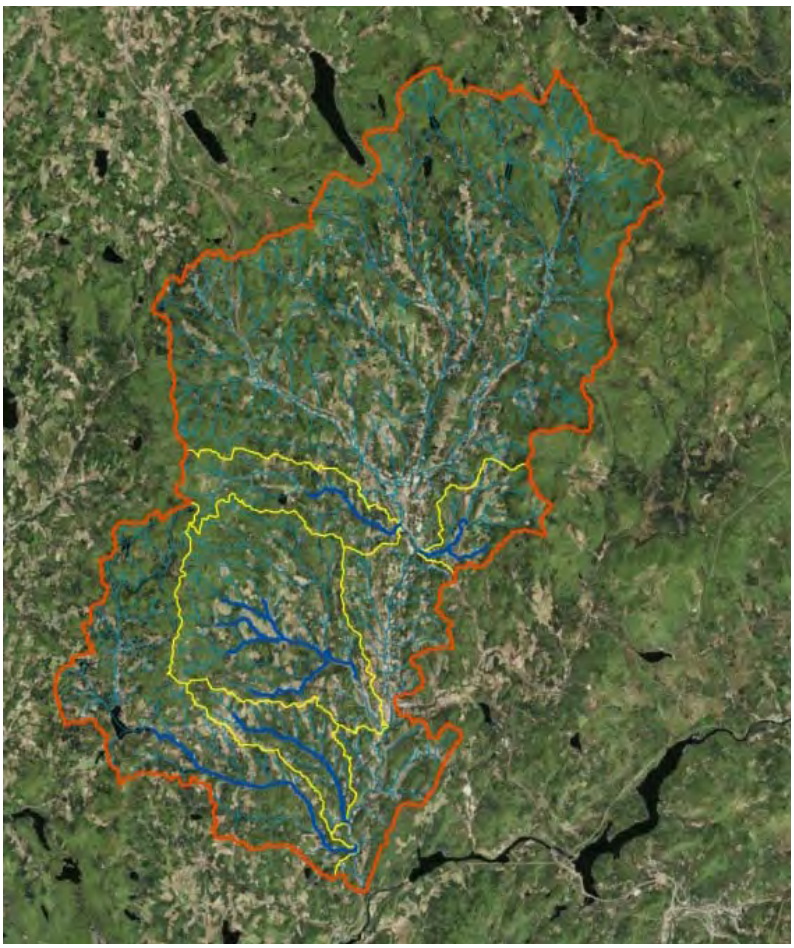
Lower Passumpsic River Tributaries
Phase 1 Stream Geomorphic Assessment Report

September 27, 2013



Prepared by:

Fitzgerald Environmental Associates, LLC.
18 Severance Green, Suite 203
Colchester, VT 05446

Fitzgerald Environmental Associates, LLC.
Applied Watershed Science & Ecology

Prepared under contract to:

Caledonia Country Natural Resources Conservation District
481 Summer Street, Suite 202
St. Johnsbury, VT 05819

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Executive Summary

As a result of dealing with severe, repeat flood and erosion damage throughout Vermont of the last two decades, Vermont's river scientists and engineers now understand that hazard mitigation and river restoration projects are most successful when carried out within a context of how reach and watershed-scale stressors influence flood and erosion hazards. In an effort to understand the root causes of stream channel instability and flood/fluvial erosion hazards in the Passumpsic River watershed, the Caledonia County Regional Natural Resources Conservation District (CCNRCD) and the Vermont Department of Environmental Conservation (VTDEC) has sought to develop a database of Stream Geomorphic Assessment (SGA) data for river reaches of significant size throughout the watershed. This data allows for a much more comprehensive approach to flood and erosion hazard planning, in contrast to the conventional approach of multiple "spot fixes" with limited knowledge of the river system. Fitzgerald Environmental Associates, LLC (FEA) was hired by CCNRCD in summer of 2012 to complete a Phase 1 SGA study on a group of five tributaries in the southern portion of the Passumpsic River watershed. The objectives of the Phase 1 study are described below.

1) Develop baseline watershed and reach-scale data for the study reaches.
2) Identify river reaches where more detailed field data collection (i.e., Phase 2 SGA) is needed.
3) Develop a basis for understanding the overall causes of channel instability, flood/erosion hazards, and habitat degradation along the river corridor in the watershed.

The Passumpsic River is one of the dominant landscape features in the Northeast Kingdom of Vermont. Its headwaters are found in the northern portions of Caledonia and Essex counties, and it empties into the Connecticut River just north of Barnet, Vermont. Numerous towns and town centers are found within its alluvial valley and along its steep banks, including St. Johnsbury and Lyndonville. The Lower Passumpsic River tributary watersheds are located primarily in Caledonia County in the southern portion of the Passumpsic watershed and drain a combined a combined area of 141.1 square miles. Four tributaries (Joe's Brook, Water Andric, Sleepers River, and Wheelock Brook) and five sub-tributaries (Whiteman Brook, Badger Brook, Morrill Brook, North Brook, and Pope Brook) enter the Passumpsic from the west and drain the towns of Barnet, Cabot, Danville, Lyndon, Peacham, Stannard, St. Johnsbury , Walden, and Wheelock. Sheldon Brook and sub-tributary South Branch Sheldon Brook drain the towns of Kirby, Lyndon, and Victory, and enter the Passumpsic from the east near the mouth of Wheelock Brook.

A major flood along the Passumpsic River in 2002 initiated several studies and efforts to mitigate flooding and erosion hazards in Lyndonville and St. Johnsbury. A mitigation study was prepared by Gomez and Sullivan Engineers, PC to understand causes of flooding and potential mitigation measures along the river. Flooding and erosion hazards are again a top concern for citizens within the Lower Passumpsic tributary watersheds following major flooding in spring of 2011 (and again to a lesser degree during Tropical Storm Irene in the summer of 2011). These recent flood events caused major damage to roads, properties, and homes in several areas throughout the tributary watersheds.

Below is a summary of key findings from the Phase 1 SGA study on the Lower Passumpsic River tributaries:

- A total of 68 reaches along 48.5 river miles were delineated during the Phase 1 analysis. Full Phase 1 data and windshield survey data was collected by FEA for the five tributary and six sub-tributary watersheds.

- The Phase 1 SGA approach resulted in watershed-scale data about the landscape (e.g., soils and land cover) and the stream channel (e.g., slope and form), providing a basis for understanding the natural and human-impacted conditions within the watershed. The Phase 1 data will also aid in future identification of specific stressors affecting the physical conditions of the stream channels and structures (e.g., bridges and culverts, bank armoring, etc).
- Approximately 20 percent of the assessed reaches (15 reaches) are found in a confined valley setting that would normally support sediment transport channels with A or B-type geometry. The remaining 53 reaches are found in an unconfined valley setting with meandering, depositional, C, D, or E-type channel geometry.
- Approximately 80% of the tributary watersheds are forested, with agricultural land use representing approximately 10-20%. Developed lands represent 1-4% of the land area and are mainly associated with development corridors along major roads, the towns of Lyndon and Danville, and dense residential development around Joe's Pond. Wetlands and other surface waters represent 0-5% of the land cover within the tributary watersheds.
- Impact ratings were developed for each reach using the Phase 1 parameters representing four classes of watershed and reach-scale impacts: 1) Land Cover and Reach Hydrology; 2) Channel Modifications; 3) Floodplain Modifications and Planform Changes; 4) Bed and Bank Conditions. Out of a total possible impact score of 32, the average rating for all reaches was 8.9, with a maximum score of 18 and a minimum score of 1.
- Based on the Phase 1 impact ratings, a total of 36 high-priority reaches in Danville and Lyndon are recommended for Phase 2 assessment, including reaches on four tributaries (Water Andric, Sleepers River, Sheldon Brook, and Wheelock Brook) and four sub-tributaries (Whiteman Brook, Badger Brook, North Brook, and South Branch Sheldon Brook) . The selected reaches have a total channel length of approximately 25 miles.

1.0 Project Background

In 2012 the Caledonia County Natural Resources Conservation District (CCNRCD) and the Vermont Department of Environmental Conservation (VTDEC) identified tributaries to the Lower Passumpsic River in northeastern Vermont for assessment of fluvial geomorphic conditions. Prior to this, geomorphic assessment data had been collected for other areas of the Passumpsic River watershed; flooding and erosion damage sustained during 2011 storm events in the lower watershed led to the selection of these tributaries for further study. The study is part of a larger effort to characterize the physical and biological conditions of the Passumpsic River watershed and to aid in the identification of stressors on channel stability and aquatic biota communities. In addition, the study results will form the basis for future flood mitigation, stream corridor, and Fluvial Erosion Hazard (FEH) planning efforts in the watershed. Fitzgerald Environmental Associates, LLC. (FEA) was retained by CCNRCD in 2012 to complete river assessments on five tributaries and six sub-tributaries in the Lower Passumpsic watershed following the Phase 1 Stream Geomorphic Assessment (SGA) Protocols (VTDEC, 2009) developed by the VTDEC.

Watershed restoration projects are most successful when carried out within a context for understanding how reach and watershed-scale stressors cause channel instability. The VTDEC SGA Protocols and River Corridor Planning Guide provides sound, scientifically-defensible methods for identifying stressors on channel stability and restoration projects that will address them appropriately (VTDEC, 2010). The overall goal of the VTDEC RMP is to "manage toward, protect, and restore the fluvial geomorphic equilibrium condition of Vermont rivers by resolving conflicts between human investments and river dynamics in the most economically and ecologically sustainable manner," (VTDEC, 2010) achieved through:

- Fluvial erosion hazard mitigation;
- Sediment and nutrient load reduction; and
- Aquatic and riparian protection and restoration

The Phase 1 SGA approach results in watershed-scale data about the landscape (e.g., soils and land cover) and the stream channel (e.g., slope and form), providing a basis for understanding the natural and human-impacted conditions within the watershed. The SGA data also aids in the identification of specific stressors affecting the physical conditions of the stream channels and structures (e.g., bridges and culverts).

FEA used the Stream Geomorphic Assessment Tool (SGAT) to develop the baseline GIS data for the watershed in 2012 and 2013. A total of 68 reaches along 48.5 river miles were assessed during the Phase 1 analysis. Full Phase 1 data, FIT, and windshield survey data were collected by FEA for five tributaries and six sub-tributaries covering the 48.5 river miles.

2.0 Watershed Background

2.1 Geographic Setting and Land Use History

The Passumpsic River watershed is located in the Upper Connecticut River Basin in Northeastern Vermont (Figure 1). At the confluence with the Connecticut River in Barnet, the Passumpsic River drains 374.5 square miles primarily in Caledonia County, and includes small portions of Essex, Orleans, and Washington Counties. The Moose River is a major tributary to the Passumpsic River that is represented by a separate Hydrologic Unit Code (HUC10) and drains an additional 130 square miles to the east in

Caledonia and Essex Counties. This report covers the two HUC10 areas that represent the Passumpsic mainstem and all tributaries other than the Moose River.

The Lower Passumpsic River tributary watersheds drain the southern portion of the Passumpsic River watershed primarily in Caledonia County, and include small portions of Essex and Washington Counties. The five tributary watersheds included in this study cover approximately 38% of the Passumpsic River watershed. Joe's Brook is the largest sub-basin at 52.9mi^2 and drains the southwestern portion of the watershed including portions of the towns of Stannard, Walden, Cabot, Danville, Peacham, and Barnet. Joe's Pond is formed by a dam on the Brook and is an important recreational and tourist attraction for the area. Water Andric borders Joe's Brook to the north and drains an area of 13.1 square miles including portions of Danville and Barnet. The watershed for Sleepers River borders Water Andric to the south and Joe's Brook to the west. The 46.6 square mile watershed includes portions of Wheelock, Lyndon, Walden, St. Johnsbury, and Danville. The Wheelock Brook watershed borders Sleepers River to the south and a small portion of the Joe's Brook headwaters to the west. The 17.1 square mile watershed drains portions of Stannard, Wheelock, and Lyndon. The Sheldon Brook watershed is located on the east side of the Passumpsic River and drains 11.5 square miles including portions of Victory, Kirby, and Lyndon.

Land cover data based on imagery from 2006 (NOAA, 2008a) are summarized in Table 1. The Lower Passumpsic Tributaries drain rural watersheds, with forest representing the dominant cover type. Agricultural lands cover 12% of the Passumpsic River watershed, and 10-20% of the tributary watersheds. There is limited developed land within the watersheds ranging from 1 - 4% Concentrated areas of residential and commercial development are found in the towns of Lyndon, Danville, and St. Johnsbury.

Table 1: Percent Land Cover for Lower Passumpsic River watershed and tributaries

Watershed	Drainage area (mi^2)	Developed	Agricultural	Scrub/Shrub	Forest	Wetland	Open Water	Total
Andric	13.1	4%	11%	4%	79%	2%	0%	100%
Joe's	52.9	3%	19%	4%	74%	0%	0%	100%
Sheldon*	11.5	2%	10%	4%	79%	3%	2%	100%
Sleepers*	46.6	1%	20%	4%	74%	1%	0%	100%
Wheelock	17.1	4%	16%	4%	76%	1%	0%	100%
Remaining Watershed	233.4	2%	11%	4%	81%	1%	1%	100%
Entire Watershed	374.5	3%	12%	4%	78%	2%	1%	100%

*Land cover data for sub-tributaries of Sheldon Brook and Sleepers River are included.

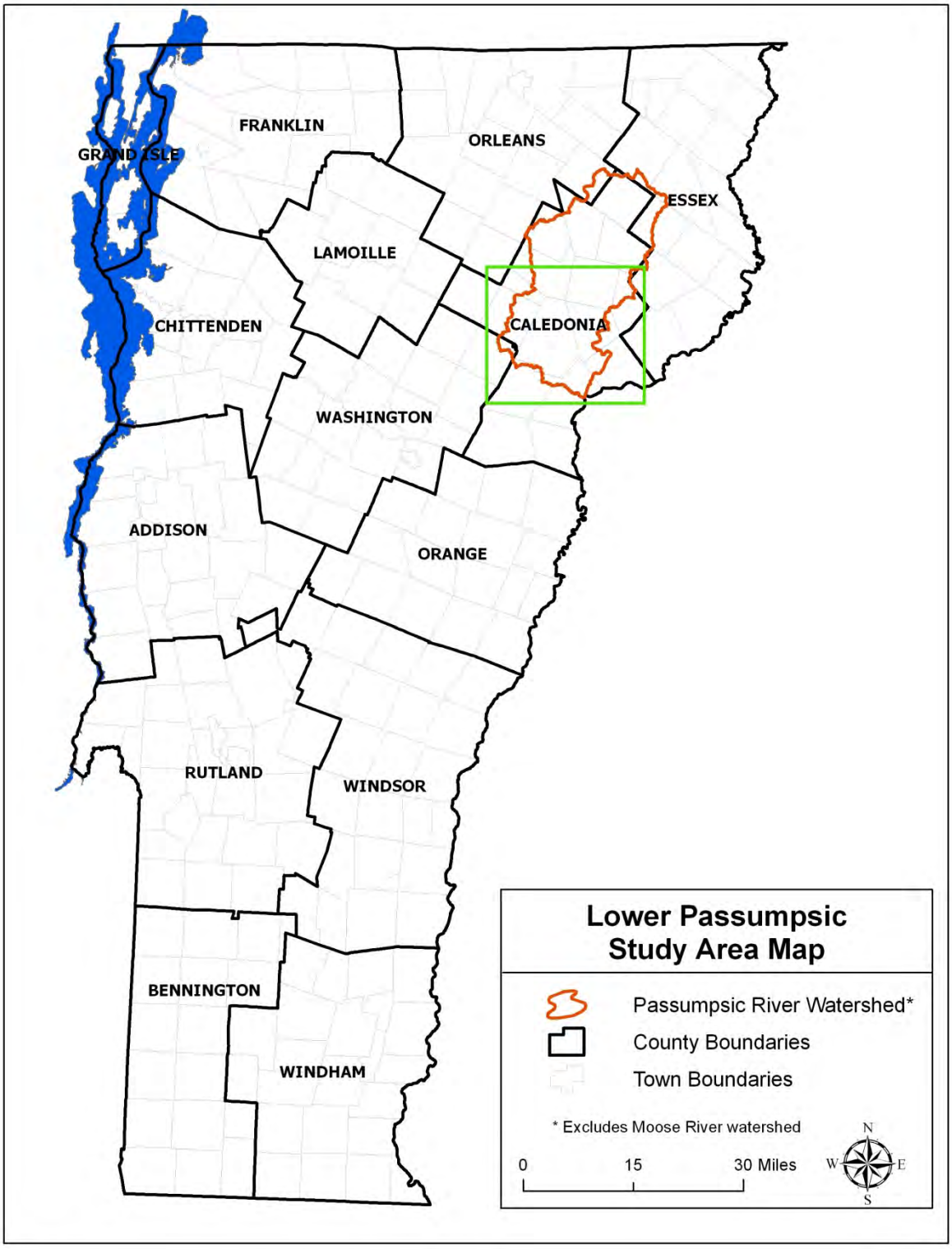

Figure 1: Location map for the Lower Passumpsic River watershed study area.

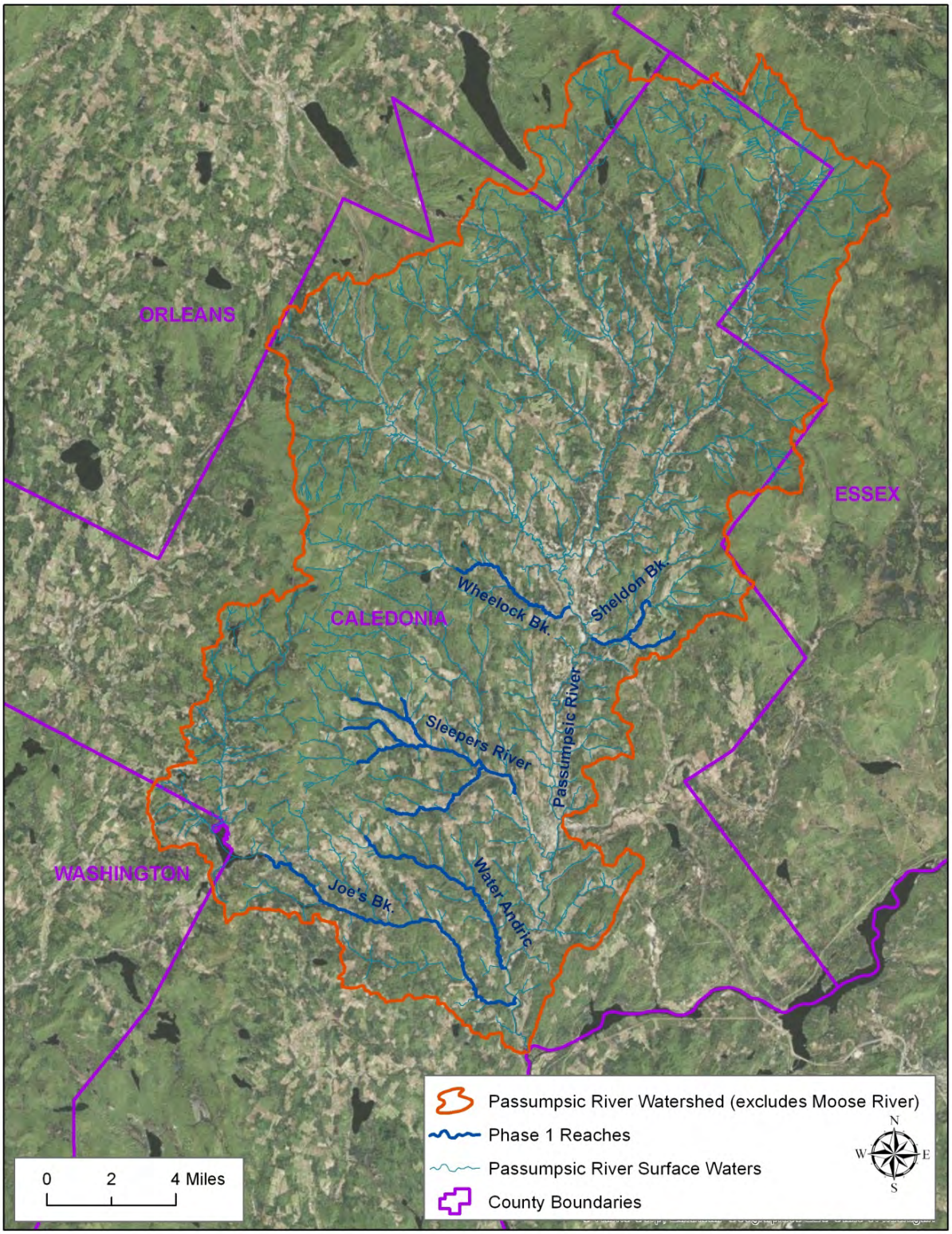

Figure 2: Lower Passumpsic watershed study area, Phase 1 surface waters, and county boundaries.

Historical Land Uses

Historically, the impacts of agricultural practices on the Vermont landscape left a lasting legacy on waterways like the Passumpsic River. Prior to the deforestation associated with human settlement, the watershed would have been a mixture of deciduous forest on the valley floors, coniferous forest along the mountain spines, and a mixture of both along the slopes. Deforestation and grazing, largely from sheep farms, likely left over 90 percent of the watershed devoid of trees at one time or another (Albers, 1998). This landscape change had a tremendous impact on waterways like the Passumpsic River. Exposed, highly-erodible soils (e.g. glacial tills) on steep slopes were carried to the valley floors and aggraded on river bottoms; a legacy that still influences the way Vermont's rivers are managed today.

As Vermont's farmers began to move to the Midwest in search of more productive farmland in the mid to late 1800's, the deciduous forests along the mountain slopes began to recover (Albers, 1998). Throughout the early and mid 1900's, as more family farms on marginal lands were given up, the forests continued to recover. Today, approximately 80 percent of the Lower Passumpsic River watershed is covered by forest. With the increasing tourism sector in the state, and the need for lumber for second-homes and construction, forestry has replaced agriculture in many of the rural hill slopes of Vermont.

2.2 Geologic and Geomorphic Setting

Geologic Setting

The underlying geology of the Lower Passumpsic River watershed is comprised of a mixture of rock types from the Lower Devonian - Upper Silurian Period including igneous rock types (Ratcliffe et al., 2011). The Waits River Formation, which contains a mixture of schist and marble, is found in the majority of the watershed. The weathering of calcium carbonate rich (sea bottom) sediments in these formations results in basic soils that typically support communities of rich woods species. Micaceous quartzite rocks from the Gile Mountain Formation (Lower Devonian Period) are found in the mid to upper Sheldon Brook watershed and the lower Joe's Brook and Water Andric watersheds.

The presence of Glacial Lake Hitchcock also had a significant effect on the surficial geology of the Lower Passumpsic watershed (Figure 3). This lake occupied the Connecticut River Valley from central Connecticut to north of St. Johnsbury during the retreat of the Laurentide ice sheet beginning approximately 18,000 years ago (Ridge and Larson, 1990). The great size of the lake, combined with the erosive forces of the glacier moving over bedrock surfaces allowed for the development of annual layering of fine sediments (e.g., varves) throughout the area affected by the lake.

Surficial geologic deposits of the Lower Passumpsic River watershed were governed largely by glacial activity. During the Wisconsin glaciation, glaciers one mile in thickness extended across New England, reaching their maximum extents approximately 20,000 years ago. This glacial event left the Green Mountains with a physical imprint that is clearly evident today. In the Lower Passumpsic River watershed dense till, glacial till, and outwash areas reflect the dynamic nature with which glaciers shaped the landscape (Figure 4). Most of the surficial geology of the watershed is dominated by till and the stream corridors are primarily outwash. The resultant soils are largely sands (Adams series) and sandy loams (Colton-Duxbury complex) along the Lower Passumpsic River and are fine sandy loams and silty loams (Buckland and Cabot complexes) in the tributary watersheds.

Figure 3: Extent of glacial Lake Hitchcock (NPS, 2010).

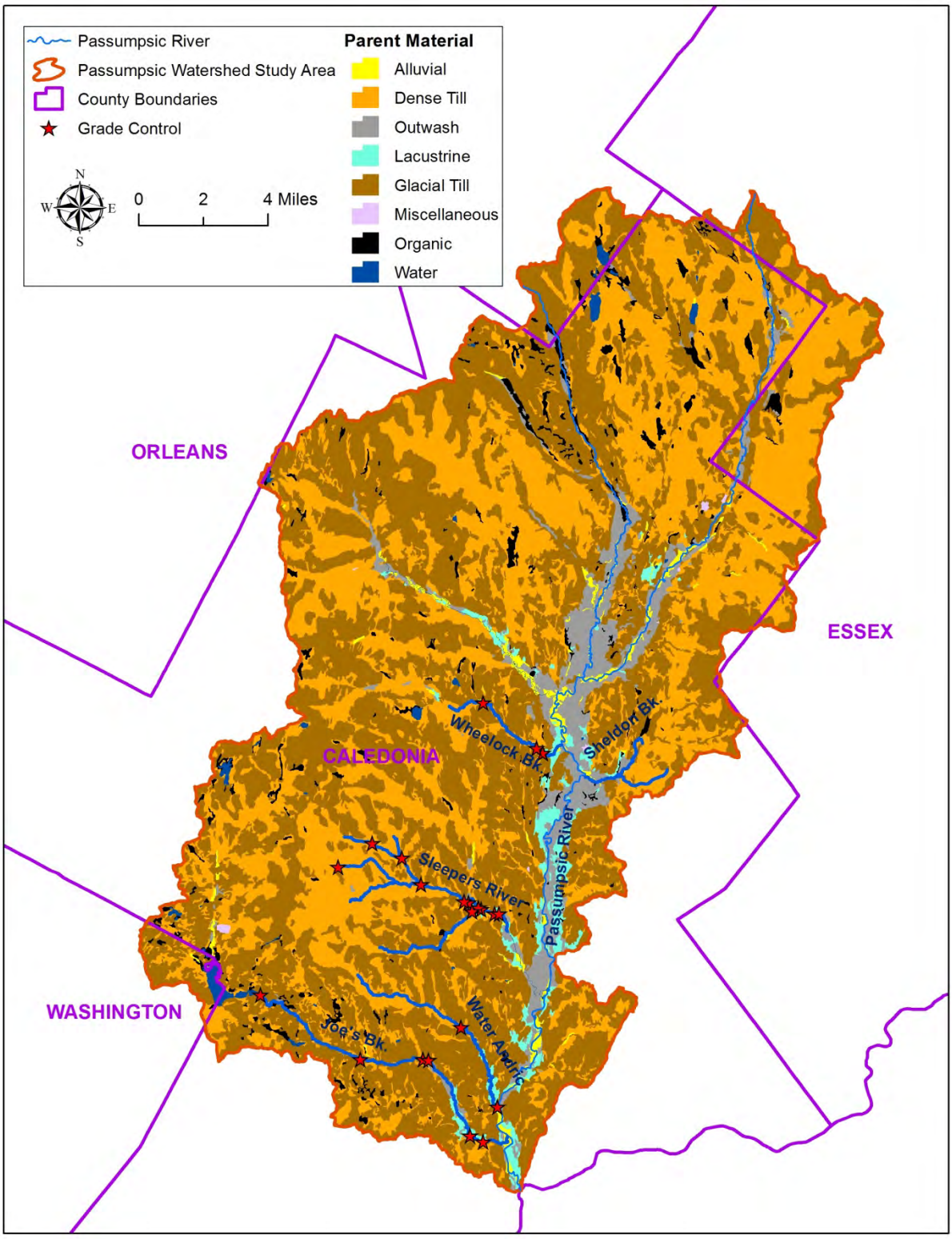

Figure 4: Parent surficial materials and grade controls in the Lower Passumpsic River Watershed Study Area (excludes Moose River drainage).

Geomorphic Setting

The lower Passumpsic tributaries included in this Phase 1 assessment represent five major tributaries and six additional sub-tributaries. The study reaches on Joe's Brook (T1) flow from the dam at the outlet of Joe's Pond to the mouth at the Passumpsic River. The first reach has a slope of 1% and flows through an unconfined valley within the floodplain of the Passumpsic River. The stream then enters a narrow to semi-confined valley with a portion of the valley occupied by adjacent roads (Joe's Brook Road, Covered Bridge Road, and Harvey Hollow Road) for most of the study area. The channel slope through the study area is typically 2-3.5%; however, two reaches in the middle of the study area have lower slopes and broad valleys. The last reach (T1.13) is a steep and confined bedrock cascade ending at the dam at Joe's Pond.

The study reaches on Water Andric (T2) border Joe's Brook immediately to the north and start with a short steep bedrock cascade under Route 5 and the railroad tracks to the Passumpsic River. The study reaches flow through unconfined valleys above this cascade to the upstream boundary near Route 2. Channel slopes range from 0.2% to 1.4% in the lower reaches and 2.0% to 3.2% in the upper reaches.

The Sleepers River (T3.4 - T3.10) watershed and its five sub-tributary watersheds border Water Andric to the north. The study reaches on Sleepers River flow from the confluence of two sub-tributaries (Morill Brook and North Brook) to the USGS weir upstream of Emerson Falls. The reaches on Sleepers River start in an unconfined valley with channel slopes of 0.5%. Channel slope increases to 1% to 2% and valley width is variable but typically confined. North Danville Road is located within the valley throughout the study area.

Whiteman Brook (T3.7S1) enters Sleepers River in the middle of the study area and flows west along the border with Water Andric. The study reaches on Whiteman Brook flow through unconfined valleys and slopes are typically 2.3% to 3.6% except for two reaches in the middle of the study area having low slopes (0.3% to 0.6%) and very broad valleys. Badger Brook (T3.10S1) and sub-tributary Morrill Brook (T310S1.3s1) join Sleepers from the west. The lower reaches of Badger Brook flow through narrow unconfined valleys and have slopes ranging from 1.9% to 2.9%. The upper reach of Badger and both reaches on Morrill Brook are steeper and confined as typical with headwater reaches. North Brook (T3.11 -T3.11S1) and sub-tributary Pope Brook (T3.12 - T3.15) flow in to Sleepers River from the north. North Brook flows through a unconfined broad to very broad valley with intermediate slopes of 1.2% to 2.4%. Pope Brook flows through a narrow unconfined valley with slopes ranging from 3% to 3.8%. Historic and current USGS weirs are present in several locations along Sleepers River, Badger Brook, Pope Brook, and North Brook.

Sheldon Brook and sub-tributary South Branch (T4 and T4.2S1) join the Passumpsic River from the east approximately seven miles north of Sleepers River. The mainstream reaches flow through an unconfined valley with slopes ranging from 1.7% to 2.7%. The sub-tributary is steeper (4.8% to 7.5%) and more confined as typical with headwater reaches.

Wheelock Brook (T5) flows in to the Passumpsic from the west approximately 1.5 miles north of Sheldon Brook. Valley confinement is variable throughout the study area ranging from semi-confined to very broad. Channel slopes are also variable ranging from 0.5% to 3.1% with the steepest reach at the upstream boundary of the study area.

A summary of the average channel slopes for the major tributaries and sub-tributaries is found below in Table 2.

Table 2: Average channel slopes for major and sub tributaries

Channel (SGA Reaches)	Average Slope
Joe's Brook (T1.01 - T1.13)	1.7%
Water Andric (T2.01 - T2.12)	1.7%
Sleepers River (T3.04 - T3.10	1.3%
Whiteman Brook (T3.7S1.01 - T3.7S1.07)	2.2%
Badger Brook (T3.10S1.01 - T3.10S1.05)	3.7%
Morrill Brook (T3.10S1.3s1 - T3.10S1.3s2)	3.2%
North Brook (T3.11 - T3.11S1.01)	1.7%
Pope Brook (T3.12 - T3.15)	3.4%
Sheldon Brook (T4.01 - T4.04)	1.9%
South Branch Sheldon Brook (T4.2S1.01 - T4.2S1.04)	5.9%
Wheelock Brook (T5.01 - T5.08)	1.4%

2.3 Hydrology and Flood History

The United States Geological Survey (USGS) currently operates two real-time flow monitoring gages in the Sleepers River watershed (Sleepers - 01135300 and Pope - 01135150) and two gages on the Passumpsic River (Mainstem - 01135500, and East Branch - 01133000). Two additional gages were recently decommissioned on small tributaries on Joe's Brook and Wheelock Brook. The Sleepers River watershed has been the focus of a major long-term research effort conducted by numerous Federal organizations. Fifteen (15) stream gaging stations were operated from 1959-1979 and two gaging stations remain operational. More information on the Sleepers River Research Watershed can be found at the following USGS website: http://nh.water.usgs.gov/projects/sleepers/.

The Sleepers River gage is located at the start of the study area immediately downstream of T3.04. The Pope Brook gage is located in reach T3.14 (USGS, 2008). The Passumpsic River gage is located approximately 0.75 miles upstream of Water Andric. Long-term flow frequency data for these three gages was included in a USGS study to summarize flow-frequency characteristics of Vermont rivers and streams (Olson, 2002). The magnitude and return frequency (e.g., 100-year flood) data produced from this study are included below in Table 3.

Table 3: Frequency and magnitude of flow events in the Passumpsic River watershed based on USGS gage data

	Discharge (cfs)		
Return Frequency	Passumpsic	Sleepers	Pope
2 year	7,600	1,430	146
5 year	10,100	2,390	188
10 year	11,700	3,260	216
25 year	13,800	4,670	254
50 year	15,400	6,010	283
100 year	16,900	7,620	314
500 year	20,700	12,800	389

The two USGS gages in the Sleepers watershed have peak streamflow data available since 1991 and recorded major flood events (greater than 25 year) in 2008 and 2011 (two events) on Pope Brook and 1998 and 2011 (two events) on Sleepers River (Figure 5). The peak flows on May 27th, 2011 exceeded the 100 year event on Sleepers and the 500 year event on Pope as identified by Olson (2002). Tropical Storm Irene caused another major streamflow event on August 28th, 2011 for both streams. This storm represented a 25 year event and a 50 year event on Sleepers River and Pope Brook respectively. The USGS peak streamflow record for the Passumpsic gage exists for 1928 to present and identifies major flood events for 1936, 1973, 2002, and 2011. Discharge was not estimated for the November 1927 flood, however, the stream gage height was 31.50 feet, 8 feet higher than the next largest storm (18,200 cfs in 1973).

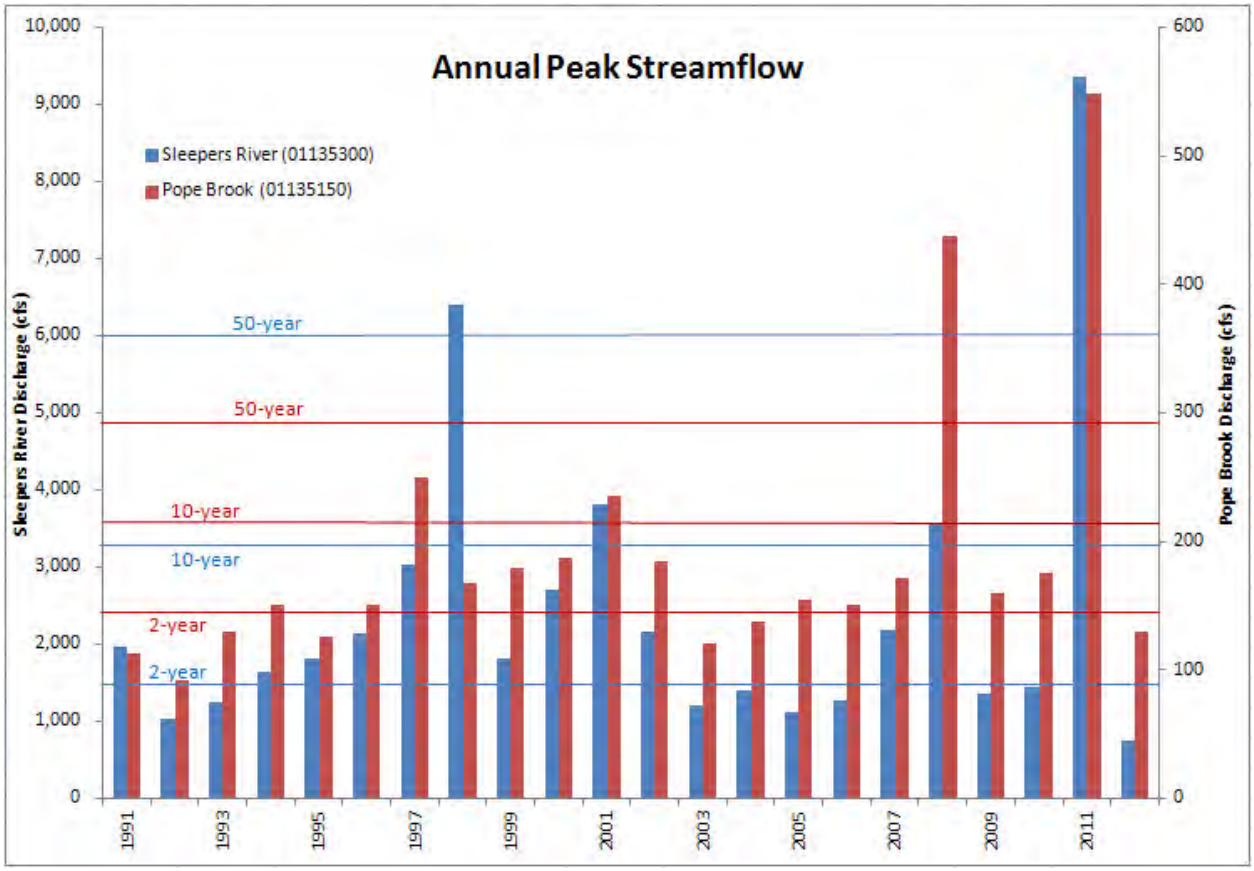

Figure 5: Annual peak streamflows from USGS gages on Sleepers River and Pope Brook

2.4 Ecological Setting

The study watersheds are primarily found in the Northern Vermont Piedmont (NVP) biophysical region. The eastern half of the Sheldon Brook watershed lies within the Northeastern Highlands (NEH) region (Thompson and Sorenson, 2000). The NVP is characterized by rolling hills and calcareous bedrock geology that supports Northern Hardwood Forest communities. Some areas of igneous intrusions are much harder to weather and comprise some of the regions highest peaks; such as Knox Mountain, Spruce Mountain, Blue Mountain, and Black Hills. Rich soils of loam and silt along the Connecticut River

that once supported extensive areas of silver maple (Acer saccharinum) and ostrich fern (Matteuccia struthiopteris) were converted to agricultural following European settlement in the late 18th century. Sand and gravel deposits from melting glaciers (moraines) are not typically found in Vermont, however the NVP has the largest continuous moraine in the State.

The NEH biophysical region in the upper Sheldon Brook watershed has similar geologic characteristics as the NVP. However, in addition to calcareous underlying bedrock that helps form rich northern hardwood forests, the NEH has extensive granite bedrock. The NEH region has greater topographic relieve and colder temperatures, suited for lowland spruce-fir forests. The NEH is often compared to the White Mountains of New Hampshire having similar climate, vegetation, and wildlife.

Elevations within the study area range from 500 feet at the confluence of Joe's Brook with the Passumpsic River to approximately 2,750 feet at the summits of Wheelock Mountain and Kirby Mountain within Wheelock Brook and Sheldon Brook watersheds respectively. The watershed is comprised primarily of mixed hardwood tree species, with areas of white pine (Pinus strobus) and eastern hemlock (Tsuga canadensis) found within younger grown and along steeper slopes respectively. Higher elevation portions of the study watersheds are comprised of spruce-fir forests composed mostly of red spruce (Picea rubens) and balsam fir (Abies balsamea).

3.0 Data Collection

3.1 Data Collection Methods

The Vermont River Management Program (RMP) has invested many person-years of effort into developing a state-of-the-art system of Stream Geomorphic Assessment (SGA) protocols. The SGA protocols are intended to be used by resource managers, community watershed groups, municipalities and others to identify how changes to land use affect hydro-geomorphic processes at the landscape and reach scale, and how these changes alter the physical structure and biological habitat of streams in Vermont. The SGA protocols have become a key tool in the prioritization of restoration projects that will 1) reduce sediment and nutrient loading to downstream receiving waters such as Lake Champlain and the Connecticut River, 2) reduce the risk of property damage from flooding and erosion, and 3) enhance the quality of instream biological habitat. The protocols are based on defensible scientific principles and have been tested widely in many watersheds throughout the state. Data collected for the lower Passumpsic River tributary watersheds using the protocols will form the basis for preliminary project identification carried out during future Phase 2 SGA and River Corridor Planning efforts.

The SGA protocols include three phases (VTDEC, 2009):

- **Phase 1**: The Phase 1 SGA approach utilizes the Stream Geomorphic Assessment Tool (SGAT), a GIS extension developed by RMP for the collection of reach and watershed scale data. In addition to the GIS and remote sensing effort, a cursory field assessment (“windshield survey”) is included for the verification of stream and valley forms, significant channel features and the location of man-made infrastructure. The Phase 1 SGA approach results in watershed-scale data about the landscape (e.g., soils and land cover) and the stream channel (e.g., slope and form), which provides a basis for understanding the natural and human-impacted conditions within the watershed. The SGA data also aids in the identification of specific stressors affecting the physical conditions of the stream channels and structures (e.g., bridges and culverts). Table 4 summarizes the parameters collected in Phase 1 using the Feature Indexing Tool (FIT), which include those utilized to develop the final impact ratings.

- **Phase 2**: The Phase 2 approach builds upon Phase 1 data through the collection of reach-specific data about the current physical conditions. Characterization of reach conditions utilizes a suite of quantitative (e.g., channel geometry, pebble counts) and qualitative (e.g., pool-riffle habitat) measurements to calculate two indices: Rapid Geomorphic Assessment (RGA) Score; Rapid Habitat Assessment (RHA) score. Using the RGA scores in conjunction with knowledge about the background or "reference" conditions, a sensitivity rating is developed to predict the degree to which the channel will adjust to human and natural impacts in the future.

Table 4: Parameters collected with FIT

Phase 1 Step	Phase 2 Step	Data Type	Impact	Sub-Impact
3.1	**1.2**	Point	Alluvial Fan	NA
3.2	**1.6**	Point	Grade Control	Dam Ledge Waterfall Weir
NA	**3.3**	Point	Mass Failure	NA
5.5	**5.5**	Point	Dredging	Dredging Gravel Mining Commercial Mining
NA	**4.4**	Point	Debris Jam	NA
NA	**4.6**	Point	Stormwater Input	NA
NA	**4.9**	Point	Beaver Dam	NA
NA	**5.2**	Point	Migration	Neck Cut Off Flood chute Avulsion Braiding
NA	**5.3**	Point	Steep Riffle or Head Cut	Head Cut Steep Riffle
NA	**5.4**	Point	Stream Crossing	Stream Ford Animal Crossing
NA	**3.3**	Point	Gully	NA
6.2	**1.3**	Line	Development	NA
6.1	**1.3**	Line	Encroachment	Berm Improved Path Road Railroad
5.3	**3.1**	Line	Bank Armoring or Revetment	Rip-Rap Hard Bank Other
7.2	**3.1**	Line	Erosion	NA
5.4	**5.5**	Line	Straightening	Straightening With Windrowing

- **Phase 3**: Phase 3 surveys involve the collection of detailed, reach-scale survey data to verify or build upon Phase 2 data. These surveys are typically carried out prior to project development for an "active" channel management approach (e.g., floodplain restoration), or for long-term monitoring purposes.

Prior to running SGAT, VTDEC developed the subwatershed theme, and FEA developed the valley wall and meander centerline themes for the study reaches. FEA ran SGAT in late 2012, and the remaining Phase 1 data was collected remotely by FEA and through windshield surveys for reaches along 48.5 river miles. All major human impacts and natural features were indexed in a GIS using the Feature Indexing Tool (FIT; VTDEC, 2009).

3.2 Quality Assurance

The VTDEC Quality Assurance (QA) protocols outlined in the SGA protocols (VTDEC, 2009) were followed in order to ensure a complete and accurate dataset. FEA and VTDEC shared responsibility for QA for the SGAT shapefiles and the finalized Phase 1 datasets. All metadata describing the data sources were entered in the Data Management System (DMS), with extraordinary sources noted in the comments section in Phase 1 Step 5. The DMS database for all assessed reaches in the watershed was finalized in June, 2013. The QA summary is included in Appendix B.

4.0 Phase 1 Results

4.1 Reach Delineations

The 48.5 miles of surface waters within the Lower Passumpsic tributary watersheds were divided into 68 reaches during the SGAT analysis carried out by FEA. Reach divisions were based on changes in valley geometry, channel slope, and the size and influence of tributaries entering the mainstem channel (VTDEC, 2009). Five (5) major tributaries and six (6) sub-tributaries were included in the SGAT analysis. Table 5 summarizes data for the tributary and sub-tributary watersheds. Detailed information about each reach location is found in the reach reports in Appendix A.

Table 5: Tributary and sub-tributary summary data

DMS ID	Name	Watershed Area (square miles)	Assessed River Length (mi)	Number of Assessed Reaches
T1	Joe's Brook	52.9	11.7	13
T2	Water Andric	13.1	8.7	12
T3	Sleepers River	46.6	3.9	7
T4	Sheldon Brook	11.5	3.2	4
T5	Wheelock Brook	17.1	5.3	8
T3.7S1	Whiteman Brook	6.6	4.6	7
T3.10S1	Badger Brook	8.5	3.3	5
T3.10S1.03s1	Morrill Brook	5.2	2.0	2
T3.11 - T3.11S1	North Brook	4.6	2.0	2
T3.12	Pope Brook	3.8	2.1	4
T4.2S1	South Branch Sheldon Brook	1.4	1.9	4

4.2 Reference Stream Types

Windshield survey measurements and observations as well as remotely collected data of valley confinement, channel slope, and sinuosity were used to develop reference stream types for the assessed reaches according to the Rosgen (1994) and Montgomery and Buffington (1997) classification systems. Characterization of reference stream types is based on the channel forms and processes we would expect in a particular geologic and geomorphic setting without human influences. Detailed information about each reach reference stream type is found in the reach reports in Appendix A. Table 6

presents general valley and channel characteristics associated with reference stream types found in the Lower Passumpsic River tributary watersheds. Table 7 describes the reference stream conditions for each study reach.

Table 6: Reference stream type characteristics

Stream Type	Valley Confinement	Channel Slope	Sinuosity	Bedform	Number of Study Reaches*
A	Confined	> 4%	Low	Cascade or Step-pool	6 (9%)
B	Confined	2 – 4%	Low	Step-pool or Plane bed	29 (43%)
C	Unconfined	< 2%	Moderate	Riffle Pool	28 (41%)
D	Unconfined	<4%	Variable	Variable	1 (1%)
E	Unconfined	<2%	Highly	Dune Ripple	4 (6%)

* Number of reaches and percentage of total reaches represented by type.

Table 7: Reach and watershed characteristics

Surface Water	Reach ID	Watershed Area (Mi^2)	Channel Length (Mi)	Channel Width (ft)	Channel Slope (%)	Sinuosity	Valley Type*	Reference Stream Type†	Bedform‡
Joe's Brook	T1.01	52.9	0.44	75.1	1.02	1.28	BD	C4	Riffle-Pool
	T1.02	52.8	0.77	75.0	2.29	1.02	SC	B3	Step-Pool
	T1.03	51.9	1.36	74.4	0.50	1.18	NW	C4	Riffle-Pool
	T1.04	44.6	2.12	69.7	1.73	1.05	NW	B4	Riffle-Pool
	T1.05	42.8	0.61	68.4	2.14	1.04	SC	B3	Step-Pool
	T1.06	41.8	0.66	67.7	3.54	1.03	SC	B3	Step-Pool
	T1.07	40.2	0.71	66.6	3.19	1.11	SC	B2	Step-Pool
	T1.08	34.4	1.01	62.1	1.56	1.03	NW	C3	Riffle-Pool
	T1.09	33.8	1.04	61.6	0.47	1.05	BD	C4	Riffle-Pool
	T1.10	30.2	1.07	58.7	1.19	1.09	NW	B3	Riffle-Pool
	T1.11	29.7	0.58	58.3	1.78	1.08	NW	B3	Riffle-Pool
	T1.12	29.3	0.93	57.9	0.74	1.21	BD	C4	Riffle-Pool
	T1.13	27.7	0.37	56.5	4.91	1.02	SC	A2	Cascade
Water Andric	T2.01	13.1	0.03	40.6	21.60	1.01	NC	A1	Cascade
	T2.02	13.1	0.12	40.6	0.69	1.12	BD	C4	Riffle-Pool
	T2.03	13.1	1.21	35.0	0.22	1.68	VB	E5	Dune-Ripple
	T2.04	11.9	0.47	39.0	1.25	1.78	VB	C4	Riffle-Pool
	T2.05	11.6	0.51	38.6	0.26	1.92	BD	E5	Dune-Ripple
	T2.06	11.4	0.73	38.2	1.44	1.06	NW	C4	Riffle-Pool
	T2.07	10.4	0.78	36.8	0.62	1.26	BD	C4	Riffle-Pool
	T2.08	9.0	0.72	34.5	2.29	1.11	BD	B3	Riffle-Pool
	T2.09	6.8	1.23	30.4	2.17	1.08	VB	C4	Riffle-Pool
	T2.10	4.6	0.65	25.6	3.17	1.10	VB	B3	Step-Pool
	T2.11	4.2	1.37	24.6	2.80	1.08	VB	C3	Riffle-Pool
	T2.12	2.5	0.88	19.5	2.01	1.24	VB	C4	Riffle-Pool
Sleepers River	T3.04	42.7	0.76	68.3	0.52	1.09	BD	C5	Riffle-Pool
	T3.05	41.9	0.37	67.8	0.42	1.03	NW	C4	Riffle-Pool

Table 7: Reach and watershed characteristics

Surface Water	Reach ID	Watershed Area (Mi^2)	Channel Length (Mi)	Channel Width (ft)	Channel Slope (%)	Sinuosity	Valley Type*	Reference Stream Type†	Bedform‡
	T3.06	40.7	0.34	66.9	1.12	1.00	SC	B3	Riffle-Pool
	T3.07	40.5	0.54	66.8	0.97	1.38	BD	D3	Braided
	T3.08	16.9	0.95	45.4	1.93	1.06	NW	B3	Riffle-Pool
	T3.09	15.4	0.78	43.7	1.87	1.04	SC	B3	Riffle-Pool
	T3.10	14.6	0.11	42.6	1.83	1.05	NW	B4	Riffle-Pool
Badger Brook	T3.10S1.01	8.5	0.25	33.5	1.89	1.09	NW	B3	Riffle-Pool
	T3.10S1.02	8.4	0.07	33.4	2.41	1.01	NW	C3	Riffle-Pool
	T3.10S1.03	8.4	0.63	33.4	2.89	1.19	NW	C3	Riffle-Pool
	T3.10S1.04	2.7	1.21	20.3	2.26	1.09	NW	C3	Riffle-Pool
	T3.10S1.05	1.3	1.16	14.8	6.06	1.08	SC	A3	Step-Pool
Morrill Brook	T3.10S1.3s1.01	5.2	0.91	27.1	3.15	1.17	SC	B3	Step-Pool
	T3.10S1.3s1.02	4.6	1.06	25.7	3.15	1.17	SC	B3	Step-Pool
North Brook	T3.11	6.1	1.07	29.1	1.19	1.14	BD	C4	Riffle-Pool
	T3.11S1.01	1.7	0.88	16.5	2.42	1.10	VB	C4	Riffle-Pool
Pope Brook	T3.12	3.8	0.43	23.7	3.06	1.10	NW	B3	Step-Pool
	T3.13	3.7	0.64	23.3	3.06	1.04	NW	B4	Step-Pool
	T3.14	3.4	0.23	22.4	3.54	1.02	NW	B3	Step-Pool
	T3.15	2.1	0.78	18.1	3.79	1.06	NW	B3	Step-Pool
Whiteman Brook	T3.7S1.01	6.6	0.69	30.1	3.64	1.14	BD	B3	Step-Pool
	T3.7S1.02	6.3	0.40	29.5	2.63	1.09	BD	C4	Riffle-Pool
	T3.7S1.03	6.1	0.48	24.0	0.30	1.18	VB	E4	Dune-Ripple
	T3.7S1.04	3.3	0.79	18.0	0.69	1.21	VB	E4	Dune-Ripple
	T3.7S1.05	2.7	0.61	20.4	2.63	1.02	NW	B3	Riffle-Pool
	T3.7S1.06	2.3	0.80	19.0	2.28	1.24	VB	C4	Riffle-Pool
	T3.7S1.07	1.5	0.86	15.8	2.76	1.20	VB	C4	Riffle-Pool
Sheldon Brook	T4.01	11.4	0.72	38.3	1.93	1.06	VB	C4	Riffle-Pool
	T4.02	11.1	0.50	37.8	2.74	1.04	NW	B3	Riffle-Pool
	T4.03	9.6	1.06	35.5	1.78	1.15	BD	B3	Riffle-Pool
	T4.04	7.4	0.89	31.6	1.65	1.20	VB	C3	Riffle-Pool
South Branch Sheldon Brook	T4.2S1.01	1.4	0.38	15.0	4.84	1.00	NW	B3	Step-Pool
	T4.2S1.02	1.1	0.39	13.4	5.29	1.02	SC	A3	Step-Pool
	T4.2S1.03	0.9	0.55	12.2	5.29	1.02	SC	A3	Step-Pool
	T4.2S1.04	0.4	0.63	9.2	7.53	1.04	SC	A3	Step-Pool
Wheelock Brook	T5.01	17.1	0.40	45.7	0.47	1.05	VB	C4	Riffle-Pool
	T5.02	17.0	0.44	45.5	1.53	1.08	NW	C4	Riffle-Pool
	T5.03	15.7	0.63	44.1	1.17	1.16	SC	B3	Riffle-Pool
	T5.04	15.4	0.44	43.6	0.65	1.29	NW	C4	Riffle-Pool
	T5.05	14.7	0.89	42.8	0.90	1.06	NW	B3	Riffle-Pool
	T5.06	12.3	0.69	39.5	1.12	1.05	NW	B4	Riffle-Pool
	T5.07	11.7	1.02	38.7	1.67	1.24	BD	C4	Riffle-Pool
	T5.08	10.1	0.78	36.2	3.12	1.08	NW	B3	Step-Pool

* SC= Semi-confined; NW= Narrow; BD=Broad; VB=Very Broad, NC=No Confinement; † per Rosgen, 1994
‡ per Montgomery and Buffington, 1997

Figure 6 presents the location of the reference stream types developed for the Lower Passumpsic River Tributaries. B-type and C-type reaches are most common in the watershed under reference conditions (43% and 41% respectively). B-type streams are typically characterized by a low to moderately sinuous channel in a confined valley that is dominated by sediment transport processes. C-type streams are typically characterized by a moderately sinuous channel found in a broad, unconfined valley setting with a balance between the upslope sediment supply and the transport capacity. Four reaches were characterized as E-type. These reaches are typically found in broad valleys with low slope and depositional environments. Six reaches were characterized as A-type. These reaches are typically found in the steep headwater areas. One reach (T3.07) was characterized as D-type, this reach is very wide and braided through an alluvial fan. Data from the reaches covered in the full Phase 1 analysis are shown in Table 8.

Channel slope is relatively consistent through most of the study area, therefore reference stream type is primarily influenced by confinement. C-type reaches typically have broad and very broad confinement, and B-type reaches are typically found in semi-confined or narrow valleys. E-type reaches are found in low-slope and wide valley areas along Water Andric and Whiteman Brook. A-type reaches were found in upper headwater areas and a bedrock cascade where Water Andric meets the Passumpsic River.

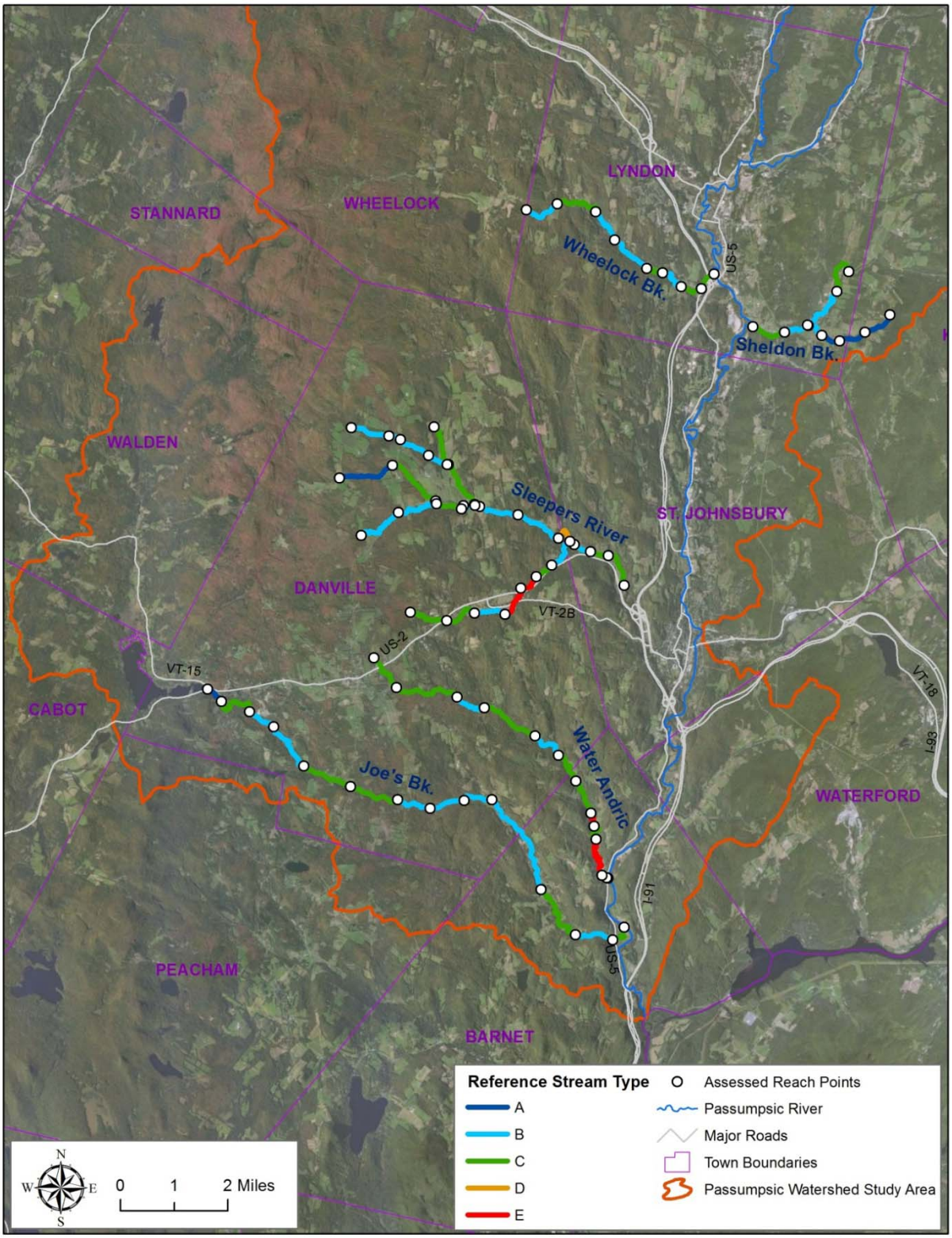

Figure 6: Reference stream types per Rosgen (1994) for the Lower Passumpsic tributary watersheds.

4.3 Watershed Geology and Soils

The NRCS soils dataset (NRCS, 2008) was utilized to review the parent material of the watershed. Figure 4 depicts the main classes of parent materials distributed across the Passumpsic River watershed. Grade controls observed in the field during the windshield surveys are also displayed in Figures 7 and 8. Detailed geologic information about each reach is found in the reach reports found in Appendix A.

Berming was not observed along any of the reaches during the windshield survey. Areas of maintenance dredging were identified in reaches T3.06, T4.01, and T5.02. A historic channel modification was also identified on T5.01 to channelize South Wheelock Brook during construction of the I-91 interchange (B. Cahoon, personal communication, February 21, 2013).

Eleven natural bedrock grade controls were identified during the windshield surveys on Joe's Brook, Water Andric, Sleepers River, Whiteman Brook, and Wheelock Brook. Several of these were very large features occupying hundreds of feet of longitudinal channel (Figure 7). Thirteen dams were identified during windshield surveys and from the Vermont Dam Inventory GIS layer (VTANR 2005). Many of these dams appear to be located at natural grade controls. Several abandoned and active USGS weirs were observed throughout the Sleepers River and sub-tributary watersheds during windshield surveys (Figure 9).

Figure 7: Large bedrock cascade in reach T3.06

Figure 8: Small gorge in T5.04

Figure 9: Active USGS weir in T3.14

4.4 Land Cover and Reach Hydrology

Step 4 of the Phase 1 protocols evaluates the impacts of watershed land use, riparian vegetative cover, and other reach-scale controls on hydrologic processes. Conversion of natural forest cover to urban and agricultural land uses in a watershed, even at low levels (e.g., 10% of watershed area), has been shown to have measurable impacts on channel stability and aquatic biota (Paul and Meyer, 2001; CWP, 2003). Loss of forest cover reduces the infiltration capacity of soils, and typically results in increased runoff during infrequent storm events and reduced baseflow during the dry periods of the year. In addition, direct impacts to riparian cover along the river bank and within the corridor are also known to have negative impacts on channel stability (e.g., loss of boundary resistance) and available habitat for biota (e.g., canopy shading, large woody debris, etc.). Other local-scale influences on reach hydrology include adjacent wetlands, small tributaries, and other sources of groundwater inputs (abundant in 23 Ph1 reaches). These areas provide important inputs of cooler waters that are critical for microhabitats, especially during the late summer and fall months when water temperatures can become elevated to levels that are harmful to native cold water fish.

Land cover data in the Lower Passumpsic River tributaries watersheds were summarized with the SGAT tool using data derived from 1992 satellite imagery (VCGI, 2003). This dataset was clipped to the local watershed (e.g., area draining directly to reach) and stream corridor to understand the impacts to each reach at each scale. Impact ratings were automatically generated upon upload of the data to the DMS based on the rankings provided in Table 8. In addition to the DMS summarized data, more recent land cover data (NOAA, 2008) was summarized at the subwatershed scale, as previously reviewed in Table 1 in Section 2.1, and as shown in Figure 11.

Table 8: SGA land use impact ratings

Impact Rating	Land Cover Value
High	10% or more of reach watershed is crop and/or urban
Low	Between 2 - 10% of reach watershed is crop and/or urban
Not Significant	Less than 2% of reach watershed is crop and/or urban

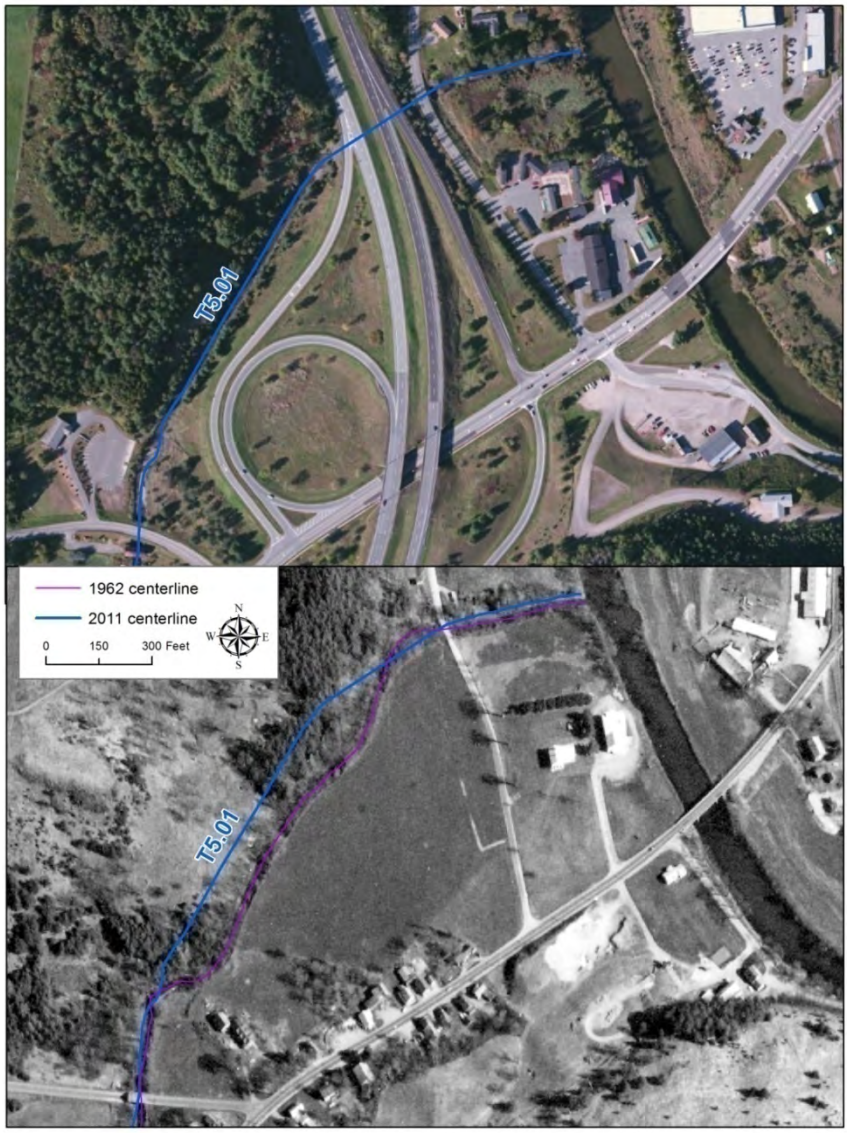

Figure 10: Major channel alteration in reach T5.01 visible from 1962 imagery (bottom) to current imagery (top).

Historic land cover data for the reach watershed and corridor scales was reviewed using a series of geo-rectified aerial photos from the study area from 1970's. Agricultural land use has remained relatively consistent within the study area. Minor increases in forest cover as agricultural fields are abandoned is visible is all of the study watersheds. Increased developed lands and transportation corridors are most visible in the Sleepers River and Wheelock Brook watersheds. The construction of the I-91 interchange in Lower Wheelock Brook (T5.01) required the stream to be relocated approximately 100 feet to the northwest (Figure 10).

Riparian buffer widths were estimated remotely and verified in the field where possible during the windshield surveys. Areas where the buffer widths were less than 25 feet were mapped remotely and indexed using the FIT. Areas that received high impact scores for the lack of a healthy riparian buffer were due to roadway encroachment or were alluvial valleys where adjacent lands have been intensively used for agricultural or residential uses for many years. A total of 27 reaches from all tributaries and the Whiteman, Badger, North, and South Branch Sheldon Brook sub-tributaries were identified as having a high impact from reduced buffer width.

Groundwater and small tributary inputs were reviewed for each reach using the National Wetlands Inventory (NWI, 2003) and the Vermont Hydrography Dataset. Additional detailed information about each Step 4 parameter for all reaches is found in the reach reports found in Appendix A.

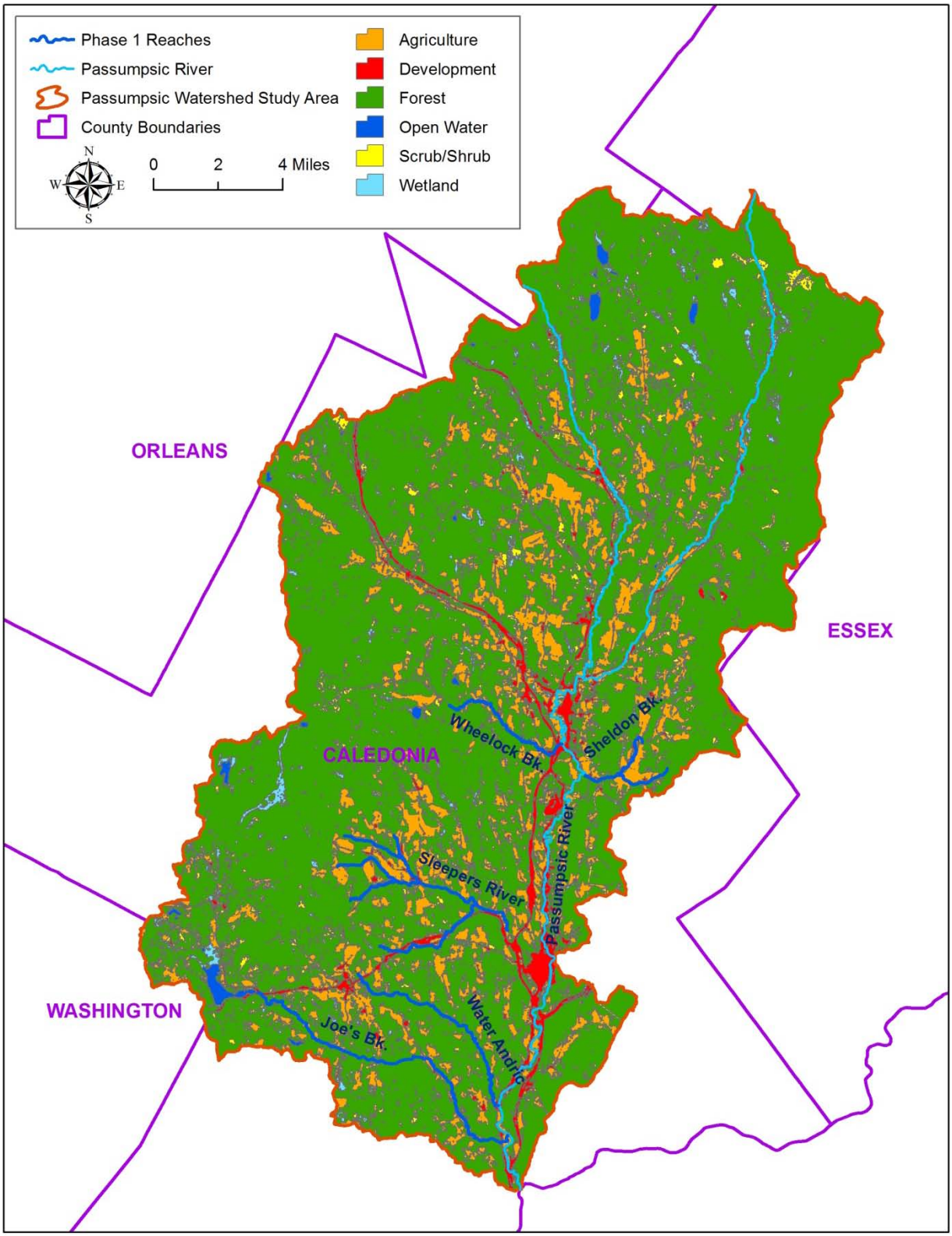

Figure 11: CCAP land cover data for the Passumpsic River watershed

4.5 Instream Channel Modifications

Data collected as part of SGA Step 5 aids in the understanding of how direct impacts to the channel boundaries have altered the sediment supply and transport regimes at the reach scale. Flow-regulating structures that span the channel impact the natural flow variability in downstream reaches, and interrupt the sediment supply along the channel network. These features often result in reduced instream habitat as well as channel incision in downstream areas where the sediment transport capacity exceeds the limited supply from upslope. Bridges and culverts that are inadequately sized to accommodate channel forming flows have similar impacts to habitat and sediment transport as flow-regulating structures. In addition, culverts that have severely "perched" outlets create a discontinuity in habitat along the channel by preventing fish passage. Bank armoring, channel straightening, and dredging are human impacts that increase the sediment transport capacity of the channel through the increase of 1) resistance to lateral migration, and 2) channel slope. Further discussion of the impacts of instream channel modifications is provided in the SGA Phase 1 Handbook (VTDEC, 2009). Reaches with significant impacts from these features are summarized below. Additional detailed information about each Step 5 parameter for all reaches is found in the reach reports found in Appendix A.

Impoundments and Flow Regulations

Flow regulations were reviewed and mapped using the VTANR Dam Inventory (VTANR, 2005), as well as further field observations and discussions with VTDEC staff. These features are summarized below for the mainstem and tributary reaches. Each of the flow regulations indexed with the FIT is considered a run-of-the-river feature (e.g., no current water withdrawals).

Run of the river features were observed on three reaches. The large dam (14 feet high, 90 feet wide) that forms Joe's Pond was located at the upstream boundary of T1.13. A large timber crib dam with a historic mill run was located near the downstream reach point on T3.10 (Figure 12). This dam was observed to be approximately 8 feet high and approximately 60 feet wide. A small concrete dam was observed immediately downstream of the Fellows Road crossing on T3.10S1.05. The large dam on T1.13 is listed as a "high" impact, the two smaller dams are considered "low" impact features.

Figure 12: Timber crib dam on T3.10

Bridges and Culverts

The locations and lengths of bridge and culvert crossings were mapped remotely and were verified in the field where possible (Figure 13). A total of 45 bridges and 19 culverts were noted on the 68 reaches. Impacts from these structures were found to be "not significant" for all but T2.01 a short reach with two bridges resulting in a "high" impact, and T5.01 which has a "low" impact from the approximately 400 foot culvert under Interstate 91.

Figure 13: Covered bridge and box culverts on T5.02

Bank Armoring

Bank armoring and revetments were observed during the windshield survey and were entered through FIT. Bank armoring was mostly observed along road embankments and near bridges and culverts (Figure 14). Ten reaches were identified has having a "high" impact (>20% of reach impacted) from bank armoring. All of these reaches had significant armoring to protect adjacent roadways sharing the stream corridor. "Low" impacts from bank armoring also primarily along adjacent roadways were identified for an additional 13 reaches. Joe's Brook Road and North Danville Road were associated with reaches containing armoring for more than 50% of the reach; T1.02 and T3.06 respectively. Bank armoring was observed on one or both banks for over 90% of the first reach on Wheelock Brook (T5.01).

Figure 14: Bank armoring along Roy Rd in Reach T3.7S1.02

Channel Straightening and Dredging

Channel straightening was observed during windshield surveys of from historic and current aerial imagery. Eleven reaches were assigned a "high" impact rating and four reaches were assigned a "low" impact. Channel straightening was observed along roads and in lower reaches where current or historic agricultural activities likely straightened the streams to reduce channel migration through farmlands. Major straightening was recorded for over 70% of T5.01. Historic imagery indicates that the entire reach was relocated during the construction of the I-91 interchange (Figure 10). Areas of maintenance dredging were identified on reaches T3.06, T4.01, and T5.02 (Cahoon, 2013).

4.6 Floodplain Modifications and Planform Changes

Due to the historical development of road networks and settlement patterns in the lowland areas of Vermont, many alluvial rivers in the state have been encroached upon by roads and development over the years. As discussed in the previous section, many of these areas have also been historically manipulated and straightened to maintain an unnaturally steep slope in a state of sediment transport, allowing for a short term sense of security from flooding and subsequent encroachment of infrastructure in the floodplain. In addition to historic alterations to channel slope in Vermont's alluvial rivers, the lowering of stream beds (e.g., dredging) and the raising of floodplains (e.g., berming) has resulted in an increase in channel depth (VTANR, 2007a). Channel depths have typically been increased through the encroachment on the floodplain by roads, development and railroads and subsequent filling and armoring required to construct and maintain this infrastructure. Increases in impervious cover have also led to the deepening and eventual widening of channels throughout urbanized areas of Vermont (Fitzgerald, 2007). These human impacts tend to induce a series of channel adjustments that begin with

channel incision and leads to widening and eventually a redevelopment of a sinuous planform in alluvial reaches. Reaches with significant impacts associated with the above-described human impacts are summarized below according to the SGA impact ratings listed in Table 9. Reaches affected by an increase in depositional or migrational features are also summarized below. Additional detailed information about each Step 6 parameter for all reaches is found in the reach reports found in Appendix A.

Table 9: Impact ratings for corridor encroachments and development

Impact Rating	Impact Criteria
High	Greater than 20% of reach length affected.
Low	Between 5 - 20% of reach length affected.
Not Significant	Less than 5% of reach length affected.

Encroachments

Following the Phase 1 protocol, any berms, roads, driveways, railroads and/or improved paths found within the stream corridor were indexed using the FIT (Figure 15). These areas were identified using current aerial imagery, and were confirmed and/or refined during the field observations. Figure 16 depicts the reaches where encroachment has significantly impacted the stream corridor, with ratings based on the percentage of the reach length that was impacted as indicated in Table 10. Impacts classified as “High” from corridor encroachment were found in reaches along much of Joe's Brook, Water Andric, Sleepers River (mainstem), and Wheelock Brook. A total of 29 reaches have "high" encroachment impacts and 6 reaches have "low" impacts.

Figure 15: Encroachment from Water Andric Road along much of T2.08

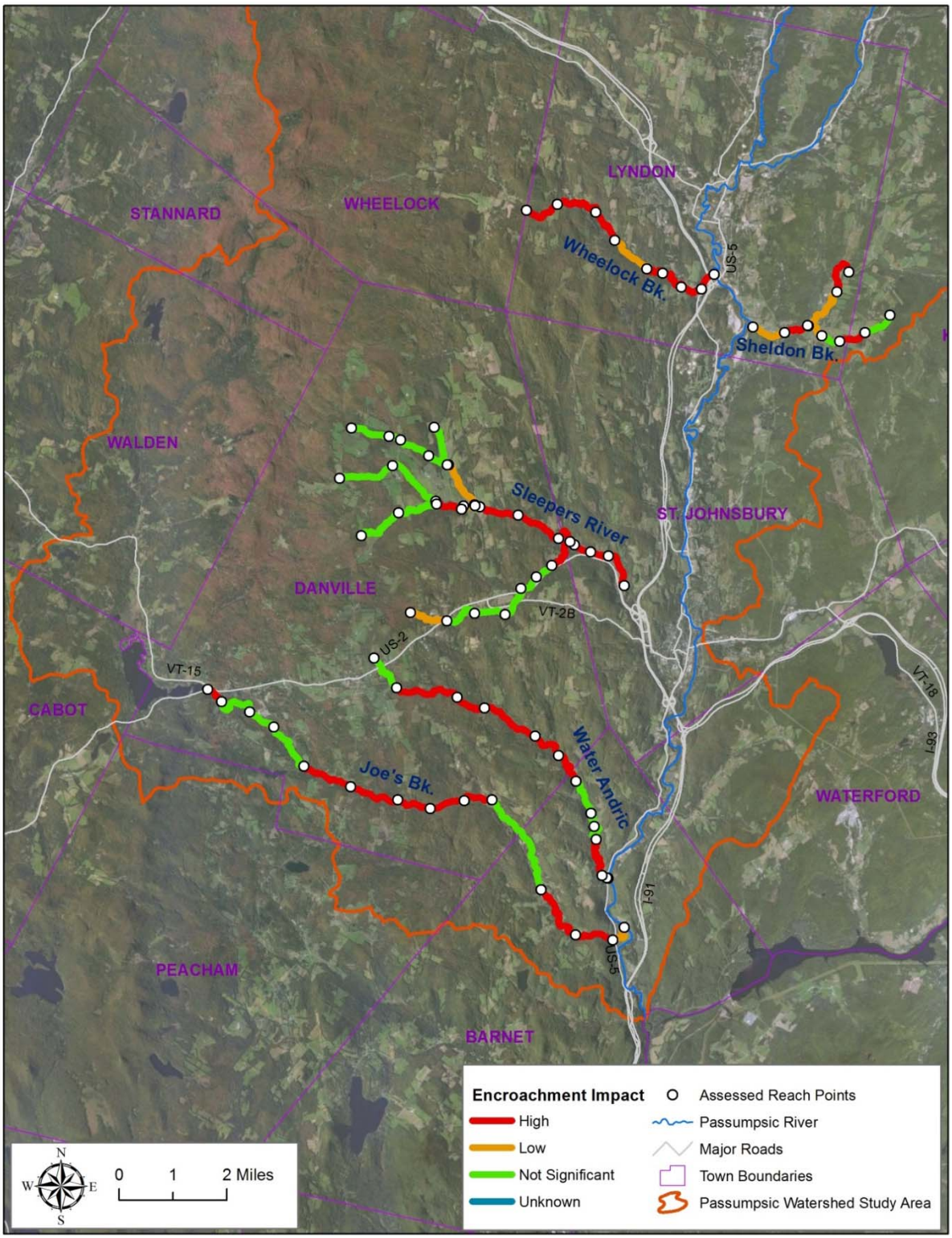

Figure 16: Impacts from corridor encroachments from roads, berms, and development in the Lower Passumpsic River tributary watersheds

Development

The impact of development within the stream corridor was evaluated using current aerial imagery, and was confirmed and/or refined during the field observations (Figure 17). The presence of development was indexed using the FIT, and impact ratings for each reach were developed based on SGA criteria presented in Table 10. A total of 15 reaches including reaches from all five tributaries were assigned "high" impacts for corridor development (T1.05, T1.09, T2.02, T2.03, T3.05, T3.06, T3.08, T3.10, T4.02, T5.02, T5.03, T5.07). An additional 20 reaches had a "low" impact for corridor development.

Figure 17: Development impacts on Water Andric in Danville, Reach T2.08.

Depositional Features

Sediment depositional features (e.g., point bars, mid channel bars, etc.) were evaluated using current aerial imagery, and were confirmed and/or refined during the field observations. Reaches with multiple types of depositional features indicated where upslope sediment supply exceeded the transport capacity (Figures 18 and 19). These areas represent conditions that are favorable for increased lateral channel migration that could endanger adjacent infrastructure and properties. A total of 10 reaches were identified as having "high" depositional impacts. Most of these reaches were observed to have numerous and large depositional features, likely resulting from channel migration and bank/mass failures from major storm events in the Spring of 2011. Other depositional areas were associated with major tributary confluences (T3.07 and T3.10S1.03), reaches located at large channel slope transitions (T1.03, T3.7S1.01,T5.02, T5.07), or within reaches where sediment movement is interrupted by natural grade controls or dams (T3.07 and T3.10). Additional detailed data about the types of depositional features and their relative impacts for all reaches are found in the reach reports found in Appendix A.

Figure 18: Sediment deposition upstream of abandoned USGS weir on T3.10S1.02

Figure 19: Braided channel and alluvial fan on T3.07

Meander Migration

Recent and historic aerial photographs and imagery were reviewed to identify areas of channel migration, bifurcation, and avulsions on the Lower Passumpsic River Tributaries. Aerial photos (1:5K) from the 1970's and 1990's were compared to 2011 imagery from Bing maps. Previous channel locations were compared with two recent sources of imagery: 1) the Vermont Hydrography Dataset stream centerlines developed from the aerial photographs during the 1990's for the watershed; 2) the 2011 Bing aerial imagery. Two reaches were characterized as having "high" migration impact (T2.03 and T3.07) and 13 reaches have a "low" impact.

For reaches characterized within unconfined valley settings (C-type or E-type channels), meander geometry was reviewed following the Phase 1 protocols; 36 of the 68 reaches had meandering profiles suitable for assessment of meander width and wavelength. GIS shapefiles were developed to indicate the areas where meander width and wavelength was measured (Figure 20). Where the meander wavelengths and widths fell outside of the range of expected values relative to the predicted channel width, impact ratings of high or low were assigned according to the degree of departure (VTDEC, 2009). Only three of these 36 reaches had no significant impacts for either meander width or wavelength (T2.04, T2.06, and T3.11s1.01); 18 reaches had "high" impacts for meander width and 16 reaches had "high" impacts for meander wavelength.

Figure 20: Meander geometry assessment on Reach T2.03

4.7 Bed and Bank Windshield Surveys

Windshield surveys were completed following the initial classification of stream type and substrate based on remotely sensed data alone. Surveys were completed in early December, 2012 on all reaches accessible by public roads; 56 of the 68 reaches in the study area were at least partially accessible by roads and were viewed. The Phase 1 parameters verified and/or evaluated during the field surveys included:

- General stream and valley geometry, including valley width and confinement, bed substrate, and bedform features (Step 2).
- Grade controls and areas of known or potential alluvial fans (Step 3).
- Impacts on the buffer and stream corridor, including areas of reduced buffer vegetation, road encroachments, and the presence of development within the stream corridor (Steps 4 and 6).
- Types of stream crossing structures (e.g., bridges and culverts), and their potential for causing ice and debris jams (Steps 5 and 7).
- Areas of bank erosion and armoring (Steps 5 and 7).
- Areas of increased sediment deposition and meander migration (Step 6).

Particular attention was paid to recording bank erosion and ice/debris jam potential at the stream crossings. Due to limited direct accessibility on most reaches, bank erosion along the entire channel length was not practical; rather, bank erosion plainly visible along roads or at stream crossings was indexed using the FIT. Therefore the relative length of the reach impacted by bank erosion was likely underestimated compared to typical Phase 2 field observations (Figure 21).

Debris and ice jam potential at points of channel constrictions associated with stream crossings and sharp channel bends were recorded in the field. Qualitative ratings of the impact of these areas on sediment and debris continuity were developed and entered into the DMS. Bank erosion was observed on six reaches (T2.07, T3.07, T3.09, T3.10S1.03, T3.11, and T4.01). Ice and debris jam potential was observed at bridges on three reaches (T2.01, T3.06, and T5.08).

Figure 21: Bank erosion and mass failure on T3.09, Sleeper's River in Danville.

5.0 Phase 1 Data Analysis

5.1 Final Impact Ratings and Geomorphic Condition

Based on the Phase 1 impact scores, the DMS also develops predictions for channel adjustment processes (VTDEC, 2009). These predictions are based on the dominant impacts recorded for each reach, and are categorized based on the impacts typically associated with the following four channel adjustment processes: 1) Degradation (e.g., channel incision); 2) Aggradation (e.g., increased sediment deposition); 3) Channel widening (e.g., increased bank erosion); 4) Planform Changes (e.g., irregular meander patterns) (Table 10 and Figure 22). Using the channel adjustment process ratings, a provisional geomorphic rating is developed for each reach based on the methods outlined in the SGA Phase 1 protocols (VTDEC, 2009). Table 11 outlines the four possible geomorphic ratings based on the SGA methods, and Figure 23 presents the provisional geomorphic condition for all study reaches.

Table 10: Final Impact Score Parameters for Phase 1 Dataset

Phase 1 Step	Phase 1 Parameter	Impact Category
4.1	Local Watershed Land Cover/Land Use	Land Use
4.2	Corridor Watershed Land Cover/Land Use	
4.3	Riparian Buffer Width	
5.1	Flow Regulations	Channel Modifications
5.2	Bridges and Culverts	
5.3	Bank Armoring	
5.4	Channel Straightening	
5.5	Dredging and Gravel Mining	
6.1	River Corridor Encroachments	Floodplain Modifications and Planform Changes
6.2	River Corridor Development	
6.3	Depositional Features	
6.4	Meander Migration	
6.5	Meander Belt Width Departure	
6.6	Meander Wavelength Departure	
7.2	Bank Erosion	Bed and Bank Conditions
7.3	Debris and Ice Jam Potential	

Table 11: SGA Reach Condition Ratings

SGA Rating	Predicted Conditions and Processes
Reference	In Equilibrium – no apparent or significant channel, floodplain, or land cover modifications; channel geometry is likely to be in balance with the flow and sediment produced in its watershed.
Good	In Equilibrium but may be in transition into or out of the range of natural variability – minor erosion or lateral adjustment but adequate floodplain function; any adjustment from historic modifications nearly complete.
Fair	In Adjustment – moderate loss of floodplain function; or moderate to major planform adjustments that could lead to channel avulsions.
Poor	In Adjustment and Stream Type Departure - may have changed to a new stream type or central tendency of fluvial processes – significant channel and floodplain modifications may have altered the channel geometry such that the stream is not in balance with the flow and sediment produced in its watershed.

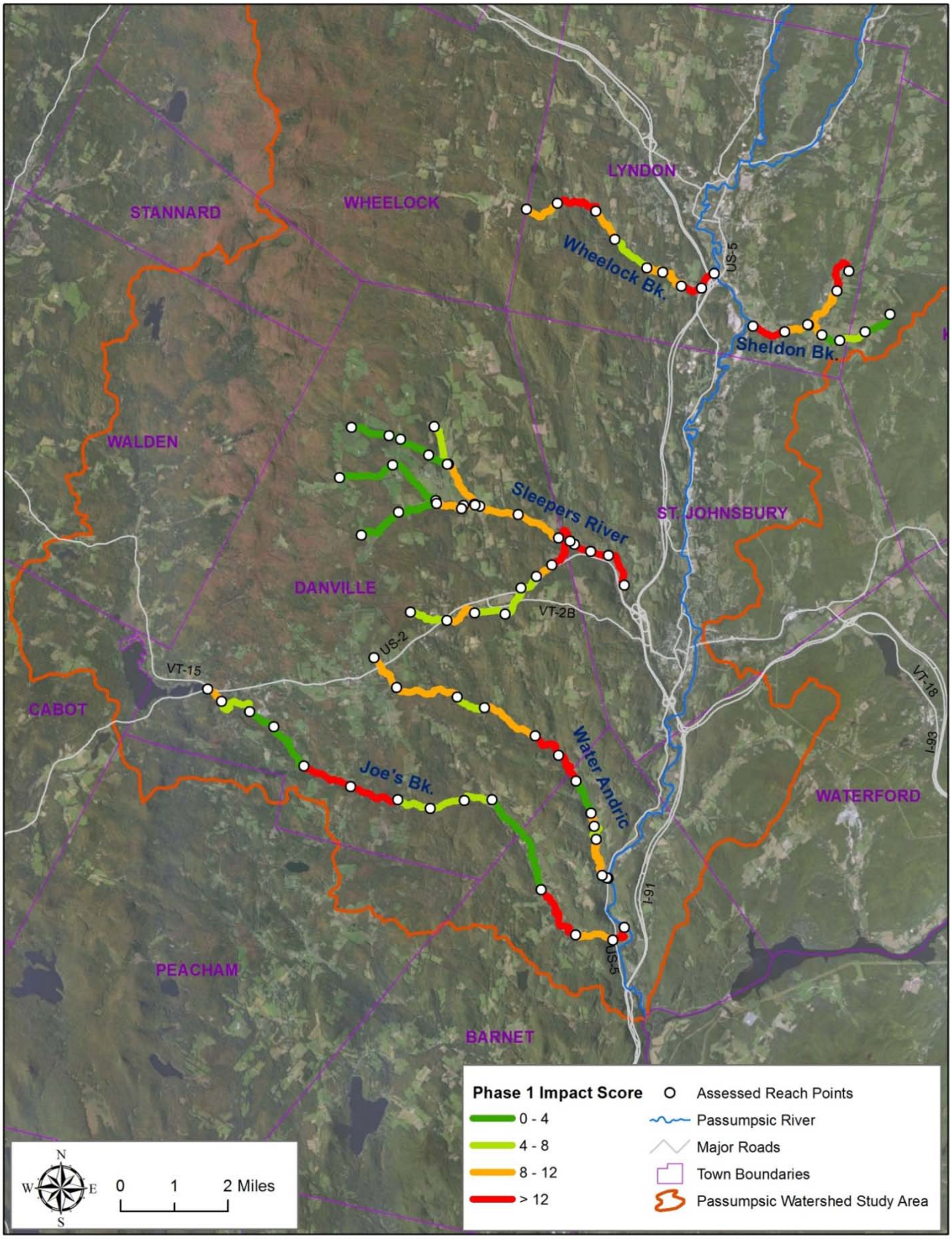

Figure 22. Phase 1 impact scores for the Lower Passumpsic River Tributaries

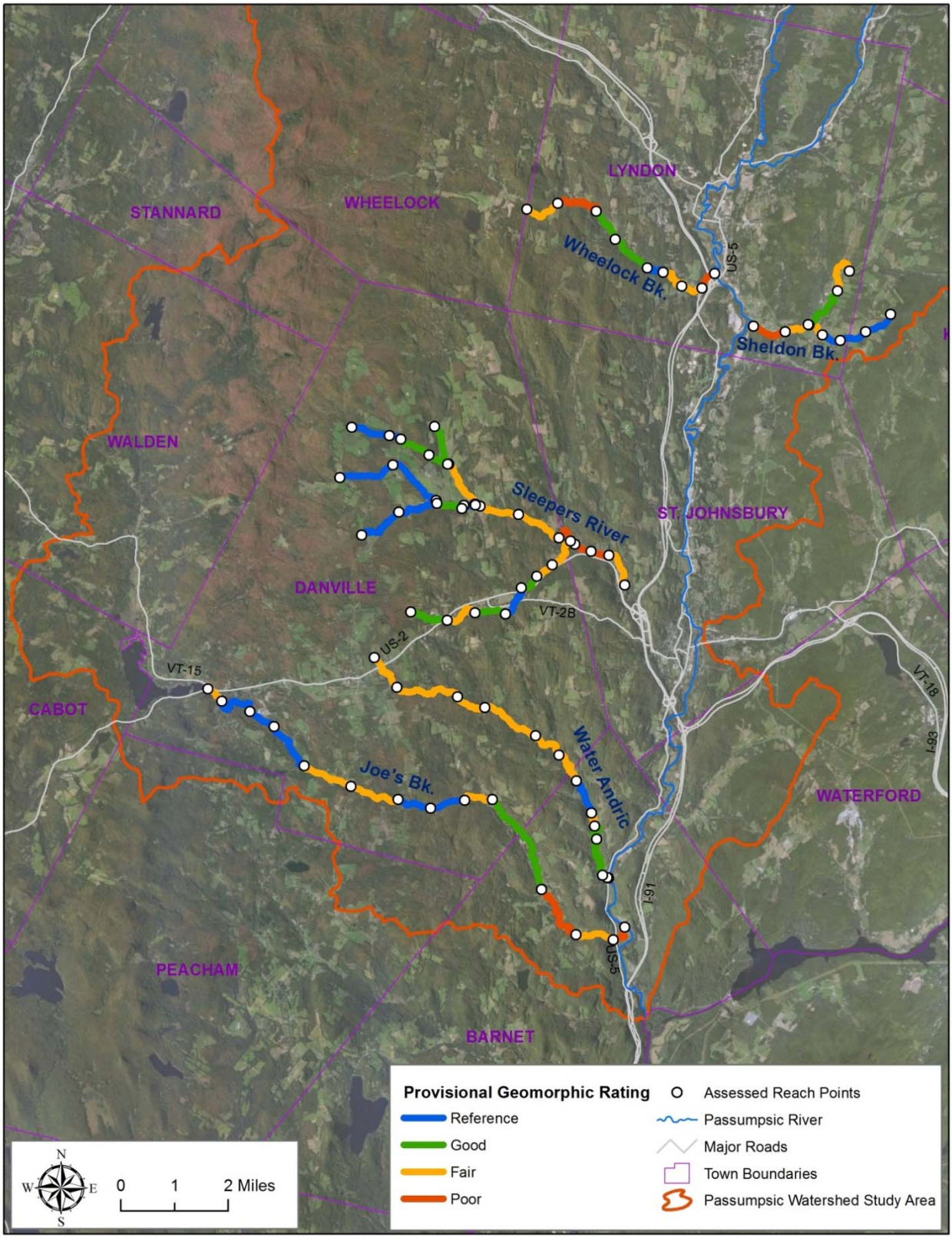

Figure 23: Provisional geomorphic ratings for the Lower Passumpsic River Tributaries

5.2 Phase 2 Reach Recommendations

Using the Phase 1 Impact Ratings as the primary basis for reach selection, a list of reaches was developed for Phase 2 surveys within the towns of Lyndon and Danville. Table 12 summarizes the selected reaches based on watershed location, channel length, and preliminary reference stream type.

Table 12: Phase 2 reaches and Phase 1 Impact Ratings

Surface Water	Reach ID	Channel Length (Mi)	Reference Stream Type†	Bedform‡	Impact Score (Geo Condition)
Water Andric	T2.07	0.78	C4	Riffle-Pool	16 (Fair)
	T2.08	0.72	B3	Riffle-Pool	15 (Fair)
	T2.09	1.23	C4	Riffle-Pool	12 (Fair)
	T2.10	0.65	B3	Step-Pool	8 (Fair)
	T2.11	1.37	C3	Riffle-Pool	9 (Fair)
	T2.12	0.88	C4	Riffle-Pool	9 (Fair)
Sleepers River	T3.04	0.76	C5	Riffle-Pool	17 (Fair)
	T3.05	0.37	C4	Riffle-Pool	17 (Poor)
	T3.06	0.34	B3	Riffle-Pool	15 (Poor)
	T3.07	0.54	D3	Braided	16 (Poor)
	T3.08	0.95	B3	Riffle-Pool	12 (Fair)
	T3.09	0.78	B3	Riffle-Pool	11 (Fair)
	T3.10	0.11	B4	Riffle-Pool	13 (Fair)
Badger Bk	T3.10S1.01	0.25	B3	Riffle-Pool	10 (Reference)
	T3.10S1.02	0.07	C3	Riffle-Pool	6 (Reference)
	T3.10S1.03	0.63	C3	Riffle-Pool	9 (Good)
North Bk	T3.11	1.07	C4	Riffle-Pool	11 (Fair)
Whiteman Bk	T3.7S1.01	0.69	B3	Step-Pool	15 (Fair)
	T3.7S1.02	0.40	C4	Riffle-Pool	11 (Fair)
	T3.7S1.03	0.48	E4	Dune-Ripple	7 (Good)
	T3.7S1.04	0.79	E4	Dune-Ripple	6 (Reference)
	T3.7S1.05	0.61	B3	Riffle-Pool	5 (Good)
	T3.7S1.06	0.80	C4	Riffle-Pool	9 (Fair)
	T3.7S1.07	0.86	C4	Riffle-Pool	8 (Good)
Sheldon Bk	T4.01	0.72	C4	Riffle-Pool	19 (Poor)
	T4.02	0.50	B3	Riffle-Pool	11 (Fair)
	T4.03	1.06	B3	Riffle-Pool	10 (Good)
	T4.04	0.89	C3	Riffle-Pool	13 (Fair)
Sheldon Bk SB	T4.2S1.01	0.38	B3	Step-Pool	9 (Fair)
Wheelock Bk	T5.01	0.40	C4	Riffle-Pool	18 (Poor)
	T5.02	0.44	C4	Riffle-Pool	16 (Fair)
	T5.03	0.63	B3	Riffle-Pool	10 (Fair)
	T5.04	0.44	C4	Riffle-Pool	10 (Reference)
	T5.05	0.89	B3	Riffle-Pool	8 (Good)
	T5.06	0.69	B4	Riffle-Pool	11 (Good)
	T5.07	1.02	C4	Riffle-Pool	15 (Poor)

* SC= Semi-confined; NW= Narrow; BD=Broad; VB=Very Broad, NC=No Confinement; † per Rosgen, 1994

‡ per Montgomery and Buffington, 1997

6.0 Conclusions

The reaches of the Lower Passumpsic River tributaries are still adjusting their dimensions, patterns, and profiles to impacts from historical sedimentation in the valleys from early European settlement and deforestation that caused hillslope erosion, as well as modern day impacts from channel straightening, dredging and corridor encroachment associated with adjacent roads, upslope development, and other land uses. Recent flood events over the last 20 years likely triggered channel incision and redevelopment of floodplain access in some reaches. Ongoing vertical and lateral channel migration is likely in the future for many reaches in the watershed.

Given these predictions for future channel adjustments, the municipalities in the watershed (in cooperation with CCNRCD and VTDEC) are wise to take a long-term corridor planning approach to better understand, plan for, and mitigate flooding and fluvial erosion hazards in the watersheds.

Additional Phase 2 data collection for the 36 high-priority reaches in Danville and Lyndon identified in Section 5 is currently underway. This data will aid in the understanding of sediment and floodwater storage, and support planning along the entire river corridor. The data will also provide the basis for mapping of the Fluvial Erosion Hazard (FEH) for these Phase 2 reaches. Should the towns benefiting from this information wish to plan proactively for future flood events, they could consider the adoption of a FEH zone ordinance to prevent additional conflicts in river corridors resulting from new development.

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8.0 Glossary of Terms

Adapted from:
Restoration Terms, by Craig Fischenich, February, 2000, USAE Research and Development Center, Environmental Laboratory, 3909 Halls Ferry Rd., Vicksburg, MS 39180
And
Vermont Stream Geomorphic Assessment Handbook, 2007, Vermont Agency of Natural Resources, Waterbury, VT http://www.anr.state.vt.us/dec/waterq/rivers/htm/rv_geoassesspro.htm

Acre -- A measure of area equal to 43,560 ft ^{2} (4,046.87 m^2). One square mile equals 640 acres.
Adjustment process --or type of change, that is underway due to natural causes or human activity that has or will result in a change to the valley, floodplain, and/or channel condition (e.g., vertical, lateral, or channel plan form adjustment processes)
Aggradation -- A progressive buildup or raising of the channel bed and floodplain due to sediment deposition. The geologic process by which streambeds are raised in elevation and floodplains are formed. Aggradation indicates that stream discharge and/or bed-load characteristics are changing. Opposite of degradation.
Algae -- Microscopic plants that grow in sunlit water containing phosphates, nitrates, and other nutrients. Algae, like all aquatic plants, add oxygen to the water and are important in the fish food chain.
Alluvial -- Deposited by running water.
Alluvium -- A general term for detrital deposits make by streams on riverbeds, floodplains, and alluvial fans; esp. a deposit of silt or silty clay laid down during time of flood. The term applies to stream deposits of recent time. It does not include subaqueous sediments of seas or lakes.
Anadromous -- Pertaining to fish that spend a part of their life cycle in the sea and return to freshwater streams to spawn.
Aquatic ecosystem -- Any body of water, such as a stream, lake, or estuary, and all organisms and nonliving components within it, functioning as a natural system.
Armoring -- A natural process where an erosion-resistant layer of relatively large particles is established on the surface of the streambed through removal of finer particles by stream flow. A properly armored streambed generally resists movement of bed material at discharges up to approximately 3/4 bank-full depth. Augmentation (of stream flow) – Increasing flow under normal conditions, by releasing storage water from reservoirs.
Avulsion -- A change in channel course that occurs when a stream suddenly breaks through its banks, typically bisecting an overextended meander arc.
Backwater -- (1) A small, generally shallow body of water attached to the main channel, with little or no current of its own, or (2) A condition in subcritical flow where the water surface elevation is raised by downstream flow impediments.
Backwater pool -- A pool that formed as a result of an obstruction like a large tree, weir, dam, or boulder.
Bank stability -- The ability of a streambank to counteract erosion or gravity forces.
Bankfull channel depth -- The maximum depth of a channel within a riffle segment when flowing at a bank-full discharge.
Bankfull channel width -- The top surface width of a stream channel when flowing at a bank-full discharge.
Bankfull discharge -- The stream discharge corresponding to the water stage that overtops the natural banks. This flow occurs, on average, about once every 1 to 2 years and given its frequency and magnitude is responsible for the shaping of most stream or river channels.
Bankfull width -- The width of a river or stream channel between the highest banks on either side of a stream.
Bar -- An accumulation of alluvium (usually gravel or sand) caused by a decrease in sediment transport capacity on the inside of meander bends or in the center of an overwide channel.
Barrier -- A physical block or impediment to the movement or migration of fish, such as a waterfall (natural barrier) or a dam (man-made barrier).
Base flow -- The sustained portion of stream discharge that is drawn from natural storage sources, and not affected by human activity or regulation.
Bed load -- Sediment moving on or near the streambed and transported by jumping, rolling, or sliding on the bed layer of a stream. See also suspended load.
Bed material -- The sediment mixture that a streambed is composed of.
Bed material load -- That portion of the total sediment load with sediments of a size found in the streambed.
Bed roughness -- A measure of the irregularity of the streambed as it contributes to flow resistance. Commonly expressed as a Manning "n" value.
Bed slope -- The inclination of the channel bottom, measured as the elevation drop per unit length of channel.

Bedform -- Individual patterns which streams follow that characterize the condition of the stream bed into several categories. (*See*: braided, dune-ripple, plane bed, riffle-pool, step-pool, and cascade)
Benthic invertebrates -- Aquatic animals without backbones that dwell on or in the bottom sediments of fresh or salt water. Examples: clams, crayfish, and a wide variety of worms.
Berms -- mounds of dirt, earth, gravel, or other fill built parallel to the stream banks designed to keep flood flows from entering the adjacent floodplain.
Biota -- All living organisms of a region, as in a stream or other body of water.
Boulder -- A large substrate particle that is larger than cobble, between 10 and 160 inches in diameter.
Boundary resistance -- The ability a stream bank has to withstand the erosional forces of the flowing water at varying intensities. Under natural conditions boundary resistance is increased due to stream bank vegetation (roots), cohesive clays, large boulder substrate, etc.
Braided -- A stream channel characterized by flow within several channels, which successively meet and divide. Braiding often occurs when sediment loading is too large to be carried by a single channel.
Braiding (of river channels) -- Successive division and rejoining of riverflow with accompanying islands.
Buffer strip -- A barrier of permanent vegetation, either forest or other vegetation, between waterways and land uses such as agriculture or urban development, designed to intercept and filter out pollution before it reaches the surface water resource.
Canopy -- A layer of foliage in a forest stand. This most often refers to the uppermost layer of foliage, but it can be used to describe lower layers in a multistoried stand. Leaves, branches and vegetation that are above ground and/or water that provide shade and cover for fish and wildlife.
Cascade -- A short, steep drop in streambed elevation often marked by boulders and agitated white water.
Catchment -- (1) The catching or collecting of water, especially rainfall. (2) A reservoir or other basin for catching water. (3) The water thus caught. (4) A watershed.
Channel -- An area that contains continuously or periodically flowing water that is confined by banks and a streambed.
Channelization -- The process of changing (usually straightening) the natural path of a waterway.
Channel evolution model (CEM) -- A series of stages used to describe the erosional or depositional processes that occur within a stream or river in order to regain a dynamic equilibrium following a disturbance.
Clay -- Substrate particles that are smaller than silt and generally less than 0.0001 inches in diameter.
Coarse gravel -- Substrate that is smaller than cobble, but larger than fine gravel. The diameter of this stream-bottom particulate is between 0.63 and 2.5 inches.
Cobble -- Substrate particles that are smaller than boulders and larger than gravels, and are generally between 2.5 and 10 inches in diameter.
Confinement -- *see* Valley confinement
Confluence -- (1) The act of flowing together; the meeting or junction of two or more streams; also, the place where these streams meet. (2) The stream or body of water formed by the junction of two or more streams; a combined flood.
Conifer -- A tree belonging to the order Gymnospermae, comprising a wide range of trees that are mostly evergreens. Conifers bear cones (hence, coniferous) and have needle-shaped or scalelike leaves.
Conservation -- The process or means of achieving recovery of viable populations.
Contiguous habitat -- Habitat suitable to support the life needs of a species that is distributed continuously or nearly continuously across the landscape.
Cover -- "cover" is the general term used to describe any structure that provides refuge for fish, reptiles or amphibians. These animals seek cover to hide from predators, to avoid warm water temperatures, and to rest, by avoiding higher velocity water. These animals come in all sizes, so even cobbles on the stream bottom that are not sedimented in with fine sands and silt can serve as cover for small fish and salamanders. Larger fish and reptiles often use large boulders, undercut banks, submerged logs, and snags for cover.
Critical shear stress -- The minimum amount of shear stress exerted by stream currents required to initiate soil particle motion. Because gravity also contributes to streambank particle movement but not on streambeds, critical shear stress along streambanks is less than for streambeds.]
Cross-section -- A series of measurements, relative to bankfull, that are taken across a stream channel that are representative of the geomorphic condition and stream type of the reach.
Crown -- The upper part of a tree or other woody plant that carries the main system of branches and the foliage.
Crown cover -- The degree to which the crowns of trees are nearing general contact with one another.
Cubic feet per second (cfs) -- A unit used to measure water flow. One cubic foot per second is equal to 449 gallons per minute.
Culvert -- A buried pipe that allows flows to pass under a road.

Debris flow -- A rapidly moving mass of rock fragments, soil, and mud, with more than half of the particles being larger than sand size.
Deciduous -- Trees and plants that shed their leaves at the end of the growing season.
Degradation -- (1) A progressive lowering of the channel bed due to scour. Degradation is an indicator that the stream's discharge and/or sediment load is changing. The opposite of aggradation. (2) A decrease in value for a designated use.
Detritus -- is organic material, such as leaves, twigs, and other dead plant matter, that collects on the stream bottom. It may occur in clumps, such as leaf packs at the bottom of a pool, or as single pieces, such as a fallen tree branch.
Dike -- (1) (Engineering) An embankment to confine or control water, especially one built along the banks of a river to prevent overflow of lowlands; a levee. (2) A low wall that can act as a barrier to prevent a spill from spreading. (3) (Geology) A tabular body of igneous (formed by volcanic action) rock that cuts across the structure of adjacent rocks or cuts massive rocks.
Dissolved oxygen (DO) -- The amount of free (not chemically combined) oxygen dissolved in water, wastewater, or other liquid, usually expressed in milligrams per liter, parts per million, or percent of saturation.
Ditch -- A long narrow trench or furrow dug in the ground, as for irrigation, drainage, or a boundary line.
Drainage area -- The total surface area upstream of a point on a stream that drains toward that point. Not to be confused with watershed. The drainage area may include one or more watersheds.
Drainage basin -- The total area of land from which water drains into a specific river.
Dredging -- Removing material (usually sediments) from wetlands or waterways, usually to make them deeper or wider.
Dune-ripple -- A bedform associated with low-gradient, sand-bed channels; the low gradient nature of the channel causes the sand to form a sequence of dunes and small ripples; significant sediment transport typically occurs at most stream stages.
Ecology -- The study of the interrelationships of living organisms to one another and to their surroundings.
Ecosystem -- Recognizable, relatively homogeneous units, including the organisms they contain, their environment, and all the interactions among them.
Embankment -- An artificial deposit of material that is raised above the natural surface of the land and used to contain, divert, or store water, support roads or railways, or for other similar purposes.
Embeddedness -- is a measure of the amount of surface area of cobbles, boulders, snags and other stream bottom structures that is covered with sand and silt. An embedded streambed may be packed hard with sand and silt such that rocks in the stream bottom are difficult or impossible to pick up. The spaces between the rocks are filled with fine sediments, leaving little room for fish, amphibians, and bugs to use the structures for cover, resting, spawning, and feeding. A streambed that is not embedded has loose rocks that are easily removed from the stream bottom, and may even "roll" on one another when you walk on them.
Entrenchment ratio --The width of the flood-prone area divided by the bankfull width.
Epifaunal – "epi" means surface, and "fauna" means animals. Thus, "epifaunal substrate" is structures in the stream (on the stream bed) that provide surfaces on which animals can live. In this case, the animals are aquatic invertebrates (such as aquatic insects and other "bugs"). These bugs live on or under cobbles, boulders, logs, and snags, and the many cracks and crevices found in these structures. In general, older decaying logs are better suited for bugs to live on/in than newly fallen "green" logs and trees.
Ephemeral streams -- Streams that flow only in direct response to precipitation and whose channel is at all times above the water table.
Equilibrium Condition -- The state of a river reach in which the upstream input of energy (flow of water) and materials (sediment and debris) is equal to its output to downstream reaches. Natural river reaches without human impacts tend towards a "stable" state where predictable channel forms are maintained over the long term under varying flow conditions.
Erosion -- Wearing away of rock or soil by the gradual detachment of soil or rock fragments by water, wind, ice, and other mechanical, chemical, or biological forces.
Eutrophic -- Usually refers to a nutrient-enriched, highly productive body of water.
Eutrophication -- The process of enrichment of water bodies by nutrients.
Fine gravel -- Is substrate which is larger than sand, but smaller than coarse gravel. It is between 0.08 and 0.63 inches in diameter.
Flash flood -- A sudden flood of great volume, usually caused by a heavy rain. Also, a flood that crests in a short length of time and is often characterized by high velocity flows.
Floodplain -- Land built of fine particulate organic matter and small substrate that is regularly covered with water as a result of the flooding of a nearby stream.
Floodplain (100-year) -- The area adjacent to a stream that is on average inundated once a century.

Floodplain Function – Flood water access of floodplain which effects the velocity, depth, and slope (stream power) of the flood flow thereby influencing the sediment transport characteristics of the flood (i.e., loss of floodplain access and function may lead to higher stream power and erosion during flood).
Flow -- The amount of water passing a particular point in a stream or river, usually expressed in cubic feet per second (cfs).
Fluvial -- Migrating between main rivers and tributaries. Of or pertaining to streams or rivers.
Fluvial Geomorphology—The study of how rivers and their landforms interact over time through different climatic conditions.
Ford -- A shallow place in a body of water, such as a river, where one can cross by walking or riding on an animal or in a vehicle.
Fry -- A recently hatched fish.
Gabion -- A wire basket or cage that is filled with gravel or cobble and generally used to stabilize streambanks.
Gaging station -- A particular site in a stream, lake, reservoir, etc., where hydrologic data are obtained.
Gallons per minute (gpm) -- A unit used to measure water flow.
Geographic information system (GIS) -- A computer system capable of storing and manipulating spatial data.
Geomorphology -- A branch of both physiography and geology that deals with the form of the earth, the general configuration of its surface, and the changes that take place due to erosion of the primary elements and the buildup of erosional debris.
Glide -- A section of stream that has little or no turbulence.
Grade control -- A fixed feature on the streambed that controls the bed elevation at that point, effectively fixing the bed elevation from potential incision; typically bedrock, dams. or culverts.
Gradient -- Vertical drop per unit of horizontal distance.
Grass/forb -- Herbaceous vegetation.
Gravel -- An unconsolidated natural accumulation of rounded rock fragments, mostly of particles larger than sand (diameter greater than 2 mm), such as boulders, cobbles, pebbles, granules, or any combination of these.
Groundwater -- Subsurface water and underground streams that can be collected with wells, or that flow naturally to the earth's surface through springs.
Groundwater basin -- A groundwater reservoir, defined by an overlying land surface and the underlying aquifers that contain water stored in the reservoir. In some cases, the boundaries of successively deeper aquifers may differ and make it difficult to define the limits of the basin.
Groundwater recharge -- Increases in groundwater storage by natural conditions or by human activity. See also artificial recharge.
Groundwater Table -- The upper surface of the zone of saturation, except where the surface is formed by an impermeable body.
Habitat -- The local environment in which organisms normally live and grow.
Habitat diversity -- The number of different types of habitat within a given area.
Habitat fragmentation -- The breaking up of habitat into discrete islands through modification or conversion of habitat by management activities.
Headcut -- A sharp change in slope, almost vertical, where the streambed is being eroded from downstream to upstream.
Headwater -- Referring to the source of a stream or river.
High gradient streams -- typically appear as steep cascading streams, step/pool streams, or streams that exhibit riffle/pool sequences. Most of the streams in Vermont are high gradient streams.
Hydraulic gradient -- The slope of the water surface. See also streambed gradient.
Hydraulic radius -- The cross-sectional area of a stream divided by the wetted perimeter.
Hydric -- oil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper horizon.
Hydrograph -- A curve showing stream discharge over time.
Hydrologic balance -- An accounting of all water inflow to, water outflow from, and changes in water storage within a hydrologic unit over a specified period of time. Hydrologic region -- A study area, consisting of one or more planning subareas, that has a common hydrologic character.
Hydrologic unit Code (HUC) -- A distinct watershed or river basin defined by an 8-digit code.
Hydrology -- The scientific study of the water of the earth, its occurrence, circulation and distribution, its chemical and physical properties, and its interaction with its environment, including its relationship to living things.
Hyporheic zone -- The area under the stream channel and floodplain where groundwater and the surface waters of the stream are exchanged freely.

Impoundment -- An area where the natural flow of the river has been disrupted by the presence of human-made or natural structure (e.g. weir or beaver dam). The impoundment backwater extends upstream causing sediment to be deposited on the stream bottom.
Improved paths – Paths that are maintained and typically involve paved, gravel or macadam surfaces.
Incised river -- A river that erodes its channel by the process of degradation to a lower base level than existed previously or is consistent with the current hydrology.
Incision ratio -- The low bank height divided by the bankfull maximum depth.
Infiltration (soil) -- The movement of water through the soil surface into the soil.
Inflow -- Water that flows into a stream, lake,
Instream cover -- The layers of vegetation, like trees, shrubs, and overhanging vegetation, that are in the stream or immediately adjacent to the wetted channel.
Instream flows -- (1) Portion of a flood flow that is contained by the channel. (2) A minimum flow requirement to maintain ecological health in a stream.
Instream use -- Use of water that does not require diversion from its natural watercourse. For example, the use of water for navigation, recreation, fish and wildlife, aesthetics, and scenic enjoyment.
Intermittent stream -- Any nonpermanent flowing drainage feature having a definable channel and evidence of scour or deposition. This includes what are sometimes referred to as ephemeral streams if they meet these two criteria.
Irrigation diversion -- Generally, a ditch or channel that deflects water from a stream channel for irrigation purposes.
Islands -- mid-channel bars that are above the average water level and have established woody vegetation.
Kame – a deposit of stratified glacial drift in isolated mounds or steep-sided hills.
Lake -- An inland body of standing water deeper than a pond, an expanded part of a river, a reservoir behind a dam
Landslide -- A movement of earth mass down a steep slope.
Large woody debris (LWD) -- Pieces of wood at least 6 ft. long and 1 ft. in diameter (at the large end) contained, at least partially, within the bankfull area of a channel.
Levee -- An embankment constructed to prevent a river from overflowing (flooding).
Limiting factor -- A requirement such as food, cover, or another physical, chemical, or biological factor that is in shortest supply with respect to all resources necessary to sustain life and thus "limits" the size or retards production of a population.
Low gradient -- streams typically appear slow moving and winding, and have poorly defined riffles and pools.
Macroinvertebrate -- Invertebrates visible to the naked eye, such as insect larvae and crayfish.
Macrophytes -- Aquatic plants that are large enough to be seen with the naked eye.
Main Stem -- The principal channel of a drainage system into which other smaller streams or rivers flow.
Mass movement -- The downslope movement of earth caused by gravity. Includes but is not limited to landslides, rock falls, debris avalanches, and creep. It does not however, include surface erosion by running water. It may be caused by natural erosional processes, or by natural disturbances (e.g., earthquakes or fire events) or human disturbances (e.g., mining or road construction).
Mean annual discharge -- Daily mean discharge averaged over a period of years. Mean annual discharge generally fills a channel to about one-third of its bank-full depth.
Mean velocity -- The average cross-sectional velocity of water in a stream channel. Surface values typically are much higher than bottom velocities. May be approximated in the field by multiplying the surface velocity, as determined with a float, times 0.8.
Meander -- The winding of a stream channel, usually in an erodible alluvial valley. A series of sine-generated curves characterized by curved flow and alternating banks and shoals.
Meander amplitude -- The distance between points of maximum curvature of successive meanders of opposite phase in a direction normal to the general course of the meander belt, measured between center lines of channels.
Meander belt width -- the distance between lines drawn tangential to the extreme limits of fully developed meanders. Not to be confused with meander amplitude.
Meander length -- The lineal distance down valley between two corresponding points of successive meanders of the same phase.
Mid-channel Bars – bars located in the channel away from the banks, generally found in areas where the channel runs straight. Mid-channel bars caused by recent channel instability are unvegetated.
Milligrams per liter (mg/l) -- The weight in milligrams of any substance dissolved in 1 liter of liquid; nearly the same as parts per million by weight.
Moraine – a mass of till either carried by an active glacier or deposited on the land after a glacier recedes.
Natural flow -- The flow past a specified point on a natural stream that is unaffected by stream diversion, storage, import, export, return flow, or change in use caused by modifications in land use.

Neck cutoff -- A channel migration feature where the land that separates a meander bend is cut off by the lateral migration of the channel. This process may be part of the equilibrium regime or associated with channel instability.
Outfall -- The mouth or outlet of a river, stream, lake, drain or sewer.
Outwash – water-transported material carried away from the ablation zone of a melting glacier.
Oxbow -- An abandoned meander in a river or stream, caused by cutoff. Used to describe the U-shaped bend in the river or the land within such a bend of a river.
Peat -- Partially decomposed plants and other organic material that build up in poorly drained wetland habitats.
Perched groundwater -- Groundwater supported by a zone of material of low permeability located above an underlying main body of groundwater with which it is not hydrostatically connected.
Perennial streams -- Streams that flow continuously.
Permeability -- The capability of soil or other geologic formations to transmit water.
pH -- The negative logarithm of the molar concentration of the hydrogen ion, or, more simply acidity.
Planform -- The channel shape as if observed from the air. Changes in planform often involve shifts in large amount of sediment, bank erosion, or the migration of the channel. A channel straightened for agricultural purposes has a highly impacted planform.
Point bar -- The convex side of a meander bend that is built up due to sediment deposition.
Pond -- A body of water smaller than a lake, often artificially formed.
Pool -- A reach of stream that is characterized by deep, low-velocity water and a smooth surface.
Potential plant height -- the height to which a plant, shrub or tree would grow if undisturbed.
Probability of exceedence -- The probability that a random flood will exceed a specified magnitude in a given period of time.
Railroads – Used or unused railroad infrastructure.
Rapids -- A reach of stream that is characterized by small falls and turbulent, high-velocity water.
Reach -- A section of stream having relatively uniform physical attributes, such as valley confinement, valley slope, sinuosity, dominant bed material, and bed form, as determined in the Phase 1 assessment.
Rearing habitat -- Areas in rivers or streams where juvenile fish find food and shelter to live and grow.
Reference stream type --Uses preliminary observations to determine the natural channel form and process that would be present in the absence of anthropogenic impacts to the channel and the surrounding watershed.
Refuge area -- An area within a stream that provides protection to aquatic species during very low and/or high flows.
Regime theory -- A theory of channel formation that applies to streams that make a part of their boundaries from their transported sediment load and a portion of their transported sediment load from their boundaries. Channels are considered in regime or equilibrium when bank erosion and bank formation are equal.
Restoration -- The return of an ecosystem to a close approximation of its condition prior to disturbance.
Riffle -- A reach of stream that is characterized by shallow, fast-moving water broken by the presence of rocks and boulders.
Riffle-pool ratio -- The ratio of surface area or length of pools to the surface area or length of riffles in a given stream reach; frequently expressed as the relative percentage of each category. Used to describe fish habitat rearing quality.
Riffle-step ratio-- ratio of the distance between riffles to the stream width.
Riparian area -- An area of land and vegetation adjacent to a stream that has a direct effect on the stream. This includes woodlands, vegetation, and floodplains. Riparian buffer is the width of naturally vegetated land adjacent to the stream between the top of the bank (or top of slope, depending on site characteristics) and the edge of other land uses. A buffer is largely undisturbed and consists of the trees, shrubs, groundcover plants, duff layer, and naturally uneven ground surface. The buffer serves to protect the water body from the impacts of adjacent land uses. Riparian corridor includes lands defined by the lateral extent of a stream's meanders necessary to maintain a stable stream dimension, pattern, profile, and sediment regime. For instance, in stable pool-riffle streams, riparian corridors may be as wide as 10-12 times the channel's bankfull width. In addition the riparian corridor typically corresponds to the land area surrounding and including the stream that supports (or could support if unimpacted) a distinct ecosystem, generally with abundant and diverse plant and animal communities (as compared with upland communities).
Riparian habitat -- The aquatic and terrestrial habitat adjacent to streams, lakes, estuaries, or other waterways.
Riparian -- Located on the banks of a stream or other body of water.
Riparian vegetation -- The plants that grow adjacent to a wetland area such as a river, stream, reservoir, pond, spring, marsh, bog, meadow, etc., and that rely upon the hydrology of the associated water body.
Ripple -- (1) A specific undulated bed form found in sand bed streams. (2) Undulations or waves on the surface of flowing water.
Riprap -- Rock or other material with a specific mixture of sizes referred to as a "gradation," used to stabilize streambanks or riverbanks from erosion or to create habitat features in a stream.

River channels --Large natural or artificial open streams that continuously or periodically contain moving water, or which form a connection between two bodies of water.
River miles --Generally, miles from the mouth of a river to a specific destination or, for upstream tributaries, from the confluence with the main river to a specific destination.
River reach -- Any defined length of a river.
River stage -- The elevation of the water surface at a specified station above some arbitrary zero datum (level).
Riverine -- Relating to, formed by, or resembling a river including tributaries, streams, brooks, etc.
Riverine habitat -- The aquatic habitat within streams and rivers.
Roads -- Transportation infrastructure. Includes private, town, state roads, and roads that are dirt, gravel, or paved.
Rock -- A naturally formed mass of minerals.
Rootwad -- The mass of roots associated with a tree adjacent to or in a stream that provides refuge for fish and other aquatic life.
Run (in stream or river) -- A reach of stream characterized by fast-flowing, low-turbulence water.
Runoff -- Water that flows over the ground and reaches a stream as a result of rainfall or snowmelt.
Sand -- Small substrate particles, generally from 0.002 to 0.08 in diameter. Sand is larger than silt and smaller than gravel.
Scour -- The erosive action of running water in streams, which excavates and carries away material from the bed and banks. Scour may occur in both earth and solid rock material and can be classed as general, contraction, or local scour.
Sediment -- Soil or mineral material transported by water or wind and deposited in streams or other bodies of water.
Sedimentation -- (1) The combined processes of soil erosion, entrainment, transport, deposition, and consolidation. (2) Deposition of sediment.
Seepage -- The gradual movement of a fluid into, through, or from a porous medium. Segment: A relatively homogenous section of stream contained within a reach that has the same reference stream characteristics but is distinct from other segments in the reach in one or more of the following parameters: degree of floodplain encroachment, presence/absence of grade controls, bankfull channel dimensions (W/D ratio, entrenchment), channel sinuosity and slope, riparian buffer and corridor conditions, abundance of springs/seeps/adjacent wetlands/stormwater inputs, and degree of channel alterations.
Sensitivity -- of the valley, floodplain, and/or channel condition to change due to natural causes and/or anticipated human activity.
Shoals -- unvegetated deposits of gravels and cobbles adjacent to the banks that have a height less than the average water level. In channels that are over-widened, the stream does not have the power to transport these larger sediments, and thus they are deposited throughout the channel as shoals.
Silt -- Substrate particles smaller than sand and larger than clay; between 0.0001 and 0.002 inches in diameter.
Siltation -- The deposition or accumulation of fine soil particles.
Sinuosity -- The ratio of channel length to direct down-valley distance. Also may be expressed as the ratio of down-valley slope to channel slope.
Slope -- The ratio of the change in elevation over distance.
Slope stability -- The resistance of a natural or artificial slope or other inclined surface to failure by mass movement.
Snag -- Any standing dead, partially dead, or defective (cull) tree at least 10 in. in diameter at breast height and at least 6 ft tall. Snags are important riparian habitat features.
Spawning -- The depositing and fertilizing of eggs (or roe) by fish and other aquatic life.
Spillway -- A channel for reservoir overflow.
Stable channel -- A stream channel with the right balance of slope, planform, and cross section to transport both the water and sediment load without net long-term bed or bank sediment deposition or erosion throughout the stream segment.
Stone -- Rock or rock fragments used for construction.
Straightening -- the removal of meander bends, often done in towns and along roadways, railroads, and agricultural fields.
Stream -- A general term for a body of water flowing by gravity; natural watercourse containing water at least part of the year. In hydrology, the term is generally applied to the water flowing in a natural narrow channel as distinct from a canal. Stream banks are features that define the channel sides and contain stream flow within the channel; this is the portion of the channel bank that is between the toe of the bank slope and the bankfull elevation. The banks are distinct from the streambed, which is normally wetted and provides a substrate that supports aquatic organisms. The top of bank is the point where an abrupt change in slope is evident, and where the stream is generally able to overflow the banks and enter the adjacent floodplain during flows at or exceeding the average annual high water.

Stream channel -- A long narrow depression shaped by the concentrated flow of a stream and covered continuously or periodically by water.
Stream condition -- Given the land use, channel and floodplain modifications documented at the assessment sites, the current degree of change in the channel and floodplain from the reference condition for parameters such as dimension, pattern, profile, sediment regime, and vegetation.
Stream gradient -- A general slope or rate of change in vertical elevation per unit of horizontal distance of the bed, water surface, or energy grade of a stream.
Stream morphology -- The form and structure of streams.
Stream order -- A hydrologic system of stream classification. Each small unbranched tributary is a first-order stream. Two first-order streams join to make a second-order stream. A third-order stream has only first-and second-order tributaries, and so forth.
Stream reach -- An individual segment of stream that has beginning and ending points defined by identifiable features such as where a tributary confluence changes the channel character or order.
Stream type -- Gives the overall physical characteristics of the channel and helps predict the reference or stable condition of the reach.
Stream type departure -- When the current stream type differs from the reference stream type as a response to anthropogenic or severe natural disturbances. These departures are often characterized by large-scale incision, deposition, or changes in planform.
Streambank armoring – The installation of concrete walls, gabions, stone riprap, and other large erosion resistant material along stream banks.
Streambank erosion -- The removal of soil from streambanks by flowing water.
Streambank stabilization -- The lining of streambanks with riprap, matting, etc., or other measures intended to control erosion.
Streambed -- (1) The unvegetated portion of a channel boundary below the baseflow level. (2) The channel through which a natural stream of water runs or used to run, as a dry streambed.
Streamflow -- The rate at which water passes a given point in a stream or river, usually expressed in cubic feet per second (cfs).
Step (in a river system) --A step is a steep, step-like feature in a high gradient stream (> 2%). Steps are composed of large boulders lines across the stream. Steps are important for providing grade-control, and for dissipating energy. As fast-shallow water flows over the steps it takes various flow paths thus dissipating energy during high flow events.
Substrate -- (1) The composition of a streambed, including either mineral or organic materials. (2) Material that forms an attachment medium for organisms.
Surface erosion -- The detachment and transport of soil particles by wind, water, or gravity. Or a group of processes whereby soil materials are removed by running water, waves and currents, moving ice, or wind.
Surface water -- All waters whose surface is naturally exposed to the atmosphere, for example, rivers, lakes, reservoirs, ponds, streams, impoundments, seas, estuaries, etc., and all springs, wells, or other collectors directly influenced by surface water.
Suspended sediment -- Sediment suspended in a fluid by the upward components of turbulent currents, moving ice, or wind.
Suspended sediment load -- That portion of a stream's total sediment load that is transported within the body of water and has very little contact with the streambed.
Tailwater -- (1) The area immediately downstream of a spillway. (2) Applied irrigation water that runs off the end of a field.
Thalweg -- (1) The lowest thread along the axial part of a valley or stream channel. (2) A subsurface, groundwater stream percolating beneath and in the general direction of a surface stream course or valley. (3) The middle, chief, or deepest part of a navigable channel or waterway.
Tractive Force --The drag on a streambed or bank caused by passing water, which tends to pull soil particles along with the streamflow.
Transpiration -- An essential physiological process in which plant tissues give off water vapor to the atmosphere.
Tributary -- A stream that flows into another stream, river, or lake.
Turbidity -- A measure of the content of suspended matter that interferes with the passage of light through the water or in which visual depth is restricted. Suspended sediments are only one component of turbidity.
Urban runoff -- Storm water from city streets and gutters that usually carries a great deal of litter and organic and bacterial wastes into the sewer systems and receiving waters.
Valley confinement -- Referring to the ratio of valley width to channel width. Unconfined channels (confinement of 4 or greater) flow through broader valleys and typically have higher sinuosity and area for floodplain. Confined channels (confinement of less than 4) typically flow through narrower valleys.

Valley wall -- The side slope of a valley, which begins where the topography transitions from the gentle-sloped valley floor. The distance between valley walls is used to calculate the valley confinement.
Variable-stage stream -- Stream flows perennially but water level rises and falls significantly with storm and runoff events.
Velocity -- In this concept, the speed of water flowing in a watercourse, such as a river.
Washout -- (1) Erosion of a relatively soft surface, such as a roadbed, by a sudden gush of water, as from a downpour or floods. (2) A channel produced by such erosion.
Water quality -- A term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose.
Waterfall -- A sudden, nearly vertical drop in a stream, as it flows over rock.
Watershed -- An area of land whose total surface drainage flows to a single point in a stream.
Watershed management -- The analysis, protection, development, operation, or maintenance of the land, vegetation, and water resources of a drainage basin for the conservation of all its resources for the benefit of its residents.
Watershed project -- A comprehensive program of structural and nonstructural measures to preserve or restore a watershed to good hydrologic condition. These measures may include detention reservoirs, dikes, channels, contour trenches, terraces, furrows, gully plugs, revegetation, and possibly other practices to reduce flood peaks and sediment production.
Watershed restoration -- Improving current conditions of watersheds to restore degraded habitat and provide long-term protection to aquatic and riparian resources.
Weir -- A structure to control water levels in a stream. Depending upon the configuration, weirs can provide a specific "rating" for discharge as a function of the upstream water level.
Wetland -- Areas adjacent to, or within the stream, with sufficient surface/groundwater influence to have present hydric soils and aquatic vegetation (e.g. cattails, sedges, rushes, willows or alders).
Width/depth ratio -- The ratio of channel bankfull width to the average bankfull depth. An indicator of channel widening or aggradation, and used for stream type classification.

APPENDIX A

PHASE 1 REACH REPORTS

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Joe's Brook**
Topo Maps: **BARNET**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T1.01**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Reach begins at confluence with Passumpsic River and ends at reach break upstream of Rt 5.**

1.1 Reach Description:
1.2 Towns: **Barnet**
1.3 Downstream Latitude: **44.3440836011**
1.3 Downstream Longitude: **-72.0401714813**

Step 2. Stream Type

2.1 Elevation Upstream: **498**
2.1 Elevation Downstream: **474**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **1,823.5** ft. **0.35** Miles
2.3 Valley Slope: **1.3**
2.4 Channel Length: **2,339.7** ft. **0.44** Miles
2.5 Channel Slope: **1.02 %**
2.6 Sinuosity: **1.28**
2.7 Watershed Area: **52.9** Square Miles
2.8 Channel Width: **75.1** feet
2.9 Valley Width: **650.5** feet
2.10 Confinement Ratio: **8.7**
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.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Hilly**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant Land Cover: **Forest** **77.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Field**
Current Dominant Land Cover: **Field** **34.0** %
Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**0-25**	**0-25**
Sub-dominant:	**26-50**	**26-50**
Length w / less than 25 ft.:	**1,986.0** ft.	**2,053.0** 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** **3.4** %
5.3 Bank Armoring: **536.9** **22.9** %
Left: **536.9** ft. Right: **0.0** ft.
5.4 Channel Straightening: **1,300.8** **55.6** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **61.2** ft. **2.6**

	One Side	Both Sides
Road:	**61.2** 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: **287.2** ft. **0.0** ft.
6.3 Channel Bars: **Multiple**
6.4 Meander Migration: **Migration**
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: **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	2 High	0 N.S.	0 N.S.	2 High	2 High	0 N.S.	0 N.S.	1 Low	1 Low	1 Low	2 High	2 High	0 N.S.	0 N.S.	17

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Joe's Brook**
Topo Maps: **BARNET**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T1.02**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **From reach break upstream of Rt 5 to reach break upstream of Garfield Ln.**

1.1 Reach Description:
1.2 Towns: **Barnet**
1.3 Downstream Latitude: **44.3407761248**
1.3 Downstream Longitude: **-72.0445245395**

Step 2. Stream Type

2.1 Elevation Upstream: **591**
2.1 Elevation Downstream: **498**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **3,975.9** ft. **0.75** Miles
2.3 Valley Slope: **2.3**
2.4 Channel Length: **4,051.0** ft. **0.77** Miles
2.5 Channel Slope: **2.29 %**
2.6 Sinuosity: **1.02**
2.7 Watershed Area: **52.8** Square Miles
2.8 Channel Width: **75.0** feet
2.9 Valley Width: **173.0** feet
2.10 Confinement Ratio: **2.3**
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.: %
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: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **77.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Urban** **35.0** %
Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**0-25**
Sub-dominant:	**51-100**	**26-50**
Length w / less than 25 ft.:	**0.0** ft.	**3,305.0** 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** **0.7** %
5.3 Bank Armoring: **2,730.2** **67.4** %
Left: **0.0** ft. Right: **2,730.2** ft.
5.4 Channel Straightening: **0.0** **0.0** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **4,050.5** ft. **100.0**

	One Side	Both Sides
Road:	**4,050.5** 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: **351.3** ft. **0.0** ft.
6.3 Channel Bars: **None**
6.4 Meander Migration: **None**
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:

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.	0 N.S.	2 High	0 N.S.	0 N.S.	2 High	1 Low	0 N.S.	0 N.S.	0 N/A	0 N/A	0 N.S.	0 N.S.	11

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Joe's Brook**
Topo Maps: **BARNET**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T1.03**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Reach break above Garfield Rd to mouth of rake factory brook.**

1.1 Reach Description:
1.2 Towns: **Barnet**
1.3 Downstream Latitude: **44.3421480932**
1.3 Downstream Longitude: **-72.0584561554**

Step 2. Stream Type

2.1 Elevation Upstream: **627**
2.1 Elevation Downstream: **591**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **6,070.9** ft. **1.15** Miles
2.3 Valley Slope: **0.6**
2.4 Channel Length: **7,156.8** ft. **1.36** Miles
2.5 Channel Slope: **0.50 %**
2.6 Sinuosity: **1.18**
2.7 Watershed Area: **51.9** Square Miles
2.8 Channel Width: **74.4** feet
2.9 Valley Width: **387.7** feet
2.10 Confinement Ratio: **5.2**
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: **Dam**
3.3 Dominant Geological Mat.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Hilly**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Field verification will be needed to confirm reference stream type given low slope and confinement considerations.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **77.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Field**
Current Dominant Land Cover: **Forest** **16.0** %
Current Sub-Dominant Land Cover: **Field**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**0-25**
Sub-dominant:	**0-25**	**26-50**
Length w / less than 25 ft.:	**2,421.0** ft.	**3,973.0** 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** **0.4** %
5.3 Bank Armoring: **0.0** **0.0** %
Left: **0.0** ft. Right: **0.0** ft.
5.4 Channel Straightening: **1,819.8** **25.4** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **1,755.8** ft. **24.5**

	One Side	Both Sides
Road:	**1,755.8** 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: **687.9** ft. **0.0** ft.
6.3 Channel Bars: **Multiple**
6.4 Meander Migration: **None**
6.5 Meander Width: **251 ft.** Rato: **3.4**
6.6 Wavelength: **408 ft.** Ratio: **5.5**

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	2 High	0 N.S.	0 N.S.	0 N.S.	2 High	0 N.S.	2 High	1 Low	2 High	0 N.S.	1 Low	2 High	0 N.S.	0 N.S.	16

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Joe's Brook**
Topo Maps: **BARNET, ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T1.04**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Mouth of rake factory brook to reach break below Joe's Brook Rd crossing near Covered Bridge Rd.**

1.1 Reach Description:
1.2 Towns: **Barnet, Danville**
1.3 Downstream Latitude: **44.3543531689**
1.3 Downstream Longitude: **-72.0712919982**

Step 2. Stream Type

2.1 Elevation Upstream: **820**
2.1 Elevation Downstream: **627**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **10,673.5** ft. **2.02** Miles
2.3 Valley Slope: **1.8**
2.4 Channel Length: **11,206.1** ft. **2.12** Miles
2.5 Channel Slope: **1.73 %**
2.6 Sinuosity: **1.05**
2.7 Watershed Area: **44.6** Square Miles
2.8 Channel Width: **69.7** feet
2.9 Valley Width: **279.1** feet
2.10 Confinement Ratio: **4.0**
2.10 Confinement Type: **Narrow**
2.11 Reference Stream Type: **B**
Bedform: **Riffle-Pool**
Sub-Class Slope: **c**
Bed Material: **Gravel**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geological Mat.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **76.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **40.0** %
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.:	**853.0** ft.	**0.0** 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: **0.0** **0.0** %
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: **None**
6.4 Meander Migration: **None**
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:

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	0 N.S.	1 Low	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 Unk.	0 N.S.	0 N.S.	0 N.S.	0 N/A	0 N/A	0 N.S.	0 N.S.	3

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Joe's Brook**
Topo Maps: **ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T1.05**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Reach break below Joe's Brook Rd to reach break along Covered Bridge Rd.**

1.1 Reach Description:
1.2 Towns: **Danville**
1.3 Downstream Latitude: **44.3786470311**
1.3 Downstream Longitude: **-72.0896071208**

Step 2. Stream Type

2.1 Elevation Upstream: **889**
2.1 Elevation Downstream: **820**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **3,079.8** ft. **0.58** Miles
2.3 Valley Slope: **2.2**
2.4 Channel Length: **3,202.0** ft. **0.61** Miles
2.5 Channel Slope: **2.14 %**
2.6 Sinuosity: **1.04**
2.7 Watershed Area: **42.8** Square Miles
2.8 Channel Width: **68.4** feet
2.9 Valley Width: **212.5** feet
2.10 Confinement Ratio: **3.1**
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: **Dam**
3.3 Dominant Geological Mat.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **77.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **29.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**26-50**	**51-100**
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** **0.9** %
5.3 Bank Armoring: **0.0** **0.0** %
Left: **0.0** ft. Right: **0.0** ft.
5.4 Channel Straightening: **232.3** **7.3** %
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: **677.6** ft. **0.0** ft.
6.3 Channel Bars: **Point**
6.4 Meander Migration: **None**
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:

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.	1 Low	0 N.S.	0 Unk.	2 High	1 Low	0 N.S.	0 N/A	0 N/A	0 N.S.	0 N.S.	8

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Joe's Brook**
Topo Maps: **ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T1.06**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Parallels Covered Bridge Rd. to the north.**

1.1 Reach Description:
1.2 Towns: **Danville**
1.3 Downstream Latitude: **44.3785137027**
1.3 Downstream Longitude: **-72.1000675631**

Step 2. Stream Type

2.1 Elevation Upstream: **1,013**
2.1 Elevation Downstream: **889**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **3,400.0** ft. **0.64** Miles
2.3 Valley Slope: **3.7**
2.4 Channel Length: **3,508.4** ft. **0.66** Miles
2.5 Channel Slope: **3.54 %**
2.6 Sinuosity: **1.03**
2.7 Watershed Area: **41.8** Square Miles
2.8 Channel Width: **67.7** feet
2.9 Valley Width: **260.0** feet
2.10 Confinement Ratio: **3.8**
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: **None**
3.3 Dominant Geological Mat.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Ext. Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:
VW width estimated from HydroDEM contours.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **77.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **49.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**None**	**51-100**
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: **1,500.0** ft. **42.8**

	One Side	Both Sides
Road:	**1,500.0** 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: **None**
6.4 Meander Migration: **None**
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:

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.	2 High	0 N.S.	0 N.S.	0 N.S.	0 N/A	0 N/A	0 N.S.	0 N.S.	5

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Joe's Brook**
Topo Maps: **ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T1.07**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Reach break along Covered Bridge Road to reach break along Brook rd. Greenbarks covered bridge is in reach.**

1.1 Reach Description:
1.2 Towns: **Danville**
1.3 Downstream Latitude: **44.3764295977**
1.3 Downstream Longitude: **-72.1127968291**

Step 2. Stream Type

2.1 Elevation Upstream: **1,133**
2.1 Elevation Downstream: **1,013**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **3,380.0** ft. **0.64** Miles
2.3 Valley Slope: **3.6**
2.4 Channel Length: **3,766.2** ft. **0.71** Miles
2.5 Channel Slope: **3.19 %**
2.6 Sinuosity: **1.11**
2.7 Watershed Area: **40.2** Square Miles
2.8 Channel Width: **66.6** feet
2.9 Valley Width: **250.0** feet
2.10 Confinement Ratio: **3.8**
2.10 Confinement Type: **Semi-confined**
2.11 Reference Stream Type: **B**
Bedform: **Step-Pool**
Sub-Class Slope: **None**
Bed Material: **Boulder**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geological Mat.: %
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: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:
VW width estimated from HydroDEM contours.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **76.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **50.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**26-50**	**26-50**
Length w / less than 25 ft.:	**0.0** ft.	**0.0** 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** **0.5** %
5.3 Bank Armoring: **134.1** **3.6** %
Left: **66.7** ft. Right: **67.4** ft.
5.4 Channel Straightening: **0.0** **0.0** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **845.8** ft. **22.5**

	One Side	Both Sides
Road:	**845.8** 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. **202.8** ft.
6.3 Channel Bars: **None**
6.4 Meander Migration: **None**
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:

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.	2 High	1 Low	0 N.S.	0 N.S.	0 N/A	0 N/A	0 N.S.	0 N.S.	6

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Joe's Brook**
Topo Maps: **JOES POND, ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T1.08**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Paralells Brook Road.**

1.1 Reach Description:
1.2 Towns: **Danville**
1.3 Downstream Latitude: **44.3787802055**
1.3 Downstream Longitude: **-72.1249606667**

Step 2. Stream Type

2.1 Elevation Upstream: **1,217**
2.1 Elevation Downstream: **1,133**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **5,170.0** ft. **0.98** Miles
2.3 Valley Slope: **1.6**
2.4 Channel Length: **5,348.6** ft. **1.01** Miles
2.5 Channel Slope: **1.56 %**
2.6 Sinuosity: **1.03**
2.7 Watershed Area: **34.4** Square Miles
2.8 Channel Width: **62.1** feet
2.9 Valley Width: **250.0** feet
2.10 Confinement Ratio: **4.0**
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: **Ledge**
3.3 Dominant Geological Mat.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Very Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Field verification will be needed to confirm reference stream type given low slope and confinement considerations.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **79.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **33.0** %
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.:	**338.0** ft.	**1,299.0** 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** **0.6** %
5.3 Bank Armoring: **1,080.7** **20.2** %
Left: **0.0** ft. Right: **1,080.7** ft.
5.4 Channel Straightening: **112.3** **2.1** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **4,007.1** ft. **74.9**

	One Side	Both Sides
Road:	**4,007.1** 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: **273.6** ft. **0.0** ft.
6.3 Channel Bars: **None**
6.4 Meander Migration: **None**
6.5 Meander Width: **102 ft.** Rato: **1.6**
6.6 Wavelength: **316 ft.** Ratio: **5.1**

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
1 Low	2 High	2 High	0 N.S.	0 N.S.	2 High	0 N.S.	0 N.S.	2 High	1 Low	0 N.S.	0 N.S.	2 High	2 High	0 N.S.	0 N.S.	14

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Joe's Brook**
Topo Maps: **JOES POND**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T1.09**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Flows along Harvey's Hollow Rd.**

1.1 Reach Description:
1.2 Towns: **Danville**
1.3 Downstream Latitude: **44.3824069198**
1.3 Downstream Longitude: **-72.1426489687**

Step 2. Stream Type

2.1 Elevation Upstream: **1,242**
2.1 Elevation Downstream: **1,217**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **5,229.6** ft. **0.99** Miles
2.3 Valley Slope: **0.5**
2.4 Channel Length: **5,472.3** ft. **1.04** Miles
2.5 Channel Slope: **0.47 %**
2.6 Sinuosity: **1.05**
2.7 Watershed Area: **33.8** Square Miles
2.8 Channel Width: **61.6** feet
2.9 Valley Width: **379.5** feet
2.10 Confinement Ratio: **6.2**
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.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Hilly**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **79.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Field**
Current Dominant Land Cover: **Urban** **33.0** %
Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**51-100**
Sub-dominant:	**51-100**	**0-25**
Length w / less than 25 ft.:	**774.0** ft.	**1,975.0** 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** **0.9** %
5.3 Bank Armoring: **0.0** **0.0** %
Left: **0.0** ft. Right: **0.0** ft.
5.4 Channel Straightening: **1,395.7** **25.5** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **5,134.4** ft. **93.8**

	One Side	Both Sides
Road:	**4,880.5** ft.	**253.9** 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: **1,017.1** ft. **337.1** ft.
6.3 Channel Bars: **None**
6.4 Meander Migration: **None**
6.5 Meander Width: **61 ft.** Rato: **1.0**
6.6 Wavelength: **61 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:

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	0 N.S.	0 N.S.	2 High	2 High	0 N.S.	0 N.S.	15

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Joe's Brook**
Topo Maps: **JOES POND**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T1.10**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Reach break near Harvey's Hollow Rd to reach break above Oneida Rd.**

1.1 Reach Description:
1.2 Towns: **Danville**
1.3 Downstream Latitude: **44.38795202**
1.3 Downstream Longitude: **-72.1602448164**

Step 2. Stream Type

2.1 Elevation Upstream: **1,310**
2.1 Elevation Downstream: **1,242**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **5,200.4** ft. **0.98** Miles
2.3 Valley Slope: **1.3**
2.4 Channel Length: **5,659.1** ft. **1.07** Miles
2.5 Channel Slope: **1.19 %**
2.6 Sinuosity: **1.09**
2.7 Watershed Area: **30.2** Square Miles
2.8 Channel Width: **58.7** feet
2.9 Valley Width: **272.3** feet
2.10 Confinement Ratio: **4.6**
2.10 Confinement Type: **Narrow**
2.11 Reference Stream Type: **B**
Bedform: **Riffle-Pool**
Sub-Class Slope: **c**
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geological Mat.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Field verification will be needed to confirm reference stream type given low slope and confinement considerations.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **79.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **38.0** %
Current Sub-Dominant Land Cover: **Crop**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**51-100**	**26-50**
Length w / less than 25 ft.:	**295.0** 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** **0.4** %
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: **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: **None**
6.4 Meander Migration: **None**
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:

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.	0 N.S.	0 N.S.	0 N.S.	0 Unk.	0 N.S.	0 N.S.	0 N.S.	0 N/A	0 N/A	0 N.S.	0 N.S.	3

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Joe's Brook**
Topo Maps: **JOES POND**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T1.11**
SGAT Version: **4.56**
Date Last Edited: **September, 25 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Flows approximately 1500' northeast of Oneida Rd, along gravel pit**

1.1 Reach Description:

1.2 Towns: **Danville**

1.3 Downstream Latitude: **44.3985774016**

1.3 Downstream Longitude: **-72.1715259047**

Step 2. Stream Type

2.1 Elevation Upstream: **1,364**
2.1 Elevation Downstream: **1,310**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **2,844.0** ft. **0.54** Miles
2.3 Valley Slope: **1.9**
2.4 Channel Length: **3,075.3** ft. **0.58** Miles
2.5 Channel Slope: **1.78 %**
2.6 Sinuosity: **1.08**
2.7 Watershed Area: **29.7** Square Miles
2.8 Channel Width: **58.3** feet
2.9 Valley Width: **334.7** feet
2.10 Confinement Ratio: **5.7**
2.10 Confinement Type: **Narrow**
2.11 Reference Stream Type: **B**
Bedform: **Riffle-Pool**
Sub-Class Slope: **c**
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geological Mat.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Very Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %

7.4 Comments:

VW width estimated from HydroDEM contours. Field verification will be needed to confirm reference stream type given low slope and confinement considerations.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **80.0** %
Current Sub-Dominant Land Cover: **Crop**

4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **55.0** %
Current Sub-Dominant Land Cover: **Crop**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**None**	**None**
Length w / less than 25 ft.:	ft.	ft.

4.4 Ground Water Inputs: **None**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type:
Use:
5.2 Bridges and Culverts: **0** **0.0** %
5.3 Bank Armoring: **0.0** **0.0** %
Left: ft. Right: ft.
5.4 Channel Straightening: **0.0** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **0.0** ft. **0.0**

	One Side	Both Sides
Road:	ft.	ft.
Railroad:	ft.	ft.
Berm:	ft.	ft.
Improved Path:	ft.	ft.
6.2 Development:	ft.	ft.

6.3 Channel Bars: **None**
6.4 Meander Migration: **None**
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: **0** 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	0 N.S.	0 N.D.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N/A	0 N/A	0 N.S.	0 N.S.	1

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Joe's Brook**
Topo Maps: **JOES POND**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T1.12**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Flows approximately 1000' South of Rt 2 and along Power Plant Rd**

1.1 Reach Description:

1.2 Towns: **Danville**

1.3 Downstream Latitude: **44.4026562091**

1.3 Downstream Longitude: **-72.1804663587**

Step 2. Stream Type

2.1 Elevation Upstream: **1,401**
2.1 Elevation Downstream: **1,364**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **4,060.0** ft. **0.77** Miles
2.3 Valley Slope: **0.9**
2.4 Channel Length: **4,902.0** ft. **0.93** Miles
2.5 Channel Slope: **0.74 %**
2.6 Sinuosity: **1.21**
2.7 Watershed Area: **29.3** Square Miles
2.8 Channel Width: **57.9** feet
2.9 Valley Width: **423.1** 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.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Hilly**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %

7.4 Comments:
VW width estimated from HydroDEM contours.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **80.0** %
Current Sub-Dominant Land Cover: **Crop**

4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **72.0** %
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.:	**146.0** ft.	**102.0** 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: **0.0** **0.0** %
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: **243.9** ft. **0.0** ft.
6.3 Channel Bars: **None**
6.4 Meander Migration: **None**
6.5 Meander Width: **90 ft.** Rato: **1.6**
6.6 Wavelength: **580 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:

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.	0 N.S.	0 N.S.	0 N.S.	0 Unk.	0 N.S.	0 N.S.	0 N.S.	2 High	0 N.S.	0 N.S.	0 N.S.	5

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Joe's Brook**
Topo Maps: **JOES POND**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T1.13**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **From reach break between Keiser Pond Rd and Power Plant road to dam at Joe's Pond.**

1.1 Reach Description:
1.2 Towns: **Danville**
1.3 Downstream Latitude: **44.4054146121**
1.3 Downstream Longitude: **-72.1911215671**

Step 2. Stream Type

2.1 Elevation Upstream: **1,496**
2.1 Elevation Downstream: **1,401**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **1,905.0** ft. **0.36** Miles
2.3 Valley Slope: **5.0**
2.4 Channel Length: **1,945.7** ft. **0.37** Miles
2.5 Channel Slope: **4.91 %**
2.6 Sinuosity: **1.02**
2.7 Watershed Area: **27.7** Square Miles
2.8 Channel Width: **56.5** feet
2.9 Valley Width: **154.0** feet
2.10 Confinement Ratio: **2.7**
2.10 Confinement Type: **Semi-confined**
2.11 Reference Stream Type: **A**
Bedform: **Cascade**
Sub-Class Slope: **None**
Bed Material: **Boulder**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **Dam**
3.3 Dominant Geological Mat.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Ext. Steep**
3.4 Valley Slope Right: **Ext. Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:
VW width estimated from HydroDEM contours.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **79.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Urban** **49.0** %
Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**None**	**None**
Length w / less than 25 ft.:	**529.0** ft.	**576.0** ft.

4.4 Ground Water Inputs: **None**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **Large Run of River**
Use: **Recreation**
5.2 Bridges and Culverts: **2** **2.5** %
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: **529.2** ft. **27.2**

	One Side	Both Sides
Road:	**0.0** ft.	**529.2** 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: **0.0** ft. **571.4** ft.
6.3 Channel Bars: **None**
6.4 Meander Migration: **None**
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:

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	2 High	0 N.S.	0 N.S.	0 N.S.	0 N.S.	2 High	2 High	0 N.S.	0 N.S.	0 N/A	0 N/A	0 N.S.	0 N.S.	11

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Water Andric**
Topo Maps: **BARNET**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T2.01**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Confluence with Passumpsic to Rt 5 bridge.**

1.1 Reach Description:

1.2 Towns: **Barnet**

1.3 Downstream Latitude: **44.3574248252**

1.3 Downstream Longitude: **-72.0461426633**

Step 2. Stream Type

2.1 Elevation Upstream: **517**
2.1 Elevation Downstream: **484**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **154.0** ft. **0.03** Miles
2.3 Valley Slope: **21.8**
2.4 Channel Length: **155.4** ft. **0.03** Miles
2.5 Channel Slope: **21.60 %**
2.6 Sinuosity: **1.01**
2.7 Watershed Area: **13.1** Square Miles
2.8 Channel Width: **40.6** feet
2.9 Valley Width: **70.0** feet
2.10 Confinement Ratio: **1.7**
2.10 Confinement Type: **Narrowly Confined**
2.11 Reference Stream Type: **A**
Bedform: **Cascade**
Sub-Class Slope: **None**
Bed Material: **Bedrock**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **Waterfall**
3.3 Dominant Geological Mat.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Ext. Steep**
3.4 Valley Slope Right: **Ext. Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:
Bridge is narrow and causing deposition upstream.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **68.0** %
Current Sub-Dominant Land Cover: **Field**
4.2 Corridor
Historic Land Cover:: **Commercial**
Current Dominant Land Cover: **Urban** **74.0** %
Current Sub-Dominant Land Cover: **Crop**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**26-50**	**26-50**
Sub-dominant:	**0-25**	**None**
Length w / less than 25 ft.:	**7.0** ft.	**0.0** ft.

4.4 Ground Water Inputs: **None**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **2** **38.6** %
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: **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: **None**
6.4 Meander Migration: **None**
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
2 High	2 High	0 N.S.	0 N.S.	2 High	0 N.S.	0 N.S.	0 N.S.	0 Unk.	0 N.S.	0 N.S.	0 N.S.	0 N/A	0 N/A	0 N.S.	1 Low	7

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Water Andric**
Topo Maps: **BARNET**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T2.02**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Rt 5 bridge to reach break along log yard**

1.1 Reach Description:
1.2 Towns: **Barnet**
1.3 Downstream Latitude: **44.3574551265**
1.3 Downstream Longitude: **-72.0467280584**

Step 2. Stream Type

2.1 Elevation Upstream: **522**
2.1 Elevation Downstream: **517**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **580.2** ft. **0.11** Miles
2.3 Valley Slope: **0.8**
2.4 Channel Length: **651.2** ft. **0.12** Miles
2.5 Channel Slope: **0.69 %**
2.6 Sinuosity: **1.12**
2.7 Watershed Area: **13.1** Square Miles
2.8 Channel Width: **40.6** feet
2.9 Valley Width: **250.0** feet
2.10 Confinement Ratio: **6.2**
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.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Very Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

VW width was increased from the SGAT derived 158" to approximate reference conditions prior to significant filling of the left floodplain to build the loading area for the log yard.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Urban**
Current Dominant Land Cover: **Forest** **68.0** %
Current Sub-Dominant Land Cover: **Field**
4.2 Corridor
Historic Land Cover:: **Shrub**
Current Dominant Land Cover: **Crop** **26.0** %
Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**26-50**	**>100**
Sub-dominant:	**51-100**	**26-50**
Length w / less than 25 ft.:	**229.0** 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: **479.1** **73.6** %
Left: **479.1** ft. Right: **0.0** ft.
5.4 Channel Straightening: **368.7** **56.6** %
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: **646.1** ft. **0.0** ft.
6.3 Channel Bars: **Point**
6.4 Meander Migration: **None**
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: **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	2 High	0 N.S.	0 N.S.	2 High	2 High	0 N.S.	0 Unk.	2 High	1 Low	0 N.S.	2 High	2 High	0 N.S.	0 N.S.	17

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Water Andric**
Topo Maps: **BARNET**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T2.03**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Reach break along log yard through sinuous reach**

1.1 Reach Description:

1.2 Towns: **Barnet**

1.3 Downstream Latitude: **44.3581144276**

1.3 Downstream Longitude: **-72.0484682549**

Step 2. Stream Type

2.1 Elevation Upstream: **535**
2.1 Elevation Downstream: **522**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **3,807.1** ft. **0.72** Miles
2.3 Valley Slope: **0.4**
2.4 Channel Length: **6,385.5** ft. **1.21** Miles
2.5 Channel Slope: **0.22 %**
2.6 Sinuosity: **1.68**
2.7 Watershed Area: **13.1** Square Miles
2.8 Channel Width: **35.0** feet
2.9 Valley Width: **442.0** feet
2.10 Confinement Ratio: **12.6**
2.10 Confinement Type: **Very 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.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Flat**
3.4 Valley Slope Right: **Hilly**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant Land Cover: **Forest** **68.0** %
Current Sub-Dominant Land Cover: **Field**
4.2 Corridor
Historic Land Cover:: **Wetland**
Current Dominant Land Cover: **Forest** **39.0** %
Current Sub-Dominant Land Cover: **Wetland**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**51-100**	**None**
Length w / less than 25 ft.:	**160.0** ft.	**0.0** 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: **0.0** **0.0** %
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: **1,332.2** ft. **0.0** ft.
6.3 Channel Bars: **Multiple**
6.4 Meander Migration: **Multiple**
6.5 Meander Width: **175 ft.** Rato: **5.0**
6.6 Wavelength: **248 ft.** Ratio: **7.1**

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	1 Low	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 Unk.	2 High	2 High	2 High	0 N.S.	1 Low	0 N.S.	0 N.S.	10

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Water Andric**
Topo Maps: **BARNET**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T2.04**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Flows approximately 600' west of Tripp Ln.**

1.1 Reach Description:
1.2 Towns: **Barnet**
1.3 Downstream Latitude: **44.3678945106**
1.3 Downstream Longitude: **-72.0505435809**

Step 2. Stream Type

2.1 Elevation Upstream: **567**
2.1 Elevation Downstream: **535**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **1,401.2** ft. **0.27** Miles
2.3 Valley Slope: **2.2**
2.4 Channel Length: **2,500.6** ft. **0.47** Miles
2.5 Channel Slope: **1.25 %**
2.6 Sinuosity: **1.78**
2.7 Watershed Area: **11.9** Square Miles
2.8 Channel Width: **39.0** feet
2.9 Valley Width: **467.0** feet
2.10 Confinement Ratio: **12.0**
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.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Flat**
3.4 Valley Slope Right: **Flat**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant Land Cover: **Forest** **67.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Wetland**
Current Dominant Land Cover: **Forest** **49.0** %
Current Sub-Dominant Land Cover: **Crop**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**26-50**	**None**
Length w / less than 25 ft.:	**0.0** ft.	**419.0** 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: **0.0** **0.0** %
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: **Migration**
6.5 Meander Width: **208 ft.** Rato: **5.3**
6.6 Wavelength: **480 ft.** Ratio: **12.3**

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	1 Low	1 Low	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 Unk.	0 N.S.	1 Low	1 Low	0 N.S.	0 N.S.	0 N.S.	0 N.S.	6

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Water Andric**
Topo Maps: **BARNET**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T2.05**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Flows along Tripp Ln approximately 850' to the west.**

1.1 Reach Description:
1.2 Towns: **Barnet**
1.3 Downstream Latitude: **44.3713908152**
1.3 Downstream Longitude: **-72.0512388811**

Step 2. Stream Type

2.1 Elevation Upstream: **573**
2.1 Elevation Downstream: **567**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **1,404.7** ft. **0.27** Miles
2.3 Valley Slope: **0.5**
2.4 Channel Length: **2,701.9** ft. **0.51** Miles
2.5 Channel Slope: **0.26 %**
2.6 Sinuosity: **1.92**
2.7 Watershed Area: **11.6** Square Miles
2.8 Channel Width: **38.6** feet
2.9 Valley Width: **380.2** feet
2.10 Confinement Ratio: **9.9**
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.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Flat**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant Land Cover: **Forest** **67.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Wetland**
Current Dominant Land Cover: **Forest** **35.0** %
Current Sub-Dominant Land Cover: **Crop**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**26-50**	**None**
Length w / less than 25 ft.:	**1,959.0** ft.	**926.0** 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: **0.0** **0.0** %
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: **Migration**
6.5 Meander Width: **184 ft.** Rato: **4.8**
6.6 Wavelength: **457 ft.** Ratio: **11.9**

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	2 High	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 Unk.	0 N.S.	1 Low	1 Low	1 Low	0 N.S.	0 N.S.	0 N.S.	9

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Water Andric**
Topo Maps: **BARNET, ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T2.06**
SGAT Version: **4.56**
Date Last Edited: **September, 25 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Flows from reach break below Keyser Hill rd to reach break west of Tripp Ln.**

1.1 Reach Description:
1.2 Towns: **Barnet**
1.3 Downstream Latitude: **44.3748946585**
1.3 Downstream Longitude: **-72.052464054**

Step 2. Stream Type

2.1 Elevation Upstream: **629**
2.1 Elevation Downstream: **573**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **3,625.0** ft. **0.69** Miles
2.3 Valley Slope: **1.5**
2.4 Channel Length: **3,850.4** ft. **0.73** Miles
2.5 Channel Slope: **1.44 %**
2.6 Sinuosity: **1.06**
2.7 Watershed Area: **11.4** Square Miles
2.8 Channel Width: **38.2** feet
2.9 Valley Width: **197.2** feet
2.10 Confinement Ratio: **5.2**
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: **None**
3.3 Dominant Geological Mat.: %
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: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Field verification will be needed to confirm reference stream type given low slope and confinement considerations.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **68.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **52.0** %
Current Sub-Dominant Land Cover: **Crop**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**None**	**None**
Length w / less than 25 ft.:	ft.	ft.

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type:
Use:
5.2 Bridges and Culverts: **0** **0.0** %
5.3 Bank Armoring: **0.0** **0.0** %
Left: ft. Right: ft.
5.4 Channel Straightening: **0.0** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **0.0** ft. **0.0**

	One Side	Both Sides
Road:	ft.	ft.
Railroad:	ft.	ft.
Berm:	ft.	ft.
Improved Path:	ft.	ft.
6.2 Development:	ft.	ft.

6.3 Channel Bars: **Multiple**
6.4 Meander Migration: **None**
6.5 Meander Width: **204 ft.** Rato: **5.3**
6.6 Wavelength: **512 ft.** Ratio: **13.4**

Step 7. Windshield Survey

7.1 Bank Erosion: **0** ft
7.2 Bank Height: **0** 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	0 N.S.	0 N.D.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.D.	1 Low	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	3

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Water Andric**
Topo Maps: **ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T2.07**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Flows from Water Andric Rd crossing to Keyser Hill Rd crossing.**

1.1 Reach Description:

1.2 Towns: **Barnet, Danville**

1.3 Downstream Latitude: **44.3835494817**

1.3 Downstream Longitude: **-72.0580096729**

Step 2. Stream Type

2.1 Elevation Upstream: **654**
2.1 Elevation Downstream: **629**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **3,256.4** ft. **0.62** Miles
2.3 Valley Slope: **0.8**
2.4 Channel Length: **4,112.7** ft. **0.78** Miles
2.5 Channel Slope: **0.62 %**
2.6 Sinuosity: **1.26**
2.7 Watershed Area: **10.4** Square Miles
2.8 Channel Width: **36.8** feet
2.9 Valley Width: **342.3** feet
2.10 Confinement Ratio: **9.3**
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.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Hilly**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **66.0** %
Current Sub-Dominant Land Cover: **Field**
4.2 Corridor
Historic Land Cover:: **Field**
Current Dominant Land Cover: **Forest** **32.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**0-25**	**>100**
Sub-dominant:	**51-100**	**26-50**
Length w / less than 25 ft.:	**2,270.0** 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: **2** **1.0** %
5.3 Bank Armoring: **57.7** **1.4** %
Left: **0.0** ft. Right: **57.7** ft.
5.4 Channel Straightening: **628.1** **15.3** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **921.9** ft. **22.4**

	One Side	Both Sides
Road:	**921.9** 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: **180.4** ft. **0.0** ft.
6.3 Channel Bars: **Point**
6.4 Meander Migration: **Migration**
6.5 Meander Width: **105 ft.** Rato: **2.9**
6.6 Wavelength: **215 ft.** Ratio: **5.8**

Step 7. Windshield Survey

7.1 Bank Erosion: **244.19** 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
2 High	2 High	2 High	0 N.S.	0 N.S.	0 N.S.	1 Low	0 N.S.	2 High	0 N.S.	1 Low	1 Low	2 High	2 High	1 Low	0 N.S.	16

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Water Andric**
Topo Maps: **ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T2.08**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Immediately adjacent to and crossing Water Andric Road**

1.1 Reach Description:

1.2 Towns: **Danville**

1.3 Downstream Latitude: **44.3905692297**

1.3 Downstream Longitude: **-72.0644865282**

Step 2. Stream Type

2.1 Elevation Upstream: **742**
2.1 Elevation Downstream: **654**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **3,439.6** ft. **0.65** Miles
2.3 Valley Slope: **2.5**
2.4 Channel Length: **3,817.9** ft. **0.72** Miles
2.5 Channel Slope: **2.29 %**
2.6 Sinuosity: **1.11**
2.7 Watershed Area: **9.0** Square Miles
2.8 Channel Width: **34.5** feet
2.9 Valley Width: **271.2** feet
2.10 Confinement Ratio: **7.9**
2.10 Confinement Type: **Broad**
2.11 Reference Stream Type: **B**
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.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Hilly**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **66.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **36.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**51-100**	**51-100**
Length w / less than 25 ft.:	**376.0** ft.	**605.0** 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** **0.5** %
5.3 Bank Armoring: **1,105.3** **29.0** %
Left: **0.0** ft. Right: **1,105.3** ft.
5.4 Channel Straightening: **0.0** **0.0** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **2,734.5** ft. **71.6**

	One Side	Both Sides
Road:	**2,734.5** 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: **364.1** ft. **0.0** ft.
6.3 Channel Bars: **Point**
6.4 Meander Migration: **None**
6.5 Meander Width: **58 ft.** Rato: **1.7**
6.6 Wavelength: **240 ft.** Ratio: **7.0**

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	2 High	0 N.S.	0 N.S.	2 High	0 N.S.	0 N.S.	2 High	1 Low	1 Low	0 N.S.	2 High	1 Low	0 N.S.	0 N.S.	15

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Water Andric**
Topo Maps: **ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T2.09**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Flows along Water Andric Rd from reach break near Penny Ln to reach break near Winn High dr.**

1.1 Reach Description:
1.2 Towns: **Danville**
1.3 Downstream Latitude: **44.3957503852**
1.3 Downstream Longitude: **-72.0733443858**

Step 2. Stream Type

2.1 Elevation Upstream: **883**
2.1 Elevation Downstream: **742**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **6,018.6** ft. **1.14** Miles
2.3 Valley Slope: **2.3**
2.4 Channel Length: **6,499.1** ft. **1.23** Miles
2.5 Channel Slope: **2.17 %**
2.6 Sinuosity: **1.08**
2.7 Watershed Area: **6.8** Square Miles
2.8 Channel Width: **30.4** feet
2.9 Valley Width: **368.2** feet
2.10 Confinement Ratio: **12.1**
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.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Hilly**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Areas of significant bank erosion and channel enlargement from recent flooding. Field verification of bedform needed. May be plane bed by reference given channel slope and low sinuosity.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **65.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **39.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**51-100**	**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** **0.3** %
5.3 Bank Armoring: **584.0** **9.0** %
Left: **584.0** 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: **3,533.7** ft. **54.4**

	One Side	Both Sides
Road:	**504.3** ft.	**0.0** ft.
Railroad:	**0.0** ft.	**0.0** ft.
Berm:	**0.0** ft.	**0.0** ft.
Improved Path:	**3,029.4** ft.	**0.0** ft.

6.2 Development: **0.0** ft. **0.0** ft.
6.3 Channel Bars: **Multiple**
6.4 Meander Migration: **None**
6.5 Meander Width: **117 ft.** Rato: **3.8**
6.6 Wavelength: **155 ft.** Ratio: **5.1**

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	0 N.S.	0 N.S.	2 High	0 N.S.	2 High	0 N.S.	1 Low	2 High	0 N.S.	0 N.S.	12

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Water Andric**
Topo Maps: **ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T2.10**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Flows along TH-61 (ATV trail) accessed at Penny Ln crossing.**

1.1 Reach Description:

1.2 Towns: **Danville**

1.3 Downstream Latitude: **44.4034262313**

1.3 Downstream Longitude: **-72.092250357**

Step 2. Stream Type

2.1 Elevation Upstream: **991**
2.1 Elevation Downstream: **883**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **3,116.5** ft. **0.59** Miles
2.3 Valley Slope: **3.5**
2.4 Channel Length: **3,424.0** ft. **0.65** Miles
2.5 Channel Slope: **3.17 %**
2.6 Sinuosity: **1.10**
2.7 Watershed Area: **4.6** Square Miles
2.8 Channel Width: **25.6** feet
2.9 Valley Width: **308.9** feet
2.10 Confinement Ratio: **12.1**
2.10 Confinement Type: **Very Broad**
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: **None**
3.3 Dominant Geological Mat.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Hilly**
3.4 Valley Slope Right: **Hilly**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %

7.4 Comments:

Large depositional area upstream of TH-61 culvert, channel is braided and up to 120"" wide. Large log jams and erosion.

Field verification of bedform needed to confirm step-pool.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **59.0** %
Current Sub-Dominant Land Cover: **Crop**

4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **31.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**26-50**	**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: **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: **1,550.0** ft. **45.3**

	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:	**1,550.0** ft.	**0.0** ft.

6.2 Development: **0.0** ft. **0.0** ft.
6.3 Channel Bars: **Multiple**
6.4 Meander Migration: **Migration**
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:

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.	2 High	0 N.S.	1 Low	1 Low	0 N/A	0 N/A	0 N.S.	0 N.S.	8

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Water Andric**
Topo Maps: **JOES POND, ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T2.11**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Flows immediately adjacent to and crossing TH-61 (ATV trail)**

1.1 Reach Description:
1.2 Towns: **Danville**
1.3 Downstream Latitude: **44.4063799953**
1.3 Downstream Longitude: **-72.1025562307**

Step 2. Stream Type

2.1 Elevation Upstream: **1,193**
2.1 Elevation Downstream: **991**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **6,664.0** ft. **1.26** Miles
2.3 Valley Slope: **3.0**
2.4 Channel Length: **7,214.8** ft. **1.37** Miles
2.5 Channel Slope: **2.80 %**
2.6 Sinuosity: **1.08**
2.7 Watershed Area: **4.2** Square Miles
2.8 Channel Width: **24.6** feet
2.9 Valley Width: **420.6** feet
2.10 Confinement Ratio: **17.1**
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.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Hilly**
3.4 Valley Slope Right: **Hilly**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **57.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **60.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**51-100**	**51-100**
Length w / less than 25 ft.:	**0.0** ft.	**0.0** 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: **0.0** **0.0** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **6,548.5** ft. **90.8**

	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:	**6,548.5** ft.	**0.0** ft.

6.2 Development: **0.0** ft. **0.0** ft.
6.3 Channel Bars: **No Data**
6.4 Meander Migration: **None**
6.5 Meander Width: **116 ft.** Rato: **4.7**
6.6 Wavelength: **442 ft.** Ratio: **18.0**

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.	0 N.S.	0 N.S.	0 N.S.	2 High	0 N.S.	0 N.S.	0 N.S.	1 Low	2 High	0 N.S.	0 N.S.	9

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Water Andric**
Topo Maps: **JOES POND**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T2.12**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Reach break 1100' upstream of Rt2 to reach break 2000' downstream of Rt2.**

1.1 Reach Description:

1.2 Towns: **Danville**

1.3 Downstream Latitude: **44.4089792775**

1.3 Downstream Longitude: **-72.1253110609**

Step 2. Stream Type

2.1 Elevation Upstream: **1,287**
2.1 Elevation Downstream: **1,193**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **3,750.3** ft. **0.71** Miles
2.3 Valley Slope: **2.5**
2.4 Channel Length: **4,635.3** ft. **0.88** Miles
2.5 Channel Slope: **2.01 %**
2.6 Sinuosity: **1.24**
2.7 Watershed Area: **2.5** Square Miles
2.8 Channel Width: **19.5** feet
2.9 Valley Width: **425.9** feet
2.10 Confinement Ratio: **21.8**
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.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Hilly**
3.4 Valley Slope Right: **Hilly**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant Land Cover: **Forest** **54.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **37.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**26-50**	**26-50**
Length w / less than 25 ft.:	**589.0** ft.	**0.0** 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** **4.3** %
5.3 Bank Armoring: **114.2** **2.5** %
Left: **55.9** ft. Right: **58.2** ft.
5.4 Channel Straightening: **437.3** **9.4** %
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: **179.9** ft. **0.0** ft.
6.3 Channel Bars: **Side**
6.4 Meander Migration: **Migration**
6.5 Meander Width: **60 ft.** Rato: **3.1**
6.6 Wavelength: **160 ft.** Ratio: **8.2**

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	1 Low	0 N.S.	0 N.S.	0 N.S.	1 Low	0 N.S.	0 Unk.	0 N.S.	1 Low	1 Low	1 Low	0 N.S.	0 N.S.	0 N.S.	9

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **T3 - Sleepers River**
Topo Maps: **ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T3.04**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location

1.1 Reach Description: **Reach break at tributary north of N danville road to Reach break at VW opening ~500' upstream of Emerson Falls.**

1.2 Towns: **St. Johnsbury**

1.3 Downstream Latitude: **44.4362360523**

1.3 Downstream Longitude: **-72.0395132257**

Step 2. Stream Type

2.1 Elevation Upstream: **661**
2.1 Elevation Downstream: **640**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **3,662.8** ft. **0.69** Miles
2.3 Valley Slope: **0.6**
2.4 Channel Length: **3,987.6** ft. **0.76** Miles
2.5 Channel Slope: **0.52 %**
2.6 Sinuosity: **1.09**
2.7 Watershed Area: **42.7** Square Miles
2.8 Channel Width: **68.3** feet
2.9 Valley Width: **600.9** 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: **Sand**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **Ledge**
3.3 Dominant Geological Mat.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Hilly**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:
Field verification of stream type needed to confirm C vs E.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant Land Cover: **Forest** **73.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Field**
Current Dominant Land Cover: **Forest** **19.0** %
Current Sub-Dominant Land Cover: **Crop**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**0-25**
Sub-dominant:	**None**	**26-50**
Length w / less than 25 ft.:	**0.0** ft.	**3,109.0** 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** **0.8** %
5.3 Bank Armoring: **256.9** **6.4** %
Left: **0.0** ft. Right: **256.9** ft.
5.4 Channel Straightening: **2,681.0** **67.2** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **2,005.6** ft. **50.3**

	One Side	Both Sides
Road:	**2,005.6** 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: **425.0** ft. **0.0** ft.
6.3 Channel Bars: **Point**
6.4 Meander Migration: **None**
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: **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	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	0 N.S.	0 N.S.	17

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **T3 - Sleepers River**
Topo Maps: **ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T3.05**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Flows Along N Danville Rd from reach break at Goss Hollow Rd.**

1.1 Reach Description:
1.2 Towns: **St. Johnsbury**
1.3 Downstream Latitude: **44.4442338552**
1.3 Downstream Longitude: **-72.0453561535**

Step 2. Stream Type

2.1 Elevation Upstream: **669**
2.1 Elevation Downstream: **661**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **1,891.2** ft. **0.36** Miles
2.3 Valley Slope: **0.4**
2.4 Channel Length: **1,946.2** ft. **0.37** Miles
2.5 Channel Slope: **0.42 %**
2.6 Sinuosity: **1.03**
2.7 Watershed Area: **41.9** Square Miles
2.8 Channel Width: **67.8** feet
2.9 Valley Width: **367.8** 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: **Ledge**
3.3 Dominant Geological Mat.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **73.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Urban** **36.0** %
Current Sub-Dominant Land Cover: **Wetland**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**0-25**
Sub-dominant:	**0-25**	**51-100**
Length w / less than 25 ft.:	**306.0** ft.	**1,030.0** 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: **857.2** **44.0** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **965.3** ft. **49.6**

	One Side	Both Sides
Road:	**511.5** ft.	**453.8** 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: **944.6** ft. **0.0** ft.
6.3 Channel Bars: **Point**
6.4 Meander Migration: **Migration**
6.5 Meander Width: **192 ft.** Rato: **2.8**
6.6 Wavelength: **483 ft.** Ratio: **7.1**

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	2 High	0 N.S.	0 N.S.	0 N.S.	2 High	0 N.S.	2 High	2 High	1 Low	1 Low	2 High	1 Low	0 N.S.	0 N.S.	17

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **T3 - Sleepers River**
Topo Maps: **ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T3.06**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Flows immediately adjacent to Goss Hollow Rd to bridge.**

1.1 Reach Description:

1.2 Towns: **St. Johnsbury**

1.3 Downstream Latitude: **44.4453103611**

1.3 Downstream Longitude: **-72.0521255493**

Step 2. Stream Type

2.1 Elevation Upstream: **689**
2.1 Elevation Downstream: **669**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **1,772.0** ft. **0.34** Miles
2.3 Valley Slope: **1.1**
2.4 Channel Length: **1,772.9** ft. **0.34** Miles
2.5 Channel Slope: **1.12 %**
2.6 Sinuosity: **1.00**
2.7 Watershed Area: **40.7** Square Miles
2.8 Channel Width: **66.9** feet
2.9 Valley Width: **223.8** feet
2.10 Confinement Ratio: **3.3**
2.10 Confinement Type: **Semi-confined**
2.11 Reference Stream Type: **B**
Bedform: **Riffle-Pool**
Sub-Class Slope: **c**
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **Ledge**
3.3 Dominant Geological Mat.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Very Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Bridge is at a sharp angle to stream and is undersized.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **74.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Field**
Current Dominant Land Cover: **Urban** **44.0** %
Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**0-25**	**>100**
Sub-dominant:	**None**	**26-50**
Length w / less than 25 ft.:	**1,772.0** ft.	**76.0** ft.

4.4 Ground Water Inputs: **None**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **2** **2.5** %
5.3 Bank Armoring: **1,115.5** **62.9** %
Left: **988.0** ft. Right: **127.5** ft.
5.4 Channel Straightening: **0.0** **0.0** %
5.5 Dredging History: **Dredging**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **1,766.4** ft. **99.6**

	One Side	Both Sides
Road:	**1,497.7** ft.	**268.7** 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: **390.1** ft. **0.0** ft.
6.3 Channel Bars: **None**
6.4 Meander Migration: **None**
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
2 High	2 High	2 High	0 N.S.	0 N.S.	2 High	0 N.S.	2 High	2 High	2 High	0 N.S.	0 N.S.	0 N/A	0 N/A	0 N.S.	1 Low	15

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **T3 - Sleepers River**
Topo Maps: **ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T3.07**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Flows from reach break at Hawkins Rd to TH-8 bridge below Whiteman Bk mouth.**

1.1 Reach Description:

1.2 Towns: **Danville, St. Johnsbury**

1.3 Downstream Latitude: **44.4472626885**

1.3 Downstream Longitude: **-72.0581076278**

Step 2. Stream Type

2.1 Elevation Upstream: **717**
2.1 Elevation Downstream: **689**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **2,076.5** ft. **0.39** Miles
2.3 Valley Slope: **1.3**
2.4 Channel Length: **2,860.9** ft. **0.54** Miles
2.5 Channel Slope: **0.97 %**
2.6 Sinuosity: **1.38**
2.7 Watershed Area: **40.5** Square Miles
2.8 Channel Width: **66.8** feet
2.9 Valley Width: **565.3** feet
2.10 Confinement Ratio: **8.5**
2.10 Confinement Type: **Broad**
2.11 Reference Stream Type: **D**
Bedform: **Braided**
Sub-Class Slope: **None**
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **Yes**
3.2 Grade Control: **Ledge**
3.3 Dominant Geological Mat.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Very Steep**
3.4 Valley Slope Right: **Flat**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %

7.4 Comments:

Two large areas of erosion and deposition along road. Reach found at confluence of multiple tribs at a break in valley slope. Likely alluvial fan setting.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **74.0** %
Current Sub-Dominant Land Cover: **Crop**

4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **44.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**0-25**	**>100**
Sub-dominant:	**>100**	**26-50**
Length w / less than 25 ft.:	**1,311.0** ft.	**0.0** 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: **1,279.7** **44.7** %
Left: **1,279.7** 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: **1,940.3** ft. **67.8**

	One Side	Both Sides
Road:	**1,231.9** ft.	**708.4** 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. **298.7** 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: **261.25** ft
7.2 Bank Height: **6** 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.	0 N.S.	2 High	0 N.S.	0 N.S.	2 High	1 Low	2 High	2 High	0 N/A	0 N/A	1 Low	0 N.S.	16

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **T3 - Sleepers River**
Topo Maps: **ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T3.08**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Flows Along N Danville Rd to reach break at Hawkins Rd.**

1.1 Reach Description:
1.2 Towns: **Danville**
1.3 Downstream Latitude: **44.4490016141**
1.3 Downstream Longitude: **-72.0641879822**

Step 2. Stream Type

2.1 Elevation Upstream: **814**
2.1 Elevation Downstream: **717**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **4,721.9** ft. **0.89** Miles
2.3 Valley Slope: **2.0**
2.4 Channel Length: **5,010.6** ft. **0.95** Miles
2.5 Channel Slope: **1.93 %**
2.6 Sinuosity: **1.06**
2.7 Watershed Area: **16.9** Square Miles
2.8 Channel Width: **45.4** feet
2.9 Valley Width: **268.4** feet
2.10 Confinement Ratio: **5.9**
2.10 Confinement Type: **Narrow**
2.11 Reference Stream Type: **B**
Bedform: **Riffle-Pool**
Sub-Class Slope: **c**
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **Dam**
3.3 Dominant Geological Mat.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Very Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **70.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Urban** **34.0** %
Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**26-50**	**>100**
Sub-dominant:	**51-100**	**None**
Length w / less than 25 ft.:	**1,917.0** 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: **791.9** **15.8** %
Left: **791.9** 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: **5,010.1** ft. **100.0**

	One Side	Both Sides
Road:	**5,010.1** 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: **1,909.4** ft. **0.0** ft.
6.3 Channel Bars: **Point**
6.4 Meander Migration: **None**
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:

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.	0 N.S.	1 Low	0 N.S.	0 N.S.	2 High	2 High	1 Low	0 N.S.	0 N/A	0 N/A	0 N.S.	0 N.S.	12

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **T3 - Sleepers River**
Topo Maps: **ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T3.09**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Flows from dam below Jamieson Rd Along N Danville Rd.**

1.1 Reach Description:
1.2 Towns: **Danville**
1.3 Downstream Latitude: **44.455380988**
1.3 Downstream Longitude: **-72.0792509726**

Step 2. Stream Type

2.1 Elevation Upstream: **891**
2.1 Elevation Downstream: **814**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **3,947.8** ft. **0.75** Miles
2.3 Valley Slope: **1.9**
2.4 Channel Length: **4,105.1** ft. **0.78** Miles
2.5 Channel Slope: **1.87 %**
2.6 Sinuosity: **1.04**
2.7 Watershed Area: **15.4** Square Miles
2.8 Channel Width: **43.7** feet
2.9 Valley Width: **168.0** feet
2.10 Confinement Ratio: **3.8**
2.10 Confinement Type: **Semi-confined**
2.11 Reference Stream Type: **B**
Bedform: **Riffle-Pool**
Sub-Class Slope: **c**
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geological Mat.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Very Steep**
3.4 Valley Slope Right: **Ext. Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant Land Cover: **Forest** **71.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Urban** **30.0** %
Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**26-50**	**>100**
Sub-dominant:	**51-100**	**None**
Length w / less than 25 ft.:	**1,306.0** 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: **4,104.6** ft. **100.0**

	One Side	Both Sides
Road:	**4,104.6** 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: **272.3** ft. **0.0** ft.
6.3 Channel Bars: **Multiple**
6.4 Meander Migration: **None**
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: **299.08** ft
7.2 Bank Height: **4** 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.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	2 High	1 Low	1 Low	0 N.S.	0 N/A	0 N/A	1 Low	0 N.S.	11

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **T3 - Sleepers River**
Topo Maps: **ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T3.10**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location

1.1 Reach Description: **Confluence of North and Morrill Broosk to dam below Jamieson Rd. Reach delineated to capture area influenced by backwater and sedimentation from dam.**

1.2 Towns: **Danville**

1.3 Downstream Latitude: **44.457600849**

1.3 Downstream Longitude: **-72.0937181488**

Step 2. Stream Type

2.1 Elevation Upstream: **902**
2.1 Elevation Downstream: **891**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **579.9** ft. **0.11** Miles
2.3 Valley Slope: **1.9**
2.4 Channel Length: **607.1** ft. **0.11** Miles
2.5 Channel Slope: **1.83 %**
2.6 Sinuosity: **1.05**
2.7 Watershed Area: **14.6** Square Miles
2.8 Channel Width: **42.6** feet
2.9 Valley Width: **189.7** feet
2.10 Confinement Ratio: **4.4**
2.10 Confinement Type: **Narrow**
2.11 Reference Stream Type: **B**
Bedform: **Riffle-Pool**
Sub-Class Slope: **c**
Bed Material: **Gravel**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **Dam**
3.3 Dominant Geological Mat.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Hilly**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant Land Cover: **Forest** **72.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Urban** **50.0** %
Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**26-50**	**26-50**
Sub-dominant:	**51-100**	**51-100**
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 Run of River**
Use: **Hydro-electric**
5.2 Bridges and Culverts: **1** **4.0** %
5.3 Bank Armoring: **176.1** **29.0** %
Left: **116.1** ft. Right: **60.0** ft.
5.4 Channel Straightening: **0.0** **0.0** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **606.6** ft. **99.9**

	One Side	Both Sides
Road:	**606.6** 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: **126.4** ft. **0.0** ft.
6.3 Channel Bars: **Multiple**
6.4 Meander Migration: **None**
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:

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.	1 Low	0 N.S.	2 High	0 N.S.	0 N.S.	2 High	2 High	2 High	0 N.S.	0 N/A	0 N/A	0 N.S.	0 N.S.	13

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Badger Brook**
Topo Maps: **ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T3.10S1.01**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Morrill Bk - Flows from first reach break along Bruce Badger Hwy to confluence with North Bk**

1.1 Reach Description:
1.2 Towns: **Danville**
1.3 Downstream Latitude: **44.458013185**
1.3 Downstream Longitude: **-72.0955103141**

Step 2. Stream Type

2.1 Elevation Upstream: **928**
2.1 Elevation Downstream: **903**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **1,193.2** ft. **0.23** Miles
2.3 Valley Slope: **2.1**
2.4 Channel Length: **1,302.5** ft. **0.25** Miles
2.5 Channel Slope: **1.89 %**
2.6 Sinuosity: **1.09**
2.7 Watershed Area: **8.5** Square Miles
2.8 Channel Width: **33.5** feet
2.9 Valley Width: **176.5** feet
2.10 Confinement Ratio: **5.3**
2.10 Confinement Type: **Narrow**
2.11 Reference Stream Type: **B**
Bedform: **Riffle-Pool**
Sub-Class Slope: **c**
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geological Mat.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Hilly**
3.4 Valley Slope Right: **Very Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Morrill Bk in VHD. Field verification will be needed to confirm reference stream type given higher slope and confinement considerations.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant Land Cover: **Forest** **77.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **23.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**51-100**	**>100**
Sub-dominant:	**26-50**	**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: **None**
Use:
5.2 Bridges and Culverts: **0** **0.0** %
5.3 Bank Armoring: **133.5** **10.2** %
Left: **0.0** ft. Right: **133.5** ft.
5.4 Channel Straightening: **0.0** **0.0** %
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: **208.4** ft. **0.0** ft.
6.3 Channel Bars: **Point**
6.4 Meander Migration: **None**
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: **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
1 Low	2 High	0 N.S.	0 N.S.	0 N.S.	1 Low	0 N.S.	0 N.S.	0 Unk.	1 Low	1 Low	0 N.S.	2 High	2 High	0 N.S.	0 N.S.	10

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Badger Brook**
Topo Maps: **ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T3.10S1.02**
SGAT Version: **4.56**
Date Last Edited: **September, 25 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Morrill Bk - Short reach along Bruce Badger Hwy to the south.**

1.1 Reach Description:
1.2 Towns: **Danville**
1.3 Downstream Latitude: **44.4578520094**
1.3 Downstream Longitude: **-72.0998135759**

Step 2. Stream Type

2.1 Elevation Upstream: **937**
2.1 Elevation Downstream: **928**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **383.6** ft. **0.07** Miles
2.3 Valley Slope: **2.4**
2.4 Channel Length: **388.6** ft. **0.07** Miles
2.5 Channel Slope: **2.41 %**
2.6 Sinuosity: **1.01**
2.7 Watershed Area: **8.4** Square Miles
2.8 Channel Width: **33.4** feet
2.9 Valley Width: **178.1** feet
2.10 Confinement Ratio: **5.3**
2.10 Confinement Type: **Narrow**
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.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Morrill Bk in VHD. Field verification will be needed to confirm reference stream type given higher slope and confinement considerations.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Crop**
Current Dominant Land Cover: **Forest** **77.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **41.0** %
Current Sub-Dominant Land Cover: **Crop**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**51-100**	**>100**
Sub-dominant:	**None**	**None**
Length w / less than 25 ft.:	ft.	ft.

4.4 Ground Water Inputs: **None**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type:
Use:
5.2 Bridges and Culverts: **0** **0.0** %
5.3 Bank Armoring: **0.0** **0.0** %
Left: ft. Right: ft.
5.4 Channel Straightening: **0.0** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **0.0** ft. **0.0**

	One Side	Both Sides
Road:	ft.	ft.
Railroad:	ft.	ft.
Berm:	ft.	ft.
Improved Path:	ft.	ft.
6.2 Development:	ft.	ft.

6.3 Channel Bars: **Side**
6.4 Meander Migration: **None**
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: **0** ft
7.2 Bank Height: **0** 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	0 N.S.	0 N.D.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	1 Low	0 N.S.	2 High	2 High	0 N.S.	0 N.S.	6

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Badger Brook**
Topo Maps: **ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T3.10S1.03**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Morrill Bk - Confluence of Badger and Morrill to reach break along Bruce Badger Hwy.orrill and Badger Brook**

1.1 Reach Description:

1.2 Towns: **Danville**

1.3 Downstream Latitude: **44.4570055403**

1.3 Downstream Longitude: **-72.100601271**

Step 2. Stream Type

2.1 Elevation Upstream: **1,034**
2.1 Elevation Downstream: **937**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **2,816.0** ft. **0.53** Miles
2.3 Valley Slope: **3.4**
2.4 Channel Length: **3,347.3** ft. **0.63** Miles
2.5 Channel Slope: **2.89 %**
2.6 Sinuosity: **1.19**
2.7 Watershed Area: **8.4** Square Miles
2.8 Channel Width: **33.4** feet
2.9 Valley Width: **190.0** feet
2.10 Confinement Ratio: **5.7**
2.10 Confinement Type: **Narrow**
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.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Hilly**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %

7.4 Comments:

Morrill Bk in VHD - VW width estimated from HydroDEM contours.
Mass Failure on RB immediately downstream of road crossing - looked very fresh and active, 25"" tall and ~30-40"" wide.
Bank erosion ~6" along long stretch of RB visible from road

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **77.0** %
Current Sub-Dominant Land Cover: **Crop**

4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **46.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**51-100**	**>100**
Sub-dominant:	**0-25**	**None**
Length w / less than 25 ft.:	**1,049.0** 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** **1.2** %
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: **1,207.4** ft. **36.1**

	One Side	Both Sides
Road:	**1,207.4** 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: **15.2** ft. **0.0** ft.
6.3 Channel Bars: **Multiple**
6.4 Meander Migration: **None**
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: **509.48** ft
7.2 Bank Height: **6** 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	1 Low	2 High	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	2 High	0 N.S.	2 High	0 N.S.	0 N/A	0 N/A	1 Low	0 N.S.	9

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Badger Brook**
Topo Maps: **JOES POND, ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T3.10S1.04**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Badger Brook - from McDowell Rd to Bruce Badger Hwy.**

1.1 Reach Description:

1.2 Towns: **Danville**

1.3 Downstream Latitude: **44.459151291**

1.3 Downstream Longitude: **-72.1102476661**

Step 2. Stream Type

2.1 Elevation Upstream: **1,178**
2.1 Elevation Downstream: **1,034**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **5,869.9** ft. **1.11** Miles
2.3 Valley Slope: **2.5**
2.4 Channel Length: **6,389.6** ft. **1.21** Miles
2.5 Channel Slope: **2.26 %**
2.6 Sinuosity: **1.09**
2.7 Watershed Area: **2.7** Square Miles
2.8 Channel Width: **20.3** feet
2.9 Valley Width: **120.0** feet
2.10 Confinement Ratio: **5.9**
2.10 Confinement Type: **Narrow**
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.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Hilly**
3.4 Valley Slope Right: **Hilly**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Badger Bk in VHD - VW were reduced from SGAT derived 225ftto 120ft based on HydroDEM contours. Field verification will be needed to confirm reference stream type given higher slope and confinement considerations.

No meanders were visible from VHD, no encroachment so meander impact categories were set to NA

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant Land Cover: **Forest** **75.0** %
Current Sub-Dominant Land Cover: **Field**

4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **46.0** %
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.	**372.0** 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** **0.5** %
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: **66.3** ft. **1.0**

	One Side	Both Sides
Road:	**66.3** 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: **234.3** ft. **0.0** ft.
6.3 Channel Bars: **No Data**
6.4 Meander Migration: **Migration**
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:

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.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	1 Low	0 N/A	0 N/A	0 N.S.	0 N.S.	4

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Badger Brook**
Topo Maps: **JOES POND**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T3.10S1.05**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Badger Bk - From Fellows Rd to McDowell Rd.**

1.1 Reach Description:
1.2 Towns: **Danville**
1.3 Downstream Latitude: **44.4687923707**
1.3 Downstream Longitude: **-72.1263481501**

Step 2. Stream Type

2.1 Elevation Upstream: **1,549**
2.1 Elevation Downstream: **1,178**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **5,650.0** ft. **1.07** Miles
2.3 Valley Slope: **6.6**
2.4 Channel Length: **6,115.6** ft. **1.16** Miles
2.5 Channel Slope: **6.06 %**
2.6 Sinuosity: **1.08**
2.7 Watershed Area: **1.3** Square Miles
2.8 Channel Width: **14.8** feet
2.9 Valley Width: **50.0** feet
2.10 Confinement Ratio: **3.4**
2.10 Confinement Type: **Semi-confined**
2.11 Reference Stream Type: **A**
Bedform: **Step-Pool**
Sub-Class Slope: **None**
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **Dam**
3.3 Dominant Geological Mat.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Hilly**
3.4 Valley Slope Right: **Hilly**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Badger Brook in VHD - VW width was manually measured based on HydroDEM contours

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **86.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **49.0** %
Current Sub-Dominant Land Cover: **Field**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**None**	**26-50**
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: **Small Run of River**
Use: **Recreation**
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: **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: **Mid-channel**
6.4 Meander Migration: **None**
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:

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	0 N.S.	1 Low	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 Unk.	0 N.S.	1 Low	0 N.S.	0 N/A	0 N/A	0 N.S.	0 N.S.	4

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Morrill Brook**
Topo Maps: **ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T3.10S1.3s1.01**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Morrill Bk - Reach break at Cormier Rd to confluence with Badger Bk.**

1.1 Reach Description:
1.2 Towns: **Danville**
1.3 Downstream Latitude: **44.4584456665**
1.3 Downstream Longitude: **-72.1099739195**

Step 2. Stream Type

2.1 Elevation Upstream: **1,163**
2.1 Elevation Downstream: **1,011**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **4,109.8** ft. **0.78** Miles
2.3 Valley Slope: **3.7**
2.4 Channel Length: **4,806.8** ft. **0.91** Miles
2.5 Channel Slope: **3.15 %**
2.6 Sinuosity: **1.17**
2.7 Watershed Area: **5.2** Square Miles
2.8 Channel Width: **27.1** feet
2.9 Valley Width: **100.0** feet
2.10 Confinement Ratio: **3.7**
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: **None**
3.3 Dominant Geological Mat.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Very Steep**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

VW were reduced from SGAT derived 219ft to 100ft based on range finder measurements in the field.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant Land Cover: **Forest** **82.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **45.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**51-100**	**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: **None**
Use:
5.2 Bridges and Culverts: **0** **0.0** %
5.3 Bank Armoring: **39.0** **0.8** %
Left: **39.0** 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: **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: **No Data**
6.4 Meander Migration: **None**
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:

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.	0 Unk.	0 N.S.	0 N.S.	0 N.S.	0 N/A	0 N/A	0 N.S.	0 N.S.	1

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Morrill Brook**
Topo Maps: **JOES POND, ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T3.10S1.3s1.02**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Morrill Bk - Flows along north side of Bruce Badger Hwy to reach break at Cormier Rd.**

1.1 Reach Description:
1.2 Towns: **Danville**
1.3 Downstream Latitude: **44.4561120818**
1.3 Downstream Longitude: **-72.1242878587**

Step 2. Stream Type

2.1 Elevation Upstream: **1,339**
2.1 Elevation Downstream: **1,163**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **4,789.9** ft. **0.91** Miles
2.3 Valley Slope: **3.7**
2.4 Channel Length: **5,590.8** ft. **1.06** Miles
2.5 Channel Slope: **3.15 %**
2.6 Sinuosity: **1.17**
2.7 Watershed Area: **4.6** Square Miles
2.8 Channel Width: **25.7** feet
2.9 Valley Width: **100.0** feet
2.10 Confinement Ratio: **3.9**
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: **None**
3.3 Dominant Geological Mat.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Very Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:
NULL

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **83.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **38.0** %
Current Sub-Dominant Land Cover: **Crop**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**0-25**	**0-25**
Length w / less than 25 ft.:	**130.0** ft.	**283.0** ft.

4.4 Ground Water Inputs: **None**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **1** **0.5** %
5.3 Bank Armoring: **200.9** **3.6** %
Left: **200.9** 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: **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: **203.5** ft. **0.0** ft.
6.3 Channel Bars: **No Data**
6.4 Meander Migration: **None**
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:

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.	0 N.S.	0 N.S.	0 N.S.	0 Unk.	0 N.S.	0 N.S.	0 N.S.	0 N/A	0 N/A	0 N.S.	0 N.S.	3

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **T3 - Sleepers River**
Topo Maps: **ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T3.11**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location

1.1 Reach Description: **North Bk - Confluence with Pope Brook along N Church Rd and McReynolds Rd to confluence with Morrill Bkurch Rd**

1.2 Towns: **Danville**

1.3 Downstream Latitude: **44.4581651372**

1.3 Downstream Longitude: **-72.0957010337**

Step 2. Stream Type

2.1 Elevation Upstream: **969**
2.1 Elevation Downstream: **902**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **4,982.1** ft. **0.94** Miles
2.3 Valley Slope: **1.3**
2.4 Channel Length: **5,661.1** ft. **1.07** Miles
2.5 Channel Slope: **1.19 %**
2.6 Sinuosity: **1.14**
2.7 Watershed Area: **6.1** Square Miles
2.8 Channel Width: **29.1** feet
2.9 Valley Width: **285.0** feet
2.10 Confinement Ratio: **9.8**
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.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Hilly**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:
North Bk in VHD

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Crop**
Current Dominant Land Cover: **Forest** **65.0** %
Current Sub-Dominant Land Cover: **Field**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **22.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**26-50**	**26-50**
Length w / less than 25 ft.:	**952.0** ft.	**911.0** 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: **3** **1.2** %
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: **503.0** ft. **8.9**

	One Side	Both Sides
Road:	**503.0** 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: **1,030.2** ft. **0.0** ft.
6.3 Channel Bars: **Point**
6.4 Meander Migration: **Migration**
6.5 Meander Width: **132 ft.** Rato: **4.5**
6.6 Wavelength: **361 ft.** Ratio: **12.4**

Step 7. Windshield Survey

7.1 Bank Erosion: **177.47** ft
7.2 Bank Height: **6** 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.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	1 Low	1 Low	1 Low	1 Low	1 Low	0 N.S.	0 N.S.	0 N.S.	11

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **North Brook**
Topo Maps: **ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T3.11S1.01**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **North Bk - Reach break 1500' west of N Church rd to confluence with Pope Bk.**

1.1 Reach Description:

1.2 Towns: **Danville**

1.3 Downstream Latitude: **44.468948329**

1.3 Downstream Longitude: **-72.105449726**

Step 2. Stream Type

2.1 Elevation Upstream: **1,080**
2.1 Elevation Downstream: **968**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **4,208.9** ft. **0.80** Miles
2.3 Valley Slope: **2.7**
2.4 Channel Length: **4,635.2** ft. **0.88** Miles
2.5 Channel Slope: **2.42 %**
2.6 Sinuosity: **1.10**
2.7 Watershed Area: **1.7** Square Miles
2.8 Channel Width: **16.5** feet
2.9 Valley Width: **221.6** 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: **Gravel**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **Dam**
3.3 Dominant Geological Mat.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Hilly**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:
NULL

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant Land Cover: **Forest** **60.0** %
Current Sub-Dominant Land Cover: **Field**
4.2 Corridor
Historic Land Cover:: **Field**
Current Dominant Land Cover: **Forest** **52.0** %
Current Sub-Dominant Land Cover: **Crop**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**None**	**None**
Length w / less than 25 ft.:	**0.0** ft.	**343.0** 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** **0.4** %
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: **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: **None**
6.5 Meander Width: **92 ft.** Rato: **5.6**
6.6 Wavelength: **181 ft.** Ratio: **11.0**

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	1 Low	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.S.	0 N.S.	6

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **T3 - Sleepers River**
Topo Maps: **ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T3.12**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Pope Bk - Reach break north of McReynolds Rd to confluence with North Brook.**

1.1 Reach Description:
1.2 Towns: **Danville**
1.3 Downstream Latitude: **44.4690374084**
1.3 Downstream Longitude: **-72.1058097921**

Step 2. Stream Type

2.1 Elevation Upstream: **1,038**
2.1 Elevation Downstream: **969**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **2,066.3** ft. **0.39** Miles
2.3 Valley Slope: **3.4**
2.4 Channel Length: **2,264.1** ft. **0.43** Miles
2.5 Channel Slope: **3.06 %**
2.6 Sinuosity: **1.10**
2.7 Watershed Area: **3.8** Square Miles
2.8 Channel Width: **23.7** feet
2.9 Valley Width: **140.0** feet
2.10 Confinement Ratio: **5.9**
2.10 Confinement Type: **Narrow**
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: **None**
3.3 Dominant Geological Mat.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Pope Bk in VHD - VW were reduced from SGAT derived 341''''''' to 140''''''' based on HydroDEM contours

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **73.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **64.0** %
Current Sub-Dominant Land Cover: **Crop**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**None**	**None**
Length w / less than 25 ft.:	**0.0** ft.	**250.0** 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: **0.0** **0.0** %
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: **No Data**
6.4 Meander Migration: **None**
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:

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	1 Low	1 Low	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N/A	0 N/A	0 N.S.	0 N.S.	4

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **T3 - Sleepers River**
Topo Maps: **ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T3.13**
SGAT Version: **4.56**
Date Last Edited: **September, 25 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Pope Bk - reach break at McDowell Rd to reach break north of McReynolds Rd.**

1.1 Reach Description:
1.2 Towns: **Danville**
1.3 Downstream Latitude: **44.4714340912**
1.3 Downstream Longitude: **-72.1128411579**

Step 2. Stream Type

2.1 Elevation Upstream: **1,142**
2.1 Elevation Downstream: **1,038**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **3,273.5** ft. **0.62** Miles
2.3 Valley Slope: **3.2**
2.4 Channel Length: **3,404.1** ft. **0.64** Miles
2.5 Channel Slope: **3.06 %**
2.6 Sinuosity: **1.04**
2.7 Watershed Area: **3.7** Square Miles
2.8 Channel Width: **23.3** feet
2.9 Valley Width: **135.0** feet
2.10 Confinement Ratio: **5.8**
2.10 Confinement Type: **Narrow**
2.11 Reference Stream Type: **B**
Bedform: **Step-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.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Hilly**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Pope Bk in VHD - VW were reduced from SGAT derived 262ft to 135ft based on HydroDEM contours

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **74.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **57.0** %
Current Sub-Dominant Land Cover: **Crop**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**None**	**None**
Length w / less than 25 ft.:	ft.	ft.

4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type:
Use:
5.2 Bridges and Culverts: **0** **0.0** %
5.3 Bank Armoring: **0.0** **0.0** %
Left: ft. Right: ft.
5.4 Channel Straightening: **0.0** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **0.0** ft. **0.0**

	One Side	Both Sides
Road:	ft.	ft.
Railroad:	ft.	ft.
Berm:	ft.	ft.
Improved Path:	ft.	ft.

6.2 Development: ft. ft.
6.3 Channel Bars: **No Data**
6.4 Meander Migration: **None**
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: **0** 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	0 N.S.	0 N.D.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N/A	0 N/A	0 N.S.	0 N.S.	2

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **T3 - Sleepers River**
Topo Maps: **JOES POND, ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T3.14**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Pope Bk - Reach break upstream of unnamed tributary to reach break at Pope Brook Rd/McDowell Rd.**

1.1 Reach Description:
1.2 Towns: **Danville**
1.3 Downstream Latitude: **44.4757242053**
1.3 Downstream Longitude: **-72.1234458441**

Step 2. Stream Type

2.1 Elevation Upstream: **1,186**
2.1 Elevation Downstream: **1,142**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **1,195.5** ft. **0.23** Miles
2.3 Valley Slope: **3.6**
2.4 Channel Length: **1,224.1** ft. **0.23** Miles
2.5 Channel Slope: **3.54 %**
2.6 Sinuosity: **1.02**
2.7 Watershed Area: **3.4** Square Miles
2.8 Channel Width: **22.4** feet
2.9 Valley Width: **100.0** feet
2.10 Confinement Ratio: **4.5**
2.10 Confinement Type: **Narrow**
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: **Dam**
3.3 Dominant Geological Mat.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Pope Bk in VHD - VW were reduced from SGAT derived 180ft to 100ft based on range finder measurements in the field. Reach is short and impacted by a USGS weir upstream of the road crossing.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **75.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **45.0** %
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** **2.0** %
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: **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: **None**
6.4 Meander Migration: **None**
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:

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	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 Unk.	0 N.S.	0 N.S.	0 N.S.	0 N/A	0 N/A	0 N.S.	0 N.S.	2

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **T3 - Sleepers River**
Topo Maps: **JOES POND**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T3.15**
SGAT Version: **4.56**
Date Last Edited: **September, 25 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location

1.1 Reach Description: **Pope Bk - Reach break 1000' north of Coles Pond Rd to reach break 500' upstream of confluence with small trib w/ USGS weir, 800' upstream of weir on Pope**

1.2 Towns: **Danville**

1.3 Downstream Latitude: **44.4767173999**

1.3 Downstream Longitude: **-72.1276232087**

Step 2. Stream Type

2.1 Elevation Upstream: **1,341**
2.1 Elevation Downstream: **1,186**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **3,860.8** ft. **0.73** Miles
2.3 Valley Slope: **4.0**
2.4 Channel Length: **4,093.7** ft. **0.78** Miles
2.5 Channel Slope: **3.79 %**
2.6 Sinuosity: **1.06**
2.7 Watershed Area: **2.1** Square Miles
2.8 Channel Width: **18.1** feet
2.9 Valley Width: **80.0** feet
2.10 Confinement Ratio: **4.4**
2.10 Confinement Type: **Narrow**
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: **None**
3.3 Dominant Geological Mat.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %

7.4 Comments:
Pope Bk in VHD - VW width reduced from SGAT derived 234ft to 80ft based on range finder measurements taken in the field.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant Land Cover: **Forest** **80.0** %
Current Sub-Dominant Land Cover: **Crop**

4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **73.0** %
Current Sub-Dominant Land Cover: **Crop**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**None**	**None**
Length w / less than 25 ft.:	ft.	ft.

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type:
Use:
5.2 Bridges and Culverts: **0** **0.0** %
5.3 Bank Armoring: **0.0** **0.0** %
Left: ft. Right: ft.
5.4 Channel Straightening: **0.0** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **0.0** ft. **0.0**

	One Side	Both Sides
Road:	ft.	ft.
Railroad:	ft.	ft.
Berm:	ft.	ft.
Improved Path:	ft.	ft.

6.2 Development: ft. ft.
6.3 Channel Bars: **No Data**
6.4 Meander Migration: **None**
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: **0** 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	0 N.S.	0 N.D.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N/A	0 N/A	0 N.S.	0 N.S.	1

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Whiteman Brook**
Topo Maps: **ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T3.7S1.01**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Reach break at end of Roy Rd to confluence with Sleepers River**

1.1 Reach Description:

1.2 Towns: **Danville, St. Johnsbury**

1.3 Downstream Latitude: **44.4480737862**

1.3 Downstream Longitude: **-72.0598219112**

Step 2. Stream Type

2.1 Elevation Upstream: **825**
2.1 Elevation Downstream: **692**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **3,208.6** ft. **0.61** Miles
2.3 Valley Slope: **4.1**
2.4 Channel Length: **3,647.0** ft. **0.69** Miles
2.5 Channel Slope: **3.64 %**
2.6 Sinuosity: **1.14**
2.7 Watershed Area: **6.6** Square Miles
2.8 Channel Width: **30.1** feet
2.9 Valley Width: **252.0** feet
2.10 Confinement Ratio: **8.4**
2.10 Confinement Type: **Broad**
2.11 Reference Stream Type: **B**
Bedform: **Step-Pool**
Sub-Class Slope:
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **Multiple**
3.3 Dominant Geological Mat.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Hilly**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %

7.4 Comments:

Slope is highly variable in this reach. There is an alluvial fan setting at the downstream end. The middle and upper portions of the reach are steeper and more confined, and there is a bedrock cascade above the dam. Average slope is high for the reach, and Cb was picked to best represent the channel geometry. Segmentation likely in Ph2.

Field verification will be needed to confirm reference stream type given hig

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **65.0** %
Current Sub-Dominant Land Cover: **Crop**

4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Urban** **40.0** %
Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**51-100**	**>100**
Sub-dominant:	**0-25**	**26-50**
Length w / less than 25 ft.:	**335.0** ft.	**0.0** 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** **1.6** %
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: **3,077.5** ft. **84.4**

	One Side	Both Sides
Road:	**3,077.5** 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: **738.3** ft. **0.0** ft.
6.3 Channel Bars: **Multiple**
6.4 Meander Migration: **None**
6.5 Meander Width: **30 ft.** Rato: **1.0**
6.6 Wavelength: **30 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:

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	1 Low	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	2 High	2 High	2 High	0 N.S.	2 High	2 High	0 N.S.	0 N.S.	15

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Whiteman Brook**
Topo Maps: **ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T3.7S1.02**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Flows along Rt 2 to the south to reach break at Roy Rd.**

1.1 Reach Description:
1.2 Towns: **Danville**
1.3 Downstream Latitude: **44.4417384079**
1.3 Downstream Longitude: **-72.066640174**

Step 2. Stream Type

2.1 Elevation Upstream: **880**
2.1 Elevation Downstream: **825**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **1,931.8** ft. **0.37** Miles
2.3 Valley Slope: **2.9**
2.4 Channel Length: **2,104.9** ft. **0.40** Miles
2.5 Channel Slope: **2.63 %**
2.6 Sinuosity: **1.09**
2.7 Watershed Area: **6.3** Square Miles
2.8 Channel Width: **29.5** feet
2.9 Valley Width: **286.6** feet
2.10 Confinement Ratio: **9.7**
2.10 Confinement Type: **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.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Hilly**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Field verification will be needed to confirm reference stream type given higher slope and confinement considerations.
Avulsion visible from historic imagery

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **66.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **36.0** %
Current Sub-Dominant Land Cover: **Crop**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**None**	**26-50**
Length w / less than 25 ft.:	**0.0** ft.	**419.0** ft.

4.4 Ground Water Inputs: **None**

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: **416.0** **19.8** %
Left: **0.0** ft. Right: **416.0** ft.
5.4 Channel Straightening: **562.7** **26.7** %
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: **Point**
6.4 Meander Migration: **Avulsion**
6.5 Meander Width: **216 ft.** Rato: **7.3**
6.6 Wavelength: **470 ft.** Ratio: **15.9**

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	1 Low	0 N.S.	0 N.S.	1 Low	2 High	0 N.S.	0 Unk.	0 N.S.	1 Low	1 Low	0 N.S.	1 Low	0 N.S.	0 N.S.	11

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Whiteman Brook**
Topo Maps: **ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T3.7S1.03**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Flows along Rt 2 from reach break downstream of Rt2 crossing.**

1.1 Reach Description:
1.2 Towns: **Danville**
1.3 Downstream Latitude: **44.4386731279**
1.3 Downstream Longitude: **-72.0724718092**

Step 2. Stream Type

2.1 Elevation Upstream: **888**
2.1 Elevation Downstream: **880**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **2,135.4** ft. **0.40** Miles
2.3 Valley Slope: **0.4**
2.4 Channel Length: **2,520.9** ft. **0.48** Miles
2.5 Channel Slope: **0.30 %**
2.6 Sinuosity: **1.18**
2.7 Watershed Area: **6.1** Square Miles
2.8 Channel Width: **24.0** feet
2.9 Valley Width: **533.1** feet
2.10 Confinement Ratio: **22.2**
2.10 Confinement Type: **Very Broad**
2.11 Reference Stream Type: **E**
Bedform: **Dune-Ripple**
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.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Hilly**
3.4 Valley Slope Right: **Hilly**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:
NULL

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **66.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **28.0** %
Current Sub-Dominant Land Cover: **Wetland**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**None**	**26-50**
Length w / less than 25 ft.:	**0.0** ft.	**0.0** 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: **0.0** **0.0** %
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: **Migration**
6.5 Meander Width: **96 ft.** Rato: **4.0**
6.6 Wavelength: **225 ft.** Ratio: **9.4**

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.	0 N.S.	0 N.S.	0 N.S.	0 Unk.	0 N.S.	1 Low	1 Low	1 Low	0 N.S.	0 N.S.	0 N.S.	7

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Whiteman Brook**
Topo Maps: **ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T3.7S1.04**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Reach break at Trestle Rd to reach break at Rt 2.**

1.1 Reach Description:
1.2 Towns: **Danville**
1.3 Downstream Latitude: **44.4355728912**
1.3 Downstream Longitude: **-72.0783899197**

Step 2. Stream Type

2.1 Elevation Upstream: **916**
2.1 Elevation Downstream: **888**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **3,428.1** ft. **0.65** Miles
2.3 Valley Slope: **0.8**
2.4 Channel Length: **4,146.6** ft. **0.79** Miles
2.5 Channel Slope: **0.69 %**
2.6 Sinuosity: **1.21**
2.7 Watershed Area: **3.3** Square Miles
2.8 Channel Width: **18.0** feet
2.9 Valley Width: **514.2** feet
2.10 Confinement Ratio: **28.6**
2.10 Confinement Type: **Very Broad**
2.11 Reference Stream Type: **E**
Bedform: **Dune-Ripple**
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.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Flat**
3.4 Valley Slope Right: **Hilly**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:
NULL

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **64.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Wetland**
Current Dominant Land Cover: **Forest** **42.0** %
Current Sub-Dominant Land Cover: **Wetland**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**26-50**	**26-50**
Length w / less than 25 ft.:	**0.0** ft.	**0.0** 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** **3.9** %
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: **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: **Migration**
6.5 Meander Width: **84 ft.** Rato: **4.7**
6.6 Wavelength: **206 ft.** Ratio: **11.4**

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	1 Low	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 Unk.	0 N.S.	1 Low	1 Low	1 Low	0 N.S.	0 N.S.	0 N.S.	6

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Whiteman Brook**
Topo Maps: **ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T3.7S1.05**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Reach break south of Parker Rd to reach break atTrestle rd crossing.**

1.1 Reach Description:
1.2 Towns: **Danville**
1.3 Downstream Latitude: **44.4285712782**
1.3 Downstream Longitude: **-72.0844128483**

Step 2. Stream Type

2.1 Elevation Upstream: **1,002**
2.1 Elevation Downstream: **916**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **3,182.7** ft. **0.60** Miles
2.3 Valley Slope: **2.7**
2.4 Channel Length: **3,245.7** ft. **0.61** Miles
2.5 Channel Slope: **2.63 %**
2.6 Sinuosity: **1.02**
2.7 Watershed Area: **2.7** Square Miles
2.8 Channel Width: **20.4** feet
2.9 Valley Width: **114.3** feet
2.10 Confinement Ratio: **5.6**
2.10 Confinement Type: **Narrow**
2.11 Reference Stream Type: **B**
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.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Ext. Steep**
3.4 Valley Slope Right: **Ext. Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:
NULL

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **69.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **26.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**26-50**	**26-50**
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: **2** **1.5** %
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: **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: **None**
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:

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.	0 Unk.	0 N.S.	1 Low	0 N.S.	0 N/A	0 N/A	0 N.S.	0 N.S.	5

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Whiteman Brook**
Topo Maps: **ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T3.7S1.06**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Flows along Parker Rd from reach break below Rt 2.**

1.1 Reach Description:
1.2 Towns: **Danville**
1.3 Downstream Latitude: **44.4289838096**
1.3 Downstream Longitude: **-72.0958727546**

Step 2. Stream Type

2.1 Elevation Upstream: **1,099**
2.1 Elevation Downstream: **1,002**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **3,431.2** ft. **0.65** Miles
2.3 Valley Slope: **2.8**
2.4 Channel Length: **4,246.0** ft. **0.80** Miles
2.5 Channel Slope: **2.28 %**
2.6 Sinuosity: **1.24**
2.7 Watershed Area: **2.3** Square Miles
2.8 Channel Width: **19.0** feet
2.9 Valley Width: **201.7** feet
2.10 Confinement Ratio: **10.6**
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.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Hilly**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:
NULL

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **70.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **49.0** %
Current Sub-Dominant Land Cover: **Crop**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**0-25**	**0-25**
Length w / less than 25 ft.:	**990.0** ft.	**1,233.0** 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** **0.7** %
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: **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: **Point**
6.4 Meander Migration: **Migration**
6.5 Meander Width: **69 ft.** Rato: **3.6**
6.6 Wavelength: **204 ft.** Ratio: **10.7**

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	2 High	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 Unk.	0 N.S.	1 Low	1 Low	1 Low	0 N.S.	0 N.S.	0 N.S.	9

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Whiteman Brook**
Topo Maps: **ST. JOHNSBURY**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T3.7S1.07**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Reach break west of Cormier rd to reach break at Rt 2.**

1.1 Reach Description:
1.2 Towns: **Danville**
1.3 Downstream Latitude: **44.4269332871**
1.3 Downstream Longitude: **-72.1062891299**

Step 2. Stream Type

2.1 Elevation Upstream: **1,224**
2.1 Elevation Downstream: **1,099**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **3,793.4** ft. **0.72** Miles
2.3 Valley Slope: **3.3**
2.4 Channel Length: **4,545.1** ft. **0.86** Miles
2.5 Channel Slope: **2.76 %**
2.6 Sinuosity: **1.20**
2.7 Watershed Area: **1.5** Square Miles
2.8 Channel Width: **15.8** feet
2.9 Valley Width: **250.5** feet
2.10 Confinement Ratio: **15.8**
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.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Hilly**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:
NULL

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant Land Cover: **Forest** **73.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **38.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**26-50**	**51-100**
Length w / less than 25 ft.:	**198.0** ft.	**171.0** 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** **4.8** %
5.3 Bank Armoring: **191.6** **4.2** %
Left: **191.6** 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: **225.1** ft. **5.0**

	One Side	Both Sides
Road:	**225.1** 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: **623.3** ft. **0.0** ft.
6.3 Channel Bars: **Point**
6.4 Meander Migration: **None**
6.5 Meander Width: **106 ft.** Rato: **6.7**
6.6 Wavelength: **241 ft.** Ratio: **15.2**

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	1 Low	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	1 Low	1 Low	0 N.S.	0 N.S.	1 Low	0 N.S.	0 N.S.	8

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Sheldon Brook**
Topo Maps: **BURKE MOUNTAIN**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T4.01**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Reach break upstream of Severance Hill Rd to confluence with Passumpsic River.**

1.1 Reach Description:
1.2 Towns: **Lyndon**
1.3 Downstream Latitude: **44.5056893466**
1.3 Downstream Longitude: **-71.9905585984**

Step 2. Stream Type

2.1 Elevation Upstream: **735**
2.1 Elevation Downstream: **662**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **3,565.0** ft. **0.68** Miles
2.3 Valley Slope: **2.1**
2.4 Channel Length: **3,783.5** ft. **0.72** Miles
2.5 Channel Slope: **1.93 %**
2.6 Sinuosity: **1.06**
2.7 Watershed Area: **11.4** Square Miles
2.8 Channel Width: **38.3** feet
2.9 Valley Width: **445.0** feet
2.10 Confinement Ratio: **11.6**
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.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Hilly**
3.4 Valley Slope Right: **Flat**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant Land Cover: **Forest** **70.0** %
Current Sub-Dominant Land Cover: **Field**
4.2 Corridor
Historic Land Cover:: **Field**
Current Dominant Land Cover: **Forest** **44.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**26-50**	**51-100**
Sub-dominant:	**0-25**	**0-25**
Length w / less than 25 ft.:	**1,010.0** ft.	**455.0** 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** **1.6** %
5.3 Bank Armoring: **300.0** **7.9** %
Left: **110.0** ft. Right: **190.1** ft.
5.4 Channel Straightening: **2,256.7** **59.6** %
5.5 Dredging History: **Dredging**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **587.7** ft. **15.5**

	One Side	Both Sides
Road:	**587.7** 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: **740.3** ft. **0.0** ft.
6.3 Channel Bars: **Point**
6.4 Meander Migration: **None**
6.5 Meander Width: **38 ft.** Rato: **1.0**
6.6 Wavelength: **38 ft.** Ratio: **1.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **194.29** ft
7.2 Bank Height: **6** 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.	0 N.S.	1 Low	2 High	2 High	1 Low	1 Low	1 Low	0 N.S.	2 High	2 High	1 Low	0 N.S.	19

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Sheldon Brook**
Topo Maps: **BURKE MOUNTAIN**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T4.02**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Confluence of Hawkins and Sheldon Brooks to reach break along Red Village Rd.**

1.1 Reach Description:
1.2 Towns: **Lyndon**
1.3 Downstream Latitude: **44.5041181155**
1.3 Downstream Longitude: **-71.9785517388**

Step 2. Stream Type

2.1 Elevation Upstream: **808**
2.1 Elevation Downstream: **735**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **2,540.9** ft. **0.48** Miles
2.3 Valley Slope: **2.9**
2.4 Channel Length: **2,652.9** ft. **0.50** Miles
2.5 Channel Slope: **2.74 %**
2.6 Sinuosity: **1.04**
2.7 Watershed Area: **11.1** Square Miles
2.8 Channel Width: **37.8** feet
2.9 Valley Width: **193.6** feet
2.10 Confinement Ratio: **5.1**
2.10 Confinement Type: **Narrow**
2.11 Reference Stream Type: **B**
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.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Ext. Steep**
3.4 Valley Slope Right: **Very Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **70.0** %
Current Sub-Dominant Land Cover: **Field**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Urban** **34.0** %
Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**26-50**
Sub-dominant:	**51-100**	**0-25**
Length w / less than 25 ft.:	**0.0** ft.	**172.0** ft.

4.4 Ground Water Inputs: **None**

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: **459.7** **17.3** %
Left: **0.0** ft. Right: **459.7** ft.
5.4 Channel Straightening: **0.0** **0.0** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **2,231.4** ft. **84.1**

	One Side	Both Sides
Road:	**2,231.4** 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: **1,568.0** ft. **0.0** ft.
6.3 Channel Bars: **Point**
6.4 Meander Migration: **None**
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:

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	1 Low	0 N.S.	0 N.S.	1 Low	0 N.S.	0 N.S.	2 High	2 High	1 Low	0 N.S.	0 N/A	0 N/A	0 N.S.	0 N.S.	11

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Sheldon Brook**
Topo Maps: **BURKE MOUNTAIN**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T4.03**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Hawkins Brook - Reach break east of Red Village Rd to confluence with Sheldon Brook.**

1.1 Reach Description:
1.2 Towns: **Lyndon**
1.3 Downstream Latitude: **44.5059744195**
1.3 Downstream Longitude: **-71.9699185861**

Step 2. Stream Type

2.1 Elevation Upstream: **908**
2.1 Elevation Downstream: **808**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **4,856.4** ft. **0.92** Miles
2.3 Valley Slope: **2.1**
2.4 Channel Length: **5,597.6** ft. **1.06** Miles
2.5 Channel Slope: **1.78 %**
2.6 Sinuosity: **1.15**
2.7 Watershed Area: **9.6** Square Miles
2.8 Channel Width: **35.5** feet
2.9 Valley Width: **308.0** feet
2.10 Confinement Ratio: **8.7**
2.10 Confinement Type: **Broad**
2.11 Reference Stream Type: **B**
Bedform: **Riffle-Pool**
Sub-Class Slope: **c**
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geological Mat.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Hilly**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant Land Cover: **Forest** **73.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **32.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**51-100**	**51-100**
Length w / less than 25 ft.:	**0.0** ft.	**341.0** 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** **1.5** %
5.3 Bank Armoring: **371.3** **6.6** %
Left: **371.3** 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: **891.2** ft. **15.9**

	One Side	Both Sides
Road:	**891.2** 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: **701.2** ft. **0.0** ft.
6.3 Channel Bars: **Point**
6.4 Meander Migration: **None**
6.5 Meander Width: **128 ft.** Rato: **3.6**
6.6 Wavelength: **307 ft.** Ratio: **8.7**

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	1 Low	0 N.S.	0 N.S.	1 Low	0 N.S.	0 N.S.	1 Low	1 Low	1 Low	0 N.S.	1 Low	0 N.S.	0 N.S.	0 N.S.	10

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Sheldon Brook**
Topo Maps: **BURKE MOUNTAIN**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T4.04**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Reach break at Red Village rd and Charlies Path to reach break east of Red Village Rd.**

1.1 Reach Description:
1.2 Towns: **Lyndon**
1.3 Downstream Latitude: **44.5150195942**
1.3 Downstream Longitude: **-71.9588742088**

Step 2. Stream Type

2.1 Elevation Upstream: **985**
2.1 Elevation Downstream: **908**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **3,930.0** ft. **0.74** Miles
2.3 Valley Slope: **2.0**
2.4 Channel Length: **4,700.0** ft. **0.89** Miles
2.5 Channel Slope: **1.65 %**
2.6 Sinuosity: **1.20**
2.7 Watershed Area: **7.4** Square Miles
2.8 Channel Width: **31.6** feet
2.9 Valley Width: **415.0** feet
2.10 Confinement Ratio: **13.2**
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.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Flat**
3.4 Valley Slope Right: **Hilly**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:
VW width measured using HydroDEM contours.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant Land Cover: **Forest** **72.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **36.0** %
Current Sub-Dominant Land Cover: **Field**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**51-100**	**51-100**
Sub-dominant:	**26-50**	**26-50**
Length w / less than 25 ft.:	**0.0** ft.	**329.0** 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** **1.3** %
5.3 Bank Armoring: **0.0** **0.0** %
Left: **0.0** ft. Right: **0.0** ft.
5.4 Channel Straightening: **1,562.1** **33.2** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **273.6** ft. **5.8**

	One Side	Both Sides
Road:	**273.6** 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: **508.5** ft. **481.4** ft.
6.3 Channel Bars: **Multiple**
6.4 Meander Migration: **None**
6.5 Meander Width: **58 ft.** Rato: **1.8**
6.6 Wavelength: **245 ft.** Ratio: **7.8**

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	1 Low	1 Low	0 N.S.	0 N.S.	0 N.S.	2 High	0 N.S.	1 Low	2 High	1 Low	0 N.S.	2 High	1 Low	0 N.S.	0 N.S.	13

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Sheldon Brook (South Branch)**
Topo Maps: **BURKE MOUNTAIN**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T4.2S1.01**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Sheldon Bk - Reach break upstream of Simpson Dr to confluence with Hawkins Brook.**

1.1 Reach Description:
1.2 Towns: **Lyndon**
1.3 Downstream Latitude: **44.5058827308**
1.3 Downstream Longitude: **-71.9696824007**

Step 2. Stream Type

2.1 Elevation Upstream: **905**
2.1 Elevation Downstream: **809**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **1,970.7** ft. **0.37** Miles
2.3 Valley Slope: **4.9**
2.4 Channel Length: **1,980.3** ft. **0.38** Miles
2.5 Channel Slope: **4.84 %**
2.6 Sinuosity: **1.00**
2.7 Watershed Area: **1.4** Square Miles
2.8 Channel Width: **15.0** feet
2.9 Valley Width: **90.0** feet
2.10 Confinement Ratio: **6.0**
2.10 Confinement Type: **Narrow**
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: **None**
3.3 Dominant Geological Mat.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Hilly**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %

7.4 Comments:
VW width measured in field with a range finder. SGAT calculated sinuosity is 1.0, but it appears higher based on MCLs used.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant Land Cover: **Forest** **62.0** %
Current Sub-Dominant Land Cover: **Field**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Urban** **25.0** %
Current Sub-Dominant Land Cover: **Field**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**51-100**	**>100**
Sub-dominant:	**26-50**	**0-25**
Length w / less than 25 ft.:	**193.0** ft.	**210.0** 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** **1.3** %
5.3 Bank Armoring: **316.2** **16.0** %
Left: **158.0** ft. Right: **158.2** ft.
5.4 Channel Straightening: **156.6** **7.9** %
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: **301.5** ft. **0.0** ft.
6.3 Channel Bars: **Point**
6.4 Meander Migration: **None**
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:

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	1 Low	0 N.S.	0 Unk.	1 Low	1 Low	0 N.S.	0 N/A	0 N/A	0 N.S.	0 N.S.	9

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Sheldon Brook (South Branch)**
Topo Maps: **BURKE MOUNTAIN**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T4.2S1.02**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Sheldon Brook - Reach break near Kirby town line to reach break north of Sheldon Brook Rd.**

1.1 Reach Description:

1.2 Towns: **Lyndon**

1.3 Downstream Latitude: **44.503234249**

1.3 Downstream Longitude: **-71.9646231502**

Step 2. Stream Type

2.1 Elevation Upstream: **1,013**
2.1 Elevation Downstream: **905**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **1,998.2** ft. **0.38** Miles
2.3 Valley Slope: **5.4**
2.4 Channel Length: **2,046.7** ft. **0.39** Miles
2.5 Channel Slope: **5.29 %**
2.6 Sinuosity: **1.02**
2.7 Watershed Area: **1.1** Square Miles
2.8 Channel Width: **13.4** feet
2.9 Valley Width: **50.0** feet
2.10 Confinement Ratio: **3.7**
2.10 Confinement Type: **Semi-confined**
2.11 Reference Stream Type: **A**
Bedform: **Step-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.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %

7.4 Comments:
VW width measured in field with a range finder.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant Land Cover: **Forest** **68.0** %
Current Sub-Dominant Land Cover: **Field**

4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **34.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**51-100**
Sub-dominant:	**26-50**	**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: **None**
Use:
5.2 Bridges and Culverts: **2** **1.7** %
5.3 Bank Armoring: **191.9** **9.4** %
Left: **96.9** ft. Right: **95.0** ft.
5.4 Channel Straightening: **0.0** **0.0** %
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: **No Data**
6.4 Meander Migration: **None**
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:

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.	1 Low	0 N.S.	0 N.S.	0 Unk.	0 N.S.	0 N.S.	0 N.S.	0 N/A	0 N/A	0 N.S.	0 N.S.	4

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Sheldon Brook (South Branch)**
Topo Maps: **BURKE MOUNTAIN**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T4.2S1.03**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **North Kirby Rd to reach break downstream of town line.**

1.1 Reach Description:

1.2 Towns: **Kirby, Lyndon**

1.3 Downstream Latitude: **44.5016399523**

1.3 Downstream Longitude: **-71.957919341**

Step 2. Stream Type

2.1 Elevation Upstream: **1,167**
2.1 Elevation Downstream: **1,013**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **2,863.5** ft. **0.54** Miles
2.3 Valley Slope: **5.4**
2.4 Channel Length: **2,907.8** ft. **0.55** Miles
2.5 Channel Slope: **5.29 %**
2.6 Sinuosity: **1.02**
2.7 Watershed Area: **0.9** Square Miles
2.8 Channel Width: **12.2** feet
2.9 Valley Width: **45.0** feet
2.10 Confinement Ratio: **3.7**
2.10 Confinement Type: **Semi-confined**
2.11 Reference Stream Type: **A**
Bedform: **Step-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.: %
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: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant Land Cover: **Forest** **69.0** %
Current Sub-Dominant Land Cover: **Field**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **26.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**51-100**	**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: **None**
Use:
5.2 Bridges and Culverts: **2** **1.5** %
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: **1,938.5** ft. **66.7**

	One Side	Both Sides
Road:	**1,392.9** ft.	**545.7** 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: **202.7** ft. **0.0** ft.
6.3 Channel Bars: **No Data**
6.4 Meander Migration: **None**
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:

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.	2 High	1 Low	0 N.S.	0 N.S.	0 N/A	0 N/A	0 N.S.	0 N.S.	6

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Sheldon Brook (South Branch)**
Topo Maps: **BURKE MOUNTAIN**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T4.2S1.04**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Headwaters to reach break at North Kirby Rd.**

1.1 Reach Description:
1.2 Towns: **Kirby**
1.3 Downstream Latitude: **44.5039706901**
1.3 Downstream Longitude: **-71.9483342779**

Step 2. Stream Type

2.1 Elevation Upstream: **1,418**
2.1 Elevation Downstream: **1,167**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **3,219.3** ft. **0.61** Miles
2.3 Valley Slope: **7.8**
2.4 Channel Length: **3,338.6** ft. **0.63** Miles
2.5 Channel Slope: **7.53 %**
2.6 Sinuosity: **1.04**
2.7 Watershed Area: **0.4** Square Miles
2.8 Channel Width: **9.2** feet
2.9 Valley Width: **35.0** feet
2.10 Confinement Ratio: **3.8**
2.10 Confinement Type: **Semi-confined**
2.11 Reference Stream Type: **A**
Bedform: **Step-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.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:
VW width measured in field with a range finder.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **82.0** %
Current Sub-Dominant Land Cover: **Field**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **64.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**>100**
Sub-dominant:	**26-50**	**26-50**
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** **0.9** %
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: **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: **No Data**
6.4 Meander Migration: **None**
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:

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	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 Unk.	0 N.S.	0 N.S.	0 N.S.	0 N/A	0 N/A	0 N.S.	0 N.S.	2

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Wheelock Brook**
Topo Maps: **LYNDONVILLE**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T5.01**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Reach break at South Wheelock Rd to confluence with Passumpsic River.**

1.1 Reach Description:
1.2 Towns: **Lyndon**
1.3 Downstream Latitude: **44.5199371637**
1.3 Downstream Longitude: **-72.0049165334**

Step 2. Stream Type

2.1 Elevation Upstream: **701**
2.1 Elevation Downstream: **691**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **1,993.3** ft. **0.38** Miles
2.3 Valley Slope: **0.5**
2.4 Channel Length: **2,101.0** ft. **0.40** Miles
2.5 Channel Slope: **0.47 %**
2.6 Sinuosity: **1.05**
2.7 Watershed Area: **17.1** Square Miles
2.8 Channel Width: **45.7** feet
2.9 Valley Width: **514.7** feet
2.10 Confinement Ratio: **11.3**
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.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Very Steep**
3.4 Valley Slope Right: **Hilly**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Urban**
Current Dominant Land Cover: **Forest** **78.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Commercial**
Current Dominant Land Cover: **Urban** **41.0** %
Current Sub-Dominant Land Cover: **Crop**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**>100**	**0-25**
Sub-dominant:	**0-25**	**26-50**
Length w / less than 25 ft.:	**212.0** ft.	**737.0** ft.

4.4 Ground Water Inputs: **None**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **3** **20.0** %
5.3 Bank Armoring: **2,011.1** **95.7** %
Left: **435.3** ft. Right: **1,575.9** ft.
5.4 Channel Straightening: **1,527.8** **72.7** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **807.5** ft. **38.4**

	One Side	Both Sides
Road:	**807.5** 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: **205.1** ft. **0.0** ft.
6.3 Channel Bars: **Point**
6.4 Meander Migration: **None**
6.5 Meander Width: **45 ft.** Rato: **1.0**
6.6 Wavelength: **45 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:

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	1 Low	1 Low	0 N.S.	2 High	2 High	0 N.S.	0 N.S.	18

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Wheelock Brook**
Topo Maps: **LYNDONVILLE**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T5.02**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Chamberlain covered bridge to Schoolhouse covered bridge.**

1.1 Reach Description:
1.2 Towns: **Lyndon**
1.3 Downstream Latitude: **44.5159533981**
1.3 Downstream Longitude: **-72.0097720572**

Step 2. Stream Type

2.1 Elevation Upstream: **737**
2.1 Elevation Downstream: **701**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **2,169.3** ft. **0.41** Miles
2.3 Valley Slope: **1.6**
2.4 Channel Length: **2,341.4** ft. **0.44** Miles
2.5 Channel Slope: **1.53 %**
2.6 Sinuosity: **1.08**
2.7 Watershed Area: **17.0** Square Miles
2.8 Channel Width: **45.5** feet
2.9 Valley Width: **229.7** feet
2.10 Confinement Ratio: **5.0**
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.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **78.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Commercial**
Current Dominant Land Cover: **Urban** **34.0** %
Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**26-50**	**26-50**
Sub-dominant:	**None**	**0-25**
Length w / less than 25 ft.:	**444.0** ft.	**675.0** 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** **2.1** %
5.3 Bank Armoring: **364.1** **15.6** %
Left: **0.0** ft. Right: **364.1** ft.
5.4 Channel Straightening: **0.0** **0.0** %
5.5 Dredging History: **Dredging**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **325.3** ft. **13.9**

	One Side	Both Sides
Road:	**325.3** 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: **1,139.5** ft. **0.0** ft.
6.3 Channel Bars: **Multiple**
6.4 Meander Migration: **None**
6.5 Meander Width: **126 ft.** Rato: **2.8**
6.6 Wavelength: **290 ft.** Ratio: **6.4**

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
1 Low	2 High	2 High	0 N.S.	0 N.S.	1 Low	0 N.S.	2 High	1 Low	2 High	2 High	0 N.S.	2 High	1 Low	0 N.S.	0 N.S.	16

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Wheelock Brook**
Topo Maps: **LYNDONVILLE**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T5.03**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Flows from reach break immediately south of S Wheelock road to reach break at Chamberlain covered bridge.**

1.1 Reach Description:
1.2 Towns: **Lyndon**
1.3 Downstream Latitude: **44.5165146123**
1.3 Downstream Longitude: **-72.0173563694**

Step 2. Stream Type

2.1 Elevation Upstream: **775**
2.1 Elevation Downstream: **737**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **2,852.4** ft. **0.54** Miles
2.3 Valley Slope: **1.4**
2.4 Channel Length: **3,303.5** ft. **0.63** Miles
2.5 Channel Slope: **1.17 %**
2.6 Sinuosity: **1.16**
2.7 Watershed Area: **15.7** Square Miles
2.8 Channel Width: **44.1** feet
2.9 Valley Width: **168.3** feet
2.10 Confinement Ratio: **3.8**
2.10 Confinement Type: **Semi-confined**
2.11 Reference Stream Type: **B**
Bedform: **Riffle-Pool**
Sub-Class Slope: **c**
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geological Mat.: %
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: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Shrub**
Current Dominant Land Cover: **Forest** **79.0** %
Current Sub-Dominant Land Cover: **Field**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **24.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**26-50**	**>100**
Sub-dominant:	**51-100**	**51-100**
Length w / less than 25 ft.:	**994.0** ft.	**0.0** ft.

4.4 Ground Water Inputs: **None**

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: **472.3** **14.3** %
Left: **472.3** 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: **1,666.6** ft. **50.4**

	One Side	Both Sides
Road:	**1,666.6** 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: **930.3** ft. **0.0** ft.
6.3 Channel Bars: **No Data**
6.4 Meander Migration: **None**
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:

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.	2 High	2 High	0 N.S.	0 N.S.	0 N/A	0 N/A	0 N.S.	0 N.S.	10

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Wheelock Brook**
Topo Maps: **LYNDONVILLE**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T5.04**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Reach break at unnamed trib to reach break south of S Wheelock rd**

1.1 Reach Description:
1.2 Towns: **Lyndon**
1.3 Downstream Latitude: **44.5203539481**
1.3 Downstream Longitude: **-72.0243371586**

Step 2. Stream Type

2.1 Elevation Upstream: **791**
2.1 Elevation Downstream: **775**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **1,800.8** ft. **0.34** Miles
2.3 Valley Slope: **0.8**
2.4 Channel Length: **2,323.9** ft. **0.44** Miles
2.5 Channel Slope: **0.65 %**
2.6 Sinuosity: **1.29**
2.7 Watershed Area: **15.4** Square Miles
2.8 Channel Width: **43.6** feet
2.9 Valley Width: **241.2** feet
2.10 Confinement Ratio: **5.5**
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.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Hilly**
3.4 Valley Slope Right: **Very Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **80.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **41.0** %
Current Sub-Dominant Land Cover: **Crop**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**26-50**	**>100**
Sub-dominant:	**51-100**	**None**
Length w / less than 25 ft.:	**400.0** 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: **282.5** **12.2** %
Left: **282.5** 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: **591.7** ft. **25.5**

	One Side	Both Sides
Road:	**591.7** 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: **399.7** ft. **0.0** ft.
6.3 Channel Bars: **Point**
6.4 Meander Migration: **None**
6.5 Meander Width: **270 ft.** Rato: **6.2**
6.6 Wavelength: **840 ft.** Ratio: **19.3**

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
1 Low	1 Low	1 Low	0 N.S.	0 N.S.	1 Low	0 N.S.	0 N.S.	2 High	1 Low	1 Low	0 N.S.	0 N.S.	2 High	0 N.S.	0 N.S.	10

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Wheelock Brook**
Topo Maps: **LYNDONVILLE**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T5.05**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Flows south east along S Wheelock Rd from reach break at Cold Hill Rd.**

1.1 Reach Description:
1.2 Towns: **Lyndon**
1.3 Downstream Latitude: **44.5215482784**
1.3 Downstream Longitude: **-72.0303732368**

Step 2. Stream Type

2.1 Elevation Upstream: **833**
2.1 Elevation Downstream: **791**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **4,443.7** ft. **0.84** Miles
2.3 Valley Slope: **1.0**
2.4 Channel Length: **4,720.0** ft. **0.89** Miles
2.5 Channel Slope: **0.90 %**
2.6 Sinuosity: **1.06**
2.7 Watershed Area: **14.7** Square Miles
2.8 Channel Width: **42.8** feet
2.9 Valley Width: **194.0** feet
2.10 Confinement Ratio: **4.5**
2.10 Confinement Type: **Narrow**
2.11 Reference Stream Type: **B**
Bedform: **Riffle-Pool**
Sub-Class Slope: **c**
Bed Material: **Cobble**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geological Mat.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Very Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **81.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **41.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**51-100**	**>100**
Sub-dominant:	**>100**	**None**
Length w / less than 25 ft.:	**1,000.0** 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: **809.8** ft. **17.2**

	One Side	Both Sides
Road:	**809.8** 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: **680.1** ft. **0.0** ft.
6.3 Channel Bars: **No Data**
6.4 Meander Migration: **None**
6.5 Meander Width: **120 ft.** Rato: **2.8**
6.6 Wavelength: **482 ft.** Ratio: **11.3**

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
1 Low	1 Low	2 High	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	1 Low	1 Low	0 N.S.	0 N.S.	2 High	0 N.S.	0 N.S.	0 N.S.	8

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Wheelock Brook**
Topo Maps: **LYNDONVILLE**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T5.06**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Flows from reach break north of S Wheelock Rd to reach break at Cold Hill Rd.**

1.1 Reach Description:
1.2 Towns: **Lyndon**
1.3 Downstream Latitude: **44.5292753004**
1.3 Downstream Longitude: **-72.0423067768**

Step 2. Stream Type

2.1 Elevation Upstream: **874**
2.1 Elevation Downstream: **833**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **3,468.4** ft. **0.66** Miles
2.3 Valley Slope: **1.2**
2.4 Channel Length: **3,648.2** ft. **0.69** Miles
2.5 Channel Slope: **1.12 %**
2.6 Sinuosity: **1.05**
2.7 Watershed Area: **12.3** Square Miles
2.8 Channel Width: **39.5** feet
2.9 Valley Width: **221.0** feet
2.10 Confinement Ratio: **5.6**
2.10 Confinement Type: **Narrow**
2.11 Reference Stream Type: **B**
Bedform: **Riffle-Pool**
Sub-Class Slope: **c**
Bed Material: **Gravel**

Step 3. Basin Charateristicts

3.1 Alluvial Fan: **None**
3.2 Grade Control: **None**
3.3 Dominant Geological Mat.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Very Steep**
3.4 Valley Slope Right: **Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Field**
Current Dominant Land Cover: **Forest** **80.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **45.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**51-100**	**>100**
Sub-dominant:	**0-25**	**26-50**
Length w / less than 25 ft.:	**222.0** ft.	**306.0** ft.

4.4 Ground Water Inputs: **None**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **2** **1.8** %
5.3 Bank Armoring: **145.9** **4.0** %
Left: **0.0** ft. Right: **145.9** ft.
5.4 Channel Straightening: **0.0** **0.0** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **1,447.9** ft. **39.7**

	One Side	Both Sides
Road:	**1,447.9** 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: **587.5** ft. **0.0** ft.
6.3 Channel Bars: **No Data**
6.4 Meander Migration: **None**
6.5 Meander Width: **39 ft.** Rato: **1.0**
6.6 Wavelength: **39 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:

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	1 Low	0 N.S.	0 N.S.	0 N.S.	0 N.S.	0 N.S.	2 High	1 Low	0 N.S.	0 N.S.	2 High	2 High	0 N.S.	0 N.S.	11

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Wheelock Brook**
Topo Maps: **LYNDONVILLE**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T5.07**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Flows along S Wheelock Rd to the north and crosses Falls Brook Rd.**

1.1 Reach Description:
1.2 Towns: **Lyndon**
1.3 Downstream Latitude: **44.5368197798**
1.3 Downstream Longitude: **-72.0493968943**

Step 2. Stream Type

2.1 Elevation Upstream: **964**
2.1 Elevation Downstream: **874**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **4,371.3** ft. **0.83** Miles
2.3 Valley Slope: **2.1**
2.4 Channel Length: **5,402.9** ft. **1.02** Miles
2.5 Channel Slope: **1.67 %**
2.6 Sinuosity: **1.24**
2.7 Watershed Area: **11.7** Square Miles
2.8 Channel Width: **38.7** feet
2.9 Valley Width: **345.6** feet
2.10 Confinement Ratio: **8.9**
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: **Ledge**
3.3 Dominant Geological Mat.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Hilly**
3.4 Valley Slope Right: **Hilly**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **81.0** %
Current Sub-Dominant Land Cover: **Field**
4.2 Corridor
Historic Land Cover:: **Field**
Current Dominant Land Cover: **Forest** **20.0** %
Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer	Left Bank	Right Bank
Dominant:	**51-100**	**0-25**
Sub-dominant:	**26-50**	**26-50**
Length w / less than 25 ft.:	**337.0** ft.	**3,771.0** 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** **0.4** %
5.3 Bank Armoring: **202.7** **3.8** %
Left: **0.0** ft. Right: **202.7** ft.
5.4 Channel Straightening: **1,154.4** **21.4** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **1,348.5** ft. **25.0**

	One Side	Both Sides
Road:	**1,348.5** 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: **1,528.5** ft. **387.5** ft.
6.3 Channel Bars: **Multiple**
6.4 Meander Migration: **None**
6.5 Meander Width: **125 ft.** Rato: **3.2**
6.6 Wavelength: **265 ft.** Ratio: **6.8**

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
1 Low	2 High	2 High	0 N.S.	0 N.S.	0 N.S.	2 High	0 N.S.	2 High	2 High	2 High	0 N.S.	1 Low	1 Low	0 N.S.	0 N.S.	15

Lower Passumpsic

Phase 1 - Reach Summary Report

Basin: **Passumpsic**
Stream Name: **Wheelock Brook**
Topo Maps: **LYNDONVILLE**
Watershed: **Passumpsic River**
Sub-watershed: **Passumpsic River -- headwaters to Moose River**

Reach ID: **T5.08**
SGAT Version: **4.56**
Date Last Edited: **September, 27 2013**
QA Status: **Step 2 done**
Is Reach An Impoundment?: **No**

Step 1. Reach Location **Flows along S Wheelock Rd from reach break at Wheelock town line.**

1.1 Reach Description:
1.2 Towns: **Lyndon**
1.3 Downstream Latitude: **44.5390326711**
1.3 Downstream Longitude: **-72.0638708493**

Step 2. Stream Type

2.1 Elevation Upstream: **1,092**
2.1 Elevation Downstream: **964**
2.1 Is Gradient Gentle?: **No**
2.2 Valley Length: **3,838.5** ft. **0.73** Miles
2.3 Valley Slope: **3.4**
2.4 Channel Length: **4,129.4** ft. **0.78** Miles
2.5 Channel Slope: **3.12 %**
2.6 Sinuosity: **1.08**
2.7 Watershed Area: **10.1** Square Miles
2.8 Channel Width: **36.2** feet
2.9 Valley Width: **155.7** feet
2.10 Confinement Ratio: **4.3**
2.10 Confinement Type: **Narrow**
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: **None**
3.3 Dominant Geological Mat.: %
3.3 Sub-dom. Geological Mat.:
3.4 Valley Slope Left: **Steep**
3.4 Valley Slope Right: **Very Steep**
3.5 Soils
Hydrologic Group: %
Flooding: %
Water Table Deep: %
Water Table Shallow: %
Erodibility: **slight** %
7.4 Comments:
Bridge is at a sharp angle to channel, low ice jam potential

Step 4. Land Cover - Reach Hydrology

4.1 Watershed
Historic Land Cover: **Forest**
Current Dominant Land Cover: **Forest** **83.0** %
Current Sub-Dominant Land Cover: **Crop**
4.2 Corridor
Historic Land Cover:: **Forest**
Current Dominant Land Cover: **Forest** **28.0** %
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.:	**196.0** ft.	**763.0** ft.

4.4 Ground Water Inputs: **None**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):
Type: **None**
Use:
5.2 Bridges and Culverts: **1** **1.0** %
5.3 Bank Armoring: **889.5** **21.5** %
Left: **134.5** ft. Right: **755.0** ft.
5.4 Channel Straightening: **0.0** **0.0** %
5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old:	**1,862.2** ft.	**45.1**
	One Side	Both Sides
Road:	**1,862.2** 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: **50.7** ft. **0.0** ft.
6.3 Channel Bars: **No Data**
6.4 Meander Migration: **None**
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.	0 N.S.	2 High	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.	1 Low	10

Phase 1 - Step 9. Adjustment Process and Reach Condition

Lower Passumpsic

Basin: **Passumpsic** Watershed: **Passumpsic River** SGAT Version: **4.56**

Sub-Watershed: **Passumpsic River -- headwaters to Moose River, Passumpsic River -- Moose River to mouth** **Stream Name:** All QA Status: **Step 2 done**

		Stream Type						9.1 Predicted Adjustment Scores				9.2 Reach Condition		9.3	
Reach ID	Confinement Type	Stream Type	Bed Material	Subclass Slope	Bedform	Watershed Area	Total Impact	Degrad.	Aggrad.	Widen.	Planf.	Project	Statewide	Reach Sensitivity	QC
T1.01	BD	C	Gravel	None	Riffle-Pool	52.9 sq. mi.	17	8	8	7	10	Poor	Fair	High	2
T1.02	SC	B	Cobble	None	Step-Pool	52.8 sq. mi.	11	8	8	7	5	Fair	Good	Moderate	2
T1.03	NW	C	Gravel	None	Riffle-Pool	51.9 sq. mi.	16	8	8	9	8	Poor	Fair	High	2
T1.04	NW	B	Gravel	c	Riffle-Pool	44.6 sq. mi.	3	4	3	2	0	Good	Reference	Moderate	2
T1.05	SC	B	Cobble	None	Step-Pool	42.8 sq. mi.	8	7	6	5	4	Fair	Good	Moderate	2
T1.06	SC	B	Cobble	None	Step-Pool	41.8 sq. mi.	5	4	3	0	0	Reference	Reference	Moderate	2
T1.07	SC	B	Boulder	None	Step-Pool	40.2 sq. mi.	6	4	3	0	0	Reference	Reference	Very Low	2
T1.08	NW	C	Cobble	None	Riffle-Pool	34.4 sq. mi.	14	6	7	5	8	Fair	Good	Moderate	2
T1.09	BD	C	Gravel	None	Riffle-Pool	33.8 sq. mi.	15	8	7	5	10	Fair	Fair	High	2
T1.10	NW	B	Cobble	c	Riffle-Pool	30.2 sq. mi.	3	2	3	0	0	Reference	Reference	Moderate	2
T1.11	NW	B	Cobble	c	Riffle-Pool	29.7 sq. mi.	1	2	1	0	0	Reference	Reference	Moderate	2
T1.12	BD	C	Gravel	None	Riffle-Pool	29.3 sq. mi.	5	2	3	0	0	Reference	Reference	High	2
T1.13	SC	A	Boulder	None	Cascade	27.7 sq. mi.	11	8	9	7	7	Fair	Fair	Very Low	2
T2.01	NC	A	Bedrock	None	Cascade	13.1 sq. mi.	7	6	8	5	0	Fair	Good	Very Low	2
T2.02	BD	C	Gravel	None	Riffle-Pool	13.1 sq. mi.	17	10	8	7	12	Poor	Fair	High	2
T2.03	VB	E	Sand	None	Dune-Ripple	13.1 sq. mi.	10	4	3	4	4	Good	Good	High	2
T2.04	VB	C	Gravel	None	Riffle-Pool	11.9 sq. mi.	6	2	4	2	0	Good	Reference	High	2
T2.05	BD	E	Sand	None	Dune-Ripple	11.6 sq. mi.	9	2	6	6	5	Fair	Good	High	2
T2.06	NW	C	Gravel	None	Riffle-Pool	11.4 sq. mi.	3	2	2	2	0	Reference	Reference	High	2
T2.07	BD	C	Gravel	None	Riffle-Pool	10.4 sq. mi.	16	7	8	7	7	Fair	Fair	High	2
T2.08	BD	B	Cobble		Riffle-Pool	9.0 sq. mi.	15	8	8	7	8	Fair	Fair	Moderate	2
T2.09	VB	C	Gravel	b	Riffle-Pool	6.8 sq. mi.	12	6	6	7	4	Fair	Good	High	2
T2.10	VB	B	Cobble	None	Step-Pool	4.6 sq. mi.	8	6	6	5	4	Fair	Good	Moderate	2

		Stream Type						9.1 Predicted Adjustment Scores				9.2 Reach Condition		9.3	
Reach ID	Confinement Type	Stream Type	Bed Material	Subclass Slope	Bedform	Watershed Area	Total Impact	Degrad.	Aggrad.	Widen.	Planf.	Project	Statewide	Reach Sensitivity	QC
T2.11	VB	C	Cobble	b	Riffle-Pool	4.2 sq. mi.	9	6	6	5	4	Fair	Good	Moderate	2
T2.12	VB	C	Gravel	b	Riffle-Pool	2.5 sq. mi.	9	5	7	5	5	Fair	Good	High	2
T3.04	BD	C	Sand	None	Riffle-Pool	42.7 sq. mi.	17	8	8	7	8	Fair	Fair	High	2
T3.05	NW	C	Gravel	None	Riffle-Pool	41.9 sq. mi.	17	10	8	7	10	Poor	Fair	High	2
T3.06	SC	B	Cobble	c	Riffle-Pool	40.7 sq. mi.	15	12	8	7	9	Poor	Fair	Moderate	2
T3.07	BD	D	Cobble	None	Braided	40.5 sq. mi.	16	8	8	9	10	Poor	Fair	Extreme	2
T3.08	NW	B	Cobble	c	Riffle-Pool	16.9 sq. mi.	12	8	8	7	8	Fair	Fair	Moderate	2
T3.09	SC	B	Cobble	c	Riffle-Pool	15.4 sq. mi.	11	6	8	7	3	Fair	Good	Moderate	2
T3.10	NW	B	Gravel	c	Riffle-Pool	14.6 sq. mi.	13	10	6	7	8	Fair	Fair	Moderate	2
T3.10S1.01	NW	B	Cobble	c	Riffle-Pool	8.5 sq. mi.	10	2	3	0	0	Reference	Reference	Moderate	2
T3.10S1.02	NW	C	Cobble	b	Riffle-Pool	8.4 sq. mi.	6	2	1	0	0	Reference	Reference	Moderate	2
T3.10S1.03	NW	C	Cobble	b	Riffle-Pool	8.4 sq. mi.	9	4	4	4	2	Good	Good	Moderate	2
T3.10S1.04	NW	C	Cobble	b	Riffle-Pool	2.7 sq. mi.	4	2	3	0	0	Reference	Reference	Moderate	2
T3.10S1.05	SC	A	Cobble	None	Step-Pool	1.3 sq. mi.	4	2	2	0	0	Reference	Reference	High	2
T3.10S1.3s1.01	SC	B	Cobble	None	Step-Pool	5.2 sq. mi.	1	2	1	0	0	Reference	Reference	Moderate	2
T3.10S1.3s1.02	SC	B	Cobble	None	Step-Pool	4.6 sq. mi.	3	2	3	0	0	Reference	Reference	Moderate	2
T3.11	BD	C	Gravel	None	Riffle-Pool	6.1 sq. mi.	11	2	6	6	5	Fair	Good	High	2
T3.11S1.01	VB	C	Gravel	b	Riffle-Pool	1.7 sq. mi.	6	2	4	4	0	Good	Reference	High	2
T3.12	NW	B	Cobble	None	Step-Pool	3.8 sq. mi.	4	4	4	2	0	Good	Reference	Moderate	2
T3.13	NW	B	Gravel	None	Step-Pool	3.7 sq. mi.	2	4	2	2	0	Good	Reference	Moderate	2
T3.14	NW	B	Cobble	None	Step-Pool	3.4 sq. mi.	2	2	2	0	0	Reference	Reference	Moderate	2
T3.15	NW	B	Cobble	None	Step-Pool	2.1 sq. mi.	1	2	1	0	0	Reference	Reference	Moderate	2
T3.7S1.01	BD	B	Cobble		Step-Pool	6.6 sq. mi.	15	8	7	7	6	Fair	Good	Moderate	2
T3.7S1.02	BD	C	Gravel	b	Riffle-Pool	6.3 sq. mi.	11	5	7	5	6	Fair	Good	High	2
T3.7S1.03	VB	E	Gravel	None	Dune-Ripple	6.1 sq. mi.	7	2	4	2	0	Good	Reference	High	2
T3.7S1.04	VB	E	Gravel	None	Dune-Ripple	3.3 sq. mi.	6	2	3	2	0	Reference	Reference	High	2
T3.7S1.05	NW	B	Cobble	None	Riffle-Pool	2.7 sq. mi.	5	4	4	2	0	Good	Reference	Moderate	2
T3.7S1.06	VB	C	Gravel	b	Riffle-Pool	2.3 sq. mi.	9	4	6	6	5	Fair	Good	High	2
T3.7S1.07	VB	C	Gravel	b	Riffle-Pool	1.5 sq. mi.	8	3	5	4	2	Good	Good	High	2

		Stream Type						9.1 Predicted Adjustment Scores				9.2 Reach Condition		9.3	
Reach ID	Confinement Type	Stream Type	Bed Material	Subclass Slope	Bedform	Watershed Area	Total Impact	Degrad.	Aggrad.	Widen.	Planf.	Project	Statewide	Reach Sensitivity	QC
T4.01	VB	C	Gravel	None	Riffle-Pool	11.4 sq. mi.	19	8	8	7	10	Poor	Fair	High	2
T4.02	NW	B	Cobble	None	Riffle-Pool	11.1 sq. mi.	11	8	7	5	6	Fair	Good	Moderate	2
T4.03	BD	B	Cobble	c	Riffle-Pool	9.6 sq. mi.	10	4	5	4	2	Good	Good	Moderate	2
T4.04	VB	C	Cobble	None	Riffle-Pool	7.4 sq. mi.	13	8	6	5	8	Fair	Good	Moderate	2
T4.2S1.01	NW	B	Cobble	a	Step-Pool	1.4 sq. mi.	9	3	5	4	5	Fair	Good	Moderate	2
T4.2S1.02	SC	A	Cobble	None	Step-Pool	1.1 sq. mi.	4	2	3	0	0	Reference	Reference	High	2
T4.2S1.03	SC	A	Cobble	None	Step-Pool	0.9 sq. mi.	6	4	3	0	0	Reference	Reference	High	2
T4.2S1.04	SC	A	Cobble	None	Step-Pool	0.4 sq. mi.	2	2	2	0	0	Reference	Reference	High	2
T5.01	VB	C	Gravel	None	Riffle-Pool	17.1 sq. mi.	18	9	7	5	11	Poor	Fair	High	2
T5.02	NW	C	Gravel	None	Riffle-Pool	17.0 sq. mi.	16	6	7	7	10	Fair	Fair	High	2
T5.03	SC	B	Cobble	c	Riffle-Pool	15.7 sq. mi.	10	6	7	5	5	Fair	Good	Moderate	2
T5.04	NW	C	Gravel	None	Riffle-Pool	15.4 sq. mi.	10	4	3	0	0	Reference	Reference	High	2
T5.05	NW	B	Cobble	c	Riffle-Pool	14.7 sq. mi.	8	2	4	2	2	Good	Reference	Moderate	2
T5.06	NW	B	Gravel	c	Riffle-Pool	12.3 sq. mi.	11	4	4	0	0	Good	Reference	Moderate	2
T5.07	BD	C	Gravel	None	Riffle-Pool	11.7 sq. mi.	15	8	7	7	10	Poor	Fair	High	2
T5.08	NW	B	Cobble	None	Step-Pool	10.1 sq. mi.	10	6	7	5	8	Fair	Good	Moderate	2

APPENDIX B

QA/QC SUMMARY

Lower Passumpsic Phase 1 QA Notes
Reviewed by Staci Pomeroy 6/20/13

The questions raised in this Quality Assurance assessment are meant to address potential discrepancies within the data set, uncover data entry errors, or otherwise clarify and confirm those observations that might not have been expected. It is important to take into consideration how data might be viewed or interpreted by the myriad of users who are familiar with the science and protocols but may be unfamiliar with the assessed reaches. While providing notes and comments, try to anticipate the types of questions that may arise due to outliers and exceptions observed within the reach or segment. While attempting to clarify the data for those users wishing to utilize it years after collected, it's better to err on the side of making excessive comments than it is for them to be insufficient.

After reviewing the information noted, the consultant should update this document (preferably in a second color) with what steps, if any, were taken to address the comments/questions.

FEA responses in red - additional comments in attribute table of attached "LPassumpsic_QA_Notes" point file

General Comments:

- Staci - Due to issues with SGAT and the DMS for the soils layer, that information has not been entered in the DMS. This was not due to anything the consultant did, rather an issue in the SGAT and DMS that needs to be resolved for the soils in this region. It will be the responsibility of the River Scientist to address this at a later date and update the project as appropriate.
- The NAIP 2012 imagery was used for the QA process. BING imagery was also used for reference in some areas of question, but generally the BING imagery was not as clear due to shadowing of areas.
  All areas identified for review were checked with BING and NAIP 2011 imagery
- Specific reach information per step will not be listed in the QA due to the size of the project. A shapefile is being provided to tag areas where there was a question and/or comment on a given steps' data need at that site. A comment filed in the attribute table notes the question/comment at the site. The step number is also indicated in the comment field. An additional field "consultant" is provided for the consultant to indicate possible updates to the FIT and/or notes on the question/comment.
  FEA comments were added to this shapefile
- For a few steps, where FIT data may be uploaded, and a reach had none for that step there will need to be manual data entry of "none, no data, or not evaluated". Where there is an impact score, this will update that from "unknown or ND" to a "Not significant"
  - **Step 3.1 and 3.2 reaches:** T.11, T2.06, T3.10S1.02, T3.13, T3.15
  - **Step 5.1, 5.3, 5.4, 5.5 reaches:** T.11, T2.06, T3.10S1.02, T3.13, T3.15

  Updated
- **Step 3:** There are a couple dams (Danville 8 & 9) on T1.13 that were shown in the VT Dams layer, but were not FIT'd. Confirm if these dams should be FIT'd.
  These dams are listed as inactive and were not observed during the windshield survey
- **Step 4 buffers:** There were areas where I have indicated it "appears to be <25 ft". This was using the NAIP photos and BING to see what difference may be. I often found the BING imagery not as clear as the NAIP for buffer review. There are also areas where it appears to be a managed field in the NAIP imagery, but not as clear to use in the BING imagery. Please review and update FIT as appropriate and the comments field in the QA shapefile as to any changes or not
  All areas were reviewed and updated as necessary
- **Step 5.1 Flow Regs**. In reaches where there are dams noted these dams should generally be considered "flow regs". The dams are influencing water and sediment transport through the reaches. Most appeared to be "run of river" dams, and "small" for size. Please review and update FIT as appropriate and the comments field in the QA shapefile as to any changes or not
  Updated

- **Step 6**: Overall good, a few spots to review for possible encroachment and/or development to be included.
  Updated
- **Step 7:** The additional comments were helpful in review of the reach and information, thank you for providing notes when possible.