below,Scour Below,Alignment**
Bridge	**16.2**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Deposition Below,Scour Above,Scour Below**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**4**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**	
Mid:	**9**	Delta:	**1**	Flood chutes:	**5**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**17**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**1,913**
Side:	**7**	Braiding:	**0**	Steep Riffles:	**3**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**8**	**None**	**Yes**	Geomorphic Rating	**0.44**
7.2 Channel Aggradation		**10**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**9**	**None**	**No**	Channel Evolution Stage	**III**
7.4 Change in Planforml		**8**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**35**			Stream Sensitivity	**Very High**

Phase 2 Segment Summary Report Wells River

Stream: **Stone Road Brook**
Reach: **M12S2.02-0**
Segment Length(ft): **7,206**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Caledonia County Conservation District**
Observers: **Redstart_dr, EBM**
Completion Date: **9/28/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **trib jct ~0.4 mi up Stone Rd from Creamery Rd jct to trib jct ~0.5 mi US Hall Rd-Stone Rd jct**

Step 5 - Notes: **Reach located on frontal moraine assumed to be recessional, glacial influences have left complex topography that is highly variable both vertically (stream bed-floodplain relationship and horizontally (valley and floodplain width). High terraces inside true valley walls lead to localized channel constriction and incision with alternating pockets of aggradation in wider portions of valley. Debris jams play a large role in stream dynamics but post-Irene snagging appears relatively common along this small stream, leaving stream moderately entrenched and more erosive.**

Step 7 - Narrative: **Major planform adjustments with major reducing to minor aggradation and widening, particularly in locally confined channel areas (legacy of glacial moraine deposits alongside stream). Historic incision particularly evident in straightened area US of Hall Rd culvert (but bank revetments have largely failed over time).**

Step 1. Valley and Floodplain

1.1 Segmentation: **None**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

	Length (ft)	One Height	Both	Height
Berm:	41	4	0	
Road:	3,018	8	0	7
Railroad:	0		0	
Imp. Path:	30	15	0	
Dev.:	697		0	

1.4 Adjacent Side	Left	Right
Hillside Slope:	Extr.Steep	Extr.Steep
Continuous w/ Bank:	Sometimes	Always
Within 1 Bankfull W:	Always	Sometimes
Texture:	Mixed	Mixed

1.5 Valley Features

Valley Width (ft):	250
Width Determination:	Estimated
Confinement Type:	VB
In Rock Gorge:	No
Human Caused Change in Valley Width?:	Yes

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	2.4	1.0	Yes	

Stream: **Stone Road Brook** Reach: **M12S2.02-0**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**17.00**	2.11 Riffle/Step Spacing:	**40 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**2.00**	2.12 Substrate Composition		Bed:	**9.2**	**inches**
2.3 Mean Depth (tf):	**1.30**	Bedrock:	**0.0 %**	Bar:	**3.8**	**inches**
2.4 Floodprone Width (ft.):	**174.00**	Boulder:	**2.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**2.80**	Cobble:	**34.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**15.0 %**	Bed Material:	**Gravel**	
2.6 Width/Depth Ratio:	**13.08**	Fine Gravel:	**23.0 %**	Subclass Slope:	**b**	
2.7 Entrenchment Ratio:	**10.24**	Sand:	**26.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.40**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Moderate**	Detritus:	**3.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**398**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**1,174.8**	**1,640.3**	Dominant:	**Coniferous**	**Herbaceous**
Material Type:	**Mix**	**Mix**	Erosion Height (ft.):	**3.0**	**2.9**	Sub-dominant:	**Deciduous**	**Deciduous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**42.0**	**1,215.9**	Canopy %:	**76-100**	**51-75**
Material Type:	**Silt**	**Mix**				Mid-Channel Canopy:	**Closed**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**26-50**
Sub-Dominant	**26-50**	**0-25**
W less than 25	**1,181**	**2,451**
Buffer Vegitation Type		
Dominant	**Mixed Trees**	**Mixed Trees**
Sub-Dominant	**Shrubs/Sapling**	**Herbaceous**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Forest**	Mass Failures	**104.785**	
Sub-dominant	**Pasture**	**Bare**	Height	**11.0**	
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**Multiple**	**11.0**	Gullies Length	**0**	
Gullies	**None**				

Stream: **Stone Road Brook** Reach: **M12S2.02-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Abundant**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs			
4.2 Adjacent Wetlands:	**Abundant**	Flow Reg. Use:		Field Ditch:	**0**	Road Ditch:	**6**
4.3 Flow Status:	**Moderate**	Impoundments:		Other:	**0**	Tile Drain:	**0**
4.4 # of Debris Jams:	**41**	Impoundment Loc.:		Overland Flow:	**1**	Urb Strm Wtr Pipe:	**0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:		**0**	
		(old) Upstrm Flow Reg.:		Affected Length (ft):		**0**	

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Instream Culvert	**4.6**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Scour Above**
Bridge	**10.5**	**Yes**	**Yes**	**Yes**	**No**	**Deposition Above,Scour Above,Scour Below**
Bridge	**20**	**Yes**	**Yes**	**No**	**No**	**Scour Above,Scour Below**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**10**	5.2 Other Features	Neck Cutoff:	**1**	5.4 Stream Ford or Animal Crossing:		**Yes**	
Mid:	**20**	Delta:	**2**	Flood chutes:	**34**	Avulsion:	**0**	5.5 Straightening:	**With Windrowing**
Point:	**67**	Island:	**1**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**600**
Side:	**31**	Braiding:	**2**	Steep Riffles:	**17**	Trib Rejuv.:	**Yes**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic		
7.1 Channel Degradation	**12**	**None**	**Yes**	Geomorphic Rating	**0.54**
7.2 Channel Aggradation	**11**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel	**11**	**None**	**No**	Channel Evolution Stage	**III**
7.4 Change in Planforml	**9**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score	**43**			Stream Sensitivity	**Very High**

Phase 2 Segment Summary Report Wells River

Stream: Wells River
Reach: M13-0
Segment Length(ft): 6,361
Rain: Yes

SGAT Version: 4.56
Organization:
Observers: Redstart_dr, ES
Completion Date: 6/30/2015
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional

Step 0 - Location:

Step 5 - Notes: **'Other' stream type departure, E to C, due to straightening and subsequent planform adjustments leaving overwidened channel in comparison with expected E type reference width to depth ratio. Surprisingly little erosion downstream of Farquharson Dr bridge (not in use) likely due to good floodplain access and significant shrub cover; floodplain access apparently included house at Rte 302 bridge on US end of Creamery Rd in Irene.**

Step 7 - Narrative: **Loss of planform due to straightening now accompanied by cyclic localized incision and subsequent widening and planform adjustments in floods.'Other' STD under widening is an E to C stream type departure; reference E dune-ripple stream type likely warrants elevated 'Extreme' sensitivity.**

Step 1. Valley and Floodplain

1.1 Segmentation: None
1.2 Alluvial Fan: None
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	0		6,361	10
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	0		0	

1.4 Adjacent Side	Left	Right
Hillside Slope:	Steep	Flat
Continuous w/ Bank:	Sometimes	Always
Within 1 Bankfull W:	Sometimes	Always
Texture:	Sand	Sand

1.5 Valley Features	
Valley Width (ft):	350
Width Determination:	Measured
Confinement Type:	NW
In Rock Gorge:	No

Human Caused Change in Valley Width?: Yes

1.6 Grade Controls: None

Stream: **Wells River** Reach: **M13-0**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**71.00**	2.11 Riffle/Step Spacing:	**650 ft.**	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	**7.10**	2.12 Substrate Composition		Bed:	**N/A**
2.3 Mean Depth (tf):	**5.45**	Bedrock:	**0.0 %**	Bar:	**N/A**
2.4 Floodprone Width (ft.):	**321.00**	Boulder:	**0.0 %**	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	**7.80**	Cobble:	**0.0 %**	Stream Type:	**C**
Human Elev FloodPln (ft.):		Coarse Gravel:	**1.0 %**	Bed Material:	**Sand**
2.6 Width/Depth Ratio:	**13.03**	Fine Gravel:	**21.0 %**	Subclass Slope:	**None**
2.7 Entrenchment Ratio:	**4.52**	Sand:	**73.0 %**	Bed Form:	**Dune-Ripple**
2.8 Incision Ratio:	**1.10**	Silt and Smaller:	**5.0 %**	Field Measured Slope:	
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**Yes**	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	**Moderate**	Detritus:	**3.0 %**	Reference Stream Type:	
2.10 Riffles Type:	**Eroded**	# Large Woody Debris:	**46**	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**968.1**	**990.3**	Dominant:	**Deciduous**	**Shrubs/Sapling**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**1.6**	**2.5**	Sub-dominant:	**Herbaceous**	**Herbaceous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Multiple**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**501.0**	**520.1**	Canopy %:	**51-75**	**51-75**
Material Type:	**Sand**	**Sand**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**51-100**	**51-100**
Sub-Dominant	**None**	**None**
W less than 25	**1,138**	**3,543**
Buffer Vegitation Type		
Dominant	**Shrubs/Sapling**	**Herbaceous**
Sub-Dominant	**Herbaceous**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Shrubs/Sapling**	Mass Failures		
Sub-dominant	**None**	**Hay**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **Wells River** Reach: **M13-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch: **0**	Road Ditch: **4**
4.3 Flow Status:	**Moderate**	Impoundments:		Other: **0**	Tile Drain: **0**
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow: **0**	Urb Strm Wtr Pipe: **0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	**36**	**Yes**	**Yes**	**Yes**	**Yes**	**Scour Above**
Bridge	**60**	**Yes**	**Yes**	**Yes**	**Yes**	**Scour Above**
Old Abutment	**30**	**Yes**	**Yes**	**Yes**	**No**	**Deposition Above,Scour Above**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**0**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**0**	Delta:	**0**	Flood chutes:	**6**	Avulsion:	**0**	5.5 Straightening:		**Straightening**
Point:	**5**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):		**6,361**
Side:	**1**	Braiding:	**1**	Steep Riffles:	**0**	Trib Rejuv.:	**No**	5.5 Dredging:		**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic		
7.1 Channel Degradation	**9**			Geomorphic Rating	**0.49**
7.2 Channel Aggradation	**11**			Channel Evolution Model	**F**
7.3 Widening Channel	**11**	**Other**	**No**	Channel Evolution Stage	**III**
7.4 Change in Planforml	**8**			Geomorphic Condition	**Fair**
Total Score	**39**			Stream Sensitivity	**Extreme**

Phase 2 Segment Summary Report Wells River

Stream: **Wells River**
Reach: **M14-0**
Segment Length(ft): **5,138**
Rain: **Yes**

SGAT Version: **4.56**
Organization:
Observers: **Redstart_dr, ES**
Completion Date: **7/6/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **Segment begins at confluence of Darius James Brook and Wells River.**

Step 5 - Notes: **Railbed more distant from stream than US and DS reaches. Few signs of overt straightening in reach, but lack of sinuosity in US portion likely related to encroachments and straightening in US reaches as well as reported historic dredging practices (Ph 1); current erosion and widening are indicative of planform adjustments. Documented dredging was minor point bar scalping DS farm bridge, likely for farm rd and w/in permitted limits for landowner removals. Lots of wildlife activity (particularly a wide variety of birds) observed in riparian corridor during assessment.**

Step 7 - Narrative: **Major to minor planform change with widening and aggradation following flood-driven, localized incision and bank undermining in highly erodible sediments.**

Step 1. Valley and Floodplain

1.1 Segmentation: **None**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	0		7	10
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	0		0	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Flat	Flat
Continuous w/ Bank:	Always	Always
Within 1 Bankfull W:	Always	Always
Texture:	Sand	Sand

1.5 Valley Features

Valley Width (ft): **1,546**
Width Determination: **Measured**
Confinement Type: **VB**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **No**

1.6 Grade Controls: **None**

Stream: **Wells River** Reach: **M14-0**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**92.00**	2.11 Riffle/Step Spacing:	**833 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**5.20**	2.12 Substrate Composition		Bed:	**1.9**	**inches**
2.3 Mean Depth (tf):	**3.06**	Bedrock:	**0.0 %**	Bar:	**1.6**	**inches**
2.4 Floodprone Width (ft.):	**642.00**	Boulder:	**0.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**8.00**	Cobble:	**1.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**36.0 %**	Bed Material:	**Gravel**	
2.6 Width/Depth Ratio:	**30.07**	Fine Gravel:	**31.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**6.98**	Sand:	**32.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.54**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Moderate**	Detritus:	**2.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**33**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**1,212.1**	**1,887.8**	Dominant:	**Shrubs/Sapling**	**Herbaceous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**1.9**	**2.7**	Sub-dominant:	**Herbaceous**	**Shrubs/Sapling**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Multiple**	**Multiple**	Bank Canopy		
Lower			Revetment Length:	**510.2**	**96.4**	Canopy %:	**1-25**	**1-25**
Material Type:	**Sand**	**Sand**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**26-50**	**26-50**
Sub-Dominant	**0-25**	**0-25**
W less than 25	**1,394**	**830**
Buffer Vegitation Type		
Dominant	**Herbaceous**	**Herbaceous**
Sub-Dominant	**Shrubs/Sapling**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Hay**	**Crop**
Sub-dominant	**Crop**	**Hay**
(Legacy)	Amount	Mean Hieght
Failures	**None**	
Gullies	**None**	

	Left	Right
Mass Failures		
Height		
Gullies Number	**0**	
Gullies Length	**0**	

Stream: **Wells River** Reach: **M14-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**Abundant**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	**36**	**Yes**	**Yes**	**Yes**	**No**	**Scour Above,Scour Below**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**0**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:	**No**		
Mid:	**1**	Delta:	**1**	Flood chutes:	**3**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**7**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**1,672**
Side:	**2**	Braiding:	**1**	Steep Riffles:	**0**	Trib Rejuv.:	**No**	5.5 Dredging:	**Dredging**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**10**			Geomorphic Rating	**0.49**
7.2 Channel Aggradation		**10**			Channel Evolution Model	**F**
7.3 Widening Channel		**10**			Channel Evolution Stage	**III**
7.4 Change in Planforml		**9**			Geomorphic Condition	**Fair**
Total Score		**39**			Stream Sensitivity	**Very High**

Phase 2 Segment Summary Report Wells River

Stream: **Darius James Brook**
Reach: **M14S2.01-0**
Segment Length(ft): **1,423**
Rain: **No**

SGAT Version: **4.56**
Organization:
Observers: **Redstart_dr, ES**
Completion Date: **5/21/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **reach begins US of electric substation near Witherspoon Road and Rt. 302 intersection**

Step 5 - Notes: **Ph 2 fieldwork updated Ph 1 valley width from <400 ft to 1300 ft as valley wall in this reach joins shared valley with Wells mainstem**

Step 7 - Narrative: **Major planform adjustments, widening and aggradation following historic incision. Adjustments limited by berm and bank armoring in US portions, more evident between farm road and Wells mainstem**

Step 1. Valley and Floodplain

1.1 Segmentation: **None**

1.2 Alluvial Fan: **None**

1.3 Corridor Encroachments:

Length (ft)	One Height	Both Height
Berm:	298 9	0
Road:	40 7	0
Railroad:	0	0
Imp. Path:	0	0
Dev.:	138	0

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Flat	Flat
Continuous w/ Bank:	Always	Always
Within 1 Bankfull W:	Always	Always
Texture:	Sand	Sand

1.5 Valley Features

Valley Width (ft): **1,300**
Width Determination: **Estimated**
Confinement Type: **VB**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **No**

1.6 Grade Controls: **None**

Stream: **Darius James Brook** Reach: **M14S2.01-0**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**19.00**	2.11 Riffle/Step Spacing:	**3.5 ft.**	2.13 Average Largest Particle on			
2.2 Max Depth (ft.):	**2.80**	2.12 Substrate Composition		Bed:	**8.6**	**inches**	
2.3 Mean Depth (tf):	**1.72**	Bedrock:	**0.0 %**	Bar:	**3.8**	**inches**	
2.4 Floodprone Width (ft.):	**639.00**	Boulder:	**1.0 %**	2.14 Stream Type			
2.5 Aband. Floodpn (ft.):	**4.70**	Cobble:	**35.0 %**	Stream Type:	**C**		
Human Elev FloodPln (ft.):		Coarse Gravel:	**18.0 %**	Bed Material:	**Gravel**		
2.6 Width/Depth Ratio:	**11.05**	Fine Gravel:	**17.0 %**	Subclass Slope:	**b**		
2.7 Entrenchment Ratio:	**33.63**	Sand:	**29.0 %**	Bed Form:	**Riffle-Pool**		
2.8 Incision Ratio:	**1.68**	Silt and Smaller:	**0.0 %**	Field Measured Slope:			
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type			
2.9 Sinuosity:	**Low**	Detritus:	**0.0 %**	Reference Stream Type:			
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**20**	Reference Bed Material:			
				Reference Subclass Slope:			
				Reference Bedform:			

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Undercut**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**196.5**	**150.9**	Dominant:	**Herbaceous**	**Herbaceous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**4.1**	**3.4**	Sub-dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**140.8**	**370.3**	Canopy %:	**26-50**	**26-50**
Material Type:	**Sand**	**Sand**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**26-50**	**26-50**
Sub-Dominant	**0-25**	**0-25**
W less than 25	**0**	**0**
Buffer Vegitation Type		
Dominant	**Herbaceous**	**Herbaceous**
Sub-Dominant	**Shrubs/Sapling**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Crop**	**Crop**
Sub-dominant	**Industrial**	**None**
(Legacy)	Amount	Mean Hieght
Failures	**None**	
Gullies	**None**	

	Left	Right
Mass Failures		
Height		
Gullies Number	**0**	
Gullies Length	**0**	

Stream: **Darius James Brook** Reach: **M14S2.01-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**None**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs			
4.2 Adjacent Wetlands:	**None**	Flow Reg. Use:		Field Ditch:	**0**	Road Ditch:	**2**
4.3 Flow Status:	**Moderate**	Impoundments:		Other:	**0**	Tile Drain:	**0**
4.4 # of Debris Jams:	**4**	Impoundment Loc.:		Overland Flow:	**0**	Urb Strm Wtr Pipe:	**0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:		**0**	
		(old) Upstrm Flow Reg.:		Affected Length (ft):		**0**	

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Instream Culvert	**14.2**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**3**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:	**Yes**		
Mid:	**0**	Delta:	**1**	Flood chutes:	**6**	Avulsion:	**1**	5.5 Straightening:	**Straightening**
Point:	**6**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**1,233**
Side:	**2**	Braiding:	**0**	Steep Riffles:	**2**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**7**	**None**		Geomorphic Rating	**0.41**
7.2 Channel Aggradation		**10**			Channel Evolution Model	**F**
7.3 Widening Channel		**9**			Channel Evolution Stage	**III**
7.4 Change in Planforml		**7**			Geomorphic Condition	**Fair**
Total Score		**33**			Stream Sensitivity	**Very High**

Phase 2 Segment Summary Report Wells River

Stream: **Darius James Brook**
Reach: **M14S2.02-0**
Segment Length(ft): **1,915**
Rain: **Yes**

SGAT Version: **4.56**
Organization:
Observers: **Redstart_dr, ES**
Completion Date: **5/20/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **About 0.5 mi up Witherspoon road from Rt 302**

Step 5 - Notes: **Good buffers critical, currently limiting what could be much more erosion to scour and mass failures in this semi-confined valley. Large woody debris and significant sediment contributions from mass failures, including a good bit of coarse sediments, contribute to a combination of step and meander formation that give this reach a much more diverse planform than is apparent from the Vermont Hydrography Dataset.**

Step 7 - Narrative: **Major widening, largely mass failures, with minor aggradation and planform changes. Decent buffers limit other widening to scour rather than erosion.**

Step 1. Valley and Floodplain

1.1 Segmentation: **None**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	188	7	0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	201		0	

1.4 Adjacent Side	Left	Right
Hillside Slope:	**Steep**	**Very Steep**
Continuous w/ Bank:	**Sometimes**	**Sometimes**
Within 1 Bankfull W:	**Always**	**Always**
Texture:	**Boulder**	**Cobble**

1.5 Valley Features	
Valley Width (ft):	**50**
Width Determination:	**Estimated**
Confinement Type:	**SC**
In Rock Gorge:	**No**

Human Caused Change in Valley Width?: **No**

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	**Mid-segment**	**5.2**	**3.4**	**Yes**	
Ledge	**Mid-segment**	**7.1**	**5.7**	**Yes**	
Ledge	**Mid-segment**	**4.0**	**1.5**	**No**	
Waterfall	**Mid-segment**	**13.6**	**11.8**	**Yes**	

Stream: **Darius James Brook** Reach: **M14S2.02-0**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**23.00**	2.11 Riffle/Step Spacing:	**51 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**2.00**	2.12 Substrate Composition		Bed:	**13.4**	**inches**
2.3 Mean Depth (tf):	**1.30**	Bedrock:	**11.0 %**	Bar:	**7.2**	**inches**
2.4 Floodprone Width (ft.):	**39.50**	Boulder:	**6.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**2.80**	Cobble:	**47.0 %**	Stream Type:	**B**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**10.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**17.69**	Fine Gravel:	**7.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**1.72**	Sand:	**19.0 %**	Bed Form:	**Step-Pool**	
2.8 Incision Ratio:	**1.40**	Silt and Smaller:	**%**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Moderate**	Detritus:	**2.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**24**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**138.2**	**172.9**	Dominant:	**Coniferous**	**Coniferous**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**	Erosion Height (ft.):	**2.6**	**12.9**	Sub-dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**None**	Bank Canopy		
Lower			Revetment Length:	**65.6**	**0.0**	Canopy %:	**76-100**	**76-100**
Material Type:	**Mix**	**Mix**				Mid-Channel Canopy:	**Closed**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**51-100**
Sub-Dominant	**None**	**None**
W less than 25	**0**	**0**
Buffer Vegitation Type		
Dominant	**Coniferous**	**Coniferous**
Sub-Dominant	**Herbaceous**	**Herbaceous**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Forest**	Mass Failures	**15.43017**	**13.19697**
Sub-dominant	**Pasture**	**Residential**	Height	**10.0**	**10.0**
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**Multiple**	**10.0**	Gullies Length	**0**	
Gullies	**None**				

Stream: **Darius James Brook** Reach: **M14S2.02-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**None**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	**None**	Flow Reg. Use:		Field Ditch: **0**	Road Ditch: **2**
4.3 Flow Status:	**Moderate**	Impoundments:	**None**	Other: **0**	Tile Drain: **0**
4.4 # of Debris Jams:	**2**	Impoundment Loc.:		Overland Flow: **0**	Urb Strm Wtr Pipe: **0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:	**Unknown**	Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**2**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:	**No**		
Mid:	**3**	Delta:	**1**	Flood chutes:	**8**	Avulsion:	**0**	5.5 Straightening:	**None**
Point:	**4**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**0**
Side:	**11**	Braiding:	**0**	Steep Riffles:	**3**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Confined**	Score	STD	Historic	
7.1 Channel Degradation		**13**		**Yes**	Geomorphic Rating **0.61**
7.2 Channel Aggradation		**13**			Channel Evolution Model
7.3 Widening Channel		**10**			Channel Evolution Stage **III**
7.4 Change in Planforml		**13**			Geomorphic Condition **Fair**
Total Score		**49**			Stream Sensitivity **High**

Phase 2 Segment Summary Report Wells River

Stream: **Wells River**
Reach: **M15-0**
Segment Length(ft): **3,938**
Rain: **Yes**

SGAT Version: **4.56**
Organization:
Observers: **Redstart_dr, ES**
Completion Date: **6/25/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **Begins US of confluence of Keenan Brook and Wells River and continues to confluence of Darius James and Wells River.**

Step 5 - Notes: **Reach appears largely straightened due to encroachment from former Montpelier-Wells River railroad bed (with beaver wetland on Pine Mtn WMA on back side of railbed midreach indicative of likely disconnected former oxbow wetland) as well as impacts of multiple dams, bridges, and industrial uses in Groton village in US reaches. Recent flood events appear to be redistributing coarser sediments retained by former impoundments US (sediment discontinuity), as well as finer sediment discharge from Clark Hatch Brook (M15S101; significant stretch of plane bed downstream of this confluence).**

Step 7 - Narrative: **Major planform changes following historic incision, moving toward greater stability as sediments redistribute following discontinuities due to former dam impoundments upstream as evidenced in recent flood events.**

Step 1. Valley and Floodplain

1.1 Segmentation: **None**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	0		0	
Railroad:	3,681	12	0	
Imp. Path:	0		0	
Dev.:	616		0	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Steep	Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	Sand	Sand

1.5 Valley Features

Valley Width (ft):	450
Width Determination:	Measured
Confinement Type:	NW
In Rock Gorge:	No

Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls: **None**

Stream: **Wells River** Reach: **M15-0**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**87.20**	2.11 Riffle/Step Spacing:	**567 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**4.80**	2.12 Substrate Composition		Bed:	**4.8**	**inches**
2.3 Mean Depth (tf):	**3.47**	Bedrock:	**0.0 %**	Bar:	**2.9**	**inches**
2.4 Floodprone Width (ft.):	**454.20**	Boulder:	**0.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**5.60**	Cobble:	**12.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**63.0 %**	Bed Material:	**Gravel**	
2.6 Width/Depth Ratio:	**25.13**	Fine Gravel:	**9.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**5.21**	Sand:	**16.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.17**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Moderate**	Detritus:	**2.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**25**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**198.6**	**306.7**	Dominant:	**Herbaceous**	**Herbaceous**
Material Type:	**Mix**	**Sand**	Erosion Height (ft.):	**7.5**	**5.0**	Sub-dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**39.5**	**410.9**	Canopy %:	**1-25**	**1-25**
Material Type:	**Mix**	**Sand**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**0-25**	**0-25**
Sub-Dominant	**>100**	**51-100**
W less than 25	**151**	**2,747**
Buffer Vegitation Type		
Dominant	**Herbaceous**	**Herbaceous**
Sub-Dominant	**Coniferous**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Forest**	**Crop**
Sub-dominant	**Hay**	**Forest**
(Legacy)	Amount	Mean Hieght
Failures	**None**	
Gullies	**None**	

	Left	Right
Mass Failures		
Height		
Gullies Number	**0**	
Gullies Length	**0**	

Stream: **Wells River** Reach: **M15-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**1**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**3**	Delta:	**0**	Flood chutes:	**3**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**2**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**3,737**
Side:	**0**	Braiding:	**0**	Steep Riffles:	**0**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**10**	**None**		Geomorphic Rating	**0.57**
7.2 Channel Aggradation		**13**			Channel Evolution Model	**F**
7.3 Widening Channel		**13**			Channel Evolution Stage	**III**
7.4 Change in Planforml		**10**			Geomorphic Condition	**Fair**
Total Score		**46**			Stream Sensitivity	**Very High**

Phase 2 Segment Summary Report Wells River

Stream: Clark Hatch Brook
Reach: M15S1.01-A
Segment Length(ft): 917
Rain: Yes

SGAT Version: 4.56
Organization: Caledonia County Conservation District
Observers: Redstart_dr, ES
Completion Date: 8/27/2015
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional

Step 0 - Location: **Confluence with Wells mainstem DS of Cemetery Rd to Scott Hwy (Rte 302) culvert at Glover Rd**

Step 5 - Notes: **Glacial Lake Hitchcock lake edge sediments (pebbly sands) in US portion blend into alluvial fan midreach.Valley meanders tight and reflective of glacial stream planform. Single headcut is at valley wall pinch point broken through transverse lake edge formation parallel to valley of mainstem Wells - likely periodically builds up sediments and nickpoints-headcuts chew back through these deposits.**

Step 7 - Narrative: **Minor widening, aggradation and planform adjustments following primarily historic incision related to US straightening and increased flows through lake edge and alluvial fan fines (current headcut located at valley pinch point, likely to wash out quickly). Current stream is situated in a vastly reduced floodplain but still has decent floodplain access and good buffers, but fine sediments are very subject to changes in watershed inputs (including recent floods); we assigned an elevated Sensitivity rating of Extreme due to these factors.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Planform and Scope**
1.2 Alluvial Fan: **Yes**
1.3 Corridor Encroachments:

	Length (ft)	One Height	Both	Height
Berm:	0		0	
Road:	268	8	0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	78		0	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Hilly	Hilly
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	Mixed	Mixed

1.5 Valley Features
Valley Width (ft): 100
Width Determination: Estimated
Confinement Type: NW
In Rock Gorge: No
Human Caused Change in Valley Width?: Yes

1.6 Grade Controls: None

Stream: **Clark Hatch Brook** Reach: **M15S1.01-A**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**19.30**	2.11 Riffle/Step Spacing:	**61 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**1.30**	2.12 Substrate Composition		Bed:	**6.9**	**inches**
2.3 Mean Depth (tf):	**0.80**	Bedrock:	**0.0 %**	Bar:	**2.9**	**inches**
2.4 Floodprone Width (ft.):	**104.30**	Boulder:	**1.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**2.10**	Cobble:	**21.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**21.0 %**	Bed Material:	**Gravel**	
2.6 Width/Depth Ratio:	**24.12**	Fine Gravel:	**16.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**5.40**	Sand:	**41.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.62**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Moderate**	Detritus:	**2.0 %**	Reference Stream Type:	**C**	
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**34**	Reference Bed Material:	**Gravel**	
				Reference Subclass Slope:	**None**	
				Reference Bedform:	**Riffle-Pool**	

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Moderate**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**0.0**	**74.8**	Dominant:	**Deciduous**	**Coniferous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**0.0**	**2.0**	Sub-dominant:	**Shrubs/Sapling**	**Deciduous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**None**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**0.0**	Canopy %:	**76-100**	**76-100**
Material Type:	**Gravel**	**Gravel**				Mid-Channel Canopy:	**Closed**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**0-25**	**0-25**
W less than 25	**0**	**0**
Buffer Vegitation Type		
Dominant	**Mixed Trees**	**Mixed Trees**
Sub-Dominant	**Shrubs/Sapling**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Forest**	**Forest**
Sub-dominant	**Shrubs/Sapling**	**Shrubs/Sapling**
(Legacy)	Amount	Mean Hieght
Failures	**None**	
Gullies	**None**	

	Left	Right
Mass Failures		
Height		
Gullies Number	**0**	
Gullies Length	**0**	

Stream: **Clark Hatch Brook** Reach: **M15S1.01-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch: **0**	Road Ditch: **1**
4.3 Flow Status:	**Moderate**	Impoundments:		Other: **0**	Tile Drain: **0**
4.4 # of Debris Jams:	**7**	Impoundment Loc.:		Overland Flow: **0**	Urb Strm Wtr Pipe: **0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**0**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**3**	Delta:	**0**	Flood chutes:	**4**	Avulsion:	**0**	5.5 Straightening:	**None**
Point:	**9**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**1**	Straightening Length (ft.):	**0**
Side:	**1**	Braiding:	**1**	Steep Riffles:	**1**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**5**	**None**	**No**	Geomorphic Rating	**0.51**
7.2 Channel Aggradation		**12**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**11**	**None**	**No**	Channel Evolution Stage	**III**
7.4 Change in Planforml		**13**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**41**			Stream Sensitivity	**Extreme**

Phase 2 Segment Summary Report Wells River

Stream: Clark Hatch Brook
Reach: M15S1.01-B
Segment Length(ft): 3,089
Rain: Yes

SGAT Version: 4.56
Organization: Caledonia County Conservation District
Observers: Redstart_dr, ES
Completion Date: 8/26/2015
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional

Step 0 - Location: **Scott Hwy (Rte 302) culvert at Glover Rd to pvt driveway entrance to 432 Glover Rd**

Step 5 - Notes: **Heavy road encroachment through most of segment. Culvert between 155 and 97 Glover Rd takes half the channel off the top of a ledge grade control, diverts it under rd and across valley into what would otherwise be a disconnected meander; second culvert short distance DS returns this flow to the main channel - innovative approach to what is clearly a repeat conflict site. DS 600 ft of this segment is very confined by rd but was not segmented out due to relatively short length and occasional possibility of floodplain access in major floods.**

Step 7 - Narrative: **Major planform adjustments, widening and aggradation following historic incision due to significant straightening along Glover Rd; stream now down to bedrock in many places and primary adjustment shifting to widening. Part of stream diverted under rd into an old meander mid-segment, then returns thru another culvert DS to compensate for loss of RB floodplain along Glover Rd**

Step 1. Valley and Floodplain

1.1 Segmentation: **Planform and Scope**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

	Length (ft)	One Height	Both	Height
Berm:	0		0	
Road:	2,001	6	0	
Railroad:	0		0	
Imp. Path:	271	5	0	
Dev.:	0		0	

1.4 Adjacent Side	Left	Right
Hillside Slope:	Very Steep	Extr.Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	Mixed	Mixed

1.5 Valley Features
Valley Width (ft): 100
Width Determination: Estimated
Confinement Type: NW
In Rock Gorge: No
Human Caused Change in Valley Width?: Yes

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	2.0	1.3	Yes	
Ledge	Mid-segment	5.2	4.0	Yes	
Ledge	Mid-segment	5.3	4.0	Yes	

Stream: **Clark Hatch Brook** Reach: **M15S1.01-B**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**18.10**	2.11 Riffle/Step Spacing:	**61 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**1.70**	2.12 Substrate Composition		Bed:	**8.8**	**inches**
2.3 Mean Depth (tf):	**1.10**	Bedrock:	**0.0 %**	Bar:	**3.25**	**inches**
2.4 Floodprone Width (ft.):	**99.10**	Boulder:	**11.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**2.90**	Cobble:	**29.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**13.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**16.45**	Fine Gravel:	**14.0 %**	Subclass Slope:	**b**	
2.7 Entrenchment Ratio:	**5.48**	Sand:	**33.0 %**	Bed Form:	**Step-Pool**	
2.8 Incision Ratio:	**1.71**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Moderate**	Detritus:	**5.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**150**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**318.2**	**528.7**	Dominant:	**Coniferous**	**Coniferous**
Material Type:	**Mix**	**Mix**	Erosion Height (ft.):	**1.9**	**2.4**	Sub-dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**274.8**	Canopy %:	**76-100**	**51-75**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Closed**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**51-100**
Sub-Dominant	**0-25**	**0-25**
W less than 25	**0**	**13**
Buffer Vegitation Type		
Dominant	**Mixed Trees**	**Mixed Trees**
Sub-Dominant	**Shrubs/Sapling**	**Herbaceous**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Forest**	Mass Failures		
Sub-dominant	**Residential**	**Bare**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length		
Gullies	**None**				

Stream: **Clark Hatch Brook** Reach: **M15S1.01-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Abundant**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs			
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch:	**0**	Road Ditch:	**10**
4.3 Flow Status:	**Moderate**	Impoundments:		Other:	**0**	Tile Drain:	**0**
4.4 # of Debris Jams:	**27**	Impoundment Loc.:		Overland Flow:	**0**	Urb Strm Wtr Pipe:	**0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:		**0**	
		(old) Upstrm Flow Reg.:		Affected Length (ft):		**0**	

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Instream Culvert	**2**	**Yes**	**Yes**	**Yes**	**Yes**	**Scour Above,Scour Below**
Instream Culvert	**2.5**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above**
Instream Culvert	**7**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Scour Above,Scour Below**
Instream Culvert	**3**	**Yes**	**Yes**	**Yes**	**Yes**	**Scour Above,Scour Below**
Instream Culvert	**5.8**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Scour Below**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**1**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**	
Mid:	**1**	Delta:	**0**	Flood chutes:	**21**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**3**	Island:	**2**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**250**
Side:	**3**	Braiding:	**1**	Steep Riffles:	**7**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Confined**	Score	STD	Historic		
7.1 Channel Degradation		**8**	**None**	**Yes**	Geomorphic Rating	**0.40**
7.2 Channel Aggradation		**10**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**8**	**None**	**No**	Channel Evolution Stage	**III**
7.4 Change in Planforml		**6**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**32**			Stream Sensitivity	**High**

Phase 2 Segment Summary Report Wells River

Stream: **Keenan Brook**
Reach: **M15T2.01-0**
Segment Length(ft): **1,869**
Rain: **Yes**

SGAT Version: **4.56**
Organization:
Observers: **Redstart_dr, ES**
Completion Date: **7/27/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **Confluence with Wells mainstem near end of Little Italy Rd to confluence with East Brook, about 0.25 mi US**

Step 5 - Notes: **altered wetlands: hay and pasture occupy what would likely be alder scrub-shrub. stone bridge very undersized but easily overtopped, beavers attempting to plug side by side tank culverts under farm bridge**

Step 7 - Narrative: **Major aggradation and major-to-minor loss of planform and widening due to straightening effects of undersized culverts in recent flooding.**

Step 1. Valley and Floodplain

1.1 Segmentation: **None**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	328	6	0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	168		0	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Flat	Flat
Continuous w/ Bank:	Always	Always
Within 1 Bankfull W:	Always	Always
Texture:	Sand	Sand

1.5 Valley Features
Valley Width (ft): **467**
Width Determination: **Measured**
Confinement Type: **VB**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls: **None**

Stream: **Keenan Brook** Reach: **M15T2.01-0**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**11.90**	2.11 Riffle/Step Spacing:	**82 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**3.30**	2.12 Substrate Composition		Bed:	**1.9**	**inches**
2.3 Mean Depth (tf):	**1.85**	Bedrock:	**0.0 %**	Bar:	**0.4**	**inches**
2.4 Floodprone Width (ft.):	**279.70**	Boulder:	**0.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**3.30**	Cobble:	**1.0 %**	Stream Type:	**E**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**24.0 %**	Bed Material:	**Sand**	
2.6 Width/Depth Ratio:	**6.43**	Fine Gravel:	**21.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**23.50**	Sand:	**54.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.00**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Moderate**	Detritus:	**10.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Complete**	# Large Woody Debris:	**10**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**23.5**	**68.1**	Dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**2.0**	**1.6**	Sub-dominant:	**Herbaceous**	**Herbaceous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**66.7**	**30.3**	Canopy %:	**76-100**	**76-100**
Material Type:	**Sand**	**Sand**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**0-25**	**>100**
Sub-Dominant	**>100**	**26-50**
W less than 25	**1,255**	**803**
Buffer Vegitation Type		
Dominant	**Herbaceous**	**Herbaceous**
Sub-Dominant	**Shrubs/Sapling**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Residential**	**Shrubs/Sapling**	Mass Failures		
Sub-dominant	**Shrubs/Sapling**	**Hay**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length		
Gullies	**None**				

Stream: **Keenan Brook** Reach: **M15T2.01-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**Abundant**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:	**None**	Other:	Tile Drain:
4.4 # of Debris Jams:	**2**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Instream Culvert	**9.8**	**Yes**	**Yes**	**Yes**	**No**	**Deposition Above,Scour Above,Scour Below**
Bridge	**3.8**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Deposition Below**
Instream Culvert	**11.7**	**Yes**	**Yes**	**Yes**	**No**	**Deposition Above,Deposition Below,Scour Below**
Instream Culvert	**11**	**Yes**	**Yes**	**Yes**	**No**	**Deposition Below,Scour Below**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**1**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**Yes**
Mid:	**3**	Delta:	**1**	Flood chutes:	**0**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**10**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**826**
Side:	**3**	Braiding:	**0**	Steep Riffles:	**0**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**12**			Geomorphic Rating	**0.56**
7.2 Channel Aggradation		**10**			Channel Evolution Model	**D**
7.3 Widening Channel		**12**			Channel Evolution Stage	**IIc**
7.4 Change in Planforml		**11**			Geomorphic Condition	**Fair**
Total Score		**45**			Stream Sensitivity	**Extreme**

Phase 2 Segment Summary Report Wells River

Stream: **Keenan Brook**
Reach: **M15T2.02-0**
Segment Length(ft): **3,578**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Caledonia County Conservation District**
Observers: **Redstart_dr, ES**
Completion Date: **7/22/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **confluence of East Brook to about 1000 feet US of Snug Harbor and Railroad Street intersection.**

Step 5 - Notes: **Channel enlargement did not appear dramatic but flood debris was common along corridor DS of Railroad St and some flood chute scour was evident underneath LB offset pond dam (this pond is offset and not instream as indicated on VHD).**

Step 7 - Narrative: **Major aggradation, widening and planform change following historic incision likely related to pulse flows from former dam US as well as wetland ditching US of Railroad St. Pond off LB below Snug Harbor Rd. may be at risk for undercutting.**

Step 1. Valley and Floodplain

1.1 Segmentation: **None**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	0		0	
Railroad:	0		0	
Imp. Path:	377	6	0	
Dev.:	1,083		0	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Hilly	Hilly
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	Mixed	Mixed

1.5 Valley Features

Valley Width (ft): **250**
Width Determination: **Measured**
Confinement Type: **BD**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls: **None**

Stream: **Keenan Brook** Reach: **M15T2.02-0**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**27.00**	2.11 Riffle/Step Spacing:	**70 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**2.70**	2.12 Substrate Composition		Bed:	**5.5**	**inches**
2.3 Mean Depth (tf):	**1.56**	Bedrock:	**0.0 %**	Bar:	**2.05**	**inches**
2.4 Floodprone Width (ft.):	**189.00**	Boulder:	**8.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**5.00**	Cobble:	**19.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**16.0 %**	Bed Material:	**Gravel**	
2.6 Width/Depth Ratio:	**17.31**	Fine Gravel:	**26.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**7.00**	Sand:	**31.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.85**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Moderate**	Detritus:	**3.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**186**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**64.7**	**123.0**	Dominant:	**Herbaceous**	**Herbaceous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**2.1**	**2.7**	Sub-dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**236.4**	**53.1**	Canopy %:	**76-100**	**76-100**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Closed**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**26-50**	**>100**
Sub-Dominant	**>100**	**51-100**
W less than 25	**1,013**	**830**
Buffer Vegitation Type		
Dominant	**Herbaceous**	**Herbaceous**
Sub-Dominant	**Coniferous**	**Coniferous**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Forest**	Mass Failures		
Sub-dominant	**Residential**	**Hay**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **Keenan Brook** Reach: **M15T2.02-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**Small Withdrawal**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:	**Irrigation**	Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	**17**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Instream Culvert	**5.5**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Deposition Below,Scour Below**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**1**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**	
Mid:	**4**	Delta:	**0**	Flood chutes:	**11**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**15**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**2,032**
Side:	**5**	Braiding:	**0**	Steep Riffles:	**2**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic		
7.1 Channel Degradation	**9**		**Yes**	Geomorphic Rating	**0.46**
7.2 Channel Aggradation	**9**			Channel Evolution Model	**F**
7.3 Widening Channel	**10**			Channel Evolution Stage	**III**
7.4 Change in Planforml	**9**			Geomorphic Condition	**Fair**
Total Score	**37**			Stream Sensitivity	**Very High**

Phase 2 Segment Summary Report Wells River

Stream: **Keenan Brook**
Reach: **M15T2.03-A**
Segment Length(ft): **1,033**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Caledonia County Conservation District**
Observers: **Redstart_dr, ES**
Completion Date: **7/21/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **Old mill site just DS of power line cut 0.66 mi up Powder Spring Road from Rt 302**

Step 5 - Notes: **Major power line cut at segment break between M15T203A and B (near culvert at Powder Spring Rd), and Keenan Brook then winds past an old mill site with portions of the mostly breached dam still intact (mostly wing walls). The main dam may have been log cribbing; currently a peeled log and a single timber (8x8) are fastened to the top of the natural ledge grade controls. Beers Atlas (1875) does not indicate this mill dam.**

Step 7 - Narrative: **Major aggradation, widening and planform changes following historic incision below old dam/mill site.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Grade Controls**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One Height	Both	Height
Berm:	0	0	
Road:	0	0	
Railroad:	0	0	
Imp. Path:	0	0	
Dev.:	80	0	

1.4 Adjacent Side	Left	Right
Hillside Slope:	**Hilly**	**Hilly**
Continuous w/ Bank:	**Sometimes**	**Sometimes**
Within 1 Bankfull W:	**Sometimes**	**Sometimes**
Texture:	**Mixed**	**Mixed**

1.5 Valley Features
Valley Width (ft): **250**
Width Determination: **Measured**
Confinement Type: **BD**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **No**

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	**Mid-segment**	**16.5**	**14.3**	**Yes**	
Ledge	**Mid-segment**	**6.5**	**3.5**	**Yes**	

Stream: **Keenan Brook** Reach: **M15T2.03-A**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**54.00**	2.11 Riffle/Step Spacing:	**31.4 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**2.60**	2.12 Substrate Composition		Bed:	**6.6**	**inches**
2.3 Mean Depth (tf):	**2.15**	Bedrock:	**3.0 %**	Bar:	**2.25**	**inches**
2.4 Floodprone Width (ft.):	**113.00**	Boulder:	**35.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**3.90**	Cobble:	**18.0 %**	Stream Type:	**B**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**15.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**25.12**	Fine Gravel:	**13.0 %**	Subclass Slope:	**a**	
2.7 Entrenchment Ratio:	**2.09**	Sand:	**16.0 %**	Bed Form:	**Step-Pool**	
2.8 Incision Ratio:	**1.50**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Moderate**	Detritus:	**15.0 %**	Reference Stream Type:	**B**	
2.10 Riffles Type:	**Complete**	# Large Woody Debris:	**89**	Reference Bed Material:	**Cobble**	
				Reference Subclass Slope:	**a**	
				Reference Bedform:	**Step-Pool**	

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Shallow**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**0.0**	**0.0**	Dominant:	**Coniferous**	**Coniferous**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**	Erosion Height (ft.):	**0.0**	**0.0**	Sub-dominant:	**Shrubs/Sapling**	**Herbaceous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**None**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**0.0**	Canopy %:	**76-100**	**76-100**
Material Type:	**Mix**	**Mix**				Mid-Channel Canopy:	**Closed**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**0-25**	**None**
W less than 25	**0**	**0**
Buffer Vegitation Type		
Dominant	**Herbaceous**	**Coniferous**
Sub-Dominant	**Coniferous**	**Herbaceous**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Forest**	Mass Failures		
Sub-dominant	**Residential**	**Forest**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **Keenan Brook** Reach: **M15T2.03-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:	**None**	Other:	Tile Drain:
4.4 # of Debris Jams:	**7**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**2**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**0**	Delta:	**0**	Flood chutes:	**7**	Avulsion:	**0**	5.5 Straightening:	**None**
Point:	**1**	Island:	**4**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**0**
Side:	**1**	Braiding:	**7**	Steep Riffles:	**0**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Confined**	Score	STD	Historic	
7.1 Channel Degradation		**10**		**Yes**	Geomorphic Rating **0.47**
7.2 Channel Aggradation		**9**			Channel Evolution Model **D**
7.3 Widening Channel		**9**			Channel Evolution Stage **IId**
7.4 Change in Planforml		**10**			Geomorphic Condition **Fair**
Total Score		**38**			Stream Sensitivity **High**

Phase 2 Segment Summary Report Wells River

Stream: **Keenan Brook**
Reach: **M15T2.03-B**
Segment Length(ft): **2,188**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Caledonia County Conservation District**
Observers: **Redstart_dr, ES**
Completion Date: **7/21/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **US of power line cut 0.66 mi up Powder Spring Road from Rt 302**

Step 5 - Notes: **Channel splits at top of reach; VT Hydrography Dataset shows secondary channel, while primary channel is 200-225 ft further west. The split channel does not rejoin until near the segment break, just US of culvert (with small stone-impounded pool for new dry hydrant) at Powder Spring Rd**

Step 7 - Narrative: **Major planform changes with minor incision, aggradation, and widening. Channel is split at top of reach and does not rejoin until Power Spring Road crossing. Evidence of multiple historic abandoned channels, prone to avulsion and braiding with debris jams but very little erosion due to excellent buffers and good floodplain access.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Grade Controls**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	387	8	0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	486		0	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Hilly	Hilly
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Always	Always
Texture:	Cobble	Cobble

1.5 Valley Features

Valley Width (ft): **1,000**
Width Determination: **Estimated**
Confinement Type: **VB**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **No**

1.6 Grade Controls: **None**

Stream: **Keenan Brook** Reach: **M15T2.03-B**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**27.30**	2.11 Riffle/Step Spacing:	**17.4 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**2.80**	2.12 Substrate Composition		Bed:	**5.8**	**inches**
2.3 Mean Depth (tf):	**1.60**	Bedrock:	**0.0 %**	Bar:	**2.85**	**inches**
2.4 Floodprone Width (ft.):	**120.30**	Boulder:	**20.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**4.70**	Cobble:	**40.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**13.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**17.06**	Fine Gravel:	**5.0 %**	Subclass Slope:	**b**	
2.7 Entrenchment Ratio:	**4.41**	Sand:	**22.0 %**	Bed Form:	**Step-Pool**	
2.8 Incision Ratio:	**1.68**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**High**	Detritus:	**11.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**80**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Shallow**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**48.7**	**0.0**	Dominant:	**Coniferous**	**Coniferous**
Material Type:	**Mix**	**Mix**	Erosion Height (ft.):	**2.0**	**0.0**	Sub-dominant:	**Herbaceous**	**Herbaceous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Multiple**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**168.6**	**269.2**	Canopy %:	**76-100**	**76-100**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Closed**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**0-25**	**26-50**
W less than 25	**0**	**0**
Buffer Vegitation Type		
Dominant	**Coniferous**	**Coniferous**
Sub-Dominant	**Herbaceous**	**Herbaceous**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Forest**	Mass Failures		
Sub-dominant	**Residential**	**Residential**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **Keenan Brook** Reach: **M15T2.03-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**Small Withdrawal**	4.7 Stormwater Inputs			
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:	**Other**	Field Ditch:	**0**	Road Ditch:	**1**
4.3 Flow Status:	**Moderate**	Impoundments:		Other:	**0**	Tile Drain:	**0**
4.4 # of Debris Jams:	**7**	Impoundment Loc.:		Overland Flow:	**0**	Urb Strm Wtr Pipe:	**0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:		**0**	
		(old) Upstrm Flow Reg.:		Affected Length (ft):		**0**	

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Instream Culvert	**5.8**	**Yes**	**Yes**	**Yes**	**Yes**	**Scour Above,Scour Below**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**2**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**1**	Delta:	**0**	Flood chutes:	**14**	Avulsion:	**0**	5.5 Straightening:	**None**
Point:	**3**	Island:	**2**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**0**
Side:	**5**	Braiding:	**4**	Steep Riffles:	**4**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Confined**	Score	STD	Historic		
7.1 Channel Degradation		**11**			Geomorphic Rating	**0.55**
7.2 Channel Aggradation		**11**			Channel Evolution Model	**F**
7.3 Widening Channel		**12**			Channel Evolution Stage	**III**
7.4 Change in Planforml		**10**			Geomorphic Condition	**Fair**
Total Score		**44**			Stream Sensitivity	**High**

Phase 2 Segment Summary Report Wells River

Stream: **Wells River**
Reach: **M16-0**
Segment Length(ft): **2,852**
Rain: **Yes**

SGAT Version: **4.56**
Organization:
Observers: **Redstart_dr, ES**
Completion Date: **6/25/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **Segment begins at confluence of Tannery Brook and Wells River.**

Step 5 - Notes: **Reach is DS of historically dammed and industrialized portion of Groton village, exhibits ongoing channel adjustments related to changes in stream flow and sediment distribution related to those impacts. Old Montpelier-Wells River RR bed and Little Italy Rd form new right valley wall.**

Step 7 - Narrative: **Minor widening, planform change, and aggradation following historic incision likely due to straightening (RR bed and road encroachment) as well as pulse flows from former dams upstream.**

Step 1. Valley and Floodplain

1.1 Segmentation: **None**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	311	10	0	
Railroad:	1,264	12	0	
Imp. Path:	0		0	
Dev.:	0		465	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Hilly	Hilly
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	Sand	Sand

1.5 Valley Features
Valley Width (ft): **685**
Width Determination: **Measured**
Confinement Type: **BD**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **No**

1.6 Grade Controls: **None**

Stream: **Wells River** Reach: **M16-0**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**78.00**	2.11 Riffle/Step Spacing:	**380 ft.**	2.13 Average Largest Particle on			
2.2 Max Depth (ft.):	**4.80**	2.12 Substrate Composition			Bed:	**7.1**	**inches**
2.3 Mean Depth (tf):	**3.36**	Bedrock:	**0.0 %**		Bar:	**4.2**	**inches**
2.4 Floodprone Width (ft.):	**252.00**	Boulder:	**2.0 %**	2.14 Stream Type			
2.5 Aband. Floodpn (ft.):	**6.50**	Cobble:	**63.0 %**	Stream Type:	**C**		
Human Elev FloodPln (ft.):		Coarse Gravel:	**16.0 %**	Bed Material:	**Cobble**		
2.6 Width/Depth Ratio:	**23.21**	Fine Gravel:	**8.0 %**	Subclass Slope:	**None**		
2.7 Entrenchment Ratio:	**3.23**	Sand:	**11.0 %**	Bed Form:	**Riffle-Pool**		
2.8 Incision Ratio:	**1.35**	Silt and Smaller:	**0.0 %**	Field Measured Slope:			
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type			
2.9 Sinuosity:	**Low**	Detritus:	**18.0 %**	Reference Stream Type:			
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**18**	Reference Bed Material:			
				Reference Subclass Slope:			
				Reference Bedform:			

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**512.2**	**601.6**	Dominant:	**Herbaceous**	**Herbaceous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**3.2**	**3.7**	Sub-dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**None**	Bank Canopy		
Lower			Revetment Length:	**583.2**	**0.0**	Canopy %:	**1-25**	**1-25**
Material Type:	**Sand**	**Sand**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**0-25**	**26-50**
Sub-Dominant	**>100**	**>100**
W less than 25	**1,377**	**325**
Buffer Vegitation Type		
Dominant	**Herbaceous**	**Herbaceous**
Sub-Dominant	**Shrubs/Sapling**	**Deciduous**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Hay**	**Forest**	Mass Failures		
Sub-dominant	**Shrubs/Sapling**	**Hay**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length		
Gullies	**None**				

Stream: **Wells River** Reach: **M16-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**0**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**1**	Delta:	**0**	Flood chutes:	**2**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**5**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**1,627**
Side:	**2**	Braiding:	**0**	Steep Riffles:	**0**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**10**			Geomorphic Rating	**0.57**
7.2 Channel Aggradation		**13**			Channel Evolution Model	**F**
7.3 Widening Channel		**11**			Channel Evolution Stage	**III**
7.4 Change in Planforml		**12**			Geomorphic Condition	**Fair**
Total Score		**46**			Stream Sensitivity	**High**

Phase 2 Segment Summary Report Wells River

Stream: Tannery Brook
Reach: M16S1.01-A
Segment Length(ft): 634
Rain: Yes

SGAT Version: 4.56
Organization:
Observers: Redstart_dr, ES
Completion Date: 6/24/2015
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional

Step 0 - Location: **Segment begins upstream of Rt 302**

Step 5 - Notes: **Extensively straightened historically, both riprap and foundations. Beers Atlas (1875) indicates Tannery was US of Rte 302, carding mill and sawmill at mouth of Tannery Brook along Wells mainstem. . All riprap on DS end past footbridge-equipment bridge in disuse (community solar arrays now occupy much of field on other side) has failed and mostly forms steps in the stream; the old carding mill and sawmill buildings at the mouth are falling in on themselves (sawmill mostly gone).**

Step 7 - Narrative: **Major loss of planform due to historic straightening, increased volume of water now moving large materials so stream appears as step-pool rather than likely reference riffle-pool; floodplain only accessed in large floods, but rip-rap is limiting current erosion.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Banks and Buffers**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

	Length (ft)	One	Height	Both	Height
Berm:		0		0	
Road:		0		0	
Railroad:		0		0	
Imp. Path:		0		0	
Dev.:		161		377	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Flat	Flat
Continuous w/ Bank:	Always	Always
Within 1 Bankfull W:	Always	Always
Texture:	Mixed	Mixed

1.5 Valley Features

Valley Width (ft):	600
Width Determination:	Measured
Confinement Type:	VB
In Rock Gorge:	No
Human Caused Change in Valley Width?:	No

1.6 Grade Controls: **None**

Stream: **Tannery Brook** Reach: **M16S1.01-A**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**16.30**	2.11 Riffle/Step Spacing:	**20 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**2.40**	2.12 Substrate Composition		Bed:	**10**	**inches**
2.3 Mean Depth (tf):	**1.75**	Bedrock:	**0.0 %**	Bar:	**4**	**inches**
2.4 Floodprone Width (ft.):	**55.10**	Boulder:	**29.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**3.30**	Cobble:	**44.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**7.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**9.31**	Fine Gravel:	**7.0 %**	Subclass Slope:	**b**	
2.7 Entrenchment Ratio:	**3.38**	Sand:	**13.0 %**	Bed Form:	**Step-Pool**	
2.8 Incision Ratio:	**1.37**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**0.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**4**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**0.0**	**0.0**	Dominant:	**Herbaceous**	**Herbaceous**
Material Type:	**Mix**	**Mix**	Erosion Height (ft.):	**0.0**	**0.0**	Sub-dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**Multiple**	Bank Canopy		
Lower			Revetment Length:	**257.1**	**365.4**	Canopy %:	**51-75**	**51-75**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**26-50**	**26-50**
Sub-Dominant	**0-25**	**0-25**
W less than 25	**200**	**255**
Buffer Vegitation Type		
Dominant	**Herbaceous**	**Herbaceous**
Sub-Dominant	**Shrubs/Sapling**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Industrial**	**Residential**	Mass Failures		
Sub-dominant	**Hay**	**Shrubs/Sapling**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **Tannery Brook** Reach: **M16S1.01-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**None**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs			
4.2 Adjacent Wetlands:	**None**	Flow Reg. Use:		Field Ditch:	**0**	Road Ditch:	**1**
4.3 Flow Status:	**Moderate**	Impoundments:		Other:	**0**	Tile Drain:	**0**
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	**0**	Urb Strm Wtr Pipe:	**0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:		**0**	
		(old) Upstrm Flow Reg.:	**None**	Affected Length (ft):		**0**	

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	**5**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Deposition Below,Scour Below**
Bridge	**24.2**	**Yes**	**Yes**	**Yes**	**Yes**	**Scour Above,Scour Below**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**1**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**0**	Delta:	**0**	Flood chutes:	**0**	Avulsion:	**0**	5.5 Straightening:		**Straightening**
Point:	**0**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):		**634**
Side:	**2**	Braiding:	**0**	Steep Riffles:	**3**	Trib Rejuv.:	**No**	5.5 Dredging:		**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**7**		**Yes**	Geomorphic Rating	**0.41**
7.2 Channel Aggradation		**10**			Channel Evolution Model	**F**
7.3 Widening Channel		**9**			Channel Evolution Stage	**III**
7.4 Change in Planforml		**7**			Geomorphic Condition	**Fair**
Total Score		**33**			Stream Sensitivity	**Very High**

Phase 2 Segment Summary Report Wells River

Stream: **Tannery Brook**
Reach: **M16S1.01-B**
Segment Length(ft): **10,708**
Rain: **Yes**

SGAT Version: **4.56**
Organization:
Observers: **Redstart_dr, ES**
Completion Date: **6/22/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location:

Step 5 - Notes: **Good buffers clearly playing an important role in limiting erosion, recent flood impacts (April 2014) mostly seen in braiding, channel splits, and debris jams building floodplain access. Frequent grade controls limit current incision; overall incision likely glacially related and augmented by transitory beaver occupation. No indications of mills on Beers Atlas, though foundation remains near one of the upstream breached beaver ponds suggest there may have been one at some point (lending to hungry water-pulse flows that would contribute to incision). Alternating periods of beaver occupation and effects of debris jams contribute to planform change and new incision following channel migrations/splits, and there is some road encroachment, but overall planform meanders a lot more than indicated by Vermont Hydrography Dataset. Due to these dynamics, plus degree of point bar sediment storage in particular, have used +/- 2 'fudge factor' on w/d ratio to class as a C type stream; technically measured x-section indicated E type channel dimensions.**

Step 7 - Narrative: **Major to minor planform change, aggradation, and widening following historic incision. Incision likely glacially related - frequent grade controls limit current incision. Alternating periods of beaver occupation and effects of debris jams contribute to planform change and new incision following channel migrations/splits. Good buffers are clearly playing an important role in limiting erosion, recent flood impacts (April 2014) mostly seen in braiding, channel splits, and debris jams building floodplain access.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Banks and Buffers**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	2,259	6	126	5
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	766		0	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Very Steep	Very Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	Mixed	Mixed

1.5 Valley Features
Valley Width (ft): **93**
Width Determination: **Measured**
Confinement Type: **NW**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **No**

1.6 Grade Controls:

VERMONT

Stream Geomorphic Assessment

Agency of Natural Resouces

VT DEC

Vermont.gov

September, 12 2016

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	4.2	2.2	Yes	
Ledge	Mid-segment	2.2	1.2	Yes	
Ledge	Mid-segment	10.6	8.9	Yes	
Ledge	Mid-segment	3.4	1.6	Yes	
Ledge	Mid-segment	5.7	4.5	Yes	
Ledge	Mid-segment	3.5	2.1	Yes	
Ledge	Mid-segment	4.9	3.9	Yes	
Ledge	Mid-segment	2.2	0.9	Yes	
Ledge	Mid-segment	3.0	1.2	Yes	
Ledge	Mid-segment	5.3	4.2	Yes	
Ledge	Mid-segment	7.3	6.3	Yes	
Ledge	Mid-segment	2.4	1.8	Yes	
Ledge	Mid-segment	2.0	1.7	Yes	
Ledge	Mid-segment	3.6	2.6	Yes	
Ledge	Mid-segment	15.3	14.4	Yes	
Ledge	Mid-segment	2.0	1.7	Yes	

Stream: **Tannery Brook** Reach: **M16S1.01-B**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**17.70**	2.11 Riffle/Step Spacing:	**33 ft.**	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	**2.10**	2.12 Substrate Composition		Bed:	**5 inches**
2.3 Mean Depth (tf):	**1.60**	Bedrock:	**0.0 %**	Bar:	**2.25 inches**
2.4 Floodprone Width (ft.):	**43.10**	Boulder:	**11.0 %**	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	**4.60**	Cobble:	**36.0 %**	Stream Type:	**C**
Human Elev FloodPln (ft.):		Coarse Gravel:	**22.0 %**	Bed Material:	**Gravel**
2.6 Width/Depth Ratio:	**11.06**	Fine Gravel:	**16.0 %**	Subclass Slope:	**b**
2.7 Entrenchment Ratio:	**2.44**	Sand:	**15.0 %**	Bed Form:	**Step-Pool**
2.8 Incision Ratio:	**2.19**	Silt and Smaller:	**0.0 %**	Field Measured Slope:	
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	**Moderate**	Detritus:	**2.0 %**	Reference Stream Type:	
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**450**	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**221.5**	**239.3**	Dominant:	**Coniferous**	**Coniferous**
Material Type:	**Mix**	**Mix**	Erosion Height (ft.):	**2.7**	**2.7**	Sub-dominant:	**Herbaceous**	**Herbaceous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**355.1**	**574.0**	Canopy %:	**76-100**	**76-100**
Material Type:	**Mix**	**Mix**				Mid-Channel Canopy:	**Closed**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**26-50**	**0-25**
W less than 25	**52**	**34**
Buffer Vegitation Type		
Dominant	**Coniferous**	**Coniferous**
Sub-Dominant	**Herbaceous**	**Herbaceous**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Forest**	**Forest**
Sub-dominant	**Pasture**	**Pasture**
(Legacy)	Amount	Mean Hieght
Failures	**One**	**10.0**
Gullies	**None**	

	Left	Right
Mass Failures		**19.4872**
Height		**10.0**
Gullies Number	**0**	
Gullies Length	**0**	

Stream: **Tannery Brook** Reach: **M16S1.01-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Abundant**	4.5 Flow Regulation Type	**Small Withdrawal**	4.7 Stormwater Inputs			
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:	**Irrigation**	Field Ditch:	**0**	Road Ditch:	**8**
4.3 Flow Status:	**Moderate**	Impoundments:		Other:	**0**	Tile Drain:	**0**
4.4 # of Debris Jams:	**53**	Impoundment Loc.:		Overland Flow:	**2**	Urb Strm Wtr Pipe:	**0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:		**2**	
		(old) Upstrm Flow Reg.:	**None**	Affected Length (ft):		**150**	

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Old Abutment	**10**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Deposition Below,Scour Above,Scour Below**
Instream Culvert	**4.8**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Scour Below**
Bridge	**16**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Deposition Below,Scour Below**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**13**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**Yes**	
Mid:	**5**	Delta:	**2**	Flood chutes:	**44**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**33**	Island:	**4**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**2,615**
Side:	**36**	Braiding:	**8**	Steep Riffles:	**3**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Confined**	Score	STD	Historic		
7.1 Channel Degradation		**5**	**None**	**Yes**	Geomorphic Rating	**0.41**
7.2 Channel Aggradation		**10**			Channel Evolution Model	**F**
7.3 Widening Channel		**10**			Channel Evolution Stage	**III**
7.4 Change in Planforml		**8**			Geomorphic Condition	**Fair**
Total Score		**33**			Stream Sensitivity	**Very High**

Phase 2 Segment Summary Report Wells River

Stream: **Wells River**
Reach: **M17-A**
Segment Length(ft): **3,800**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Caledonia County Conservation District**
Observers: **Redstart_dr, ES**
Completion Date: **7/27/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **US and DS of Powder Spring Rd bridge in Groton village, from Tannery Brook Rd to DS end of Irene channel avulsion area below Welton Rd (~1800 Scott Hwy-Rte 302)**

Step 5 - Notes: **Reach located in formerly substantially industrialized portion of Groton village, with two dams formerly located within the reach now gone. Remains of Groton No 9 dam in DS portion of reach were removed in late summer 2015 after assessment had been conducted. Historic researcher Hugh Henry was compiling impressive documentation of the area including the large impoundment that extended across much of Clark's Landing when the dam was intact (1908-1927). Log cribbing dam in US portion was in place at least as late as mid-1960s (http://www.uvm.edu/landscape/asset_store/09/16/LS09163/LS09163_000_thumb_2.jpg)**

Step 7 - Narrative: **Major widening, aggradation and planform changes following historic incision related to straightening (berms and RR bed off RB, undersized bridge) and breach/removal of 2 dams.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Depositional Features**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	736	9	0	
Road:	575	10	963	12
Railroad:	0		0	
Imp. Path:	222	15	0	
Dev.:	823		1,847	

1.4 Adjacent Side	Left	Right
Hillside Slope:	**Hilly**	**Steep**
Continuous w/ Bank:	**Sometimes**	**Sometimes**
Within 1 Bankfull W:	**Always**	**Always**
Texture:	**Cobble**	**Cobble**

1.5 Valley Features
Valley Width (ft): **400**
Width Determination: **Estimated**
Confinement Type: **NW**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	**Mid-segment**	**5.7**	**3.5**	**Yes**	
Ledge	**Mid-segment**	**6.0**	**3.8**	**Yes**	
Dam	**Mid-segment**	**6.5**	**2.0**	**Yes**	

Stream: **Wells River** Reach: **M17-A**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**80.50**	2.11 Riffle/Step Spacing:	**209 ft.**	2.13 Average Largest Particle on			
2.2 Max Depth (ft.):	**4.85**	2.12 Substrate Composition			Bed:	**29**	**inches**
2.3 Mean Depth (tf):	**3.50**	Bedrock:	**0.0 %**		Bar:	**42**	**inches**
2.4 Floodprone Width (ft.):	**128.50**	Boulder:	**5.0 %**	2.14 Stream Type			
2.5 Aband. Floodpn (ft.):	**10.15**	Cobble:	**35.0 %**	Stream Type:	**B**		
Human Elev FloodPln (ft.):		Coarse Gravel:	**22.0 %**	Bed Material:	**Cobble**		
2.6 Width/Depth Ratio:	**23.00**	Fine Gravel:	**7.0 %**	Subclass Slope:	**c**		
2.7 Entrenchment Ratio:	**1.60**	Sand:	**29.0 %**	Bed Form:	**Riffle-Pool**		
2.8 Incision Ratio:	**2.09**	Silt and Smaller:	**0.0 %**	Field Measured Slope:			
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type			
2.9 Sinuosity:	**Low**	Detritus:	**0.0 %**	Reference Stream Type:			
2.10 Riffles Type:	**Eroded**	# Large Woody Debris:	**19**	Reference Bed Material:			
				Reference Subclass Slope:			
				Reference Bedform:			

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**0.0**	**0.0**	Dominant:	**Herbaceous**	**Herbaceous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**0.0**	**0.0**	Sub-dominant:	**Shrubs/Sapling**	**Deciduous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Multiple**	**Multiple**	Bank Canopy		
Lower			Revetment Length:	**1,470.7**	**516.0**	Canopy %:	**26-50**	**51-75**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**0-25**	**51-100**
Sub-Dominant	**26-50**	**0-25**
W less than 25	**2,033**	**785**
Buffer Vegitation Type		
Dominant	**Herbaceous**	**Herbaceous**
Sub-Dominant	**Shrubs/Sapling**	**Deciduous**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Residential**	**Residential**	Mass Failures		
Sub-dominant	**Hay**	**Commercial**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **Wells River** Reach: **M17-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**Small Withdrawal**	4.7 Stormwater Inputs			
4.2 Adjacent Wetlands:	**None**	Flow Reg. Use:	**Other**	Field Ditch:	**0**	Road Ditch:	**0**
4.3 Flow Status:	**Moderate**	Impoundments:		Other:	**0**	Tile Drain:	**0**
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	**0**	Urb Strm Wtr Pipe:	**0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:		**0**	
		(old) Upstrm Flow Reg.:		Affected Length (ft):		**0**	

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	**50**	**Yes**	**Yes**	**Yes**	**No**	**Scour Above,Scour Below**
Old Abutment	**0**	**No**	**No**	**No**	**No**	**Alignment**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**1**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**	
Mid:	**0**	Delta:	**0**	Flood chutes:	**1**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**4**	Island:	**1**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**3,789**
Side:	**3**	Braiding:	**2**	Steep Riffles:	**1**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**5**	**C to B**	**Yes**	Geomorphic Rating	**0.40**
7.2 Channel Aggradation		**9**			Channel Evolution Model	**F**
7.3 Widening Channel		**9**			Channel Evolution Stage	**III**
7.4 Change in Planforml		**9**			Geomorphic Condition	**Fair**
Total Score		**32**			Stream Sensitivity	**High**

Phase 2 Segment Summary Report Wells River

Stream: **Wells River**
Reach: **M17-B**
Segment Length(ft): **1,262**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Caledonia County Conservation District**
Observers: **Redstart_dr, ES**
Completion Date: **7/27/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **Irene channel avulsion area midway between Weldon Rd bridge and Powder Spring Rd bridge (~1800 Scott Hwy-Rte302)**

Step 5 - Notes: **M17B lies downstream of a highly straightened reach including low berms DS of the Welton Rd bridge (replaced and upsized 2013). Google Earth historical imagery starting May 1998 indicates sediment deposition here that likely contributed to a channel avulsion initiated in 1996 and 1997 floods, which continued to unfold over a series of subsequent floods. May 2012 aerial imagery indicates that floodwaters in Irene deposited sediment across a broad portion of the floodplain in this segment.**

Step 7 - Narrative: **Extreme planform adjustments and major aggradation have contributed to good floodplain access following channel avulsion likely initiated in 1996 and 1997 floods.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Depositional Features**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	0		0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	0		0	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	**Flat**	**Hilly**
Continuous w/ Bank:	**Always**	**Sometimes**
Within 1 Bankfull W:	**Always**	**Sometimes**
Texture:	**Mixed**	**Mixed**

1.5 Valley Features
Valley Width (ft): **900**
Width Determination: **Estimated**
Confinement Type: **VB**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **No**

1.6 Grade Controls: **None**

Stream: **Wells River** Reach: **M17-B**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**62.80**	2.11 Riffle/Step Spacing:	**206 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**6.25**	2.12 Substrate Composition		Bed:	**4.6**	**inches**
2.3 Mean Depth (tf):	**4.34**	Bedrock:	**0.0 %**	Bar:	**2.35**	**inches**
2.4 Floodprone Width (ft.):	**670.30**	Boulder:	**3.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**6.25**	Cobble:	**29.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**33.0 %**	Bed Material:	**Gravel**	
2.6 Width/Depth Ratio:	**14.47**	Fine Gravel:	**15.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**10.67**	Sand:	**20.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.00**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**High**	Detritus:	**7.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**11**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**37.7**	**0.0**	Dominant:	**Herbaceous**	**Herbaceous**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**3.0**	**0.0**	Sub-dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**None**	Bank Canopy		
Lower			Revetment Length:	**365.9**	**0.0**	Canopy %:	**1-25**	**26-50**
Material Type:	**Gravel**	**Boulder/Cobble**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**26-50**	**26-50**
Sub-Dominant	**0-25**	**0-25**
W less than 25	**1,212**	**793**
Buffer Vegitation Type		
Dominant	**Herbaceous**	**Herbaceous**
Sub-Dominant	**Shrubs/Sapling**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Hay**	**Shrubs/Sapling**
Sub-dominant	**Shrubs/Sapling**	**Hay**
(Legacy)	Amount	Mean Hieght
Failures	**One**	**12.0**
Gullies	**None**	

	Left	Right
Mass Failures		**55.43277**
Height		**12.0**
Gullies Number	**0**	
Gullies Length	**0**	

Stream: **Wells River** Reach: **M17-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:	**None**	Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**0**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**2**	Delta:	**1**	Flood chutes:	**1**	Avulsion:	**1**	5.5 Straightening:	**Straightening**
Point:	**3**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**5**
Side:	**0**	Braiding:	**1**	Steep Riffles:	**0**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**11**			Geomorphic Rating	**0.44**
7.2 Channel Aggradation		**8**			Channel Evolution Model	**F**
7.3 Widening Channel		**11**			Channel Evolution Stage	**V**
7.4 Change in Planforml		**5**			Geomorphic Condition	**Fair**
Total Score		**35**			Stream Sensitivity	**Very High**

Phase 2 Segment Summary Report Wells River

Stream: **Wells River**
Reach: **M18-0**
Segment Length(ft): **3,334**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Caledonia County Conservation District**
Observers: **Redstart_dr, ES**
Completion Date: **7/15/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **channel avulsion 0.24 mi DS of Welton Rd bridge to North Branch confluence at Branch Brook Rd (aka Fred Hayes Rd) jct with Scott Hwy (Rte 302)**

Step 5 - Notes: **Scott Hwy (Rte 302) is often effective VW more by virtue of distance from stream than by absolute elevation. x-section indicated human-elevated floodplain DS of Welton Rd bridge: low berms likely pushed up from flood materials in fields either side of channel (not easily seen through tall grass), still overtopped in higher level floods. Grade US of Welton Rd bridge also climbs gradually from grade control (~3 ft HAW) to bridge (~8-9 ft HAW). Welton Rd bridge replaced late 2013.**

Step 7 - Narrative: **Major planform alteration and historic incision, now down to bedrock in US portions. Significant riprap US, bridge floodplain constriction and low berms pushed out of fields (likely post-Irene, possibly earlier) limit floodplain access in moderate floods but high level floods still access significant floodplain.**

Step 1. Valley and Floodplain

1.1 Segmentation: **None**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		307	2
Road:	1,146	6	0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	1,186		415	

1.4 Adjacent Side	Left	Right
Hillside Slope:	**Flat**	**Hilly**
Continuous w/ Bank:	**Always**	**Sometimes**
Within 1 Bankfull W:	**Always**	**Sometimes**
Texture:	**Mixed**	**Mixed**

1.5 Valley Features
Valley Width (ft): **650**
Width Determination: **Estimated**
Confinement Type: **BD**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	**Mid-segment**	**6.0**	**4.0**	**Yes**	

Stream: **Wells River** Reach: **M18-0**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**54.10**	2.11 Riffle/Step Spacing:	**356 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**5.70**	2.12 Substrate Composition		Bed:	**6.7**	**inches**
2.3 Mean Depth (tf):	**4.44**	Bedrock:	**0.0 %**	Bar:	**4.5**	**inches**
2.4 Floodprone Width (ft.):	**839.10**	Boulder:	**4.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**5.70**	Cobble:	**71.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):	**7.10**	Coarse Gravel:	**10.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**12.18**	Fine Gravel:	**3.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**15.51**	Sand:	**12.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.00**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**1.25**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**2.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**12**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Moderate**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**170.5**	**411.0**	Dominant:	**Shrubs/Sapling**	**Pasture**
Material Type:	**Mix**	**Mix**	Erosion Height (ft.):	**2.0**	**2.9**	Sub-dominant:	**Pasture**	**Deciduous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**1,353.9**	**121.1**	Canopy %:	**26-50**	**26-50**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**0-25**	**0-25**
Sub-Dominant	**26-50**	**>100**
W less than 25	**921**	**1,023**
Buffer Vegitation Type		
Dominant	**Herbaceous**	**Herbaceous**
Sub-Dominant	**Shrubs/Sapling**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Residential**	**Pasture**
Sub-dominant	**Hay**	**Forest**
(Legacy)	Amount	Mean Hieght
Failures	**One**	**10.0**
Gullies	**None**	

	Left	Right
Mass Failures		**57.732 77**
Height		**10.0**
Gullies Number	**0**	
Gullies Length		

Stream: **Wells River** Reach: **M18-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	**60**	**Yes**	**Yes**	**No**	**Yes**	**Deposition Below,Scour Above**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**1**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:	**No**		
Mid:	**2**	Delta:	**0**	Flood chutes:	**2**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**5**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**3,000**
Side:	**1**	Braiding:	**0**	Steep Riffles:	**1**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**10**	**None**	**Yes**	Geomorphic Rating	**0.46**
7.2 Channel Aggradation		**10**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**10**	**None**	**No**	Channel Evolution Stage	**III**
7.4 Change in Planforml		**7**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**37**			Stream Sensitivity	**High**

Phase 2 Segment Summary Report Wells River

Stream: North Branch Wells River
Reach: M18T3.01-0
Segment Length(ft): 2,316
Rain: Yes

SGAT Version: 4.56
Organization: Caledonia County Conservation District
Observers: Redstart_dr, EBM
Completion Date: 9/22/2015
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional

Step 0 - Location: **jct with Wells mainstem at Branch Brook Rd and Rte 302 (Scott Hwy) US to trib jct west of log landing 0.4 mi up Branch Brook Rd (~ 500 ft US of driveway to 352 Branch Brook Rd)**

Step 5 - Notes: **Likely alluvial fan: old channels and large flood chutes common across broad valley - channel appears aggraded, flood intolerant trees along banks not very high above banfkfull.**

Step 7 - Narrative: **Major planform adjustments with major reducing to minor aggradation and widening following historic incision likely related to channel straightening and pulse flows from historic mill US; aggradation and widening amplified by recent floods.**

Step 1. Valley and Floodplain

1.1 Segmentation: None
1.2 Alluvial Fan: Yes
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	75	7	0	
Road:	0		0	
Railroad:	0		0	
Imp. Path:	133	4	0	
Dev.:	765		195	

1.4 Adjacent Side	Left	Right
Hillside Slope:	Extr.Steep	Hilly
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Always
Texture:	Mixed	Mixed

1.5 Valley Features
Valley Width (ft): 507
Width Determination: Measured
Confinement Type: VB
In Rock Gorge: No
Human Caused Change in Valley Width?: No

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	2.3	1.1	Yes	
Ledge	Mid-segment	4.3	1.5	Yes	

Stream: **North Branch Wells River** Reach: **M18T3.01-0**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**50.70**	2.11 Riffle/Step Spacing:	**60 ft.**	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	**2.80**	2.12 Substrate Composition		Bed:	**18 inches**
2.3 Mean Depth (tf):	**1.91**	Bedrock:	**0.0 %**	Bar:	**7.6 inches**
2.4 Floodprone Width (ft.):	**133.70**	Boulder:	**10.0 %**	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	**4.10**	Cobble:	**46.0 %**	Stream Type:	**C**
Human Elev FloodPln (ft.):		Coarse Gravel:	**15.0 %**	Bed Material:	**Cobble**
2.6 Width/Depth Ratio:	**26.54**	Fine Gravel:	**12.0 %**	Subclass Slope:	**b**
2.7 Entrenchment Ratio:	**2.64**	Sand:	**17.0 %**	Bed Form:	**Riffle-Pool**
2.8 Incision Ratio:	**1.46**	Silt and Smaller:	**0.0 %**	Field Measured Slope:	
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	**Moderate**	Detritus:	**2.0 %**	Reference Stream Type:	
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**31**	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Undercut**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**652.1**	**0.0**	Dominant:	**Deciduous**	**Deciduous**
Material Type:	**Mix**	**Mix**	Erosion Height (ft.):	**3.4**	**0.0**	Sub-dominant:	**Lawn**	**Pasture**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**322.4**	**298.9**	Canopy %:	**76-100**	**76-100**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Closed**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**26-50**	**0-25**
Sub-Dominant	**0-25**	**>100**
W less than 25	**775**	**455**
Buffer Vegitation Type		
Dominant	**Mixed Trees**	**Herbaceous**
Sub-Dominant	**Herbaceous**	**Mixed Trees**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Residential**	**Hay**	Mass Failures		
Sub-dominant	**Forest**	**Forest**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **North Branch Wells River** Reach: **M18T3.01-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Abundant**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs			
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch:	**0**	Road Ditch:	**1**
4.3 Flow Status:	**Moderate**	Impoundments:		Other:	**1**	Tile Drain:	**0**
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	**0**	Urb Strm Wtr Pipe:	**0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:		**0**	
		(old) Upstrm Flow Reg.:		Affected Length (ft):		**0**	

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bedrock Outcrops	**15**	**Yes**	**Yes**	**Yes**	**No**	**Deposition Above,Scour Below**
Bridge	**18**	**Yes**	**Yes**	**Yes**	**Yes**	**Scour Below,Alignment**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**8**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**	
Mid:	**1**	Delta:	**1**	Flood chutes:	**7**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**11**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**950**
Side:	**5**	Braiding:	**0**	Steep Riffles:	**2**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic		
7.1 Channel Degradation	**10**	**None**	**Yes**	Geomorphic Rating	**0.47**
7.2 Channel Aggradation	**10**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel	**10**	**None**	**No**	Channel Evolution Stage	**III**
7.4 Change in Planforml	**8**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score	**38**			Stream Sensitivity	**High**

Phase 2 Segment Summary Report Wells River

Stream: North Branch Wells River
Reach: M18T3.02-0
Segment Length(ft): 4,518
Rain: Yes

SGAT Version: 4.56
Organization: Caledonia County Conservation District
Observers: Redstart_dr, EBM
Completion Date: 9/21/2015
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional

Step 0 - Location: **Trib jct west of log landing ~0.4 mi up Branch Brook Rd, on W side of rd, to trib jct ~1200 ft US of end of Branch Brook Rd**

Step 5 - Notes: **multiple terraces in variable width valley, likely old mill site at pinch point in valley and recent log job (multiple trails) over bedrock mid-reach. Cutting not extreme but certainly removed a good number of trees along the stream.**

Step 7 - Narrative: **Major planform adjustments and widening following historic incision related to moderate straightening (road encroachment) and small mill influences (pulse flows); snagging likely as well: little large wood playing role in stream dynamics.Frequent deposition of fines and lack of large wood suggest possible beaver influences US with possibility of recent dam breaches in flood events contributing fines.**

Step 1. Valley and Floodplain

1.1 Segmentation: None
1.2 Alluvial Fan: None
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	2,180	8	0	
Railroad:	0		0	
Imp. Path:	544	5	0	
Dev.:	90		0	

1.4 Adjacent Side	Left	Right
Hillside Slope:	Extr.Steep	Extr.Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	Mixed	Mixed

1.5 Valley Features
Valley Width (ft): 120
Width Determination: Estimated
Confinement Type: SC
In Rock Gorge: No
Human Caused Change in Valley Width?: Yes

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	5.5	3.5	Yes	
Ledge	Mid-segment	8.8	5.6	Yes	
Ledge	Mid-segment	2.5	1.1	Yes	
Ledge	Mid-segment	4.5	2.8	Yes	
Ledge	Mid-segment	3.2	1.4	Yes	
Ledge	Mid-segment	5.3	3.9	Yes	
Ledge	Mid-segment	5.3	3.6	Yes	

Stream: **North Branch Wells River** Reach: **M18T3.02-0**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**38.00**	2.11 Riffle/Step Spacing:	**50 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**3.45**	2.12 Substrate Composition		Bed:	**17.2**	**inches**
2.3 Mean Depth (tf):	**2.03**	Bedrock:	**3.0 %**	Bar:	**6.4**	**inches**
2.4 Floodprone Width (ft.):	**134.50**	Boulder:	**21.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**6.35**	Cobble:	**44.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**7.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**18.72**	Fine Gravel:	**10.0 %**	Subclass Slope:	**b**	
2.7 Entrenchment Ratio:	**3.54**	Sand:	**15.0 %**	Bed Form:	**Step-Pool**	
2.8 Incision Ratio:	**1.84**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Moderate**	Detritus:	**3.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**126**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Undercut**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**349.5**	**223.7**	Dominant:	**Coniferous**	**Coniferous**
Material Type:	**Mix**	**Mix**	Erosion Height (ft.):	**2.6**	**3.2**	Sub-dominant:	**Pasture**	**Pasture**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**331.8**	**154.8**	Canopy %:	**76-100**	**76-100**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Closed**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**26-50**	**0-25**
Sub-Dominant	**51-100**	**>100**
W less than 25	**243**	**429**
Buffer Vegitation Type		
Dominant	**Mixed Trees**	**Mixed Trees**
Sub-Dominant	**Shrubs/Sapling**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Forest**	**Forest**
Sub-dominant	**Bare**	**Pasture**
(Legacy)	Amount	Mean Hieght
Failures	**Multiple**	**9.0**
Gullies	**None**	

	Left	Right
Mass Failures		**101.3998**
Height		**9.1**
Gullies Number	**0**	
Gullies Length	**0**	

Stream: North Branch Wells River Reach: M18T3.02-0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Abundant	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs			
4.2 Adjacent Wetlands:	Minimal	Flow Reg. Use:		Field Ditch:	0	Road Ditch:	5
4.3 Flow Status:	Moderate	Impoundments:		Other:	2	Tile Drain:	0
4.4 # of Debris Jams:	3	Impoundment Loc.:		Overland Flow:	0	Urb Strm Wtr Pipe:	0
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:		0	
		(old) Upstrm Flow Reg.:		Affected Length (ft):		0	

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	24	Yes	Yes	Yes	No	Scour Above,Scour Below

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	7	5.2 Other Features	Neck Cutoff:	0	5.4 Stream Ford or Animal Crossing:	Yes
Mid:	4	Delta:	0	Flood chutes:	11	Avulsion:	0	5.5 Straightening:	With Windrowing
Point:	15	Island:	3	5.3 Steep Riffles and Head Cuts		Head Cuts:	0	Straightening Length (ft.):	354
Side:	28	Braiding:	1	Steep Riffles:	3	Trib Rejuv.:	Yes	5.5 Dredging:	None

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	0	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	0.00				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Confined	Score	STD	Historic		
7.1 Channel Degradation		9	None	Yes	Geomorphic Rating	0.49
7.2 Channel Aggradation		11	None	No	Channel Evolution Model	F
7.3 Widening Channel		10	None	No	Channel Evolution Stage	III
7.4 Change in Planforml		9	None	No	Geomorphic Condition	Fair
Total Score		39			Stream Sensitivity	High

Phase 2 Segment Summary Report Wells River

Stream: **Wells River**
Reach: **M19-0**
Segment Length(ft): **2,839**
Rain: **Yes**

SGAT Version: **4.56**
Organization:
Observers: **Redstart_dr, ES**
Completion Date: **7/28/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **From confluence of South Branch and mainstem Wells River DS to confluence of North Branch and mainstem Wells river.**

Step 5 - Notes: **Possible this reach may be disorganized plane bed under reference conditions (neither steps or riffles setting up well), with ~2.1 pct slope and long stretches of ledge grade controls, but current conditions show well formed riffles and occasional steps as well. These are active adjustments with sediments being distributed in high flows after removal of a dam in US reach M20, plus Irene impacts from the South Branch (M19T4). Straightening amplified by historic impacts (Beers 1857 atlas indicates both a sawmill US and starch factory across from the current Town Garage location, and ANR Atlas indicates former Franconia Paper Mill dam was removed across from garage; also likely bridge abutment remains by Power House Rd may have had other associated infrastructure). Force of water funneling through the Rte 302 bridge and over a significant grade control at Power House Rd appears to have contributed to a large sediment dump in US end of reach M18 in Irene.**

Step 7 - Narrative: **Major planform change and aggradation with major to minor widening following historic incision likely related to straightening and dam presence; grade controls limit further incision. Funneling creates a fire hose effect; large sediment discharges evident DS post Irene.**

Step 1. Valley and Floodplain

1.1 Segmentation: **None**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	825	10	1,886	9
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	510		1,298	

1.4 Adjacent Side	Left	Right
Hillside Slope:	**Hilly**	**Steep**
Continuous w/ Bank:	**Sometimes**	**Sometimes**
Within 1 Bankfull W:	**Sometimes**	**Sometimes**
Texture:	**Mixed**	**Mixed**

1.5 Valley Features	
Valley Width (ft):	**235**
Width Determination:	**Estimated**
Confinement Type:	**NW**
In Rock Gorge:	**No**

Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	**Mid-segment**	**8.5**	**6.8**	**Yes**	
Ledge	**Mid-segment**	**5.1**	**3.0**	**Yes**	
Ledge	**Mid-segment**	**5.6**	**2.9**	**Yes**	
Ledge	**Mid-segment**	**29.4**	**25.4**	**Yes**	

Stream: **Wells River** Reach: **M19-0**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**69.50**	2.11 Riffle/Step Spacing:	**123.5 ft.**	2.13 Average Largest Particle on			
2.2 Max Depth (ft.):	**5.10**	2.12 Substrate Composition			Bed:	**7**	**inches**
2.3 Mean Depth (tf):	**3.40**	Bedrock:	**10.0 %**		Bar:	**3.9**	**inches**
2.4 Floodprone Width (ft.):	**294.50**	Boulder:	**19.0 %**	2.14 Stream Type			
2.5 Aband. Floodpn (ft.):	**8.10**	Cobble:	**43.0 %**	Stream Type:	**C**		
Human Elev FloodPln (ft.):		Coarse Gravel:	**10.0 %**	Bed Material:	**Cobble**		
2.6 Width/Depth Ratio:	**20.44**	Fine Gravel:	**8.0 %**	Subclass Slope:	**b**		
2.7 Entrenchment Ratio:	**4.24**	Sand:	**10.0 %**	Bed Form:	**Riffle-Pool**		
2.8 Incision Ratio:	**1.59**	Silt and Smaller:	**0.0 %**	Field Measured Slope:			
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type			
2.9 Sinuosity:	**Low**	Detritus:	**8.0 %**	Reference Stream Type:			
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**25**	Reference Bed Material:			
				Reference Subclass Slope:			
				Reference Bedform:			

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**228.6**	**185.9**	Dominant:	**Herbaceous**	**Herbaceous**
Material Type:	**Mix**	**Mix**	Erosion Height (ft.):	**1.9**	**2.8**	Sub-dominant:	**Coniferous**	**Deciduous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Multiple**	**Multiple**	Bank Canopy		
Lower			Revetment Length:	**1,164.0**	**1,500.6**	Canopy %:	**51-75**	**51-75**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**51-100**	**26-50**
Sub-Dominant	**>100**	**51-100**
W less than 25	**806**	**244**
Buffer Vegitation Type		
Dominant	**Coniferous**	**Herbaceous**
Sub-Dominant	**Herbaceous**	**Coniferous**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Residential**	**Residential**	Mass Failures		
Sub-dominant	**Forest**	**Shrubs/Sapling**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **Wells River** Reach: **M19-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs			
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch:	**0**	Road Ditch:	**2**
4.3 Flow Status:	**Moderate**	Impoundments:	**None**	Other:	**0**	Tile Drain:	**0**
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	**0**	Urb Strm Wtr Pipe:	**0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:		**0**	
		(old) Upstrm Flow Reg.:		Affected Length (ft):		**0**	

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	**40**	**Yes**	**Yes**	**Yes**	**No**	**Scour Above,Scour Below**
Bridge	**45**	**Yes**	**Yes**	**Yes**	**No**	**Deposition Above,Deposition Below,Scour Below,Alignment**
Old Abutment	**36**	**Yes**	**Yes**	**Yes**	**Yes**	**Scour Below**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**1**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**	
Mid:	**0**	Delta:	**1**	Flood chutes:	**4**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**6**	Island:	**1**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**2,839**
Side:	**3**	Braiding:	**1**	Steep Riffles:	**1**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**8**		**Yes**	Geomorphic Rating	**0.47**
7.2 Channel Aggradation		**10**			Channel Evolution Model	
7.3 Widening Channel		**11**			Channel Evolution Stage	**III**
7.4 Change in Planforml		**9**			Geomorphic Condition	**Fair**
Total Score		**38**			Stream Sensitivity	**High**

Phase 2 Segment Summary Report Wells River

Stream: South Branch Wells River
Reach: M19T4.01-A
Segment Length(ft): 1,938
Rain: Yes

SGAT Version: 4.56
Organization: Caledonia County Conservation District
Observers: Redstart_dr, ES
Completion Date: 8/3/2015
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional

Step 0 - Location: **Jct with Wells mainstem by Puffer ballfield US to old rail abutments by Wilson Rd**

Step 5 - Notes: **Reach is on the downstream end of a glacial outwash spillway with remarkably large boulder and cobble material, and the short stretch of bedrock gorge, old railroad abutments and degree of straightening and channelization upstream helped mobilize much of this material in Irene.Heavily channelized, substantial windrowing. Steps and riffles appear to be rapidly "washing out" erosional features and nickpoints, but are broken and clearly mobile; significant stretches of plane bed.**

Step 7 - Narrative: **Loss of planform following extensive channelization and windrowing after heavy aggradation in Irene. Reach appears to be on an alluvial fan, and flow discharge and deposition were amplified by undersized structures and a natural bedrock gorge further US. Aggradation is "washing out" nickpoints, but depositional features are unstable and mobile.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Corridor Encroachment**
1.2 Alluvial Fan: **Yes**
1.3 Corridor Encroachments:

	Length (ft)	One Height	Both	Height
Berm:	1,177	8	480	9
Road:	0		0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	990		0	

1.4 Adjacent Side	Left	Right
Hillside Slope:	Flat	Hilly
Continuous w/ Bank:	Always	Sometimes
Within 1 Bankfull W:	Always	Always
Texture:	Mixed	Mixed

1.5 Valley Features
Valley Width (ft): 850
Width Determination: Estimated
Confinement Type: VB
In Rock Gorge: No
Human Caused Change in Valley Width?: Yes

1.6 Grade Controls: None

Stream: **South Branch Wells River** Reach: **M19T4.01-A**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**53.70**	2.11 Riffle/Step Spacing:	**89 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**4.90**	2.12 Substrate Composition		Bed:	**15.6**	**inches**
2.3 Mean Depth (tf):	**2.70**	Bedrock:	**0.0 %**	Bar:	**5.5**	**inches**
2.4 Floodprone Width (ft.):	**804.00**	Boulder:	**24.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**5.90**	Cobble:	**58.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):	**8.90**	Coarse Gravel:	**5.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**19.89**	Fine Gravel:	**5.0 %**	Subclass Slope:	**b**	
2.7 Entrenchment Ratio:	**14.97**	Sand:	**8.0 %**	Bed Form:	**Step-Pool**	
2.8 Incision Ratio:	**1.20**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**1.82**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**1.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Eroded**	# Large Woody Debris:	**12**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**64.9**	**93.4**	Dominant:	**Bare**	**Herbaceous**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**	Erosion Height (ft.):	**3.0**	**3.0**	Sub-dominant:	**Herbaceous**	**Shrubs/Sapling**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Multiple**	**Multiple**	Bank Canopy		
Lower			Revetment Length:	**1,278.9**	**785.0**	Canopy %:	**1-25**	**1-25**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**0-25**	**>100**
Sub-Dominant	**26-50**	**26-50**
W less than 25	**1,565**	**455**
Buffer Vegitation Type		
Dominant	**Herbaceous**	**Mixed Trees**
Sub-Dominant	**Deciduous**	**Herbaceous**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Commercial**	**Forest**
Sub-dominant	**Residential**	**Hay**
(Legacy)	Amount	Mean Hieght
Failures	**None**	
Gullies	**None**	

	Left	Right
Mass Failures		
Height		
Gullies Number	**0**	
Gullies Length	**0**	

Stream: **South Branch Wells River** Reach: **M19T4.01-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs			
4.2 Adjacent Wetlands:	**None**	Flow Reg. Use:		Field Ditch:	**0**	Road Ditch:	**2**
4.3 Flow Status:	**Moderate**	Impoundments:		Other:	**0**	Tile Drain:	**0**
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	**0**	Urb Strm Wtr Pipe:	**0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:		**0**	
		(old) Upstrm Flow Reg.:		Affected Length (ft):		**0**	

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Old Abutment	**25**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Deposition Below,Scour Below,Alignment**
Bridge	**50**	**Yes**	**Yes**	**Yes**	**No**	**Deposition Above,Deposition Below,Scour Below**
Bridge	**54**	**Yes**	**Yes**	**Yes**	**No**	**Deposition Above,Deposition Below,Scour Above,Alignment**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**1**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**	
Mid:	**1**	Delta:	**0**	Flood chutes:	**1**	Avulsion:	**1**	5.5 Straightening:	**With Windrowing**
Point:	**2**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**1,889**
Side:	**0**	Braiding:	**0**	Steep Riffles:	**2**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**7**	**None**	**No**	Geomorphic Rating	**0.38**
7.2 Channel Aggradation		**9**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**9**	**None**	**No**	Channel Evolution Stage	**III**
7.4 Change in Planforml		**5**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**30**			Stream Sensitivity	**High**

Phase 2 Segment Summary Report Wells River

Stream: **South Branch Wells River**
Reach: **M19T4.01-B**
Segment Length(ft): **1,067**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Caledonia County Conservation District**
Observers: **Redstart_dr, ES**
Completion Date: **8/3/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **US of old rail abutments at Wilson Rd-Scott Hwy (Rte 302) jct to reachbreak M19T4.02 (~0.5 mi up Scott Hwy from jct with Wells mainstem by Puffer ballfield)**

Step 5 - Notes: **Glacial outwash spillway extends through this segment and into next DS, coarse sediment (boulder/cobble) transport enhanced as flow got funneled through natural bedrock gorge in next reach US. Appears likely that initial downcutting in Irene was offset by subsequent aggradation, reducing current incision ratio. Valley width reduction by Scott Hwy (Rte 302) is minor because current channel location is already pinned against LVW. Subreach due to steeper gradient than DS seg A, even under reference conditions (~4% slope with current straightened planform).**

Step 7 - Narrative: **Major widening and planform adjustments following recent flood impacts (Irene 8/28/2011, heavy snowmelt 4/16/2014). Reach appears to be on an alluvial fan, and short bedrock gorge in M19T4.02 has been augmented by bridge at US end of that reach, contributing to "fire hose" effect in transporting large amounts of boulder and cobble sediments in ample supply due to geology; likely initial downcutting in Irene offset by subsequent aggradation. 'Confined' evaluation due to steep gradient of stream (step-pool bedform), as valley confinement type is technically Broad.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Planform and Scope**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

	Length (ft)	One	Height	Both	Height
Berm:		0		0	
Road:		0		0	
Railroad:		0		0	
Imp. Path:		0		0	
Dev.:		249		0	

1.4 Adjacent Side	Left	Right
Hillside Slope:	**Hilly**	**Hilly**
Continuous w/ Bank:	**Sometimes**	**Sometimes**
Within 1 Bankfull W:	**Sometimes**	**Sometimes**
Texture:	**Cobble**	**Cobble**

1.5 Valley Features	
Valley Width (ft):	**375**
Width Determination:	**Estimated**
Confinement Type:	**BD**
In Rock Gorge:	**No**

Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	**Mid-segment**	**7.4**	**4.9**	**Yes**	

Stream: **South Branch Wells River** Reach: **M19T4.01-B**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**52.50**	2.11 Riffle/Step Spacing:	**35 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**5.20**	2.12 Substrate Composition		Bed:	**16.2**	**inches**
2.3 Mean Depth (tf):	**3.07**	Bedrock:	**0.0 %**	Bar:	**8.6**	**inches**
2.4 Floodprone Width (ft.):	**362.50**	Boulder:	**37.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**6.10**	Cobble:	**48.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**4.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**17.10**	Fine Gravel:	**5.0 %**	Subclass Slope:	**b**	
2.7 Entrenchment Ratio:	**6.90**	Sand:	**6.0 %**	Bed Form:	**Step-Pool**	
2.8 Incision Ratio:	**1.17**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Moderate**	Detritus:	**3.0 %**	Reference Stream Type:	**C**	
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**12**	Reference Bed Material:	**Cobble**	
				Reference Subclass Slope:	**b**	
				Reference Bedform:	**Step-Pool**	

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**117.4**	**598.5**	Dominant:	**Herbaceous**	**Coniferous**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**	Erosion Height (ft.):	**3.1**	**4.1**	Sub-dominant:	**Coniferous**	**Shrubs/Sapling**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**372.8**	**24.4**	Canopy %:	**1-25**	**51-75**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**26-50**	**>100**
Sub-Dominant	**0-25**	**None**
W less than 25	**720**	**125**
Buffer Vegitation Type		
Dominant	**Herbaceous**	**Mixed Trees**
Sub-Dominant	**Mixed Trees**	**Herbaceous**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Bare**	**Forest**	Mass Failures		
Sub-dominant	**Shrubs/Sapling**	**Hay**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **South Branch Wells River** Reach: **M19T4.01-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**None**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	**1**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**1**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**0**	Delta:	**0**	Flood chutes:	**3**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**2**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**1,063**
Side:	**2**	Braiding:	**0**	Steep Riffles:	**1**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Confined**	Score	STD	Historic		
7.1 Channel Degradation		**12**	**None**	**No**	Geomorphic Rating	**0.49**
7.2 Channel Aggradation		**11**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**9**	**None**	**No**	Channel Evolution Stage	**III**
7.4 Change in Planforml		**7**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**39**			Stream Sensitivity	**High**

Phase 2 Segment Summary Report Wells River

Stream: **South Branch Wells River**
Reach: **M19T4.02-0**
Segment Length(ft): **2,340**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Caledonia County Conservation District**
Observers: **Redstart_dr, ES**
Completion Date: **7/29/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **~0.5 mi up Scott Hwy (Rte 302) from jct with Wells mainstem (at Puffer ballfield) to ~0.2 mi US of pvt driveway bridge at 3507 Scott Hwy**

Step 5 - Notes: **Heavy bank armoring along Rte 302 significantly encroaches on current channel location in a couple spots. Aggradation appears to be offsetting incision upstream of bedrock gorge (~300 ft, narrowly confined, not segmented due to short length) as well as in the current channel location downstream of the gorge, but large flood chute off right bank DS of gorge was scoured 5 ft BELOW elevation of current channel - likely to be captured in future event.**

Step 7 - Narrative: **Channel evolution stage II-III. Major loss of planform, widening temporarily limited by heavy bank armoring along Rte 302. Aggradation US of gorge and in current channel DS of gorge, with significant headcut (5 ft below current channel elevation) at end of RB floodchute DS of gorge.**

Step 1. Valley and Floodplain

1.1 Segmentation: **None**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

	Length (ft)	One Height	Both	Height
Berm:	0		0	
Road:	1,618	7	0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	0		0	

1.4 Adjacent Side	Left	Right
Hillside Slope:	Steep	Hilly
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Always	Sometimes
Texture:	Mixed	Cobble

1.5 Valley Features
Valley Width (ft): **250**
Width Determination: **Estimated**
Confinement Type: **SC**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	7.6	4.1	Yes	

Stream: **South Branch Wells River** Reach: **M19T4.02-0**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**64.90**	2.11 Riffle/Step Spacing:	**48 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**3.70**	2.12 Substrate Composition		Bed:	**17.7**	**inches**
2.3 Mean Depth (tf):	**2.50**	Bedrock:	**20.0 %**	Bar:	**11.1**	**inches**
2.4 Floodprone Width (ft.):	**223.00**	Boulder:	**38.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**5.90**	Cobble:	**33.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**10.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**25.96**	Fine Gravel:	**7.0 %**	Subclass Slope:	**b**	
2.7 Entrenchment Ratio:	**3.44**	Sand:	**10.0 %**	Bed Form:	**Step-Pool**	
2.8 Incision Ratio:	**1.59**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**2.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**62**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**164.4**	**228.0**	Dominant:	**Coniferous**	**Coniferous**
Material Type:	**Mix**	**Mix**	Erosion Height (ft.):	**2.1**	**2.1**	Sub-dominant:	**Bare**	**Shrubs/Sapling**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**None**	Bank Canopy		
Lower			Revetment Length:	**1,091.5**	**0.0**	Canopy %:	**1-25**	**76-100**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**0-25**	**>100**
Sub-Dominant	**26-50**	**26-50**
W less than 25	**1,185**	**0**
Buffer Vegitation Type		
Dominant	**Coniferous**	**Coniferous**
Sub-Dominant	**Shrubs/Sapling**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Bare**	**Forest**	Mass Failures		
Sub-dominant	**Forest**	**None**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **South Branch Wells River** Reach: **M19T4.02-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Abundant**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs			
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch:	**0**	Road Ditch:	**7**
4.3 Flow Status:	**Moderate**	Impoundments:		Other:	**0**	Tile Drain:	**0**
4.4 # of Debris Jams:	**1**	Impoundment Loc.:		Overland Flow:	**0**	Urb Strm Wtr Pipe:	**0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:		**0**	
		(old) Upstrm Flow Reg.:		Affected Length (ft):		**0**	

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	**35**	**Yes**	**Yes**	**Yes**	**Yes**	**Scour Above,Scour Below**
Bedrock Outcrops	**37**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Scour Below**
Bedrock Outcrops	**25**	**Yes**	**Yes**	**Yes**	**Yes**	**Scour Above,Scour Below**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**2**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**	
Mid:	**1**	Delta:	**0**	Flood chutes:	**8**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**3**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**1,979**
Side:	**4**	Braiding:	**0**	Steep Riffles:	**1**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Confined**

	Score	STD	Historic		
7.1 Channel Degradation	**8**	**None**	**No**	Geomorphic Rating	**0.45**
7.2 Channel Aggradation	**11**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel	**10**	**None**	**No**	Channel Evolution Stage	**III**
7.4 Change in Planforml	**7**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score	**36**			Stream Sensitivity	**High**

Phase 2 Segment Summary Report Wells River

Stream: South Branch Wells River
Reach: M19T4.03-A
Segment Length(ft): 3,478
Rain: No

SGAT Version: 4.56
Organization:
Observers: Redstart_dr, ES
Completion Date: 8/20/2015
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional

Step 0 - Location: **Westville, DS of Rt 302 bridge**

Step 5 - Notes: **Small settlement of Westville located in close proximity to the stream in this segment, and 1875 Beers Atlas indicates this as the location of the Heath & Welch Saw & Planing Mill. Incision due to extensive straightening appears somewhat limited by large substrate size reflective of glacial outwash spillway, and recent flood impacts have contributed additional sediments from large mass failures and tributary rejuvenation.**

Step 7 - Narrative: **Extreme planform adjustments with major widening and aggradation following primarily historic incision. Nickpoints and tributary rejuvenation evident post-Irene but this degradation appears limited to some degree by large substrate size and sediment contributions from mass failures. Historic incision likely related to glacial legacy, extensive straightening (old road was closer to stream) and pulse flows related to presence of a mill in this stream segment.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Planform and Scope**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

	Length (ft)	One Height	Both	Height
Berm:	0		0	
Road:	3,352	8	0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	2,129		0	

1.4 Adjacent Side	Left	Right
Hillside Slope:	Extr.Steep	Extr.Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	Mixed	Mixed

1.5 Valley Features
Valley Width (ft): 200
Width Determination: Measured
Confinement Type: NW
In Rock Gorge: No
Human Caused Change in Valley Width?: Yes

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	6.5	4.5	Yes	
Ledge	Mid-segment	7.3	4.9	Yes	
Ledge	Mid-segment	3.0	1.4	Yes	

Stream: **South Branch Wells River** Reach: **M19T4.03-A**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**45.00**	2.11 Riffle/Step Spacing:	**37 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**5.00**	2.12 Substrate Composition		Bed:	**16.6**	**inches**
2.3 Mean Depth (tf):	**3.33**	Bedrock:	**1.0 %**	Bar:	**8.6**	**inches**
2.4 Floodprone Width (ft.):	**84.00**	Boulder:	**30.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**7.60**	Cobble:	**37.0 %**	Stream Type:	**B**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**13.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**13.51**	Fine Gravel:	**12.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**1.87**	Sand:	**7.0 %**	Bed Form:	**Step-Pool**	
2.8 Incision Ratio:	**1.52**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Moderate**	Detritus:	**3.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**73**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**606.8**	**531.0**	Dominant:	**Coniferous**	**Coniferous**
Material Type:	**Mix**	**Mix**	Erosion Height (ft.):	**3.9**	**3.2**	Sub-dominant:	**Herbaceous**	**Herbaceous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**1,557.8**	**198.0**	Canopy %:	**51-75**	**76-100**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**26-50**	**>100**
Sub-Dominant	**0-25**	**0-25**
W less than 25	**1,944**	**48**
Buffer Vegitation Type		
Dominant	**Herbaceous**	**Coniferous**
Sub-Dominant	**Shrubs/Sapling**	**Herbaceous**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Residential**	**Forest**	Mass Failures		**329.5734**
Sub-dominant	**Shrubs/Sapling**	**Bare**	Height		**28.8**
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**Multiple**	**28.3**	Gullies Length	**0**	
Gullies	**None**				

Stream: **South Branch Wells River** Reach: **M19T4.03-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Abundant**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs			
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch:	**0**	Road Ditch:	**3**
4.3 Flow Status:	**Moderate**	Impoundments:	**None**	Other:	**0**	Tile Drain:	**0**
4.4 # of Debris Jams:	**1**	Impoundment Loc.:		Overland Flow:	**0**	Urb Strm Wtr Pipe:	**0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:		**0**	
		(old) Upstrm Flow Reg.:	**None**	Affected Length (ft):		**0**	

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	**40**	**Yes**	**Yes**	**Yes**	**No**	**Scour Above,Scour Below**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**3**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**1**	Delta:	**0**	Flood chutes:	**12**	Avulsion:	**1**	5.5 Straightening:	**Straightening**
Point:	**9**	Island:	**2**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**1**	Straightening Length (ft.):	**3,472**
Side:	**2**	Braiding:	**1**	Steep Riffles:	**3**	Trib Rejuv.:	**Yes**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Confined**	Score	STD	Historic		
7.1 Channel Degradation		**8**	**C to B**		Geomorphic Rating	**0.40**
7.2 Channel Aggradation		**11**			Channel Evolution Model	**F**
7.3 Widening Channel		**8**			Channel Evolution Stage	**III**
7.4 Change in Planforml		**5**			Geomorphic Condition	**Fair**
Total Score		**32**			Stream Sensitivity	**High**

Phase 2 Segment Summary Report Wells River

Stream: **South Branch Wells River**
Reach: **M19T4.03-B**
Segment Length(ft): **1,607**
Rain: **No**

SGAT Version: **4.56**
Organization: **Caledonia County Conservation District**
Observers: **Redstart_dr, ES**
Completion Date: **8/20/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **Scott Hwy (Rte 302) bridge DS of Seyon Pond Rd to jct of Seyon Pond and Beck Rds**

Step 5 - Notes: **High degree of straightening and former mill site and old bridge abutments (evident on 1857 Beers Atlas, old foundations noted during field assessment) just US in reach M19T4.04, leading to channel avulsion in this segment in Irene. Historic orthos (April 1998) indicate this same path had been accessed (to a lesser degree) previously (4th highest peak flow at Wells gage July 1997). Current channel cut through a beaver occupied scrub-shrub wetland in the middle of the valley and now carries roughly three-quarters of the flow, with remaining one-quarter flowing weakly through what is now a mostly dry channel along the left valley wall where the channel had been maintained previously. Old channel was not completely dry at time of assessment but will likely be at low flows. Beaver chutes off RB appeared to have been blown out, not sure if there had been a pond that blew.**

Step 7 - Narrative: **Extreme planform adjustments, major widening and aggradation following channel avulsion in Irene. Incision largely offset by aggradation, though one headcut was evident and nickpoints were present in ends of flood chutes. Old channel pinned to left valley wall is mostly dry but still had some water in driest stretch of a very wet summer. Current channel carries roughly three-quarters overall flow. Avulsion cut through a beaver scrub-shrub wetland, some cohesive muck-organic soils evident in new channel.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Planform and Scope**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

	Length (ft)	One	Height	Both	Height
Berm:		**0**		**0**	
Road:		**786**	**9**	**0**	
Railroad:		**0**		**0**	
Imp. Path:		**0**		**0**	
Dev.:		**113**		**0**	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	**Flat**	**Flat**
Continuous w/ Bank:	**Always**	**Always**
Within 1 Bankfull W:	**Always**	**Always**
Texture:	**Mixed**	**Mixed**

1.5 Valley Features
Valley Width (ft): **450**
Width Determination: **Estimated**
Confinement Type: **BD**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls: **None**

Stream: **South Branch Wells River** Reach: **M19T4.03-B**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**33.30**	2.11 Riffle/Step Spacing:	**74 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**3.70**	2.12 Substrate Composition		Bed:	**14.4**	**inches**
2.3 Mean Depth (tf):	**1.94**	Bedrock:	**0.0 %**	Bar:	**6.4**	**inches**
2.4 Floodprone Width (ft.):	**373.30**	Boulder:	**10.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**4.20**	Cobble:	**40.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**12.0 %**	Bed Material:	**Gravel**	
2.6 Width/Depth Ratio:	**17.16**	Fine Gravel:	**7.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**11.21**	Sand:	**31.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.14**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Moderate**	Detritus:	**1.0 %**	Reference Stream Type:	**C**	
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**17**	Reference Bed Material:	**Gravel**	
				Reference Subclass Slope:	**None**	
				Reference Bedform:	**Riffle-Pool**	

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**202.3**	**425.1**	Dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**2.8**	**2.7**	Sub-dominant:	**Herbaceous**	**Herbaceous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**364.5**	**323.2**	Canopy %:	**51-75**	**51-75**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**0-25**	**0-25**
Sub-Dominant	**>100**	**51-100**
W less than 25	**991**	**914**
Buffer Vegitation Type		
Dominant	**Herbaceous**	**Shrubs/Sapling**
Sub-Dominant	**Shrubs/Sapling**	**Herbaceous**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Hay**	**Shrubs/Sapling**	Mass Failures		
Sub-dominant	**Forest**	**Pasture**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length		
Gullies	**None**				

Stream: **South Branch Wells River** Reach: **M19T4.03-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Abundant**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	**None**
4.2 Adjacent Wetlands:	**Abundant**	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	**Moderate**	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**2**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**2**	Delta:	**2**	Flood chutes:	**7**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**5**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**1**	Straightening Length (ft.):	**1,606**
Side:	**2**	Braiding:	**1**	Steep Riffles:	**2**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**10**	**None**	**No**	Geomorphic Rating	**0.40**
7.2 Channel Aggradation		**9**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**8**	**None**	**No**	Channel Evolution Stage	**III**
7.4 Change in Planforml		**5**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**32**			Stream Sensitivity	**Very High**

Phase 2 Segment Summary Report Wells River

Stream: South Branch Wells River
Reach: M19T4.04-0
Segment Length(ft): 2,216
Rain: Yes

SGAT Version: 4.56
Organization: Caledonia County Conservation District
Observers: Redstart_dr, AR
Completion Date: 8/24/2015
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional

Step 0 - Location: **Beck Rd-Seyon Pond Rd jct to newly riprapped corner of Seyon Pond Rd ON stream ~200 ft DS of farm bridge at ~600 Seyon Pond Rd**

Step 5 - Notes: **At least two sets of old abutments in this reach (possibly 3 or 4, but hard to tell due to significant erosion/failure), one near current utility line xing US and second at DS end near Seyon Pond and Beck Rds jct. The high degree of straightening including these abutments and significant road encroachment appears to have amplified the effects of the valley confinement and slope of this reach and contributed to a channel avulsion in the next reach DS, which appears to have also occurred (to a lesser degree) in 1997. Neighbor said that bridge at the DS abutments went out recently, but previous to Irene; Bing 2010 aerial maps (ANR Atlas) seem to show the bridge still in place. Beers Atlas (1857) also indicates a sawmill close to the DS abutments near Beck Rd., and there are old foundations and likely mill races evident in this area. Low depositional features may be due in part to sediment discontinuities due to historic dredging US where majority of large cobbles and boulders have been used as bank toe armoring.**

Step 7 - Narrative: **Major widening and planform adjustments following historic incision, now down to bedrock. Substantial stretches of riprap have failed, stream locally overwidened DS of old stream xings. Borders on complete loss of access to historic floodplains, greatly amplifying erosive powers and contributing to channel avulsion in next reach DS.**

Step 1. Valley and Floodplain

1.1 Segmentation: None
1.2 Alluvial Fan: None
1.3 Corridor Encroachments:

	Length (ft)	One	Height	Both	Height
Berm:	0			0	
Road:	1,623	7		291	6
Railroad:	0			0	
Imp. Path:	0			0	
Dev.:	1,113			0	

1.4 Adjacent Side	Left	Right
Hillside Slope:	Very Steep	Extr.Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Always
Texture:	Mixed	Mixed

1.5 Valley Features
Valley Width (ft): 160
Width Determination: Measured
Confinement Type: SC
In Rock Gorge: No
Human Caused Change in Valley Width?: Yes

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	10.3	8.1	Yes	
Ledge	Mid-segment	6.2	3.9	Yes	

Stream: **South Branch Wells River** Reach: **M19T4.04-0**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**57.90**	2.11 Riffle/Step Spacing:	**54 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**3.50**	2.12 Substrate Composition		Bed:	**11.6**	**inches**
2.3 Mean Depth (tf):	**2.32**	Bedrock:	**4.0 %**	Bar:	**6.6**	**inches**
2.4 Floodprone Width (ft.):	**105.90**	Boulder:	**25.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**6.90**	Cobble:	**37.0 %**	Stream Type:	**B**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**12.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**24.96**	Fine Gravel:	**8.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**1.83**	Sand:	**14.0 %**	Bed Form:	**Step-Pool**	
2.8 Incision Ratio:	**1.97**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**3.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**22**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**278.0**	**438.2**	Dominant:	**Coniferous**	**Deciduous**
Material Type:	**Mix**	**Mix**	Erosion Height (ft.):	**2.9**	**4.0**	Sub-dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**Multiple**	Bank Canopy		
Lower			Revetment Length:	**350.6**	**1,216.7**	Canopy %:	**76-100**	**51-75**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**26-50**
Sub-Dominant	**26-50**	**0-25**
W less than 25	**0**	**921**
Buffer Vegitation Type		
Dominant	**Mixed Trees**	**Herbaceous**
Sub-Dominant	**Shrubs/Sapling**	**Mixed Trees**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Residential**	Mass Failures		
Sub-dominant	**Shrubs/Sapling**	**Bare**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length		
Gullies	**None**				

Stream: **South Branch Wells River** Reach: **M19T4.04-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch: **0**	Road Ditch: **1**
4.3 Flow Status:	**Moderate**	Impoundments:		Other: **0**	Tile Drain: **0**
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow: **0**	Urb Strm Wtr Pipe: **0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Old Abutment	**25**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Scour Below**
Old Abutment	**50**	**No**	**No**	**Yes**	**No**	**Deposition Above,Deposition Below**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**1**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**	
Mid:	**1**	Delta:	**0**	Flood chutes:	**4**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**1**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**2,202**
Side:	**5**	Braiding:	**0**	Steep Riffles:	**3**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Confined**	Score	STD	Historic		
7.1 Channel Degradation		**7**	**None**	**Yes**	Geomorphic Rating	**0.38**
7.2 Channel Aggradation		**9**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**7**	**None**	**No**	Channel Evolution Stage	**III**
7.4 Change in Planforml		**7**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**30**			Stream Sensitivity	**High**

Phase 2 Segment Summary Report Wells River

Stream: South Branch Wells River
Reach: M19T4.05-0
Segment Length(ft): 3,913
Rain: Yes

SGAT Version: 4.56
Organization: Caledonia County Conservation District
Observers: Redstart_dr, AR
Completion Date: 9/1/2015
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional

Step 0 - Location: **Seyon Pond Rd ON stream corner just DS farm bridge at ~600 Seyon Pond Rd to confluence with Heath Brook at Buzzy's Rd**

Step 5 - Notes: **Historically snagged and dredged; majority of lg cobbles and boulders placed as bank toe armoring, much now failing**

Step 7 - Narrative: **Major planform adjustments, widening and aggradation following historic incision related to extensive straightening.Further incision limited by grade controls, planform adjustments and widening limited by extensive revetments - much of which have failed over time. Progressive fining due to windrowing or use of boulders, cobbles for riprap; stream likely cobble substrate under reference conditions.**

Step 1. Valley and Floodplain

1.1 Segmentation: None
1.2 Alluvial Fan: None
1.3 Corridor Encroachments:

	Length (ft)	One Height	Both	Height
Berm:	0		0	
Road:	3,912	7	0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	2,075		0	

1.4 Adjacent Side	Left	Right
Hillside Slope:	Very Steep	Very Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	Mixed	Mixed

1.5 Valley Features
Valley Width (ft): 350
Width Determination: Measured
Confinement Type: BD
In Rock Gorge: No
Human Caused Change in Valley Width?: Yes

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	3.0	1.2	Yes	
Ledge	Mid-segment	5.4	3.7	Yes	

Stream: **South Branch Wells River** Reach: **M19T4.05-0**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**40.00**	2.11 Riffle/Step Spacing:	**79 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**4.40**	2.12 Substrate Composition		Bed:	**7.4**	**inches**
2.3 Mean Depth (tf):	**2.98**	Bedrock:	**1.0 %**	Bar:	**3.4**	**inches**
2.4 Floodprone Width (ft.):	**150.00**	Boulder:	**12.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**6.40**	Cobble:	**37.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**25.0 %**	Bed Material:	**Gravel**	
2.6 Width/Depth Ratio:	**13.42**	Fine Gravel:	**11.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**3.75**	Sand:	**14.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.45**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Moderate**	Detritus:	**2.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**10**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**539.4**	**677.6**	Dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Material Type:	**Mix**	**Mix**	Erosion Height (ft.):	**3.2**	**3.0**	Sub-dominant:	**Pasture**	**Herbaceous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**1,242.8**	**2,158.4**	Canopy %:	**26-50**	**26-50**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**0-25**	**0-25**
Sub-Dominant	**>100**	**51-100**
W less than 25	**2,375**	**2,629**
Buffer Vegitation Type		
Dominant	**Herbaceous**	**Herbaceous**
Sub-Dominant	**Mixed Trees**	**Mixed Trees**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Pasture**	**Residential**	Mass Failures		
Sub-dominant	**Forest**	**Forest**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length		
Gullies	**None**				

Stream: **South Branch Wells River** Reach: **M19T4.05-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**Small Withdrawal**	4.7 Stormwater Inputs			
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:	**Irrigation**	Field Ditch:	**0**	Road Ditch:	**5**
4.3 Flow Status:	**Moderate**	Impoundments:		Other:	**0**	Tile Drain:	**0**
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	**0**	Urb Strm Wtr Pipe:	**0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:		**0**	
		(old) Upstrm Flow Reg.:		Affected Length (ft):		**0**	

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Old Abutment	**27**	**Yes**	**Yes**	**Yes**	**No**	**Deposition Above,Deposition Below**
Bridge	**30**	**Yes**	**Yes**	**Yes**	**No**	**Deposition Above,Deposition Below**
Old Abutment	**18**	**Yes**	**Yes**	**Yes**	**No**	**Scour Above**
Bridge	**20**	**Yes**	**Yes**	**Yes**	**Yes**	**Scour Above,Scour Below**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**6**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**	
Mid:	**5**	Delta:	**1**	Flood chutes:	**4**	Avulsion:	**0**	5.5 Straightening:	**With Windrowing**
Point:	**9**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**3,600**
Side:	**11**	Braiding:	**0**	Steep Riffles:	**2**	Trib Rejuv.:	**Yes**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**10**	**None**	**Yes**	Geomorphic Rating	**0.45**
7.2 Channel Aggradation		**10**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**9**	**None**	**No**	Channel Evolution Stage	**III**
7.4 Change in Planforml		**7**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**36**			Stream Sensitivity	**Very High**

Phase 2 Segment Summary Report Wells River

Stream: South Branch Wells River
Reach: M19T4.06-A
Segment Length(ft): 816
Rain: Yes

SGAT Version: 4.56
Organization: Caledonia County Conservation District
Observers: Redstart_dr, EBM
Completion Date: 10/13/2015
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional

Step 0 - Location: **pvt driveway bridge across from Buzzy's Rd (mouth of Heath Brook) and US ~750 ft to woods-field edge**

Step 5 - Notes: **Large flood chute off RB appears to be part of DS end of alluvial fan. No bars observed, only steps. Conceivable reference bedform may be riffle-pool rather than step-pool, but current planform gives relatively steep slope (~2.7% by GIS) and substrate is very coarse, lending to step-pool features. Single ownership for majority of next mile US, denied property access for x-secs on segs M19T4.06A-C (Step 6 RHA and Step 7 RGA scoring based on qualitative observations for channel dimensions); seg D on state forest, x-sec measured.**

Step 7 - Narrative: **Major reducing to minor aggradation, widening and planform change following historic incision; likely that aggradation in Irene and 2014 flooding (particularly from flood chutes off RB) offset some historic incision.**

Step 1. Valley and Floodplain

1.1 Segmentation: Subreach
1.2 Alluvial Fan: None
1.3 Corridor Encroachments:

	Length (ft)	One	Height	Both	Height
Berm:		0		0	
Road:		498	7	37	7
Railroad:		0		0	
Imp. Path:		0		0	
Dev.:		98		0	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Hilly	Hilly
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	Mixed	Mixed

1.5 Valley Features
Valley Width (ft): 450
Width Determination: Estimated
Confinement Type: BD
In Rock Gorge: No
Human Caused Change in Valley Width?: Yes

1.6 Grade Controls: None

Stream: **South Branch Wells River** Reach: **M19T4.06-A**

Step 2. Stream Channel

2.1Bankfull Width (ft.):		2.11 Riffle/Step Spacing:	**4 ft.**	2.13 Average Largest Particle on			
2.2 Max Depth (ft.):		2.12 Substrate Composition			Bed:	**12**	**inches**
2.3 Mean Depth (tf):		Bedrock:	**%**		Bar:	**7**	**inches**
2.4 Floodprone Width (ft.):		Boulder:	**%**	2.14 Stream Type			
2.5 Aband. Floodpn (ft.):		Cobble:	**%**	Stream Type:	**C**		
Human Elev FloodPln (ft.):		Coarse Gravel:	**%**	Bed Material:	**Cobble**		
2.6 Width/Depth Ratio:	**0.00**	Fine Gravel:	**%**	Subclass Slope:	**b**		
2.7 Entrenchment Ratio:	**0.00**	Sand:	**%**	Bed Form:	**Step-Pool**		
2.8 Incision Ratio:	**0.00**	Silt and Smaller:	**%**	Field Measured Slope:			
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type			
2.9 Sinuosity:	**Low**	Detritus:	**2.0 %**	Reference Stream Type:	**C**		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**16**	Reference Bed Material:	**Cobble**		
				Reference Subclass Slope:	**b**		
				Reference Bedform:	**Step-Pool**		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Moderate**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**41.6**	**0.0**	Dominant:	**Coniferous**	**Coniferous**
Material Type:	**Mix**	**Mix**	Erosion Height (ft.):	**3.5**	**0.0**	Sub-dominant:	**Deciduous**	**Deciduous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**68.9**	**151.1**	Canopy %:	**76-100**	**76-100**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Closed**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**51-100**	**>100**
Sub-Dominant	**>100**	**51-100**
W less than 25	**0**	**0**
Buffer Vegitation Type		
Dominant	**Mixed Trees**	**Mixed Trees**
Sub-Dominant	**Shrubs/Sapling**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Forest**	Mass Failures		
Sub-dominant	**Residential**	**Hay**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **South Branch Wells River** Reach: **M19T4.06-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Abundant**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs			
4.2 Adjacent Wetlands:	**Minimal**	Flow Reg. Use:		Field Ditch:	**0**	Road Ditch:	**1**
4.3 Flow Status:	**Moderate**	Impoundments:		Other:	**0**	Tile Drain:	**0**
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	**0**	Urb Strm Wtr Pipe:	**0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:		**0**	
		(old) Upstrm Flow Reg.:		Affected Length (ft):		**0**	

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	**25**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Alignment**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**0**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**0**	Delta:	**0**	Flood chutes:	**4**	Avulsion:	**0**	5.5 Straightening:		**Straightening**
Point:	**0**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):		**816**
Side:	**0**	Braiding:	**0**	Steep Riffles:	**1**	Trib Rejuv.:	**No**	5.5 Dredging:		**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Confined**	Score	STD	Historic		
7.1 Channel Degradation		**11**	**None**	**Yes**	Geomorphic Rating	**0.60**
7.2 Channel Aggradation		**12**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**12**	**None**	**No**	Channel Evolution Stage	**IV**
7.4 Change in Planforml		**13**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**48**			Stream Sensitivity	**High**

Phase 2 Segment Summary Report Wells River

Stream: **South Branch Wells River**
Reach: **M19T4.06-B**
Segment Length(ft): **1,640**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Caledonia County Conservation District**
Observers: **Redstart_dr, EBM**
Completion Date: **10/13/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **~750 ft US of Buzzy's Rd to field ditch at US end of hayfields along jct of Seyon Pond Rd.-So. Branch Rd**

Step 5 - Notes: **Single ownership for majority of reach M19T4.06, denied property access for x-secs on segs M19T4.06A-C (Step 6 RHA and Step 7 RGA scoring based on qualitative observations for channel dimensions); seg D on state forest, x-sec measured.**

Step 7 - Narrative: **Localized channel incision and loss of planform related to significant dredging, though fine materials quickly 'wash out' incision to some degree; stream appears to currently still retain floodplain access. Progressive fining noted from US to DS, with average bar particle size dropping from 4-5 in. to 1-2 in.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Planform and Scope**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	0		0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	0		0	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	**Hilly**	**Flat**
Continuous w/ Bank:	**Sometimes**	**Always**
Within 1 Bankfull W:	**Always**	**Always**
Texture:	**Sand**	**Sand**

1.5 Valley Features
Valley Width (ft): **700**
Width Determination: **Estimated**
Confinement Type: **VB**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls: **None**

Stream: **South Branch Wells River** Reach: **M19T4.06-B**

Step 2. Stream Channel

2.1Bankfull Width (ft.):		2.11 Riffle/Step Spacing:	**220 ft.**	2.13 Average Largest Particle on			
2.2 Max Depth (ft.):		2.12 Substrate Composition			Bed:	**5**	**inches**
2.3 Mean Depth (tf):		Bedrock:	**%**		Bar:	**3**	**inches**
2.4 Floodprone Width (ft.):		Boulder:	**%**	2.14 Stream Type			
2.5 Aband. Floodpn (ft.):		Cobble:	**%**	Stream Type:	**E**		
Human Elev FloodPln (ft.):		Coarse Gravel:	**%**	Bed Material:	**Gravel**		
2.6 Width/Depth Ratio:	**0.00**	Fine Gravel:	**%**	Subclass Slope:	**None**		
2.7 Entrenchment Ratio:	**0.00**	Sand:	**%**	Bed Form:	**Riffle-Pool**		
2.8 Incision Ratio:	**0.00**	Silt and Smaller:	**%**	Field Measured Slope:			
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type			
2.9 Sinuosity:	**Moderate**	Detritus:	**3.0 %**	Reference Stream Type:	**E**		
2.10 Riffles Type:	**Eroded**	# Large Woody Debris:	**27**	Reference Bed Material:	**Gravel**		
				Reference Subclass Slope:	**None**		
				Reference Bedform:	**Riffle-Pool**		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Undercut**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**23.5**	**469.5**	Dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**2.5**	**2.9**	Sub-dominant:	**Herbaceous**	**Herbaceous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**None**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**0.0**	Canopy %:	**76-100**	**1-25**
Material Type:	**Mix**	**Mix**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**0-25**
Sub-Dominant	**26-50**	**26-50**
W less than 25	**0**	**1,618**
Buffer Vegitation Type		
Dominant	**Shrubs/Sapling**	**Herbaceous**
Sub-Dominant	**Herbaceous**	**Mixed Trees**

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	**Shrubs/Sapling**	**Hay**
Sub-dominant	**Forest**	**Shrubs/Sapling**
(Legacy)	Amount	Mean Hieght
Failures	**None**	
Gullies	**None**	

	Left	Right
Mass Failures		
Height		
Gullies Number	**0**	
Gullies Length	**0**	

Stream: **South Branch Wells River** Reach: **M19T4.06-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Abundant**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	**Abundant**	Flow Reg. Use:		Field Ditch: **2**	Road Ditch: **0**
4.3 Flow Status:	**Moderate**	Impoundments:		Other: **0**	Tile Drain: **0**
4.4 # of Debris Jams:	**1**	Impoundment Loc.:		Overland Flow: **0**	Urb Strm Wtr Pipe: **0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**3**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**3**	Delta:	**0**	Flood chutes:	**8**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**9**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**1,640**
Side:	**6**	Braiding:	**0**	Steep Riffles:	**0**	Trib Rejuv.:	**Yes**	5.5 Dredging:	**Dredging**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**9**	**None**	**No**	Geomorphic Rating	**0.52**
7.2 Channel Aggradation		**12**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**11**	**None**	**No**	Channel Evolution Stage	**II**
7.4 Change in Planforml		**10**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**42**			Stream Sensitivity	**Extreme**

Phase 2 Segment Summary Report Wells River

Stream: **South Branch Wells River**
Reach: **M19T4.06-C**
Segment Length(ft): **2,781**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Caledonia County Conservation District**
Observers: **Redstart_dr, EBM**
Completion Date: **10/7/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **US of hayfields along jct of Seyon Pond Rd.-So. Branch Rd, past SS wetland and 2nd set of hayfields along So. Branch Rd and US to So. Branch Rd bridge**

Step 5 - Notes: **Major flood chute exited current channel at US end of this seg in Irene and deposited a lot of sediment including large cobbles and boulders in woods, heavier to fines in hayfields off RB - visible in May 2012 orthos.Single ownership for majority of reach M19T4.06, denied property access for x-secs on segs M19T4.06A-C (Step 6 RHA and Step 7 RGA scoring based on qualitative observations for channel dimensions); seg D on state forest, x-sec measured.**

Step 7 - Narrative: **Major aggradation and planform adjustments following Irene, likely offset historic incision but current headcut and nickpoints are working back upstream through aggradation - particularly in areas of localized dredging and snagging. Major floodchutes visible off RB in May 2012 orthos, lg material spread through woods US; progressive fining moving DS into alluvial material.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Planform and Scope**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	31	3	0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	0		0	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	**Hilly**	**Flat**
Continuous w/ Bank:	**Sometimes**	**Always**
Within 1 Bankfull W:	**Always**	**Always**
Texture:	**Sand**	**Mixed**

1.5 Valley Features
Valley Width (ft): **750**
Width Determination: **Estimated**
Confinement Type: **VB**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls: **None**

Stream: **South Branch Wells River** Reach: **M19T4.06-C**

Step 2. Stream Channel

2.1Bankfull Width (ft.):		2.11 Riffle/Step Spacing:	**70 ft.**	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):		2.12 Substrate Composition		Bed:	**10 inches**
2.3 Mean Depth (tf):		Bedrock:	**%**	Bar:	**5 inches**
2.4 Floodprone Width (ft.):		Boulder:	**%**	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):		Cobble:	**%**	Stream Type:	**C**
Human Elev FloodPln (ft.):		Coarse Gravel:	**%**	Bed Material:	**Cobble**
2.6 Width/Depth Ratio:	**0.00**	Fine Gravel:	**%**	Subclass Slope:	**None**
2.7 Entrenchment Ratio:	**0.00**	Sand:	**%**	Bed Form:	**Riffle-Pool**
2.8 Incision Ratio:	**0.00**	Silt and Smaller:	**%**	Field Measured Slope:	
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	**Moderate**	Detritus:	**5.0 %**	Reference Stream Type:	
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**46**	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Shallow**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**97.4**	**119.7**	Dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Material Type:	**Mix**	**Mix**	Erosion Height (ft.):	**2.2**	**2.4**	Sub-dominant:	**Deciduous**	**Deciduous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**None**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**0.0**	Canopy %:	**76-100**	**76-100**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Closed**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**26-50**
Sub-Dominant	**26-50**	**>100**
W less than 25	**629**	**1,867**
Buffer Vegitation Type		
Dominant	**Herbaceous**	**Herbaceous**
Sub-Dominant	**Shrubs/Sapling**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Shrubs/Sapling**	**Hay**	Mass Failures		
Sub-dominant	**Hay**	**Shrubs/Sapling**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **South Branch Wells River** Reach: **M19T4.06-C**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Abundant**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs			
4.2 Adjacent Wetlands:	**Abundant**	Flow Reg. Use:		Field Ditch:	**2**	Road Ditch:	**0**
4.3 Flow Status:	**Moderate**	Impoundments:		Other:	**0**	Tile Drain:	**0**
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	**0**	Urb Strm Wtr Pipe:	**0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:		**0**	
		(old) Upstrm Flow Reg.:		Affected Length (ft):		**0**	

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**8**	5.2 Other Features	Neck Cutoff:	**1**	5.4 Stream Ford or Animal Crossing:	**Yes**		
Mid:	**5**	Delta:	**0**	Flood chutes:	**23**	Avulsion:	**0**	5.5 Straightening:	**With Windrowing**
Point:	**26**	Island:	**2**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**2**	Straightening Length (ft.):	**2,774**
Side:	**5**	Braiding:	**2**	Steep Riffles:	**2**	Trib Rejuv.:	**No**	5.5 Dredging:	**Dredging**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**11**	**None**	**No**	Geomorphic Rating	**0.51**
7.2 Channel Aggradation		**11**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**10**	**None**	**No**	Channel Evolution Stage	**III**
7.4 Change in Planforml		**9**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**41**			Stream Sensitivity	**High**

Phase 2 Segment Summary Report Wells River

Stream: South Branch Wells River
Reach: M19T4.06-D
Segment Length(ft): 968
Rain: Yes

SGAT Version: 4.56
Organization: Caledonia County Conservation District
Observers: Redstart_dr, EBM
Completion Date: 10/7/2015
Qualtiy Control Status - Consultant: Provisional
Qualtiy Control Status - Staff: Provisional

Step 0 - Location: **~300 ft DS S. Branch Rd bridge to rchbrk M19T4.07 (~600 ft US of same bridge)**

Step 5 - Notes: **Irregular topography with multiple flood chutes and likely old channels both sides, clear signs of recent access to these. Headcut working back up through aggraded sediments at debris jam.**

Step 7 - Narrative: **Major planform adjustments, with major reducing to minor aggradation and widening; largely flood driven but accentuated by effects of road encroachment and undersized bridge (split channel). Aggradation is likely offsetting historic incision as well as more recent bed degradation in Irene, still evident in nickpoints at ends of flood chutes.**

Step 1. Valley and Floodplain

1.1 Segmentation: Planform and Scope
1.2 Alluvial Fan: None
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	686	3	0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	0		0	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	Hilly	Hilly
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	Mixed	Mixed

1.5 Valley Features

Valley Width (ft):	420
Width Determination:	Estimated
Confinement Type:	VB
In Rock Gorge:	No
Human Caused Change in Valley Width?:	No

1.6 Grade Controls: None

Stream: **South Branch Wells River** Reach: **M19T4.06-D**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**33.50**	2.11 Riffle/Step Spacing:	**50 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**2.80**	2.12 Substrate Composition		Bed:	**12.8**	**inches**
2.3 Mean Depth (tf):	**1.70**	Bedrock:	**0.0 %**	Bar:	**7.9**	**inches**
2.4 Floodprone Width (ft.):	**118.50**	Boulder:	**14.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**3.75**	Cobble:	**42.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**13.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**19.71**	Fine Gravel:	**20.0 %**	Subclass Slope:	**b**	
2.7 Entrenchment Ratio:	**3.54**	Sand:	**11.0 %**	Bed Form:	**Step-Pool**	
2.8 Incision Ratio:	**1.34**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Moderate**	Detritus:	**3.0 %**	Reference Stream Type:	**C**	
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**30**	Reference Bed Material:	**Cobble**	
				Reference Subclass Slope:	**b**	
				Reference Bedform:	**Step-Pool**	

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Steep**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**127.6**	**103.4**	Dominant:	**Coniferous**	**Coniferous**
Material Type:	**Mix**	**Mix**	Erosion Height (ft.):	**2.4**	**2.5**	Sub-dominant:	**Shrubs/Sapling**	**Deciduous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**103.2**	Canopy %:	**76-100**	**76-100**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Closed**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**0-25**	**0-25**
W less than 25	**0**	**0**
Buffer Vegitation Type		
Dominant	**Coniferous**	**Mixed Trees**
Sub-Dominant	**Shrubs/Sapling**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Forest**	Mass Failures		
Sub-dominant	**Bare**	**Bare**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **South Branch Wells River** Reach: **M19T4.06-D**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs			
4.2 Adjacent Wetlands:	**None**	Flow Reg. Use:		Field Ditch:	**0**	Road Ditch:	**1**
4.3 Flow Status:	**Moderate**	Impoundments:		Other:	**0**	Tile Drain:	**0**
4.4 # of Debris Jams:	**1**	Impoundment Loc.:		Overland Flow:	**1**	Urb Strm Wtr Pipe:	**0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:		**0**	
		(old) Upstrm Flow Reg.:		Affected Length (ft):		**0**	

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	**25**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Deposition Below,Alignment**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**2**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**Yes**	
Mid:	**1**	Delta:	**0**	Flood chutes:	**2**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**4**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**687**
Side:	**8**	Braiding:	**0**	Steep Riffles:	**0**	Trib Rejuv.:	**Yes**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Confined**	Score	STD	Historic		
7.1 Channel Degradation		**12**	**None**	**No**	Geomorphic Rating	**0.54**
7.2 Channel Aggradation		**11**	**None**	**No**	Channel Evolution Model	**F**
7.3 Widening Channel		**11**	**None**	**No**	Channel Evolution Stage	**III**
7.4 Change in Planforml		**9**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**43**			Stream Sensitivity	**High**

Phase 2 Segment Summary Report Wells River

Stream: **Wells River**
Reach: **M20-0**
Segment Length(ft): **2,117**
Rain: **Yes**

SGAT Version: **4.56**
Organization:
Observers: **Redstart_dr, ES**
Completion Date: **7/9/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location:

Step 5 - Notes: **Reach M20 had a strange feel to it overall, wondered more than once if it had been dam influenced (backwater). Significant scrub-shrub wetlands off LB are beaver influenced. Franconia Paper Mill Dam removal (2014) was further DS in reach M19 (by Groton Town Garage), but Beers Atlas 1875 also indicates a sawmill just DS of the South Branch confluence (DS end of reach M20) that may have influenced this reach historically.**

Step 7 - Narrative: **Minor to major aggradation and widening following moderate historic incision due to mill dam upstream and beaver influence. Stream still has fairly good floodplain access, slightly reduced by road encroachment.**

Step 1. Valley and Floodplain

1.1 Segmentation: **None**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	537	8	0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	1,103		720	

1.4 Adjacent Side

	Left	Right
Hillside Slope:	**Flat**	**Flat**
Continuous w/ Bank:	**Always**	**Always**
Within 1 Bankfull W:	**Sometimes**	**Always**
Texture:	**Mixed**	**Mixed**

1.5 Valley Features

Valley Width (ft):	**600**
Width Determination:	**Measured**
Confinement Type:	**VB**
In Rock Gorge:	**No**

Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls: **None**

Stream: **Wells River** Reach: **M20-0**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**60.20**	2.11 Riffle/Step Spacing:	**106 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**4.40**	2.12 Substrate Composition		Bed:	**8.3**	**inches**
2.3 Mean Depth (tf):	**1.85**	Bedrock:	**0.0 %**	Bar:	**4.8**	**inches**
2.4 Floodprone Width (ft.):	**620.20**	Boulder:	**10.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**5.75**	Cobble:	**54.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**15.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**32.54**	Fine Gravel:	**4.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**10.30**	Sand:	**17.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.31**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**0.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**15**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Shallow**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**0.0**	**0.0**	Dominant:	**Shrubs/Sapling**	**Shrubs/Sapling**
Material Type:	**Sand**	**Sand**	Erosion Height (ft.):	**0.0**	**0.0**	Sub-dominant:	**Herbaceous**	**Herbaceous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**None**	**None**	Bank Canopy		
Lower			Revetment Length:	**0.0**	**0.0**	Canopy %:	**76-100**	**76-100**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**51-100**
Sub-Dominant	**0-25**	**0-25**
W less than 25	**110**	**478**
Buffer Vegitation Type		
Dominant	**Shrubs/Sapling**	**Shrubs/Sapling**
Sub-Dominant	**Coniferous**	**Herbaceous**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Shrubs/Sapling**	**Shrubs/Sapling**	Mass Failures		
Sub-dominant	**Forest**	**Residential**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **Wells River** Reach: **M20-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Minimal**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs			
4.2 Adjacent Wetlands:	**Abundant**	Flow Reg. Use:		Field Ditch:	**0**	Road Ditch:	**0**
4.3 Flow Status:	**Moderate**	Impoundments:		Other:	**1**	Tile Drain:	**0**
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	**0**	Urb Strm Wtr Pipe:	**0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:		**0**	
		(old) Upstrm Flow Reg.:	**Unknown**	Affected Length (ft):		**0**	

4.8 Channel Constrictions: **None**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**1**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**2**	Delta:	**0**	Flood chutes:	**2**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**2**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**2,112**
Side:	**1**	Braiding:	**1**	Steep Riffles:	**1**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**11**		**Yes**	Geomorphic Rating	**0.61**
7.2 Channel Aggradation		**12**			Channel Evolution Model	**F**
7.3 Widening Channel		**11**			Channel Evolution Stage	**III**
7.4 Change in Planforml		**15**			Geomorphic Condition	**Good**
Total Score		**49**			Stream Sensitivity	**Moderate**

Phase 2 Segment Summary Report Wells River

Stream: **Wells River**
Reach: **M21-0**
Segment Length(ft): **1,374**
Rain: **Yes**

SGAT Version: **4.56**
Organization:
Observers: **Redstart_dr, ES**
Completion Date: **8/5/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **By falls just off NE side of Rt 232 (state forest rd), about 0.2 miles from junction with Rt 302.**

Step 5 - Notes: **Straightening along Rt 232 particularly evidenced by stretches of rip rap. Large floodchute off LB turned into a road, buildings off LB appear to be at high risk.**

Step 7 - Narrative: **Extreme widening, migration and planform change following recent flooding events (Irene 2011, 4/16/2014). Bedrock grade controls limit downcutting but grassed bars were carved into braided sections, flood chutes along margins contain headcuts and large floodchute off LB has now been turned into a road. Buildings off LB appear to be at high risk.**

Step 1. Valley and Floodplain

1.1 Segmentation: **None**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

	Length (ft)	One Height	Both Height
Berm:	0		0
Road:	1,374	6	0
Railroad:	0		0
Imp. Path:	524	3	0
Dev.:	440		0

1.4 Adjacent Side	Left	Right
Hillside Slope:	Hilly	Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	Cobble	Cobble

1.5 Valley Features
Valley Width (ft): **300**
Width Determination: **Measured**
Confinement Type: **NW**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	4.8	2.8	Yes	
Ledge	Mid-segment	2.3	0.3	Yes	
Ledge	Mid-segment	3.2	1.1	Yes	
Waterfall	Mid-segment	9.0	6.0	Yes	
Ledge	Mid-segment	7.5	3.5	Yes	

Stream: **Wells River** Reach: **M21-0**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**85.40**	2.11 Riffle/Step Spacing:	**83 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**2.70**	2.12 Substrate Composition		Bed:	**7.2**	**inches**
2.3 Mean Depth (tf):	**1.70**	Bedrock:	**6.0 %**	Bar:	**3.3**	**inches**
2.4 Floodprone Width (ft.):	**217.40**	Boulder:	**35.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**2.70**	Cobble:	**27.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**12.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**50.24**	Fine Gravel:	**12.0 %**	Subclass Slope:	**None**	
2.7 Entrenchment Ratio:	**2.55**	Sand:	**8.0 %**	Bed Form:	**Riffle-Pool**	
2.8 Incision Ratio:	**1.00**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Low**	Detritus:	**8.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**20**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Shallow**

Bank Texture	Left	Right	Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper			Erosion Length (ft.):	**0.0**	**0.0**	Dominant:	**Coniferous**	**Shrubs/Sapling**
Material Type:	**Mix**	**Mix**	Erosion Height (ft.):	**0.0**	**0.0**	Sub-dominant:	**Shrubs/Sapling**	**Herbaceous**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**Rip-Rap**	Bank Canopy		
Lower			Revetment Length:	**206.5**	**334.7**	Canopy %:	**76-100**	**51-75**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Open**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**51-100**
Sub-Dominant	**51-100**	**0-25**
W less than 25	**0**	**464**
Buffer Vegitation Type		
Dominant	**Coniferous**	**Herbaceous**
Sub-Dominant	**Shrubs/Sapling**	**Shrubs/Sapling**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Bare**	Mass Failures		
Sub-dominant	**Residential**	**Forest**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **Wells River** Reach: **M21-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Abundant**	4.5 Flow Regulation Type	**None**	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	**Abundant**	Flow Reg. Use:		Field Ditch: **0**	Road Ditch: **3**
4.3 Flow Status:	**Moderate**	Impoundments:		Other: **0**	Tile Drain: **0**
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow: **0**	Urb Strm Wtr Pipe: **0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:	**0**
		(old) Upstrm Flow Reg.:		Affected Length (ft):	**0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	**32**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Below,Scour Above,Alignment**
Bedrock Outcrops	**20**	**Yes**	**Yes**	**Yes**	**Yes**	**Deposition Above,Scour Below**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**2**	5.2 Other Features		Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**No**
Mid:	**3**	Delta:	**0**	Flood chutes:	**3**	Avulsion:	**0**	5.5 Straightening:		**Straightening**
Point:	**2**	Island:	**0**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):		**1,368**
Side:	**1**	Braiding:	**2**	Steep Riffles:	**0**	Trib Rejuv.:	**No**	5.5 Dredging:		**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Unconfined**	Score	STD	Historic		
7.1 Channel Degradation		**10**	**None**	**No**	Geomorphic Rating	**0.40**
7.2 Channel Aggradation		**8**	**None**	**No**	Channel Evolution Model	**D**
7.3 Widening Channel		**8**	**None**	**No**	Channel Evolution Stage	**IId**
7.4 Change in Planforml		**6**	**None**	**No**	Geomorphic Condition	**Fair**
Total Score		**32**			Stream Sensitivity	**High**

Phase 2 Segment Summary Report Wells River

Stream: **Wells River**
Reach: **M22-0**
Segment Length(ft): **7,713**
Rain: **Yes**

SGAT Version: **4.56**
Organization:
Observers: **Redstart_dr, ES**
Completion Date: **8/18/2015**
Qualtiy Control Status - Consultant: **Provisional**
Qualtiy Control Status - Staff: **Provisional**

Step 0 - Location: **US of garage for house at 304 Rt. 232 to Ricker Pond dam.**

Step 5 - Notes: **Flood impacts evident in multiple braided areas, though LWD and current debris jams surprisingly few. Old channels evident on both sides of valley . Is reach affected by seasonal dam releases at Ricker Pond, or just recent flooding?**

Step 7 - Narrative: **Major aggradation, widening and planform adjustments following historic incision limited by 14 grade controls. High degree of braiding and numerous islands evident throughout reach, with large flood chutes and old channels evident on both sides of valley. Complex microtopography due to glacial legacy has left alternating pockets of flood plain access and locally confining lateral moraines and recent flood events have accessed many flood chutes and side channels.**

Step 1. Valley and Floodplain

1.1 Segmentation: **None**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments:

Length (ft)	One	Height	Both	Height
Berm:	0		0	
Road:	3,314	7	0	
Railroad:	0		0	
Imp. Path:	495	4	0	
Dev.:	1,206		0	

1.4 Adjacent Side	Left	Right
Hillside Slope:	**Very Steep**	**Hilly**
Continuous w/ Bank:	**Sometimes**	**Sometimes**
Within 1 Bankfull W:	**Sometimes**	**Sometimes**
Texture:	**Mixed**	**Mixed**

1.5 Valley Features	
Valley Width (ft):	**300**
Width Determination:	**Measured**
Confinement Type:	**NW**
In Rock Gorge:	**No**

Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	3.8	1.5	Yes	
Ledge	Mid-segment	5.2	3.4	Yes	
Ledge	Mid-segment	5.3	3.3	Yes	
Ledge	Mid-segment	10.8	8.5	Yes	
Ledge	Mid-segment	7.1	4.4	Yes	
Ledge	Mid-segment	11.2	8.9	Yes	
Ledge	Mid-segment	7.9	5.4	Yes	
Ledge	Mid-segment	12.7	10.6	Yes	
Ledge	Mid-segment	6.1	4.3	Yes	
Ledge	Mid-segment	4.4	2.3	Yes	
Ledge	Mid-segment	6.2	3.4	Yes	
Ledge	Mid-segment	5.2	3.2	Yes	
Ledge	Mid-segment	7.0	4.5	Yes	
Ledge	Mid-segment	6.5	5.0	Yes	

Stream: **Wells River** Reach: **M22-0**

Step 2. Stream Channel

2.1Bankfull Width (ft.):	**61.20**	2.11 Riffle/Step Spacing:	**93 ft.**	2.13 Average Largest Particle on		
2.2 Max Depth (ft.):	**3.10**	2.12 Substrate Composition		Bed:	**6.9**	**inches**
2.3 Mean Depth (tf):	**1.85**	Bedrock:	**5.0 %**	Bar:	**2.65**	**inches**
2.4 Floodprone Width (ft.):	**311.20**	Boulder:	**35.0 %**	2.14 Stream Type		
2.5 Aband. Floodpn (ft.):	**4.10**	Cobble:	**35.0 %**	Stream Type:	**C**	
Human Elev FloodPln (ft.):		Coarse Gravel:	**3.0 %**	Bed Material:	**Cobble**	
2.6 Width/Depth Ratio:	**33.08**	Fine Gravel:	**7.0 %**	Subclass Slope:	**b**	
2.7 Entrenchment Ratio:	**5.08**	Sand:	**15.0 %**	Bed Form:	**Plane Bed**	
2.8 Incision Ratio:	**1.32**	Silt and Smaller:	**0.0 %**	Field Measured Slope:		
Human Elevated Inc. Rat.:	**0.00**	Silt/Clay Present:	**No**	2.15 Sub-reach Stream Type		
2.9 Sinuosity:	**Moderate**	Detritus:	**5.0 %**	Reference Stream Type:		
2.10 Riffles Type:	**Sedimented**	# Large Woody Debris:	**52**	Reference Bed Material:		
				Reference Subclass Slope:		
				Reference Bedform:		

Step 3. Riparian Features

3.1 Stream Banks — Typical Bank Slope: **Moderate**

Bank Texture			Bank Erosion	Left	Right	Near Bank Vegetation Type	Left	Right
Upper	Left	Right	Erosion Length (ft.):	**0.0**	**0.0**	Dominant:	**Herbaceous**	**Herbaceous**
Material Type:	**Mix**	**Mix**	Erosion Height (ft.):	**0.0**	**0.0**	Sub-dominant:	**Coniferous**	**Shrubs/Sapling**
Consistency:	**Non-cohesive**	**Non-cohesive**	Revetment Type:	**Rip-Rap**	**Multiple**	Bank Canopy		
Lower			Revetment Length:	**298.5**	**699.6**	Canopy %:	**76-100**	**76-100**
Material Type:	**Boulder/Cobble**	**Boulder/Cobble**				Mid-Channel Canopy:	**Closed**	
Consistency:	**Non-cohesive**	**Non-cohesive**						

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	**>100**	**>100**
Sub-Dominant	**0-25**	**26-50**
W less than 25	**146**	**205**
Buffer Vegitation Type		
Dominant	**Coniferous**	**Mixed Trees**
Sub-Dominant	**Herbaceous**	**Herbaceous**

3.3 Riparian Corridor

Corridor Land	Left	Right		Left	Right
Dominant	**Forest**	**Forest**	Mass Failures		
Sub-dominant	**Residential**	**Shrubs/Sapling**	Height		
(Legacy)	Amount	Mean Hieght	Gullies Number	**0**	
Failures	**None**		Gullies Length	**0**	
Gullies	**None**				

Stream: **Wells River** Reach: **M22-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	**Abundant**	4.5 Flow Regulation Type	**Small Withdrawal**	4.7 Stormwater Inputs			
4.2 Adjacent Wetlands:	**Abundant**	Flow Reg. Use:	**Irrigation**	Field Ditch:	**0**	Road Ditch:	**2**
4.3 Flow Status:	**Moderate**	Impoundments:	**None**	Other:	**0**	Tile Drain:	**0**
4.4 # of Debris Jams:	**0**	Impoundment Loc.:		Overland Flow:	**0**	Urb Strm Wtr Pipe:	**0**
		4.6 Up/Down Strm flow reg.:	**None**	4.9 # of Beaver Dams:		**3**	
		(old) Upstrm Flow Reg.:		Affected Length (ft):		**900**	

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	**32**	**Yes**	**Yes**	**Yes**	**No**	**Scour Above,Scour Below**
Bridge	**32**	**Yes**	**Yes**	**Yes**	**No**	**Scour Above,Scour Below**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	**5**	5.2 Other Features	Neck Cutoff:	**0**	5.4 Stream Ford or Animal Crossing:		**Yes**	
Mid:	**0**	Delta:	**0**	Flood chutes:	**22**	Avulsion:	**0**	5.5 Straightening:	**Straightening**
Point:	**3**	Island:	**20**	5.3 Steep Riffles and Head Cuts		Head Cuts:	**0**	Straightening Length (ft.):	**2,667**
Side:	**1**	Braiding:	**15**	Steep Riffles:	**2**	Trib Rejuv.:	**No**	5.5 Dredging:	**None**

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradiant Type	Left Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:	
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection	
Total Score:	**0**	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:	
Habitat Rating:	**0.00**				
Habitat Stream Condition:					

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	**Plane Bed**	Score	STD	Historic		
7.1 Channel Degradation		**11**		**Yes**	Geomorphic Rating	**0.45**
7.2 Channel Aggradation		**8**			Channel Evolution Model	**F**
7.3 Widening Channel		**8**			Channel Evolution Stage	**III**
7.4 Change in Planforml		**9**			Geomorphic Condition	**Fair**
Total Score		**36**			Stream Sensitivity	**High**

– Appendix 5 –

Quality Assurance/Quality Control Documentation

Datasets include reaches beyond the scope of the 2015 Upper Wells Phase 2 study area reported in this Corridor Plan. For scores and summary data pages the relevant reaches reported in this Corridor Plan are as follows:

Wells mainstem: M10-M22
Scott Brook: M11T1.01-M11T1.08
Stone Rd. Brook: M12S2.01-M12S2.02
Darius James Brook: M14S2.01-M14S2.02
Clark Hatch Brook: M15S1.01
Keenan Brook: M15T2.01-M15T2.03
Tannery Brook: M16S1.01
North Branch Wells: M18T3.01-M18T3.02
South Branch Wells: M19T4.01-M19T4.06

Reaches M11T1.03, M11T1.06, and M15S1.01 were not assessed in Phase 1

M11T1.03B, M11T1.06A, M11T1.08B were excluded in Phase 2 *(due to beaver impoundment influences; some parameters could not be assessed)*

Phase 2 - Quality Control - X.1 Null Fields

Wells River

Step Number	0	1.3	1.6	2.11	2.13	2.14	3.1			3.3		4.5	4.8	4.9	5.1
Description -> Reach	Assessed	Encroa-chments	Grade Controls	Riffle Spacing	Largest Particle	Stream Type	Texture	Erosion	Revet-ment	Failure Height	Gully Height	Impound-ment	Constricti ons	Beaver Dams	Bar Type
M01-0	Yes														
M02-0	Yes														
M04-A	Yes														
M04-B	Yes														
M04S3.01-A	Yes														
M04S3.01-B	No			X	X	X	X						X		
M04S3.01-C	No		X	X	X	X	X						X		
M04S3.01-D	Yes														
M05-0	Yes														
M06-A	Yes														
M06-B	Yes														
M07-A	Yes														
M07-B	Yes														
M08-A	Yes														
M08-B	Yes														
M08-C	No			X	X	X	X						X		
M09-A	No	X	X	X	X	X	X						X		
M09-B	Yes														
M10-A	Yes														
M10-B	Yes														
M11-0	Yes														
M11T1.01-0	Yes														
M11T1.02-0	Yes														
M11T1.03-A	Yes														
M11T1.03-B	No			X	X	X									X
M11T1.03-C	Yes														
M11T1.04-0	Yes														

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Step Number	0	1.3	1.6	2.11	2.13	2.14	3.1			3.3		4.5	4.8	4.9	5.1
Description -> Reach	Assessed	Encroa-chments	Grade Controls	Riffle Spacing	Largest Particle	Stream Type	Texture	Erosion	Revet-ment	Failure Height	Gully Height	Impound-ment	Constricti ons	Beaver Dams	Bar Type
M11T1.05-0	Yes														
M11T1.06-A	No			X	X	X							X		
M11T1.06-B	Yes														
M11T1.07-A	Yes														
M11T1.07-B	Yes														
M11T1.08-A	Yes														
M11T1.08-B	No			X	X								X		X
M11T1.08-C	Yes														
M12-0	Yes														
M12S2.01-A	Yes														
M12S2.01-B	Yes														
M12S2.02-0	Yes														
M13-0	Yes														
M14-0	Yes														
M14S2.01-0	Yes														
M14S2.02-0	Yes														
M15-0	Yes														
M15S1.01-A	Yes														
M15S1.01-B	Yes														
M15T2.01-0	Yes														
M15T2.02-0	Yes														
M15T2.03-A	Yes														
M15T2.03-B	Yes														
M16-0	Yes														
M16S1.01-A	Yes														
M16S1.01-B	Yes														
M17-A	Yes														
M17-B	Yes														
M18-0	Yes														

Step Number	0	1.3	1.6	2.11	2.13	2.14	3.1			3.3		4.5	4.8	4.9	5.1
Description -> Reach	Assessed	Encroa-chments	Grade Controls	Riffle Spacing	Largest Particle	Stream Type	Texture	Erosion	Revet-ment	Failure Height	Gully Height	Impound-ment	Constricti ons	Beaver Dams	Bar Type
M18T3.01-0	Yes														
M18T3.02-0	Yes														
M19-0	Yes														
M19T4.01-A	Yes														
M19T4.01-B	Yes														
M19T4.02-0	Yes														
M19T4.03-A	Yes														
M19T4.03-B	Yes														
M19T4.04-0	Yes														
M19T4.05-0	Yes														
M19T4.06-A	Yes														
M19T4.06-B	Yes														
M19T4.06-C	Yes														
M19T4.06-D	Yes														
M20-0	Yes														
M21-0	Yes														
M22-0	Yes														

x = Failed Test, blank = Passed Test

Phase 2 - Quality Control

Wells River

X.2 Null Field Check and X.4 Conflicting Phase 1 vs Phase 2 Data

X.2 Null Fields Check **Status** Provisional

Reach v Step >	0	1	2	3	4	5
M01-0						
M02-0						
M04-A						
M04-B						
M04S3.01-A						
M04S3.01-B		X	X	X	X	X
M04S3.01-C		X	X	X	X	X
M04S3.01-D						
M05-0						
M06-A						
M06-B						
M07-A						
M07-B						
M08-A						
M08-B						
M08-C		X	X	X	X	X
M09-A		X	X	X	X	X
M09-B						
M10-A						
M10-B						
M11-0						
M11T1.01-0						
M11T1.02-0						
M11T1.03-A						
M11T1.03-B			X			
M11T1.03-C						
M11T1.04-0						

X.4 Conflicting Phase 1 - Phase 2 data **Status** Passed

Reach v Step >	P1 2.4 P2 0	P1 2.9 P2 1.5	P1 2.10 P2 1.5	P1 3.1 P2 1.2	P1 5.1 P2 4.5	P1 5.5 P2 5.5	P1 7.1 P2 2.14
M01-0							
M02-0							
M04-A							
M04-B							
M04S3.01-A							
M04S3.01-B							
M04S3.01-C							
M04S3.01-D							
M05-0							
M06-A							
M06-B							
M07-A							
M07-B							
M08-A							
M08-B							
M08-C							
M09-A							
M09-B							
M10-A							
M10-B							
M11-0							
M11T1.01-0							
M11T1.02-0							
M11T1.03-A							
M11T1.03-B							
M11T1.03-C							

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Reach v Step >	0	1	2	3	4	5
M11T1.05-0						
M11T1.06-A			X	X		X
M11T1.06-B						
M11T1.07-A						
M11T1.07-B						
M11T1.08-A						
M11T1.08-B			X			
M11T1.08-C						
M12-0						
M12S2.01-A						
M12S2.01-B						
M12S2.02-0						
M13-0						
M14-0						
M14S2.01-0						
M14S2.02-0						
M15-0						
M15S1.01-A						
M15S1.01-B						
M15T2.01-0						
M15T2.02-0						
M15T2.03-A						
M15T2.03-B						
M16-0						
M16S1.01-A						
M16S1.01-B						
M17-A						
M17-B						
M18-0						
M18T3.01-0						
M18T3.02-0						

Reach v Step >	P1 2.4 P2 0	P1 2.9 P2 1.5	P1 2.10 P2 1.5	P1 3.1 P2 1.2	P1 5.1 P2 4.5	P1 5.5 P2 5.5	P1 7.1 P2 2.14
M11T1.04-0							
M11T1.05-0							
M11T1.06-A							
M11T1.06-B							
M11T1.07-A							
M11T1.07-B							
M11T1.08-A							
M11T1.08-B							
M11T1.08-C							
M12-0							
M12S2.01-A							
M12S2.01-B							
M12S2.02-0							
M13-0							
M14-0							
M14S2.01-0							
M14S2.02-0							
M15-0							
M15S1.01-A							
M15S1.01-B							
M15T2.01-0							
M15T2.02-0							
M15T2.03-A							
M15T2.03-B							
M16-0							
M16S1.01-A							
M16S1.01-B							
M17-A							
M17-B							
M18-0							

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Reach v Step >	0	1	2	3	4	5
M19-0						
M19T4.01-A						
M19T4.01-B						
M19T4.02-0						
M19T4.03-A						
M19T4.03-B						
M19T4.04-0						
M19T4.05-0						
M19T4.06-A						
M19T4.06-B						
M19T4.06-C						
M19T4.06-D						
M20-0						
M21-0						
M22-0						

Reach v Step >	P1 2.4 P2 0	P1 2.9 P2 1.5	P1 2.10 P2 1.5	P1 3.1 P2 1.2	P1 5.1 P2 4.5	P1 5.5 P2 5.5	P1 7.1 P2 2.14
M18T3.01-0							
M18T3.02-0							
M19-0							
M19T4.01-A							
M19T4.01-B							
M19T4.02-0							
M19T4.03-A							
M19T4.03-B							
M19T4.04-0							
M19T4.05-0							
M19T4.06-A							
M19T4.06-B							
M19T4.06-C							
M19T4.06-D							
M20-0							
M21-0							
M22-0							

x = Failed Test, blank = Passed Test

Phase 2 - Quality Control - X.3 Conflicting Phase 2 data

Wells River

Passed X.3 Test: **Provisional**

Step Numbers	1.3 - 3.3	1.3 - 1.5	1.5 - 2.1	2.14 - 2.11	2.10 - 5.3	2.10 - 5.3	5.3 - 5.3	2.14 - 2.14	3.2 - 3.3	4.1 - 5.3
Reach v Description >	Encroachments Industriall Land Use	Encroachments Human Caused Change	Valley Width Bankfull Width	Riffle Spacing Plane Bed	Riffle Type Steep Riffles	Riffle Type Head Cutts	Steep Riffles Head Cuts	Dune Ripple Bed Material	Buffer Type Industrial Land Use	Springs/Seeps Tributary Rejuvenation
M11-0										
M11T1.03-C										
M12-0										
M11T1.08-A										
M11T1.08-B										
M11T1.08-C										
M12S2.02-0										
M11T1.02-0										
M22-0										
M11T1.07-B										
M14S2.01-0										
M14S2.02-0										
M12S2.01-A										
M18T3.02-0										
M14-0										
M17-A										
M12S2.01-B										
M16-0										
M11T1.05-0										
M19T4.06-B										
M15T2.03-A										
M10-A										
M10-B										
M08-A										
M08-C			X	X				X		X

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Step Numbers	1.3 - 3.3	1.3 - 1.5	1.5 - 2.1	2.14 - 2.11	2.10 - 5.3	2.10 - 5.3	5.3 - 5.3	2.14 - 2.14	3.2 - 3.3	4.1 - 5.3
Reach v Description >	Encroachments Industriall Land Use	Encroachments Human Caused Change	Valley Width Bankfull Width	Riffle Spacing Plane Bed	Riffle Type Steep Riffles	Riffle Type Head Cutts	Steep Riffles Head Cuts	Dune Ripple Bed Material	Buffer Type Industrial Land Use	Springs/Seeps Tributary Rejuvenation
M04S3.01-A										
M04S3.01-B			X	X				X		X
M04S3.01-C			X	X				X		X
M04S3.01-D										
M19T4.06-C										
M19T4.06-D										
M16S1.01-B										
M09-A			X	X				X		X
M09-B										
M01-0										
M02-0										
M06-A										
M06-B										
M04-A										
M04-B										
M05-0										
M16S1.01-A										
M11T1.06-B										
M11T1.06-A			X	X				X		
M15-0										
M11T1.04-0										
M11T1.01-0										
M18T3.01-0										
M13-0										
M17-B										
M15T2.03-B										
M15T2.02-0										
M15T2.01-0										
M19T4.05-0										

Step Numbers	1.3 - 3.3	1.3 - 1.5	1.5 - 2.1	2.14 - 2.11	2.10 - 5.3	2.10 - 5.3	5.3 - 5.3	2.14 - 2.14	3.2 - 3.3	4.1 - 5.3
Reach v Description >	Encroachments Industriall Land Use	Encroachments Human Caused Change	Valley Width Bankfull Width	Riffle Spacing Plane Bed	Riffle Type Steep Riffles	Riffle Type Head Cutts	Steep Riffles Head Cuts	Dune Ripple Bed Material	Buffer Type Industrial Land Use	Springs/Seeps Tributary Rejuvenation
M08-B										
M07-A										
M19T4.02-0										
M11T1.07-A										
M20-0										
M19-0										
M11T1.03-A										
M11T1.03-B										
M21-0										
M19T4.04-0										
M07-B										
M19T4.03-A										
M19T4.03-B										
M19T4.01-A										
M19T4.01-B										
M15S1.01-A										
M15S1.01-B										
M18-0										
M19T4.06-A										

x = Failed QC Test, blank = passed QC Test

Phase 2 X.1 - X.4 Quality Control Comments — Wells River

M04S3.01- A	X.3, Phase 2, Step 1.3 Encroachments vs 1.5 Humman caused change (conflict) **Route 132 does change valley width but it is outside of the corridor for the stream.**
M05- 0	X.3, Phase 2, Step 1.3 Encroachments vs 1.5 Humman caused change (conflict) **There is a gravel pit on the left bank that has altered the valley width. The valley is acually widened generally, although there may be areas where movement and deposition of material has narrowed the valley**
M05- 0	X.3, Phase 2, Step 2.13 Largest Bed/Bar Particle vs 2.14 Bed Form (conflict) **Larger particles were scattered in the stream and cobbles were located along a part of one bank. Overall, the bed form was dune ripple or possible plane bed.**
M06- A	X.3, Phase 2, Step 2.13 Largest Bed/Bar Particle vs 2.14 Bed Form (conflict) **There is some gravel in the stream and the stream is capable of moving it. Many bars are comprised of sands only though.**
M09- B	X.3, Phase 2, Step 2.13 Largest Bed/Bar Particle vs 2.14 Bed Form (conflict) **There is some gravel present in the stream and the stream is capable of moving it. Sand is dominant.**
M11T1.05- 0	X.4, Phase 1, Step 7.1 Bed form vs Phase 2, Step 2.14 Bed form (conflict) **assessed as step-pool reference for habitat due to deep historic incision that leaves current channel in a vastly reduced floodplain and valley, moving larger material and setting up steps; riffle-pool subdominant bedform is common, particularly in midreach transverse valley inclusion, but not dominant. Forest will need to mature significantly to provide large enough wood and more stable debris jams to begin to re-access historic floodplains.**
M12- 0	X.4, Phase 1, Step 7.1 Bed form vs Phase 2, Step 2.14 Bed form (conflict) **Stream habitat type departure from riffle-pool to planebed: straightened, heavily armored, pools and undercuts lacking; predominantly planebed with weak riffle formation**
M14S2.01- 0	X.1, Step 1.6: GradeControls (null value)
M14S2.02- 0	X.1, Step 4.8: Constrictons (null value) **no channel constrictions**
M14S2.02- 0	X.1, Step 5.1: Bar Types (null value)
M15S1.01- A	X.3, Phase 2, Step 2.10 Riffle Type vs 5.3 headcuts (conflict) **Single headcut is at valley wall pinch point broken through transverse lake edge formation parallel to valley of mainstem Wells - likely periodically builds up sediments and nickpoints-headcuts chew back through these deposits.**
M15S1.01- A	X.3, Phase 2, Step 5.3 Steep Riffles vs Headcuts (conflict) **Single headcut is at valley wall pinch point broken through transverse lake edge formation parallel to valley of mainstem Wells - likely periodically builds up sediments and nickpoints-headcuts chew back through these deposits.**

M17- A	X.3, Phase 2, Step 2.10 Riffle Type vs 5.3 Steep Riffles (conflict) **though most sediments retained behind 2 former dams are being eroded-redistributed, steep riffle was a sediment slug US of former impoundment area behind Groton No 9 dam**
M19T4.01- A	X.3, Phase 2, Step 2.10 Riffle Type vs 5.3 Steep Riffles (conflict) **Heavily channelized following Irene, substantial windrowing. Steps and riffles appear to be rapidly "washing out" erosional features and nickpoints, but are broken and clearly mobile; significant stretches of plane bed.**
M19T4.03- A	X.3, Phase 2, Step 2.10 Riffle Type vs 5.3 headcuts (conflict) **headcut formed at US end of a flood chute accessed following a debris jam in Irene and is now close to the upstream end of an island around which active channel splits; currently not accessed at low flows**
M19T4.03- A	X.3, Phase 2, Step 5.3 Steep Riffles vs Headcuts (conflict) **headcut formed at US end of a flood chute accessed following a debris jam in Irene and is now close to the upstream end of an island around which active channel splits; currently not accessed at low flows**
M19T4.03- B	X.3, Phase 2, Step 2.10 Riffle Type vs 5.3 headcuts (conflict) **single headcut at US end of flood chute-now-turned-primary active channel after debris jam broke and channel avulsed in Irene**
M19T4.03- B	X.3, Phase 2, Step 5.3 Steep Riffles vs Headcuts (conflict) **single headcut at US end of flood chute-now-turned-primary active channel after debris jam broke and channel avulsed in Irene**
M19T4.06- A	X.2, Step 2 contains null values **Denied access after completing initial mapping, unable to return for a x-section. Single ownership for majority of reach M19T4.06, denied property access for x-secs on segs M19T4.06A-C (Step 6 RHA and Step 7 RGA scoring based on qualitative observations for channel dimensions); seg D on state forest, x-sec measured.**
M19T4.06- B	X.2, Step 2 contains null values **Denied access after completing initial mapping, unable to return for a x-section. Single ownership for majority of reach M19T4.06, denied property access for x-secs on segs M19T4.06A-C (Step 6 RHA and Step 7 RGA scoring based on qualitative observations for channel dimensions); seg D on state forest, x-sec measured.**
M19T4.06- B	X.3, Phase 2, Step 1.3 Encroachments vs 1.5 Humman caused change (conflict) **slight reduction of width of a Very Broad valley by Seyon Pond Rd falls outside the river corridor and thus does not appear as an ancroachment**
M19T4.06- C	X.2, Step 2 contains null values **Denied access after completing initial mapping, unable to return for a x-section. Single ownership for majority of reach M19T4.06, denied property access for x-secs on segs M19T4.06A-C (Step 6 RHA and Step 7 RGA scoring based on qualitative observations for channel dimensions); seg D on state forest, x-sec measured.**
M19T4.06- C	X.3, Phase 2, Step 2.10 Riffle Type vs 5.3 headcuts (conflict) **Clear deposition zone in Irene, visible in VCGI 2012 orthos; headcuts are working back up through aggraded materials near areas of localized dredging.**

M19T4.06- C X.3, Phase 2, Step 5.3 Steep Riffles vs Headcuts (conflict)

Clear deposition zone in Irene, visible in VCGI 2012 orthos; headcuts are working back up through aggraded materials near areas of localized dredging.

– Appendix 6 –

Consolidated Project Identification

(sorted by priority – reach-scale priority first, then watershed, then reach;
11x17 format – digital appendix includes Excel file that can be sorted by field)

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M17-B	Protect River Corridors	Very High	Very High	Y	High value attenuation asset US of village and DS of straightened area	1
M17-B	Stream Buffers	Very High	Very High	Y	Priority planting area	1
M18-0	Protect River Corridors	Very High	Very High	Y	Intermittent attenuation assets at Power House Rd and downstream of Welton Rd bridge, important for mitigating effects of highly straightened reaches upstream	1
M18-0	Stream Buffers	Very High	Very High	Y	create-protect wider set-aside for natural regen, low-cost plantings with ample setback due to likely lateral adjustments	1
M18-0	Remove Berms	Very High	Very High	Y	will impact existing buffer but gains likely outweigh impacts	1
M18-0	Restore Incised Reach	Very High	Very High	Y	high priority corridor protection DS end of reach and into M17B, berm removal; development US in M18 currently constrains possibilities for reducing impacts of extensive straightening	1
M15-0	Protect River Corridors	Very High	Very High	Y	In progress since SGA was undertaken, corridor here in motion toward being protected	2

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M14-0	Protect River Corridors	Next Highest	Very High	Y	In progress since SGA was undertaken, corridor here in motion toward being protected	2
M15-0	Stream Buffers	Next Highest	Very High	Y	protect wider set-aside for natural regen and low-cost plantings thru much of reach; narrow buffers present (technically compliant), parent sources exist; active adjustments suggest ample setback for plantings	2
M14-0	Stream Buffers	Medium	Very High	Y	protect wider set-aside for natural regen and low-cost plantings thru much of reach; narrow buffers present (technically compliant), parent sources exist; active adjustments suggest ample setback for plantings	2
M19T4.06-B	Protect River Corridors	Very High	Very High	Y	landowner outreach: corridor easement	3
M19T4.06-B	Restore Incised Reach	Very High	Very High	Y	potential passive restoration; landowner outreach	3
M19T4.06-C	Protect River Corridors	Very High	Very High	Y	landowner outreach: corridor easement	3
M19T4.06-C	Restore Incised Reach	Very High	Very High	Y	potential passive restoration; landowner outreach	3

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M19T4.06-B	Stream Buffers	Next Highest	Next Highest	Y	passive or low cost due to lateral instability; set-back important, ideally part of corridor protection-passive restoration	3
M19T4.06-C	Stream Buffers	Next Highest	Next Highest	Y	passive or low cost due to lateral instability; set-back important, ideally part of corridor protection-passive restoration	3
M19T4.03-B	Protect River Corridors	Very High	Very High	Y	Corridor easement: high value attenuation asset DS of highly straightened area (long-term challenges) and US of Westville and major infrastructure issues along Rte. 302	4
M19T4.03-B	Restore Incised Reach	Very High	Very High	N	corridor protection and removal of encroachments upstream in M19T4.04 - old abutments and possibly old mill infrastructure	4
M19T4.03-B	Stream Buffers	Next Highest	Next Highest	Y	ideally in conjunction with corridor protection-channel management easement	4

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M10-A	Protect River Corridors	Next Highest	Medium	Y	Attenuation asset for watershed (stormwater and urban) changes upstream. Previous landowner contacts made regarding easements; follow up. Full benefit only if old RR abutments removed, railbed lowered; currently impacts passed downstream, making reach M09 primary attenuation asset	5
M16S1.01-A	Restore Incised Reach	Very High	Medium	N	needs to include addressing structures (Rte. 302 and pvt wooden bridge), corridor protection to accommodate passive floodplain access and meander development, addressing potential conflicts with development in corridor	6
M11T1.01-0	Watershed Strategies	Very High	Very High	Y	Remove upstream mill infrastructure. Municipal corridor protection, stormwater management, capital planning with eye to moving road, bridge replacements, develop info on bridge and culvert options for private landowners	7

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M11T1.02-0	Remove/Replace Structures	Very High	Very High	Y	Remove mill infrastructure to increase LB floodplain access and meander formation, replace bridges to reduce stream power and scour	7
M11T1.01-0	Remove/Replace Structures	Very High	Next Highest	Y	Highest priority Terry Hill Rd. bridge. Rte 302 culvert being scoped (2016) for replacement with a bridge. Pvt bridges might be able to be placed on waste block outside channel width.	7
M10-B	Protect River Corridors	Next Highest	Next Highest	Y	passive to start - unclear of elevation of old railbed off LB; explore opportunities for removal or lowering, may reduce pressure on Rte 302	8
M11-0	Protect River Corridors	Very High	Medium	Y	primary assets upstream of Pinehurst Cemetery and downstream of Creamery Rd bridge, but incision means difficult to access at this point.	8

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M11-0	Stream Buffers	Medium	Medium	Y	create set-aside for natural regen (low-cost plantings possible with ample setback) downstream of Scott Brook confluence, downstream of old RR abutments mid-reach; planting ideally in conjunction with addressing old RR bed	8
M11-0	Remove/Replace Structures	Medium	Medium	Y	Creamery Rd bridge 70 pct bkfw, biggest gains. Old RR and rd abutments gain limited floodplain without addressing old railbed, and even then most of this reach is relatively confined naturally	8
M19T4.04-0	Remove/Replace Structures	Very High	Next Highest	Y	remove 2 sets old abutments (highest priority downstream set); 2 possible other sets largely failed, not affecting channel dynamics as greatly	9
M19T4.04-0	Restore Incised Reach	Medium	Next Highest	Y	high priority river corridor protection at downstream reach M19T4.03 to attenuate flow and sediment transported through channelized reaches M19T4.05 and M19T4.04	9

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M19T4.04-0	Stream Buffers	Medium	Medium	Y	Flood resiliency benefits for camp off RB in addition to general benefits of buffers; other reduced buffers primarily rdside - important to protect but difficult to augment without addtl considerations	9
M13-0	Restore Incised Reach	Next Highest	Next Highest	N	Passive-active; increases value of buffers and attenuation assets in M10 due to likelihood of erosion as stream evolves. Brown Dr (built on old RR bed) and Rte 302 constrain, but more meanders can develop; active possibility for relocation of Brown Dr to connect with Barr Dr	10
M19T4.01-A	Potential restoration/protection project	Very High	Very High	N	Information gathering for possibility of lowering or removing old railbed off right bank to restore floodplain access, then removing old rail abutments	11

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M19T4.01-A	Remove/Replace Structures	Very High	Very High	Y	Rte 302 bridge effective width reduced by alignment and aggradation; "clean-out" increases flood risk to house at end of South Branch	11
M19T4.01-A	Remove Berms	Very High	Next Highest	N	Potential for lowering old railbed off right bank; evaluate for cost-effectiveness, potential for impacts to developed areas	11
M10-A	Remove/Replace Structures	Very High	Very High	Y	would open floodplain access; important to keep buffers intact as could also increase erosion possibilities due to incision and high terraces	
M10-B	Remove/Replace Structures	Very High	Very High	Y	maybe lower railbed approach as well, would open floodplain access; important to keep buffers intact	
M12-0	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, stormwater mgmnt (Stone Rd Brook)	
M13-0	Protect River Corridors	Very High	Very High	N	Extremely sensitive reach, attenuation asset. Full benefit only if old bridge abutments removed. Retain post-Irene guidance for landowners for buyout and elevation options if needed in future.	

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M13-0	Stream Buffers	Very High	Very High	Y	protect wider set-aside for natural regen, low-cost plantings with ample setback; some buffers present, parent sources exist	
M13-0	Remove/Replace Structures	Very High	Very High	Y	bridge below Farquharson Rd not functional, more substantial-higher priority; old stone abutments at US end of reach are collapsing over time but remain a constriction	
M13-0	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection: corridor adoption to raise level of Emergency Relief Assistance Funds cost shares (house at risk); stormwater management	
M16-0	Remove/Replace Structures	Very High	Very High	Y	remove old sawmill foundation and former Tannery Rd bridge abutment (on right bank, side that went to old RR); technically in reach M17 but impacts reach M16	

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M16-0	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, familiarity with buyout options if-when flooding occurs; occupation of floodplains on both sides of RR bed constrains opportunities for restoring large amount of floodplain thru lowering RR bed elevation	
M17-A	Remove Berms	Very High	Very High	N	Remove old dam wing extension by Groton No 9 (may have issues connected with dam removal permitting). Berm on US end of segment may restrict stream access to former gravel pit, needs further analysis; lower priority	
M17-A	Restore Incised Reach	Very High	Very High	N	Further analysis of berm removal projects and constraints. High priority corridor protection for attenuation downstream, now enacted in M14 and M15	
M17-A	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, stormwater management	
M18-0	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, stormwater management	

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M19-0	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, capital budget planning with eye to bridge replacement	
M20-0	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, stormwater management	
M21-0	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, develop info on bridge and culvert options for private landowners	
M22-0	Remove/Replace Structures	Very High	Very High	Y	S County Rd. bridge and pvt driveway 1076 State Forest Rd. both ~60 pct bkfw; not class 3 town rds, could maybe placed on waste block on tops of banks outside bkfw	
M22-0	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, capital budget planning with eye to bridge replacement (may include state and pvt)	

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M11T1.01-0	Stream Buffers	Very High	Very High	Y	Highest priority only for 311-259 Church St, others Medium priority (or higher if part of reach restoration); lawn areas might be planted but many missing buffers due to road encroachment and need additional considerations for a buffer to establish	
M11T1.02-0	Watershed Strategies	Very High	Very High	Y	Stormwater and drainage management (including erosion control under perched culvert in this reach)	
M11T1.08-A	Watershed Strategies	Very High	Very High	Y	muncipal corridor protection including small stream setbacks; assess dam integrity at pond in upstream segment B	
M11T1.08-C	Watershed Strategies	Very High	Very High	Y	muncipal corridor protection including small stream setbacks; assess dam integrity at pond in upstream segment B	

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M12S2.01-A	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, stormwater management, capital planning with eye to structure replacements-identify problem structures and target replacement sizes for when opportunities arise to replace damaged structures	
M12S2.01-B	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, stormwater management, capital planning with eye to structure replacements	
M12S2.02-0	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, stormwater management, capital planning with eye to bridge replacements, develop info on bridge and culvert options for private landowners. Significant loss of wetland attenuation upstream, hydrologic loads may well shift with stormwater mgmnt	
M14S2.02-0	Protect River Corridors	Very High	Very High	Y	Municipal corridor protection	

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M14S2.02-0	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, stormwater management, capital planning with eye to bridge replacements, develop info on bridge and culvert options for private landowners. Significant loss of wetland attenuation upstream, hydrologic loads may well shift with stormwater mgmnt	
M15S1.01-A	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, stormwater management, capital planning with eye to culvert replacements upstream, develop info on bridge and culvert options for private landowners.	
M15S1.01-B	Remove/Replace Structures	Very High	Very High	Y	Undersized structures amplify stream power in this rd-encroached segment, adequate sizing would help reduce erosive impacts and help allow large wood to play its critical role in a stream setting like this	

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M15S1.01-B	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, stormwater management, capital planning with eye to culvert replacements, develop info on bridge and culvert options for private landowners. Groton rd erosion inventory, capital planning and stormwater management planning are great model for starting point	
M15T2.01-0	Watershed Strategies	Very High	Very High	Y	Evaluate pond embankment upstream. Municipal corridor protection, stormwater management, capital planning with eye to culvert replacements, develop info on bridge and culvert options for private landowners. Groton planning is great model for starting point	
M15T2.02-0	Remove/Replace Structures	Very High	Very High	Y	Railroad St. culvert is ~26 pct bankfull width, amplifies flood impacts downstream	

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M15T2.02-0	Watershed Strategies	Very High	Very High	Y	Structure replacements, municipal corridor protection, stormwater and drainage (increase infiltration, vegetative filters) ,establish-ensure buffer integrity - large wood plays critical role in sediment retention and rebuilding floodplain access	
M15T2.03-A	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, stormwater and drainage (increase infiltration, vegetative filters, prevent gullies), ensure buffer integrity - large wood plays critical role in sediment retention and rebuilding floodplain access	
M15T2.03-B	Protect River Corridors	Very High	Very High	Y	important attenuation asset but parcelized; municipal corridor protection recommended - corridor in this segment needs to accomodate rapid planform changes	

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M15T2.03-B	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, stormwater and drainage (increase infiltration, vegetative filters, prevent gullies), ensure buffer integrity - large wood plays critical role in sediment retention and rebuilding floodplain access	
M16S1.01-A	Remove/Replace Structures	Very High	Very High	Y	highest priority to Rte. 302 bridge at Tannery Brook, high priority hazard mitgation area; remove or upsize wooden bridge by solar array	
M16S1.01-A	Watershed Strategies	Very High	Very High	Y	High priority hazard mitgation site includes replacement of extremely undersized Rte. 302 bridge at Tannery Brook Rd, brownfields assessment and potential clean-up at old Tannery just upstream; keep properties upstresam of this bridge in mind for potential buy-outs if opportunities arise	

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M16S1.01-B	Watershed Strategies	Very High	Very High	N	address hazard mitigation downstream first (addressing structures and floodplain reconnection here may increase sediment transport into segment A), protect corridor (muncipal protection recommended), stormwater managment	
M16S1.01-B	Watershed Strategies	Very High	Very High	Y	Minard Hill Rd project is a top priority in Groton road erosion planning 2015-19 (short term fix in near future). Municipal corridor protection, stormwater management, capital planning with eye to culvert replacements, develop info on bridge and culvert options for private landowners. Groton rd erosion inventory, capital planning and stormwater management planning are great model for starting point	

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M18T3.01-0	Remove/Replace Structures	Very High	Very High	Y	Rte. 302 bridge undersized, effective width significantly reduced by angle of alignment; substantial concrete structure uincreases risk of repeat damage to road	
M18T3.01-0	Watershed Strategies	Very High	Very High	Y	Hazard mitigation and emergency operations planning, municipal corridor protection, stormwater management	
M18T3.02-0	Protect River Corridors	Very High	Very High	Y	Rd and utility upgrades increase development pressure; municipal corridor protection important due to risks, semi-confined valley limits value as attenuation asset	
M18T3.02-0	Watershed Strategies	Very High	Very High	Y	Municipal corridor protection, stormwater and drainage (increase infiltration, vegetative filters, prevent gullies), ensure buffer integrity - large wood plays critical role in sediment retention and rebuilding floodplain access	
M19T4.01-A	Watershed Strategies	Very High	Very High	Y	Hazard mitigation and emergency operations planning, municipal corridor protection, stormwater management	

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M19T4.01-B	Watershed Strategies	Very High	Very High	N	Priority to addressing headcut in floodchute in M19T4.02, protection of attenuation assets in M19T4.03	
M19T4.02-0	Restore Incised Reach	Very High	Very High	N	Potential project: alternatives analysis for 5 ft headcut plugged by debris jam-sediment wedge at end of floodchute on DS end of reach, consider opportunities for habitat restoraton in bed armored area; ensure watershed strategies for stormwater maangement BMPs are being pursued	
M19T4.02-0	Watershed Strategies	Very High	Very High	Y	drainage and stormwater management BMPs	
M19T4.03-A	Watershed Strategies	Very High	Very High	Y	Hazard mitigation and emergency operations planning, municipal corridor protection, stormwater management	
M19T4.04-0	Watershed Strategies	Very High	Very High	Y	Hazard mitigation and emergency operations planning, municipal corridor protection, stormwater management, develop info on bridge and culvert options for private landowners	

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M19T4.05-0	Watershed Strategies	Very High	Very High	Y	Hazard mitigation and emergency operations planning, municipal corridor protection, stormwater management, develop info on bridge and culvert options for private landowners	
M19T4.06-A	Restore Incised Reach	Very High	Very High	Y	high priority river corridor protection to accommodate passive flood plain and meander redevelopment	
M11-0	Watershed Strategies	Next Highest	Very High	Y	Municipal corridor protection, bridge and culvert prioritzation and capital planning	
M14-0	Watershed Strategies	Low	Very High	N	Stormwater mgmnt US; corridor here in motion toward being protected	
M11T1.03-A	Remove/Replace Structures	Very High	Next Highest	Y	ideally structure would exceed bankfull to ensure access to left bank floodplain downstream; Swamp Rd. likely to continue being undercut with current configuration	

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M11T1.03-A	Restore Incised Reach	Very High	Next Highest	N	primary issue is replacement of bridge to allow left bank floodplain access, remainder is passive-corridor protection to ensure long-term viability	
M11T1.03-C	Stream Buffers	Very High	Next Highest	Y	Ideally accompanied by corridor protection for passive meander restroation, but beneficial in reducing erosion regardless. May need exclsuion fencing.	
M11T1.07-A	Remove/Replace Structures	Very High	Next Highest	Y	private culverts all significantly undersized; box culvert under Swamp Rd. is lowest priority but is also undersized, especially for passgae of wood and sediment once better buffers are established	
M11T1.07-B	Protect River Corridors	Very High	Next Highest	Y	Attenuation asset upstream of rapidly developing area with significant encroachments	

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M11T1.07-B	Remove/Replace Structures	Very High	Next Highest	Y	Undersized culverts (under road and private driveway) increase straightening and force of water moving downstream, limiting floodplain access and increasing risk of impacts downstream	
M12S2.02-0	Stream Buffers	Very High	Next Highest	Y	protect wider set-aside for natural regen and low-cost plantings (with ample setback) thru portions of reach; narrow buffers present, parent sources exist. Exclusion fencing and off-stream watering near Hall Rd	
M14S2.01-0	Watershed Strategies	Very High	Next Highest	N	Municipal corridor protection: corridor adoption to raise level of Emergency Relief Assistance Funds cost shares (house at risk). Stormwater management US likely to affect discharge and sediment loads. Reach-scale restoration: address undersized structure,remove portion of berm DS of substation, channel mgmnt easement in DS portions	

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M15S1.01-A	Protect River Corridors	Very High	Next Highest	Y	Reach priority elevated by difficulty in addressing upstream conflicts; watershed priority only reduced by relatively small size of drainage and inaccessiblity to mainstem dynamics - but appears susceptible to development-encroachment as well	
M16S1.01-B	Remove/Replace Structures	Very High	Next Highest	Y	culvert at upstream end of reach (Minard Hill Site #1 in Groton capital planning) priority due to road impacts, Pound Road needs to pass large wood, old abutments by farm at downstream end of reach lower priority	
M19T4.03-A	Remove/Replace Structures	Very High	Next Highest	Y	Rte 302 bridge upstream of Westville has 60 ft span at rd level but only 40 ft effective width due to armoring inside structure	
M19T4.05-0	Remove/Replace Structures	Very High	Next Highest	Y	old abutments on US end increase hazard to house off RB; private bridges constrict due to abutments, may be candidates for modulars on waste block outside channel	

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M22-0	Restore Incised Reach	Next Highest	Next Highest	N	Bridge replacements important piece (whose domain is S. County Rd.), otherwise primarily passive. Need to understand impacts of damming upstream; seasonal releases?	
M11T1.03-A	Protect River Corridors	Next Highest	Next Highest	Y	ensure any crossings meet general permit at minimum; wooded corridor does not seem at high risk for development, but additional stream crossing mid-reach could impact already diminished attenuation assets; downstream becomes more confined	
M11T1.07-A	Stream Buffers	Next Highest	Next Highest	Y	low-cost plantings, refrain from mowing to edge of stream; ledge grade controls increase risk of rapid lateral migrations	
M11T1.07-B	Stream Buffers	Next Highest	Next Highest	Y	Stream mowed to banks in vicinity of driveway culvert to 162 Topsham Rd	

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M12S2.01-B	Remove/Replace Structures	Next Highest	Next Highest	Y	Upstream culvert more undersized, higher priority but more constrained by nearby development; downstream bridge replaced 2006, substantial concrete (places road at higher risk), undersized and effective width reduced by angle	
M15T2.02-0	Stream Buffers	Next Highest	Next Highest	Y	Deeply incised, erodible; wood important to stream dynamics and rebuilding floodplain access	
M15T2.01-0	Stream Buffers	Medium	Next Highest	Y	Widen buffers by hayfields, residential area; alder-dominated naturally, critical to bank stability and soil retention as widening is primary adjustment - but beavers likely to impact	
M11T1.06-B	Watershed Strategies	Medium	Next Highest	Y	culvert replacements, drainage management to increase infiltration and filtering through vegetation upstream should reduce sediment and nutrient loading here	

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M19T4.05-0	Restore Incised Reach	Medium	Next Highest	Y	high priority river corridor protection at downstream reach M19T4.03 to attenuate flow and sediment transported through channelized reaches	
M14-0	Remove/Replace Structures	Very High	Medium	Y	replace farm bridge; undersized and skewed to stream	
M15-0	Remove Berms	Very High	Medium	N	lower old railbed to reconnect floodplain behind it; corridor now protected-find out to what extent	
M15-0	Restore Incised Reach	Very High	Medium	N	passive with active component of railbed lowering; not deeply incised	
M16-0	Protect River Corridors	Very High	Medium	N	Retain post-Irene guidance for landowners for buyout options if needed in future (dwelling on riverside of RR bed).	
M19-0	Remove/Replace Structures	Very High	Medium	Y	Replace Cochran Rd bridge-57 pct bkfw; substantial concrete structure makes it likely that rd will bear brunt of damage in a flood	
M20-0	Stream Buffers	Very High	Medium	Y	create-protect wider set-aside for natural regen, low-cost plantings with ample setback due to likely lateral adjustments	

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M11T1.03-C	Protect River Corridors	Very High	Medium	N	Channel management easement would greatly benefit reach, lend stability and reduce erosion in long term; significant attenuation assets also in close proximity downstream	
M11T1.03-C	Restore Incised Reach	Very High	Medium	N	Passive meander restoration throguh corridor protection (channel management easement possibility). Animal crossings may need gated access and off stream watering set-up. Size any bridge replacements to bankfull width plus, preferably on block outside channel width. Prority only reduced by presence of downstream attenuation assets.	
M11T1.04-0	Remove/Replace Structures	Very High	Medium	Y	Low clearance 1928 bridge with cracked parapet wall; structure likely to pass water but not sediment and wood, substantial concrete increases risk of outflanking	

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M11T1.05-0	Protect River Corridors	Very High	Medium	Y	Homestead off right bank in downstream half of reach had multiple undersized structures and development encroachments. Critical that any easements in this area include a wide buffer and channel management rights due to stream dynamics that are likely to impact encroachments.	
M11T1.05-0	Restore Incised Reach	Very High	Medium	N	Remove encroachments (bridges, outbuildings), pursue corridor protection	
M11T1.07-A	Watershed Strategies	Very High	Medium	Y	Address undersized structures (capital budget planning, develop/clarify options for private structures), stormwater management to increase infiltration and filtration through vegetation	
M11T1.07-B	Watershed Strategies	Very High	Medium	Y	Address undersized structures (capital budget planning, develop/clarify options for private structures)	

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M11T1.08-A	Restore Incised Reach	Very High	Medium	Y	Passive; allow wood to play critical role in retaining sediments and rebuilding floodplain access	
M12S2.01-B	Protect River Corridors	Very High	Medium	Y	Limited but important possibility for corridor protection on upstream end	
M12S2.02-0	Protect River Corridors	Very High	Medium	Y	Channel mgmnt easements might allow large wood to play appropriate important role is establishing more stability, encourage better buffers	
M15T2.01-0	Protect River Corridors	Very High	Medium	Y	Attenuation asset with Extreme sensitivity, possible development pressure; crucial to prevent encroachment if railbed is ever to be addressed	
M15T2.01-0	Remove/Replace Structures	Very High	Medium	N	Important to watershed dynamics (loss of soils, but fines contribute to wash load not bed load, not benefical to stability); complicated by property impacts, ideally part of reach restoration	
M15T2.03-B	Remove/Replace Structures	Very High	Medium	Y	undersized Powder Spring Rd culvert increases risk to road	

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M19T4.05-0	Stream Buffers	Very High	Medium	Y	passive or low cost due to lateral instability, existing armoring may buy some time for buffer establishment that will be more beneficial in long term; set-back important, ideally part of corridor protection-passive restoration	
M19T4.06-D	Remove/Replace Structures	Very High	Medium	Y	likely recently replaced or repaired, still undersized; rd may be at risk from avulsion	
M16-0	Stream Buffers	Next Highest	Medium	Y	create-protect wider set-aside for natural regen, low-cost plantings with ample setback due to lateral instability; US end in particular	
M17-A	Stream Buffers	Next Highest	Medium	Y	create-protect wider set-aside for natural regen, low-cost plantingswith ample setback due to lateral instability; US end in particular	

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M19-0	Stream Buffers	Next Highest	Medium	Y	low-cost plantings US and DS ends-US end a good buffer would create more of a physical floodbreak for house at mouth of South Branch; otherwise natural regen and low-cost plantings with ample setback for a wider buffer	
M21-0	Remove/Replace Structures	Next Highest	Medium	Y	replace bridge at 304 State Forest Rd (Rte 232) with longer span	
M22-0	Stream Buffers	Next Highest	Medium	Y	localized buffers missing - lawn settings and roadside (roadside likely requires additional considerations for anything beside natural regen)	
M11T1.03-C	Remove/Replace Structures	Next Highest	Medium	Y	Sugarbush access bridge could be placed on waste bloock outside cahnnel width off right bank to increase floodplain access and reduce scour on both banks	

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M11T1.04-0	Restore Incised Reach	Next Highest	Medium	N	Primarily passive restoration: large woody debris currently at diminished levels, likely to change with time; important to size bridge replacement to accommodate wood and sediment as well as water - consider removal of berm just US of bridge at same time as replacement	
M11T1.05-0	Remove/Replace Structures	Next Highest	Medium	Y	Culvert on woods road highly prone to failure, if replaced a bridge would be better and alingment should be addressed. If sugarhouse bridges need to be replaced, place on block outside channel width; portable modular would be even better	
M11T1.08-A	Remove/Replace Structures	Next Highest	Medium	Y	Topsham Rd culvert undersized, prone to fail, header open to erosion; culvert on trail beneath pond extremely undersized, perched, plugged inrecent floods	

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M12S2.02-0	Remove/Replace Structures	Next Highest	Medium	Y	Hall Rd culvert significantly undersized-scour currently localized but rd also at risk. Farm bridge short distance downstream may not be in use, best option removal; if replaced, consider design on waste blocks outside channel width	
M14S2.01-0	Stream Buffers	Next Highest	Medium	Y	Create-protect wider buffer. Natural regen may be possible, some parent sources present. Ideally part of restoration of incised reach, but low-cost plantings would still be a benefit and could establish due to armoring	
M14S2.01-0	Remove/Replace Structures	Next Highest	Medium	Y	Minimal gains unless other restoration of incised reach occurs	
M15S1.01-B	Stream Buffers	Next Highest	Medium	N	Lawn areas might be planted but most missing buffers due to rd encroachment and need additional considerations for a buffer to establish; ideally part of incised reach restoration	

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M16S1.01-B	Protect River Corridors	Next Highest	Medium	Y	corridor relatively undeveloped but limited attenuation asset-small pockets over multiple parcels-municipal corridor protection high value for risk reduction (rapid planform changes especially)	
M18T3.02-0	Stream Buffers	Next Highest	Medium	Y	limited planting opportunity on upstream end of reach, augmenting existing; primarily ensuring integrity of existing buffers as impacts greatly increase risk of mass failures	
M19T4.02-0	Remove/Replace Structures	Next Highest	Medium	Y	Private bridge restricts floodplain access at a critical juncture where grade controls give some possibility of retaining it, but floodplain gains may be limited even in best of scenarios	
M17-A	Remove/Replace Structures	Medium	Medium	N	Powder Spring Rd bridge is 65 pct bkfw but replacement is severely constrained by surrounding development; currently increases flood impacts downstream	

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M20-0	Protect River Corridors	Medium	Medium	Y	Beaver wetlands deter encroachment LB, but RB more at risk. Lateral adjustments likely; limit structure encroachments, including rec area	
M21-0	Stream Buffers	Medium	Medium	N	missing buffers important but primarily along roadside, would likely require additional considerations for anything beside natural regen	
M11T1.06-B	Protect River Corridors	Medium	Medium	Y	important attenuation asset for upstream impacts, should technically already have some protections-Class 2 wetland-maintain compliance	
M11T1.08-A	Protect River Corridors	Medium	Medium	Y	Low probability of further development (distant from road) but municipal corridor protection including small stream setbacks would help	
M12S2.01-A	Stream Buffers	Medium	Medium	Y	Lawn areas might be planted but many missing buffers due to rd encroachment and need additional considerations for a buffer to establish	

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M12S2.01-B	Stream Buffers	Medium	Medium	Y	Possibility for wider natural regen and low cost planting (with ample setback) on US end; lawn areas might be planted but many missing buffers due to rd encroachment and need additional considerations for a buffer to establish	
M16S1.01-A	Stream Buffers	Medium	Medium	Y	create-protect buffer, low-cost plantings need ample setback - preference to shrubs near solar array; ideally part of passive floodplain and meander restoration	
M16S1.01-B	Stream Buffers	Medium	Medium	Y	natural regen or low-cost planting upstream in vicinity of Minard Hill Site # 1 (road erosion inventory and capital planning 2015-2019)	

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M18T3.01-0	Stream Buffers	Medium	Medium	Y	Ample setbacks for low-cost plantings as missing buffers are often in vicinity of active erosion; existing armoring might be leveraged for some time for buffer establishment before it fails - buffers far better for long term dynamics and stability; natural regen also	
M18T3.02-0	Remove/Replace Structures	Medium	Medium	Y	placing footbridge on upstream end of reach on waste block on top of banks outside channel would reduce erosion; structure is wood, not a significant floodplain constriction	
M19T4.01-A	Stream Buffers	Medium	Medium	Y	Missing buffers primarily in areas of overwidened stream, windrowing, riprap; buffers important but limited planting (ample setback, natural regen with focus on flood and ice scour tolerant species due to overwidened state)	

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M19T4.01-B	Stream Buffers	Medium	Medium	Y	Missing buffers primarily in areas of overwidened stream, windrowing, riprap; buffers important but limited planting (ample setback, natural regen with focus on flood and ice scour tolerant species due to overwidened state)	
M19T4.06-A	Remove/Replace Structures	Medium	Medium	Y	consider impacts to land use, structures DS	
M11-0	Restore Incised Reach	Next Highest	Low	N	Low priority due esp. to hydrologic (stormwater) changes. May be opportunities to address lowering old railbed, primary foci US Pinehurst Cemetery and DS Creamery Rd bridge. DS Creamery Rd bridge a short berm adds to railbed height by seasonal camp.	
M12-0	Stream Buffers	Next Highest	Low	Y	protect wider set-aside for natural regen, low-cost plantings with ample setback thru much of reach; narrow buffers present, parent sources exist	

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M12-0	Remove/Replace Structures	Next Highest	Low	Y	wooden pilings on LB below Church St bridge non-functional but limited gains from removal; Church St bridge 88 pct bkfw, also limited gains	
M14S2.02-0	Stream Buffers	Next Highest	Low	Y	Encourage revegetation of areas near erosion-mass failures; could be passive, but refrain from impacting buffers	
M10-B	Stream Buffers	Medium	Low	Y	create set-aside for natural regen, low-cost planting (with ample setback) along Rte 302 upstream of segment break (old RR abutments)	
M15T2.03-A	Protect River Corridors	Medium	Low	Y	appears likely mostly under single ownership, but limited access reduces development pressure	
M15T2.03-A	Stream Buffers	Medium	Low	Y	left bank mowed in vicinity of old mill site; large wood plays important role in stream dynamics, but other wood is making it to stream and erosion is limited	

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M19T4.02-0	Stream Buffers	Medium	Low	N	missing buffers important but primarily along roadside, would likely require additional considerations for anything beside natural regen	
M19T4.03-A	Stream Buffers	Medium	Low	Y	primarily by dwellings along banks - reestablish or plant to widen-ample setbacks	
M19T4.06-D	Protect River Corridors	Medium	Low	Y	state land; bridge is larger issue	
M11T1.06-B	Stream Buffers	Low	Low	Y	reed canary grass well established and likely to inhibit tree establishment, as well as beavers; does not appear to be in active ag use, may establish woody veg eventually on its own and has herbaceous wetland vegetation present currently	
M12S2.01-A	Remove/Replace Structures	Low	Low	N	Four structures all significantly undersized but currently difficult to remedy due to pervasive development encroachments. Creamery Rd box culvert headers washing out but limited in extent of potential sediment contribution	

River Segment	*Project*	*Reach Priority*	*Watershed Priority*	*Completed Independent of Other Practices*	*Next Steps and Other Project Notes*	reach-scale rank
M12S2.01-A	Restore Incised Reach	Low	Low	N	High priority corridor protection DS, likely in reach M10 at this point in time, to attenuate elevated flows and sediment discharges through channelized reach	
M11T1.03-B	Excluded				EXCLUDED SEGMENT (active beaverponds and wetlands, access issues on upstream end	
M11T1.06-A	Excluded				EXCLUDED SEGMENT (active beaver ponds and wetlands, frequent lack of defined channel)	
M11T1.08-B	Excluded				EXCLUDED SEGMENT (active beaver-human pond, blown ponds upstream with subsurface channel)	

– Appendix 7 –

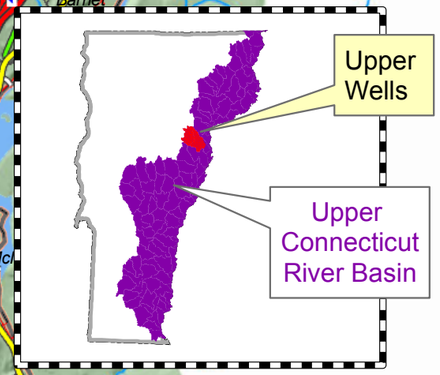
Large Format (11x17) Maps

Reach maps

Analysis maps

Overview
Land cover/ Land use
Hydrologic alterations
Sediment load indicators
Channel slope modifiers
Channel depth modifiers
Boundary condition and riparian modifiers
Constraints to channel evolution
Sediment regime departure
Stream sensitivity

Upper Wells 2016 Phase 2 Stream Geomorphic Assessment



Groton Management Unit (VT ANR)

North Branch Wells River

Tannery Brook

Clark Hatch Brook

Darius James Brook

Stone Road Brook

South Branch Wells River

Keenan Brook

Wells mainstem

Pine Mtn WMA (VT Dept Fish & Wildlife)

Scott Brook

Upper Wells Ph2 rchbrks
Upper Wells Ph2 reaches
Wells reaches
Upper Wells basin
Wells River basin
Roads (E911)

0 1 2 3 4 Miles

Upper Wells 2015-16 Phase 2 Stream Geomorphic Assessment: Land cover/Land use

Peacham Corner
Lanesboro
Green Bay
South Peacham
S Main St
Peacham Groton Rd
West Barnet
W Barnet Rd
Groton Rd
Boulder Beach Rd
232
Mosquitoville
Peacham Rd
Lakeside
Ricker Mills
Ricker Mills
Minard Hill Rd
M22
M21
M20
M19
M18T3.02
M18T3.01
M19T4.06
M19T4.05
M19T4.04
M19T4.03
M19T4.02
M19T4.01
West Groton
Groton
M18
M17
M16S1.01
M16
M15T2.03
M15T2.02
M15
M14S2.02
M14S2.01
M14
302
Powder Spring Rd
Ryegate Corner
M12S2.02
M12S2.01
M13
M12
M11T1.02
M11
M11T1.03
M10
Scotch Hollow Rd
M11T1.04
M11T1.05
M11T1.06
M11T1.07
M11T1.08
Newbury Center
East Topsham
Topsham Four Corners
Swamp Rd
Walts River
91

Land cover_land use
- **Agricultural & other**
- **Urban/Built-up**
- **Forest**
- **Water**

Upper Wells basin
Hydric soils x ag-urban

0 0.5 1 1.5 2 Miles

Upper Wells 2015-16 SGA Hydrologic alterations*

*SGA: Stream Geomorphic Assessment

All "crop" land use assessments, at both subwatershed and cumulative stream impact levels, indicated 'low' impacts

Urban - Cumulative upstream effect

- Low (< 5%)
- Moderate (>= 5% and < 10%)
- High (>= 10% and < 20%)
- Stormwater Input

Urban by subwatershed

- Moderate (>= 5% and < 10%)
- High (>= 10% and < 20%)
- Extreme (>= 20%)
- Unassessed

- UpWells_rchbrks
- UpWells_segbrks
- Roads (E911)

0 0.5 1 1.5 2 Miles

N

Upper Wells 2015-16 SGA: Sediment Load Indicators*

*SGA: Stream Geomorphic Assessment

Avulsion
Steep Riffle
Braiding
Mass Failure

Erosion

Left Bank
Right Bank
Trib rejuvenation

UpWells_rchbrks
UpWells_segbrks
Roads (E911)

Miles
0 0.5 1 1.5 2

N

Jennison Mountain
Beaver Pond
Jerry Lund Mountain
Groton Pond
Levi Pond
Wesson Hill
Lakeside
Ricker Pond
Ricker Mills
Mosquitoville
McLam Pond
Blue Mountain
West Groton
Groton
Ryegate Corner
Whitcher Mountain
South Ryegate
Pine Mountains
White Hill
Melvin Hill
Burnham Mountain
Boltonville
Tenney Pond
Norwich Reservoir
Galusha Hill
Mason Mountain
Eastman Pond
Newbury Center
East Topsham
Pierson Hill
Williams Hill
Leighton Hill
Muddy Pond
Long Pond
Round Pond
Currier Hill
Woodchuck Mountain
Tucker Mountain
Brock Hill

Groton Rd
Peacham Rd
Witherspoon Rd
Powder Spring Rd
Scotch Hollow Rd
Topsham Four Corners
Swamp Rd

Upper Wells 2015-16 SGA: Channel Slope Modifiers

SGA: Stream Geomorphic Assessment

Slope decreases

- Human-made grade control
- Natural grade control
- Beaver Dam

Slope increases

- Mass Failure
- Development/encroachment
- Straightening
- With Windrowing
- >=50% straightened
- Head Cut
- Avulsion

Ricker Pond
Ricker Mills
Noyes Pond
West Groton
Groton
Ryegate Corner
South Ryegate
Boltonville
Norwich Reservoir
Tenney Pond
Mimard Hill Rd
Witherspoon Rd
East Rd
S Bayley Hazen Rd
Powder Spring Rd
Creamery Rd
Boltonville Rd
Swamp Rd
Scotch Hollow Rd
EXIT 17
232
M22
M21
M20
M19
M18
M17
M15
M14
M12
M11
M10
M19T4.06
M19T4.05
M19T4.04
M19T4.03
M19T4.02
M19T4.01
M18T3.02
M18T3.01
M16S1.01
M14S2.02
M15T2.03
M15T2.02
M15S1.01
M14S2.01
M12S2.02
M12S2.01
M11T1.02
M11T1.03
M11T1.04
M11T1.05
M11T1.06
M11T1.07
M11T1.08
25
302
91

UpWells_rchbrks
UpWells_segbrks
Roads (E911)

0 0.5 1 1.5 2 Miles

N

Upper Wells 2015-16 SGA: Channel Depth Modifers

*SGA: Stream Geomorphic Assessment

Depth increases
- Bridge or Culvert
- Roads (E911)
- Berm
- Stormwater Input

Encroachment range
- <5%
- >5% <=20%
- >20%

Depth Decreases
- Beaver Dam
- Steep Riffle
- Stream Ford
- Dam
- Roads (E911)

Depositon features/mi
- <=2
- >2 <= 5
- > 5

M22 M21 M20 M19 M18 M17 M16 M15 M14 M12 M11 M10

M19T4.06 M19T4.05 M19T4.04 M19T4.03 M19T4.02 M19T4.01 M18T3.02 M18T2.01 M16S1.01 M15T2.03 M15T2.02 M14S2.02 M14S2.01 M12S2.02 M12S2.01 M11T1.01 M11T1.02 M11T1.03 M11T1.04 M11T1.05 M11T1.06 M11T1.07 M11T1.08

B C D

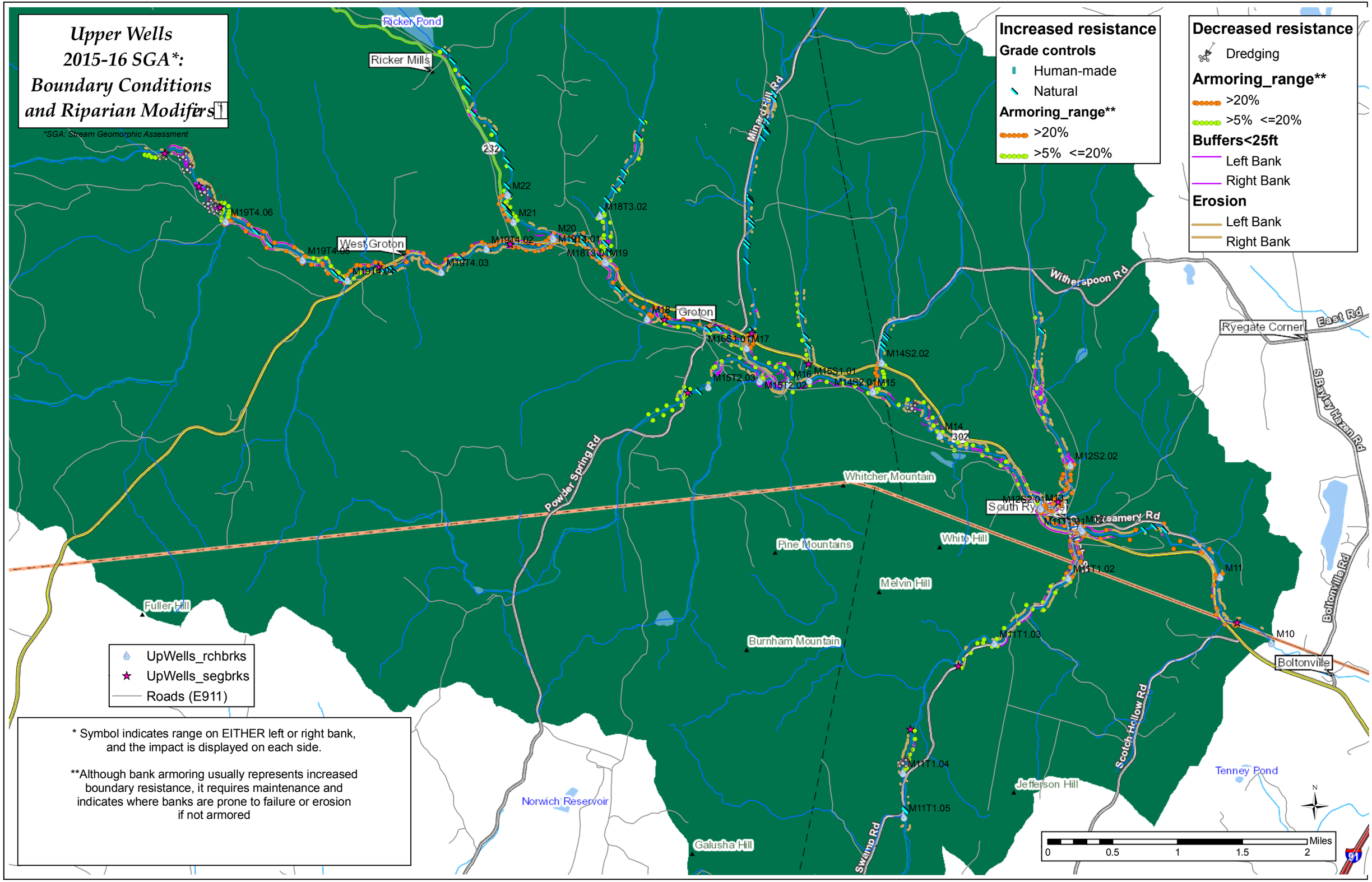
UpWells_segbrks
UpWells_rchbrks
Roads (E911)

N

Miles
0 0.5 1 1.5 2

Upper Wells 2015-16 SGA: Boundary Conditions and Riparian Modifers*

*SGA: Stream Geomorphic Assessment



* Symbol indicates range on EITHER left or right bank, and the impact is displayed on each side.

**Although bank armoring usually represents increased boundary resistance, it requires maintenance and indicates where banks are prone to failure or erosion if not armored

Upper Wells 2015-16 SGA: Constraints to Channel Evolution*

*SGA: Stream Geomorphic Assessment

Grade controls
- Human-made
- Natural
- Lateral constraints

Existing sediment regime
- Coarse Equilibrium (in = out) and Fine Deposition
- Confined Source and Transport
- Unconfined Source and Transport
- Fine Source and Transport and Coarse Deposition

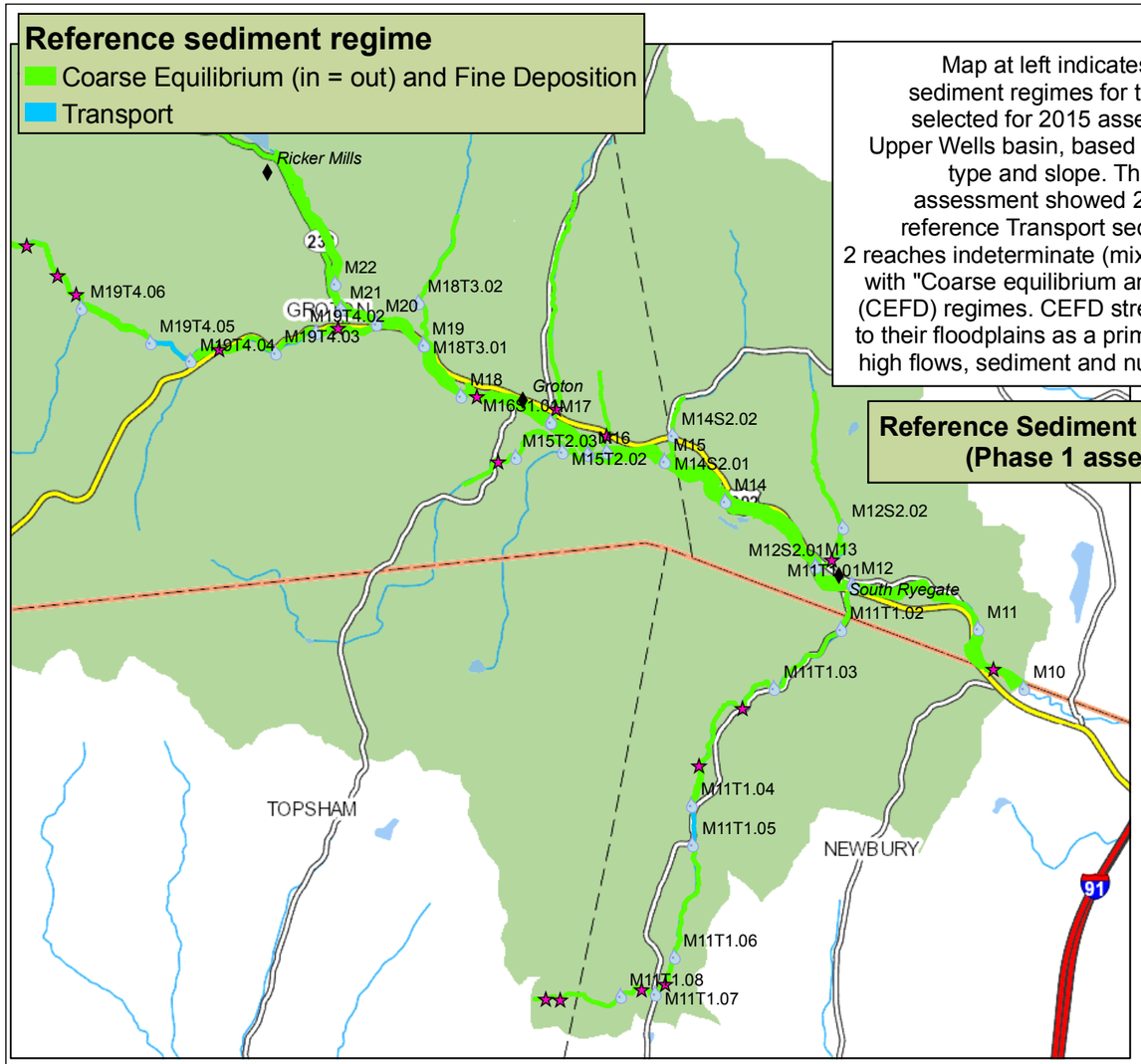
- UpWells_rchbrks
- UpWells_segbrks
- Roads (E911)

0 0.5 1 1.5 2 Miles

Ricker Pond
Ricker Mill$
Noyes Pond
McLam Pond
West Groton
Groton
Ryegate Corner
South Ryegate
Boltonville
Tenney Pond
Norwich Reservoir
Eastman Pond
Witherspoon Rd
Powder Spring Rd
Swamp Rd
Scotch Hollow Rd
East Rd
S Bayley Hazen Rd
Boltonville Rd
Kinneman Rd
EXIT 17
25
91
302

Upper Wells 2015-16 SGA: Sediment Regime Departure*

**SGA: Stream Geomorphic Assessment*

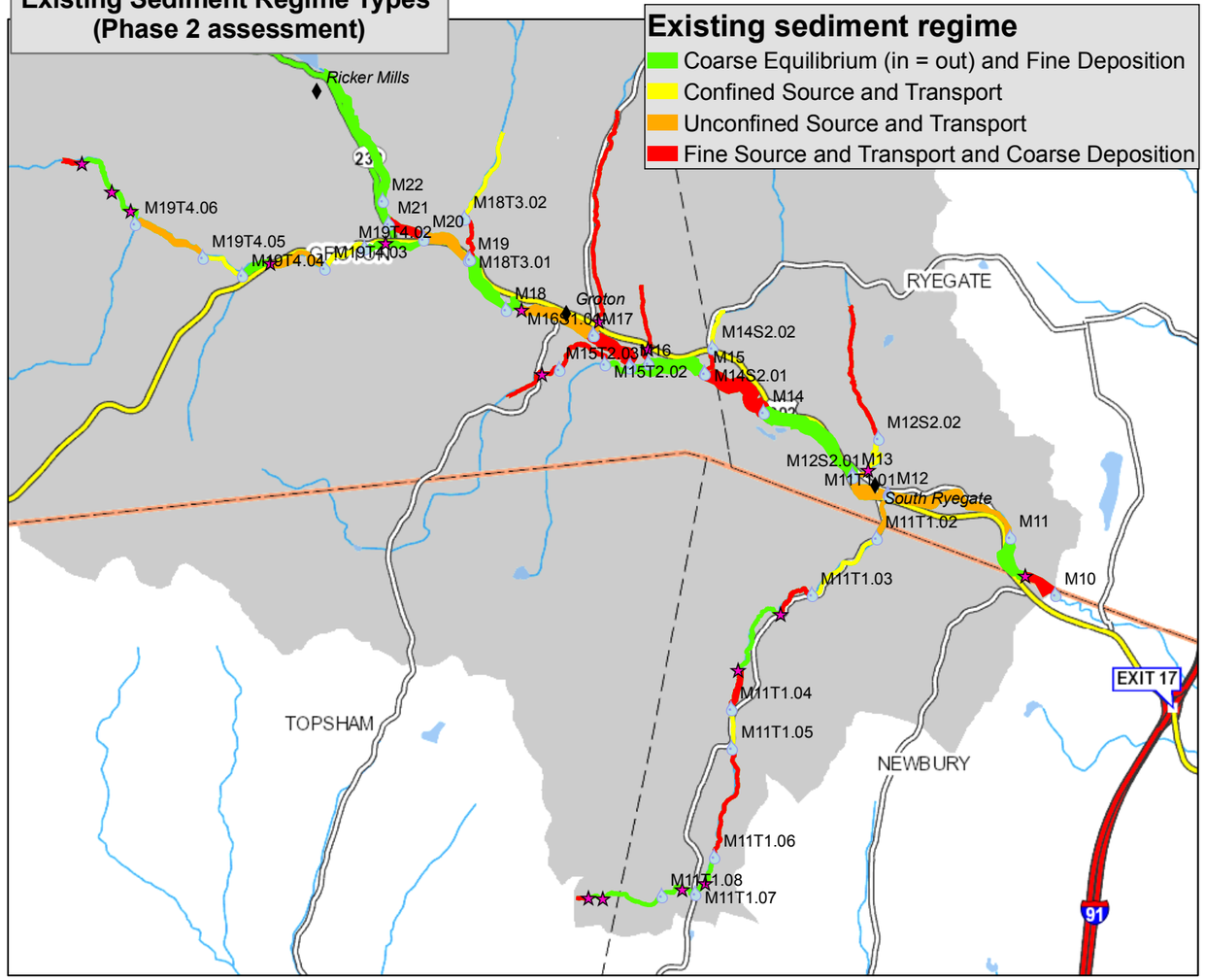


Reference Sediment Regime Types (Phase 1 assessment)

Map at left indicates reference sediment regimes for the 38 reaches selected for 2015 assessment in the Upper Wells basin, based primarily on valley type and slope. This Phase 1 assessment showed 2 reaches with reference Transport sediment regimes, 2 reaches indeterminate (mixed), and 34 reaches with "Coarse equilibrium and Fine Deposition" (CEFD) regimes. CEFD streams utilize access to their floodplains as a primary means to store high flows, sediment and nutrients in the basin.

Due particularly to significant straightening leading to historic incision (downcutting) through highly erodible sediments, Phase 2 field work (map below) indicated roughly two-thirds of the former CEFD reaches have now been converted to some sort of Transport sediment regime.

Existing Sediment Regime Types (Phase 2 assessment)



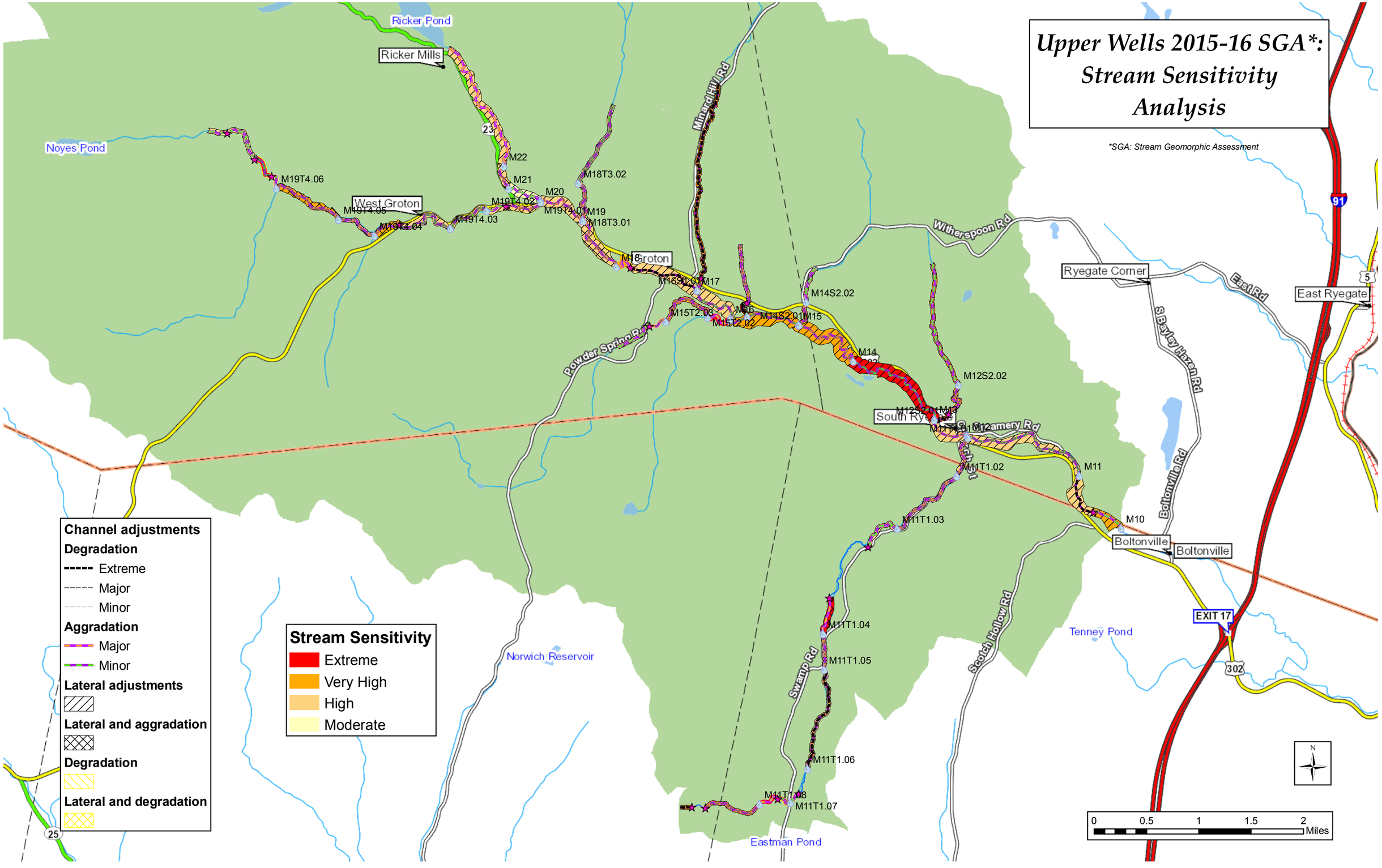
The good news for flood resilience and stream health in the Upper Wells basin is that stream segments that retain a CEFD sediment regime are well distributed thoguh most of the stream network. Coarse sediment deposits and large woody debris, the raw materials for rebuilding access to restricted floodplains - particularly if floodplain encroachments don't conflict with these highly valuable processes - are redstributing through the network as a series of former channel constrictions including bridges and dams have been removed or resized.

Straightening along stream corridors, current and historic, still limits natural diffusion of stream power through meander formation and accompanying slope reduction in numerous areas. Heightened flood impacts are thus felt by extensive encroachments in the narrow valleys.

Sizing bridges adequately to pass water, sediment and wood is extremely important, as is limiting encroachments on the stream corridor. Hazard mitigation and emergency operations planning for existing encroachments are high priorities.

Upper Wells 2015-16 SGA: Stream Sensitivity Analysis*

*SGA: Stream Geomorphic Assessment



– Appendix 7 –

Large Format (11x17) Maps

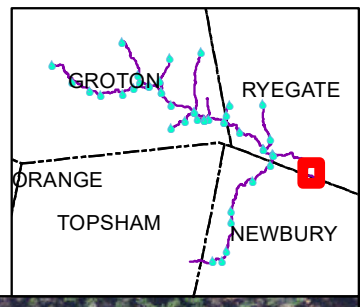
Reach maps

Analysis maps

Overview
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Hydrologic alterations
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Channel depth modifiers
Boundary condition and riparian modifiers
Constraints to channel evolution
Sediment regime departure
Stream sensitivity

Upper Wells Ph2 SGA 2015-16
Reach M10

0 500 Feet
0 0.1 Miles



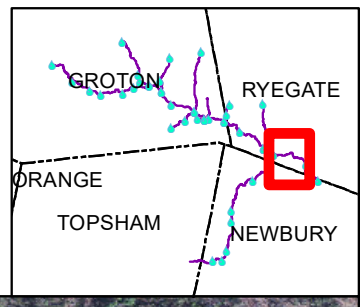


- Animal Crossing
- Avulsion
- Braiding
- Bridge
- Culvert
- Dam
- Dredging
- Flood Chute
- Head Cut
- Ledge
- Migration
- Neck Cutoff
- Steep Riffle
- Stream Ford
- Waterfall
- Weir
- Alluvial Fan
- Beaver Dam
- Cross Section
- Debris Jam
- Withdrawals
- Gully
- Stormwater Input
- Stream Crossing

- Bank Armoring
- Buffers <25 ft
- Erosion
- Mass Failure
- Berm Both Sides
- Berm One Side
- valley wall
- Development both sides
- Encroachment both sides
- Development one side
- Encroachment one side
- Straightening
- With Windrowing
- SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M11

0 500 Feet
0 0.35 Miles



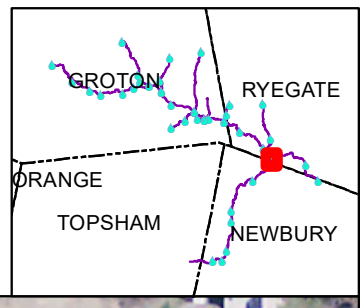


- Animal Crossing
- Avulsion
- Braiding
- Bridge
- Culvert
- Dam
- Dredging
- Flood Chute
- Head Cut
- Ledge
- Migration
- Neck Cutoff
- Steep Riffle
- Stream Ford
- Waterfall
- Weir
- Alluvial Fan
- Beaver Dam
- Cross Section
- Debris Jam
- Withdrawals
- Gully
- Stormwater Input
- Stream Crossing

- Bank Armoring
- Buffers <25 ft
- Erosion
- Mass Failure
- Berm Both Sides
- Berm One Side
- valley wall
- Development both sides
- Encroachment both sides
- Development one side
- Encroachment one side
- Straightening
- With Windrowing
- SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M11T1.01

0 500 Feet
0 0.095 Miles

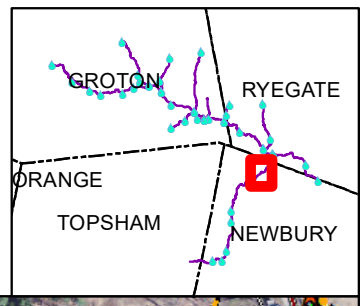


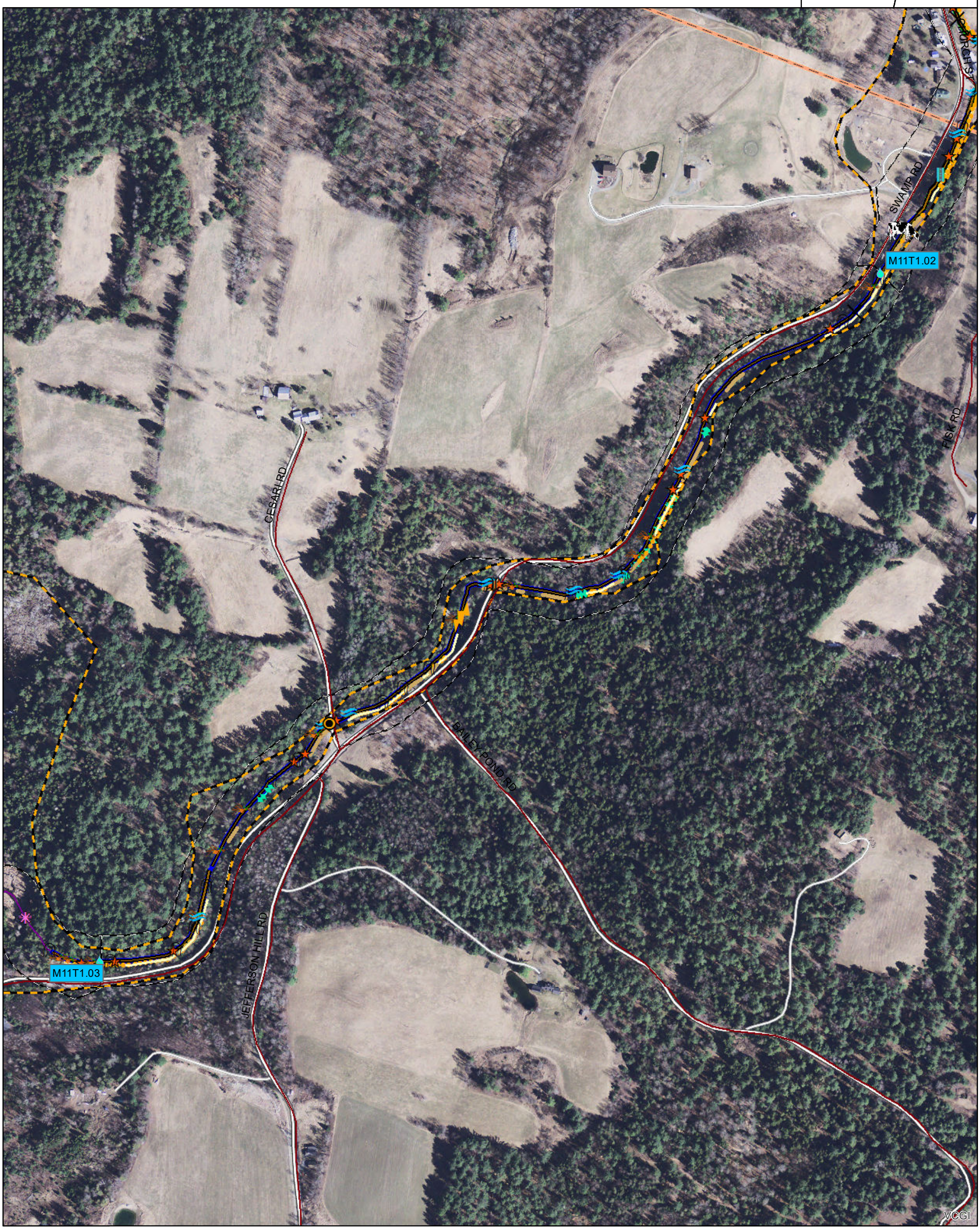


- Animal Crossing
- Avulsion
- Braiding
- Bridge
- Culvert
- Dam
- Dredging
- Flood Chute
- Head Cut
- Ledge
- Migration
- Neck Cutoff
- Steep Riffle
- Stream Ford
- Waterfall
- Weir
- Alluvial Fan
- Beaver Dam
- Cross Section
- Debris Jam
- Withdrawals
- Gully
- Stormwater Input
- Stream Crossing
- Bank Armoring
- Buffers <25 ft
- Erosion
- Mass Failure
- Berm Both Sides
- Berm One Side
- valley wall
- Development both sides
- Encroachment both sides
- Development one side
- Encroachment one side
- Straightening
- With Windrowing
- SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M11T1.02

0 500 Feet
0 0.15 Miles



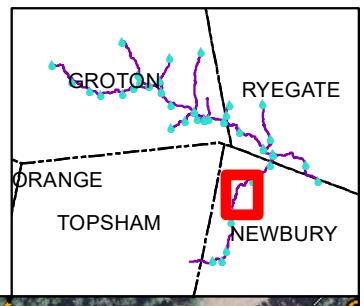


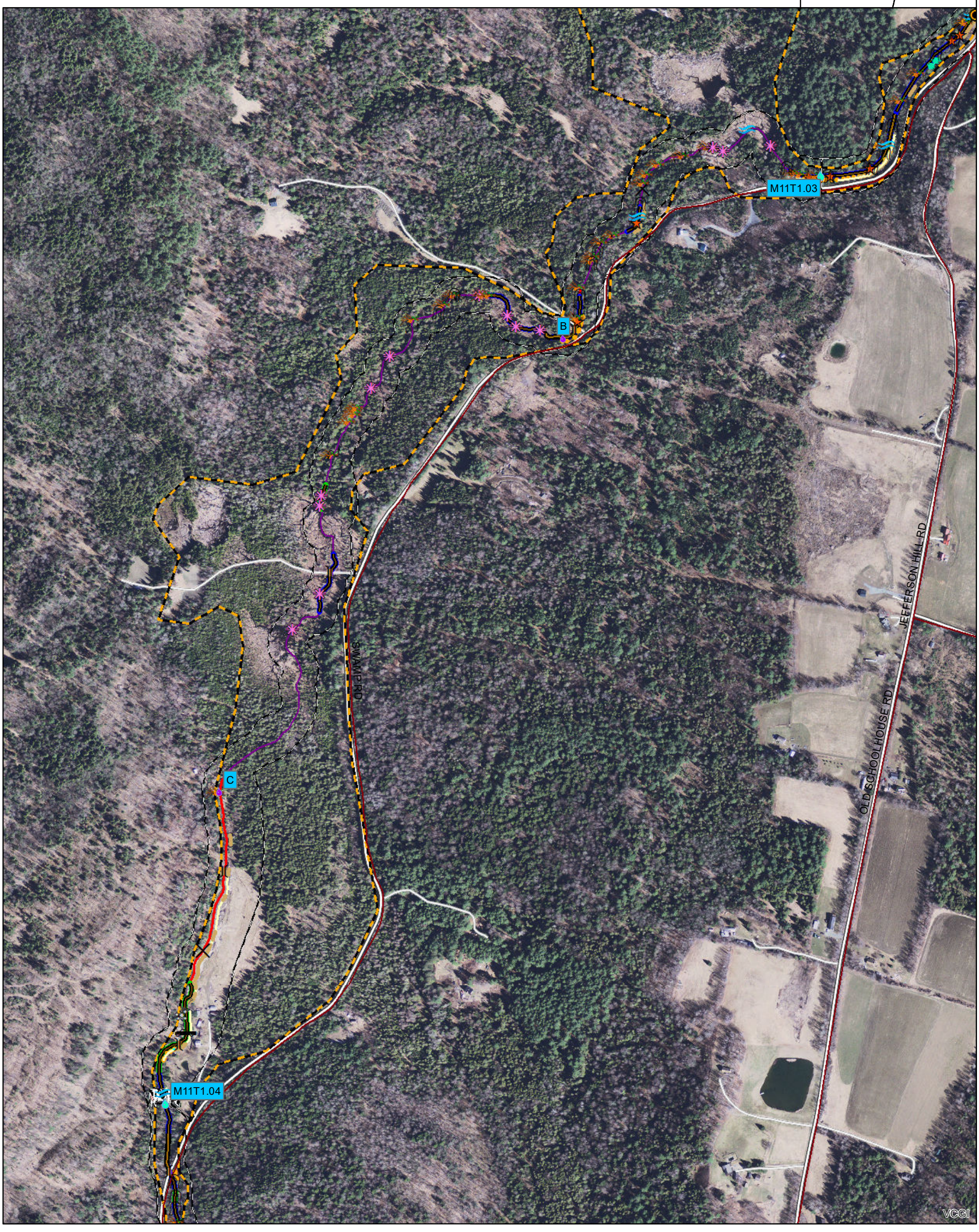
- Animal Crossing
- Avulsion
- Braiding
- Bridge
- Culvert
- Dam
- Dredging
- Flood Chute
- Head Cut
- Ledge
- Migration
- Neck Cutoff
- Steep Riffle
- Stream Ford
- Waterfall
- Weir
- Alluvial Fan
- Beaver Dam
- Cross Section
- Debris Jam
- Withdrawals
- Gully
- Stormwater Input
- Stream Crossing

- Bank Armoring
- Buffers <25 ft
- Erosion
- Mass Failure
- Berm Both Sides
- Berm One Side
- valley wall
- Development both sides
- Encroachment both sides
- Development one side
- Encroachment one side
- Straightening
- With Windrowing
- SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M11T1.03

0 500 Feet
0 0.25 Miles

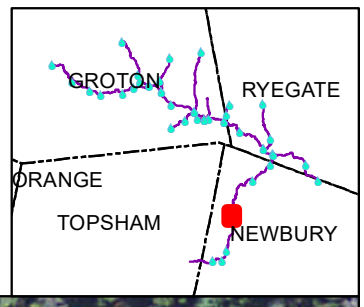




- Animal Crossing
- Avulsion
- Braiding
- Bridge
- Culvert
- Dam
- Dredging
- Flood Chute
- Head Cut
- Ledge
- Migration
- Neck Cutoff
- Steep Riffle
- Stream Ford
- Waterfall
- Weir
- Alluvial Fan
- Beaver Dam
- Cross Section
- Debris Jam
- Withdrawals
- Gully
- Stormwater Input
- Stream Crossing
- Bank Armoring
- Buffers <25 ft
- Erosion
- Mass Failure
- Berm Both Sides
- Berm One Side
- valley wall
- Development both sides
- Encroachment both sides
- Development one side
- Encroachment one side
- Straightening
- With Windrowing
- SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M11T1.04

0 500 Feet
0 0.09 Miles

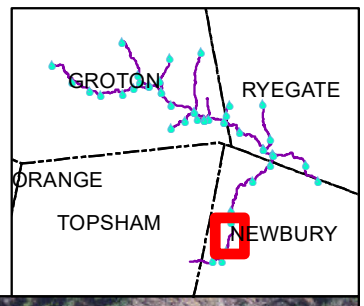




Animal Crossing
Avulsion
Braiding
Bridge
Culvert
Dam
Dredging
Flood Chute
Head Cut
Ledge
Migration
Neck Cutoff
Steep Riffle
Stream Ford
Waterfall
Weir
Alluvial Fan
Beaver Dam
Cross Section
Debris Jam
Withdrawals
Gully
Stormwater Input
Stream Crossing
Bank Armoring
Buffers <25 ft
Erosion
Mass Failure
Berm Both Sides
Berm One Side
valley wall
Development both sides
Encroachment both sides
Development one side
Encroachment one side
Straightening
With Windrowing
SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M11T1.05

0 500 Feet
0 0.25 Miles



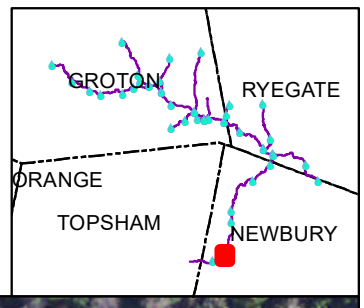
M11T1.05
M11T1.06
GRAPES RD
SWAMP RD
SAXIE WELCH TRL
JOHNS WAY
VCGI

Animal Crossing
Avulsion
Braiding
Bridge
Culvert
Dam
Dredging
Flood Chute
Head Cut
Ledge
Migration
Neck Cutoff
Steep Riffle
Stream Ford
Waterfall
Weir
Alluvial Fan
Beaver Dam
Cross Section
Debris Jam
Withdrawals
Gully
Stormwater Input
Stream Crossing

Bank Armoring
Buffers <25 ft
Erosion
Mass Failure
Berm Both Sides
Berm One Side
valley wall
Development both sides
Encroachment both sides
Development one side
Encroachment one side
Straightening
With Windrowing
SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M11T1.06

0 500 Feet
0 0.085 Miles



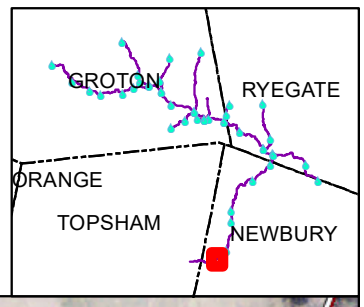


Animal Crossing
Avulsion
Braiding
Bridge
Culvert
Dam
Dredging
Flood Chute
Head Cut
Ledge
Migration
Neck Cutoff
Steep Riffle
Stream Ford
Waterfall
Weir
Alluvial Fan
Beaver Dam
Cross Section
Debris Jam
Withdrawals
Gully
Stormwater Input
Stream Crossing

Bank Armoring
Buffers <25 ft
Erosion
Mass Failure
Berm Both Sides
Berm One Side
valley wall
Development both sides
Encroachment both sides
Development one side
Encroachment one side
Straightening
With Windrowing
SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M11T1.07

0 500 Feet
0 0.095 Miles



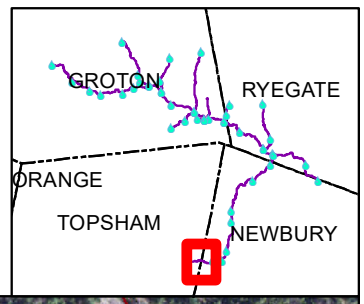


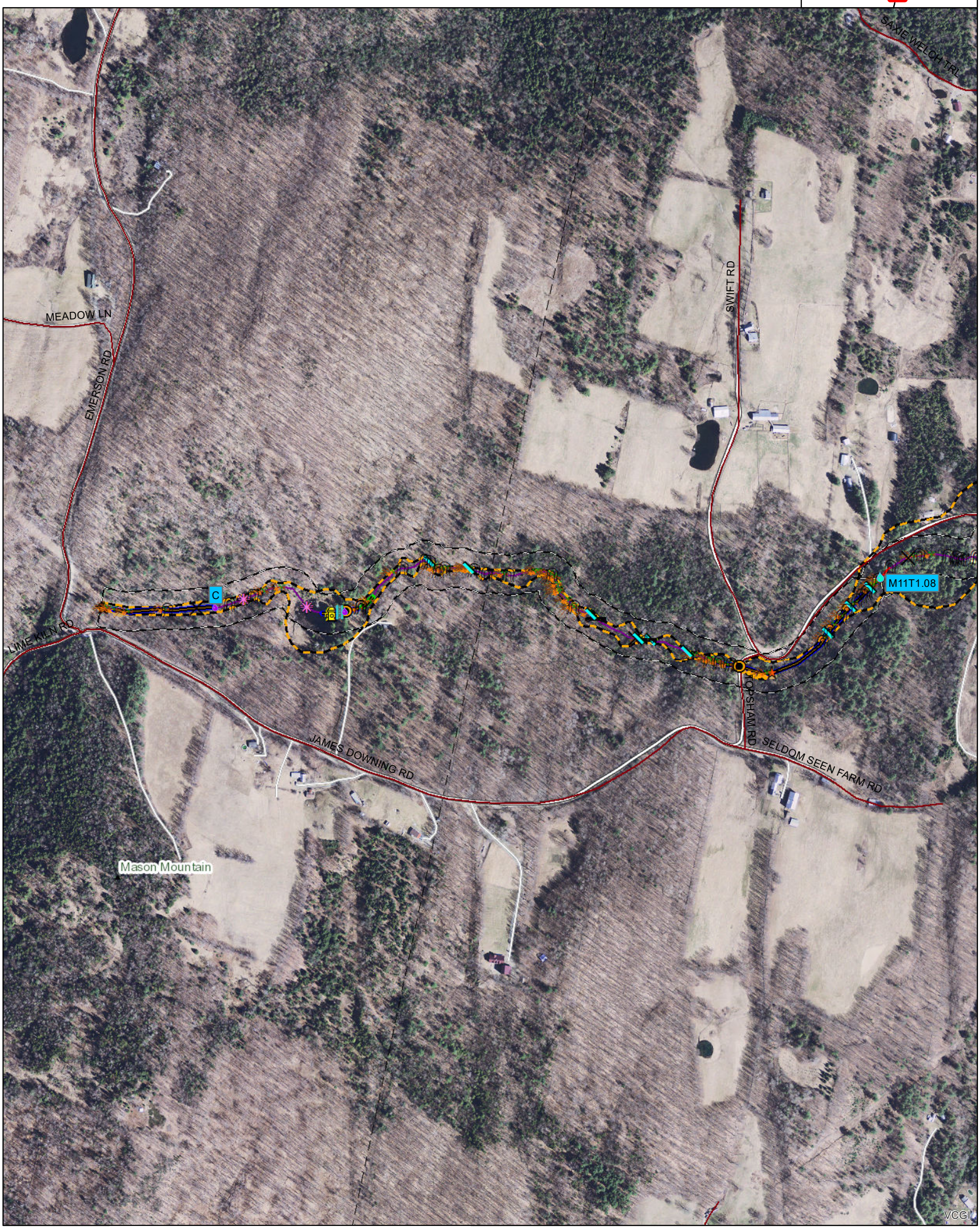
- Animal Crossing
- Avulsion
- Braiding
- Bridge
- Culvert
- Dam
- Dredging
- Flood Chute
- Head Cut
- Ledge
- Migration
- Neck Cutoff
- Steep Riffle
- Stream Ford
- Waterfall
- Weir
- Alluvial Fan
- Beaver Dam
- Cross Section
- Debris Jam
- Withdrawals
- Gully
- Stormwater Input
- Stream Crossing

- Bank Armoring
- Buffers <25 ft
- Erosion
- Mass Failure
- Berm Both Sides
- Berm One Side
- valley wall
- Development both sides
- Encroachment both sides
- Development one side
- Encroachment one side
- Straightening
- With Windrowing
- SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M11T1.08

0 500 Feet
0 0.25 Miles



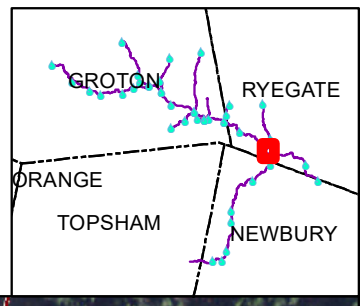


- Animal Crossing
- Avulsion
- Braiding
- Bridge
- Culvert
- Dam
- Dredging
- Flood Chute
- Head Cut
- Ledge
- Migration
- Neck Cutoff
- Steep Riffle
- Stream Ford
- Waterfall
- Weir
- Alluvial Fan
- Beaver Dam
- Cross Section
- Debris Jam
- Withdrawals
- Gully
- Stormwater Input
- Stream Crossing

- Bank Armoring
- Buffers <25 ft
- Erosion
- Mass Failure
- Berm Both Sides
- Berm One Side
- valley wall
- Development both sides
- Encroachment both sides
- Development one side
- Encroachment one side
- Straightening
- With Windrowing
- SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M12

0 500 Feet
0 0.1 Miles



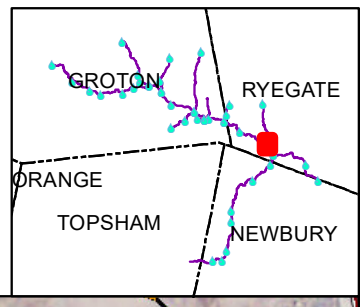


Animal Crossing
Avulsion
Braiding
Bridge
Culvert
Dam
Dredging
Flood Chute
Head Cut
Ledge
Migration
Neck Cutoff
Steep Riffle
Stream Ford
Waterfall
Weir
Alluvial Fan
Beaver Dam
Cross Section
Debris Jam
Withdrawals
Gully
Stormwater Input
Stream Crossing

Bank Armoring
Buffers <25 ft
Erosion
Mass Failure
Berm Both Sides
Berm One Side
valley wall
Development both sides
Encroachment both sides
Development one side
Encroachment one side
Straightening
With Windrowing
SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M12S2.01

0 500 Feet
0 0.095 Miles



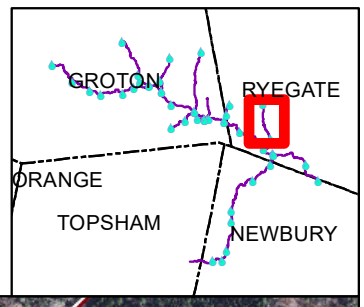


Animal Crossing
Avulsion
Braiding
Bridge
Culvert
Dam
Dredging
Flood Chute
Head Cut
Ledge
Migration
Neck Cutoff
Steep Riffle
Stream Ford
Waterfall
Weir
Alluvial Fan
Beaver Dam
Cross Section
Debris Jam
Withdrawals
Gully
Stormwater Input
Stream Crossing

Bank Armoring
Buffers <25 ft
Erosion
Mass Failure
Berm Both Sides
Berm One Side
valley wall
Development both sides
Encroachment both sides
Development one side
Encroachment one side
Straightening
With Windrowing
SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M12S2.02

0 500 Feet
0 0.3 Miles

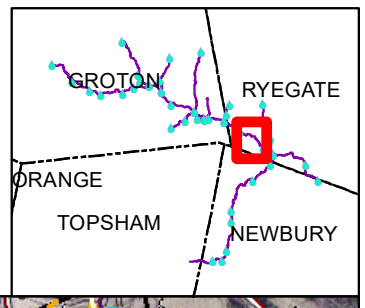


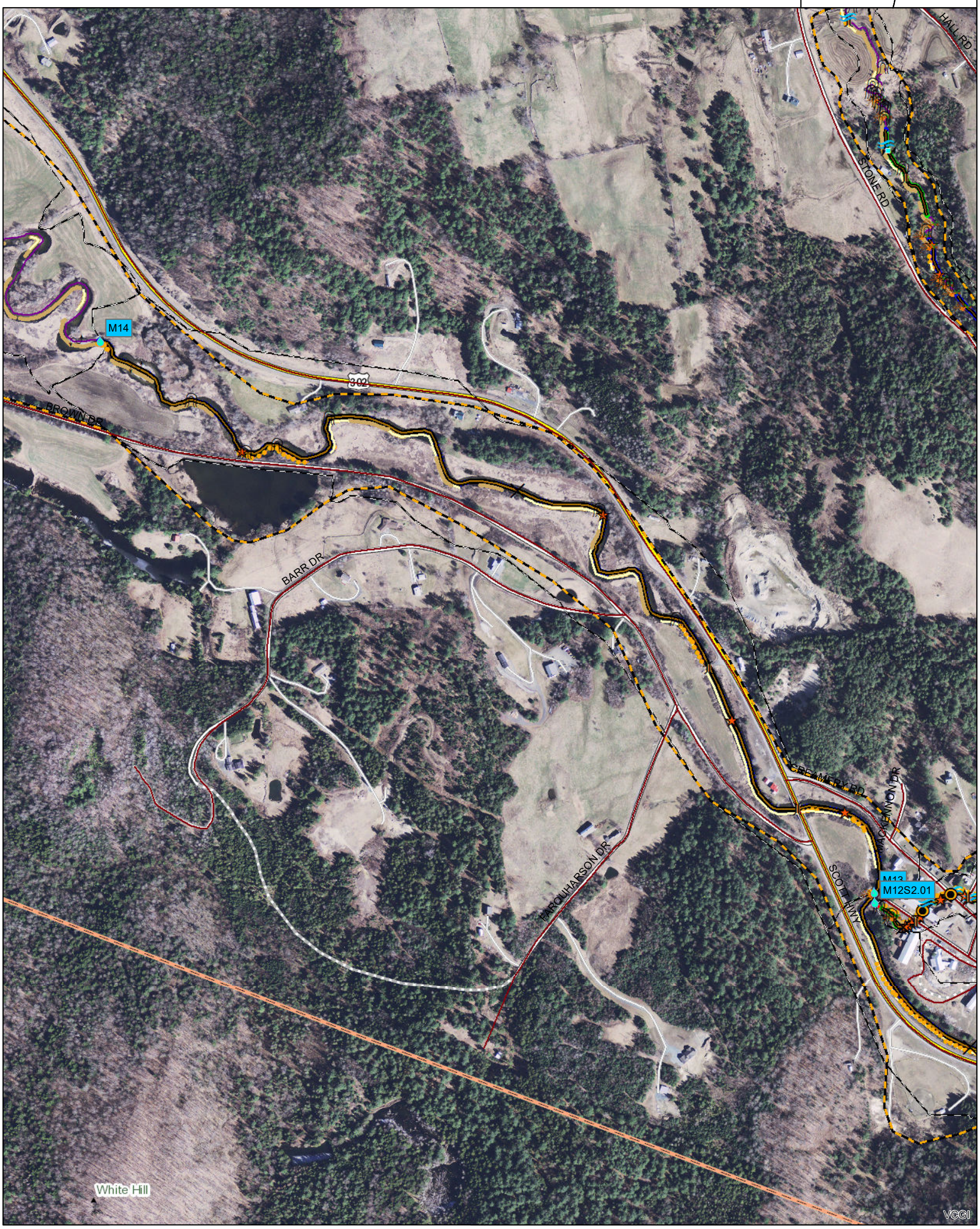


- Animal Crossing
- Avulsion
- Braiding
- Bridge
- Culvert
- Dam
- Dredging
- Flood Chute
- Head Cut
- Ledge
- Migration
- Neck Cutoff
- Steep Riffle
- Stream Ford
- Waterfall
- Weir
- Alluvial Fan
- Beaver Dam
- Cross Section
- Debris Jam
- Withdrawals
- Gully
- Stormwater Input
- Stream Crossing
- Bank Armoring
- Buffers <25 ft
- Erosion
- Mass Failure
- Berm Both Sides
- Berm One Side
- valley wall
- Development both sides
- Encroachment both sides
- Development one side
- Encroachment one side
- Straightening
- With Windrowing
- SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M13

0 500 Feet
0 0.25 Miles



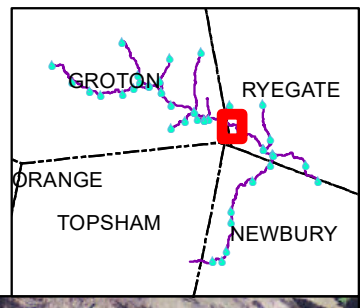


- Animal Crossing
- Avulsion
- Braiding
- Bridge
- Culvert
- Dam
- Dredging
- Flood Chute
- Head Cut
- Ledge
- Migration
- Neck Cutoff
- Steep Riffle
- Stream Ford
- Waterfall
- Weir
- Alluvial Fan
- Beaver Dam
- Cross Section
- Debris Jam
- Withdrawals
- Gully
- Stormwater Input
- Stream Crossing

- Bank Armoring
- Buffers <25 ft
- Erosion
- Mass Failure
- Berm Both Sides
- Berm One Side
- valley wall
- Development both sides
- Encroachment both sides
- Development one side
- Encroachment one side
- Straightening
- With Windrowing
- SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M14

0 500 Feet
0 0.15 Miles



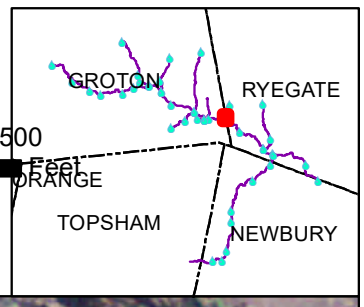


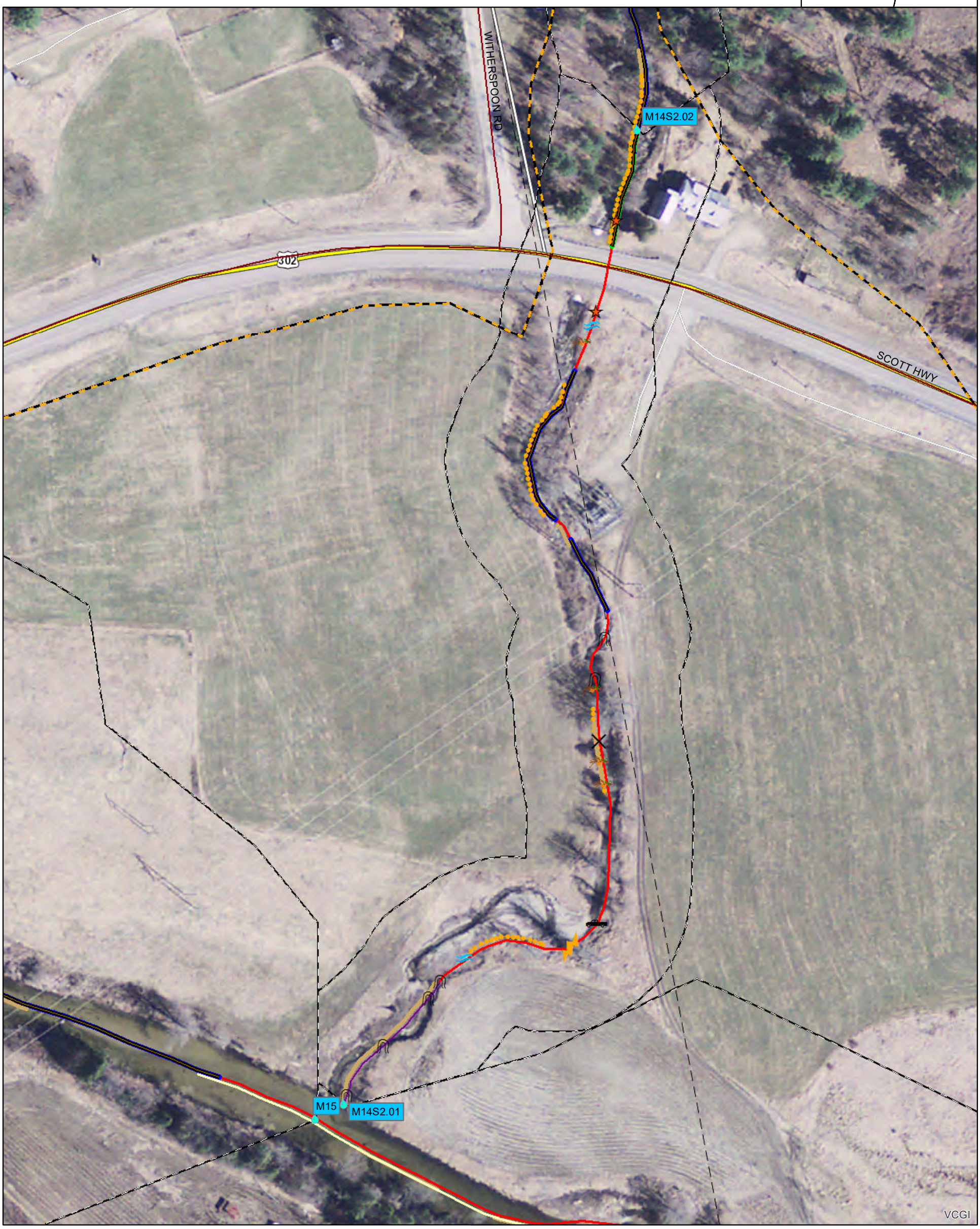
- Animal Crossing
- Avulsion
- Braiding
- Bridge
- Culvert
- Dam
- Dredging
- Flood Chute
- Head Cut
- Ledge
- Migration
- Neck Cutoff
- Steep Riffle
- Stream Ford
- Waterfall
- Weir
- Alluvial Fan
- Beaver Dam
- Cross Section
- Debris Jam
- Withdrawals
- Gully
- Stormwater Input
- Stream Crossing

- Bank Armoring
- Buffers <25 ft
- Erosion
- Mass Failure
- Berm Both Sides
- Berm One Side
- valley wall
- Development both sides
- Encroachment both sides
- Development one side
- Encroachment one side
- Straightening
- With Windrowing
- SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M14S2.01

0 500 Feet
0 0.055 Miles



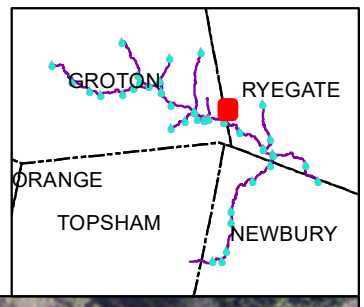


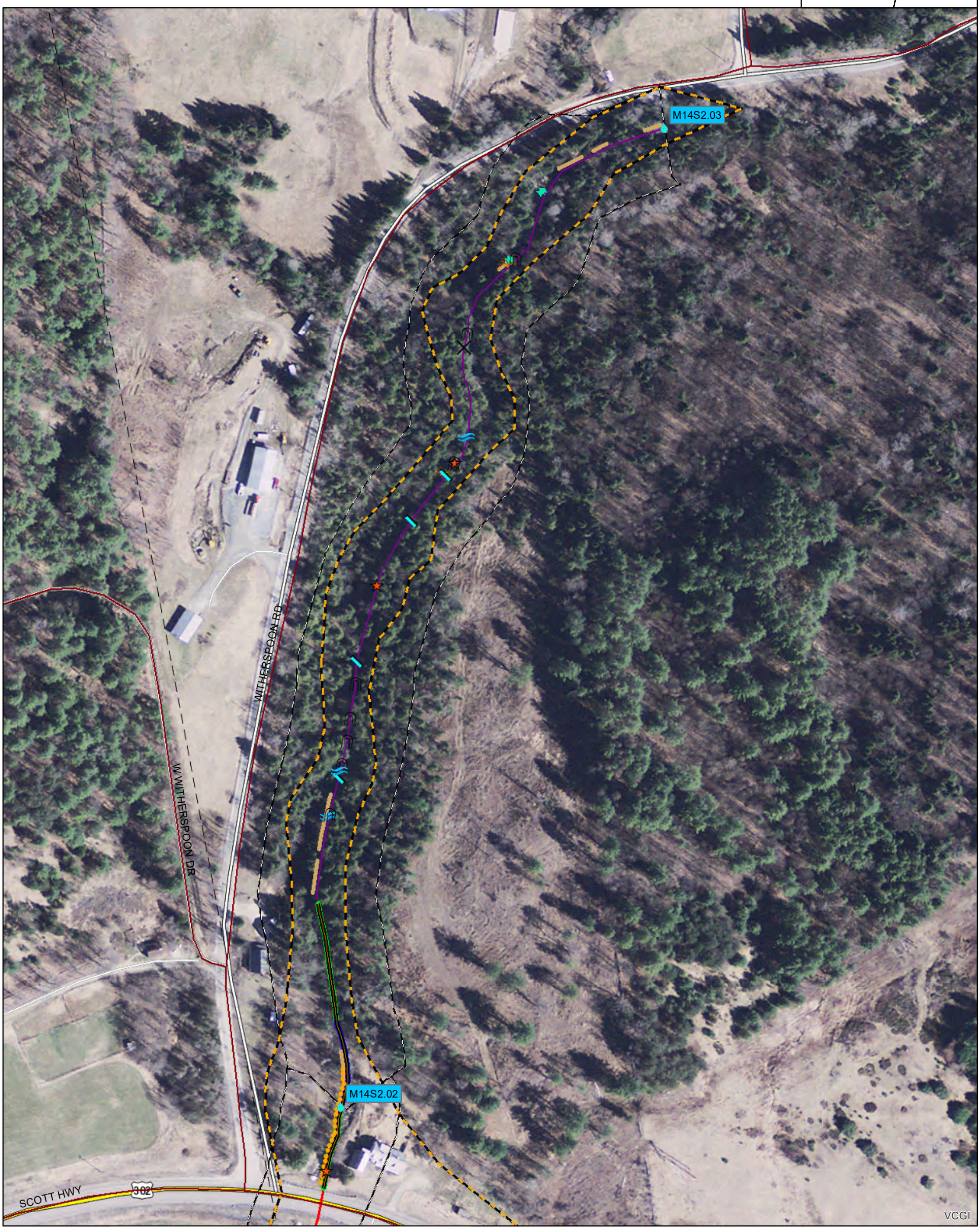
Animal Crossing
Avulsion
Braiding
Bridge
Culvert
Dam
Dredging
Flood Chute
Head Cut
Ledge
Migration
Neck Cutoff
Steep Riffle
Stream Ford
Waterfall
Weir
Alluvial Fan
Beaver Dam
Cross Section
Debris Jam
Withdrawals
Gully
Stormwater Input
Stream Crossing

Bank Armoring
Buffers <25 ft
Erosion
Mass Failure
Berm Both Sides
Berm One Side
valley wall
Development both sides
Encroachment both sides
Development one side
Encroachment one side
Straightening
With Windrowing
SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M14S2.02

0 500 Feet
0 0.08 Miles



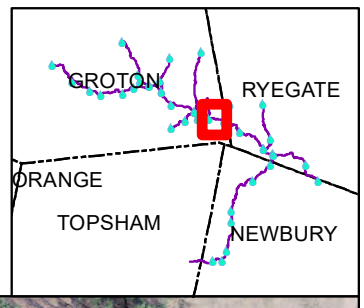


Animal Crossing
Avulsion
Braiding
Bridge
Culvert
Dam
Dredging
Flood Chute
Head Cut
Ledge
Migration
Neck Cutoff
Steep Riffle
Stream Ford
Waterfall
Weir
Alluvial Fan
Beaver Dam
Cross Section
Debris Jam
Withdrawals
Gully
Stormwater Input
Stream Crossing

Bank Armoring
Buffers <25 ft
Erosion
Mass Failure
Berm Both Sides
Berm One Side
valley wall
Development both sides
Encroachment both sides
Development one side
Encroachment one side
Straightening
With Windrowing
SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M15

0 500 Feet
0 0.2 Miles



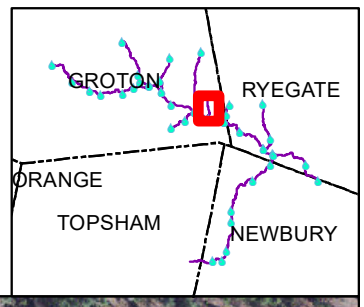


Animal Crossing
Avulsion
Braiding
Bridge
Culvert
Dam
Dredging
Flood Chute
Head Cut
Ledge
Migration
Neck Cutoff
Steep Riffle
Stream Ford
Waterfall
Weir
Alluvial Fan
Beaver Dam
Cross Section
Debris Jam
Withdrawals
Gully
Stormwater Input
Stream Crossing

Bank Armoring
Buffers <25 ft
Erosion
Mass Failure
Berm Both Sides
Berm One Side
valley wall
Development both sides
Encroachment both sides
Development one side
Encroachment one side
Straightening
With Windrowing
SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M15S1.01

0 500 Feet
0 0.15 Miles



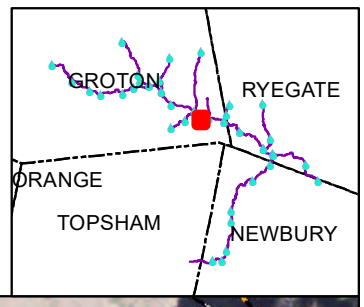


Animal Crossing
Avulsion
Braiding
Bridge
Culvert
Dam
Dredging
Flood Chute
Head Cut
Ledge
Migration
Neck Cutoff
Steep Riffle
Stream Ford
Waterfall
Weir
Alluvial Fan
Beaver Dam
Cross Section
Debris Jam
Withdrawals
Gully
Stormwater Input
Stream Crossing

Bank Armoring
Buffers <25 ft
Erosion
Mass Failure
Berm Both Sides
Berm One Side
valley wall
Development both sides
Encroachment both sides
Development one side
Encroachment one side
Straightening
With Windrowing
SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M15T2.01

0 500 Feet
0 0.07 Miles



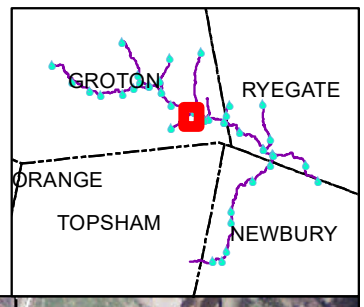


Animal Crossing
Avulsion
Braiding
Bridge
Culvert
Dam
Dredging
Flood Chute
Head Cut
Ledge
Migration
Neck Cutoff
Steep Riffle
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Waterfall
Weir
Alluvial Fan
Beaver Dam
Cross Section
Debris Jam
Withdrawals
Gully
Stormwater Input
Stream Crossing

Bank Armoring
Buffers <25 ft
Erosion
Mass Failure
Berm Both Sides
Berm One Side
valley wall
Development both sides
Encroachment both sides
Development one side
Encroachment one side
Straightening
With Windrowing
SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M15T2.02

0 500 Feet
0 0.1 Miles



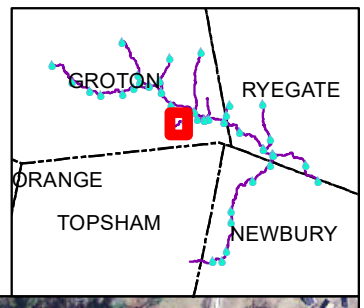


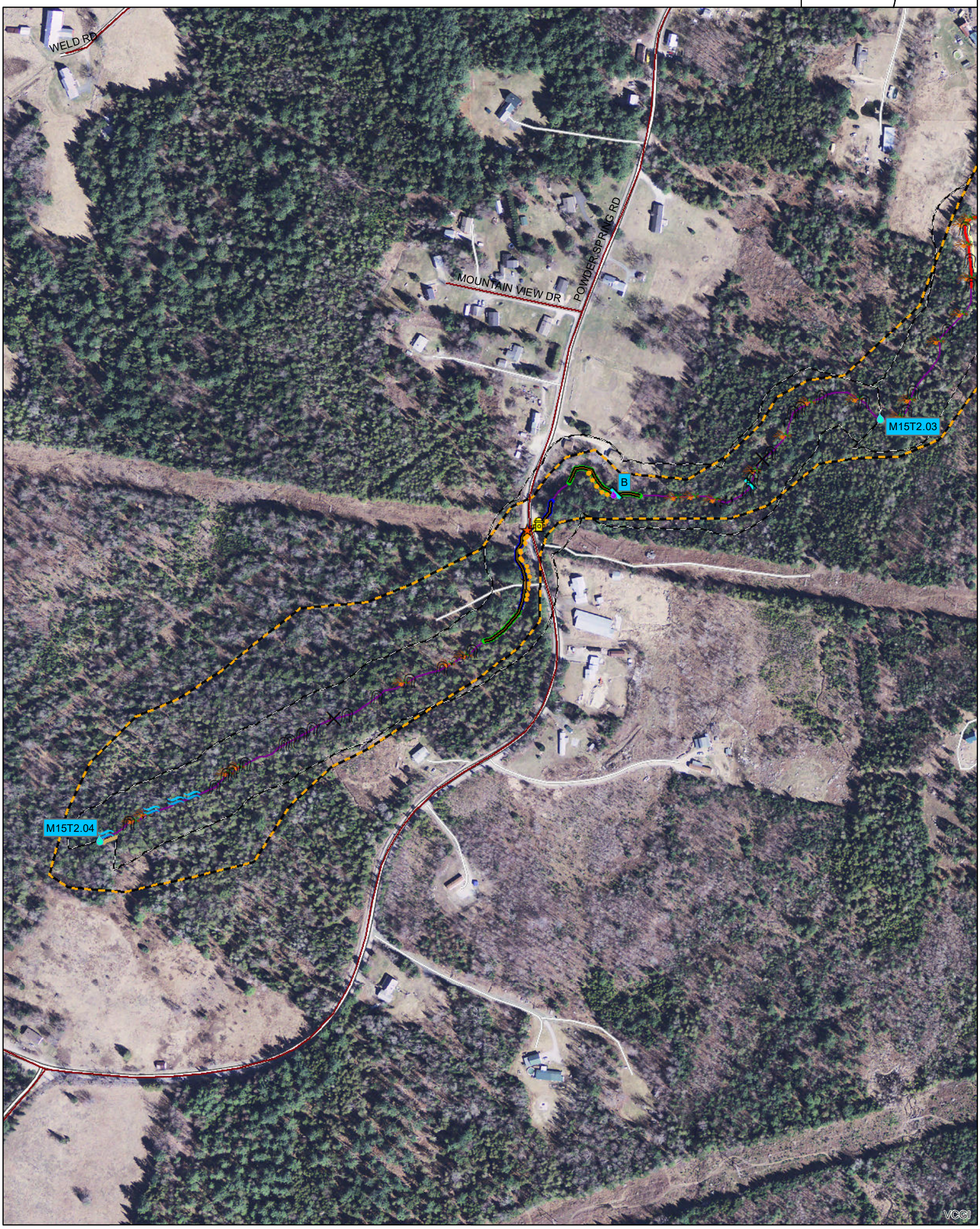
- Animal Crossing
- Avulsion
- Braiding
- Bridge
- Culvert
- Dam
- Dredging
- Flood Chute
- Head Cut
- Ledge
- Migration
- Neck Cutoff
- Steep Riffle
- Stream Ford
- Waterfall
- Weir
- Alluvial Fan
- Beaver Dam
- Cross Section
- Debris Jam
- Withdrawals
- Gully
- Stormwater Input
- Stream Crossing

- Bank Armoring
- Buffers <25 ft
- Erosion
- Mass Failure
- Berm Both Sides
- Berm One Side
- valley wall
- Development both sides
- Encroachment both sides
- Development one side
- Encroachment one side
- Straightening
- With Windrowing
- SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M15T2.03

0 500 Feet
0 0.15 Miles



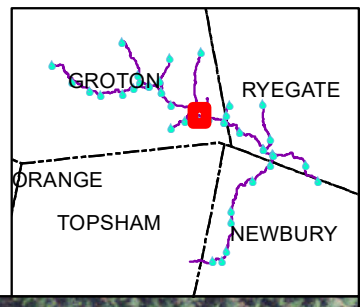


- Animal Crossing
- Avulsion
- Braiding
- Bridge
- Culvert
- Dam
- Dredging
- Flood Chute
- Head Cut
- Ledge
- Migration
- Neck Cutoff
- Steep Riffle
- Stream Ford
- Waterfall
- Weir
- Alluvial Fan
- Beaver Dam
- Cross Section
- Debris Jam
- Withdrawals
- Gully
- Stormwater Input
- Stream Crossing

- Bank Armoring
- Buffers <25 ft
- Erosion
- Mass Failure
- Berm Both Sides
- Berm One Side
- valley wall
- Development both sides
- Encroachment both sides
- Development one side
- Encroachment one side
- Straightening
- With Windrowing
- SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M16

0 500 Feet
0 0.1 Miles



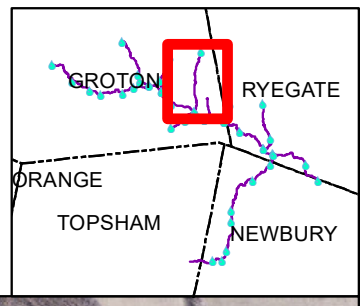


- Animal Crossing
- Avulsion
- Braiding
- Bridge
- Culvert
- Dam
- Dredging
- Flood Chute
- Head Cut
- Ledge
- Migration
- Neck Cutoff
- Steep Riffle
- Stream Ford
- Waterfall
- Weir
- Alluvial Fan
- Beaver Dam
- Cross Section
- Debris Jam
- Withdrawals
- Gully
- Stormwater Input
- Stream Crossing

- Bank Armoring
- Buffers <25 ft
- Erosion
- Mass Failure
- Berm Both Sides
- Berm One Side
- valley wall
- Development both sides
- Encroachment both sides
- Development one side
- Encroachment one side
- Straightening
- With Windrowing
- SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M16S1.01

0 500 Feet
0 0.5 Miles

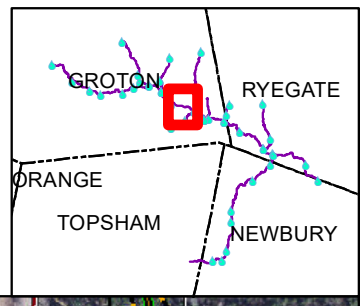


M18T3.03
M16S1.02
M18
B
M16S1.01
M17
M14S2.02
GREAT RD
CROSS RD
HEATH HILL RD
HOOPER HILL RD
MOUNT ARA RD
ROUND RD
SAYERS RD
TOWN HWY 37
MINARD HILL RD
GLOVER RD
MOUNT MEDAD
MILL ST
OLD RAILROAD BED
RAILROAD ST
WELD RD
SCOTT HWY
CEMETERY RD
WITHERSPOON RD
302
VCGI

- Animal Crossing
- Avulsion
- Braiding
- Bridge
- Culvert
- Dam
- Dredging
- Flood Chute
- Head Cut
- Ledge
- Migration
- Neck Cutoff
- Steep Riffle
- Stream Ford
- Waterfall
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- Alluvial Fan
- Beaver Dam
- Cross Section
- Debris Jam
- Withdrawals
- Gully
- Stormwater Input
- Stream Crossing
- Bank Armoring
- Buffers <25 ft
- Erosion
- Mass Failure
- Berm Both Sides
- Berm One Side
- valley wall
- Development both sides
- Encroachment both sides
- Development one side
- Encroachment one side
- Straightening
- With Windrowing
- SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M17

0 500 Feet
0 0.25 Miles

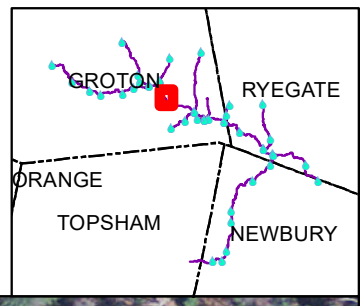




- Animal Crossing
- Avulsion
- Braiding
- Bridge
- Culvert
- Dam
- Dredging
- Flood Chute
- Head Cut
- Ledge
- Migration
- Neck Cutoff
- Steep Riffle
- Stream Ford
- Waterfall
- Weir
- Alluvial Fan
- Beaver Dam
- Cross Section
- Debris Jam
- Withdrawals
- Gully
- Stormwater Input
- Stream Crossing
- Bank Armoring
- Buffers <25 ft
- Erosion
- Mass Failure
- Berm Both Sides
- Berm One Side
- valley wall
- Development both sides
- Encroachment both sides
- Development one side
- Encroachment one side
- Straightening
- With Windrowing
- SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M18

0 500 Feet
0 0.1 Miles



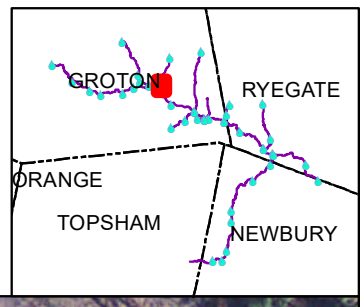


- Animal Crossing
- Avulsion
- Braiding
- Bridge
- Culvert
- Dam
- Dredging
- Flood Chute
- Head Cut
- Ledge
- Migration
- Neck Cutoff
- Steep Riffle
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- Debris Jam
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- Gully
- Stormwater Input
- Stream Crossing
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- Buffers <25 ft
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- Berm Both Sides
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- Development both sides
- Encroachment both sides
- Development one side
- Encroachment one side
- Straightening
- With Windrowing
- SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M18T3.01

0 500 Feet
0 0.095 Miles

N



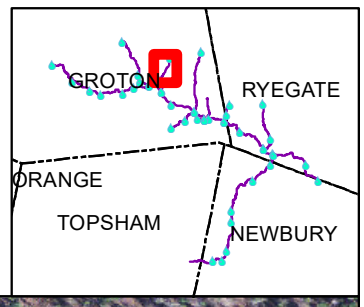


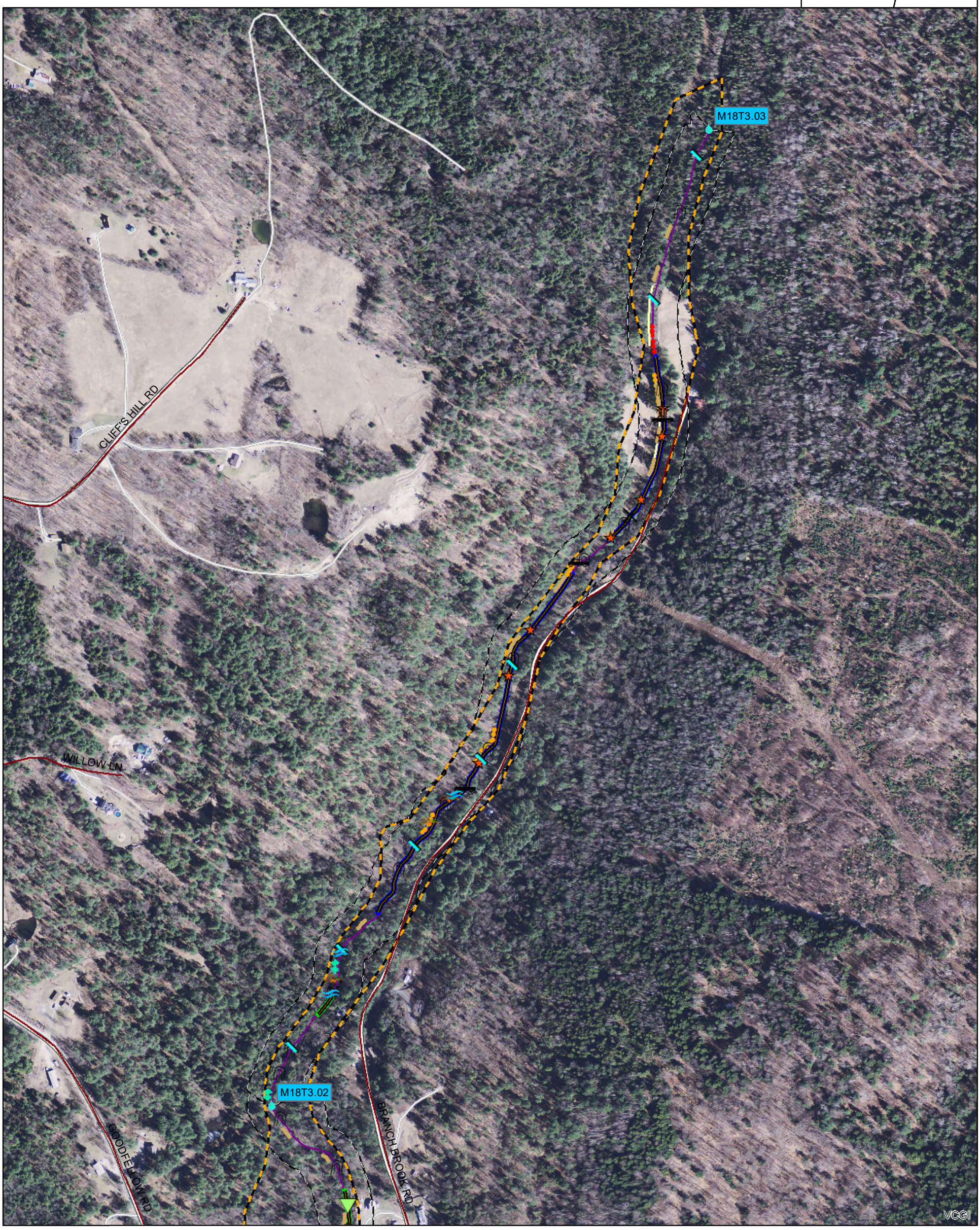
- Animal Crossing
- Avulsion
- Braiding
- Bridge
- Culvert
- Dam
- Dredging
- Flood Chute
- Head Cut
- Ledge
- Migration
- Neck Cutoff
- Steep Riffle
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- Debris Jam
- Withdrawals
- Gully
- Stormwater Input
- Stream Crossing

- Bank Armoring
- Buffers <25 ft
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- valley wall
- Development both sides
- Encroachment both sides
- Development one side
- Encroachment one side
- Straightening
- With Windrowing
- SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M18T3.02

0 500 Feet
0 0.15 Miles



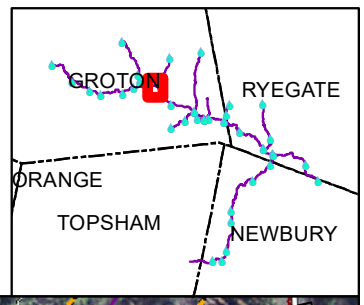


Animal Crossing
Avulsion
Braiding
Bridge
Culvert
Dam
Dredging
Flood Chute
Head Cut
Ledge
Migration
Neck Cutoff
Steep Riffle
Stream Ford
Waterfall
Weir
Alluvial Fan
Beaver Dam
Cross Section
Debris Jam
Withdrawals
Gully
Stormwater Input
Stream Crossing

Bank Armoring
Buffers <25 ft
Erosion
Mass Failure
Berm Both Sides
Berm One Side
valley wall
Development both sides
Encroachment both sides
Development one side
Encroachment one side
Straightening
With Windrowing
SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M19

0 500 Feet
0 0.1 Miles



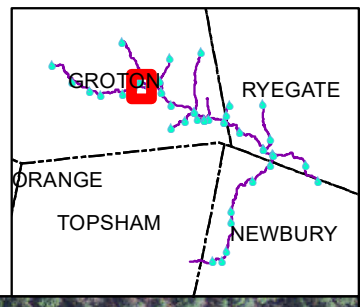


- Animal Crossing
- Avulsion
- Braiding
- Bridge
- Culvert
- Dam
- Dredging
- Flood Chute
- Head Cut
- Ledge
- Migration
- Neck Cutoff
- Steep Riffle
- Stream Ford
- Waterfall
- Weir
- Alluvial Fan
- Beaver Dam
- Cross Section
- Debris Jam
- Withdrawals
- Gully
- Stormwater Input
- Stream Crossing

- Bank Armoring
- Buffers <25 ft
- Erosion
- Mass Failure
- Berm Both Sides
- Berm One Side
- valley wall
- Development both sides
- Encroachment both sides
- Development one side
- Encroachment one side
- Straightening
- With Windrowing
- SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M19T4.01

0 500 Feet
0 0.15 Miles



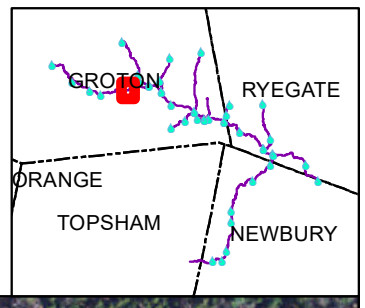


- Animal Crossing
- Avulsion
- Braiding
- Bridge
- Culvert
- Dam
- Dredging
- Flood Chute
- Head Cut
- Ledge
- Migration
- Neck Cutoff
- Steep Riffle
- Stream Ford
- Waterfall
- Weir
- Alluvial Fan
- Beaver Dam
- Cross Section
- Debris Jam
- Withdrawals
- Gully
- Stormwater Input
- Stream Crossing

- Bank Armoring
- Buffers <25 ft
- Erosion
- Mass Failure
- Berm Both Sides
- Berm One Side
- valley wall
- Development both sides
- Encroachment both sides
- Development one side
- Encroachment one side
- Straightening
- With Windrowing
- SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M19T4.02

0 500 Feet
0 0.1 Miles



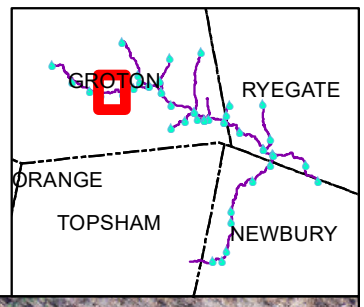


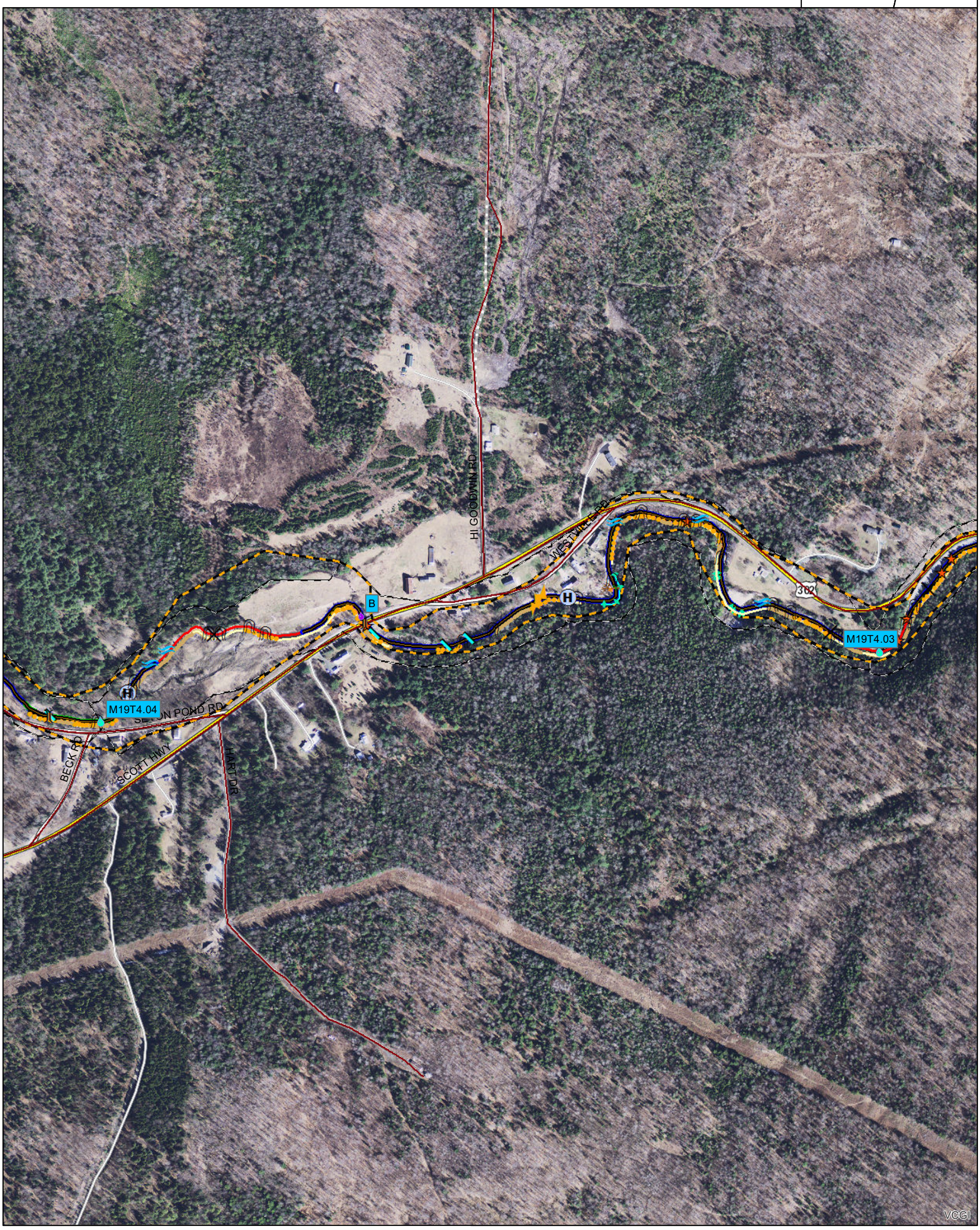
- Animal Crossing
- Avulsion
- Braiding
- Bridge
- Culvert
- Dam
- Dredging
- Flood Chute
- Head Cut
- Ledge
- Migration
- Neck Cutoff
- Steep Riffle
- Stream Ford
- Waterfall
- Weir
- Alluvial Fan
- Beaver Dam
- Cross Section
- Debris Jam
- Withdrawals
- Gully
- Stormwater Input
- Stream Crossing

- Bank Armoring
- Buffers <25 ft
- Erosion
- Mass Failure
- Berm Both Sides
- Berm One Side
- valley wall
- Development both sides
- Encroachment both sides
- Development one side
- Encroachment one side
- Straightening
- With Windrowing
- SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M19T4.03

0 500 Feet
0 0.2 Miles



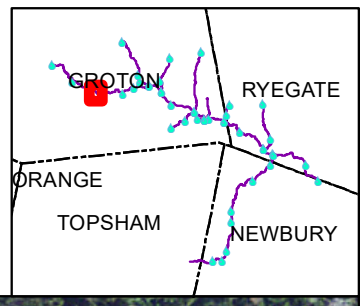


Animal Crossing
Avulsion
Braiding
Bridge
Culvert
Dam
Dredging
Flood Chute
Head Cut
Ledge
Migration
Neck Cutoff
Steep Riffle
Stream Ford
Waterfall
Weir
Alluvial Fan
Beaver Dam
Cross Section
Debris Jam
Withdrawals
Gully
Stormwater Input
Stream Crossing

Bank Armoring
Buffers <25 ft
Erosion
Mass Failure
Berm Both Sides
Berm One Side
valley wall
Development both sides
Encroachment both sides
Development one side
Encroachment one side
Straightening
With Windrowing
SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M19T4.04

0 500 Feet
0 0.1 Miles

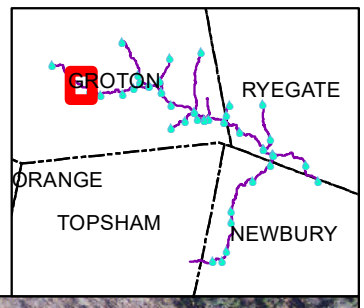


M19T4.05
M19T4.04
SEYDN POND RD
BECK RD
WELCH RD
SCOTT HWY
302
VCGI

- Animal Crossing
- Avulsion
- Braiding
- Bridge
- Culvert
- Dam
- Dredging
- Flood Chute
- Head Cut
- Ledge
- Migration
- Neck Cutoff
- Steep Riffle
- Stream Ford
- Waterfall
- Weir
- Alluvial Fan
- Beaver Dam
- Cross Section
- Debris Jam
- Withdrawals
- Gully
- Stormwater Input
- Stream Crossing
- Bank Armoring
- Buffers <25 ft
- Erosion
- Mass Failure
- Berm Both Sides
- Berm One Side
- valley wall
- Development both sides
- Encroachment both sides
- Development one side
- Encroachment one side
- Straightening
- With Windrowing
- SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M19T4.05

0 500 Feet
0 0.15 Miles



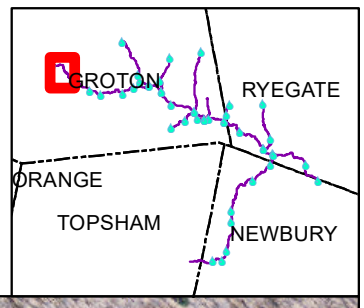


Animal Crossing
Avulsion
Braiding
Bridge
Culvert
Dam
Dredging
Flood Chute
Head Cut
Ledge
Migration
Neck Cutoff
Steep Riffle
Stream Ford
Waterfall
Weir
Alluvial Fan
Beaver Dam
Cross Section
Debris Jam
Withdrawals
Gully
Stormwater Input
Stream Crossing

Bank Armoring
Buffers <25 ft
Erosion
Mass Failure
Berm Both Sides
Berm One Side
valley wall
Development both sides
Encroachment both sides
Development one side
Encroachment one side
Straightening
With Windrowing
SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M19T4.06

0 500 Feet
0 0.2 Miles



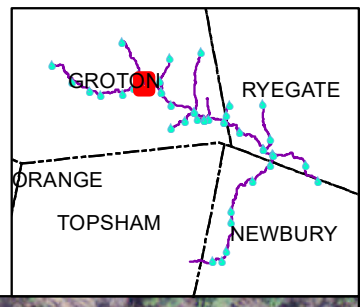


Animal Crossing
Avulsion
Braiding
Bridge
Culvert
Dam
Dredging
Flood Chute
Head Cut
Ledge
Migration
Neck Cutoff
Steep Riffle
Stream Ford
Waterfall
Weir
Alluvial Fan
Beaver Dam
Cross Section
Debris Jam
Withdrawals
Gully
Stormwater Input
Stream Crossing

Bank Armoring
Buffers <25 ft
Erosion
Mass Failure
Berm Both Sides
Berm One Side
valley wall
Development both sides
Encroachment both sides
Development one side
Encroachment one side
Straightening
With Windrowing
SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M20

0 500 Feet
0 0.1 Miles



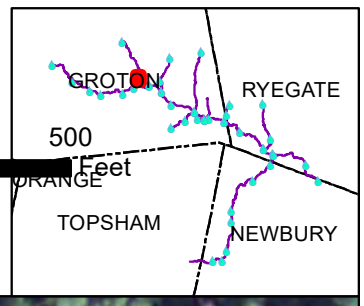
M21
STATE FOREST RD
232
OLD RAILROAD BED
WILSON DR
SCOTT HWY
302
COCHRAN RD
OLD DUMP RD
M20
M19T4.01
OLD RAILROAD BED
VCGI

- Animal Crossing
- Avulsion
- Braiding
- Bridge
- Culvert
- Dam
- Dredging
- Flood Chute
- Head Cut
- Ledge
- Migration
- Neck Cutoff
- Steep Riffle
- Stream Ford
- Waterfall
- Weir
- Alluvial Fan
- Beaver Dam
- Cross Section
- Debris Jam
- Withdrawals
- Gully
- Stormwater Input
- Stream Crossing

- Bank Armoring
- Buffers <25 ft
- Erosion
- Mass Failure
- Berm Both Sides
- Berm One Side
- valley wall
- Development both sides
- Encroachment both sides
- Development one side
- Encroachment one side
- Straightening
- With Windrowing
- SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M21

0
0 0.055 Miles
500 Feet

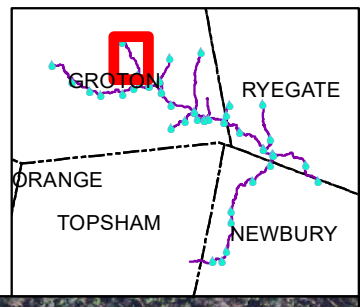


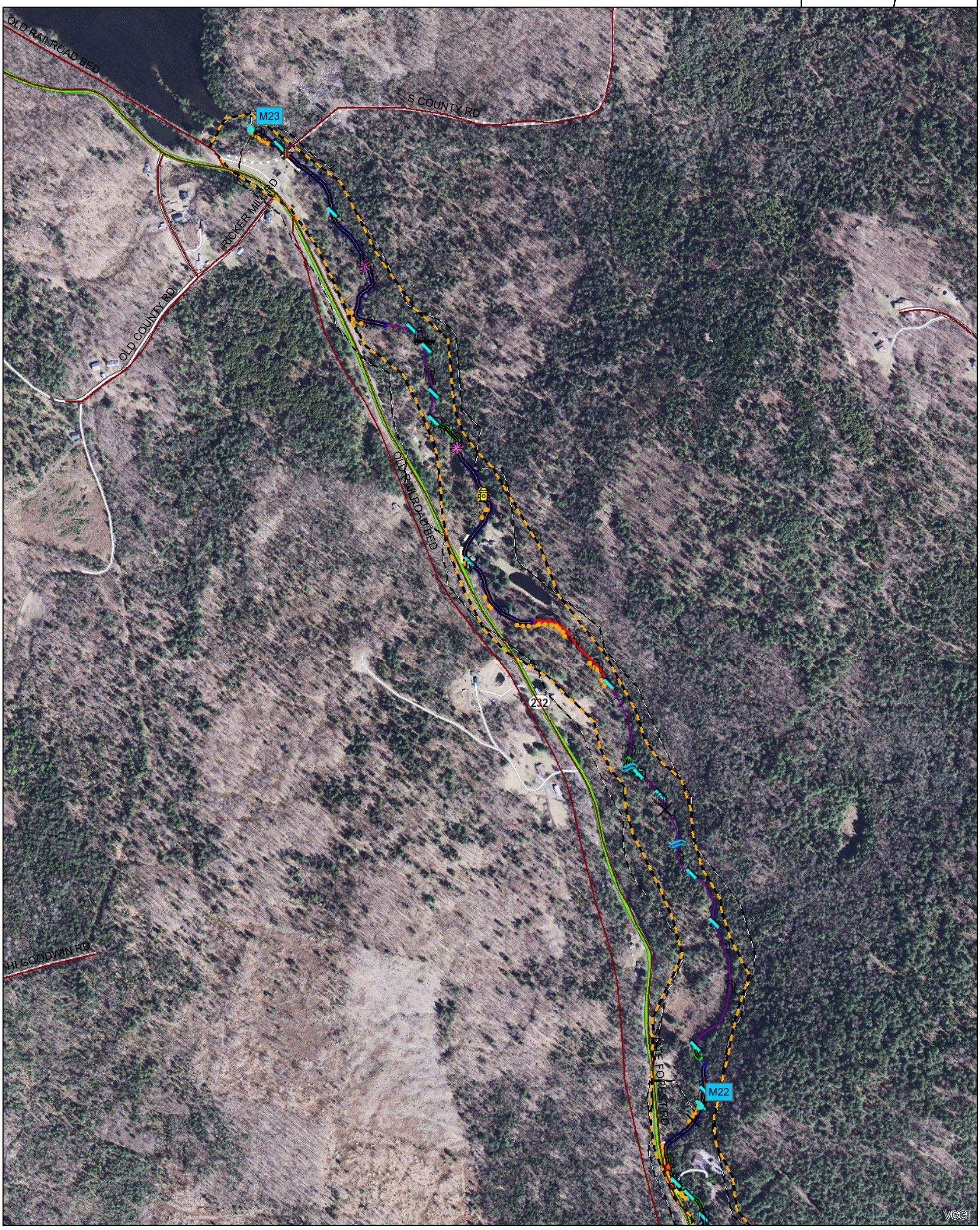


- Animal Crossing
- Avulsion
- Braiding
- Bridge
- Culvert
- Dam
- Dredging
- Flood Chute
- Head Cut
- Ledge
- Migration
- Neck Cutoff
- Steep Riffle
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- Waterfall
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- Alluvial Fan
- Beaver Dam
- Cross Section
- Debris Jam
- Withdrawals
- Gully
- Stormwater Input
- Stream Crossing
- Bank Armoring
- Buffers <25 ft
- Erosion
- Mass Failure
- Berm Both Sides
- Berm One Side
- valley wall
- Development both sides
- Encroachment both sides
- Development one side
- Encroachment one side
- Straightening
- With Windrowing
- SgaCorridor

Upper Wells Ph2 SGA 2015-16
Reach M22

0 500 Feet
0 0.25 Miles





Animal Crossing
Avulsion
Braiding
Bridge
Culvert
Dam
Dredging
Flood Chute
Head Cut
Ledge
Migration
Neck Cutoff
Steep Riffle
Stream Ford
Waterfall
Weir
Alluvial Fan
Beaver Dam
Cross Section
Debris Jam
Withdrawals
Gully
Stormwater Input
Stream Crossing

Bank Armoring
Buffers <25 ft
Erosion
Mass Failure
Berm Both Sides
Berm One Side
valley wall
Development both sides
Encroachment both sides
Development one side
Encroachment one side
Straightening
With Windrowing
SgaCorridor

- Appendix 8 –

Bridge and Culvert Survey Reports

Structure summary reports
Failure modes: Geomorphic incompatibility
Failure modes: Problem causes
Aquatic organism passage (AOP) ratings:
Passage, geomorphic compatibility, retrofit potential
Wildlife passage

Easiest method to find summary report for a bridge or culvert:
Use interactive Vermont Agency of Natural Resources Atlas, http://anrmaps.vermont.gov/websites/anra/: ANR Atlas layers→Fish and Wildlife→Stream Crossings, then use the Identify/Query toolbars, click on the structure of interest and a link to the Bridge or Culvert Summary report will be summoned by clicking on the blue highlighted Stream Crossing (Fig. Apx8-1, reverse side of this page)

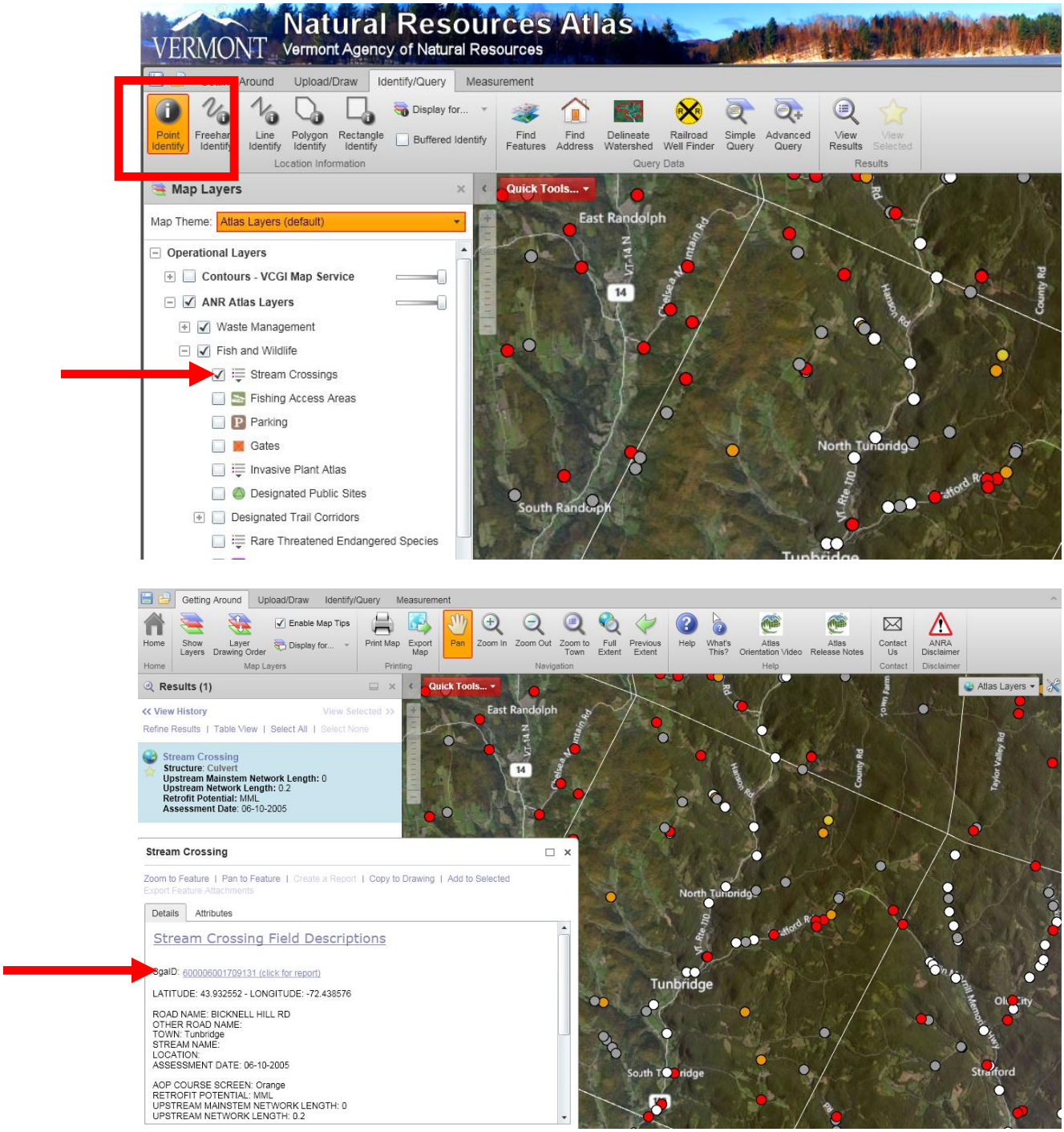


Figure Apx8-1. Easiest method for obtaining Bridge and Culvert summary for a particular structure is through the Natural Resource Atlas hosted by the Vermont Agency of Natural Resources.

VERMONT

Stream Geomorphic Assessment

Agency of Natural Resouces

VT DEC

Vermont.gov

September, 15 201

Culvert Summary Report

Wells River

General Information

SgaID	700000001603043	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, ES	Assessment Date	7/23/2015	Project Name	Wells River
Town	Groton	Latitude	44.20326	Longitude	-72.18481
Location	old railbed between end of Little Italy Rd out of Groton village and Wells river mainstem beneath Cemetery Rd off Rte 302			Reach VTID	M15T2.01
Road Name	OLD RAILROAD BED	Road Type	Gravel	Stream Name	Keenan Brook
High Flow Stage	No			Channel Width	31.9

Culvert Information

Culvert Length	45	Material	Concrete
Culvert Height	5.5	Number of culverts	2
Culvert Width	11	Culvert Overflow Pipe	No
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No
		Culvert slope as compared with channel slope is significantly	Same

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Channelized Straight
If channel avulses, stream will	Unsure		

Downstream

Pool present immediately downstream of structure	Yes	Water depth in culvert (at outlet)	0.6
Downstream bank heights are substantially higher than upstream bank heights	No	Culvert outlet invert	At Grade
Stepped Footers	2 ft.	Backwater Length (measured from outlet)	0
Maximum pool depth	> 4.0 ft.	Backwater Length (measured from outlet)	0

	Upstream	Downstream	In Structure
Dominant Bed Material	Gravel	Sand	Gravel
Bedrock Present	No	No	
Type of Sediment Deposits	None	Side	None
Material Present throughout			No
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	Low	High	
Hard Bank Armoring	Failing	Failing	
Stream bed scour causing undermining around or under structure	None	Culvert,Footers	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Mixed Forest	Mixed Forest	
Dominant Vegetation Type - Right	Mixed Forest	Mixed Forest	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	Yes	Yes	
Vegitation Band -Right	Yes	Yes	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments

pair of 5.5 ft culverts. GUID2014 assigned to this culvert was also assigned to a culvert inventoried at this location in 2004, Local ID 322; the same 2004 inventory documented the accompanying culvert at this location, local ID 321, which was assigned GUID2014 7ec74a84-63c7-4f16-8f3d-a7d79a76c423. ANR protocols record the combined width of side by side culverts at a single location, so these two culverts are combined here under GUID2014 09d9d75b-fabf-4502-9ae4-ae4d6eda931c. pix 613-619.

Culvert Summary Report

Wells River

General Information

SgaID	700000004409073	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, ES	Assessment Date	6/15/2015	Project Name	Wells River
Town	Newbury	Latitude	44.15402	Longitude	-72.166
Location	logging rd ~0.1 mi US of trib jct at sharp bend in Swamp Rd that is ~2.8 mi US up from Rte 302 in S. Ryegate village (or ~0.5 mi DS Grapes Rd-Swamp Rd jct)			Reach VTID	M11T1.05
Road Name		Road Type		Stream Name	Scott Brook
High Flow Stage	No			Channel Width	18.3

Culvert Information

Culvert Length	25	Material	Tank
Culvert Height	5.3	Number of culverts	1
Culvert Width	4.8	Culvert Overflow Pipe	No
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No
		Culvert slope as compared with channel slope is significantly	Lower

Upstream

Obstructions at the opening of the structure	Wood debris,Sediment,Deformation	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	Yes	Angle of stream flow approaching structure	Sharp Bend
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	Yes	Water depth in culvert (at outlet)	1
Downstream bank heights are substantially higher than upstream bank heights	No	Culvert outlet invert	At Grade
Stepped Footers	1.6 ft.	Backwater Length (measured from outlet)	0
Maximum pool depth	2 ft.	Backwater Length (measured from outlet)	0

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Cobble	None
Bedrock Present	No	No	
Type of Sediment Deposits	Side	None	None
Material Present throughout			No
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	Low	None	
Hard Bank Armoring	Failing	Failing	
Stream bed scour causing undermining around or under structure	Culvert,Wing walls	Culvert,Wing walls	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Mixed Forest	Mixed Forest	
Dominant Vegetation Type - Right	Mixed Forest	Mixed Forest	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	Yes	Yes

Vegitation Band -Right	Yes	Yes

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? **Yes** Photos taken? **Yes**

Comments **Was 5 ft round, dimensions changed by deformation. pix 341-344**

Bridge Summary Report

Wells River

General Information

SgaID	700000004709073	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, ES	Assessment Date	8/12/2015	Project Name	Wells River
Town	Newbury	Latitude	44.16838	Longitude	-72.16282
Location	pvt driveway at beaver pond visible from Swamp Rd ~0.9 mi US of Jefferson Hill Rd-Swamp Rd jct			Reach VTID	M11T1.03
Road Name		Road Type	Gravel	Stream Name	Scott Brook
High Flow Stage	No			Channel Width	30.8

Bridge Information

Bridge Width	12	Material	Steel
Bridge Clearance	1	Number of bridge piers/arches	0
Bridge/Arch Span	20		
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Not Significant	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	Deformation	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Mild Bend
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	Yes		
Downstream bank heights are substantially higher than upstream bank heights	No		
Pool Depth at point of streamflow entry	No 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Sand	Sand	Sand
Bedrock Present	No	No	No
Type of Sediment Deposits	None	None	None
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	Low	Low	
Hard Bank Armoring	Intact	Intact	
Stream bed scour causing undermining around or under structure	None	Abutments	
Beaver Dam near Structure	Yes	Yes	
Beaver Dam distance (ft.)	100	100	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Shrub/Sapling	Shrub/Sapling	
Dominant Vegetation Type - Right	Shrub/Sapling	Shrub/Sapling	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	Yes	Yes

Vegitation Band -Right	Yes	Yes

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	Beaver - Lodge	None

Other Information

Spatial location data collected with GPS? **Yes** Photos taken? **Yes**

Comments **New steel bridge was placed on top of collapsing timber bridge. Deformation of timber structure leaves <1 ft clearance above water though steel structure has 4 ft clearance; although steel bridge is 30 ft L, abutments of timber structure underneath give 20 ft span. Beaver controlled areas both US and DS. pix 0795-0798**

VERMONT

Stream Geomorphic Assessment

Agency of Natural Resouces

VT DEC

Vermont.gov

September, 15 201

Bridge Summary Report

Wells River

General Information

SgaID	200302000003042	Local SgaID		VOBCIT struct_num	200026003103042
Observers	Redstart_dr, ES	Assessment Date	8/19/2015	Project Name	Wells River
Town	Groton	Latitude	44.21677	Longitude	-72.24755
Location	DS Seyon Pond Rd-Scott Hwy (Rte 302) jct			Reach VTID	M19T4.03
Road Name	SCOTT HWY	Road Type	Paved	Stream Name	South Branch Wells
High Flow Stage	No			Channel Width	45

Bridge Information

Bridge Width	35	Material	Steel
Bridge Clearance	13	Number of bridge piers/arches	0
Bridge/Arch Span	40		
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Channelized Straight
If channel avulses, stream will	Unsure		

Downstream

Pool present immediately downstream of structure	Yes		
Downstream bank heights are substantially higher than upstream bank heights	Yes		
Pool Depth at point of streamflow entry	No 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Cobble	Cobble
Bedrock Present	No	Yes	No
Type of Sediment Deposits	Point	Point	None
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	High	Low	
Hard Bank Armoring	Intact	Failing	
Stream bed scour causing undermining around or under structure	None	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Herbaceous/Grass	Mixed Forest	
Dominant Vegetation Type - Right	Shrub/Sapling	Mixed Forest	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	Yes	Yes	
Vegitation Band -Right	Yes	Yes	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments 40 ft span in step 2 is effective width due to stone inside structure; bridge span at rd level is 60 ft. pix 895-898

VERMONT

Stream Geomorphic Assessment

Agency of Natural Resouces

VT DEC

Vermont.gov

September, 15 201

Bridge Summary Report

Wells River

General Information

SgaID	700000000603043	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, ES	Assessment Date	7/29/2015	Project Name	Wells River
Town	Groton	Latitude	44.21776	Longitude	-72.23474
Location	pvt dw to 3571 Scott Hwy (Rte 302)			Reach VTID	M19T4.02
Road Name		Road Type	Gravel	Stream Name	South Branch Wells
High Flow Stage	No			Channel Width	64.9

Bridge Information

Bridge Width	12	Material	Steel
Bridge Clearance	9	Number of bridge piers/arches	0
Bridge/Arch Span	35		
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure		Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	Yes	Angle of stream flow approaching structure	Channelized Straight
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure		Yes	
Downstream bank heights are substantially higher than upstream bank heights		Yes	
Pool Depth at point of streamflow entry		Yes 0 ft.	0

	Upstream	Downstream	In Structure
Dominant Bed Material	Boulder	Cobble	Bedrock
Bedrock Present	Yes	Yes	Yes
Type of Sediment Deposits	None	None	None
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	High	High	
Hard Bank Armoring	Failing	Failing	
Stream bed scour causing undermining around or under structure	Wing walls	Abutments	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Road Embankment	Road Embankment	
Dominant Vegetation Type - Right	Coniferous Forest	Coniferous Forest	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	No	No	
Vegitation Band -Right	Yes	Yes	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? **Yes** Photos taken? **Yes**

Comments **bridge is short distance US of 300 ft long narrowly confined bedrock gorge. pix 666-669**

VERMONT

Stream Geomorphic Assessment

Agency of Natural Resouces

VT DEC

Vermont.gov

September, 15 201

Bridge Summary Report

Wells River

General Information

SgaID	200302000203042	Local SgaID		VOBCIT struct_num	200026003603042
Observers	Redstart_dr, EBM	Assessment Date	9/22/2015	Project Name	Wells River
Town	Groton	Latitude	44.21746	Longitude	-72.21224
Location	confluence of North Branch and Wells mainstem at jct Scott Hwy (Rte 302) and Branch Brook (Fred Hayes) Rd			Reach VTID	M18T3.01
Road Name	SCOTT HWY	Road Type	Paved	Stream Name	North Branch Wells
High Flow Stage	No			Channel Width	35.5

Bridge Information

Bridge Width	28	Material	Concrete
Bridge Clearance	3.5	Number of bridge piers/arches	0
Bridge/Arch Span	18		
		Skewed to roadway?	Yes

Geomorphic Information

General

Floodplain filled by roadway approaches	Partially	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	100
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Mild Bend
If channel avulses, stream will	Follow Road		

Downstream

Pool present immediately downstream of structure	Yes		
Downstream bank heights are substantially higher than upstream bank heights	Yes		
Pool Depth at point of streamflow entry	No 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Cobble	Cobble
Bedrock Present	No	No	No
Type of Sediment Deposits	Point	None	None
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	Low	Low	
Hard Bank Armoring	Intact	Intact	
Stream bed scour causing undermining around or under structure	None	Abutments	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Herbaceous/Grass	Shrub/Sapling	
Dominant Vegetation Type - Right	Herbaceous/Grass	Mixed Forest	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	No	No	
Vegitation Band -Right	No	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments

New riprap. 18 ft span measured as effective width due to skew; VTrans lists max span as 22 ft, upper deck 25 ft span. Appears likely to be structure assessed in 2006 (by LSC) with GUID2014 D57EA5E9-D7A4-4414-B909-700A3C9F3B45. pix 1124-1127

VERMONT

Stream Geomorphic Assessment

Agency of Natural Resouces

VT DEC

Vermont.gov

September, 15 201

Culvert Summary Report

Wells River

General Information

SgaID	700000001003043	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, ES	Assessment Date	7/23/2015	Project Name	Wells River
Town	Groton	Latitude	44.204	Longitude	-72.18737
Location	farm road at 556 Little Italy Rd			Reach VTID	M15T2.01
Road Name		Road Type	Trail	Stream Name	Keenan Brook
High Flow Stage	No			Channel Width	25

Culvert Information

Culvert Length	20	Material	Tank
Culvert Height	4.9	Number of culverts	2
Culvert Width	9.8	Culvert Overflow Pipe	No
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No
		Culvert slope as compared with channel slope is significantly	Same

Upstream

Obstructions at the opening of the structure	Wood debris,Deformation	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Channelized Straight
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	Yes	Water depth in culvert (at outlet)	1.2
Downstream bank heights are substantially higher than upstream bank heights	Yes	Culvert outlet invert	At Grade
Stepped Footers	1.4 ft.	Backwater Length (measured from outlet)	0
Maximum pool depth	2.4 ft.	Backwater Length (measured from outlet)	0

	Upstream	Downstream	In Structure
Dominant Bed Material	Gravel	Sand	Sand
Bedrock Present	No	No	
Type of Sediment Deposits	Side	None	None
Material Present throughout			No
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	Low	Low	
Hard Bank Armoring	Failing	Failing	
Stream bed scour causing undermining around or under structure	None	Culvert	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Shrub/Sapling	Shrub/Sapling	
Dominant Vegetation Type - Right	Shrub/Sapling	Shrub/Sapling	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	No	No
Vegitation Band -Right	Yes	Yes

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments **used 25 ft measured stream width instead of 31.9 curve width due to E type stream. pix 606-609**

VERMONT

Stream Geomorphic Assessment

Agency of Natural Resouces

VT DEC

Vermont.gov

September, 15 201

Culvert Summary Report

Wells River

General Information

SgaID	600051000003101	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, EBM	Assessment Date	9/28/2015	Project Name	Wells River
Town	Ryegate	Latitude	44.20333	Longitude	-72.14511
Location	just SE of Hall Rd-Stone Rd jct ~1.2 mi upslope from Rte 302			Reach VTID	M12S2.02
Road Name	HALL RD	Road Type	Gravel	Stream Name	Stone Rd Brook
High Flow Stage	No			Channel Width	17

Culvert Information

Culvert Length	25	Material	Steel Corrugated
Culvert Height	5	Number of culverts	1
Culvert Width	4.6	Culvert Overflow Pipe	No
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No
		Culvert slope as compared with channel slope is significantly	Same

Upstream

Obstructions at the opening of the structure	Wood debris,Sediment	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	Yes	Angle of stream flow approaching structure	Channelized Straight
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	Yes	Water depth in culvert (at outlet)	0.9
Downstream bank heights are substantially higher than upstream bank heights	No	Culvert outlet invert	Partially Backwatered
Stepped Footers	1.2 ft.	Backwater Length (measured from outlet)	15
Maximum pool depth	2.2 ft.	Backwater Length (measured from outlet)	0

	Upstream	Downstream	In Structure
Dominant Bed Material	Sand	Sand	Sand
Bedrock Present	No	No	
Type of Sediment Deposits	None	None	None
Material Present throughout			No
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	High	Low	
Hard Bank Armoring	Failing	Intact	
Stream bed scour causing undermining around or under structure	Culvert,Wing walls	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Mixed Forest	Herbaceous/Grass	
Dominant Vegetation Type - Right	Herbaceous/Grass	Herbaceous/Grass	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	No	No
Vegitation Band -Right	No	No

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	Unsure - Tracks	None

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments

appears to be same structure assessed in a town inventory 2002 and by LSC (ANR protocols) in 2006 so used same GUID2014as those structures, which were already xlinked by this ID. 'Unsure' tracks outside structure were raccoon (no valid data entry option for this). pix 1190-1193

Culvert Summary Report

Wells River

General Information

SgaID	400009000009071	Local SgaID	0587	VOBCIT struct_num	
Observers	Redstart_milchman,dr, EBM	Assessment Date	11/18/2015	Project Name	Wells River
Town	Newbury	Latitude	44.1771	Longitude	-72.14868
Location	jct Swamp-Cesari Rds, ~0.95 mi up Swamp Rd from Rte 302 in S. Ryegate village			Reach VTID	M11T1.02
Road Name	CESARI RD	Road Type	Gravel	Stream Name	Scott Brook
High Flow Stage	No			Channel Width	30

Culvert Information

Culvert Length	16	Material	Concrete
Culvert Height	10	Number of culverts	1
Culvert Width	9.3	Culvert Overflow Pipe	No
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No
		Culvert slope as compared with channel slope is significantly	Same

Upstream

Obstructions at the opening of the structure	Sediment	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Mild Bend
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	Yes	Water depth in culvert (at outlet)	0.2
Downstream bank heights are substantially higher than upstream bank heights	No	Culvert outlet invert	At Grade
Stepped Footers	1.5 ft.	Backwater Length (measured from outlet)	0
Maximum pool depth	> 4.0 ft.	Backwater Length (measured from outlet)	0

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Cobble	None
Bedrock Present	No	No	
Type of Sediment Deposits	Side,Mid-channel	Side,Mid-channel	None
Material Present throughout			No
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	High	High	
Hard Bank Armoring	Intact	Failing	
Stream bed scour causing undermining around or under structure	None	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Coniferous Forest	Coniferous Forest	
Dominant Vegetation Type - Right	Coniferous Forest	Road Embankment	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	Yes	Yes	
Vegitation Band -Right	Yes	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? **Yes** Photos taken? **Yes**

Comments **Assessed as culvert, but intermediate between culvert and bridge - mixed stone and concrete sides, but poured concrete bottom that by protocols probably technically qualifies it as a culvert. GUID2014 of 24f7660c-5506-4108-9c5a-15ca1d7f2587 x-links to a Town inventory 2003, local ID 0353, that appears to be the same 'Mixed type' structure BUT WAS NOT ABLE TO BE SELECTED in dialog box below. 2013 inventory lists this structure with GUID2014 (selected in dialog below) of d7d64fef-c9d1-4c5a-9fea-752d089e2f60, no Local ID imported but assigned State ID B64 - no further attributes.**

Bridge Summary Report

Wells River

General Information

SgaID	400002000509071	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, EBM	Assessment Date	9/16/2015	Project Name	Wells River
Town	Newbury	Latitude	44.17854	Longitude	-72.14629
Location	~0.77 mi up Swamp Rd off Rte 302 in S. Ryegate village, 0.1 mi DS Bailey Pond Rd			Reach VTID	M11T1.02
Road Name	SWAMP RD	Road Type	Gravel	Stream Name	Scott Brook
High Flow Stage	No			Channel Width	33

Bridge Information

Bridge Width	40	Material	Concrete
Bridge Clearance	5.9	Number of bridge piers/arches	0
Bridge/Arch Span	12		
		Skewed to roadway?	Yes

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	Sediment	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	Yes	Angle of stream flow approaching structure	Mild Bend
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	Yes		
Downstream bank heights are substantially higher than upstream bank heights	No		
Pool Depth at point of streamflow entry	No 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Gravel	Gravel	Gravel
Bedrock Present	No	No	No
Type of Sediment Deposits	Point,Mid-channel	Side,Mid-channel	None
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	Low	Low	
Hard Bank Armoring	Intact	Failing	
Stream bed scour causing undermining around or under structure	Wing walls	Abutments	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Mixed Forest	Mixed Forest	
Dominant Vegetation Type - Right	Mixed Forest	Mixed Forest	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	Yes	Yes

Vegitation Band -Right	Yes	Yes

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? **Yes** Photos taken? **Yes**

Comments **used existing GUID2014 that x-links to town inventory 2003, Local ID 0451, and appears to be same structure. Did not use GUID2014 for structure inventoried 2013 as State ID B10, no Local ID imported and no further attributes. pix 1063-1067**

Bridge Summary Report

Wells River

General Information

SgaID	700000000903043	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, ES	Assessment Date	6/24/2015	Project Name	Wells River
Town	Groton	Latitude	44.20819	Longitude	-72.19005
Location	ftbridge between residence at 37 Tannery Brook Rd and Community Solar Farm at 1035 Scott Hwy			Reach VTID	M16S1.01
Road Name		Road Type	Trail	Stream Name	Tannery Brook
High Flow Stage	No			Channel Width	19.6

Bridge Information

Bridge Width	5.8	Material	Timber
Bridge Clearance	2.6	Number of bridge piers/arches	0
Bridge/Arch Span	26.2		
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Partially	Structure is located at significant break in valley slope	Unsure

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	Yes	Angle of stream flow approaching structure	Channelized Straight
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	No		
Downstream bank heights are substantially higher than upstream bank heights	No		
Pool Depth at point of streamflow entry	Yes 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Cobble	Cobble
Bedrock Present	No	No	No
Type of Sediment Deposits	None	None	None
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	Low	High	
Hard Bank Armoring	Failing	Failing	
Stream bed scour causing undermining around or under structure	None	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Herbaceous/Grass	Herbaceous/Grass	
Dominant Vegetation Type - Right	Herbaceous/Grass	Herbaceous/Grass	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	No	No
Vegitation Band -Right	No	No

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? **Yes** Photos taken? **Yes**

Comments **footbridge-equipment bridge does not appear to be in use currently. community solar farm off LB is new (within last 3 yrs max) in 2015; appears previously there was just a barn on this lot. pix 394-398**

Culvert Summary Report — Wells River

General Information

SgaID	100318000003101	Local SgaID		VOBCIT struct_num	100310002003101
Observers	Redstart_dr, EBM	Assessment Date	9/24/2015	Project Name	Wells River
Town	Ryegate	Latitude	44.18563	Longitude	-72.1398
Location	jct Church and Pleasant Sts, ~0.9 mi up Church St off Rte 302			Reach VTID	M11T1.01
Road Name	PLEASANT ST	Road Type	Paved	Stream Name	Scott Brook
High Flow Stage	No			Channel Width	35.5

Culvert Information

Culvert Length	30	Material	Concrete
Culvert Height	5.6	Number of culverts	2
Culvert Width	20	Culvert Overflow Pipe	No
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Not Significant	Structure is located at significant break in valley slope	No
		Culvert slope as compared with channel slope is significantly	Same

Upstream

Obstructions at the opening of the structure	Sediment	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Channelized Straight
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	Yes	Water depth in culvert (at outlet)	0.3
Downstream bank heights are substantially higher than upstream bank heights	No	Culvert outlet invert	At Grade
Stepped Footers	0.5 ft.	Backwater Length (measured from outlet)	0
Maximum pool depth	1.3 ft.	Backwater Length (measured from outlet)	0

	Upstream	Downstream	In Structure
Dominant Bed Material	Gravel	Gravel	Gravel
Bedrock Present	No	No	
Type of Sediment Deposits	Side	Side	Side
Material Present throughout			No
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	High	Low	
Hard Bank Armoring	Intact	Intact	
Stream bed scour causing undermining around or under structure	None	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Bare	Herbaceous/Grass	
Dominant Vegetation Type - Right	Deciduous Forest	Mixed Forest	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	No	No
Vegitation Band -Right	No	No

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	Unsure - Tracks	None

Other Information

Spatial location data collected with GPS? **Yes** Photos taken? **Yes**

Comments **used existing GUID2014 from a 2013 inventory that classed this as a bridge, state ID B20, no local ID imported and no further attributes. VTrans tracks and inspects this structure; StructNum in Step 1 is from this record but the record did not appear to have a GUID2014. Double barrel concrete box culvert, east culvert significantly sedimented and not carrying any water at lower level flows. 'Unsure' tracks in Step 6 (outside structure) were raccoon - no menu option for this data entry. pix 1154-1158.**

Culvert Summary Report — Wells River

General Information

SgaID	600053000003041	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, ES	Assessment Date	7/22/2015	Project Name	Wells River
Town	Groton	Latitude	44.20606	Longitude	-72.19461
Location	0.2 mi SE jct Railroad St and Powder Spring Rd, which is 0.2 mi up Powder Spring Rd from Rte 302 (Scott Hwy) in Groton village			Reach VTID	M15T2.02
Road Name	RAILROAD ST	Road Type	Gravel	Stream Name	Keenan Brook
High Flow Stage	No			Channel Width	26.2

Culvert Information

Culvert Length	30	Material	Steel Corrugated
Culvert Height	5.5	Number of culverts	1
Culvert Width	5.5	Culvert Overflow Pipe	No
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No
		Culvert slope as compared with channel slope is significantly	Same

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Mild Bend
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	Yes	Water depth in culvert (at outlet)	1.5
Downstream bank heights are substantially higher than upstream bank heights	Yes	Culvert outlet invert	At Grade
Stepped Footers	1.5 ft.	Backwater Length (measured from outlet)	0
Maximum pool depth	3.5 ft.	Backwater Length (measured from outlet)	0

	Upstream	Downstream	In Structure
Dominant Bed Material	Gravel	Gravel	None
Bedrock Present	No	No	
Type of Sediment Deposits	None	None	None
Material Present throughout			No
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	Low	Low	
Hard Bank Armoring	Intact	Intact	
Stream bed scour causing undermining around or under structure	Culvert	Culvert	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Shrub/Sapling	Herbaceous/Grass	
Dominant Vegetation Type - Right	Shrub/Sapling	Mixed Forest	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	Yes	No
Vegitation Band -Right	Yes	Yes

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? **Yes** Photos taken? **Yes**

Comments **Likely to be same structure as GUID2014 4a79fb20-3763-44bd-94a4-debf951c65e0 which was inventoried in 2004, local ID 353, though that structure was reported with length of 5 ft. GUID2014 5b642674-4996-43b7-9622-50b86456ce35, inventoried 2013 as State ID B11 (no local ID imported) lacked any other accompanying data. pix 577-580**

VERMONT

Stream Geomorphic Assessment

Agency of Natural Resouces

VT DEC

Vermont.gov

September, 15 201

Bridge Summary Report

Wells River

General Information

SgaID	700000000303043	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, AR	Assessment Date	9/1/2015	Project Name	Wells River
Town	Groton	Latitude	44.22213	Longitude	-72.27146
Location	DW entrance to 1212 Seyon Pond Rd, at jct with Buzzy's Rd			Reach VTID	M19T4.06
Road Name		Road Type	Gravel	Stream Name	South Branch Wells
High Flow Stage	No			Channel Width	33

Bridge Information

Bridge Width	12.5	Material	Steel
Bridge Clearance	7	Number of bridge piers/arches	0
Bridge/Arch Span	25		
		Skewed to roadway?	Yes

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	Yes	Angle of stream flow approaching structure	Mild Bend
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	Yes		
Downstream bank heights are substantially higher than upstream bank heights	Yes		
Pool Depth at point of streamflow entry	Yes 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Cobble	Cobble
Bedrock Present	No	No	No
Type of Sediment Deposits	Point	Side	None
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	Low	Low	
Hard Bank Armoring	Failing	Failing	
Stream bed scour causing undermining around or under structure	None	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Mixed Forest	Mixed Forest	
Dominant Vegetation Type - Right	Deciduous Forest	Herbaceous/Grass	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	Yes	Yes	
Vegitation Band -Right	Yes	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments Heath Brook confluence immediately DS. Likely "cleaned out", repaired post-Irene. pix 1001-1004

VERMONT

Stream Geomorphic Assessment

Agency of Natural Resouces

VT DEC

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Bridge Summary Report

Wells River

General Information

SgaID	100025000003041	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, EBM	Assessment Date	10/7/2015	Project Name	Wells River
Town	Groton	Latitude	44.22966	Longitude	-72.28224
Location	entrance to Groton State Forest on South Branch Rd (Class 4), ~0.6 mi from jct Seyon Pond Rd			Reach VTID	M19T4.06
Road Name	S BRANCH RD	Road Type	Gravel	Stream Name	South Branch Wells
High Flow Stage	No			Channel Width	33.5

Bridge Information

Bridge Width	12.5	Material	Steel
Bridge Clearance	5.3	Number of bridge piers/arches	0
Bridge/Arch Span	25		
		Skewed to roadway?	Yes

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	Sediment	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Mild Bend
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	No		
Downstream bank heights are substantially higher than upstream bank heights	No		
Pool Depth at point of streamflow entry	No 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Boulder	Boulder	Boulder
Bedrock Present	No	No	No
Type of Sediment Deposits	Side	Point	Point
Elevation of sediment deposits >= 1/2 bankfull	Yes	Yes	Yes
Bank Erosion	Low	Low	
Hard Bank Armoring	Failing	Intact	
Stream bed scour causing undermining around or under structure	None	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Mixed Forest	Mixed Forest	
Dominant Vegetation Type - Right	Mixed Forest	Mixed Forest	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	Yes	Yes	
Vegitation Band -Right	Yes	Yes	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments split channel US of bridge, channel also outflanked RB in Irene. pix 1263-1266

VERMONT

Stream Geomorphic Assessment

Agency of Natural Resouces

VT DEC

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Bridge Summary Report

Wells River

General Information

SgaID	700000000403103	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, EBM	Assessment Date	9/23/2015	Project Name	Wells River
Town	Ryegate	Latitude	44.18432	Longitude	-72.13918
Location	footbridge by house at 311 Church St, ~150 ft DS Terry Hill bridge			Reach VTID	M11T1.01
Road Name		Road Type	Trail	Stream Name	Scott Brook
High Flow Stage	No			Channel Width	35.5

Bridge Information

Bridge Width	6	Material	Timber
Bridge Clearance	4.5	Number of bridge piers/arches	0
Bridge/Arch Span	18		
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Not Significant	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	Yes	Angle of stream flow approaching structure	Channelized Straight
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	No		
Downstream bank heights are substantially higher than upstream bank heights	No		
Pool Depth at point of streamflow entry	Yes 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Cobble	Cobble
Bedrock Present	No	No	No
Type of Sediment Deposits	Mid-channel	None	None
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	High	High	
Hard Bank Armoring	Failing	Failing	
Stream bed scour causing undermining around or under structure	Wing walls	Wing walls	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Herbaceous/Grass	Herbaceous/Grass	
Dominant Vegetation Type - Right	Herbaceous/Grass	Herbaceous/Grass	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	No	No	
Vegitation Band -Right	No	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments **markedly stepped footers, hard bank armoring substantially impacted in recent flooding. pix 1142-1145**

VERMONT

Stream Geomorphic Assessment

Agency of Natural Resouces

VT DEC

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Bridge Summary Report

Wells River

General Information

SgaID	700000004609073	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, ES	Assessment Date	8/12/2015	Project Name	Wells River
Town	Newbury	Latitude	44.16373	Longitude	-72.16515
Location	sugarbush access bridge at edge of hay fields on US end of fenced dog run along Swamp Rd, ~0.3 mi US of pvt driveway bridge at beaver ponds visible from Swamp Rd ~0.9 mi US of Jefferson Hill Rd			Reach VTID	M11T1.03
Road Name		Road Type	Trail	Stream Name	Scott Brook
High Flow Stage	No			Channel Width	30.8

Bridge Information

Bridge Width	8	Material	Timber
Bridge Clearance	4.5	Number of bridge piers/arches	0
Bridge/Arch Span	20		
		Skewed to roadway?	Yes

Geomorphic Information

General

Floodplain filled by roadway approaches	Partially	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	Wood debris	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Channelized Straight
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	No		
Downstream bank heights are substantially higher than upstream bank heights	Yes		
Pool Depth at point of streamflow entry	No 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Gravel	Gravel	Gravel
Bedrock Present	No	No	No
Type of Sediment Deposits	Point	None	Point
Elevation of sediment deposits >= 1/2 bankfull	Yes	No	No
Bank Erosion	High	High	
Hard Bank Armoring	Failing	Failing	
Stream bed scour causing undermining around or under structure	Abutments	Abutments	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Mixed Forest	Mixed Forest	
Dominant Vegetation Type - Right	Herbaceous/Grass	Mixed Forest	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	Yes	Yes	
Vegitation Band -Right	Yes	Yes	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS?	Yes	Photos taken?	Yes

Comments **sugarbush access bridge is short distance US of DS-swinging gate that completely blocks access out (US) from fenced dog run. pix 0786-0788, 0794**

VERMONT

Stream Geomorphic Assessment

Agency of Natural Resouces

VT DEC

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Bridge Summary Report

Wells River

General Information

SgaID	300320000003101	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, EBM	Assessment Date	9/23/2015	Project Name	Wells River
Town	Ryegate	Latitude	44.18377	Longitude	-72.13918
Location	~0.2 mi up Church St off Rte 302 in S. Ryegate village			Reach VTID	M11T1.01
Road Name	TERRY HILL RD	Road Type	Gravel	Stream Name	Scott Brook
High Flow Stage	No			Channel Width	33.1

Bridge Information

Bridge Width	19	Material	Concrete
Bridge Clearance	5	Number of bridge piers/arches	0
Bridge/Arch Span	8.4		
		Skewed to roadway?	Yes

Geomorphic Information

General

Floodplain filled by roadway approaches	Partially	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	200
Steep riffle present immediately upstream of structure	Yes	Angle of stream flow approaching structure	Mild Bend
If channel avulses, stream will	Follow Road		

Downstream

Pool present immediately downstream of structure	Yes		
Downstream bank heights are substantially higher than upstream bank heights	Yes		
Pool Depth at point of streamflow entry	Yes 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Gravel	Cobble	Boulder
Bedrock Present	No	No	No
Type of Sediment Deposits	Mid-channel	Side	None
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	High	Low	
Hard Bank Armoring	Intact	Intact	
Stream bed scour causing undermining around or under structure	None	Wing walls	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Herbaceous/Grass	Herbaceous/Grass	
Dominant Vegetation Type - Right	Herbaceous/Grass	Herbaceous/Grass	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	No	No	
Vegitation Band -Right	No	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments Hard bank armoring is intact because its new. pix 1138-1141

Bridge Summary Report

Wells River

General Information

SgaID	700000000203043	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, ES	Assessment Date	8/17/2015	Project Name	Wells River
Town	Groton	Latitude	44.24089	Longitude	-72.23716
Location	500 ft DS outlet Ricker Pond			Reach VTID	M22
Road Name	S COUNTY RD	Road Type	Trail	Stream Name	Wells River
High Flow Stage	No			Channel Width	61

Bridge Information

Bridge Width	12	Material	Steel
Bridge Clearance	6	Number of bridge piers/arches	0
Bridge/Arch Span	32		
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Channelized Straight
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	Yes		
Downstream bank heights are substantially higher than upstream bank heights	Yes		
Pool Depth at point of streamflow entry	Yes 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Cobble	Cobble
Bedrock Present	No	No	No
Type of Sediment Deposits	None	None	None
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	High	Low	
Hard Bank Armoring	Failing	Failing	
Stream bed scour causing undermining around or under structure	Abutments	Abutments	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Mixed Forest	Mixed Forest	
Dominant Vegetation Type - Right	Mixed Forest	Mixed Forest	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	Yes	Yes
Vegitation Band -Right	No	No

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments pix 0834-0837

Bridge Summary Report

Wells River

General Information

SgaID	700000000503103	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, EBM	Assessment Date	9/23/2015	Project Name	Wells River
Town	Ryegate	Latitude	44.18468	Longitude	-72.13956
Location	pvt driveway to 259 Church St, ~0.15 mi up Church St from Rte 302			Reach VTID	M11T1.01
Road Name		Road Type	Gravel	Stream Name	Scott Brook
High Flow Stage	No			Channel Width	35

Bridge Information

Bridge Width	9.8	Material	Steel
Bridge Clearance	6.7	Number of bridge piers/arches	0
Bridge/Arch Span	12		
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Not Significant	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	Yes	Angle of stream flow approaching structure	Channelized Straight
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	Yes		
Downstream bank heights are substantially higher than upstream bank heights	Yes		
Pool Depth at point of streamflow entry	Yes 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Cobble	Cobble
Bedrock Present	No	No	No
Type of Sediment Deposits	Mid-channel	Side	Side
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	Low	High	
Hard Bank Armoring	Failing	Failing	
Stream bed scour causing undermining around or under structure	None	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Herbaceous/Grass	Bare	
Dominant Vegetation Type - Right	Herbaceous/Grass	Deciduous Forest	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	No	No	
Vegitation Band -Right	No	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments pix 1149-1152

VERMONT

Stream Geomorphic Assessment

Agency of Natural Resouces

VT DEC

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Bridge Summary Report

Wells River

General Information

SgaID	700000001903043	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, ES	Assessment Date	8/5/2015	Project Name	Wells River
Town	Groton	Latitude	44.22362	Longitude	-72.22818
Location	pvt driveway to 304 State Forest Rd (Rte 232), ~0.3 mi US from Rte 302			Reach VTID	M21
Road Name		Road Type	Gravel	Stream Name	Wells River
High Flow Stage	Yes			Channel Width	85.4

Bridge Information

Bridge Width	12	Material	Steel
Bridge Clearance	5.1	Number of bridge piers/arches	0
Bridge/Arch Span	32		
		Skewed to roadway?	Yes

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Channelized Straight
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	Yes		
Downstream bank heights are substantially higher than upstream bank heights	No		
Pool Depth at point of streamflow entry	No 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Gravel	Cobble	Bedrock
Bedrock Present	Yes	Yes	Yes
Type of Sediment Deposits	None	None	None
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	Low	Low	
Hard Bank Armoring	Failing	Intact	
Stream bed scour causing undermining around or under structure	Wing walls	Wing walls	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Mixed Forest	Mixed Forest	
Dominant Vegetation Type - Right	Road Embankment	Road Embankment	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	Yes	Yes	
Vegitation Band -Right	No	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments

85 ft Wbkf measured at x-section; curve width is 53 ft, but x-sectional areas (measured and curve) were within 2% - structure located on bedrock. pix 730-0734

Bridge Summary Report

Wells River

General Information

SgaID	700000000103043	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, ES	Assessment Date	8/17/2015	Project Name	Wells River
Town	Groton	Latitude	44.23402	Longitude	-72.23295
Location	1076 State Forest Rd (Rte 232)			Reach VTID	M22
Road Name		Road Type	Gravel	Stream Name	Wells River
High Flow Stage	No			Channel Width	61

Bridge Information

Bridge Width	14	Material	Steel
Bridge Clearance	4	Number of bridge piers/arches	0
Bridge/Arch Span	32		
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Channelized Straight
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	Yes		
Downstream bank heights are substantially higher than upstream bank heights	No		
Pool Depth at point of streamflow entry	No 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Bedrock	Bedrock
Bedrock Present	Yes	Yes	Yes
Type of Sediment Deposits	None	None	None
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	High	Low	
Hard Bank Armoring	Intact	Failing	
Stream bed scour causing undermining around or under structure	None	None	
Beaver Dam near Structure	Yes	Yes	
Beaver Dam distance (ft.)	600	600	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Herbaceous/Grass	Herbaceous/Grass	
Dominant Vegetation Type - Right	Road Embankment	Road Embankment	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	No	No	
Vegitation Band -Right	No	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments pix 0853-0856

VERMONT

Stream Geomorphic Assessment

Agency of Natural Resouces

VT DEC

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Bridge Summary Report

Wells River

General Information

SgaID	100002000003101	Local SgaID		VOBCIT struct_num	100310000203101
Observers	Redstart_dr, ES	Assessment Date	6/30/2015	Project Name	Wells River
Town	Ryegate	Latitude	44.18722	Longitude	-72.14066
Location	100 ft N of Scott Hwy (Rte 302) in South Ryegate village, just W of Post Office			Reach VTID	M12
Road Name	CHURCH ST	Road Type	Paved	Stream Name	Wells River
High Flow Stage	No			Channel Width	88

Bridge Information

Bridge Width	25	Material	Steel
Bridge Clearance	8	Number of bridge piers/arches	0
Bridge/Arch Span	70		
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Mild Bend
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	Yes		
Downstream bank heights are substantially higher than upstream bank heights	Yes		
Pool Depth at point of streamflow entry	Yes 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Gravel	Cobble	Cobble
Bedrock Present	No	No	No
Type of Sediment Deposits	None	None	None
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	Low	Low	
Hard Bank Armoring	Intact	Failing	
Stream bed scour causing undermining around or under structure	None	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Herbaceous/Grass	Mixed Forest	
Dominant Vegetation Type - Right	Road Embankment	Road Embankment	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	No	Yes	
Vegitation Band -Right	No	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments

Appears to be in both VTrans (http://crashweb.vtransweb.aot.state.vt.us/VTransparency/ViewReport.aspx?rpt=RecordID&RecordID=6083&Type=structuresL STRUCNUM 100310000203101) database and DMS (https://anrweb.vt.gov/DEC/SGA/datasets/structures/data/sStep1.aspx?sid=2631&did=2413&option=view&phid=3) but GUID2014 search did not turn up any match w/in 20m; created new GUID. Second set of old abutments 50 ft DS.

Bridge Summary Report

Wells River

General Information

SgaID	100024000003041	Local SgaID		VOBCIT struct_num	100304001003041
Observers	Redstart_dr, AR	Assessment Date	9/1/2015	Project Name	Wells River
Town	Groton	Latitude	44.22186	Longitude	-72.27135
Location	immediately DS Seyon Pond Rd-Buzzys Rd jct			Reach VTID	M19T4.05S2.01
Road Name	SEYON POND RD	Road Type	Gravel	Stream Name	Heath Brook
High Flow Stage	No			Channel Width	28

Bridge Information

Bridge Width	30	Material	Concrete
Bridge Clearance	9	Number of bridge piers/arches	0
Bridge/Arch Span	25		
		Skewed to roadway?	Yes

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	Yes

Upstream

Obstructions at the opening of the structure	Sediment	Estimated distance avulsion would follow road	300
Steep riffle present immediately upstream of structure	Yes	Angle of stream flow approaching structure	Mild Bend
If channel avulses, stream will	Follow Road		

Downstream

Pool present immediately downstream of structure	Yes		
Downstream bank heights are substantially higher than upstream bank heights	No		
Pool Depth at point of streamflow entry	No 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Gravel	Gravel
Bedrock Present	No	No	No
Type of Sediment Deposits	Point	Delta	Side
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	Low	None	
Hard Bank Armoring	Failing	Failing	
Stream bed scour causing undermining around or under structure	None	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Deciduous Forest	Herbaceous/Grass	
Dominant Vegetation Type - Right	Mixed Forest	Shrub/Sapling	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	Yes	No
Vegitation Band -Right	Yes	No

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? **Yes**

Photos taken? **Yes**

Comments **Confluence with South Branch Wells immediately DS structure. May have been 'cleaned out' after Irene. pix 1006-1009**

VERMONT

Stream Geomorphic Assessment

Agency of Natural Resouces

VT DEC

Vermont.gov

September, 15 201

Culvert Summary Report

Wells River

General Information

SgaID	400032000003041	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, ES	Assessment Date	7/23/2015	Project Name	Wells River
Town	Groton	Latitude	44.20306	Longitude	-72.18492
Location	near end of Little Italy Rd in Groton village, separated from Wells mainstem by old railroad bed situated on high berm just north of this stream crossing			Reach VTID	M15T2.01
Road Name	LITTLE ITALY RD	Road Type	Gravel	Stream Name	Keenan Brook
High Flow Stage	No			Channel Width	25

Culvert Information

Culvert Length	20	Material	Steel Corrugated
Culvert Height	7.7	Number of culverts	2
Culvert Width	11.7	Culvert Overflow Pipe	No
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No
		Culvert slope as compared with channel slope is significantly	Same

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Mild Bend
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	Yes	Water depth in culvert (at outlet)	0.5
Downstream bank heights are substantially higher than upstream bank heights	Yes	Culvert outlet invert	At Grade
Stepped Footers	3 ft.	Backwater Length (measured from outlet)	0
Maximum pool depth	> 4.0 ft.	Backwater Length (measured from outlet)	0

	Upstream	Downstream	In Structure
Dominant Bed Material	Sand	Sand	Sand
Bedrock Present	No	No	
Type of Sediment Deposits	Point,Side	Mid-channel	None
Material Present throughout			No
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	High	Low	
Hard Bank Armoring	None	None	
Stream bed scour causing undermining around or under structure	None	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Herbaceous/Grass	Herbaceous/Grass	
Dominant Vegetation Type - Right	Shrub/Sapling	Herbaceous/Grass	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	Yes	No
Vegitation Band -Right	Yes	No

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments GUID2014 assigned to this culvert was also assigned to a culvert inventoried at this location in 2004, Local ID 196; the same 2004 inventory documented the accompanying 4 ft culvert at this location, local ID 195, which was assigned GUID2014 776884dc-47e4-4099-a448-abf7c5e97ac3. ANR protocols record the combined width of side by side culverts at a single location, so these two culverts (4 ft and 7.7 ft wide) are combined here under GUID2014 487bcf43-418e-4f6f-bd99-aee01c189785. A bridge (state ID B12, no Local ID imported) was inventoried here in 2013 and assigned GUID2014 23e77bb3-3102-44b6-90c9-7985b9137b1c; appears likely this was a remote sensing effort and the culverts documented in 2004 and updated in 2015 are the actual structures located here. pix 613-616.

Bridge Summary Report

Wells River

General Information

SgaID	700000000303103	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, EBM	Assessment Date	10/6/2015	Project Name	Wells River
Town	Ryegate	Latitude	44.18949	Longitude	-72.1439
Location	underneath old granite stone shed building between Stoneshed Rd and Creamery St in South Ryegate village			Reach VTID	M12S2.01
Road Name		Road Type	Trail	Stream Name	Stone Rd Brook
High Flow Stage	No			Channel Width	20

Bridge Information

Bridge Width	30	Material	Concrete
Bridge Clearance	4.7	Number of bridge piers/arches	0
Bridge/Arch Span	10.8		
		Skewed to roadway?	Yes

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	Sediment	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	Yes	Angle of stream flow approaching structure	Mild Bend
If channel avulses, stream will	Unsure		

Downstream

Pool present immediately downstream of structure		No	
Downstream bank heights are substantially higher than upstream bank heights		Yes	
Pool Depth at point of streamflow entry		Yes 0 ft.	0

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Unknown	Sand
Bedrock Present	No	No	No
Type of Sediment Deposits	Point	None	Side
Elevation of sediment deposits >= 1/2 bankfull	Yes	No	Yes
Bank Erosion	High	High	
Hard Bank Armoring	Failing	Failing	
Stream bed scour causing undermining around or under structure	Footers	Wing walls	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Shrub/Sapling	Shrub/Sapling	
Dominant Vegetation Type - Right	Herbaceous/Grass	Shrub/Sapling	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	No	No
Vegitation Band -Right	No	No

Wildlife

Species	Roadkill	Outside Structure	Inside Structure
	None	Unsure - Tracks	None

Other Information

Spatial location data collected with GPS? **Yes** Photos taken? **Yes**

Comments **structure curves as it passes beneath old granite stoneshed building. did not find records of any previous assessments. Tracks outside structure were probably coyote. pix 1244-1247**

VERMONT

Stream Geomorphic Assessment

Agency of Natural Resouces

VT DEC

Vermont.gov

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Bridge Summary Report

Wells River

General Information

SgaID	700000004809073	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, ES	Assessment Date	8/13/2015	Project Name	Wells River
Town	Newbury	Latitude	44.17218	Longitude	-72.15749
Location	pvt driveway to 1198 Swamp Rd, ~0.6 mi US Jefferson Hill Rd-Swamp Rd jct			Reach VTID	M11T1.03
Road Name		Road Type	Gravel	Stream Name	Scott Brook
High Flow Stage	No			Channel Width	31.5

Bridge Information

Bridge Width	15	Material	Steel
Bridge Clearance	3.5	Number of bridge piers/arches	0
Bridge/Arch Span	25		
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	Wood debris	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Channelized Straight
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	No		
Downstream bank heights are substantially higher than upstream bank heights	No		
Pool Depth at point of streamflow entry	No 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Gravel	Gravel	Cobble
Bedrock Present	No	No	No
Type of Sediment Deposits	None	None	None
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	Low	Low	
Hard Bank Armoring	Intact	Intact	
Stream bed scour causing undermining around or under structure	None	None	
Beaver Dam near Structure	Yes	Yes	
Beaver Dam distance (ft.)	300	300	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Shrub/Sapling	Shrub/Sapling	
Dominant Vegetation Type - Right	Road Embankment	Road Embankment	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	Yes	Yes	
Vegitation Band -Right	No	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	Beaver - Feeding Signs	None

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments Concrete slabs on top of steel I-beams. pix 083-0816

VERMONT

Stream Geomorphic Assessment

Agency of Natural Resouces

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Bridge Summary Report

Wells River

General Information

SgaID	700000000103103	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, EBM	Assessment Date	10/5/2015	Project Name	Wells River
Town	Ryegate	Latitude	44.20243	Longitude	-72.1453
Location	just DS field ditch between fields ~325 ft DS of first Hall Rd culvert SE of Stone Rd-Hall Rd jct ~1.2 mi upslope of Rte 302			Reach VTID	M12S2.02
Road Name		Road Type	Trail	Stream Name	Stone Rd Brook
High Flow Stage	No			Channel Width	17

Bridge Information

Bridge Width	6	Material	Timber
Bridge Clearance	1.7	Number of bridge piers/arches	0
Bridge/Arch Span	10.5		
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Not Significant	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	Wood debris	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	Yes	Angle of stream flow approaching structure	Mild Bend
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	Yes		
Downstream bank heights are substantially higher than upstream bank heights	No		
Pool Depth at point of streamflow entry	No 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Gravel	Gravel	Gravel
Bedrock Present	No	No	No
Type of Sediment Deposits	Mid-channel	None	None
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	High	High	
Hard Bank Armoring	Failing	Failing	
Stream bed scour causing undermining around or under structure	Footers	Footers	
Beaver Dam near Structure	Yes	No	
Beaver Dam distance (ft.)	100	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Shrub/Sapling	Shrub/Sapling	
Dominant Vegetation Type - Right	Shrub/Sapling	Shrub/Sapling	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	No	No
Vegitation Band -Right	No	No

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	Deer - Tracks	None

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments **footbridge in disrepair, does not appear to be in recent use. pix 1196-1199**

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Stream Geomorphic Assessment

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Bridge Summary Report

Wells River

General Information

SgaID	300302000003101	Local SgaID		VOBCIT struct_num	990302000803101
Observers	Redstart_dr, EBM	Assessment Date	10/6/2015	Project Name	Wells River
Town	Ryegate	Latitude	44.19225	Longitude	-72.14042
Location	DS of two structures that channel stream around house at 273 Stone Rd, ~0.27 mi upslope of Creamery Rd-Stone Rd jct			Reach VTID	M12S2.01
Road Name	STONE RD	Road Type	Paved	Stream Name	Stone Rd Brook
High Flow Stage	No			Channel Width	19.3

Bridge Information

Bridge Width	25	Material	Concrete
Bridge Clearance	5.8	Number of bridge piers/arches	0
Bridge/Arch Span	16.2		
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	Sediment	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	Yes	Angle of stream flow approaching structure	Mild Bend
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	Yes		
Downstream bank heights are substantially higher than upstream bank heights	No		
Pool Depth at point of streamflow entry	No 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Sand	Sand	Gravel
Bedrock Present	No	No	No
Type of Sediment Deposits	Mid-channel	Side	Side
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	High	High	
Hard Bank Armoring	Failing	Failing	
Stream bed scour causing undermining around or under structure	None	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Herbaceous/Grass	Herbaceous/Grass	
Dominant Vegetation Type - Right	Mixed Forest	Mixed Forest	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	No	No	
Vegitation Band -Right	Yes	Yes	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments

appears likely to be structure assessed by LSC in 2006 (ANR protocols); that assessment noted 'New Structure', and landowner also reported bridge was replaced before Irene. VTrans database shows bridge with State ID B14, imported with no Local ID, at this location for a 2013 inventory - most other data lacking for that assessment but is already xlinked using same GUID2014; this was also assigned to the current assessment reported here. pix 1225-1228

Bridge Summary Report

Wells River

General Information

SgaID	400302000103101	Local SgaID		VOBCIT struct_num	990302001403101
Observers	Redstart_dr, EBM	Assessment Date	10/6/2015	Project Name	Wells River
Town	Ryegate	Latitude	44.18969	Longitude	-72.14298
Location	US of 2 structures at corner of Stone Rd and Creamery Rd in South Ryegate village			Reach VTID	M12S2.01
Road Name	STONE RD	Road Type	Paved	Stream Name	Stone Rd Brook
High Flow Stage	No			Channel Width	19.3

Bridge Information

Bridge Width	20	Material	Concrete
Bridge Clearance	4.7	Number of bridge piers/arches	0
Bridge/Arch Span	12.5		
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	Sediment	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	Yes	Angle of stream flow approaching structure	Sharp Bend
If channel avulses, stream will	Unsure		

Downstream

Pool present immediately downstream of structure	Yes		
Downstream bank heights are substantially higher than upstream bank heights	Yes		
Pool Depth at point of streamflow entry	No 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Gravel	Sand
Bedrock Present	No	No	No
Type of Sediment Deposits	Side	None	Side
Elevation of sediment deposits >= 1/2 bankfull	Yes	No	Yes
Bank Erosion	Low	Low	
Hard Bank Armoring	Intact	Failing	
Stream bed scour causing undermining around or under structure	None	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Herbaceous/Grass	Herbaceous/Grass	
Dominant Vegetation Type - Right	Herbaceous/Grass	Mixed Forest	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	No	No
Vegitation Band -Right	No	No

Wildlife

Roadkill	Outside Structure	Inside Structure

Species	None	None	None

Other Information

Spatial location data collected with GPS? **Yes** Photos taken? **Yes**

Comments **appears to be same structure assessed by LSC in 2006, 'newish structure', using ANR protocols; shares GUID2014 with VTrans database entry for inventory 2013, State ID B22, no local ID imported; used same GUID2014 for assessment reported here. pix 1235-1239**

VERMONT

Stream Geomorphic Assessment

Agency of Natural Resouces

VT DEC

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Culvert Summary Report

Wells River

General Information

SgaID	700000001803043	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, ES	Assessment Date	8/26/2015	Project Name	Wells River
Town	Groton	Latitude	44.20822	Longitude	-72.18115
Location	logging rd or trail across rd from driveway at 155 Glover Rd			Reach VTID	M15S1.01
Road Name		Road Type	Trail	Stream Name	Clark Hatch Brook
High Flow Stage	No			Channel Width	18

Culvert Information

Culvert Length	20	Material	Steel Corrugated
Culvert Height	3	Number of culverts	1
Culvert Width	3	Culvert Overflow Pipe	No
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Partially	Structure is located at significant break in valley slope	No
		Culvert slope as compared with channel slope is significantly	Same

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	Yes	Angle of stream flow approaching structure	Naturally Straight
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	Yes	Water depth in culvert (at outlet)	0.3
Downstream bank heights are substantially higher than upstream bank heights	No	Culvert outlet invert	Free Fall
Stepped Footers	1 ft.	Backwater Length (measured from outlet)	0
Maximum pool depth	2 ft.	Backwater Length (measured from outlet)	0.3

	Upstream	Downstream	In Structure
Dominant Bed Material	Gravel	Cobble	Gravel
Bedrock Present	No	No	
Type of Sediment Deposits	None	None	None
Material Present throughout			No
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	High	Low	
Hard Bank Armoring	Failing	Failing	
Stream bed scour causing undermining around or under structure	Culvert	Culvert	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Mixed Forest	Mixed Forest	
Dominant Vegetation Type - Right	Road Embankment	Road Embankment	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	Yes	Yes	
Vegitation Band -Right	No	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments pix 1015-1018

VERMONT

Stream Geomorphic Assessment

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Bridge Summary Report

Wells River

General Information

SgaID	700000004509073	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, ES	Assessment Date	6/11/2015	Project Name	Wells River
Town	Newbury	Latitude	44.15104	Longitude	-72.16547
Location	on log rd, 0.3 mi east of Grapes Rd-Swamp Rd jct			Reach VTID	M11T1.05
Road Name		Road Type		Stream Name	Scott Brook
High Flow Stage	No			Channel Width	18.3

Bridge Information

Bridge Width	8	Material	Timber
Bridge Clearance	2.6	Number of bridge piers/arches	0
Bridge/Arch Span	9		
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Partially	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	Wood debris	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	Yes	Angle of stream flow approaching structure	Channelized Straight
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	No		
Downstream bank heights are substantially higher than upstream bank heights	Yes		
Pool Depth at point of streamflow entry	No 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Cobble	Cobble
Bedrock Present	No	No	No
Type of Sediment Deposits	Side	None	None
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	Low	High	
Hard Bank Armoring	Intact	Intact	
Stream bed scour causing undermining around or under structure	None	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Mixed Forest	Mixed Forest	
Dominant Vegetation Type - Right	Mixed Forest	Mixed Forest	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	Yes	Yes	
Vegitation Band -Right	Yes	Yes	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments likely used for logging and/or sugaring, then converted to footbridge; does not appear to have seen much use in some time but stone bank armoring still largely intact. pix 324-326

VERMONT

Stream Geomorphic Assessment

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Culvert Summary Report

Wells River

General Information

SgaID	300302000003042	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, ES	Assessment Date	8/27/2015	Project Name	Wells River
Town	Groton	Latitude	44.20607	Longitude	-72.18055
Location	at base of Glover Rd across from Groton Cemetery			Reach VTID	M15S1.01
Road Name	SCOTT HWY	Road Type	Paved	Stream Name	Clark Hatch Brook
High Flow Stage	No			Channel Width	19

Culvert Information

Culvert Length	100	Material	Steel Corrugated
Culvert Height	7	Number of culverts	1
Culvert Width	7	Culvert Overflow Pipe	No
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	Yes
		Culvert slope as compared with channel slope is significantly	Higher

Upstream

Obstructions at the opening of the structure	Wood debris,Sediment	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	Yes	Angle of stream flow approaching structure	Sharp Bend
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	Yes	Water depth in culvert (at outlet)	0.2
Downstream bank heights are substantially higher than upstream bank heights	Yes	Culvert outlet invert	Free Fall
Stepped Footers	1 ft.	Backwater Length (measured from outlet)	0
Maximum pool depth	3.5 ft.	Backwater Length (measured from outlet)	0.1

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Sand	None
Bedrock Present	No	No	
Type of Sediment Deposits	Point	None	None
Material Present throughout			No
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	Low	Low	
Hard Bank Armoring	Intact	Intact	
Stream bed scour causing undermining around or under structure	None	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Mixed Forest	Deciduous Forest	
Dominant Vegetation Type - Right	Road Embankment	Deciduous Forest	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	Yes	Yes	
Vegitation Band -Right	No	Yes	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments **surprised not to find existing inventory on ANR Atlas; new GUID2014 created. pix 1030-1036**

VERMONT

Stream Geomorphic Assessment

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Culvert Summary Report

Wells River

General Information

SgaID	700000001703043	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, ES	Assessment Date	8/26/2015	Project Name	Wells River
Town	Groton	Latitude	44.21181	Longitude	-72.18179
Location	pvt driveway at 410 Glover Rd, ~0.4 mi off Rte 302			Reach VTID	M15S1.01
Road Name		Road Type	Gravel	Stream Name	Clark Hatch Brook
High Flow Stage	No			Channel Width	18

Culvert Information

Culvert Length	40	Material	Steel Corrugated
Culvert Height	3.7	Number of culverts	1
Culvert Width	5.8	Culvert Overflow Pipe	No
		Skewed to roadway?	Yes

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No
		Culvert slope as compared with channel slope is significantly	Same

Upstream

Obstructions at the opening of the structure	Wood debris,Deformation	Estimated distance avulsion would follow road	50
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Channelized Straight
If channel avulses, stream will	Follow Road		

Downstream

Pool present immediately downstream of structure	Yes	Water depth in culvert (at outlet)	0.25
Downstream bank heights are substantially higher than upstream bank heights	No	Culvert outlet invert	Free Fall
Stepped Footers	2 ft.	Backwater Length (measured from outlet)	0
Maximum pool depth	2.5 ft.	Backwater Length (measured from outlet)	0.6

	Upstream	Downstream	In Structure
Dominant Bed Material	Gravel	Sand	None
Bedrock Present	No	No	
Type of Sediment Deposits	None	None	None
Material Present throughout			No
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	Low	High	
Hard Bank Armoring	Intact	Intact	
Stream bed scour causing undermining around or under structure	Wing walls	Culvert,Wing walls	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Coniferous Forest	Coniferous Forest	
Dominant Vegetation Type - Right	Mixed Forest	Mixed Forest	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	Yes	Yes	
Vegitation Band -Right	Yes	Yes	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? **Yes** Photos taken? **Yes**

Comments **significantly deformed. some medium size honeysuckle around structure. pix 1001-1005**

Bridge Summary Report

Wells River

General Information

SgaID	400314000003101	Local SgaID		VOBCIT struct_num	990314001803101
Observers	Redstart_dr, EBM	Assessment Date	10/6/2015	Project Name	Wells River
Town	Ryegate	Latitude	44.8934	Longitude	-72.14403
Location	old granite stoneshed yards in South Ryegate village			Reach VTID	M12S2.01
Road Name	STONESHED RD	Road Type	Gravel	Stream Name	Stone Rd Brook
High Flow Stage	No			Channel Width	20

Bridge Information

Bridge Width	15.6	Material	Timber
Bridge Clearance	4.5	Number of bridge piers/arches	0
Bridge/Arch Span	11.3		
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Mild Bend
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	No		
Downstream bank heights are substantially higher than upstream bank heights	No		
Pool Depth at point of streamflow entry	No 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Sand	Sand	Gravel
Bedrock Present	No	No	No
Type of Sediment Deposits	Side	Point	None
Elevation of sediment deposits >= 1/2 bankfull	No	Yes	No
Bank Erosion	High	High	
Hard Bank Armoring	Failing	Failing	
Stream bed scour causing undermining around or under structure	None	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Shrub/Sapling	Shrub/Sapling	
Dominant Vegetation Type - Right	Shrub/Sapling	Shrub/Sapling	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	No	No	
Vegitation Band -Right	No	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments

appears to be same structure xlinked by GUID2014 used here, which was also assessed in 2006 (LSC, ANR protocols) and inventoried as State ID B30, no local ID imported, in 2013; StructNum is from 2006 assessment. pix 1248-1251

Bridge Summary Report

Wells River

General Information

SgaID	100002000009071	Local SgaID		VOBCIT struct_num	100907001209071
Observers	Redstart_dr, ES	Assessment Date	8/10/2015	Project Name	Wells River
Town	Newbury	Latitude	44.15907	Longitude	-72.16639
Location	~1.5 mi US Jefferson Hill Rd			Reach VTID	M11T1.04
Road Name	SWAMP RD	Road Type	Gravel	Stream Name	Scott Brook
High Flow Stage	No			Channel Width	31.7

Bridge Information

Bridge Width	20	Material	Concrete
Bridge Clearance	4.7	Number of bridge piers/arches	0
Bridge/Arch Span	21		
		Skewed to roadway?	Yes

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Channelized Straight
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	No		
Downstream bank heights are substantially higher than upstream bank heights	No		
Pool Depth at point of streamflow entry	No 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Cobble	Cobble
Bedrock Present	No	No	No
Type of Sediment Deposits	Side	Point	Side
Elevation of sediment deposits >= 1/2 bankfull	Yes	No	No
Bank Erosion	High	High	
Hard Bank Armoring	Intact	Intact	
Stream bed scour causing undermining around or under structure	Wing walls	Wing walls	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Road Embankment	Mixed Forest	
Dominant Vegetation Type - Right	Coniferous Forest	Road Embankment	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	No	Yes	
Vegitation Band -Right	Yes	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? **Yes** Photos taken? **Yes**

Comments **Bridge built 1928. Parapet wall reduces effective width of rd from 20 ft to less than 18 ft; wall on DS end is cracked through and partially buckled. Assigned new GUID2014: VTrans tracks this structure as Bridge B12, Newbury-Swamp Rd Bridge (last inspected October 2015), but this record did not have a GUID2014 (did have StructNum given in Step 1). Existing GUID2014 (fd21230a-6bcd-4163-960b-69606e70dd24) near this location was from a 2003 town inventory, Local ID 0429, for a 24 ft long, 8 ft round concrete sectional culvert - did not appear to be the same structure so did not use that GUID2014. Channel width of 31.7 ft was measured at representative x-sec for overall reach; hydraulic curve width is 23 ft. pix 754-757**

Culvert Summary Report

Wells River

General Information

SgaID	400005000003101	Local SgaID		VOBCIT struct_num	990005000403101
Observers	Redstart_dr, EBM	Assessment Date	10/6/2015	Project Name	Wells River
Town	Ryegate	Latitude	44.18973	Longitude	-72.14334
Location	DS of 2 structures at corner of Creamery Rd and Stone Rd in South Ryegate village			Reach VTID	M12S2.01
Road Name	CREAMERY RD	Road Type	Paved	Stream Name	Stone Rd Brook
High Flow Stage	No			Channel Width	20

Culvert Information

Culvert Length	30	Material	Concrete
Culvert Height	4.6	Number of culverts	1
Culvert Width	12.5	Culvert Overflow Pipe	No
		Skewed to roadway?	Yes

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No
		Culvert slope as compared with channel slope is significantly	Lower

Upstream

Obstructions at the opening of the structure	Sediment	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	Yes	Angle of stream flow approaching structure	Sharp Bend
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	No	Water depth in culvert (at outlet)	0.4
Downstream bank heights are substantially higher than upstream bank heights	No	Culvert outlet invert	At Grade
Stepped Footers	0 ft.	Backwater Length (measured from outlet)	0
Maximum pool depth	0 ft.	Backwater Length (measured from outlet)	0

	Upstream	Downstream	In Structure
Dominant Bed Material	Gravel	Gravel	Gravel
Bedrock Present	No	No	
Type of Sediment Deposits	Point	Side	Side
Material Present throughout			No
Elevation of sediment deposits >= 1/2 bankfull	Yes	Yes	No
Bank Erosion	High	Low	
Hard Bank Armoring	Intact	Failing	
Stream bed scour causing undermining around or under structure	Wing walls	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Herbaceous/Grass	Shrub/Sapling	
Dominant Vegetation Type - Right	Mixed Forest	Herbaceous/Grass	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	No	No

Vegitation Band -Right	No	No

Wildlife

Species	Roadkill	Outside Structure	Inside Structure
	None	None	None

Other Information

Spatial location data collected with GPS? **Yes** Photos taken? **Yes**

Comments **Box culvert appears to be same structure xlinked by GUID2014 used here, which was also assessed in 2006 (LSC, ANR protocols) and inventoried as State ID B10, no local ID imported, in 2013; StructNum is from 2006 assessment. pix 1240-1243**

VERMONT

Stream Geomorphic Assessment

Agency of Natural Resouces

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September, 15 201

Bridge Summary Report

Wells River

General Information

SgaID	700000000003043	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, ES	Assessment Date	6/29/2015	Project Name	Wells River
Town	Ryegate	Latitude	44.20105	Longitude	-72.16522
Location	~0.2 mi NE Brown Dr at Ryegate/Groton town line			Reach VTID	M14
Road Name		Road Type	Trail	Stream Name	Wells River
High Flow Stage	Yes			Channel Width	92

Bridge Information

Bridge Width	15.5	Material	Steel
Bridge Clearance	6	Number of bridge piers/arches	0
Bridge/Arch Span	36		
		Skewed to roadway?	Yes

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Sharp Bend
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	Yes		
Downstream bank heights are substantially higher than upstream bank heights	No		
Pool Depth at point of streamflow entry	No 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Sand	Sand	Sand
Bedrock Present	No	No	No
Type of Sediment Deposits	None	Point,Side	None
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	Low	Low	
Hard Bank Armoring	Intact	Intact	
Stream bed scour causing undermining around or under structure	None	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Herbaceous/Grass	Herbaceous/Grass	
Dominant Vegetation Type - Right	Herbaceous/Grass	Herbaceous/Grass	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	No	No	
Vegitation Band -Right	No	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments Clough farm bridge; rd is in VCGI-E911 driveways layer

Bridge Summary Report

Wells River

General Information

SgaID	200302000003101	Local SgaID		VOBCIT struct_num	200026004003102
Observers	Redstart_dr, ES	Assessment Date	6/30/2015	Project Name	Wells River
Town	Ryegate	Latitude	44.19099	Longitude	-72.1464
Location	150 ft from US end of Creamery Rd			Reach VTID	M13
Road Name	SCOTT HWY	Road Type	Paved	Stream Name	Wells River
High Flow Stage	No			Channel Width	86

Bridge Information

Bridge Width	40	Material	Steel
Bridge Clearance	10.7	Number of bridge piers/arches	2
Bridge/Arch Span	60		
		Skewed to roadway?	Yes

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Mild Bend
If channel avulses, stream will	Unsure		

Downstream

Pool present immediately downstream of structure		No	
Downstream bank heights are substantially higher than upstream bank heights		No	
Pool Depth at point of streamflow entry		No 0 ft.	0

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Sand	Cobble
Bedrock Present	Yes	No	No
Type of Sediment Deposits	None	None	None
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	High	Low	
Hard Bank Armoring	Intact	Intact	
Stream bed scour causing undermining around or under structure	None	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Road Embankment	Road Embankment	
Dominant Vegetation Type - Right	Road Embankment	Road Embankment	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	No	No	
Vegitation Band -Right	No	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments

Span in Step 2 is between piers. Structure appears to be in VTrans database (http://crashweb.vtransweb.aot.state.vt.us/VTransparency/ViewReport.aspx?rpt=RecordID&RecordID=1655&Type=structuresL, STRUCNUM 200026004003102) and in DMS (https://anrweb.vt.gov/DEC/SGA/datasets/structures/data/sStep1.aspx?sid=4915&did=24&option=view&phid=3) but no match turned up for GUID2014 w/in 20 m; created new GUID.

Bridge Summary Report

Wells River

General Information

SgaID	100048000003041	Local SgaID		VOBCIT struct_num	100304001803041
Observers	Redstart_dr, ES	Assessment Date	7/15/2015	Project Name	Wells River
Town	Groton	Latitude	44.2134	Longitude	-72.20946
Location	300 ft SW off Rte 302 on Welton Rd, between Groton and W. Groton villages			Reach VTID	M18
Road Name	WELTON RD	Road Type	Gravel	Stream Name	Wells River
High Flow Stage	No			Channel Width	55

Bridge Information

Bridge Width	16.5	Material	Steel
Bridge Clearance	6	Number of bridge piers/arches	0
Bridge/Arch Span	60		
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	60
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Channelized Straight
If channel avulses, stream will	Follow Road		

Downstream

Pool present immediately downstream of structure	No		
Downstream bank heights are substantially higher than upstream bank heights	No		
Pool Depth at point of streamflow entry	No 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Cobble	Cobble
Bedrock Present	No	No	No
Type of Sediment Deposits	None	Side	None
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	Low	Low	
Hard Bank Armoring	Intact	Intact	
Stream bed scour causing undermining around or under structure	None	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Herbaceous/Grass	Herbaceous/Grass	
Dominant Vegetation Type - Right	Herbaceous/Grass	Herbaceous/Grass	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	No	No	
Vegitation Band -Right	No	No	

Wildlife

Roadkill	Outside Structure	Inside Structure

Species	None	None	None

Other Information

Spatial location data collected with GPS? **Yes** Photos taken? **Yes**

Comments **Elected to create new GUID2014 as structure was a new replacement in 2013. Former GUID2014 (384f5976-bc25-47bd-9f38-49e00d2ad456) appeared to be for a 40'L 18'W ft bridge, with Comment that Doug Morton posted the record in Jan 2014 as a test; that GUID2014 also appears on assessment of the 40 ft bridge by LSC in 2006 (using ANR protocols). VTrans tracks and inspects this structure with StructNum entered in Step 1.**

Bridge Summary Report — Wells River

General Information

SgaID	500302000003042	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, ES	Assessment Date	6/24/2015	Project Name	Wells River
Town	Groton	Latitude	44.20868	Longitude	-72.1898
Location	Scott Hwy (Rte 302) at Tannery Brook Rd, Groton village; 0.1 mi SE Minard Hill Rd-Rte 302 jct			Reach VTID	M16S1.01
Road Name	SCOTT HWY	Road Type	Paved	Stream Name	Tannery Brook
High Flow Stage	No			Channel Width	19.6

Bridge Information

Bridge Width	21	Material	Concrete
Bridge Clearance	6	Number of bridge piers/arches	0
Bridge/Arch Span	5		
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	Wood debris	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	Yes	Angle of stream flow approaching structure	Channelized Straight
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	Yes		
Downstream bank heights are substantially higher than upstream bank heights	Yes		
Pool Depth at point of streamflow entry	No 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Cobble	Cobble
Bedrock Present	No	No	No
Type of Sediment Deposits	None	None	None
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	None	High	
Hard Bank Armoring	Intact	Failing	
Stream bed scour causing undermining around or under structure	None	Wing walls	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Mixed Forest	Herbaceous/Grass	
Dominant Vegetation Type - Right	Mixed Forest	Herbaceous/Grass	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	No	No

Vegitation Band -Right	No	No

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? **Yes** Photos taken? **Yes**

Comments **Remarkable that this structure does not appear on ANR Atlas or VCGI VTrans layers, likely because it is an ultra-short. Hard for two vehicles to pass over this bridge at same time, no shoulders, and tree on US end is major inlet obstruction. pix 388-392.**

Bridge Summary Report

Wells River

General Information

SgaID	700000000703043	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, ES	Assessment Date	8/3/2015	Project Name	Wells River
Town	Groton	Latitude	44.21926	Longitude	-72.22167
Location	DS parking lot of Upper Valley Grill & General Store, ~140 ft US of Scott Hwy (Rte 302) bridge by Puffer ballfield and confluence of South Branch with Wells mainstem			Reach VTID	M19T4.01
Road Name		Road Type	Trail	Stream Name	South Branch Wells
High Flow Stage	No			Channel Width	53.7

Bridge Information

Bridge Width	12	Material	Steel
Bridge Clearance	8.5	Number of bridge piers/arches	0
Bridge/Arch Span	50		
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	250
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Channelized Straight
If channel avulses, stream will	Follow Road		

Downstream

Pool present immediately downstream of structure	No		
Downstream bank heights are substantially higher than upstream bank heights	No		
Pool Depth at point of streamflow entry	Yes 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Cobble	Cobble
Bedrock Present	No	No	No
Type of Sediment Deposits	Side	Side	Side
Elevation of sediment deposits >= 1/2 bankfull	Yes	Yes	Yes
Bank Erosion	High	High	
Hard Bank Armoring	Intact	Failing	
Stream bed scour causing undermining around or under structure	None	Abutments	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Road Embankment	Road Embankment	
Dominant Vegetation Type - Right	Mixed Forest	Mixed Forest	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	No	No
Vegitation Band -Right	Yes	Yes

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? **Yes** Photos taken? **Yes**

Comments **snowmobile bridge. pix 705-708**

Bridge Summary Report

Wells River

General Information

SgaID	400021000003041	Local SgaID		VOBCIT struct_num	990021000703041
Observers	Redstart_dr, ES	Assessment Date	6/22/2015	Project Name	Wells River
Town	Groton	Latitude	44.22057	Longitude	-72.19016
Location	.79 mi up Minard Hill Rd off Rte 302			Reach VTID	M16S1.01
Road Name	POUND RD	Road Type	Gravel	Stream Name	Tannery Brook
High Flow Stage	No			Channel Width	17.7

Bridge Information

Bridge Width	13	Material	Steel
Bridge Clearance	4.4	Number of bridge piers/arches	0
Bridge/Arch Span	16		
		Skewed to roadway?	Yes

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	Wood debris	Estimated distance avulsion would follow road	100
Steep riffle present immediately upstream of structure	Yes	Angle of stream flow approaching structure	Mild Bend
If channel avulses, stream will	Unsure		

Downstream

Pool present immediately downstream of structure	No		
Downstream bank heights are substantially higher than upstream bank heights	No		
Pool Depth at point of streamflow entry	No 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Cobble	Cobble
Bedrock Present	No	No	No
Type of Sediment Deposits	Point	Point,Side	Point
Elevation of sediment deposits >= 1/2 bankfull	Yes	Yes	Yes
Bank Erosion	Low	High	
Hard Bank Armoring	Failing	Failing	
Stream bed scour causing undermining around or under structure	None	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Mixed Forest	Mixed Forest	
Dominant Vegetation Type - Right	Mixed Forest	Mixed Forest	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	Yes	Yes
Vegitation Band -Right	No	No

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? **Yes** Photos taken? **Yes**

Comments **likely to be same structure assessed by LSC in 2006 (GUID2014 15A0BEEB-45B9-452D-B62C-FB296B06A784 Structnum 990021000703041), but clearance reduced and wood decking is snapped on overhangs and deteriorating in other places. Lg boulder riprap inside structure reduces effective width.**

Culvert Summary Report — Wells River

General Information

SgaID	600002000003041	Local SgaID		VOBCIT struct_num	700002011703043
Observers	Redstart_dr, ES	Assessment Date	6/17/2015	Project Name	Wells River
Town	Groton	Latitude	44.23417	Longitude	-72.18658
Location	2.0 mi up Minard Hill Rd off Rte 302 (Scott Hwy); 0.2 mi SW of Minard Hill-Cross-Glover Rds jct			Reach VTID	M16S1.01
Road Name	MINARD HILL RD	Road Type	Paved	Stream Name	Tannery Brook
High Flow Stage	No			Channel Width	15

Culvert Information

Culvert Length	50	Material	Steel Corrugated
Culvert Height	5	Number of culverts	1
Culvert Width	4.8	Culvert Overflow Pipe	No
		Skewed to roadway?	Yes

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No
		Culvert slope as compared with channel slope is significantly	Same

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	Yes	Angle of stream flow approaching structure	Sharp Bend
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	Yes	Water depth in culvert (at outlet)	1.4
Downstream bank heights are substantially higher than upstream bank heights	No	Culvert outlet invert	At Grade
Stepped Footers	1.4 ft.	Backwater Length (measured from outlet)	0
Maximum pool depth	1.4 ft.	Backwater Length (measured from outlet)	0

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Gravel	Sand
Bedrock Present	Yes	No	
Type of Sediment Deposits	Side	None	None
Material Present throughout			No
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	High	High	
Hard Bank Armoring	Failing	Intact	
Stream bed scour causing undermining around or under structure	Culvert	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Road Embankment	Shrub/Sapling	

Dominant Vegetation Type - Right	Shrub/Sapling	Road Embankment

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	No	Yes
Vegitation Band -Right	Yes	No

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? **Yes** Photos taken? **Yes**

Comments **appears to be same structure assessed by LSC in 2006, town in 2004; this was source of VOBCIT Struct_num (700002011703043) as well as GUID2014 (B379583E-D28F-4157-82EB-72BCC82AA622). LSC 2006 assessment noted scour pool US of structure, now sedimented in. Significant rust, no holes. Channel curve width (based on drainage area above culvert) is for reach point M16S1.02, short distance US. pix 348-351.**

Culvert Summary Report

Wells River

General Information

SgaID	400001000003041	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, ES	Assessment Date	7/21/2015	Project Name	Wells River
Town	Groton	Latitude	44.20245	Longitude	-72.20061
Location	0.67 mi up Powder Spring Rd off Rte 302 (Scott Hwy) in Groton village, by large power line cut			Reach VTID	M15T2.03
Road Name	POWDER SPRING RD	Road Type	Paved	Stream Name	Keenan Brook
High Flow Stage	No			Channel Width	27.3

Culvert Information

Culvert Length	50	Material	Steel Corrugated
Culvert Height	6	Number of culverts	1
Culvert Width	6	Culvert Overflow Pipe	No
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No
		Culvert slope as compared with channel slope is significantly	Same

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Sharp Bend
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	Yes	Water depth in culvert (at outlet)	2.7
Downstream bank heights are substantially higher than upstream bank heights	Yes	Culvert outlet invert	At Grade
Stepped Footers	2.7 ft.	Backwater Length (measured from outlet)	0
Maximum pool depth	2.9 ft.	Backwater Length (measured from outlet)	0

	Upstream	Downstream	In Structure
Dominant Bed Material	Gravel	Sand	Sand
Bedrock Present	No	No	
Type of Sediment Deposits	None	None	None
Material Present throughout			No
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	Low	High	
Hard Bank Armoring	Intact	Intact	
Stream bed scour causing undermining around or under structure	Culvert,Wing walls	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Mixed Forest	Mixed Forest	
Dominant Vegetation Type - Right	Road Embankment	Mixed Forest	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	Yes	Yes
Vegitation Band -Right	No	Yes

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? **Yes** Photos taken? **Yes**

Comments **Appears to be same structure as one entered under this GUID2014 as a bridge (state ID B5, Local ID not imported) inventoried in 2013, as well as GUID2014 395a1f14-6675-4066-bbb4-8e0207a18f81 (local ID 286), a culvert inventoried in 2004. 2013 inventory notes structure was reset in 1973 flood; riprap on DS end indicates it may have been reset again more recently, but this may have been part of hydrant install. Channel splits 800 ft US and rejoins on US end of this culvert. Granite slab on US end to check incision. pix 555-558**

Culvert Summary Report

Wells River

General Information

SgaID	300302000103042	Local SgaID		VOBCIT struct_num	300026003903101
Observers	Redstart_dr, ES	Assessment Date	5/20/2015	Project Name	Wells River
Town	Ryegate	Latitude	44.20561	Longitude	-72.16966
Location	Rte 302 at base of Witherspoon Rd at Ryegate-Groton town line			Reach VTID	M14S2.01
Road Name	SCOTT HWY	Road Type	Paved	Stream Name	Darius James Brook
High Flow Stage	No			Channel Width	19

Culvert Information

Culvert Length	90	Material	Steel Corrugated
Culvert Height	8.5	Number of culverts	1
Culvert Width	14.2	Culvert Overflow Pipe	No
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No
		Culvert slope as compared with channel slope is significantly	Same

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	Yes	Angle of stream flow approaching structure	Channelized Straight
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	No	Water depth in culvert (at outlet)	0.5
Downstream bank heights are substantially higher than upstream bank heights	No	Culvert outlet invert	At Grade
Stepped Footers	0 ft.	Backwater Length (measured from outlet)	0
Maximum pool depth	0 ft.	Backwater Length (measured from outlet)	0

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Gravel	Gravel
Bedrock Present	No	No	
Type of Sediment Deposits	Side	None	None
Material Present throughout			No
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	Low	Low	
Hard Bank Armoring	Intact	Intact	
Stream bed scour causing undermining around or under structure	None	None	

Beaver Dam near Structure	No	No
Beaver Dam distance (ft.)	0	0

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Mixed Forest	Herbaceous/Grass	
Dominant Vegetation Type - Right	Mixed Forest	Herbaceous/Grass	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	Yes	No
Vegitation Band -Right	Yes	No

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? **Yes** Photos taken? **Yes**

Comments **Appears to be same structure as assessed in 2006 by LSC, so used the existing GUID2014 for that structure though that record indicates RoadName of Hall Rd and GUID Lookup tool did not turn it up in search radius (appears nearby on ANR Atlas). VTrans also maintains data for this structure (StructNum 300026003903101) but there does not appear to be a GUID2014 currently associated with that record. Baffles installed in structure for AOP retrofit. pix 0115-0119**

Culvert Summary Report

Wells River

General Information

SgaID	400302000003101	Local SgaID		VOBCIT struct_num	990302000903101
Observers	Redstart_dr, EBM	Assessment Date	10/5/2015	Project Name	Wells River
Town	Ryegate	Latitude	44.19281	Longitude	-72.14087
Location	US of two structures that channel stream in a loop around house at 273 Stone Rd, ~0.27 mi upslope from Creamery Rd-Stone Rd jct			Reach VTID	M12S2.01
Road Name	STONE RD	Road Type	Paved	Stream Name	Stone Rd Brook
High Flow Stage	No			Channel Width	19.3

Culvert Information

Culvert Length	60	Material	Steel Corrugated
Culvert Height	7.3	Number of culverts	1
Culvert Width	11.3	Culvert Overflow Pipe	No
		Skewed to roadway?	Yes

Geomorphic Information

General

Floodplain filled by roadway approaches	Partially	Structure is located at significant break in valley slope	No
		Culvert slope as compared with channel slope is significantly	Same

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	200
Steep riffle present immediately upstream of structure	Yes	Angle of stream flow approaching structure	Sharp Bend
If channel avulses, stream will	Follow Road		

Downstream

Pool present immediately downstream of structure	Yes	Water depth in culvert (at outlet)	0.4
Downstream bank heights are substantially higher than upstream bank heights	No	Culvert outlet invert	Free Fall
Stepped Footers	0.6 ft.	Backwater Length (measured from outlet)	0
Maximum pool depth	1.1 ft.	Backwater Length (measured from outlet)	0.5

	Upstream	Downstream	In Structure
Dominant Bed Material	Gravel	Gravel	None
Bedrock Present	No	No	
Type of Sediment Deposits	Mid-channel	Mid-channel	None
Material Present throughout			No
Elevation of sediment deposits >= 1/2 bankfull	No	No	No

Bank Erosion	High	High
Hard Bank Armoring	Failing	Failing
Stream bed scour causing undermining around or under structure	Wing walls	None
Beaver Dam near Structure	No	No
Beaver Dam distance (ft.)	0	0

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Deciduous Forest	Herbaceous/Grass	
Dominant Vegetation Type - Right	Mixed Forest	Shrub/Sapling	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	No	No
Vegitation Band -Right	No	Yes

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? **Yes** Photos taken? **Yes**

Comments **appears likely to be structure assessed by LSC in 2006 (ANR protocols), so used existing GUID2014 from that structure; that assessment noted 'culvert replaced old bridge'. VTrans database shows bridge with State ID B15, GUID2014 855f4deb-2d35-4a89-913c-8995b060f645, imported with no Local ID at this location for a 2013 inventory - most other data lacking for that assessment, did not use that GUID2014. pix 1220-1224**

VERMONT

Stream Geomorphic Assessment

Agency of Natural Resouces

VT DEC

Vermont.gov

September, 15 201

Bridge Summary Report

Wells River

General Information

SgaID	700000000203103	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, EBM	Assessment Date	10/5/2015	Project Name	Wells River
Town	Ryegate	Latitude	44.20016	Longitude	-72.14418
Location	ftbridge just E of house at 848 Stone Rd			Reach VTID	M12S2.02
Road Name		Road Type	Trail	Stream Name	Stone Rd Brook
High Flow Stage	No			Channel Width	17

Bridge Information

Bridge Width	4	Material	Timber
Bridge Clearance	3.5	Number of bridge piers/arches	0
Bridge/Arch Span	20		
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Not Significant	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Channelized Straight
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	No		
Downstream bank heights are substantially higher than upstream bank heights	No		
Pool Depth at point of streamflow entry	No 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Gravel	Gravel	Gravel
Bedrock Present	No	No	No
Type of Sediment Deposits	None	None	None
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	Low	Low	
Hard Bank Armoring	Failing	Failing	
Stream bed scour causing undermining around or under structure	Footers	Footers	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Shrub/Sapling	Shrub/Sapling	
Dominant Vegetation Type - Right	Herbaceous/Grass	Herbaceous/Grass	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	Yes	Yes	
Vegitation Band -Right	No	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? **Yes**

Photos taken? **Yes**

Comments **ftbridge in use, relatively new; area appears fenced as dog run (beagles?). signs of beaver activity but no nearby dams. pix 1204-1208**

VERMONT

Stream Geomorphic Assessment

Agency of Natural Resouces

VT DEC

Vermont.gov

September, 15 201

Culvert Summary Report

Wells River

General Information

SgaID	600013000003041	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, ES	Assessment Date	8/27/2015	Project Name	Wells River
Town	Groton	Latitude	44.20794	Longitude	-72.18101
Location	just DS of driveway to 155 Glover Rd			Reach VTID	M15S1.01
Road Name	GLOVER RD	Road Type	Gravel	Stream Name	Clark Hatch Brook
High Flow Stage	No			Channel Width	18

Culvert Information

Culvert Length	35	Material	Steel Corrugated
Culvert Height	2	Number of culverts	1
Culvert Width	2	Culvert Overflow Pipe	No
		Skewed to roadway?	Yes

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No
		Culvert slope as compared with channel slope is significantly	Higher

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	400
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Channelized Straight
If channel avulses, stream will	Follow Road		

Downstream

Pool present immediately downstream of structure	Yes	Water depth in culvert (at outlet)	0.2
Downstream bank heights are substantially higher than upstream bank heights	Yes	Culvert outlet invert	Free Fall
Stepped Footers	0.6 ft.	Backwater Length (measured from outlet)	0
Maximum pool depth	1.2 ft.	Backwater Length (measured from outlet)	0.2

	Upstream	Downstream	In Structure
Dominant Bed Material	Bedrock	Gravel	None
Bedrock Present	Yes	No	
Type of Sediment Deposits	None	None	None
Material Present throughout			No
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	High	Low	
Hard Bank Armoring	Failing	None	
Stream bed scour causing undermining around or under structure	Culvert	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Mixed Forest	Road Embankment	
Dominant Vegetation Type - Right	Road Embankment	Mixed Forest	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	Yes	No	
Vegitation Band -Right	No	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments

Interesting set-up in that this structure only carries part of the flow of the stream, diverting it off the top of ledge grade controls and into a small flood chute on the opposite side of the road before that flow is returned to the main channel through a second culvert a short distance downstream. culvert appears to have been assessed in inventory of town structures, June 2011 so assessment reported here (ANR protocols) uses the same GUID2014. pix 1020-1023

Culvert Summary Report

Wells River

General Information

SgaID	600013000103041	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, ES	Assessment Date	8/27/2015	Project Name	Wells River
Town	Groton	Latitude	44.20762	Longitude	-72.18085
Location	just US of driveway to 97 Glover Rd, ~0.1 mi off Rte 302			Reach VTID	M15S1.01
Road Name	GLOVER RD	Road Type	Gravel	Stream Name	Clark Hatch Brook
High Flow Stage	No			Channel Width	18

Culvert Information

Culvert Length	34	Material	Steel Corrugated
Culvert Height	2.5	Number of culverts	1
Culvert Width	2.5	Culvert Overflow Pipe	No
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No
		Culvert slope as compared with channel slope is significantly	Higher

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Channelized Straight
If channel avulses, stream will	Unsure		

Downstream

Pool present immediately downstream of structure	No	Water depth in culvert (at outlet)	0.3
Downstream bank heights are substantially higher than upstream bank heights	Yes	Culvert outlet invert	Free Fall
Stepped Footers	0 ft.	Backwater Length (measured from outlet)	0
Maximum pool depth	0 ft.	Backwater Length (measured from outlet)	1.2

	Upstream	Downstream	In Structure
Dominant Bed Material	Gravel	Boulder	None
Bedrock Present	No	No	
Type of Sediment Deposits	Side	None	None
Material Present throughout			No
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	Low	High	
Hard Bank Armoring	Intact	Failing	
Stream bed scour causing undermining around or under structure	Culvert	Wing walls	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Mixed Forest	Mixed Forest	
Dominant Vegetation Type - Right	Herbaceous/Grass	Road Embankment	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	Yes	Yes	
Vegitation Band -Right	No	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? **Yes** Photos taken? **Yes**

Comments **DS end of a loop that carries part of the stream flow off the top of ledge grade controls a short distance US, diverts it under Glover Rd into an old flood chute, and returns it to stream through this culvert. Appears to be same structure as one assessed in an inventory of town structures in 2004, so used the GUID2014 assigned to that structure already. The 2004 inventory reported no perch, but this culvert now appears to be well above stream level-a boulder appears to be placed below the invert to create a cascade effect. pix 1024-1027.**

Bridge Summary Report — Wells River

General Information

SgaID	200302000103042	Local SgaID		VOBCIT struct_num	200026003203042
Observers	Redstart_dr, ES	Assessment Date	8/3/2015	Project Name	Wells River
Town	Groton	Latitude	44.21954	Longitude	-72.22092
Location	by Puffer ballfield and Upper Valley Grill & General Store at confluence of South Branch and Wells mainstem			Reach VTID	M19T4.01
Road Name	SCOTT HWY	Road Type	Paved	Stream Name	South Branch Wells
High Flow Stage	No			Channel Width	53.7

Bridge Information

Bridge Width	45	Material	Steel
Bridge Clearance	5.7	Number of bridge piers/arches	0
Bridge/Arch Span	54		
		Skewed to roadway?	Yes

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	Wood debris,Sediment	Estimated distance avulsion would follow road	450
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Mild Bend
If channel avulses, stream will	Follow Road		

Downstream

Pool present immediately downstream of structure	No		
Downstream bank heights are substantially higher than upstream bank heights	No		
Pool Depth at point of streamflow entry	No 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Cobble	Cobble
Bedrock Present	No	No	No
Type of Sediment Deposits	Point	Point	Point
Elevation of sediment deposits >= 1/2 bankfull	Yes	Yes	Yes
Bank Erosion	High	High	
Hard Bank Armoring	Intact	Intact	
Stream bed scour causing undermining around or under structure	None	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Road Embankment	Mixed Forest	
Dominant Vegetation Type - Right	Mixed Forest	Road Embankment	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	No	Yes

Vegitation Band -Right	Yes	No

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? **Yes** Photos taken? **Yes**

Comments **point bar begins US, continues thru and DS of bridge; >half bkf height, occupies half bridge opening. pix 710-713**

Bridge Summary Report

Wells River

General Information

SgaID	100001000003041	Local SgaID		VOBCIT struct_num	200193000603042
Observers	Redstart_dr, ES	Assessment Date	7/15/2015	Project Name	Wells River
Town	Groton	Latitude	44.20971	Longitude	-72.19714
Location	400 ft SW US Rte 302 in Groton village, jct of Powder Spring Rd, Mill St, River St and Little Italy Rd			Reach VTID	M17
Road Name	POWDER SPRING RD	Road Type	Paved	Stream Name	Wells River
High Flow Stage	No			Channel Width	76

Bridge Information

Bridge Width	30	Material	Steel
Bridge Clearance	10	Number of bridge piers/arches	0
Bridge/Arch Span	50		
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Channelized Straight
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	No		
Downstream bank heights are substantially higher than upstream bank heights	No		
Pool Depth at point of streamflow entry	No 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Cobble	Cobble
Bedrock Present	Yes	Yes	Yes
Type of Sediment Deposits	None	None	None
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	High	High	
Hard Bank Armoring	Failing	Intact	
Stream bed scour causing undermining around or under structure	Wing walls	Wing walls	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Shrub/Sapling	Deciduous Forest	
Dominant Vegetation Type - Right	Deciduous Forest	Deciduous Forest	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	**No**	**No**
Vegitation Band -Right	**No**	**No**

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	**None**	**None**	**None**

Other Information

Spatial location data collected with GPS? **Yes** Photos taken? **Yes**

Comments **GUID2014 x-links to 2014 town inventory for Bridge 6. VTrans also tracks and inspects this structure-Step 1 StructNum is from their record. pix 0525-0528**

VERMONT

Stream Geomorphic Assessment

Agency of Natural Resouces

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September, 15 201

Bridge Summary Report

Wells River

General Information

SgaID	700000000403043	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, AR	Assessment Date	9/1/2015	Project Name	Wells River
Town	Groton	Latitude	44.22126	Longitude	-72.26807
Location	to garden at 1080 Seyon Pond Rd			Reach VTID	M19T4.06
Road Name		Road Type	Trail	Stream Name	South Branch Wells
High Flow Stage	No			Channel Width	40.4

Bridge Information

Bridge Width	12.5	Material	Timber
Bridge Clearance	5.6	Number of bridge piers/arches	0
Bridge/Arch Span	30		
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Partially	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	Yes	Angle of stream flow approaching structure	Channelized Straight
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	No		
Downstream bank heights are substantially higher than upstream bank heights	No		
Pool Depth at point of streamflow entry	Yes 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Cobble	Gravel
Bedrock Present	No	No	No
Type of Sediment Deposits	Mid-channel	Point	None
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	Low	Low	
Hard Bank Armoring	Failing	Failing	
Stream bed scour causing undermining around or under structure	None	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Mixed Forest	Shrub/Sapling	
Dominant Vegetation Type - Right	Mixed Forest	Mixed Forest	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	No	Yes
Vegitation Band -Right	No	Yes

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments Wood is treated with creosote. pix 1015-1018

Culvert Summary Report

Wells River

General Information

SgaID	300302000203102	Local SgaID		VOBCIT struct_num	300026004103101
Observers	Redstart_dr, EBM	Assessment Date	9/24/2015	Project Name	Wells River
Town	Ryegate	Latitude	44.18662	Longitude	-72.13874
Location	Next to Alley's Market at jct of Scott Brook and Wells mainstem in center of South Ryegate village			Reach VTID	M11T1.01
Road Name	SCOTT HWY	Road Type	Paved	Stream Name	Scott Brook
High Flow Stage	No			Channel Width	33

Culvert Information

Culvert Length	90	Material	Steel Corrugated
Culvert Height	8.2	Number of culverts	1
Culvert Width	16.9	Culvert Overflow Pipe	No
		Skewed to roadway?	Yes

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No
		Culvert slope as compared with channel slope is significantly	Same

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	Yes	Angle of stream flow approaching structure	Mild Bend
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	No	Water depth in culvert (at outlet)	0.8
Downstream bank heights are substantially higher than upstream bank heights	No	Culvert outlet invert	At Grade
Stepped Footers	0 ft.	Backwater Length (measured from outlet)	0
Maximum pool depth	0 ft.	Backwater Length (measured from outlet)	0

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Gravel	Sand
Bedrock Present	No	No	
Type of Sediment Deposits	Point	Side	Side
Material Present throughout			Yes
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	Low	Low	
Hard Bank Armoring	Intact	None	
Stream bed scour causing undermining around or under structure	None	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Herbaceous/Grass	Shrub/Sapling	
Dominant Vegetation Type - Right	Deciduous Forest	Deciduous Forest	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	Yes	Yes	
Vegitation Band -Right	No	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments

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Corrugated steel squash tube. Created new GUID2014; structure is tracked by VTrans - StructNum in Step 1 is from that record - but it did not appear to have a GUID2014. pix 1164-1168

Bridge Summary Report

Wells River

General Information

SgaID	400002000009071	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, ES	Assessment Date	5/27/2015	Project Name	Wells River
Town	Newbury	Latitude	44.13655	Longitude	-72.17313
Location	Swamp Rd at Topsham Rd			Reach VTID	M11T1.07
Road Name	SWAMP RD	Road Type	Gravel	Stream Name	Scott Brook
High Flow Stage	No			Channel Width	10.4

Bridge Information

Bridge Width	25	Material	Concrete
Bridge Clearance	4	Number of bridge piers/arches	0
Bridge/Arch Span	9.3		
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	Yes

Upstream

Obstructions at the opening of the structure	Sediment	Estimated distance avulsion would follow road	250
Steep riffle present immediately upstream of structure	Yes	Angle of stream flow approaching structure	Channelized Straight
If channel avulses, stream will	Follow Road		

Downstream

Pool present immediately downstream of structure	No		
Downstream bank heights are substantially higher than upstream bank heights	No		
Pool Depth at point of streamflow entry	No 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Cobble	Gravel
Bedrock Present	No	No	No
Type of Sediment Deposits	Mid-channel	None	None
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	Low	None	
Hard Bank Armoring	Failing	None	
Stream bed scour causing undermining around or under structure	None	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Road Embankment	Mixed Forest	
Dominant Vegetation Type - Right	Herbaceous/Grass	Mixed Forest	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	No	Yes	
Vegitation Band -Right	No	Yes	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS?	Yes	Photos taken?	Yes

Comments possibly a box culvert, but enough material in structure that bottom was not found. wetland complex downstream but beavers have moved quite a ways downstream into next reach, not active in vicinity of this structure in quite a while. GUID2014 0cf4695e-7ff1-44f1-afc0-3d009a686198, Local ID 0403 in a 2003 town inventory, appears in this same location but was a 22 ft long,3x4 ft concrete sectional with a damaged end; likely replaced by current structure, which was assigned the same GUID2014 as a bridge inventoried in 2013 at this location, State ID B2(no further attribute data).

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Bridge Summary Report

Wells River

General Information

SgaID	700000000803043	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, EBM	Assessment Date	9/21/2015	Project Name	Wells River
Town	Groton	Latitude	44.2302	Longitude	-72.20717
Location	to hayfields on last residence at US end of Branch Brook (Fred Hayes) Rd			Reach VTID	M18T3.02
Road Name		Road Type	Trail	Stream Name	North Branch Wells
High Flow Stage	No			Channel Width	38

Bridge Information

Bridge Width	3.3	Material	Timber
Bridge Clearance	4	Number of bridge piers/arches	0
Bridge/Arch Span	24		
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Not Significant	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Channelized Straight
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure		Yes	
Downstream bank heights are substantially higher than upstream bank heights		No	
Pool Depth at point of streamflow entry		No 0 ft.	0

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Sand	Sand
Bedrock Present	No	No	No
Type of Sediment Deposits	None	None	None
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	Low	Low	
Hard Bank Armoring	Intact	Failing	
Stream bed scour causing undermining around or under structure	None	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Coniferous Forest	Herbaceous/Grass	
Dominant Vegetation Type - Right	Mixed Forest	Herbaceous/Grass	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	No	No	
Vegitation Band -Right	No	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments footbridge between mowings; road ends at this homestead. pix 1088-1091

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Bridge Summary Report

Wells River

General Information

SgaID	100005000003101	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, ES	Assessment Date	7/13/2015	Project Name	Wells River
Town	Ryegate	Latitude	44.18502	Longitude	-72.12007
Location	0.17 mi off US Rte 302, DS end of Creamery Rd near jct with Quint Rd			Reach VTID	M11
Road Name	CREAMERY RD	Road Type	Paved	Stream Name	Wells River
High Flow Stage	No			Channel Width	92

Bridge Information

Bridge Width	32	Material	Steel
Bridge Clearance	11.8	Number of bridge piers/arches	0
Bridge/Arch Span	65		
		Skewed to roadway?	Yes

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	Yes	Angle of stream flow approaching structure	Mild Bend
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	No		
Downstream bank heights are substantially higher than upstream bank heights	No		
Pool Depth at point of streamflow entry	No 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Cobble	Cobble
Bedrock Present	No	No	No
Type of Sediment Deposits	Point,Side	Side	None
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	High	Low	
Hard Bank Armoring	Intact	Intact	
Stream bed scour causing undermining around or under structure	None	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Mixed Forest	Coniferous Forest	
Dominant Vegetation Type - Right	Mixed Forest	Road Embankment	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	Yes	Yes	
Vegitation Band -Right	Yes	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments sign on bridge dates it to 1929; no GUID match w/in 20m

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Bridge Summary Report

Wells River

General Information

SgaID	700000000003103	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, ES	Assessment Date	6/30/2015	Project Name	Wells River
Town	Ryegate	Latitude	44.19305	Longitude	-72.14819
Location	0.13 mi NW of upstream	Creamery Rd/Scott Hwy (US Rte 302) jct		Reach VTID	M13
Road Name		Road Type	Trail	Stream Name	Wells River
High Flow Stage	No			Channel Width	86

Bridge Information

Bridge Width	14	Material	Steel
Bridge Clearance	7.4	Number of bridge piers/arches	0
Bridge/Arch Span	36		
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Channelized Straight
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	Yes		
Downstream bank heights are substantially higher than upstream bank heights	No		
Pool Depth at point of streamflow entry	Yes 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Sand	Sand	Gravel
Bedrock Present	No	No	Yes
Type of Sediment Deposits	None	None	None
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	High	None	
Hard Bank Armoring	Intact	Intact	
Stream bed scour causing undermining around or under structure	Footers	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Shrub/Sapling	Shrub/Sapling	
Dominant Vegetation Type - Right	Shrub/Sapling	Shrub/Sapling	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	No	No	
Vegitation Band -Right	No	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments

appears unused now (or possibly only at haying time), cable across Scott Hwy (Rte 302) end, but may have served to connect Farquharson, Brown (was RR) and Barr Drs to Scott Hwy at one time. Hayfields RB both US and DS, road embankments LB, but banks thick with scrub-shrub. Surprisingly little erosion and decent floodplain access DS. pix 0421-0424

Bridge Summary Report

Wells River

General Information

SgaID	100017000003041	Local SgaID		VOBCIT struct_num	100304001603041
Observers	Redstart_dr, ES	Assessment Date	7/28/2015	Project Name	Wells River
Town	Groton	Latitude	44.22006	Longitude	-72.21956
Location	just DS Puffer ballfield and jct of Wells mainstem and South Branch, ~0.3 mi E of State Forest Rd (Rte 232)-Rte 302 jct			Reach VTID	M19
Road Name	COCHRAN RD	Road Type	Paved	Stream Name	Wells River
High Flow Stage	No			Channel Width	69.5

Bridge Information

Bridge Width	17	Material	Steel
Bridge Clearance	6	Number of bridge piers/arches	0
Bridge/Arch Span	40		
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	50
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Channelized Straight
If channel avulses, stream will	Follow Road		

Downstream

Pool present immediately downstream of structure	Yes		
Downstream bank heights are substantially higher than upstream bank heights	Yes		
Pool Depth at point of streamflow entry	No 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Cobble	Cobble
Bedrock Present	No	No	No
Type of Sediment Deposits	None	None	None
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	Low	Low	
Hard Bank Armoring	Intact	Intact	
Stream bed scour causing undermining around or under structure	Wing walls	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Herbaceous/Grass	Mixed Forest	
Dominant Vegetation Type - Right	Road Embankment	Road Embankment	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	No	Yes	
Vegitation Band -Right	No	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS?	Yes	Photos taken?	Yes

Comments

used existing GUID2014 from 2006 assessment (using ANR protocols) by LSC. VTrans tracks and inspects this structure but their record (StuctNum in Step 1 is from this) did not appear to have a GUID2014. pix 0637-0639, 0641

Bridge Summary Report

Wells River

General Information

SgaID	200302000303042	Local SgaID		VOBCIT struct_num	200026003503042
Observers	Redstart_dr, ES	Assessment Date	7/28/2015	Project Name	Wells River
Town	Groton	Latitude	44.21872	Longitude	-72.21452
Location	In between Powerhouse Rd and Goodfellow Rd jcts with Rte 302			Reach VTID	M19
Road Name	SCOTT HWY	Road Type	Paved	Stream Name	Wells River
High Flow Stage	No			Channel Width	69.5

Bridge Information

Bridge Width	45	Material	Steel
Bridge Clearance	17	Number of bridge piers/arches	0
Bridge/Arch Span	90		
		Skewed to roadway?	Yes

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	Yes

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	350
Steep riffle present immediately upstream of structure	Yes	Angle of stream flow approaching structure	Channelized Straight
If channel avulses, stream will	Follow Road		

Downstream

Pool present immediately downstream of structure	Yes		
Downstream bank heights are substantially higher than upstream bank heights	Yes		
Pool Depth at point of streamflow entry	No 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Boulder	Gravel	Bedrock
Bedrock Present	Yes	Yes	Yes
Type of Sediment Deposits	Mid-channel	Mid-channel	None
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	High	Low	
Hard Bank Armoring	Intact	Intact	
Stream bed scour causing undermining around or under structure	None	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Mixed Forest	Road Embankment	
Dominant Vegetation Type - Right	Road Embankment	Road Embankment	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	Yes	No	
Vegitation Band -Right	No	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species			

Other Information

Spatial location data collected with GPS? **Yes** Photos taken? **Yes**

Comments **Break in slope is DS, not US. Pool DS is limited-carved in bedrock. Effective width significantly reduced by skew to rd (~90 ft to 45 ft). Used existing GUID2014 from 2006 assessment (using ANR protocols) by LSC. VTrans tracks and inspects this structure but their record (StuctNum in Step 1 is from this) did not appear to have a GUID2014.**

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Bridge Summary Report

Wells River

General Information

SgaID	700000001103043	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, ES	Assessment Date	7/23/2015	Project Name	Wells River
Town	Groton	Latitude	44.20413	Longitude	-72.18671
Location	stone bridge along besdie Little Italy Rd just DS 556 Little Italy Rd			Reach VTID	M15T2.01
Road Name		Road Type	Trail	Stream Name	Keenan Brook
High Flow Stage	No			Channel Width	25

Bridge Information

Bridge Width	10	Material	Masonary (arches) & Slabs
Bridge Clearance	2	Number of bridge piers/arches	1
Bridge/Arch Span	3.8		
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Mild Bend
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	Yes		
Downstream bank heights are substantially higher than upstream bank heights	No		
Pool Depth at point of streamflow entry	Yes 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Gravel	Gravel	Gravel
Bedrock Present	No	No	No
Type of Sediment Deposits	None	None	None
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	High	High	
Hard Bank Armoring	Failing	Failing	
Stream bed scour causing undermining around or under structure	Abutments	Abutments	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Shrub/Sapling	Road Embankment	
Dominant Vegetation Type - Right	Shrub/Sapling	Shrub/Sapling	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	No	No
Vegitation Band -Right	Yes	Yes

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments

extremely undersized. used 25 ft measured channel width (from measured x-sec short distance DS) instead of 31.9 curve width due to E type stream. pix 609-610

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Bridge Summary Report

Wells River

General Information

SgaID	700000000503043	Local SgaID		VOBCIT struct_num	
Observers	Redstart_dr, AR	Assessment Date	9/1/2015	Project Name	Wells River
Town	Groton	Latitude	44.21832	Longitude	-72.26015
Location	to hayfields off LB just DS 653 Seyon Pond Rd			Reach VTID	M19T4.06
Road Name		Road Type	Gravel	Stream Name	South Branch Wells
High Flow Stage	No			Channel Width	40.4

Bridge Information

Bridge Width	14	Material	Steel
Bridge Clearance	7	Number of bridge piers/arches	0
Bridge/Arch Span	20		
		Skewed to roadway?	Yes

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Channelized Straight
If channel avulses, stream will	Cross Road		

Downstream

Pool present immediately downstream of structure	Yes		
Downstream bank heights are substantially higher than upstream bank heights	No		
Pool Depth at point of streamflow entry	No 0 ft.		0

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Gravel	Sand
Bedrock Present	No	No	No
Type of Sediment Deposits	None	None	None
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	Low	High	
Hard Bank Armoring	Failing	Failing	
Stream bed scour causing undermining around or under structure	None	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Shrub/Sapling	Mixed Forest	
Dominant Vegetation Type - Right	Mixed Forest	Shrub/Sapling	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	Yes	Yes
Vegitation Band -Right	No	No

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None	None	None

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments **substantial structure, may have been shored up recently. pix 1034-1037**

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Culvert Summary Report

Wells River

General Information

SgaID	600035000009071	Local SgaID	1730	VOBCIT struct_num	
Observers	Redstart_dr, ES	Assessment Date	5/28/2015	Project Name	Wells River
Town	Newbury	Latitude	44.13732	Longitude	-72.17649
Location	0.2 miles up topsham rd from swamp rd			Reach VTID	M11T1.07
Road Name	TOPSHAM RD	Road Type	Gravel	Stream Name	Scott Brook
High Flow Stage	No			Channel Width	10

Culvert Information

Culvert Length	20	Material	Concrete
Culvert Height	3.5	Number of culverts	1
Culvert Width	3.5	Culvert Overflow Pipe	No
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No
		Culvert slope as compared with channel slope is significantly	Higher

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Mild bend
If channel avulses, stream will	Cross road		

Downstream

Pool present immediately downstream of structure	Yes	Water depth in culvert (at outlet)	0.5
Downstream bank heights are substantially higher than upstream bank heights	Yes	Culvert outlet invert	At grade
Stepped Footers	1 ft.	Backwater Length (measured from outlet)	0
Maximum pool depth	1 ft.	Backwater Length (measured from outlet)	0

	Upstream	Downstream	In Structure
Dominant Bed Material	Sand	Gravel	None
Bedrock Present	No	No	No
Type of Sediment Deposits	None	Side	None
Material Present throughout			No
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	Low	High	
Hard Bank Armoring	None	Intact	
Stream bed scour causing undermining around or under structure	None	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Shrub/Sapling	Shrub/Sapling	
Dominant Vegetation Type - Right	Shrub/Sapling	Mixed Forest	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	Yes	Yes	
Vegitation Band -Right	Yes	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None		

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments

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Culvert Summary Report

Wells River

General Information

SgaID	700000000109073	Local SgaID	rs1_528	VOBCIT struct_num	
Observers	Redstart_dr, ES	Assessment Date	5/28/2015	Project Name	Wells River
Town	Newbury	Latitude	44.13748	Longitude	-72.17598
Location	162 Topsham Road			Reach VTID	M11T1.07
Road Name		Road Type	Gravel	Stream Name	Scott Brook
High Flow Stage	No	Channel Width			10

Culvert Information

Culvert Length	30	Material	Tank
Culvert Height	3.6	Number of culverts	1
Culvert Width	3.6	Culvert Overflow Pipe	No
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No
		Culvert slope as compared with channel slope is significantly	Lower

Upstream

Obstructions at the opening of the structure	None	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Naturally straight
If channel avulses, stream will	Unsure		

Downstream

Pool present immediately downstream of structure	No	Water depth in culvert (at outlet)	1
Downstream bank heights are substantially higher than upstream bank heights	No	Culvert outlet invert	At grade
Stepped Footers	0 ft.	Backwater Length (measured from outlet)	0
Maximum pool depth	0 ft.	Backwater Length (measured from outlet)	0

	Upstream	Downstream	In Structure
Dominant Bed Material	Sand	Gravel	Sand
Bedrock Present	No	No	No
Type of Sediment Deposits	None	None	None
Material Present throughout			No
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	Low	Low	
Hard Bank Armoring	Unknown	Unknown	
Stream bed scour causing undermining around or under structure	None	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Mixed Forest	Herbaceous/Grass	
Dominant Vegetation Type - Right	Mixed Forest	Herbaceous/Grass	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	No	No
Vegitation Band -Right	No	No

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None		

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments

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September, 15 201

Culvert Summary Report

Wells River

General Information

SgaID	700000000209073	Local SgaID	0933	VOBCIT struct_num	
Observers	Redstart_dr, ES	Assessment Date	5/28/2015	Project Name	Wells River
Town	Newbury	Latitude	44.13721	Longitude	-72.17483
Location	shared driveway to 96-98 Topsham Rd			Reach VTID	M11T1.07
Road Name		Road Type	Gravel	Stream Name	Scott Brook
High Flow Stage	No			Channel Width	10

Culvert Information

Culvert Length	17	Material	Tank
Culvert Height	4	Number of culverts	1
Culvert Width	4	Culvert Overflow Pipe	No
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No
		Culvert slope as compared with channel slope is significantly	Higher

Upstream

Obstructions at the opening of the structure	Wood Debris	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	No	Angle of stream flow approaching structure	Mild bend
If channel avulses, stream will	Cross road		

Downstream

Pool present immediately downstream of structure	Yes	Water depth in culvert (at outlet)	0.4
Downstream bank heights are substantially higher than upstream bank heights	No	Culvert outlet invert	At grade
Stepped Footers	0.6 ft.	Backwater Length (measured from outlet)	0
Maximum pool depth	0.6 ft.	Backwater Length (measured from outlet)	0

	Upstream	Downstream	In Structure
Dominant Bed Material	Sand	Gravel	None
Bedrock Present	No	Yes	No
Type of Sediment Deposits	None	None	None
Material Present throughout			No
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	Low	High	
Hard Bank Armoring	Failing	Intact	
Stream bed scour causing undermining around or under structure	Wing walls	Wing walls	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Shrub/Sapling	Deciduous Forest	
Dominant Vegetation Type - Right	Herbaceous/Grass	Road Embankment	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	Yes	Yes	
Vegitation Band -Right	No	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None		

Other Information

Spatial location data collected with GPS? **Yes**

Photos taken? **Yes**

Comments **coordinates placed on VHD streamline; location in field was ~ 40 ft NNW on driveway as mapped location of VHD streamline is closer to Topsham Rd than in the field.**

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Stream Geomorphic Assessment

Agency of Natural Resouces

VT DEC

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September, 15 201

Culvert Summary Report

Wells River

General Information

SgaID	600035000109071	Local SgaID	2730	VOBCIT struct_num	
Observers	Redstart_dr, ES	Assessment Date	5/28/2015	Project Name	Wells River
Town	Newbury	Latitude	44.13678	Longitude	-72.17387
Location	DS of 67 Topsham Road			Reach VTID	M11T1.07
Road Name	TOPSHAM RD	Road Type	Gravel	Stream Name	Scott Brook
High Flow Stage	No			Channel Width	10

Culvert Information

Culvert Length	25	Material	Steel Corrugated
Culvert Height	3	Number of culverts	1
Culvert Width	5	Culvert Overflow Pipe	No
		Skewed to roadway?	Yes

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No
		Culvert slope as compared with channel slope is significantly	Higher

Upstream

Obstructions at the opening of the structure	Deformation	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	Yes	Angle of stream flow approaching structure	Sharp bend
If channel avulses, stream will	Cross road		

Downstream

Pool present immediately downstream of structure	Yes	Water depth in culvert (at outlet)	0.2
Downstream bank heights are substantially higher than upstream bank heights	Yes	Culvert outlet invert	Free fall
Stepped Footers	1 ft.	Backwater Length (measured from outlet)	0
Maximum pool depth	1 ft.	Backwater Length (measured from outlet)	0.6

	Upstream	Downstream	In Structure
Dominant Bed Material	Cobble	Gravel	Gravel
Bedrock Present	No	No	No
Type of Sediment Deposits	None	None	None
Material Present throughout			Yes
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	Low	High	
Hard Bank Armoring	Failing	Failing	
Stream bed scour causing undermining around or under structure	None	None	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Deciduous Forest	Road Embankment	
Dominant Vegetation Type - Right	Road Embankment	Mixed Forest	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	Yes	No	
Vegitation Band -Right	No	Yes	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None		

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments

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Stream Geomorphic Assessment

Agency of Natural Resouces

VT DEC

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September, 15 201

Culvert Summary Report

Wells River

General Information

SgaID	700000000309073	Local SgaID	rs2_528	VOBCIT struct_num	
Observers	Redstart_dr, ES	Assessment Date	5/28/2015	Project Name	Wells River
Town	Newbury	Latitude	44.13652	Longitude	-72.17368
Location	DW US from intersection of Topsham and Swamp roads			Reach VTID	M11T1.07
Road Name		Road Type	Gravel	Stream Name	Scott Brook
High Flow Stage	No			Channel Width	10

Culvert Information

Culvert Length	20	Material	Tank
Culvert Height	6	Number of culverts	1
Culvert Width	6	Culvert Overflow Pipe	No
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	Yes
		Culvert slope as compared with channel slope is significantly	Same

Upstream

Obstructions at the opening of the structure	Sediment,Deformation	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	Yes	Angle of stream flow approaching structure	Mild bend
If channel avulses, stream will	Cross road		

Downstream

Pool present immediately downstream of structure	No	Water depth in culvert (at outlet)	0.2
Downstream bank heights are substantially higher than upstream bank heights	Yes	Culvert outlet invert	At grade
Stepped Footers	0 ft.	Backwater Length (measured from outlet)	0
Maximum pool depth	0 ft.	Backwater Length (measured from outlet)	0

	Upstream	Downstream	In Structure
Dominant Bed Material	Gravel	Gravel	Gravel
Bedrock Present	No	No	No
Type of Sediment Deposits	None	None	None
Material Present throughout			Yes
Elevation of sediment deposits >= 1/2 bankfull	No	No	No
Bank Erosion	Low	Low	
Hard Bank Armoring	Intact	Intact	
Stream bed scour causing undermining around or under structure	Wing walls	Wing walls	
Beaver Dam near Structure	No	No	
Beaver Dam distance (ft.)	0	0	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Road Embankment	Road Embankment	
Dominant Vegetation Type - Right	Herbaceous/Grass	Herbaceous/Grass	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	No	No	
Vegitation Band -Right	No	No	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None		

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments

VERMONT

Stream Geomorphic Assessment

Agency of Natural Resouces

VT DEC

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September, 15 201

Culvert Summary Report

Wells River

General Information

SgaID	700000000209123	Local SgaID	rs_3	VOBCIT struct_num	
Observers	Redstart_dr, ES	Assessment Date	6/3/2015	Project Name	Wells River
Town	Topsham	Latitude	44.13601	Longitude	-72.18928
Location	DS end of pond at 29 James Downing Rd			Reach VTID	M11T1.08
Road Name		Road Type	Trail	Stream Name	Scott Brook
High Flow Stage	No			Channel Width	8.2

Culvert Information

Culvert Length	25	Material	Steel Corrugated
Culvert Height	1	Number of culverts	1
Culvert Width	1	Culvert Overflow Pipe	No
		Skewed to roadway?	No

Geomorphic Information

General

Floodplain filled by roadway approaches	Entirely	Structure is located at significant break in valley slope	No
		Culvert slope as compared with channel slope is significantly	Higher

Upstream

Obstructions at the opening of the structure	Sediment	Estimated distance avulsion would follow road	
Steep riffle present immediately upstream of structure	Yes	Angle of stream flow approaching structure	Mild bend
If channel avulses, stream will	Cross road		

Downstream

Pool present immediately downstream of structure	No	Water depth in culvert (at outlet)	0.2
Downstream bank heights are substantially higher than upstream bank heights	No	Culvert outlet invert	Free fall
Stepped Footers	0 ft.	Backwater Length (measured from outlet)	0
Maximum pool depth	0 ft.	Backwater Length (measured from outlet)	0.6

	Upstream	Downstream	In Structure
Dominant Bed Material	Sand	Sand	Sand
Bedrock Present	No	No	No
Type of Sediment Deposits	None	None	Mid-channel
Material Present throughout			No
Elevation of sediment deposits >= 1/2 bankfull	No	No	Yes
Bank Erosion	Low	Low	
Hard Bank Armoring	None	None	
Stream bed scour causing undermining around or under structure	Culvert	Culvert	
Beaver Dam near Structure	Yes	Yes	
Beaver Dam distance (ft.)	30	55	

Vegetation

	Upstream	Downstream	In Structure
Dominant Vegetation Type - Left	Mixed Forest	Mixed Forest	
Dominant Vegetation Type - Right	Mixed Forest	Mixed Forest	

Does a band of shrub/forest vegetation 50 ft. wide start within 25 ft. of the structure and extend at least 500 ft. up/downstream?

Vegitation Band - Left	Yes	Yes	
Vegitation Band -Right	Yes	Yes	

Wildlife

	Roadkill	Outside Structure	Inside Structure
Species	None		

Other Information

Spatial location data collected with GPS? Yes

Photos taken? Yes

Comments may have been dam breach at pond just US in recent floods; culvert replaced, old black plastic culvert still nearby. road overtopped, US end significantly sedimented/braided. pix 0226-0230

Structure Failure Modes

Wells River

Explanation of codes used in table header

Failure Modes		Existing Problems	
F1	Concern for structure due to fluvial condition or process	P1	Upstream sediment deposit
F2	Potential failure due to out-flanking	P2	Upstream Scour and/or erosion present
F3	Potential failure due to scour	P3	Downstream Scour and/or erosion present
F4	Potential failure due to ice or debris jam	P4	Inlet obstruction present
F5	Structure related damage due to flooding of adjacent property	P5	Poor location or alignment
F6	Structure related damage due to erosion of adjacent property	P6	Beaver activity
Width	Structure width divided by channel width as a percent (% bankfull width)	P7	Floodplain filled entirely or partially by roadway approaches

X = meets criteria MD = missing data

Town	Road	Stream Name	SgaID / struct_num	Type	F1	F2	F3	F4	F5	F6	P1	P2	P3	P4	P5	P6	P7	Width
Groton	Glover Rd-driveway	Clark Hatch Brook	700000001703043	Culvert	-	X	X	X	X	X	-	-	X	-	X	-	X	32 %
Groton	Glover Rd-trail	Clark Hatch Brook	700000001803043	Culvert	-	X	X	X	X	X	X	X	X	X	-	-	X	17 %
Groton	farm rd at 556 Little Italy Rd	Keenan Brook	700000001003043	Culvert	-	X	X	X	X	X	-	X	X	-	-	-	X	39 %
Groton	trail off Little Italy Rd	Keenan Brook	700000001103043	Bridge	-	X	X	X	X	X	-	X	X	X	-	-	X	15 %
Groton	trail off Branch Brook (Fred Hayes) Rd	North Branch Wells	700000000803043	Bridge	-	X	X	X	-	X	-	-	-	X	-	-	-	63 %
Groton	US 302	North Branch Wells River	200026003603042	Bridge	-	-	X	X	-	X	X	-	X	X	X	-	X	100 %

Town	Road	Stream Name	SgaID / struct_num	Type	F1	F2	F3	F4	F5	F6	P1	P2	P3	P4	P5	P6	P7	Width
Groton	DW to 1212 Seyon Pond Rd	South Branch Wells	700000000303043	Bridge	-	-	X	X	X	X	X	X	X	X	-	-	X	76 %
Groton	pvt off Seyon Pond Rd	South Branch Wells	700000000403043	Bridge	-	X	X	X	X	X	X	X	X	X	-	-	X	74 %
Groton	pvt off Seyon Pond Rd	South Branch Wells	700000000503043	Bridge	-	X	X	X	X	X	-	X	X	X	-	-	X	50 %
Groton	pvt dw to 3571 Scott Hwy	South Branch Wells	700000000603043	Bridge	MD	MD	MD	MD	MD	MD	MD	MD	MD	MD	MD	MD	MD	54 %
Groton	VAST trail at Upper Valley Grill	South Branch Wells	700000000703043	Bridge	-	X	X	X	X	X	X	X	X	X	X	-	X	93 %
Groton	trail off Tannery Brook Rd	Tannery Brook	700000000903043	Bridge	-	-	X	-	-	X	X	X	X	X	-	-	X	134 %
Groton	US 302	Wells River	200026003503042	Bridge	-	-	-	X	-	X	-	-	-	X	X	-	X	242 %
Groton	DW off State Forest Rd	Wells River	700000000103043	Bridge	-	X	X	X	X	X	-	X	X	X	-	-	X	52 %
Groton	pvt dw to 304 State Forest Rd (Rte 232)	Wells River	700000001903043	Bridge	-	X	X	X	X	X	-	X	X	X	-	-	X	37 %
Groton	BROCK RD	Tannery Brook	70001100510304X 700011024803043	Culvert	-	X	X	X	X	X	-	X	X	X	X	-	X	80 %
Groton	COCHRAN RD	Wells River	100017000003041 100304001603041	Bridge	-	X	X	X	X	X	-	X	-	X	X	-	X	58 %
Groton	COCHRAN RD	Wells River	100304001603041	Bridge	-	-	-	X	-	X	-	-	-	X	-	-	X	108 %
Groton	CROSS RD	Tannery Brook	400304000803041 990010000403041	Bridge	-	X	X	X	X	X	-	X	X	X	X	-	X	69 %
Groton	GLOVER RD	Clark Hatch Brook	600013000003041	Culvert	-	X	X	X	X	X	-	X	X	X	X	-	X	11 %

Town	Road	Stream Name	SgaID / struct_num	Type	F1	F2	F3	F4	F5	F6	P1	P2	P3	P4	P5	P6	P7	Width
Groton	GLOVER RD	Clark Hatch Brook	600013000103041	Culvert	-	X	X	X	X	X	-	X	-	X	-	-	X	14 %
Groton	GREAT RD	North Branch Wells River Trib	70000401440304X 700004016403043	Culvert	-	X	X	X	X	X	X	X	X	X	X	-	X	86 %
Groton	GREAT RD	North Branch Wells River Trib	70000401550304X 700004017503043	Culvert	-	X	X	X	X	X	X	X	X	X	X	-	X	75 %
Groton	GREAT RD	Tannery Brook Trib	70000401310304X 700004015103043	Culvert	-	X	X	X	X	X	-	X	X	X	-	-	X	50 %
Groton	HARV ORR RD	North Branch Wells River	70000601660304X 700006021903043	Culvert	-	X	X	X	X	X	X	X	X	-	X	-	X	50 %
Groton	HARV ORR RD	North Branch Wells River Trib	70000601620304X 700006021503043	Culvert	-	X	X	X	X	X	-	X	X	X	X	-	X	50 %
Groton	HARV ORR RD	North Branch Wells River Trib	70000601640304X 700006021703043	Culvert	-	X	X	X	X	-	-	X	X	-	-	-	X	38 %
Groton	HOOPER HILL RD	Clark Hatch Brook Trib	70001401810304X 700014027403043	Culvert	-	X	X	X	X	X	-	X	X	X	-	-	X	57 %
Groton	LITTLE ITALY RD	Keenan Brook	400032000003041	Culvert	-	X	X	X	X	X	-	X	X	X	-	-	X	47 %
Groton	MINARD HILL RD	Tannery Brook	600002000003041 700002011703043	Culvert	-	X	X	X	X	X	X	X	X	X	X	-	X	32 %
Groton	MINARD HILL RD	Tannery Brook	70000202340304X 700002011703043	Culvert	-	X	X	X	X	X	-	X	-	X	X	-	X	63 %
Groton	MINARD HILL RD	Tannery Brook	70000202440304X 700002012703043	Culvert	-	X	X	X	X	X	X	X	X	X	X	-	X	77 %
Groton	MINARD HILL RD	Tannery Brook	70000202460304X 700002012903043	Culvert	-	-	X	X	-	X	X	X	X	-	X	-	X	168 %
Groton	MINARD HILL RD	Tannery Brook Trib	70000202230304X 700002010603043	Culvert	-	X	X	X	X	X	X	X	X	-	X	-	X	60 %
Groton	MINARD HILL RD	Tannery Brook Trib	70000202310304X 700002011403043	Culvert	-	-	X	X	-	-	X	X	X	-	-	-	X	114 %
Groton	MT ARA RD	Tannery Brook Trib	70002002470304X 700020029903043	Culvert	-	X	X	X	X	X	-	X	-	X	X	-	X	83 %

Town	Road	Stream Name	SgaID / struct_num	Type	F1	F2	F3	F4	F5	F6	P1	P2	P3	P4	P5	P6	P7	Width
Groton	N COUNTY RD	North Branch Wells River	70000502660304X 700005021003043	Culvert	-	X	X	X	X	X	-	X	X	X	-	-	X	50 %
Groton	N COUNTY RD	Red Brook	70000502640304X 990005000903041	Culvert	-	X	X	X	X	X	-	X	X	X	X	-	X	69 %
Groton	N COUNTY RD	Red Brook Trib	70000502570304X 700005020103043	Culvert	-	X	X	X	X	X	-	X	X	X	X	-	X	80 %
Groton	N COUNTY RD	Red Brook Trib	70000502630304X 700005020703043	Culvert	-	X	X	X	X	X	-	X	X	X	X	-	X	67 %
Groton	OLD RAILROAD BED	Keenan Brook	700000001603043	Culvert	-	X	X	X	X	X	-	X	X	X	-	-	X	34 %
Groton	POUND RD	Tannery Brook	400021000003041 990021000703041	Bridge	-	X	-	X	-	X	X	X	X	-	-	-	X	90 %
Groton	POUND RD	Tannery Brook	400304001303041 990021000703041	Bridge	-	-	-	X	-	X	-	-	-	X	X	-	X	129 %
Groton	POWDER SPRING RD	Keenan Brook	400001000003041	Culvert	-	X	X	X	X	X	-	X	-	X	X	-	X	22 %
Groton	POWDER SPRING RD	Wells River	100001000003041 200193000603042	Bridge	-	X	X	X	X	X	-	X	X	X	-	-	X	66 %
Groton	RAILROAD ST	Keenan Brook	600053000003041	Culvert	-	X	X	X	X	X	-	X	X	X	-	-	X	21 %
Groton	RED BROOK RD	North Branch Wells River	70000703610304X 700007022703043	Culvert	-	X	X	X	X	X	X	X	X	X	X	-	X	78 %
Groton	RED BROOK RD	North Branch Wells River	70000703630304X 700007022903043	Culvert	-	-	X	X	-	-	-	X	X	-	-	-	X	107 %
Groton	RED BROOK RD	North Branch Wells River Trib	70000703560304X 700007022203043	Culvert	-	X	X	X	X	X	-	X	X	X	X	-	X	60 %

Town	Road	Stream Name	SgaID / struct_num	Type	F1	F2	F3	F4	F5	F6	P1	P2	P3	P4	P5	P6	P7	Width
Groton	RED BROOK RD	Red Brook	70000703660304X 700007023203043	Culvert	-	-	X	-	X	X	-	-	X	X	X	-	X	95 %
Groton	RED BROOK RD	Red Brook Trib	70000703680304X 700007023403043	Culvert	-	X	X	X	X	X	X	X	X	-	X	-	X	38 %
Groton	S BRANCH RD	South Branch Wells	100025000003041	Bridge	-	X	X	X	X	X	X	X	X	-	-	-	X	75 %
Groton	S COUNTY RD	Wells River	700000000203043	Bridge	-	X	X	X	X	X	-	X	X	X	-	-	X	52 %
Groton	SCOTT HWY	Clark Hatch Brook	300302000003042	Culvert	-	X	X	X	X	-	X	-	-	-	X	-	X	37 %
Groton	SCOTT HWY	North Branch Wells	200302000203042 200026003603042	Bridge	-	X	X	X	X	X	-	-	X	X	X	-	X	51 %
Groton	SCOTT HWY	South Branch Wells	200302000003042 200026003103042	Bridge	-	-	-	-	X	X	-	X	X	X	-	-	X	89 %
Groton	SCOTT HWY	South Branch Wells	200302000103042 200026003203042	Bridge	-	-	-	X	-	X	X	X	X	-	X	-	X	101 %
Groton	SCOTT HWY	Tannery Brook	500302000003042	Bridge	-	X	X	X	X	X	X	-	X	-	-	-	X	26 %
Groton	SCOTT HWY	Wells River	200302000303042 200026003503042	Bridge	-	-	-	-	-	X	X	X	X	X	X	-	X	129 %
Groton	SEYON POND RD	Heath Brook	100024000003041 100304001003041	Bridge	-	X	-	X	-	X	X	X	X	-	X	-	X	89 %
Groton	WELTON RD	Wells River	100048000003041 100304001803041	Bridge	-	-	-	-	-	X	-	-	-	X	X	-	X	109 %
Groton	WELTON RD	Wells River	100304001803041	Bridge	-	-	X	X	X	X	-	X	-	X	X	-	X	88 %
Newbury		Scott Brook	700000000109073	Culvert	-	X	X	X	X	X	-	-	-	X	-	-	X	36 %
Newbury		Scott Brook	700000000209073	Culvert	-	X	X	X	X	X	-	X	X	-	-	-	X	40 %
Newbury		Scott Brook	700000000309073	Culvert	-	X	X	X	X	-	X	-	-	-	X	-	X	60 %
Newbury	log rd off Swamp Rd	Scott Brook	700000004409073	Culvert	-	X	X	X	X	X	X	X	X	-	X	-	X	26 %

Town	Road	Stream Name	SgaID / struct_num	Type	F1	F2	F3	F4	F5	F6	P1	P2	P3	P4	P5	P6	P7	Width
Newbury	log rd across from Grapes Rd-Swamp Rd jct	Scott Brook	700000004509073	Bridge	-	X	X	X	-	X	X	-	-	-	-	-	X	49 %
Newbury	sugarbush access bridge W edge of hayfields off Swamp Rd	Scott Brook	700000004609073	Bridge	-	X	X	X	-	X	X	X	X	-	-	-	X	65 %
Newbury	driveway off Swamp Rd	Scott Brook	700000004709073	Bridge	-	X	X	X	-	-	-	-	X	-	-	-	-	65 %
Newbury	pvt dw to 1198 Swamp Rd	Scott Brook	700000004809073	Bridge	-	X	-	X	-	-	-	-	-	-	-	-	X	79 %
Newbury	CESARI RD	Scott Brook	400009000009071	Culvert	-	X	X	X	X	X	X	X	X	-	-	-	X	31 %
Newbury	SWAMP RD	Scott Brook	100002000009071 100907001209071	Bridge	-	X	X	X	X	X	X	X	X	X	-	-	X	66 %
Newbury	SWAMP RD	Scott Brook	400002000009071	Bridge	-	X	-	X	-	X	X	X	X	-	X	-	X	89 %
Newbury	SWAMP RD	Scott Brook	400002000509071	Bridge	-	X	X	X	X	X	X	X	X	-	-	-	X	36 %
Newbury	TOPSHAM RD	Scott Brook	600035000009071	Culvert	-	X	X	X	X	X	-	-	-	X	-	-	X	35 %
Newbury	TOPSHAM RD	Scott Brook	600035000109071	Culvert	-	X	X	X	X	X	X	X	X	-	X	-	X	50 %
Newbury	TOPSHAM RD	Unnamed	600035000609071	Culvert	-	X	X	X	X	-	-	X	X	-	-	-	X	38 %
Ryegate	yard bridge at 311 Church St	Scott Brook	700000000403103	Bridge	-	X	X	X	-	X	X	X	X	X	-	-	-	51 %

Town	Road	Stream Name	SgaID / struct_num	Type	F1	F2	F3	F4	F5	F6	P1	P2	P3	P4	P5	P6	P7	Width
Ryegate	pvt dw to 259 Church St	Scott Brook	700000000503103	Bridge	-	X	X	X	-	X	X	X	X	X	-	-	-	34 %
Ryegate	ftbridge 325 ft DS Hall Rd	Stone Rd Brook	700000000103103	Bridge	-	X	X	X	-	X	X	X	X	-	-	-	-	62 %
Ryegate	ftbridge just E of 848 Stone Rd	Stone Rd Brook	700000000203103	Bridge	-	-	X	-	-	X	-	X	X	X	-	-	-	118 %
Ryegate	under bldg between Stoneshed Rd and Creamery St	Stone Rd Brook	700000000303103	Bridge	-	X	X	X	X	X	X	X	X	-	-	-	X	54 %
Ryegate	US302	Wells River	200026004003102	Bridge	-	-	-	X	-	X	-	-	-	X	-	-	X	221 %
Ryegate	Clough farm rd off Brown Dr	Wells River	700000000003043	Bridge	-	X	X	X	X	X	-	-	-	X	X	-	X	39 %
Ryegate	spur off Rte 302 to Brown Dr	Wells River	700000000003103	Bridge	-	X	X	X	X	X	-	X	X	X	-	-	X	42 %
Ryegate	APPLETON PERRY DR	Wells River Trib	70005601060310X 700056061103103	Culvert	-	X	X	X	X	X	X	X	X	X	X	-	X	83 %
Ryegate	CHURCH ST	Wells River	100002000003101 100310000203101	Bridge	-	-	X	-	X	X	-	-	-	X	-	-	X	80 %
Ryegate	CHURCH ST	Wells River	100310000203101	Bridge	-	-	X	X	X	X	-	-	-	X	-	-	X	89 %
Ryegate	CREAMERY RD	Stone Rd Brook	400005000003101 990005000403101	Culvert	-	X	X	X	X	X	X	X	X	-	X	-	X	63 %
Ryegate	CREAMERY RD	Wells River	100005000003101	Bridge	-	X	X	X	X	X	X	X	X	X	-	-	X	71 %
Ryegate	CREAMERY RD	Wells River	100310000403101	Bridge	-	-	-	X	X	X	-	-	-	X	X	-	X	75 %

Town	Road	Stream Name	SgaID / struct_num	Type	F1	F2	F3	F4	F5	F6	P1	P2	P3	P4	P5	P6	P7	Width
Ryegate	CREAMERY RD	Wells River Trib	400310001003101 990005000403101	Bridge	-	X	X	X	-	X	X	-	-	-	X	-	X	133 %
Ryegate	GILFILLAN RD	Wells River Trib	70004400920310X 700044055203103	Culvert	-	X	X	X	X	X	X	-	-	X	X	-	X	75 %
Ryegate	HALL RD	Darius James Brook	300026003903101	Culvert	-	X	-	X	X	X	X	-	-	X	X	-	X	88 %
Ryegate	HALL RD	Stone Rd Brook	600051000003101	Culvert	-	X	X	X	X	X	X	X	X	-	-	-	X	27 %
Ryegate	HALL RD	Wells River trib	70000603220310X 700051018903103	Culvert	-	X	X	X	X	X	X	-	-	X	X	-	X	60 %
Ryegate	HALL RD	Wells River trib	70000603240310X 700051019103103	Culvert	-	X	X	X	X	X	X	X	X	-	-	-	X	47 %
Ryegate	HALL RD	Wells River trib	70000603310310X 700308019803103	Culvert	-	-	X	-	-	X	-	-	X	X	X	-	X	100 %
Ryegate	PAGE DR	Tannery Brook	70001103680310X 700011033703103	Culvert	-	-	X	-	-	X	-	-	X	X	X	-	X	150 %
Ryegate	PLEASANT ST	Scott Brook	100318000003101 100310002003101	Culvert	-	X	-	X	-	X	X	X	X	-	-	-	-	56 %
Ryegate	QUINT RD	Wells River Trib	70006301570310X 700063066603103	Culvert	-	X	X	X	X	-	X	X	X	-	X	-	X	38 %
Ryegate	RENFREW DR	Wells River trib	70003702520310X 700037051003103	Culvert	-	X	X	X	X	X	X	X	X	X	-	-	X	40 %
Ryegate	SCOTT HWY	Darius James Brook	300302000103042 300026003903101	Culvert	-	X	X	X	X	X	X	-	-	X	-	-	X	75 %
Ryegate	SCOTT HWY	Scott Brook	300302000203102 300026004103101	Culvert	-	X	X	X	X	X	X	-	-	X	-	-	X	51 %
Ryegate	SCOTT HWY	Wells River	200302000003101 200026004003102	Bridge	-	X	X	X	X	X	-	X	X	X	-	-	X	70 %
Ryegate	STONE RD	Stone Rd Brook	300302000003101 990302000803101	Bridge	-	X	-	X	-	X	X	X	X	-	-	-	X	84 %
Ryegate	STONE RD	Stone Rd Brook	400302000003101 990302000903101	Culvert	-	X	X	X	X	X	X	X	X	X	X	-	X	59 %
Ryegate	STONE RD	Stone Rd Brook	400302000103101 990302001403101	Bridge	-	X	X	X	X	X	X	-	-	-	X	-	X	65 %
Ryegate	STONE RD	Wells River Trib	400310001403101 990302000803101	Bridge	-	-	-	X	-	X	X	X	X	X	-	-	X	129 %

Town	Road	Stream Name	SgaID / struct_num	Type	F1	F2	F3	F4	F5	F6	P1	P2	P3	P4	P5	P6	P7	Width
Ryegate	STONE RD	Wells River Trib	400310001503101 990302000903101	Culvert	-	X	X	X	X	X	X	X	X	X	X	-	X	92 %
Ryegate	STONE RD	Wells River Trib	400310002203101 990302001403101	Bridge	-	-	X	X	-	-	X	-	-	-	X	-	X	120 %
Ryegate	STONESHED RD	Stone Rd Brook	400314000003101 990314001803101	Bridge	-	X	X	X	X	X	-	X	X	X	-	-	X	56 %
Ryegate	STONESHED RD	Wells River trib	400310003103101 990314001803101	Bridge	-	X	X	X	X	X	X	X	X	X	X	-	X	83 %
Ryegate	TERRY HILL RD	Scott Brook	300320000003101	Bridge	-	X	X	X	X	X	X	X	X	X	X	-	X	25 %
Ryegate	WITHERSPOON RD	Darius James Brook trib	70000502270310X 700006016003103	Culvert	-	X	X	X	-	X	X	X	-	-	-	-	X	75 %
Ryegate	WITHERSPOON RD	Darius James Brook trib	70000502340310X 700006016703103	Culvert	-	X	X	X	X	X	X	X	X	X	-	-	X	83 %
Ryegate	WITHERSPOON RD	Wells River trib	70000502250310X 700006015803103	Culvert	-	X	X	X	X	X	X	-	X	X	-	-	X	57 %
Topsham		Scott Brook	700000000209123	Culvert	-	X	X	X	X	-	X	X	X	-	-	-	X	12 %

Failure Modes - Problems and Causes

Wells River

Explanation of codes used in table header

Upstream Sediment Deposition		Upstream Scour and Erosion		Downstream Scour and Erosion		Poor Locacation or Aligment	
C1	Opening obstructed by sediment	C4	Bank armoring failing	C7	Bank armoring failing	C12	Stream approach angle is sharp bend
C2	Sediment deposits >= half bankfull	C5	Bank erosion high	C8	Bank erosion high	C13	Located at significant valley break
C3	Steep riffle upstream	C6	Scour under structure	C9	Scour under structure	C14	Avulsion follow road
				C10	Banks higher downstream than upstream		
				C11	Culvert outlet is cascade or freefall		

Yes = Condtion exists No = Condition does not exist MD = missing data

						Upstream Sediment Deposition			Upstream Scour and Erosion			Downstream Scour and Erosion					Poor Location or Alignment		
Town	Road	Stream Name	SgaID / struct_num	Type	Bankfull Width Percent	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14
Groton	Glover Rd-driveway	Clark Hatch Brook	700000001703043	Culvert	32 %	No	No	No	No	No	No	No	Yes	Yes	No	Yes	No	No	Yes
Groton	Glover Rd-driveway	Clark Hatch Brook	700000001703043	Culvert	32 %	No	No	No	No	No	No	No	Yes	Yes	No	Yes	No	No	Yes
Groton	Glover Rd-driveway	Clark Hatch Brook	700000001703043	Culvert	32 %	No	No	No	No	No	No	No	Yes	No	No	Yes	No	No	Yes
Groton	Glover Rd-driveway	Clark Hatch Brook	700000001703043	Culvert	32 %	No	No	No	No	No	No	No	Yes	No	No	Yes	No	No	Yes
Groton	Glover Rd-trail	Clark Hatch Brook	700000001803043	Culvert	17 %	No	No	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	No	No	No
Groton	farm rd at 556 Little Italy Rd	Keenan Brook	700000001003043	Culvert	39 %	No	No	No	Yes	No	No	Yes	No	Yes	Yes	No	No	No	No
Groton	farm rd at 556 Little Italy Rd	Keenan Brook	700000001003043	Culvert	39 %	No	No	No	Yes	No	No	Yes	No	Yes	Yes	No	No	No	No

						Upstream Sediment Deposition			Upstream Scour and Erosion			Downstream Scour and Erosion					Poor Location or Alignment		
Town	Road	Stream Name	SgaID / struct_num	Type	Bankfull Width Percent	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14
Groton	trail off Little Italy Rd	Keenan Brook	700000001103043	Bridge	15 %	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No		No	No	No
Groton	trail off Branch Brook (Fred Hayes) Rd	North Branch Wells	700000000803043	Bridge	63 %	No	No	No	No	No	No	Yes	No	No	No		No	No	No
Groton	US 302	North Branch Wells River	200026003603042	Bridge	100 %	No	No	Yes	No	No	No	No	No	Yes	No		Yes	Yes	Yes
Groton	DW to 1212 Seyon Pond Rd	South Branch Wells	700000000303043	Bridge	76 %	No	No	Yes	Yes	No	No	Yes	No	No	Yes		No	No	No
Groton	pvt off Seyon Pond Rd	South Branch Wells	700000000403043	Bridge	74 %	No	No	Yes	Yes	No	No	Yes	No	No	No		No	No	No
Groton	pvt off Seyon Pond Rd	South Branch Wells	700000000503043	Bridge	50 %	No	No	No	Yes	No	No	Yes	Yes	No	No		No	No	No
Groton	pvt dw to 3571 Scott Hwy	South Branch Wells	700000000603043	Bridge	54 %	MD	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		No	No	No
Groton	VAST trail at Upper Valley Grill	South Branch Wells	700000000703043	Bridge	93 %	No	Yes	No	No	Yes	No	Yes	Yes	Yes	No		No	No	Yes
Groton	trail off Tannery Brook Rd	Tannery Brook	700000000903043	Bridge	134 %	No	No	Yes	Yes	No	No	Yes	Yes	No	No		No	Unsure	No
Groton	US 302	Wells River	200026003503042	Bridge	242 %	No	No	No	No	No	No	No	No	No	No		No	Yes	Yes
Groton	DW off State Forest Rd	Wells River	700000000103043	Bridge	52 %	No	No	No	No	Yes	No	Yes	No	No	No		No	No	No

						Upstream Sediment Deposition			Upstream Scour and Erosion			Downstream Scour and Erosion					Poor Location or Alignment		
Town	Road	Stream Name	SgaID / struct_num	Type	Bankfull Width Percent	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14
Groton	pvt dw to 304 State Forest Rd (Rte 232)	Wells River	700000001903043	Bridge	37 %	No	No	No	Yes	No	Yes	No	No	Yes	No		No	No	No
Groton	BROCK RD	Tannery Brook	70001100510304X 700011024803043	Culvert	80 %	No	No	No	No	No	Yes	No	No	Yes	No	Yes	No	Yes	No
Groton	COCHRAN RD	Wells River	100017000003041 100304001603041	Bridge	58 %	No	No	No	No	No	Yes	No	No	No	Yes		No	No	Yes
Groton	COCHRAN RD	Wells River	100304001603041	Bridge	108 %	No	No	No	No	No	No	No	No	No	No		No	No	No
Groton	CROSS RD	Tannery Brook	400304000803041 990010000403041	Bridge	69 %	No	No	No	No	Yes	No	No	No	No	No		No	Yes	No
Groton	GLOVER RD	Clark Hatch Brook	600013000003041	Culvert	11 %	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	No	No	Yes
Groton	GLOVER RD	Clark Hatch Brook	600013000103041	Culvert	14 %	No	No	No	No	No	Yes	Yes	Yes	No	Yes	Yes	No	No	No
Groton	GREAT RD	North Branch Wells River Trib	70000401440304X 700004016403043	Culvert	86 %	No	Yes	No	No	No	Yes	No	Yes	Yes	Yes	No	Yes	No	No
Groton	GREAT RD	North Branch Wells River Trib	70000401550304X 700004017503043	Culvert	75 %	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No
Groton	GREAT RD	Tannery Brook Trib	70000401310304X 700004015103043	Culvert	50 %	No	No	No	No	Yes	No	No	No	Yes	No	Yes	No	No	No
Groton	HARV ORR RD	North Branch Wells River	70000601660304X 700006021903043	Culvert	50 %	No	Yes	No	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	No
Groton	HARV ORR RD	North Branch Wells River	70000601660304X 700006021903043	Culvert	50 %	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	No
Groton	HARV ORR RD	North Branch Wells River	70000601660304X 700006021903043	Culvert	50 %	No	Yes	No	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	No
Groton	HARV ORR RD	North Branch Wells River Trib	70000601620304X 700006021503043	Culvert	50 %	No	No	No	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No

						Upstream Sediment Deposition			Upstream Scour and Erosion			Downstream Scour and Erosion					Poor Location or Alignment		
Town	Road	Stream Name	SgaID / struct_num	Type	Bankfull Width Percent	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14
Groton	HARV ORR RD	North Branch Wells River Trib	70000601640304X 700006021703043	Culvert	38 %	No	No	No	No	No	Yes	No	No	Yes	No	No	No	No	No
Groton	HARV ORR RD	North Branch Wells River Trib	70000601640304X 700006021703043	Culvert	38 %	No	No	No	No	No	Yes	No	No	Yes	No	No	No	No	No
Groton	HOOPER HILL RD	Clark Hatch Brook Trib	70001401810304X 700014027403043	Culvert	57 %	No	No	No	No	No	Yes	No	No	Yes	No	Yes	No	No	No
Groton	LITTLE ITALY RD	Keenan Brook	400032000003041	Culvert	47 %	No	No	No	No	Yes	No	No	No	No	Yes	No	No	No	No
Groton	MINARD HILL RD	Tannery Brook	600002000003041 700002011703043	Culvert	32 %	No	No	Yes	Yes	Yes	Yes	No	Yes	No	No	No	Yes	No	No
Groton	MINARD HILL RD	Tannery Brook	70000202340304X 700002011703043	Culvert	63 %	No	No	No	No	No	Yes	No	No	No	Yes	No	Yes	Yes	Yes
Groton	MINARD HILL RD	Tannery Brook	70000202440304X 700002012703043	Culvert	77 %	No	No	Yes	No	No	Yes	No	Yes	Yes	Yes	Yes	No	No	Yes
Groton	MINARD HILL RD	Tannery Brook	70000202460304X 700002012903043	Culvert	168 %	Yes	No	Yes	No	Yes	Yes	No	No	No	Yes	No	Yes	No	Yes
Groton	MINARD HILL RD	Tannery Brook Trib	70000202230304X 700002010603043	Culvert	60 %	No	No	No	No	No	Yes	No	Yes	Yes	No	Yes	Yes	No	No
Groton	MINARD HILL RD	Tannery Brook Trib	70000202230304X 700002010603043	Culvert	60 %	Yes	No	No	No	No	Yes	No	Yes	Yes	No	Yes	Yes	No	No
Groton	MINARD HILL RD	Tannery Brook Trib	70000202310304X 700002011403043	Culvert	114 %	Yes	No	Yes	No	No	Yes	No	No	Yes	No	No	No	No	No
Groton	MT ARA RD	Tannery Brook Trib	70002002470304X 700020029903043	Culvert	83 %	No	No	No	No	No	Yes	No	No	No	No	No	Yes	Yes	No
Groton	N COUNTY RD	North Branch Wells River	70000502660304X 700005021003043	Culvert	50 %	No	No	No	No	Yes	Yes	No	Yes	Yes	No	No	No	No	No
Groton	N COUNTY RD	Red Brook	70000502640304X 990005000903041	Culvert	69 %	No	No	No	No	No	Yes	No	No	Yes	No	No	No	No	Yes

						Upstream Sediment Deposition			Upstream Scour and Erosion			Downstream Scour and Erosion					Poor Location or Alignment		
Town	Road	Stream Name	SgaID / struct_num	Type	Bankfull Width Percent	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14
Groton	N COUNTY RD	Red Brook Trib	70000502570304X 700005020103043	Culvert	80 %	No	No	No	No	No	Yes	No	No	Yes	No	No	Yes	No	No
Groton	N COUNTY RD	Red Brook Trib	70000502630304X 700005020703043	Culvert	67 %	No	No	No	No	No	Yes	No	No	Yes	No	No	Yes	Yes	No
Groton	OLD RAILROAD BED	Keenan Brook	700000001603043	Culvert	34 %	No	No	No	Yes	No	No	Yes	Yes	Yes	No	No	No	No	No
Groton	OLD RAILROAD BED	Keenan Brook	700000001603043	Culvert	34 %	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	No	No
Groton	POUND RD	Tannery Brook	400021000003041 990021000703041	Bridge	90 %	No	Yes	Yes	Yes	No	No	Yes	Yes	No	No		No	No	No
Groton	POUND RD	Tannery Brook	400304001303041 990021000703041	Bridge	129 %	No	No	No	No	No	No	No	Yes	No	No		No	No	Yes
Groton	POWDER SPRING RD	Keenan Brook	400001000003041	Culvert	22 %	No	No	No	No	No	Yes	No	Yes	No	Yes	No	Yes	No	No
Groton	POWDER SPRING RD	Keenan Brook	400001000003041	Culvert	22 %	No	No	No	No	No	No	No	Yes	No	Yes	No	Yes	No	No
Groton	POWDER SPRING RD	Wells River	100001000003041 200193000603042	Bridge	66 %	No	No	No	Yes	Yes	Yes	No	Yes	Yes	No		No	No	No
Groton	RAILROAD ST	Keenan Brook	600053000003041	Culvert	21 %	No	No	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No
Groton	RED BROOK RD	North Branch Wells River	70000703610304X 700007022703043	Culvert	78 %	No	Yes	Yes	No	No	Yes	No	Yes	Yes	No	No	No	Yes	Yes
Groton	RED BROOK RD	North Branch Wells River	70000703630304X 700007022903043	Culvert	107 %	No	No	No	No	No	Yes	No	No	Yes	No	No	No	No	No

						Upstream Sediment Deposition			Upstream Scour and Erosion			Downstream Scour and Erosion					Poor Location or Alignment		
Town	Road	Stream Name	SgaID / struct_num	Type	Bankfull Width Percent	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14
Groton	RED BROOK RD	North Branch Wells River Trib	70000703560304X 700007022203043	Culvert	60 %	No	No	No	No	No	Yes	No	No	Yes	No	Yes	No	No	Yes
Groton	RED BROOK RD	Red Brook	70000703660304X 700007023203043	Culvert	95 %	No	No	No	No	No	No	No	No	Yes	No	No	No	No	Yes
Groton	RED BROOK RD	Red Brook Trib	70000703680304X 700007023403043	Culvert	38 %	No	Yes	No	No	No	Yes	No	No	Yes	No	No	Yes	No	Yes
Groton	RED BROOK RD	Red Brook Trib	70000703680304X 700007023403043	Culvert	38 %	Yes	Yes	No	No	No	Yes	No	No	Yes	No	No	Yes	No	Yes
Groton	S BRANCH RD	South Branch Wells	100025000003041	Bridge	75 %	Yes	Yes	No	Yes	No	No	No	No	No	No		No	No	No
Groton	S COUNTY RD	Wells River	700000000203043	Bridge	52 %	No	No	No	Yes	Yes	Yes	Yes	No	Yes	Yes		No	No	No
Groton	SCOTT HWY	Clark Hatch Brook	300302000003042	Culvert	37 %	No	No	Yes	No	No	No	No	No	No	Yes	Yes	Yes	Yes	No
Groton	SCOTT HWY	Clark Hatch Brook	300302000003042	Culvert	37 %	Yes	No	Yes	No	No	No	No	No	No	Yes	Yes	Yes	Yes	No
Groton	SCOTT HWY	North Branch Wells	200302000203042 200026003603042	Bridge	51 %	No	No	No	No	No	No	No	No	Yes	Yes		No	No	Yes
Groton	SCOTT HWY	South Branch Wells	200302000003042 200026003103042	Bridge	89 %	No	No	No	No	Yes	No	Yes	No	No	Yes		No	No	No
Groton	SCOTT HWY	South Branch Wells	200302000103042 200026003203042	Bridge	101 %	No	Yes	No	No	Yes	No	No	Yes	No	No		No	No	Yes
Groton	SCOTT HWY	South Branch Wells	200302000103042 200026003203042	Bridge	101 %	Yes	Yes	No	No	Yes	No	No	Yes	No	No		No	No	Yes
Groton	SCOTT HWY	Tannery Brook	500302000003042	Bridge	26 %	No	No	Yes	No	No	No	Yes	Yes	Yes	Yes		No	No	No
Groton	SCOTT HWY	Wells River	200302000303042 200026003503042	Bridge	129 %	No	No	Yes	No	Yes	No	No	No	No	Yes		No	Yes	Yes

						Upstream Sediment Deposition			Upstream Scour and Erosion			Downstream Scour and Erosion					Poor Location or Alignment		
Town	Road	Stream Name	SgaID / struct_num	Type	Bankfull Width Percent	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14
Groton	SEYON POND RD	Heath Brook	100024000003041 100304001003041	Bridge	89 %	Yes	No	Yes	Yes	No	No	Yes	No	No	No		No	Yes	Yes
Groton	WELTON RD	Wells River	100048000003041 100304001803041	Bridge	109 %	No	No	No	No	No	No	No	No	No	No		No	No	Yes
Groton	WELTON RD	Wells River	100304001803041	Bridge	88 %	No	No	No	No	No	Yes	No	No	No	No		No	No	Yes
Newbury		Scott Brook	700000000109073	Culvert	36 %	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Newbury		Scott Brook	700000000209073	Culvert	40 %	No	No	No	Yes	No	No	No	Yes	No	No	No	No	No	No
Newbury		Scott Brook	700000000309073	Culvert	60 %	Yes	No	Yes	No	No	No	No	No	No	Yes	No	No	Yes	No
Newbury		Scott Brook	700000000309073	Culvert	60 %	No	No	Yes	No	No	No	No	No	No	Yes	No	No	Yes	No
Newbury	log rd off Swamp Rd	Scott Brook	700000004409073	Culvert	26 %	No	No	Yes	Yes	No	Yes	Yes	No	Yes	No	No	Yes	No	No
Newbury	log rd off Swamp Rd	Scott Brook	700000004409073	Culvert	26 %	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	No	No	Yes	No	No
Newbury	log rd off Swamp Rd	Scott Brook	700000004409073	Culvert	26 %	No	No	Yes	Yes	No	Yes	Yes	No	Yes	No	No	Yes	No	No
Newbury	log rd off Swamp Rd	Scott Brook	700000004409073	Culvert	26 %	No	No	Yes	Yes	No	No	Yes	No	Yes	No	No	Yes	No	No
Newbury	log rd off Swamp Rd	Scott Brook	700000004409073	Culvert	26 %	Yes	No	Yes	Yes	No	No	Yes	No	Yes	No	No	Yes	No	No
Newbury	log rd off Swamp Rd	Scott Brook	700000004409073	Culvert	26 %	No	No	Yes	Yes	No	No	Yes	No	Yes	No	No	Yes	No	No
Newbury	log rd off Swamp Rd	Scott Brook	700000004409073	Culvert	26 %	No	No	Yes	Yes	No	Yes	Yes	No	No	No	No	Yes	No	No
Newbury	log rd off Swamp Rd	Scott Brook	700000004409073	Culvert	26 %	Yes	No	Yes	Yes	No	Yes	Yes	No	No	No	No	Yes	No	No
Newbury	log rd off Swamp Rd	Scott Brook	700000004409073	Culvert	26 %	No	No	Yes	Yes	No	Yes	Yes	No	No	No	No	Yes	No	No
Newbury	log rd off Swamp Rd	Scott Brook	700000004409073	Culvert	26 %	No	No	Yes	Yes	No	No	Yes	No	No	No	No	Yes	No	No
Newbury	log rd off Swamp Rd	Scott Brook	700000004409073	Culvert	26 %	Yes	No	Yes	Yes	No	No	Yes	No	No	No	No	Yes	No	No

						Upstream Sediment Deposition			Upstream Scour and Erosion			Downstream Scour and Erosion					Poor Location or Alignment		
Town	Road	Stream Name	SgaID / struct_num	Type	Bankfull Width Percent	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14
Newbury	log rd off Swamp Rd	Scott Brook	700000004409073	Culvert	26 %	No	No	Yes	Yes	No	No	Yes	No	No	No	No	Yes	No	No
Newbury	log rd across from Grapes Rd-Swamp Rd jct	Scott Brook	700000004509073	Bridge	49 %	No	No	Yes	No	No	No	No	Yes	No	Yes		No	No	No
Newbury	sugarbush access bridge W edge of hayfields off Swamp Rd	Scott Brook	700000004609073	Bridge	65 %	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes		No	No	No
Newbury	driveway off Swamp Rd	Scott Brook	700000004709073	Bridge	65 %	No	No	No	No	No	No	No	No	Yes	No		No	No	No
Newbury	pvt dw to 1198 Swamp Rd	Scott Brook	700000004809073	Bridge	79 %	No	No	No	No	No	No	No	No	No	No		No	No	No
Newbury	CESARI RD	Scott Brook	400009000009071	Culvert	31 %	Yes	No	No	No	Yes	No	Yes	Yes	No	No	No	No	No	No
Newbury	SWAMP RD	Scott Brook	100002000009071 100907001209071	Bridge	66 %	No	Yes	No	No	Yes	Yes	No	Yes	Yes	No		No	No	No
Newbury	SWAMP RD	Scott Brook	400002000009071	Bridge	89 %	Yes	No	Yes	Yes	No	No	No	No	No	No		No	Yes	Yes
Newbury	SWAMP RD	Scott Brook	400002000509071	Bridge	36 %	Yes	No	Yes	No	No	Yes	Yes	No	Yes	No		No	No	No
Newbury	TOPSHAM RD	Scott Brook	600035000009071	Culvert	35 %	No	No	No	No	No	No	No	Yes	No	Yes	No	No	No	No
Newbury	TOPSHAM RD	Scott Brook	600035000109071	Culvert	50 %	No	No	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes	Yes	No	No

						Upstream Sediment Deposition			Upstream Scour and Erosion			Downstream Scour and Erosion					Poor Location or Alignment		
Town	Road	Stream Name	SgaID / struct_num	Type	Bankfull Width Percent	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14
Newbury	TOPSHAM RD	Unnamed	600035000609071	Culvert	38 %	No	No	No	No	No	Yes	No	No	Yes	No	Yes	No	No	No
Newbury	TOPSHAM RD	Unnamed	600035000609071	Culvert	38 %	No	No	No	No	No	No	No	No	Yes	No	Yes	No	No	No
Ryegate	yard bridge at 311 Church St	Scott Brook	700000000403103	Bridge	51 %	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No		No	No	No
Ryegate	pvt dw to 259 Church St	Scott Brook	700000000503103	Bridge	34 %	No	No	Yes	Yes	No	No	Yes	Yes	No	Yes		No	No	No
Ryegate	ftbridge 325 ft DS Hall Rd	Stone Rd Brook	700000000103103	Bridge	62 %	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No		No	No	No
Ryegate	ftbridge just E of 848 Stone Rd	Stone Rd Brook	700000000203103	Bridge	118 %	No	No	No	Yes	No	Yes	Yes	No	Yes	No		No	No	No
Ryegate	under bldg between Stoneshed Rd and Creamery St	Stone Rd Brook	700000000303103	Bridge	54 %	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		No	No	No
Ryegate	US302	Wells River	200026004003102	Bridge	221 %	No	No	No	No	No	No	No	No	No	No		No	No	No
Ryegate	Clough farm rd off Brown Dr	Wells River	700000000003043	Bridge	39 %	No	No	No	No	No	No	No	No	No	No		Yes	No	No
Ryegate	spur off Rte 302 to Brown Dr	Wells River	700000000003103	Bridge	42 %	No	No	No	No	Yes	Yes	No	No	No	No		No	No	No
Ryegate	APPLETON PERRY DR	Wells River Trib	70005601060310X 700056061103103	Culvert	83 %	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No

						Upstream Sediment Deposition			Upstream Scour and Erosion			Downstream Scour and Erosion					Poor Location or Alignment		
Town	Road	Stream Name	SgaID / struct_num	Type	Bankfull Width Percent	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14
Ryegate	CHURCH ST	Wells River	100002000003101 100310000203101	Bridge	80 %	No	No	No	No	No	No	Yes	No	No	Yes		No	No	No
Ryegate	CHURCH ST	Wells River	100310000203101	Bridge	89 %	No	No	No	No	No	No	No	No	No	No		No	No	No
Ryegate	CREAMERY RD	Stone Rd Brook	400005000003101 990005000403101	Culvert	63 %	Yes	Yes	Yes	No	Yes	No	Yes	No	No	No	No	Yes	No	No
Ryegate	CREAMERY RD	Wells River	100005000003101	Bridge	71 %	No	No	Yes	No	Yes	No	No	No	No	No		No	No	No
Ryegate	CREAMERY RD	Wells River	100310000403101	Bridge	75 %	No	No	No	No	No	No	No	No	No	No		No	No	Yes
Ryegate	CREAMERY RD	Wells River Trib	400310001003101 990005000403101	Bridge	133 %	Yes	Yes	Yes	No	No	No	No	No	No	No		No	Yes	Yes
Ryegate	GILFILLAN RD	Wells River Trib	70004400920310X 700044055203103	Culvert	75 %	No	No	Yes	No	No	No	Yes	No	No	Yes	Yes	Yes	Yes	No
Ryegate	HALL RD	Darius James Brook	300026003903101	Culvert	88 %	No	No	Yes	No	No	No	No	No	No	No	No	No	Yes	No
Ryegate	HALL RD	Stone Rd Brook	600051000003101	Culvert	27 %	No	No	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No
Ryegate	HALL RD	Stone Rd Brook	600051000003101	Culvert	27 %	Yes	No	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No
Ryegate	HALL RD	Stone Rd Brook	600051000003101	Culvert	27 %	No	No	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No
Ryegate	HALL RD	Stone Rd Brook	600051000003101	Culvert	27 %	Yes	No	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No
Ryegate	HALL RD	Wells River trib	70000603220310X 700051018903103	Culvert	60 %	No	No	Yes	No	No	No	No	No	No	No	No	No	Yes	No
Ryegate	HALL RD	Wells River trib	70000603240310X 700051019103103	Culvert	47 %	No	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes	Yes	No	No	No
Ryegate	HALL RD	Wells River trib	70000603240310X 700051019103103	Culvert	47 %	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes	Yes	No	No	No
Ryegate	HALL RD	Wells River trib	70000603310310X 700308019803103	Culvert	100 %	No	No	No	No	No	No	No	No	Yes	Yes	Yes	No	Yes	No

						Upstream Sediment Deposition			Upstream Scour and Erosion			Downstream Scour and Erosion					Poor Location or Alignment		
Town	Road	Stream Name	SgaID / struct_num	Type	Bankfull Width Percent	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14
Ryegate	PAGE DR	Tannery Brook	70001103680310X 700011033703103	Culvert	150 %	No	No	No	No	No	No	No	No	Yes	Yes	No	No	Yes	Yes
Ryegate	PAGE DR	Tannery Brook	70001103680310X 700011033703103	Culvert	150 %	No	No	No	No	No	No	No	No	No	Yes	No	No	Yes	Yes
Ryegate	PLEASANT ST	Scott Brook	100318000003101 100310002003101	Culvert	56 %	Yes	No	No	No	Yes	No	No	No	No	No	No	No	No	No
Ryegate	QUINT RD	Wells River Trib	70006301570310X 700063066603103	Culvert	38 %	No	No	Yes	No	No	Yes	No	No	Yes	Yes	No	No	Yes	No
Ryegate	RENFREW DR	Wells River trib	70003702520310X 700037051003103	Culvert	40 %	No	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No	No	No
Ryegate	RENFREW DR	Wells River trib	70003702520310X 700037051003103	Culvert	40 %	No	No	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	No	No	No
Ryegate	SCOTT HWY	Darius James Brook	300302000103042 300026003903101	Culvert	75 %	No	No	Yes	No	No	No	No	No	No	No	No	No	No	No
Ryegate	SCOTT HWY	Scott Brook	300302000203102 300026004103101	Culvert	51 %	No	No	Yes	No	No	No	No	No	No	No	No	No	No	No
Ryegate	SCOTT HWY	Wells River	200302000003101 200026004003102	Bridge	70 %	No	No	No	No	Yes	No	No	No	No	No		No	No	No
Ryegate	STONE RD	Stone Rd Brook	300302000003101 990302000803101	Bridge	84 %	Yes	No	Yes	Yes	Yes	No	Yes	Yes	No	No		No	No	No
Ryegate	STONE RD	Stone Rd Brook	400302000003101 990302000903101	Culvert	59 %	No	No	Yes	Yes	Yes	No	Yes	Yes	No	No	Yes	Yes	No	Yes
Ryegate	STONE RD	Stone Rd Brook	400302000103101 990302001403101	Bridge	65 %	Yes	Yes	Yes	No	No	No	Yes	No	No	Yes		Yes	No	No
Ryegate	STONE RD	Wells River Trib	400310001403101 990302000803101	Bridge	129 %	No	No	Yes	Yes	Yes	No	No	No	No	No		No	No	No
Ryegate	STONE RD	Wells River Trib	400310001503101 990302000903101	Culvert	92 %	No	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	No	Yes	No	Yes
Ryegate	STONE RD	Wells River Trib	400310002203101 990302001403101	Bridge	120 %	No	No	Yes	No	No	No	No	No	No	No		No	Yes	No
Ryegate	STONE RD	Wells River Trib	400310002203101 990302001403101	Bridge	120 %	Yes	No	Yes	No	No	No	No	No	No	No		No	Yes	No

						Upstream			Upstream			Downstream					Poor		
					Bankfull Width	Sediment Deposition			Scour and Erosion			Scour and Erosion					Location or Alignment		
Town	Road	Stream Name	SgaID / struct_num	Type	Percent	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14
Ryegate	STONESHED RD	Stone Rd Brook	400314000003101 990314001803101	Bridge	57 %	No	No	No	Yes	Yes	No	Yes	Yes	No	No		No	No	No
Ryegate	STONESHED RD	Wells River trib	400310003103101 990314001803101	Bridge	83 %	No	No	Yes	Yes	No	Yes	No	Yes	Yes	No		No	Yes	No
Ryegate	STONESHED RD	Wells River trib	400310003103101 990314001803101	Bridge	83 %	No	No	Yes	Yes	No	Yes	No	Yes	Yes	No		No	Yes	No
Ryegate	STONESHED RD	Wells River trib	400310003103101 990314001803101	Bridge	83 %	No	No	Yes	Yes	No	Yes	No	Yes	Yes	No		No	Yes	No
Ryegate	STONESHED RD	Wells River trib	400310003103101 990314001803101	Bridge	83 %	No	No	Yes	Yes	No	Yes	No	Yes	Yes	No		No	Yes	No
Ryegate	TERRY HILL RD	Scott Brook	300320000003101	Bridge	25 %	No	No	Yes	No	Yes	No	No	No	Yes	Yes		No	No	Yes
Ryegate	WITHERS POON RD	Darius James Brook trib	70000502270310X 700006016003103	Culvert	75 %	No	Yes	No	No	No	Yes	No	No	No	Yes	No	No	No	No
Ryegate	WITHERS POON RD	Darius James Brook trib	70000502340310X 700006016703103	Culvert	83 %	No	No	Yes	No	No	Yes	No	No	Yes	Yes	Yes	No	No	No
Ryegate	WITHERS POON RD	Wells River trib	70000502250310X 700006015803103	Culvert	57 %	No	No	Yes	No	No	No	No	Yes	Yes	Yes	Yes	No	No	No
Topsham		Scott Brook	700000000209123	Culvert	12 %	Yes	No	Yes	No	No	Yes	No	No	Yes	No	Yes	No	No	No

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Aquatic Organism Passage

Wells River

Geomorphic Compatibility

Retrofit Potential

Explanation of codes used in table header

Explanation of data acquisition (link)

AOP Coarse Screen		AOP Geomorphic Compatibility		AOP Retrofit Potential	
Green	Full AOP for all aquatic organisms	**Green**	Structure is fully compatable geomorphically 20 < GC < 25	**H**	High probablity the existing culvert can be retrofited
Gray	Reduced AOP for all aquatic organisms	**Light Green**	Structure is mostly compatable geomorphically 15 < GC < 20	**M**	Medium probablity the existing culvert can be retrofited
Orange	No AOP for all aquatic organisms except adult salmonids	**Yellow**	Structure is partially compatable geomorphically 10 < GC < 15	**L**	Low probablity the existing culvert can be retrofited
Red	No AOP for all aquatic organisms including adult salmonids	**Orange**	Structure is mostly incompatable geomorphically 5 < GC < 10	**Pos 1 (left)**	For strong swimmers
		Red	Structure is fully incompatable geomorphically 0 < GC < 5	**Pos2 (Center)**	For moderate swimmers
				Pos 3 (right)	For weak swimmers

Town	Road	Stream Name	SgaID / struct_num	AOP Coarse Screen	AOP Geomorphic Compatibility	AOP Retrofit Potential	Percent Bankfull Width
Groton	Glover Rd-driveway	Clark Hatch Brook	700000001703043	No AOP Including Adult Salmonids	Partially Compatable	MLL	32 %
Groton	Glover Rd-trail	Clark Hatch Brook	700000001803043	No AOP Except Adult Salmonids	Partially Compatable	LLL	17 %
Groton	farm rd at 556 Little Italy Rd	Keenan Brook	700000001003043	Reduced AOP	Mostly Incompatable	MLL	39 %
Groton	BROCK RD	Tannery Brook	70001100510304X 700011024803043	No AOP Except Adult Salmonids	Partially Compatable	HHM	80 %
Groton	GLOVER RD	Clark Hatch Brook	600013000003041	No AOP Including Adult Salmonids	Mostly Incompatable	LLL	11 %
Groton	GLOVER RD	Clark Hatch Brook	600013000103041	No AOP Including Adult Salmonids	Fully Incompatable	LLL	14 %
Groton	GREAT RD	North Branch Wells River Trib	70000401440304X 700004016403043	Reduced AOP	Mostly Incompatable	LLL	86 %
Groton	GREAT RD	North Branch Wells River Trib	70000401550304X 700004017503043	No AOP Including Adult Salmonids	Fully Incompatable	HML	75 %

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Town	Road	Stream Name	SgaID / struct_num	AOP Coarse Screen	AOP Geomorphic Compatibility	AOP Retrofit Potential	Percent Bankfull Width
Groton	GREAT RD	Tannery Brook Trib	70000401310304X 700004015103043	No AOP Including Adult Salmonids	Partially Compatable	MML	50 %
Groton	HARV ORR RD	North Branch Wells River	70000601660304X 700006021903043	No AOP Including Adult Salmonids	Fully Incompatable	MML	50 %
Groton	HARV ORR RD	North Branch Wells River Trib	70000601620304X 700006021503043	Reduced AOP	Mostly Incompatable	MML	50 %
Groton	HARV ORR RD	North Branch Wells River Trib	70000601640304X 700006021703043	Reduced AOP	Partially Compatable	MLL	38 %
Groton	HOOPER HILL RD	Clark Hatch Brook Trib	70001401810304X 700014027403043	No AOP Including Adult Salmonids	Partially Compatable	MML	57 %
Groton	LITTLE ITALY RD	Keenan Brook	400032000003041	Reduced AOP	Partially Compatable	MLL	47 %
Groton	MINARD HILL RD	Tannery Brook	600002000003041 700002011703043	Reduced AOP	Mostly Incompatable	MLL	32 %
Groton	MINARD HILL RD	Tannery Brook	70000202340304X 700002011703043	Reduced AOP	Partially Compatable	MML	63 %
Groton	MINARD HILL RD	Tannery Brook	70000202440304X 700002012703043	No AOP Except Adult Salmonids	Partially Compatable	HHM	77 %
Groton	MINARD HILL RD	Tannery Brook	70000202460304X 700002012903043	Reduced AOP	Partially Compatable	HHH	168 %
Groton	MINARD HILL RD	Tannery Brook Trib	70000202230304X 700002010603043	Reduced AOP	Mostly Incompatable	MML	60 %
Groton	MINARD HILL RD	Tannery Brook Trib	70000202310304X 700002011403043	Reduced AOP	Mostly Compatable	HHH	114 %
Groton	MT ARA RD	Tannery Brook Trib	70002002470304X 700020029903043	Reduced AOP	Mostly Compatable	HHM	83 %
Groton	N COUNTY RD	North Branch Wells River	70000502660304X 700005021003043	Reduced AOP	Partially Compatable	MML	50 %
Groton	N COUNTY RD	Red Brook	70000502640304X 990005000903041	Reduced AOP	Mostly Compatable	MML	69 %
Groton	N COUNTY RD	Red Brook Trib	70000502570304X 700005020103043	Reduced AOP	Mostly Compatable	HHM	80 %
Groton	N COUNTY RD	Red Brook Trib	70000502630304X 700005020703043	Reduced AOP	Partially Compatable	MML	67 %

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Town	Road	Stream Name	SgaID / struct_num	AOP Coarse Screen	AOP Geomorphic Compatibility	AOP Retrofit Potential	Percent Bankfull Width
Groton	OLD RAILROAD BED	Keenan Brook	700000001603043	Reduced AOP	Partially Compatable	MLL	34 %
Groton	POWDER SPRING RD	Keenan Brook	400001000003041	Reduced AOP	Partially Compatable	LLL	22 %
Groton	RAILROAD ST	Keenan Brook	600053000003041	Reduced AOP	Partially Compatable	LLL	21 %
Groton	RED BROOK RD	North Branch Wells River	70000703610304X 700007022703043	Full AOP	Partially Compatable	HHM	78 %
Groton	RED BROOK RD	North Branch Wells River	70000703630304X 700007022903043	Reduced AOP	Mostly Compatable	HHH	107 %
Groton	RED BROOK RD	North Branch Wells River Trib	70000703560304X 700007022203043	No AOP Including Adult Salmonids	Partially Compatable	MML	60 %
Groton	RED BROOK RD	Red Brook	70000703660304X 700007023203043	Reduced AOP	Fully Compatable	HHM	95 %
Groton	RED BROOK RD	Red Brook Trib	70000703680304X 700007023403043	Reduced AOP	Mostly Incompatable	MLL	38 %
Groton	SCOTT HWY	Clark Hatch Brook	300302000003042	No AOP Including Adult Salmonids	Mostly Incompatable	MLL	37 %
Newbury		Scott Brook	700000000109073	Reduced AOP	Partially Compatable	MLL	36 %
Newbury		Scott Brook	700000000209073	Reduced AOP	Mostly Incompatable	MLL	40 %
Newbury		Scott Brook	700000000309073	Reduced AOP	Partially Compatable	MML	60 %
Newbury	log rd off Swamp Rd	Scott Brook	700000004409073	Reduced AOP	Fully Incompatable	LLL	26 %
Newbury	CESARI RD	Scott Brook	400009000009071	Reduced AOP	Partially Compatable	MLL	31 %
Newbury	TOPSHAM RD	Scott Brook	600035000009071	Reduced AOP	Partially Compatable	MLL	35 %
Newbury	TOPSHAM RD	Scott Brook	600035000109071	No AOP Including Adult Salmonids	Mostly Incompatable	MML	50 %
Newbury	TOPSHAM RD	Unnamed	600035000609071	No AOP Including Adult Salmonids	Partially Compatable	MLL	38 %

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Town	Road	Stream Name	SgaID / struct_num	AOP Coarse Screen	AOP Geomorphic Compatibility	AOP Retrofit Potential	Percent Bankfull Width
Ryegate	APPLETON PERRY DR	Wells River Trib	70005601060310X 700056061103103	Reduced AOP	Partially Compatable	HHM	83 %
Ryegate	CREAMERY RD	Stone Rd Brook	400005000003101 990005000403101	Reduced AOP	Mostly Incompatable	MML	63 %
Ryegate	GILFILLAN RD	Wells River Trib	70004400920310X 700044055203103	No AOP Including Adult Salmonids	Mostly Incompatable	HHM	75 %
Ryegate	HALL RD	Darius James Brook	300026003903101	Reduced AOP	Mostly Compatable	HHM	88 %
Ryegate	HALL RD	Stone Rd Brook	600051000003101	Reduced AOP	Partially Compatable	LLL	27 %
Ryegate	HALL RD	Wells River trib	70000603220310X 700051018903103	Reduced AOP	Mostly Compatable	MML	60 %
Ryegate	HALL RD	Wells River trib	70000603240310X 700051019103103	No AOP Including Adult Salmonids	Mostly Incompatable	MLL	47 %
Ryegate	HALL RD	Wells River trib	70000603310310X 700308019803103	No AOP Including Adult Salmonids	Partially Compatable	MLL	100 %
Ryegate	PAGE DR	Tannery Brook	70001103680310X 700011033703103	Reduced AOP	Fully Compatable	HHH	150 %
Ryegate	PLEASANT ST	Scott Brook	100318000003101 100310002003101	Reduced AOP	Partially Compatable	MML	56 %
Ryegate	QUINT RD	Wells River Trib	70006301570310X 700063066603103	Reduced AOP	Mostly Incompatable	MLL	38 %
Ryegate	RENFREW DR	Wells River trib	70003702520310X 700037051003103	No AOP Including Adult Salmonids	Mostly Incompatable	MLL	40 %
Ryegate	SCOTT HWY	Darius James Brook	300302000103042 300026003903101	Reduced AOP	Partially Compatable	MML	75 %
Ryegate	SCOTT HWY	Scott Brook	300302000203102 300026004103101	Full AOP	Mostly Compatable	MML	51 %
Ryegate	STONE RD	Stone Rd Brook	400302000003101 990302000903101	No AOP Except Adult Salmonids	Partially Compatable	MML	59 %
Ryegate	STONE RD	Wells River Trib	400310001503101 990302000903101	Reduced AOP	Mostly Incompatable	HHM	92 %
Ryegate	WITHERSPOON RD	Darius James Brook trib	70000502270310X 700006016003103	Reduced AOP	Mostly Compatable	HHM	75 %

Agency of Natural Resouces

September, 15

Town	Road	Stream Name	SgaID / struct_num	AOP Coarse Screen	AOP Geomorphic Compatibility	AOP Retrofit Potential	Percent Bankfull Width
Ryegate	WITHERSPOON RD	Darius James Brook trib	70000502340310X 700006016703103	No AOP Including Adult Salmonids	Partially Compatable	MLL	83 %
Ryegate	WITHERSPOON RD	Wells River trib	70000502250310X 700006015803103	No AOP Including Adult Salmonids	Mostly Incompatable	MML	57 %
Topsham		Scott Brook	700000000209123	No AOP Including Adult Salmonids	Partially Compatable	LLL	12 %

Wildlife Passage

Wells River

Structures Potentially Suitable for Terrestrial Wildlife Movement

Large Wildlife = deer, moose, bear

Medium Wildlife = fisher, otter, coyote, fox

Small Wildlife = herps, small mammals

			X = meets criteria MD = missing data					Wildlife Species Observed		
Town	Road	Stream Name	SgaID / struct_num	Type	Small Wildlife	Medium Wildlife	Large Wildlife	Roadkill	Outside Structure	Inside Structure
Groton	Glover Rd-driveway	Clark Hatch Brook	700000001703043	Culvert	-	-	-	---	---	---
Groton	Glover Rd-trail	Clark Hatch Brook	700000001803043	Culvert	-	-	-	---	---	---
Groton	farm rd at 556 Little Italy Rd	Keenan Brook	700000001003043	Culvert	-	-	-	---	---	---
Groton	trail off Little Italy Rd	Keenan Brook	700000001103043	Bridge	-	-	MD	---	---	---
Groton	trail off Branch Brook (Fred Hayes) Rd	North Branch Wells	700000000803043	Bridge	-	-	MD	---	---	---
Groton	US 302	North Branch Wells River	200026003603042	Bridge	-	-	MD	Turtle	---	---
Groton	DW to 1212 Seyon Pond Rd	South Branch Wells	700000000303043	Bridge	X	-	MD	---	---	---
Groton	pvt off Seyon Pond Rd	South Branch Wells	700000000403043	Bridge	-	-	MD	---	---	---
Groton	pvt off Seyon Pond Rd	South Branch Wells	700000000503043	Bridge	-	-	MD	---	---	---
Groton	pvt dw to 3571 Scott Hwy	South Branch Wells	700000000603043	Bridge	-	-	MD	---	---	---
Groton	VAST trail at Upper Valley Grill	South Branch Wells	700000000703043	Bridge	X	-	MD	---	---	---
Groton	trail off Tannery Brook Rd	Tannery Brook	700000000903043	Bridge	-	-	MD	---	---	---
Groton	US 302	Wells River	200026003503042	Bridge	-	-	MD	---	---	---

Town	Road	Stream Name	SgaID / struct_num	Type	Small Wildlife	Medium Wildlife	Large Wildlife	Roadkill	Outside Structure	Inside Structure
Groton	DW off State Forest Rd	Wells River	700000000103043	Bridge	-	-	MD	---	---	---
Groton	pvt dw to 304 State Forest Rd (Rte 232)	Wells River	700000001903043	Bridge	-	-	MD	---	---	---
Groton	BROCK RD	Tannery Brook	70001100510304X 700011024803043	Culvert	-	-	-	---	Deer - Tracks	---
Groton	COCHRAN RD	Wells River	100017000003041 100304001603041	Bridge	-	-	MD	---	---	---
Groton	COCHRAN RD	Wells River	100304001603041	Bridge	X	-	MD	---	---	---
Groton	CROSS RD	Tannery Brook	400304000803041 990010000403041	Bridge	-	-	MD	---	---	---
Groton	GLOVER RD	Clark Hatch Brook	600013000003041	Culvert	-	-	-	---	---	---
Groton	GLOVER RD	Clark Hatch Brook	600013000103041	Culvert	-	-	-	---	---	---
Groton	GREAT RD	North Branch Wells River Trib	70000401440304X 700004016403043	Culvert	-	-	-	---	---	---
Groton	GREAT RD	North Branch Wells River Trib	70000401550304X 700004017503043	Culvert	-	-	-	---	---	---
Groton	GREAT RD	Tannery Brook Trib	70000401310304X 700004015103043	Culvert	-	-	-	---	---	---
Groton	HARV ORR RD	North Branch Wells River	70000601660304X 700006021903043	Culvert	-	-	-	---	---	---
Groton	HARV ORR RD	North Branch Wells River Trib	70000601620304X 700006021503043	Culvert	-	-	-	---	---	---
Groton	HARV ORR RD	North Branch Wells River Trib	70000601640304X 700006021703043	Culvert	-	-	-	---	---	---
Groton	HOOPER HILL RD	Clark Hatch Brook Trib	70001401810304X 700014027403043	Culvert	-	-	-	---	Deer - Tracks	---
Groton	LITTLE ITALY RD	Keenan Brook	400032000003041	Culvert	-	-	-	---	---	---
Groton	MINARD HILL RD	Tannery Brook	600002000003041 700002011703043	Culvert	-	-	-	---	---	---
Groton	MINARD HILL RD	Tannery Brook	70000202340304X 700002011703043	Culvert	-	-	-	---	---	---
Groton	MINARD HILL RD	Tannery Brook	70000202440304X 700002012703043	Culvert	-	-	-	---	---	---

Town	Road	Stream Name	SgaID / struct_num	Type	Small Wildlife	Medium Wildlife	Large Wildlife	Roadkill	Outside Structure	Inside Structure
Groton	MINARD HILL RD	Tannery Brook	70000202460304X 700002012903043	Culvert	-	-	-	---	Deer - Tracks	---
Groton	MINARD HILL RD	Tannery Brook Trib	70000202230304X 700002010603043	Culvert	-	-	-	---	---	---
Groton	MINARD HILL RD	Tannery Brook Trib	70000202310304X 700002011403043	Culvert	-	-	-	---	---	---
Groton	MT ARA RD	Tannery Brook Trib	70002002470304X 700020029903043	Culvert	-	-	-	---	---	---
Groton	N COUNTY RD	North Branch Wells River	70000502660304X 700005021003043	Culvert	-	-	-	---	---	---
Groton	N COUNTY RD	Red Brook	70000502640304X 990005000903041	Culvert	-	-	-	---	Beaver - Feeding Signs	---
Groton	N COUNTY RD	Red Brook Trib	70000502570304X 700005020103043	Culvert	-	-	-	---	---	---
Groton	N COUNTY RD	Red Brook Trib	70000502630304X 700005020703043	Culvert	-	-	-	---	---	---
Groton	OLD RAILROAD BED	Keenan Brook	700000001603043	Culvert	-	-	-	---	---	---
Groton	POUND RD	Tannery Brook	400021000003041 990021000703041	Bridge	X	-	MD	---	---	---
Groton	POUND RD	Tannery Brook	400304001303041 990021000703041	Bridge	X	-	MD	---	Deer - Tracks	---
Groton	POWDER SPRING RD	Keenan Brook	400001000003041	Culvert	-	-	-	---	---	---
Groton	POWDER SPRING RD	Wells River	100001000003041 200193000603042	Bridge	-	-	MD	---	---	---
Groton	RAILROAD ST	Keenan Brook	600053000003041	Culvert	-	-	-	---	---	---
Groton	RED BROOK RD	North Branch Wells River	70000703610304X 700007022703043	Culvert	X	X	-	---	Deer - Tracks	---
Groton	RED BROOK RD	North Branch Wells River	70000703630304X 700007022903043	Culvert	-	-	-	---	---	---
Groton	RED BROOK RD	North Branch Wells River Trib	70000703560304X 700007022203043	Culvert	-	-	-	---	---	---

Town	Road	Stream Name	SgaID / struct_num	Type	Small Wildlife	Medium Wildlife	Large Wildlife	Roadkill	Outside Structure	Inside Structure
Groton	RED BROOK RD	Red Brook	70000703660304X 700007023203043	Culvert	-	-	-	---	---	---
Groton	RED BROOK RD	Red Brook Trib	70000703680304X 700007023403043	Culvert	-	-	-	---	---	---
Groton	S BRANCH RD	South Branch Wells	100025000003041	Bridge	-	-	MD	---	---	---
Groton	S COUNTY RD	Wells River	700000000203043	Bridge	-	-	MD	---	---	---
Groton	SCOTT HWY	Clark Hatch Brook	300302000003042	Culvert	-	-	-	---	---	---
Groton	SCOTT HWY	North Branch Wells	200302000203042 200026003603042	Bridge	-	-	MD	---	---	---
Groton	SCOTT HWY	South Branch Wells	200302000003042 200026003103042	Bridge	X	-	MD	---	---	---
Groton	SCOTT HWY	South Branch Wells	200302000103042 200026003203042	Bridge	X	-	MD	---	---	---
Groton	SCOTT HWY	Tannery Brook	500302000003042	Bridge	-	-	MD	---	---	---
Groton	SCOTT HWY	Wells River	200302000303042 200026003503042	Bridge	-	-	MD	---	---	---
Groton	SEYON POND RD	Heath Brook	100024000003041 100304001003041	Bridge	-	-	MD	---	---	---
Groton	WELTON RD	Wells River	100048000003041 100304001803041	Bridge	-	-	MD	---	---	---
Groton	WELTON RD	Wells River	100304001803041	Bridge	-	-	MD	---	---	---
Newbury		Scott Brook	700000000109073	Culvert	-	-	-	---	---	---
Newbury		Scott Brook	700000000209073	Culvert	-	-	-	---	---	---
Newbury		Scott Brook	700000000309073	Culvert	-	-	-	---	---	---
Newbury	log rd off Swamp Rd	Scott Brook	700000004409073	Culvert	-	-	-	---	---	---
Newbury	log rd across from Grapes Rd-Swamp Rd jct	Scott Brook	700000004509073	Bridge	-	-	MD	---	---	---
Newbury	sugarbush access bridge W edge of hayfields off Swamp Rd	Scott Brook	700000004609073	Bridge	-	-	MD	---	---	---

Town	Road	Stream Name	SgaID / struct_num	Type	Small Wildlife	Medium Wildlife	Large Wildlife	Roadkill	Outside Structure	Inside Structure
Newbury	driveway off Swamp Rd	Scott Brook	700000004709073	Bridge	-	-	MD	---	Beaver - Lodge	---
Newbury	pvt dw to 1198 Swamp Rd	Scott Brook	700000004809073	Bridge	X	-	MD	---	Beaver - Feeding Signs	---
Newbury	CESARI RD	Scott Brook	400009000009071	Culvert	-	-	-	---	---	---
Newbury	SWAMP RD	Scott Brook	100002000009071 100907001209071	Bridge	-	-	MD	---	---	---
Newbury	SWAMP RD	Scott Brook	400002000009071	Bridge	-	-	MD	---	---	---
Newbury	SWAMP RD	Scott Brook	400002000509071	Bridge	-	-	MD	---	---	---
Newbury	TOPSHAM RD	Scott Brook	600035000009071	Culvert	-	-	-	---	---	---
Newbury	TOPSHAM RD	Scott Brook	600035000109071	Culvert	-	-	-	---	---	---
Newbury	TOPSHAM RD	Unnamed	600035000609071	Culvert	-	-	-	---	---	---
Ryegate	yard bridge at 311 Church St	Scott Brook	700000000403103	Bridge	-	-	MD	---	---	---
Ryegate	pvt dw to 259 Church St	Scott Brook	700000000503103	Bridge	-	-	MD	---	---	---
Ryegate	ftbridge 325 ft DS Hall Rd	Stone Rd Brook	700000000103103	Bridge	-	-	MD	---	Deer - Tracks	---
Ryegate	ftbridge just E of 848 Stone Rd	Stone Rd Brook	700000000203103	Bridge	X	-	MD	---	---	---
Ryegate	under bldg between Stoneshed Rd and Creamery St	Stone Rd Brook	700000000303103	Bridge	-	-	MD	---	Unsure - Tracks	---
Ryegate	US302	Wells River	200026004003102	Bridge	-	-	MD	---	Mink - Tracks	Mink - Tracks
Ryegate	Clough farm rd off Brown Dr	Wells River	700000000003043	Bridge	-	-	MD	---	---	---
Ryegate	spur off Rte 302 to Brown Dr	Wells River	700000000003103	Bridge	-	-	MD	---	---	---
Ryegate	APPLETON PERRY DR	Wells River Trib	70005601060310X 700056061103103	Culvert	-	-	-	---	Deer - Tracks	---
Ryegate	CHURCH ST	Wells River	100002000003101 100310000203101	Bridge	-	-	MD	---	---	---

Town	Road	Stream Name	SgaID / struct_num	Type	Small Wildlife	Medium Wildlife	Large Wildlife	Roadkill	Outside Structure	Inside Structure
Ryegate	CHURCH ST	Wells River	100310000203101	Bridge	-	-	MD	---	---	---
Ryegate	CREAMERY RD	Stone Rd Brook	400005000003101 990005000403101	Culvert	-	-	-	---	---	---
Ryegate	CREAMERY RD	Wells River	100005000003101	Bridge	-	-	MD	---	---	---
Ryegate	CREAMERY RD	Wells River	100310000403101	Bridge	X	-	MD	---	---	---
Ryegate	CREAMERY RD	Wells River Trib	400310001003101 990005000403101	Bridge	-	-	MD	---	---	---
Ryegate	GILFILLAN RD	Wells River Trib	70004400920310X 700044055203103	Culvert	-	-	-	---	Deer - Tracks	---
Ryegate	HALL RD	Darius James Brook	300026003903101	Culvert	-	-	-	---	---	---
Ryegate	HALL RD	Stone Rd Brook	600051000003101	Culvert	-	-	-	---	Unsure - Tracks	---
Ryegate	HALL RD	Wells River trib	70000603220310X 700051018903103	Culvert	-	-	-	---	---	---
Ryegate	HALL RD	Wells River trib	70000603240310X 700051019103103	Culvert	-	-	-	---	---	---
Ryegate	HALL RD	Wells River trib	70000603310310X 700308019803103	Culvert	-	-	-	---	---	---
Ryegate	PAGE DR	Tannery Brook	70001103680310X 700011033703103	Culvert	-	-	-	---	---	---
Ryegate	PLEASANT ST	Scott Brook	100318000003101 100310002003101	Culvert	-	-	-	---	Unsure - Tracks	---
Ryegate	QUINT RD	Wells River Trib	70006301570310X 700063066603103	Culvert	-	-	-	---	---	---
Ryegate	RENFREW DR	Wells River trib	70003702520310X 700037051003103	Culvert	-	-	-	---	---	---
Ryegate	SCOTT HWY	Darius James Brook	300302000103042 300026003903101	Culvert	-	-	-	---	---	---
Ryegate	SCOTT HWY	Scott Brook	300302000203102 300026004103101	Culvert	-	-	-	---	---	---
Ryegate	SCOTT HWY	Wells River	200302000003101 200026004003102	Bridge	-	-	MD	---	---	---
Ryegate	STONE RD	Stone Rd Brook	300302000003101 990302000803101	Bridge	X	-	MD	---	---	---

Town	Road	Stream Name	SgaID / struct_num	Type	Small Wildlife	Medium Wildlife	Large Wildlife	Roadkill	Outside Structure	Inside Structure
Ryegate	STONE RD	Stone Rd Brook	400302000003101 990302000903101	Culvert	-	-	-	---	---	---
Ryegate	STONE RD	Stone Rd Brook	400302000103101 990302001403101	Bridge	-	-	MD	---	---	---
Ryegate	STONE RD	Wells River Trib	400310001403101 990302000803101	Bridge	-	-	MD	---	---	---
Ryegate	STONE RD	Wells River Trib	400310001503101 990302000903101	Culvert	-	-	-	---	Mink - Tracks	---
Ryegate	STONE RD	Wells River Trib	400310002203101 990302001403101	Bridge	-	-	MD	---	---	---
Ryegate	STONESHED RD	Stone Rd Brook	400314000003101 990314001803101	Bridge	-	-	MD	---	---	---
Ryegate	STONESHED RD	Wells River trib	400310003103101 990314001803101	Bridge	-	-	MD	---	---	---
Ryegate	TERRY HILL RD	Scott Brook	300320000003101	Bridge	-	-	MD	---	---	---
Ryegate	WITHERSPOON RD	Darius James Brook trib	70000502270310X 700006016003103	Culvert	X	X	-	---	---	---
Ryegate	WITHERSPOON RD	Darius James Brook trib	70000502340310X 700006016703103	Culvert	-	-	-	---	---	---
Ryegate	WITHERSPOON RD	Wells River trib	70000502250310X 700006015803103	Culvert	-	-	-	---	---	---
Topsham		Scott Brook	700000000209123	Culvert	-	-	-	---	---	---