Seeley Creek Watershed
Strategic Plan

January 2002

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Funding provided by
National Fish and Wildlife Foundation
Chesapeake Bay Small Watershed Grant Program

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BACKGROUND

Seeley Creek is a Chemung River tributary that flows northward through Tioga County, Pennsylvania; Bradford County, Pennsylvania; and Chemung County, New York. The land area that drains into Seeley Creek and its tributaries comprises the Seeley Creek watershed and is shown in Figure 1. This watershed is drained by 227 miles of streams and encompasses agricultural, rural, suburban, and urban areas in two states. Seeley Creek and its tributaries experience problems associated with streambank erosion, channel instability, sedimentation, habitat degradation, and flooding. High sediment loads originating in the Seeley Creek watershed are carried downstream into the Chemung River, the Susquehanna River, and the Chesapeake Bay. The Seeley Creek Watershed Association provides a bi-state forum for coordinated resolution of these problems and preservation of the aquatic resource.

The quality of Seeley Creek is directly linked to the quality of the ponds, wetlands, and streams that drain into Seeley Creek and to the quality of the environment surrounding these waters. This Plan represents a watershed-wide approach to resource protection and hazard mitigation. It attempts to address the whole system, including both land and water, in order to successfully manage problems associated with Seeley Creek and its tributaries. It is based on the premise that many water quality concerns and natural hazards are best addressed by integrated solutions aimed at the root causes of the problems.

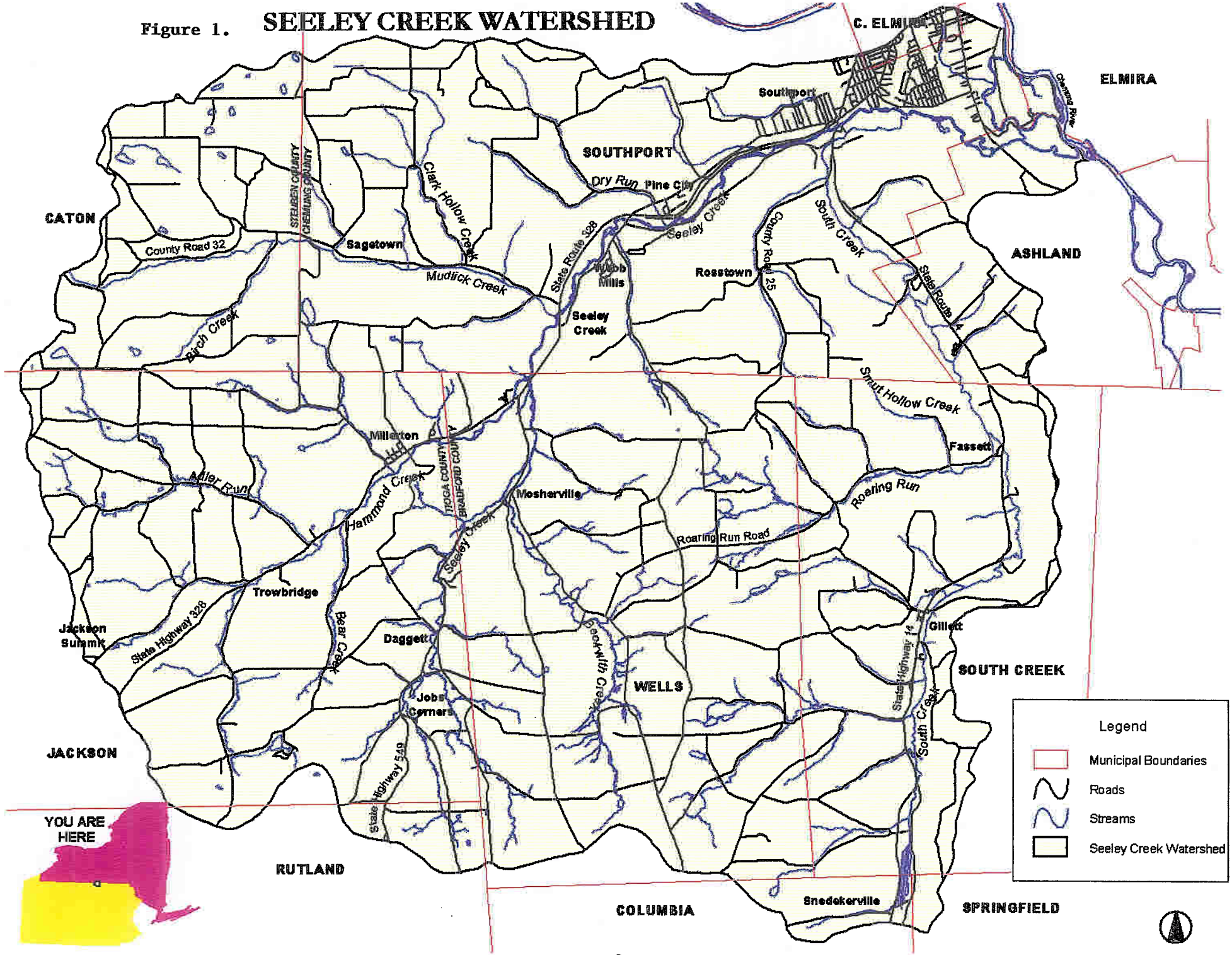
WATERSHED HISTORY

The Seeley Creek watershed consists of 146 square miles of glacially modified terrain underlain by Devonian bedrock, primarily shale. The hilltops are generally covered by thin soils, with glacial outwash in the valleys. The widespread occurrence of poorly consolidated glacial deposits (which are particularly susceptible to erosive forces) contributes to high sediment loads in the streams. Alluvial fans have formed along the edges of the Seeley Creek valley near the mouths of some of the tributary streams. These fan-shaped mounds of sediment have accumulated where stream gradients decrease and the streams are no longer able to carry as much sediment. The streams that flow across alluvial fans are naturally unstable—they frequently overflow their banks, accumulate sediment within the channel, and are prone to changing course.

Prior to European settlement, the Seeley Creek watershed consisted of mixed deciduous hardwoods and conifers with a few open meadows. By the early 19th century, extensive land clearing had contributed to increased runoff down steep slopes, carrying vast quantities of soil, gravel, and cobbles.

Early in the 20th century, Seeley Creek had two channels in both the Webb Mills and Pine City areas. In the early 1960's, the New York State Department of Transportation built a four-lane highway (Route 328) in the west channel of Seeley Creek from the Southport Town Hall through Pine City. After Hurricane Agnes in 1972, flood debris was dumped into the west channel of Seeley Creek in the Webb Mills area. This construction and fill forced the creek into a smaller volume channel. Near Pine City, the main channel of the stream is now adjacent to a

Figure 1. **SEELEY CREEK WATERSHED**



hill on the south, resulting in continual landslides of gravel into the creek. Additional channel alterations were implemented in 2000-01 (near the Southport Town Hall) in order to accommodate construction of the Elmira Arterial South Extension (by New York State Department of Transportation).

After severe flooding in 1946, the U.S. Army Corps of Engineers constructed a flood control levee on the left (north) bank of Seeley Creek to protect a densely developed area in the Town of Southport (adjacent to the City of Elmira). The flow of Mountain View Creek was diverted away from the protected area and into Seeley Creek just upstream of the dike. This levee protection extends for 2.7 miles and is maintained by the New York State Department of Environmental Conservation.

In the 1990's, the Seeley Creek watershed experienced several flash floods. These events caused watercourse alterations and erosion damage, in addition to flood damage. In August 1994, flooding occurred when remnants of Tropical Storm Beryl dropped heavy rainfall in the watershed. In January 1996, heavy rainfall and snowmelt produced severe flooding. Additional flooding occurred in November 1996, when 5 inches of rain fell in five hours. In addition to these major events, localized flash flooding has occurred on numerous other occasions.

Development, road construction, agriculture, and timber harvesting have all impacted drainage characteristics in the watershed. The cumulative impact of land use changes throughout the watershed results in increased stream flow during high runoff events, increased streambank erosion, and increased sediment loads. Development in low-lying areas and on alluvial fans is subject to flooding. Stream crossings and development adjacent to streams are threatened by streambank erosion. In some areas, the shallow water table contributes to basement flooding and septic system failure.

SEELEY CREEK WATERSHED ASSOCIATION

Following severe flooding in August 1994 and January 1996, the Town of Southport formed a citizens' Drainage Committee to investigate and resolve drainage and flooding issues in the Town. This committee supervised the hiring of a part-time Drainage Officer in July 1996 and oversaw the completion of many flood mitigation initiatives. Despite the numerous accomplishments in the Town of Southport, it became apparent that comprehensive solutions to flooding, erosion, and water quality problems must be implemented basin-wide. This realization led to the formation of a bi-state, multi-county watershed association. The initial, organizational meeting of the Seeley Creek Watershed Association was held on April 22, 1997.

The Seeley Creek Watershed Association is comprised of citizens, elected officials, and government agencies working together in Pennsylvania and New York to improve water quality, reduce flooding, and conserve the natural resources of the Seeley Creek watershed. The working goals of the Seeley Creek Watershed Association are: (1) to protect and restore the living resources and water quality of the Seeley Creek watershed and (2) to foster cooperation between Pennsylvania and New York to help solve the natural resource problems in the Seeley Creek watershed. The association promotes:

- Mitigation of flood hazards
- Conservation of natural resources
- Improvement of water quality
- Prevention of soil erosion and sedimentation of streams
- Prevention of water pollution
- Proper management of nutrients
- Proper management of stormwater runoff
- Efficient use of human resources, equipment, funding, and materials
- Minimization of duplicated efforts
- The health, safety, and general welfare of residents and landowners in the Seeley Creek watershed

The Seeley Creek Watershed Association has facilitated communication and cooperation among the numerous organizations and agencies involved in natural resource efforts throughout the watershed. The organizations and agencies that have supported and participated in the Seeley Creek Watershed Association include:

Municipalities:

Town of Southport (NY)
Town of Ashland (NY)
Town of Caton (NY)
Jackson Township (PA)
Wells Township (PA)
South Creek Township (PA)

Local/County Agencies and Departments:

Chemung County Soil and Water Conservation District (NY)
Chemung County Water Quality Strategy Committee (NY)
Chemung County Emergency Management Office (NY)
Chemung County Environmental Management Council (NY)
Steuben County Soil and Water Conservation District (NY)
Steuben County Emergency Management Office (NY)
Steuben County Environmental Management Council (NY)
Bradford County Conservation District (PA)
Bradford County Office of Community Planning (PA)
Bradford County Emergency Management Office (PA)
Tioga County Conservation District (PA)
Big Elm Fire Department (PA)

Regional Agencies and Organizations:

Southern Tier Central Regional Planning and Development Board (NY)
Upper Susquehanna Coalition (NY and PA)
Flood Warning Service of Chemung and Steuben Counties (NY)
Sullivan Trail Resource Conservation and Development Council (NY)
Endless Mountains Resource Conservation and Development Council (PA)
Susquehanna River Basin Commission (NY, PA, and MD)
Canaan Valley Institute
Cornell University Center for the Environment

State/Federal Agencies and Organizations:

Pennsylvania Department of Environmental Protection
New York State Department of Environmental Conservation
New York State Department of Transportation
New York State Emergency Management Office
Pennsylvania Emergency Management Agency
USDA Natural Resource Conservation Service
New York State Assemblyman's Office
United States Congressman's Office

Citizen Committees and Organizations:

Southport Storm Water Drainage Committee (NY)
Chemung County Sportsmen's Federation (NY)
Trout Unlimited (NY)

The accomplishments of the Seeley Creek Watershed Association and its members include:

- Ongoing coordination of support for flood mitigation and water quality initiatives throughout the watershed in both New York and Pennsylvania.
- Provides a public forum for discussion of watershed issues and concerns.
- Numerous local stream stabilization, infrastructure, and drainage improvement projects have been implemented throughout the Seeley Creek watershed (funded and implemented by municipalities and local, county, and state highway departments).
- Weekly monitoring of groundwater levels at 5 wells in the Town of Southport (ongoing program initiated in 1994; wells installed by Chemung County Soil and Water Conservation District with funding from Town of Southport; monitored weekly by volunteers).
- Employment of a Drainage Officer for the Town of Southport (part time position from 1996 to present; funded by Town of Southport).
- Watershed exhibit and video of local flooding at the Chemung County Fair in August 1997.
- Interns conducted a field survey of the watershed to identify potential sites for development or enhancement of wetlands (1997; funded by U.S. Army Corps of Engineers; implemented by Upper Susquehanna Coalition).
- Water quality monitoring in the Town of Southport (part of an ongoing county program initiated in 1998; implemented by volunteers and various county agencies; funded and coordinated by Chemung County Water Quality Strategy Committee). Monitoring was conducted in Mudlick Creek and five sites in Seeley Creek in 1998-1999 and was resumed in 2002.
- Construction of the Holecek Avenue/Mount Zoar Storm Sewer project in the Town of Southport (1998; funded, in part, by Federal Emergency Management Agency; implemented by Town of Southport).
- Assembly of digital GIS (Geographic Information System) data for the watershed (implemented by Southern Tier Central Regional Planning Board and Town of Southport; funded by NY State Department of Environmental Conservation).
- Development of flood hydrographs for Seeley Creek and its tributaries (using TR-55 and HEC-HMS computer modeling programs). This ongoing effort is used to design projects, evaluate the hydrologic impact of potential projects, and provide information for local flood

warning efforts (initiated in 1998; not yet complete; implemented by Town of Southport Drainage Officer).

- Development of *Flood Mitigation Action Plans* for the Town of Southport and Town of Ashland (prepared in 1998-1999; Town of Southport Plan updated in 2000; facilitated by Southern Tier Central Regional Planning and Development Board; funded by Federal Emergency Management Agency).
- Construction of the Charles Street Storm Sewer project in Universal Village, Town of Southport (1999-2000; funded, in part, by Federal Emergency Management Agency; implemented by Town of Southport).
- Seeley Creek Watershed Workshop, A Facilitated Approach to Planning for Better Resource Management, April 16, 1999 (Coordinated Resource Management workshop; funded and facilitated by Canaan Valley Institute). The workshop results are summarized below.
- A public Watershed Meeting, June 23, 1999 (funded and facilitated by Canaan Valley Institute). Public input reinforced the recommendations made at the Seeley Creek Watershed Workshop.
- Presentations about water quality and the Seeley Creek watershed have been made to students at Broadway School and the Southport Business Association.
- Publication of a Seeley Creek Watershed Newsletter in the spring of 2000; distributed to all watershed residents (7,000 addresses); articles about watersheds, the Seeley Creek Watershed Association, the Coordinated Resource Management workshop, and hydrology (articles by Watershed Association members; funded by Canaan Valley Institute).
- Development, printing, and distribution of a Seeley Creek Coloring Book (funded by the Chemung County Environmental Management Council, Chemung County Soil and Water Conservation District, and Chemung County Water Quality Strategy Committee).
- Assisted with distribution of a brochure entitled *Seeley Creek Stream Restoration Project*. This brochure describes natural stream restoration, habitat improvement, and bioengineering techniques applicable to Seeley Creek (prepared for a proposed U.S. Army Corps of Engineers project that was not implemented; funded by U.S. Army Corps of Engineers, Pennsylvania Department of Environmental Conservation, and Bradford County).
- Assessed drainage on dirt and gravel roads throughout Tioga and Bradford Counties; findings were documented in a GIS database (2000; implemented by county Conservation Districts as part of Pennsylvania's "Dirt and Gravel Road Pollution Prevention Program;" funded by the Commonwealth of Pennsylvania).
- Drainage restoration along 600 feet of road in Wells Township (2001; implemented by Wells Township as part of Pennsylvania's "Dirt and Gravel Road Pollution Prevention Program;" funded by the Commonwealth of Pennsylvania).
- Prepared colorful Seeley Creek watershed placemats and distributed them to restaurants, schools, churches, and fire departments throughout the watershed. This project has been an effective mechanism for increasing the public's awareness of the Seeley Creek watershed, its assets, and its problems (2000; funded by Chesapeake Bay Small Watershed Grants Program with significant time contributions by local partners; implemented by Seeley Creek Watershed Association).
- Adoption of timber harvesting regulations for the Town of Ashland and Town of Southport to prevent runoff and stream pollution problems from timber harvesting operations (Ashland ordinance adopted in 1995; Southport ordinance adopted in 2000).

- Recompiled soil survey information for the New York portion of the watershed in order to utilize this information as a digital data layer (2000; not yet digitized; implemented by Upper Susquehanna Coalition with funding from the U.S. Environmental Protection Agency).
- Construction of two flood attenuation wetlands on private property in the Dry Run Creek subwatershed in the Town of Southport (2000; funded by U.S. Environmental Protection Agency's Five Star Program; numerous local partners contributed time and resources; implementation coordinated by Chemung County Soil and Water Conservation District). Public dedication of these wetlands on May 2, 2001 (attended by approximately 40 people and the media; coordinated by Southern Tier Central Regional Planning and Development Board).
- Field assessment of streambank erosion problems in Bradford County; documentation of findings in GIS database (2000; funded and implemented by Bradford County Conservation District; GIS database tool developed by Penn State University).
- Level I assessment of stream types in parts of the watershed (2000; implemented by Upper Susquehanna Coalition; funded by National Fish and Wildlife Foundation, Chesapeake Bay Small Watershed Grant Program).
- Data loggers placed in the Clark Hollow subwatershed to monitor stream stage and rainfall (ongoing data collection was initiated in 2000; implemented by Upper Susquehanna Coalition; funded by National Fish and Wildlife Foundation, Chesapeake Bay Small Watershed Grant Program).
- Distributed a survey, entitled *Seeley Creek Watershed, Issues and Answers*, to 740 addresses throughout the watershed. The results are summarized below (2000-2001; final report in progress; funded and implemented by Center for the Environment, Cornell University).
- Field assessment of stream reaches in the Clark Hollow and Dry Run subwatersheds, including stream description, visual assessment of riparian areas, streambank assessment, and streambank erosion inventory; documentation of findings in GIS database (2001; Locally Led Conservation Project of the Upper Susquehanna Coalition; funded by the NYS Department of Environmental Conservation and the USDA Natural Resources Conservation Service; GIS database tool refined by Penn State University and Upper Susquehanna Coalition).
- The Town of Southport enacted a local ordinance that prohibits dumping in the Chapel Park ditch (2000).
- Eight potential wetland projects were identified in the Clark Hollow subwatershed. All are located on private property with interested property owners. Construction of three wetland creation projects began in 2001 (funded by the USDA Natural Resources Conservation Service Wetland Reserve Program and Town of Southport). Three additional wetlands are scheduled for construction in 2002.
- A municipal sewer project is being designed for the State Route 328 corridor in Jackson Township. This project was mandated by the Pennsylvania Department of Environmental Protection and is controversial due to the proposed local fee structure. This system will serve 283 homes and businesses located in the Hammond Creek valley, primarily in the hamlets of Jackson Summit and Millerton (scheduled for completion in 2003; funded in part by U.S. Department of Agriculture Rural Utility Services).
- Development of a flash flood warning system for the Seeley Creek watershed (ongoing development effort; not yet functional; implementation by Town of Southport Drainage Officer and Chemung County Director of Emergency Services).

WATERSHED PLANNING

In 1996, the Town of Southport drafted a *Preliminary Seeley Creek Watershed Plan* (December 17, 1996), which focused primarily on the Town of Southport portion of the watershed. This plan included a Draft *Stormwater Drainage System Maintenance Plan* for the Town of Southport (which was subsequently adopted by the Town Board in 2000).

The Town of Ashland and Town of Southport have both prepared and adopted *Flood Mitigation Action Plan*s (1999 and 2000). Each of these plans was developed with extensive community and agency input and was subsequently adopted by the Town Board. They describe the local flood hazards and document flooding problems and potential problems throughout each town. Long-range goals were developed for reducing future flood damages. These goals address the need for public information, preventive actions, natural resource protection, protection of at-risk property, emergency services, and cooperation with neighboring municipalities. Each plan presents a list of specific activities that the municipality and county can implement to address flooding problems. Many of the flood mitigation measures proposed in the Southport and Ashland *Flood Mitigation Action Plan*s are also included in the recommendations of this plan.

On April 16, 1999, a daylong, facilitated workshop brought together representatives from numerous organizations to discuss a vision, resource issues, barriers, and plans for the entire Seeley Creek watershed. The results of this workshop are presented in *Seeley Creek Watershed Workshop, A Facilitated Approach to Planning for Better Resource Management*. The need for increased community involvement was identified as a high priority at this workshop. The workshop recommendations are summarized below:

A. The things participants value about the watershed community include: beauty, mixed rural/urban land uses, rural resources, agriculture, good water quality, fish habitat, wildlife habitat, economic and social diversity, community values, involved citizens, and a good quality of life.

B. The primary threats to the watershed are:
- stream instability (bank erosion and in-stream gravel accumulation),
- flooding and flash flooding (existing development at risk, high velocity floodwaters, and continued construction in high hazard areas),
- land use changes (resulting in increased runoff and loss of rural charm), and
- non-point pollution.

C. The barriers to addressing watershed issues include:
- lack of coordination (particularly across the state line),
- lack of planning (for resource management and future development),
- limited public understanding of watershed issues (hazards, impacts of land use decisions, conservation practices, maintenance requirements, available resources, etc.),
- lack of property owner commitment and involvement in solving watershed problems,
- conflicts between private property rights and the common good,
- regulatory hurdles, and
- limited funds (for remediation, technical assistance, and property owner incentives).

D. The proposed actions were:

- follow up meeting,
- public meeting,
- break down the "state barrier" (increase understanding, collaboration, and cooperation across the state line), and
- develop education and understanding (particularly about government structures in both states, sources of information, sources of technical assistance, other watershed efforts, interactions between the New York State Department of Environmental Conservation and Pennsylvania Department of Environmental Protection, and sources of funding).

E. The information needed to get started includes:

- contact information (mailing list of watershed property owners),
- additional watershed information (water quality assessment, habitat assessment, assessment of streambank erosion problems, assessment of riparian vegetation, hydrologic modeling, details of historical flooding, land use inventory, historical land use patterns, identification of environmentally sensitive areas, identification of archeological resources, delineation of stream types, morphological description of stream reaches, culvert/bridge inventory, assessment of culvert and bridge condition, etc.),
- documentation/sharing of existing watershed information (land use, transportation infrastructure, property boundaries, streams, wetlands, floodplains, soils, etc.)
- prioritized list of problem areas (with economic and social impacts of each),
- identified sources/causes of problems,
- potential solutions to problems (with benefit/cost ratios),
- potential funding sources,
- information about regulations and permit requirements,
- recommendations about how to effectively lobby legislators, and
- advice on how to coordinate across the state line.

F. Achievements will be measured by:

- formation of an active watershed organization,
- development of a watershed plan (documenting goals, objectives, vision, and solutions),
- implementation of best management practices (good agricultural and timber harvesting practices, planting of riparian buffers, construction/enhancement of wetlands and ponds, good construction practices, etc.),
- improved water quality,
- stream stability (construction of stream protection structures, reduced streambank erosion, decreased bed load, less debris, etc.),
- landowner/community commitment (good riparian stewardship, project funding, stream clean up efforts, committee involvement, media coverage, increased participation, etc.),
- good trout stream (recreational use, public access, and aesthetics), and
- less flooding (less flood damage and properly managed stormwater).

G. The next steps were:

- Task I: Compile/summarize information from the April 16 "Planning for Better Resource Management" Workshop.

- Task II: Organize a public meeting with an agenda that includes presentation of workshop ideas, addition of ideas from the public, and sign up sheets for identified projects/activities.
- Task III: Organize Publicity Committee with responsibility to ensure large turnout at the public meeting.
- Task IV: Hold public meeting(s).
- Task V: Organize ongoing committees from sign up sheets.

Following the Seeley Creek Watershed Workshop, the Watershed Association concentrated on public outreach efforts. A public Watershed Meeting was held on June 23, 1999. The objectives of this meeting were: (1) to present the recommendations of the watershed workshop, (2) to assemble a group of people who are committed to improving the watershed, (3) to formalize and strengthen the Seeley Creek Watershed Association, (4) to set goals and establish priorities for the watershed, and (5) to seek funding for watershed association expenses. The public input received at this meeting reinforced the recommendations that were made at the Watershed Workshop.

The ideas and hopes shared at the workshop and public meeting were incorporated into the following vision statement for the Seeley Creek Watershed Association:

> "Seeley Creek is once again a healthy trout stream enjoyed by people, young and old, with interests from fishing and hunting to paddling and bird watching. The Creek is bordered by a ribbon of trees and plants, which harbors wildlife and filters runoff. It meanders through its floodplain, which is maintained to channel high flows without damage to property. It flows through a landscape that absorbs or slows rainwater through a series of wetlands, reforested areas, grassed "buffers," and decorative ponds serving well-designed housing developments. The Creek recharges wells with high quality water, and, in return, the communities protect the Creek from runoff, septic tank leakage, and other "nonpoint" pollution.
>
> "Seeley Creek is a priceless resource."

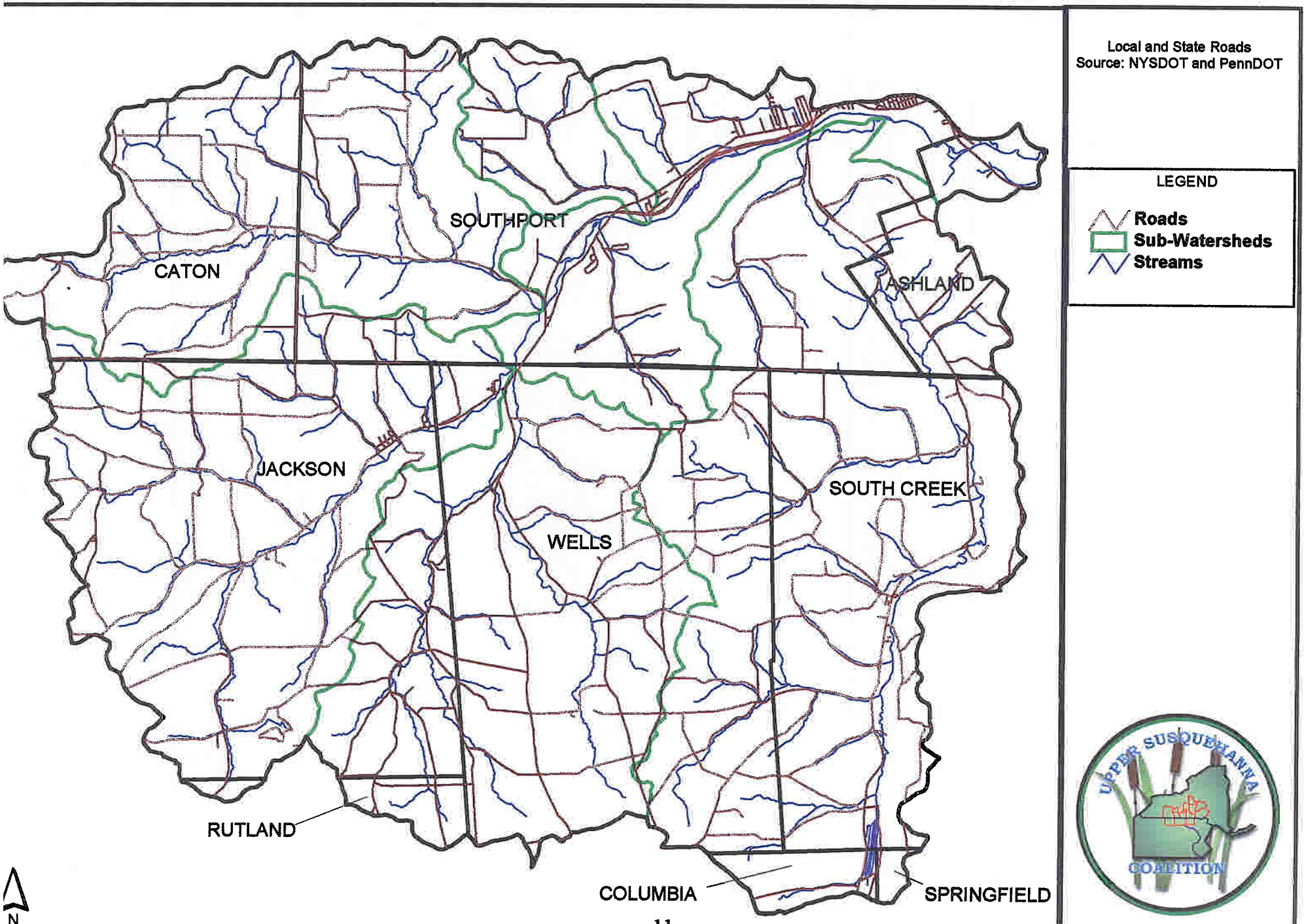
The present plan builds on these previous planning efforts and identifies the steps needed to implement this vision for the Seeley Creek watershed.

WATERSHED DATA

The Seeley Creek watershed lies in the glaciated portion of the Appalachian Plateau Province of the Susquehanna River Basin. The watershed comprises part of the following municipalities, as shown in Figure 2:

Town of Caton, Steuben County, New York (9.1% of the watershed)
Town of Southport, Chemung County, New York (26.8% of the watershed)
Town of Ashland, Chemung County, New York (3.5% of the watershed)
Jackson Township, Tioga County, Pennsylvania (22.1% of the watershed)

Figure 2. **Seeley Creek Watershed - Roads, Municipal Boundaries, Streams, & Watersheds**



Rutland Township, Tioga County, Pennsylvania (1.1% of the watershed)
Wells Township, Bradford County, Pennsylvania (22.7% of the watershed)
South Creek Township, Bradford County, Pennsylvania (13.4% of the watershed)
Columbia Township, Bradford County, Pennsylvania (1.1% of the watershed)
Springfield Township, Bradford County, Pennsylvania (0.2% of the watershed)

For this report, the Seeley Creek watershed was divided into 6 subwatersheds as shown in Figure 3:

- Lower Seeley Creek: Main stem and minor tributaries downstream of the confluence of Seeley Creek and Hammond Creek; 15 square miles (principally in the Town of Southport)
- South Creek: Southeastern tributary to Seeley Creek; 44 square miles (principally in the Town of Southport, Town of Ashland, and South Creek Township)
- Dry Run: Northwestern tributary to Seeley Creek; 5 square miles (in the Town of Southport)
- Mudlick Creek: Western tributary to Seeley Creek; 24 square miles (principally in the Towns of Caton and Southport)
- Hammond Creek: Western tributary to Seeley Creek; 29 square miles (principally in Jackson Township)
- Upper Seeley Creek: Main stem and tributaries upstream of the confluence of with Hammond Creek; 27 square miles (principally Jackson and Wells Townships)

Survey of Watershed Issues

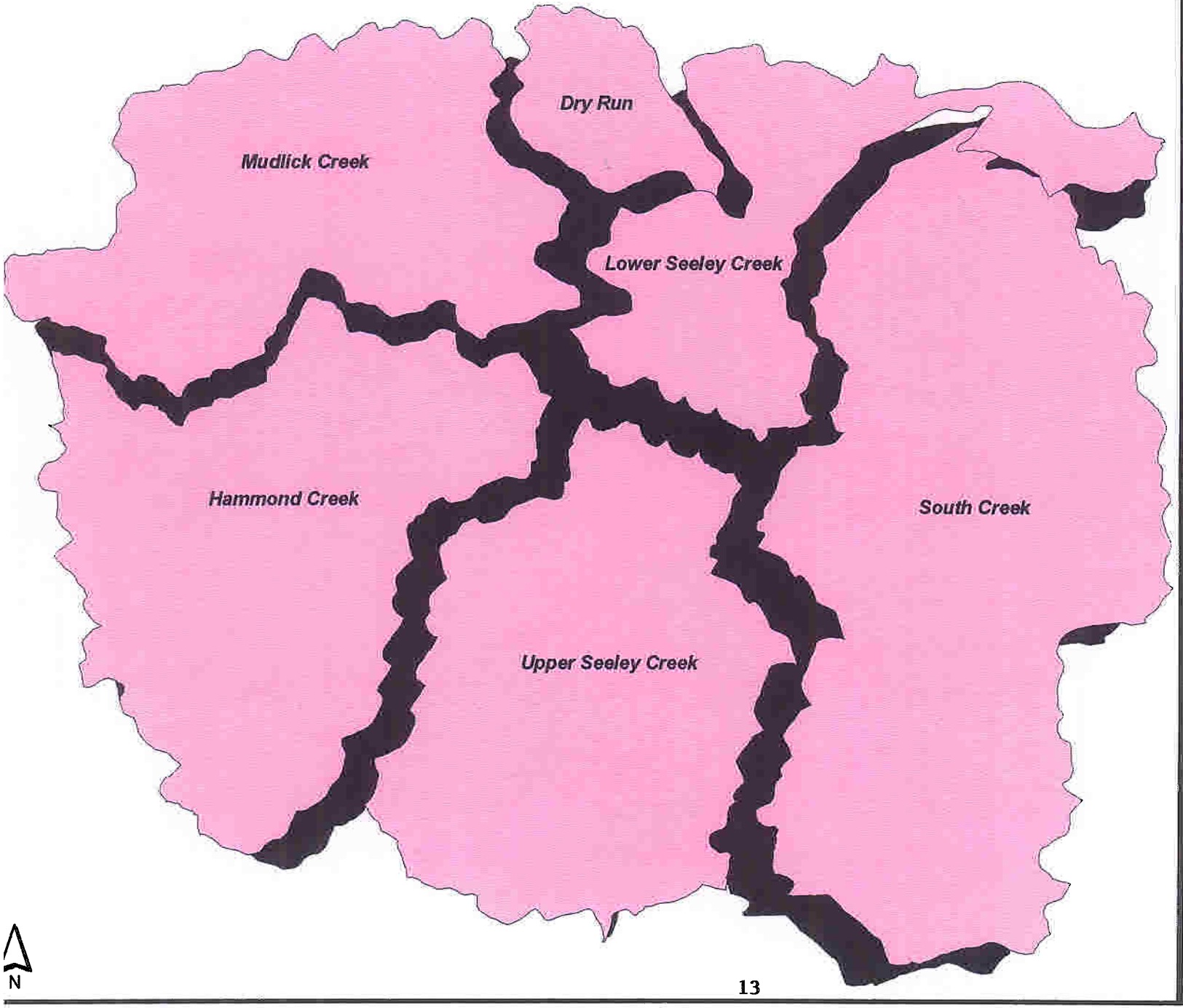
A survey, entitled *Seeley Creek Watershed, Issues and Answers*, was distributed to 740 addresses throughout the watershed in 2000. 355 usable responses were received and tabulated. A report of the survey results is being prepared by the Cornell University Center for the Environment.

The survey respondents indicated that the most important issues facing Seeley Creek are flooding (80.3% very important, 13.5% somewhat important), water quality (77.3% very important, 16.1% somewhat important), and streambank erosion (76.0% very important, 19.6% somewhat important). The highest ranked recommendations for protecting Seeley Creek's health are to: restore streambanks (64.1% very important, 26.2% somewhat important), restore or construct wetlands to reduce or prevent flooding (54.9% very important, 27.9% somewhat important), and promote sustainable forestry practices (53.6% very important, 32.8% somewhat important). Additional survey results are included in the following discussion.

Topography

Seeley Creek drains the dissected plateaus formed by horizontally bedded sedimentary rock. The landscape is characterized by steep hillsides, rolling upland areas, flat-bottomed valleys for the larger streams, and v-shaped valleys for the smaller tributaries (Figure 4). Many of the small headwater tributaries have extremely high gradients. The elevations range from 820 feet at the Chemung River (Town of Ashland) to 2,300 feet at Tower Hill (Rutland Township). The steep slopes that bound many valleys in the Seeley Creek watershed pose severe limitations for development (Figure 5). Approximately 3% of the watershed has slopes greater than 20%; and 15 % of the watershed area has slopes of 12-20%.

Figure 3. **Seeley Creek Watershed - Sub-Watersheds**



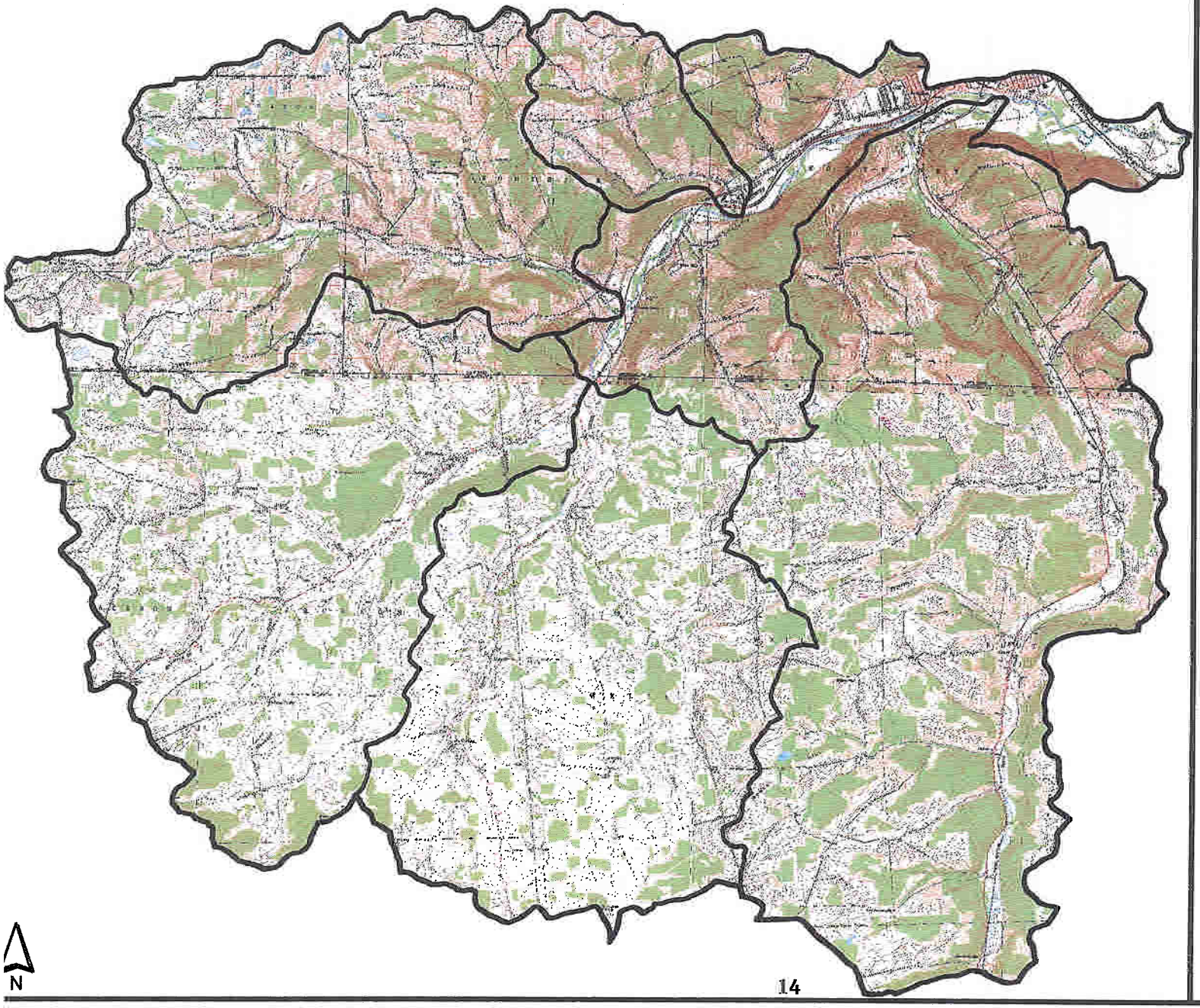
Seeley Creek Sub-Watersheds
Source: Chemung County SWCD

LEGEND

Sub-Watersheds

Name	Acres
Dry Run	3122.183
South Creek	28471.612
Lower Seeley Creek	9656.935
Hammond Creek	18809.466
Upper Seeley Creek	17313.455
Mudlick Creek	15154.420

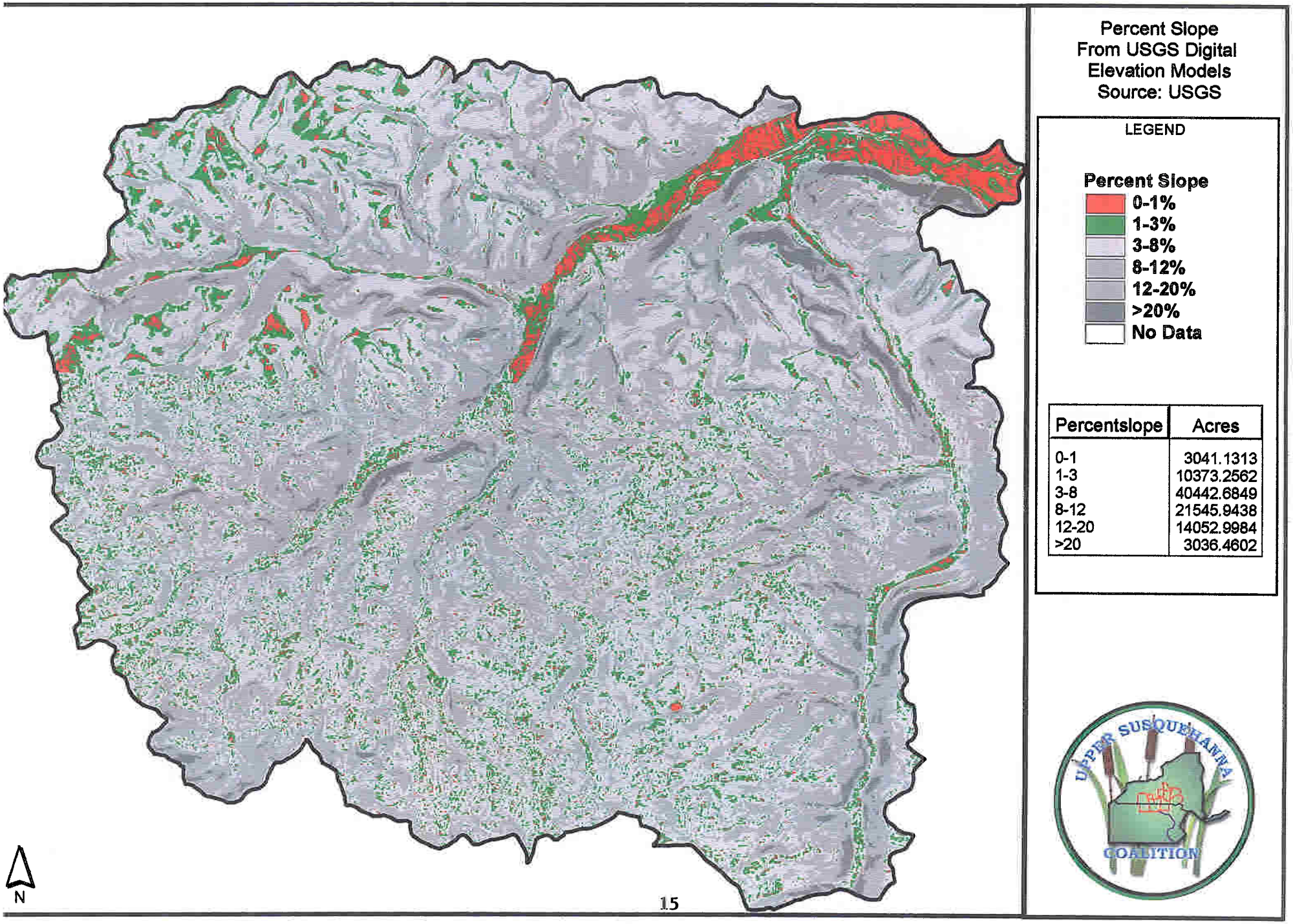
Figure 4. **Seeley Creek Watershed - USGS Topo Quads**



1:24,000 USGS Topo Quads
Source: USGS

N

Figure 5. **Seeley Creek Watershed - Slope**



Percentslope	Acres
0-1	3041.1313
1-3	10373.2562
3-8	40442.6849
8-12	21545.9438
12-20	14052.9984
>20	3036.4602

Soils

Healthy soils, with a good soil structure, support plant growth, cycle nutrients, receive and store water, resist soil erosion, and filter nonpoint pollutant sources. Information about soil types can be applied to land use planning; site selection for roads, ponds, buildings, and other structures; managing farms and woodlands; and assessing the potential impacts of land use changes.

Most of the upland soils in the Seeley Creek watershed formed on glacial till. Valley sections are dominated by soils that formed in glacial outwash or alluvial sediments. The Soil Survey of each county provides detailed soil mapping, descriptions of each soil unit, and information about the capabilities and limitations of the various soils. The mapped soils in the New York portion of the watershed have been recompiled to enable digitization. When the development of digital soil survey data is complete, this data layer will enhance the usability of soil information by enabling display of soil units in conjunction with other map-based data, such as air photographs, property boundaries, or land use information.

Land Use

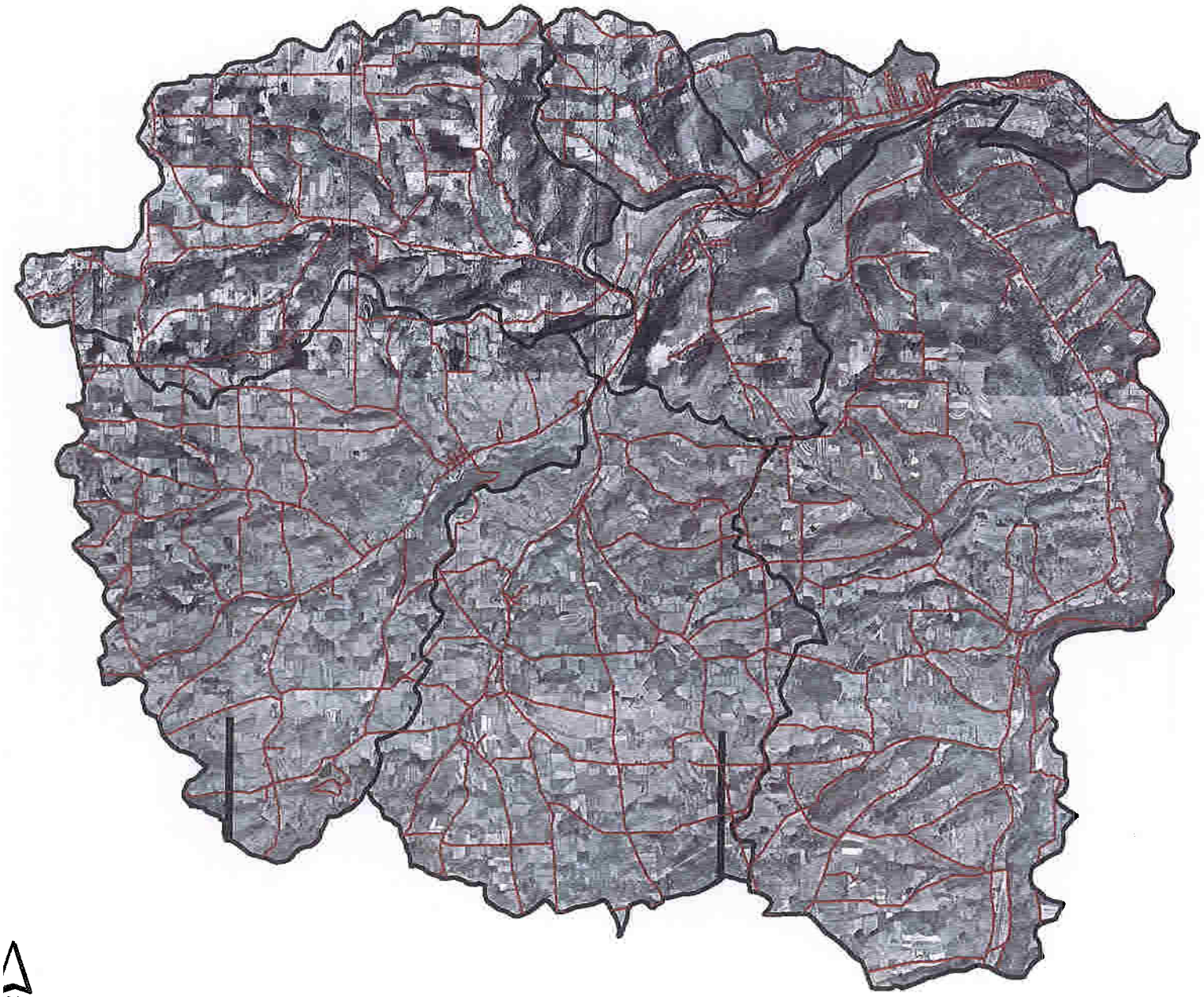
Seeley Creek is a rural watershed, in which most of the land is covered by forests or utilized for agriculture. An aerial photographic image of the watershed is shown in Figure 6. The information in Figure 7 and Table 1 is from the National Land Cover Dataset (30x30 meter resolution) assembled by the U.S. Geological Survey. Urban land uses (low intensity residential, high intensity residential, and commercial/industrial/transportation) comprise less than 1% of the land area. This urbanization is concentrated near the City of Elmira in the Lower Seeley Creek subwatershed and the downstream areas of the South Creek and Dry Run subwatersheds. Approximately 37% of the watershed is agricultural land, the majority of which is utilized for pasture or hay production (35%). Agricultural land use is typically located on the gentler slopes, either within the stream valleys or on the less steep upland areas. Agricultural land use is more intensive in the Pennsylvania portions of the watershed, comprising 48% of the Hammond Creek subwatershed and 52% of the Upper Seeley Creek subwatershed. The majority of the watershed, 61%, is forestland, including most of the areas with steep slopes. The watershed is crossed by 334 miles of roads.

Since U.S. census boundaries do not follow watershed boundaries, the population living within the Seeley Creek watershed is not known. The watershed mailing list, which was assembled from tax map information, consists of approximately 7,000 addresses. The 2000 census data for the watershed municipalities is given in Table 2. These population data show declining populations in the more urbanized areas and corresponding population increases in rural areas. Although the overall population within the watershed is relatively stable, the rural countryside is increasingly being developed for residential use.

Land Use Controls

In both New York and Pennsylvania, the power to enact local land use controls is granted to municipalities. Local governments can establish planning boards/commissions, prepare comprehensive plans, regulate land uses through zoning, control land subdivision, conduct land development or site plan review, and enact other land use regulations. These tools can be used to

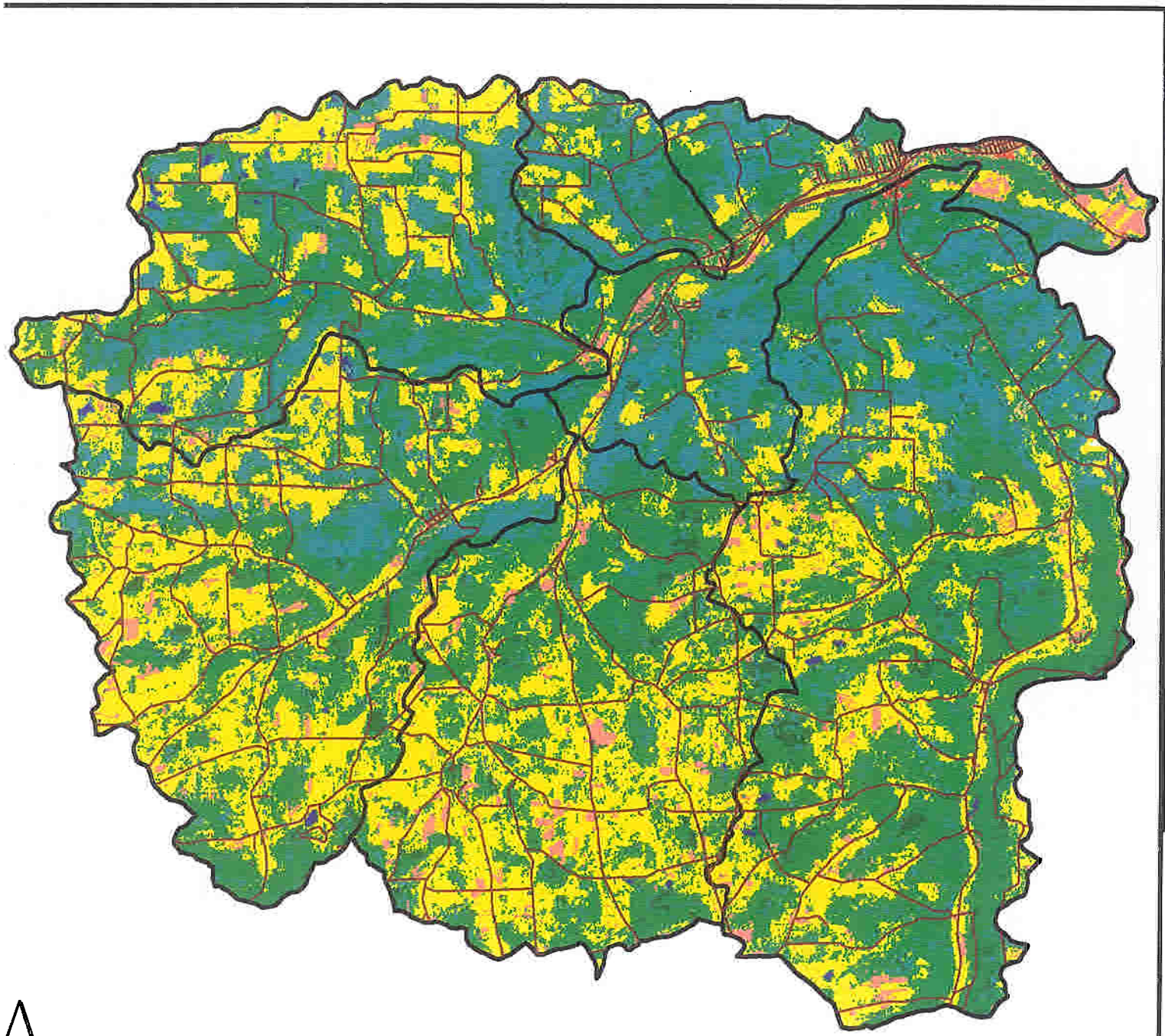
Figure 6. **Seeley Creek Watershed - Digital Ortho-Photography**



1 Meter Resolution DOQs
Source: NYSOFT and PASDA

N

Figure 7. **Seeley Creek Watershed - National Land Cover Dataset**



NLCD Landuse
30x30 meter USGS

LEGEND

NLCD Landuse

- Open Water
- Ice and Snow
- Low Inensity Residential
- High Intensity Residential
- Commerical/Industrial/Transportation
- Bare Rock/Sand/Clay
- Quarries
- Transitional
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Shrubland
- Orchard/Vineyard
- Grassland/Herbaceous
- Pasture / Hay
- Row Crops
- Small Grains
- Fallow
- Urban Recreational Grasses
- Woody Wetlands
- Emergent Herbaceous Wetlands

Landuse	Acres
Open Water	223.7289
Low Intensity Residential	603.8011
High Intensity Residential	43.1445
Commercial-Industrial-Transportatio	125.8753
Quarries-Gravel Pits	2.0016
Transitional	4.4479
Deciduous Forest	36594.5702
Evergreen Forest	2302.2279
Mixed Forest	17673.2461
Pasture-Hay	31922.2851
Row Crops	2510.6115
Urban-Recreational Grasses	376.0691
Woddy Wetlands	20.2379
Emergent Herbaceous Wetlands	43.3669

N

Table 1
Land Use Data*

LAND USE CLASS (National Land Cover Dataset, 30x30 meter resolution)	Lower Seeley Creek (acres)	South Creek (acres)	Dry Run (acres)	Mudlick Creek (acres)	Hammond Creek (acres)	Upper Seeley Creek (acres)	TOTAL (acres)
Open Water	9	61	0	80	56	16	**223**
Low Intensity Residential	420	81	37	4	42	20	**604**
High Intensity Residential	37	4	2	0	0	0	**43**
Commercial/Industrial/Transportation	60	45	6	1	9	5	**126**
Quarries/Strip Mines/Gravel Pits	1.6	0.4	0	0	0	0	**2**
Transitional	0	2	0	0	1	1	**4**
Deciduous Forest	3,372	13,397	1,168	5,393	6,467	6,766	**36,564**
Evergreen Forest	173	853	63	147	505	558	**2,299**
Mixed Forest	3,258	5,233	1,127	4,405	2,641	1,003	**17,666**
Pasture/Hay	1,688	8,029	672	4,811	8,501	8,187	**31,888**
Row Crops	373	686	9	255	462	716	**2,501**
Urban/Recreational Grasses	262	33	39	8	34	0	**376**
Woody Wetlands	0	0	0	8	13	0	**20**
Emergent Herbaceous Wetlands	0	6	0	30	5	3	**43**
TOTAL	**9,654**	**28,431**	**3,122**	**15,142**	**18,736**	**17,275**	**92,360**

*From National Land Cover Dataset, 30x30 meter USGS.

Table 2
Municipal Population Data

Municipality	Percent of Municipality in the Watershed	Population 2000 Census	Change 1990-2000	Percent Change 1990-2000
T. Caton, NY	35%	2,097	+209	+11.1%
T. Southport, NY	83%	11,185	-386	-3.3%
T. Ashland, NY	36%	1,951	-15	-0.8%
Jackson Twp., PA	78%	2,054	-18	-0.9%
Wells Twp., PA	97%	1,278	+260	+25.5%
South Creek Twp., PA	70%	1,261	+32	+2.6%
Rutland Twp., PA	4%	736	+90	+13.9%
Columbia Twp., PA	4%	1,162	+85	+7.9%
Springfield Twp., PA	1%	1,167	+49	+4.4%

insure that new development is safe and does not unduly impact the surrounding environment. The land use controls utilized by each municipality in the watershed are indicated in Table 3.

Each municipality in the watershed has enacted a Local Law for Flood Damage Prevention to enable participation in the National Flood Insurance Program. These laws regulate all development within the areas designated as 100-year floodplain on Flood Insurance Rate Maps prepared by the Federal Emergency Management Agency. These floodplain development regulations specify that new development within the regulated floodplain must comply with elevation requirements and construction standards that are intended to protect structures from the 100-year flood event.

Comprehensive planning is a process in which a community develops a shared, long-term vision for the protection, enhancement, growth, and development of the municipality. The comprehensive plan also identifies standards, devices, and instruments for immediate and long-range measures for achieving this vision. The comprehensive plan generally forms a basis for the development of land use regulations. Most of the municipalities in the watershed are currently involved in comprehensive planning efforts: Town of Caton, Town of Southport, Jackson Township, Rutland Township, Wells Township, Columbia Township, and Springfield Township. After these comprehensive plans are completed, these municipalities are expected to revise or adopt municipal land use regulations.

Zoning ordinances are used to encourage the most appropriate use of land within the municipality. They involve the division of a municipality into districts and regulation within these districts of (1) the use of structures and land, (2) the height and bulk of structures, (3) the size of lots, and (4) the density of use. Because zoning regulations differ from district to district, they can be used to set special standards for land uses in areas that are subject to hazards.

Table 3
Municipal Land Use Controls

Municipality	Flood Damage Prevention (NFIP)	Zoning Regulations	Subdivision Regulations	Site Plan/ Development Review	Timber Harvesting Regulations
T. Caton, NY	X	X	X	X	
T. Southport, NY	X	X	X	X	X
T. Ashland, NY	X	X		X	X
Jackson Twp., PA	X				
Wells Twp., PA	X				
South Creek Twp., PA	X				
Rutland Twp., PA	X	X			
Columbia Twp., PA	X				
Springfield Twp., PA	X				

Subdivision regulations are used to guide the division of large parcels of land into smaller lots for the purpose of sale or building development. These regulations can assure that property is suitable for its intended use and that required improvements such as roads, sewers, drainage facilities, recreation areas, water supply systems, and safe building sites are provided. If municipalities do not enact subdivision regulations, subdivision proposals are reviewed at the county level.

In New York, site plan review has increasingly become a favorite tool of rural communities that want to make sure that development is appropriate without locking residents into a restrictive zoning ordinance. Using site plan review powers, a community can evaluate specified land uses in terms of their suitability to natural site conditions, their compatibility with surrounding land uses, and their conformance with overall plans for the community. It is typically used to review proposals for multi-family housing, shopping centers, industrial development, and other projects under single ownership that cannot be reviewed under subdivision regulations. In Pennsylvania, this process is referred to as land development review and is usually enacted with subdivision regulations.

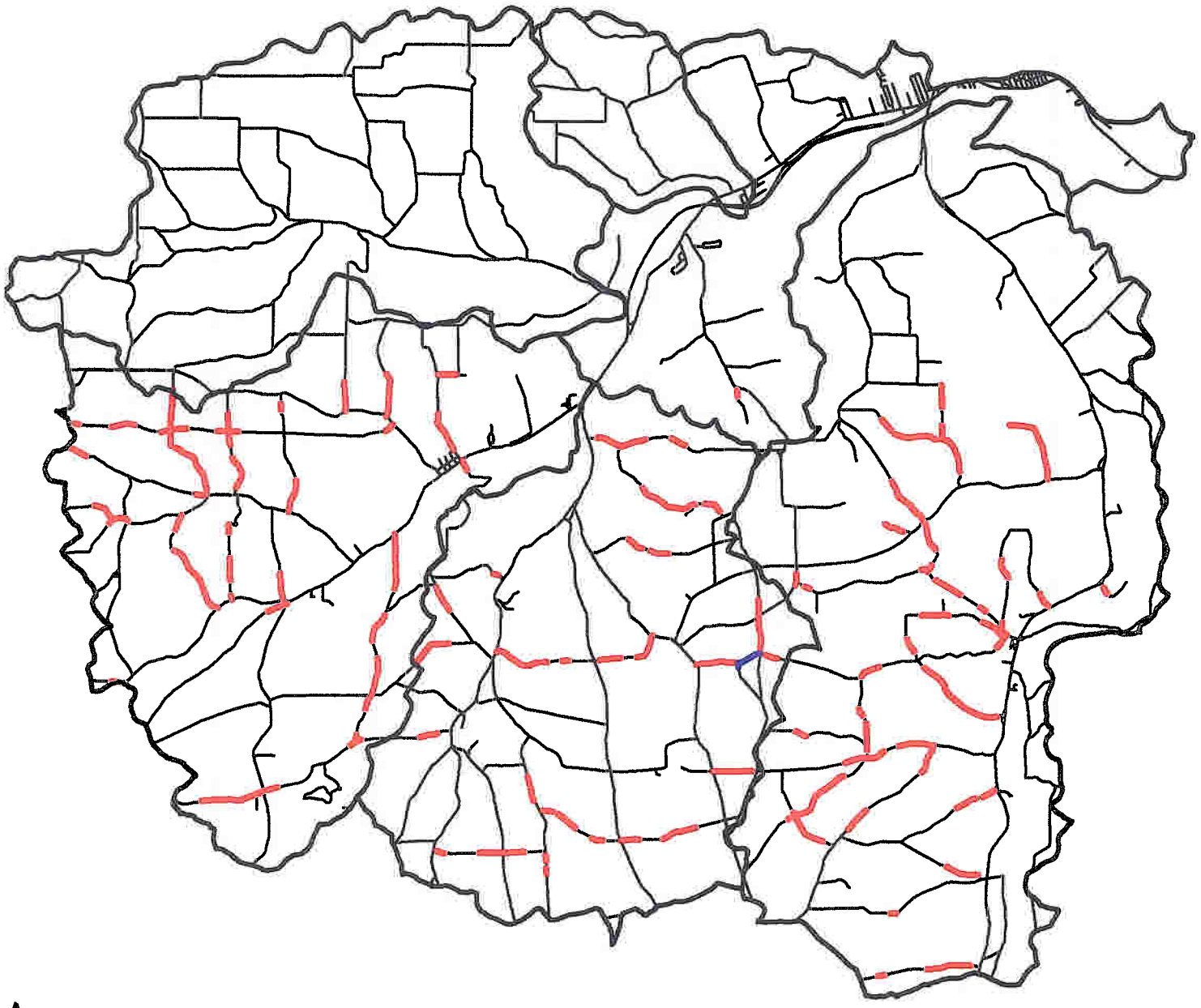
The Towns of Ashland and Southport have both enacted local ordinances to regulate timber harvesting operations. The objective of these regulations is to ensure that road construction, stream crossings, and other practices do not result in high sediment loads and impaired water quality. In Pennsylvania, timber harvesting activities are permitted by the Department of Environmental Protection.

Roadside Drainage

The Seeley Creek watershed contains 334 miles of roads (compared to 227 stream miles). These roads can significantly alter drainage patterns by intercepting dispersed overland flow and conveying it in roadside drainage channels. Erosion can occur in roadside ditches and on the surfaces of dirt and gravel roads. Roadside ditches concentrate overland flow and increase the speed at which runoff reaches the streams. Roadside drainage can contribute significant volumes of sediment and deicing materials to nearby streams. Additional impacts occur when roads constrict streams and floodplains, particularly at bridges and culverts. The hardening of streambanks with rock riprap to protect roads can impact the stability of stream systems.

In order to fund "environmentally sound" maintenance of unpaved roadways, Pennsylvania established the "Dirt and Gravel Road Pollution Prevention Program" in 1997. This program involves inspection of unpaved roads to identify the sources of dust and sediment pollution, followed by funding of environmentally sound maintenance projects. A user-friendly, GIS-based software package was developed to assess, map, and quantify problem areas on roads and in roadside ditches. This tool provides digital data sheets, generates maps, imports digital photographs, develops reports, and allows prioritization of road drainage and road ditch problems. Conservation District staff assessed all of the dirt and gravel roads in the Pennsylvania portions of the watershed, identifying 21.35 miles of problems in Bradford County and 14.58 miles of problems in Tioga County (shown in Figure 8). Numerical site assessment scores were generated to rank the severity of each identified drainage problem and prioritize implementation projects. To date, one project has been completed in the Upper Seeley Creek subwatershed in Bradford County.

Figure 8. **Seeley Creek Watershed - Pennsylvania Dirt & Gravel Road Assessment Inventory**



Seeley Creek Watershed
Bradford County, PA
Tioga County, PA

Dirt & Gravel Road Inventory Sites

Data collected by
Bradford County SWCD
Tioga County SWCD
2000-2001

LEGEND

Dirt & Gravel Roads Sites
Completed
Incomplete

334.34 Miles of roads in watershed
35.93 Miles of dirt and gravel roads have been assessd in PA.

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Wetlands

Figure 9 shows the locations of wetlands and deepwater habitats listed in the National Wetland Inventory (NWI) database maintained by the U.S. Fish and Wildlife Service (USFWS). This database includes ponds, lakes, rivers, and streams, as well as wetlands. These wetlands and waterbodies occupy about 2% of the watershed area. The wetland types are classified using the Cowardin classification system. The wetlands and waterbodies within the Seeley Creek watershed include the following systems.

- Riverine: Wetland and deepwater habitats contained within natural or artificial channels, excluding wetlands dominated by trees, shrubs, persistent emergent plants, emergent mosses or lichens. Rivers and streams fall within this system; subsystems include perennial and intermittent watercourses.
- Palustrine: All non-tidal wetlands dominated by trees, shrubs, persistent emergent vegetation, emergent mosses or lichens. This system also includes wetlands lacking such vegetation if they are: (1) less than 8 hectares (20 acres); (2) lack wave-action or bedrock shoreline features; and, (3) at the deepest spot, are no deeper than 2 meters at low water. Examples include ponds, marshes, swamps, bogs, fens, and potholes. Palustrine wetlands may be situated shoreward of lakes or river channels; as islands in lakes or rivers; on river floodplains; in isolated catchments; or on slopes.

The Commonwealth of Pennsylvania regulates all wetlands, regardless of whether they are included in the NWI database. The State of New York only regulates the larger wetlands and those with special value. The wetlands regulated by New York State are shown in Figure 10. The U.S. Army Corps of Engineers also regulates some projects that impact wetlands.

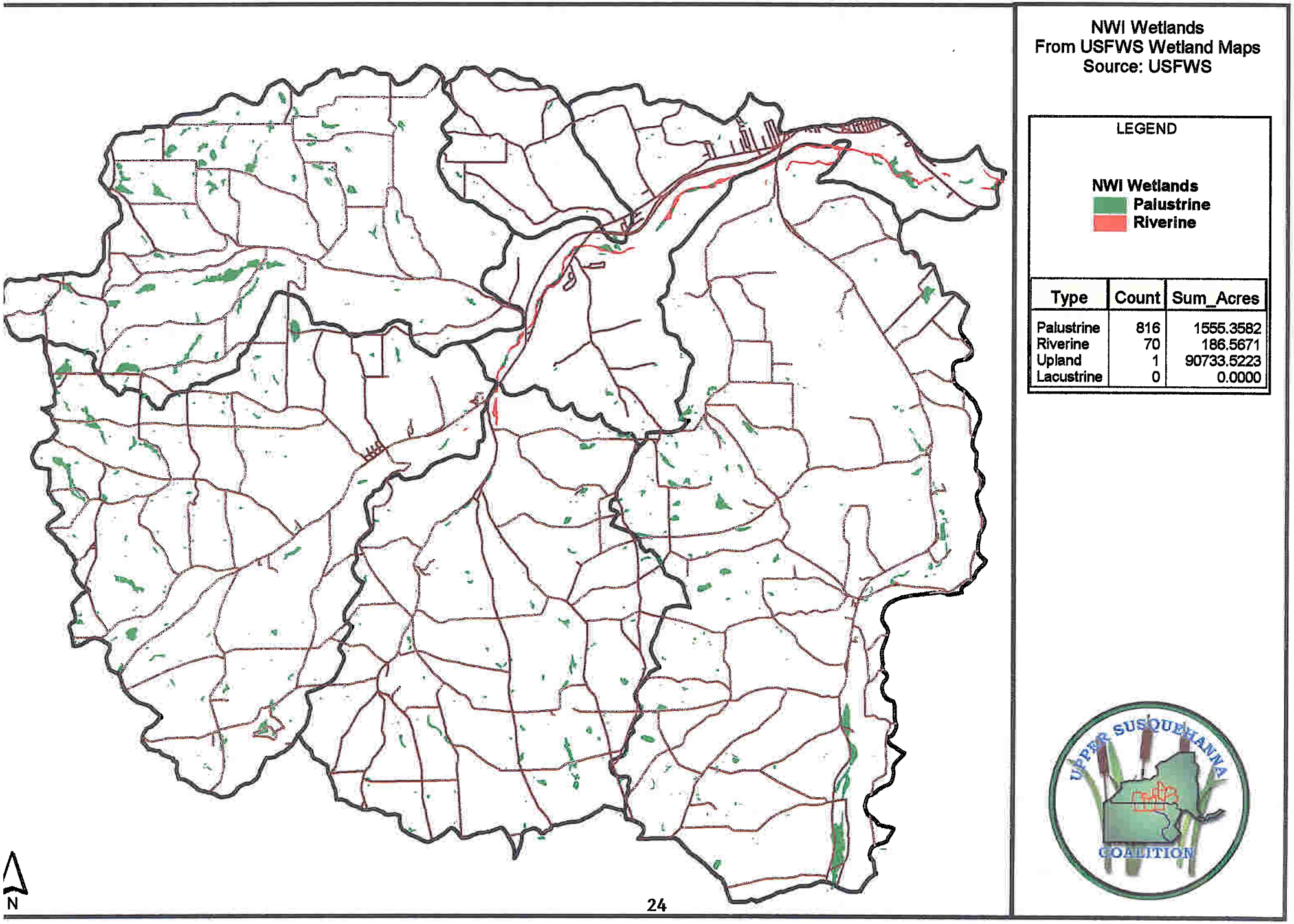
In 1997, the Upper Susquehanna Coalition conducted a wetland inventory study of the Seeley Creek watershed. Interns conducted a field survey of the watershed to identify potential sites for development or enhancement of wetlands (funded by U.S. Army Corps of Engineers as part of a Chemung Basin Reconnaissance Study). The identified sites are shown in Figure 11. Some of the existing wetland sites were assessed to have potential for enhancement. Ten sites were identified as potential locations for wetland creation projects.

Stream Assessment

In order to address the streambank erosion and stream instability problems in the watershed, it is desirable to assess the severity of the problems and the overall condition of each stream. If a stable stream system is to be restored, additional information is needed to quantitatively assess the degree to which the stream's existing conditions differ from its potential state of equilibrium.

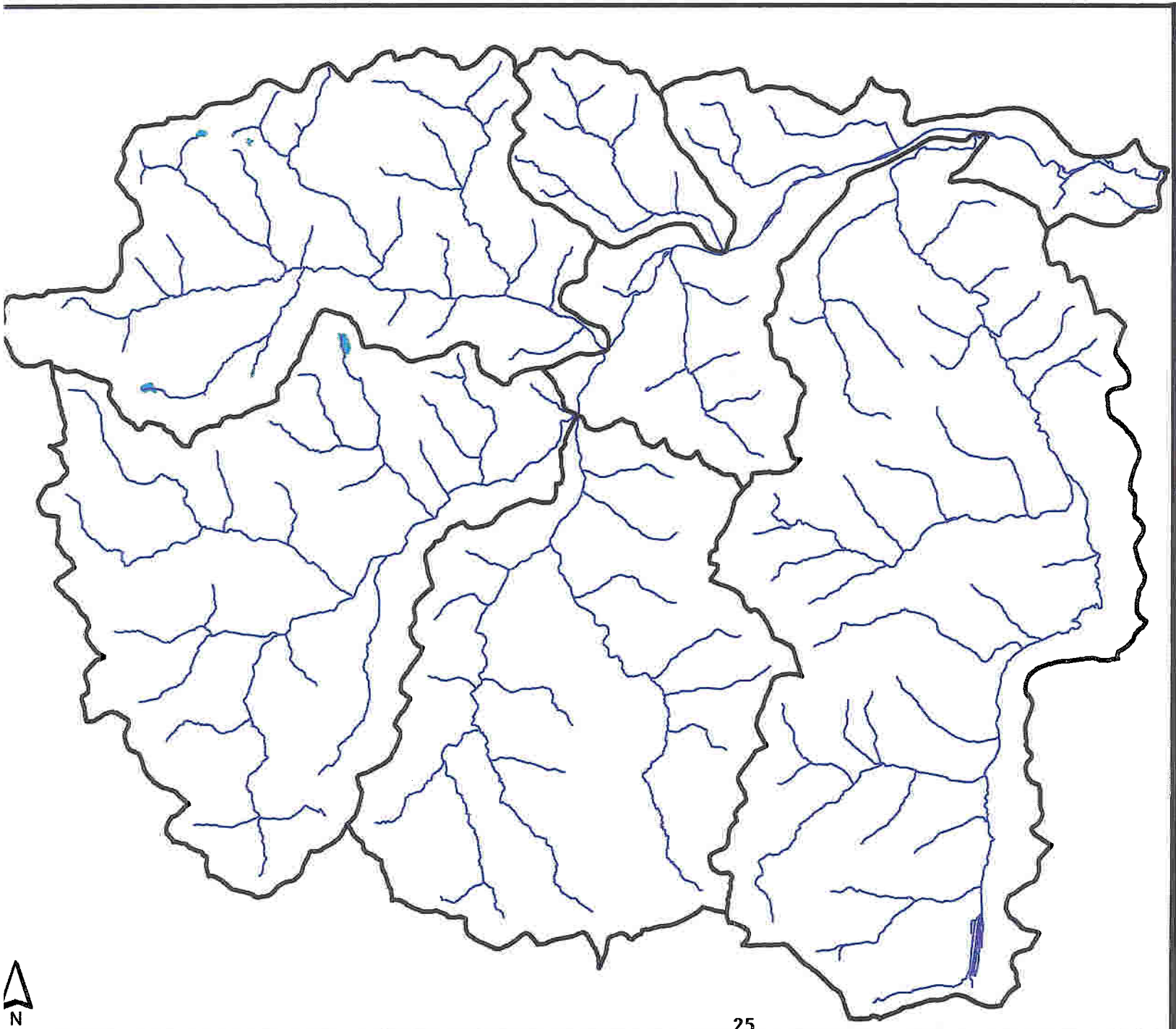
Interns have walked some of the streams in the Seeley Creek watershed to assess stream condition and document streambank erosion. Some of this information has been compiled into a computer database using a GIS assessment tool, based on that developed for the Pennsylvania Dirt and Gravel Roads Program. This computer tool can be used to: (1) record fluvial geomorphic data, (2) rank stream segment problems based on visual characteristics (using a procedure developed by the Natural Resources Conservation Service), and (3) calculate erosion rates (estimated tons per year) using a procedure developed by the Natural Resources Conservation Service. Additional capabilities are under development. Stream and buffer zone

Figure 9. **Seeley Creek Watershed - National Wetlands Inventory**



Type	Count	Sum_Acres
Palustrine	816	1555.3582
Riverine	70	186.5671
Upland	1	90733.5223
Lacustrine	0	0.0000

Figure 10. **Seeley Creek Watershed - New York State Regulated Wetlands**



New York State Regulated Wetlands
From NYSDEC Wetland Maps
Source: NYSDEC

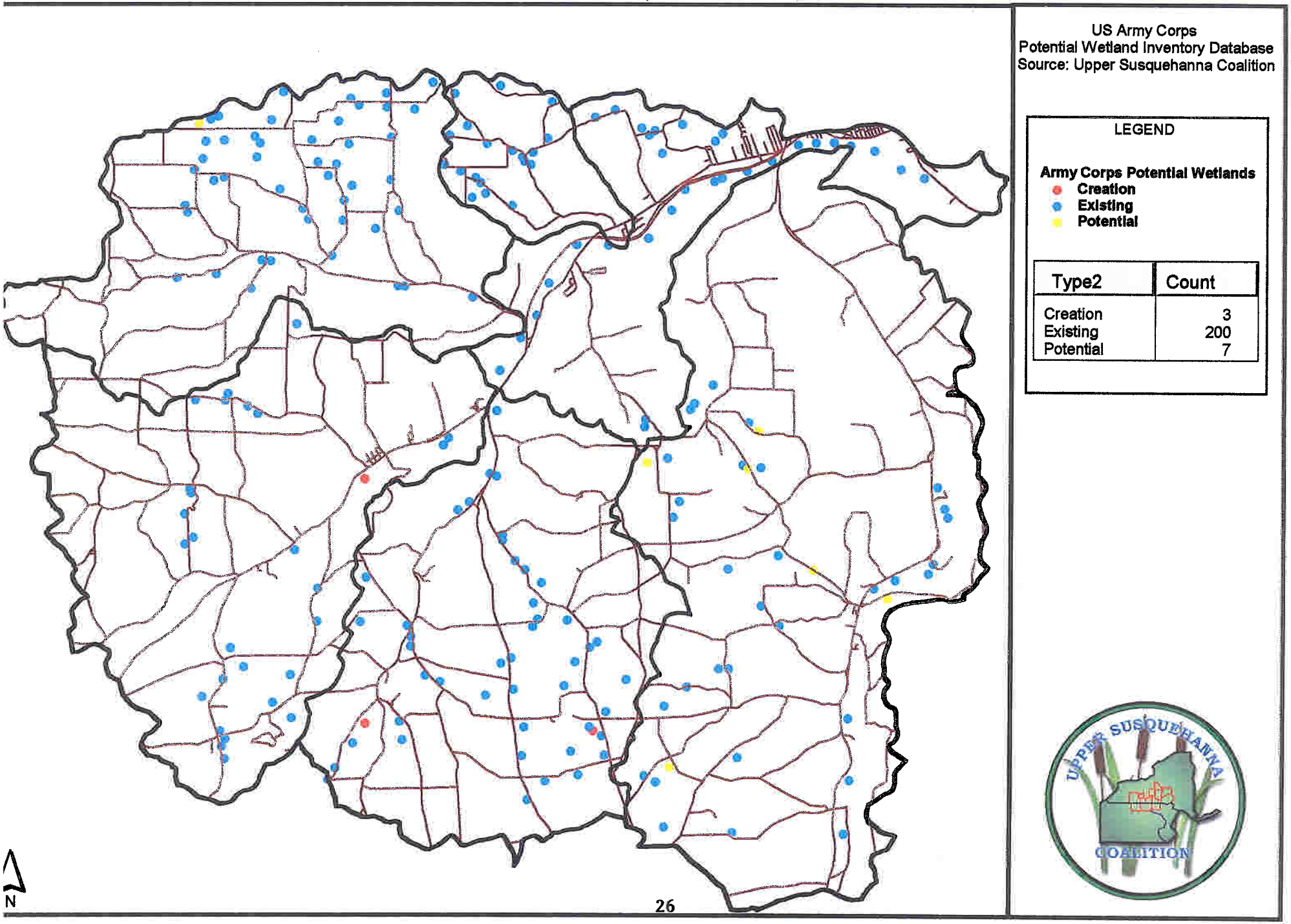
LEGEND

DEC Wetlands

Wetland	Count	Sum_Acres
NYSDEC	5	44.2381

N

Figure 11. **Seeley Creek Watershed - Potential Wetland Inventory**



assessments have been conducted in Bradford County (along Seeley, Hammond, and Beckwith Creeks), in the Dry Run subwatershed, and in the Clark Hollow subwatershed (within the Mudlick Creek subwatershed). The identified sites of streambank erosion are presented in Figures 12 through 14. The estimated erosion rates from documented erosion points are presented in Figures 15 and 16. The erosion inventory totals are:

Dry Run subwatershed: 223 tons/year eroded from 63 sites

Clark Hollow subwatershed: 49 tons/year eroded from 54 sites

The most severe erosion was documented from a 2,000-foot reach of Dry Run Creek along Dry Run Road (near Peacefield Road), where an estimated 126 tons of soil are eroded from unstable streambanks each year (shown in blue on Figure 15).

Water Quality

The Susquehanna River Basin Commission conducts an interstate water quality monitoring program, which includes periodic monitoring of Seeley Creek (in Seeley Creek, NY), South Creek (at Fassett, PA), and Bird Creek (near Webb Mills, NY). The most recent monitoring results are presented in *Assessment of Interstate Streams in the Susquehanna River Basin* (Monitoring Report No. 14, July 1, 1999, Through June 20, 2000, Susquehanna River Basin Commission Publication No. 215, June 30, 2001). Additional assessments of two Seeley Creek sites and three South Creek sites were conducted in 1997 (*Water Quality and Biological Assessment of the Chemung Subbasin*, Susquehanna River Basin Commission Publication No. 198, 1998). These assessments have documented poor habitat conditions in Seeley Creek (classified as "nonsupporting"), fair to good water quality, and slightly to moderately impaired biological communities. The biological impairment in Seeley Creek is attributed to disturbance of instream habitat (channel alterations, streambank erosion, and exposed substrate were observed). The South Creek sites had similar water quality characteristics, but the impairments were less than in Seeley Creek (partially supporting to supporting habitat conditions, fair to good water quality, and biological conditions ranging from moderately impaired to nonimpaired). Impairment of South Creek may be due to periodic drying of the streambed or to poor habitat diversity. Bird Creek had a moderately impaired biological community, excellent habitat, and acceptable field chemistry measurements.

Water quality monitoring by New York State in the downstream reaches of Seeley Creek indicates that the overall water quality is good. In 1998, a biological (macroinvertebrate) assessment was conducted by the NYS Department of Environmental Conservation at three sites on Seeley Creek and one site on Mudlick Creek. They found that the water quality was non-impacted at two Seeley Creek sites. The water quality was slightly impacted at one Seeley Creek site and the Mudlick Creek location, but the type of impact was not clear. Some siltation effects were noted. *The 1998 Chemung River Basin Waterbody Inventory and Priority Waterbodies List*, prepared by New York State (Department of Environmental Conservation) suggests that the biological impacts that do exist are more likely due to significant habitat alteration, poor substrate quality and/or overall instability than due to problems related to water quality. The reach of Seeley Creek downstream of Mudlick Creek is listed as a "threatened segment." This listing is based on the silt/sediment pollution that results primarily from streambank erosion. Continuing streambank erosion and instability are considered a threat to the biologic community and fishery.

Figure 12. **Seeley Creek Watershed - Bradford County Streambank Assessment Inventory**

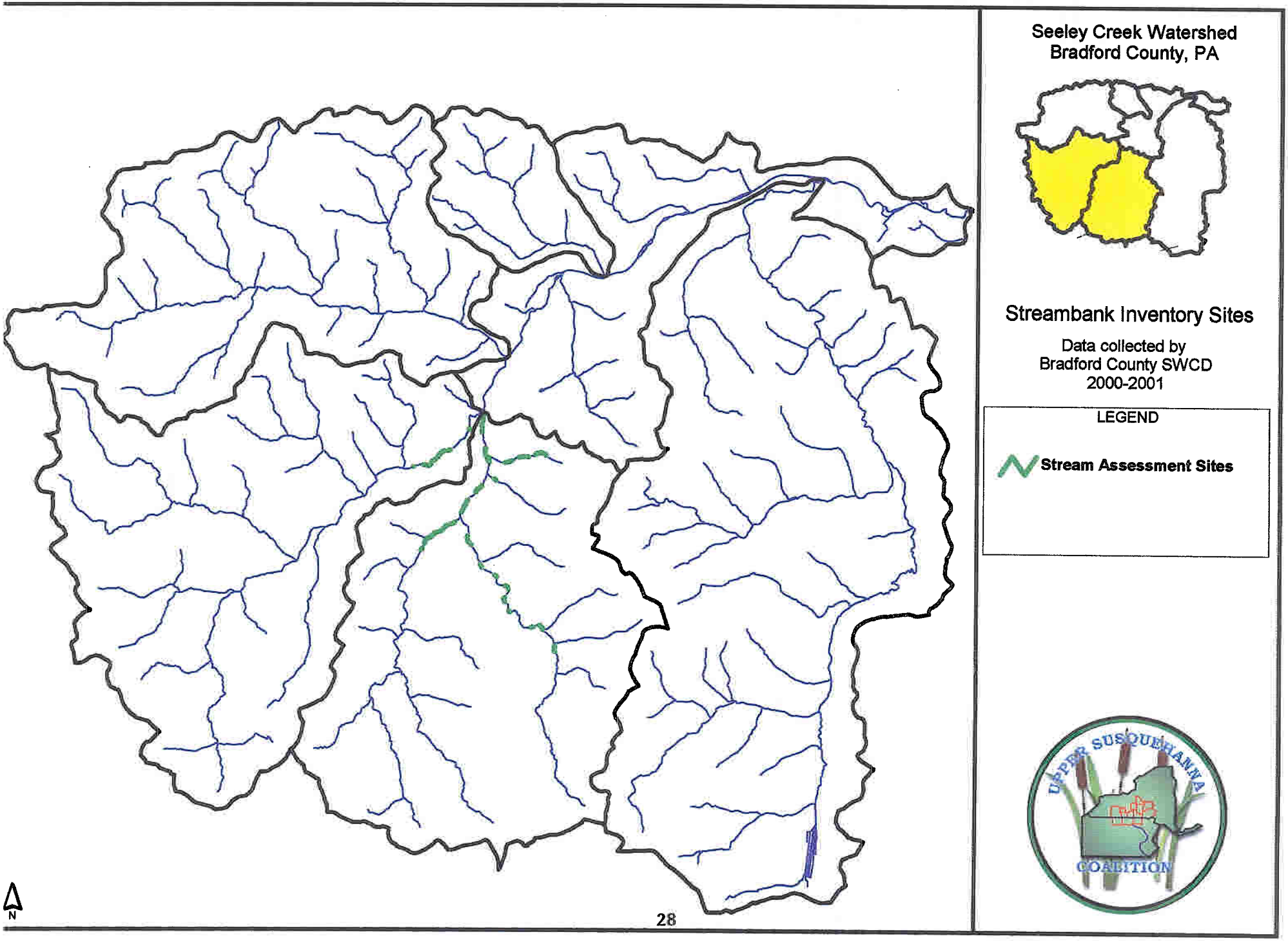
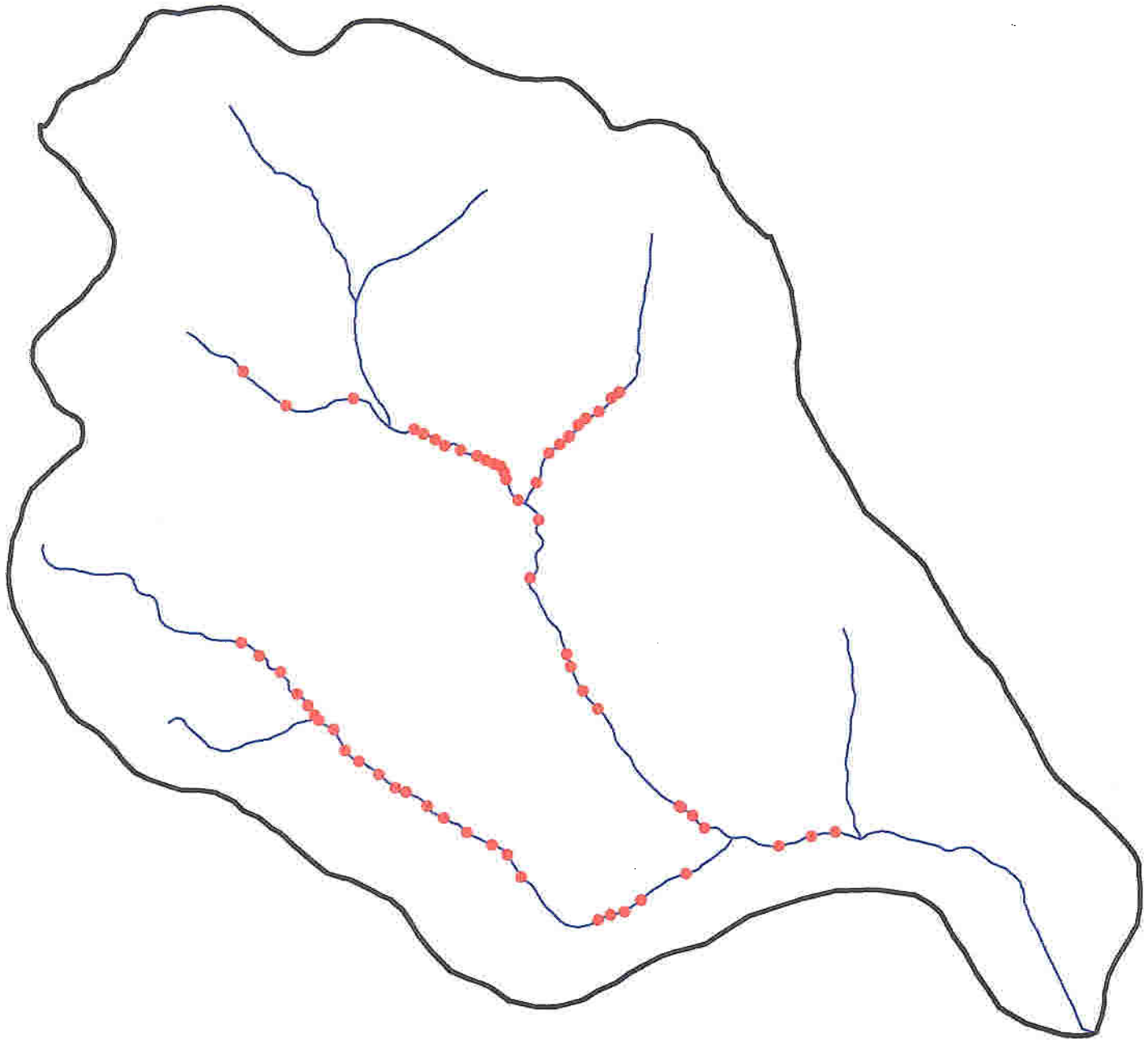
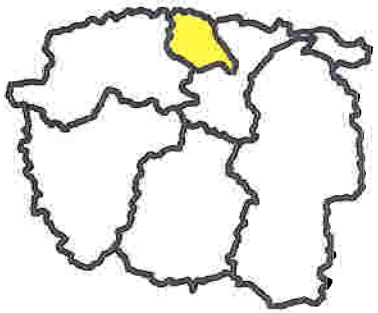


Figure 13. **Seeley Creek Watershed - Dry Run Sub-Watershed Erosion Inventory**



Dry Run Watershed



Erosion Inventory Sites

Data collected by
Chemung County SWCD
Summer 2001

LEGEND

● **Erosion Points**

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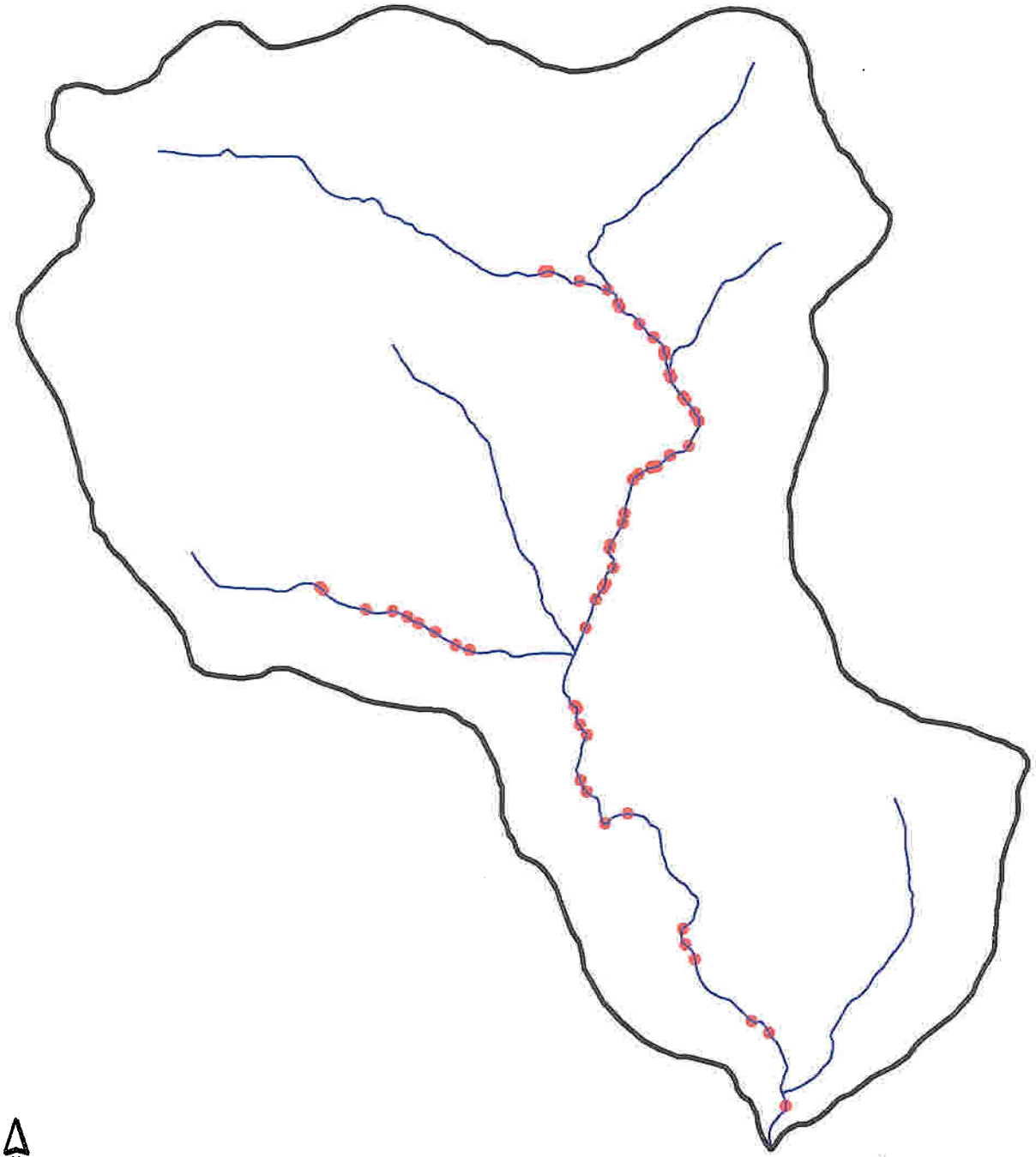
Figure 14. **Seeley Creek Watershed - Clark Hollow Creek Sub-Watershed Erosion Inventory**



Clark Hollow Creek Watershed

Erosion Inventory Sites

Data collected by
Chemung County SWCD
Summer 2000

LEGEND

Erosion Points

N

Figure 15. **Seeley Creek Watershed - Dry Run Sub-Watershed Erosion Inventory**

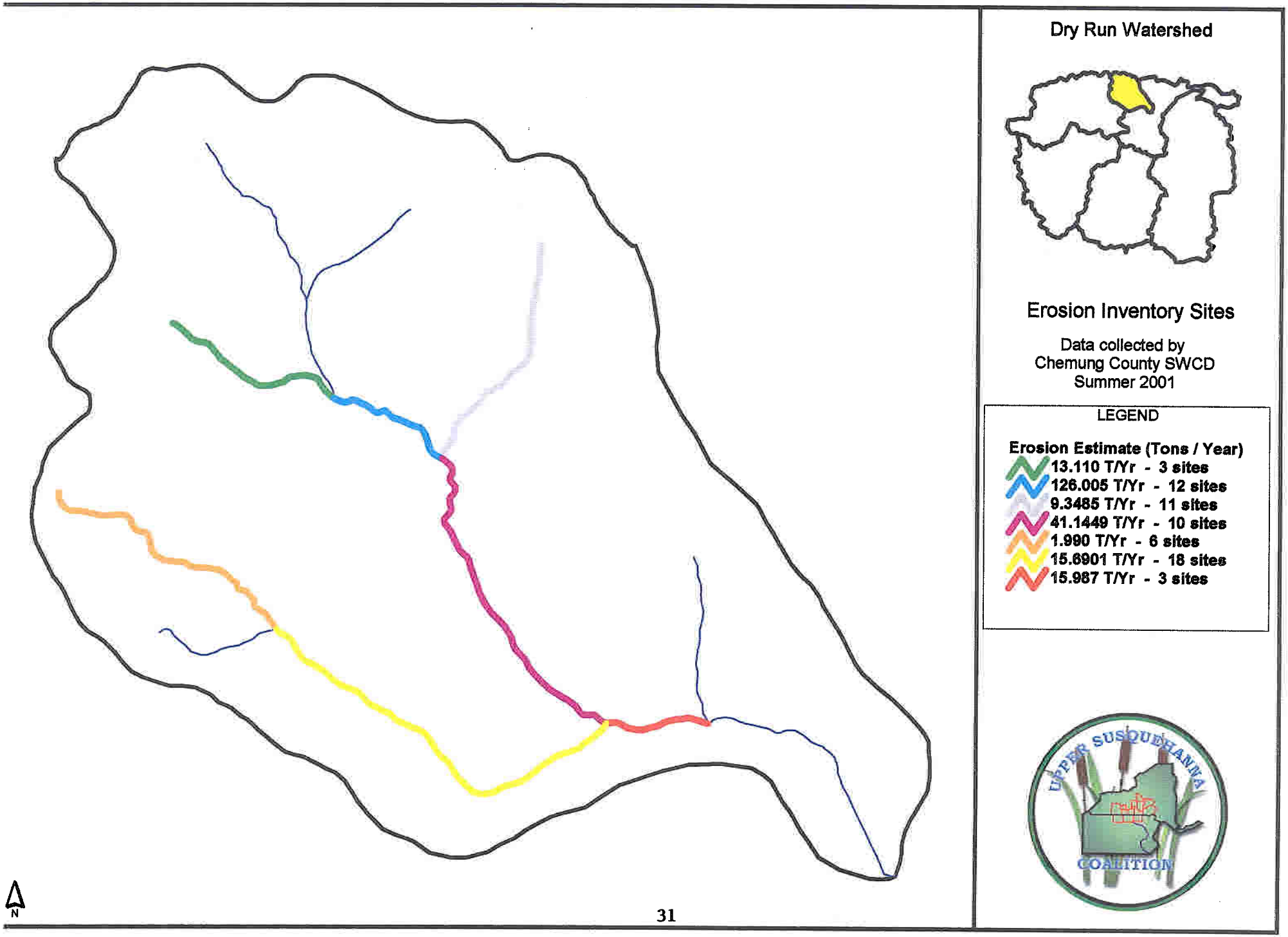
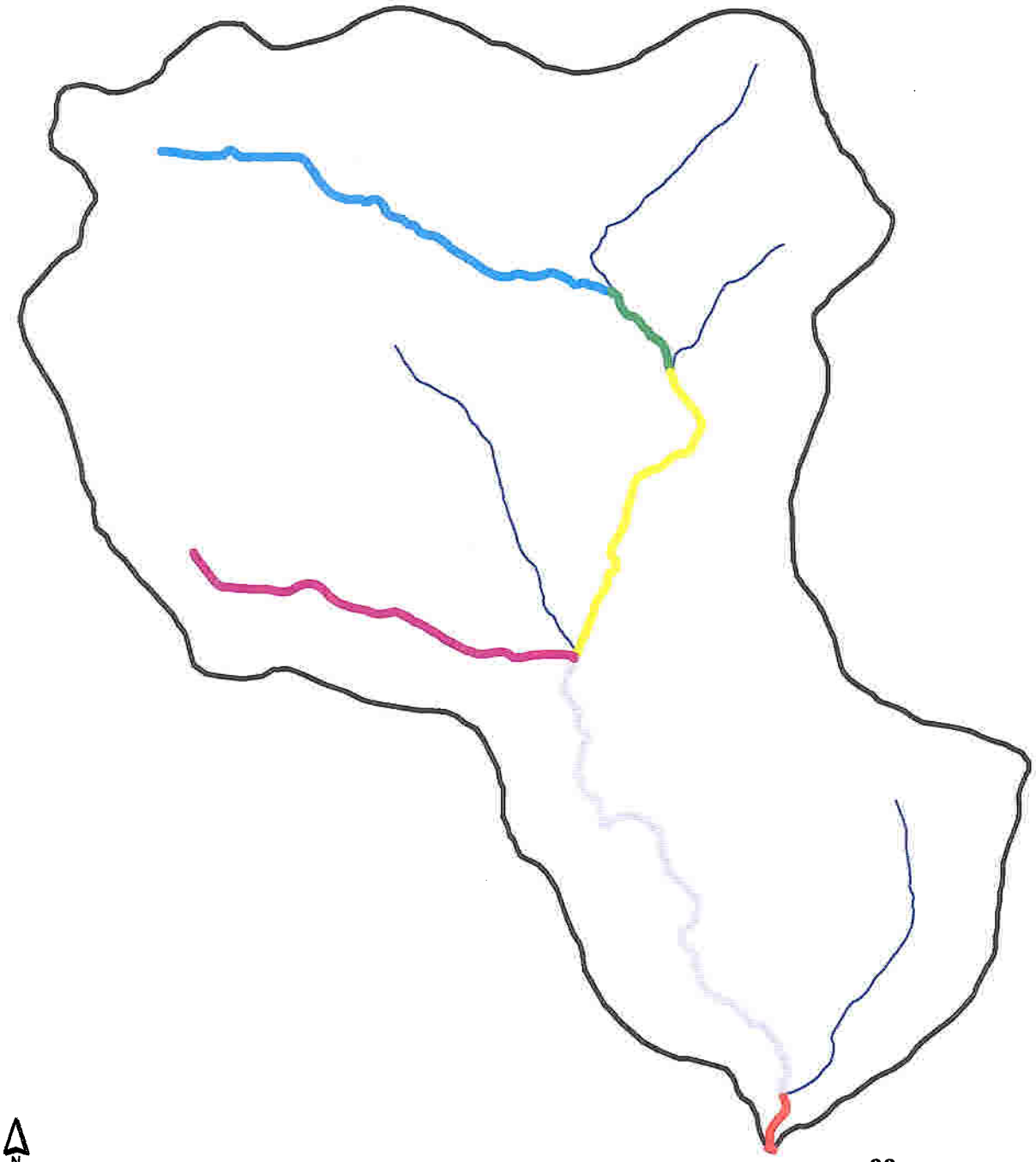


Figure 16. **Seeley Creek Watershed - Clark Hollow Creek Sub-Watershed Erosion Inventory**



Clark Hollow Creek Watershed

Erosion Inventory Sites

Data collected by
Chemung County SWCD
Summer 2000

LEGEND

Erosion Estimate (Tons/Year)

- **2.006 T/Yr - 4 sites**
- **0.6793 T/Yr - 6 sites**
- **6.054 T/Yr - 21 sites**
- **5.547 T/Yr - 9 sites**
- **31.042 T/Yr - 13 sites**
- **3.966 T/Yr - 1 site**

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The Chemung County Water Quality Strategy Committee conducted water quality monitoring in Seeley Creek in 1998 and 1999 and is resuming this monitoring effort in 2002. Trained volunteers conduct sampling at four sites on Seeley Creek and one on Mudlick Creek in the Town of Southport. Analysis includes temperature, pH, conductivity, dissolved oxygen, turbidity, alkalinity, hardness, chlorides, total suspended solids, nitrates, and phosphorous. All measurements have been within standard ranges. The lack of shade within the flood control project results in high summer temperatures at some Seeley Creek sites.

Hydrologic Modeling and Data

The Town of Southport Drainage Officer is developing a hydrologic model of the Seeley Creek watershed. The hydrologic analysis is conducted using Soil Conservation Service TR-55 procedures to calculate runoff parameters and the HEC-HMS computer model (developed by the U.S. Army Corps of Engineers) to compute stream flow hydrographs. The objective of this effort is to develop a basis for anticipating the effects of short intense storms on flash flooding. The model can be used to prepare hydrographs (plots of discharge as a function of time at specified locations) for model storms or actual rainfall events. This information will enable comparison of the peak discharges throughout the watershed and travel times of these peaks from upstream to downstream locations. The model can also be used to evaluate the flood attenuation benefits of proposed stormwater detention or wetland projects.

Although the hydrologic model is not yet complete, information from the existing model (which does not yet include the South Creek portion of the watershed) is summarized in Tables 4 and 5. Table 4 lists the total volume of discharge produced in each subwatershed for a model 100-year storm event. These results indicate a significant contribution of surface runoff from the Dry Run subwatershed. Although this subwatershed constitutes only about 5% of the watershed area that was modeled, it contributes more than 10% of the total discharge volume. Table 5 shows the timing of peak discharges at selected stream confluence locations. This information can be used to estimate the arrival time of peak flood conditions at downstream locations based on observations of upstream flood peaks. These data can also be used to compare the peak arrival times at the confluence of two streams. When the peak discharge of a tributary arrives at the same time as the peak in the main stream, the downstream flood impact is greater than if the peak flows are staggered. The hydrologic model can be used to evaluate the flood attenuation benefits of proposed wetland, detention pond, and other projects on downstream flooding. The project benefits can be enhanced if the location and design contribute to increased desynchronization of peak discharges from various tributaries.

The Seeley Creek hydrologic model is a valuable planning tool, but cannot predict the actual flood conditions that will occur. Soil moisture conditions, rainfall patterns, debris blockages and other factors can have a significant influence on flood characteristics. When the model was run for winter conditions (when the ground is frozen and thus unable to absorb water), the estimated discharges were almost twice those that were calculated for the same storm during the growing season. The rainfall pattern can also have a significant impact. A storm front that moves from the headwaters to the mouth of a stream will generally result in greater synchronization of discharge and higher flood levels than would result from a similar storm that moved in the opposite direction. Model results cannot simulate the impacts of ice jams or debris

Table 4
Hydrologic Modeling Results:
Subwatershed Contributions to Discharge Volume

Subwatershed	Drainage Area		Volume of Discharge	
	Square Miles	% of Watershed	Acre Feet	% of Watershed Discharge
Lower Seeley Creek (excluding area downstream of Mountain View Cr.)	12	13.0%	1,410	11.9%
Dry Run	5	4.9%	1,217	10.3%
Mudlick	21	21.8%	2,617	22.1%
Hammond Creek	30	31.7%	3,269	27.5%
Upper Seeley Creek	27	28.5%	3,356	28.3%
TOTAL (excluding South Cr. subwater-shed and area downstream of Mountain View Cr.)	**96**	**100%**	**11,869**	**100%**

blockages, which have historically contributed to flooding problems in the Seeley Creek watershed, particularly at bridges and culverts.

The Upper Susquehanna Coalition began monitoring stream levels and rainfall in the Seeley Creek watershed in 2000. There are presently two stream meters and data loggers collecting continuous records of stream stage (water height) in Clark Hollow Creek and Dry Run. An additional gauge monitors rainfall in the Clark Hollow subwatershed. The data collected by these devises is periodically downloaded onto a portable computer for data storage and analysis. An example of the stream level and rainfall data for one storm event is presented in Figure 17, which illustrates a very rapid response of the stream to the measured rainfall at this location. Current plans call for additional gauges to be placed downstream of planned wetland projects to monitor the impact of the wetlands on downstream flow conditions. It is anticipated that information from these data loggers will enable calibration of the hydrologic model for the Seeley Creek watershed. In order to do this, a rating curve must be developed at each stream gauge site to correlate stream stage (water height) with the discharge (water volume). This requires measurement of velocity profiles at each site under a range of stream flow conditions.

Groundwater levels have been monitored weekly at 5 wells in the Pine City area of Southport since 1994. The groundwater levels measured in 2000 are shown in Figure 18. In this area, the groundwater response to rainfall events is highly localized. One of the five wells has been consistently dry, despite repeated flooding of a basement located 150 feet away. At other wells, water has repeatedly risen to within 1 to 3 feet of the ground surface.

Table 5
Hydrologic Modeling Results:
Timing of Peak Discharges at Stream Confluences

Confluence Location	Peak Flow (cubic feet per second)	Time of Peak* (hours:minutes)	Volume of Discharge (acre feet)
Chapel Park:			
Seeley Creek	25,099	3:10	11,661
Mountain View Cr.	528	1:50	139
Below confluence	25,329	3:10	11,869
Pine City:			
Seeley Creek	22,426	2:45	10,065
Dry Run	3,538	1:45	1,217
Below confluence	24,670	2:30	11,330
Webb Mills:			
Seeley Creek	21,628	2:40	9,371
Bird Creek	2,140	1:25	516
Below confluence	22,431	2:30	10,065
Seeley Creek Hamlet:			
Seeley Creek	17,009	2:05	6,625
Mudlick Creek	5,440	3:35	2,617
Below confluence	21,638	2:15	9,371
State line:			
Seeley Creek	9,658	1:55	3,356
Hammond Creek	8,012	2:50	3,269
Below confluence	17,009	2:05	6,625
Millerton:			
Hammond Creek	6,799	2:40	2,255
Widger Hill trib.	1,484	1:40	390
Below confluence	7,670	2:35	2,765
Mouth Alder Run:			
Hammond Creek	3,951	2:20	1,147
Alder Run	2,298	2:55	845
Below confluence	6,012	2:25	1,992
Mosherville:			
Seeley Creek	3,385	2:10	1,223
Beckwith Creek	3,757	1:50	1,246
Below confluence	8,266	1:45	2,943

*Time of peak is given as the time after the middle of the period of maximum rainfall intensity for the model storm. This reference time is 12 hours after the start time for a model 24-hour, 100-year storm event (with summer runoff conditions).

Figure 17. Clark Hollow Aug.16/17, 2001

Rain and Stream Gauge Data

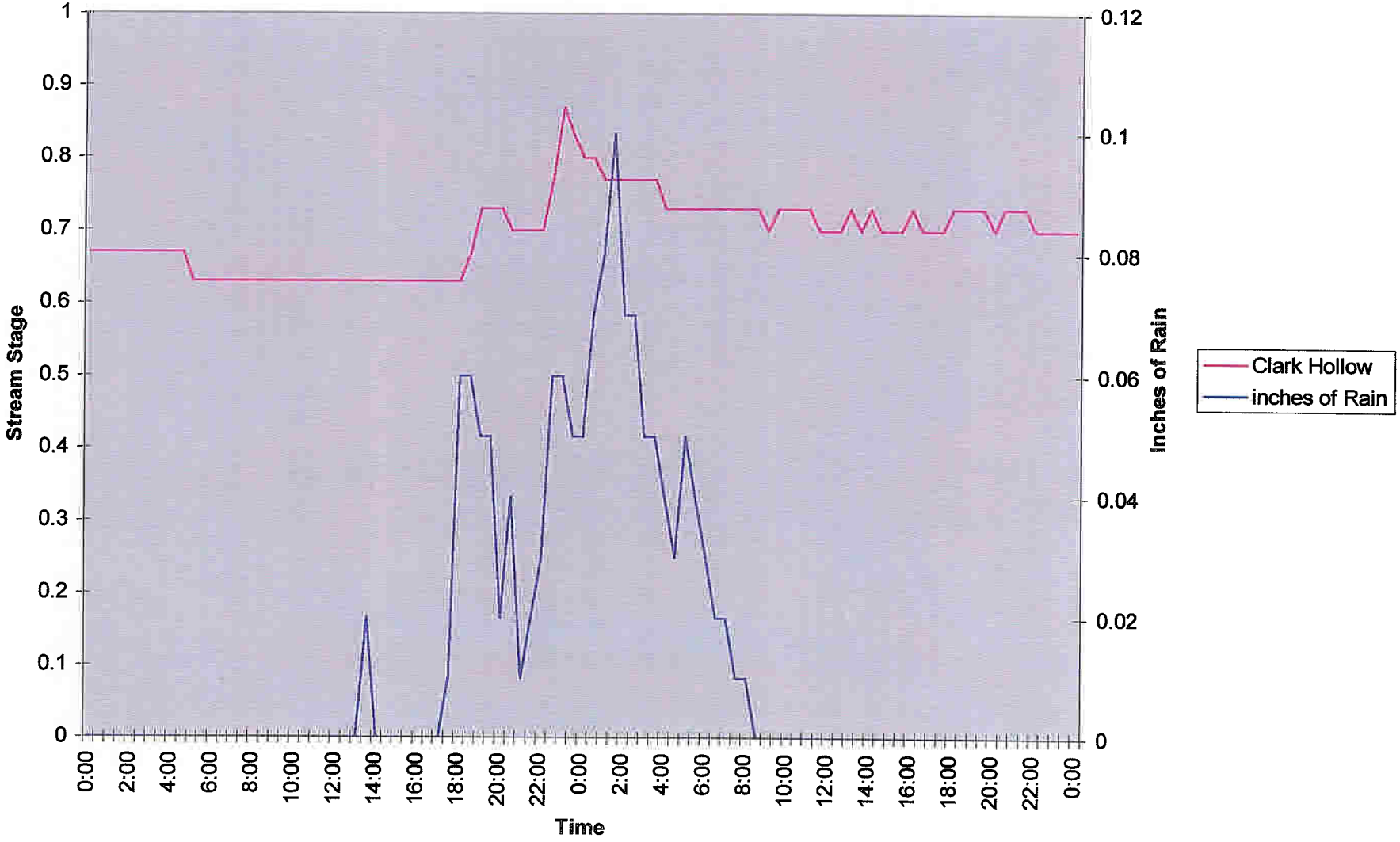
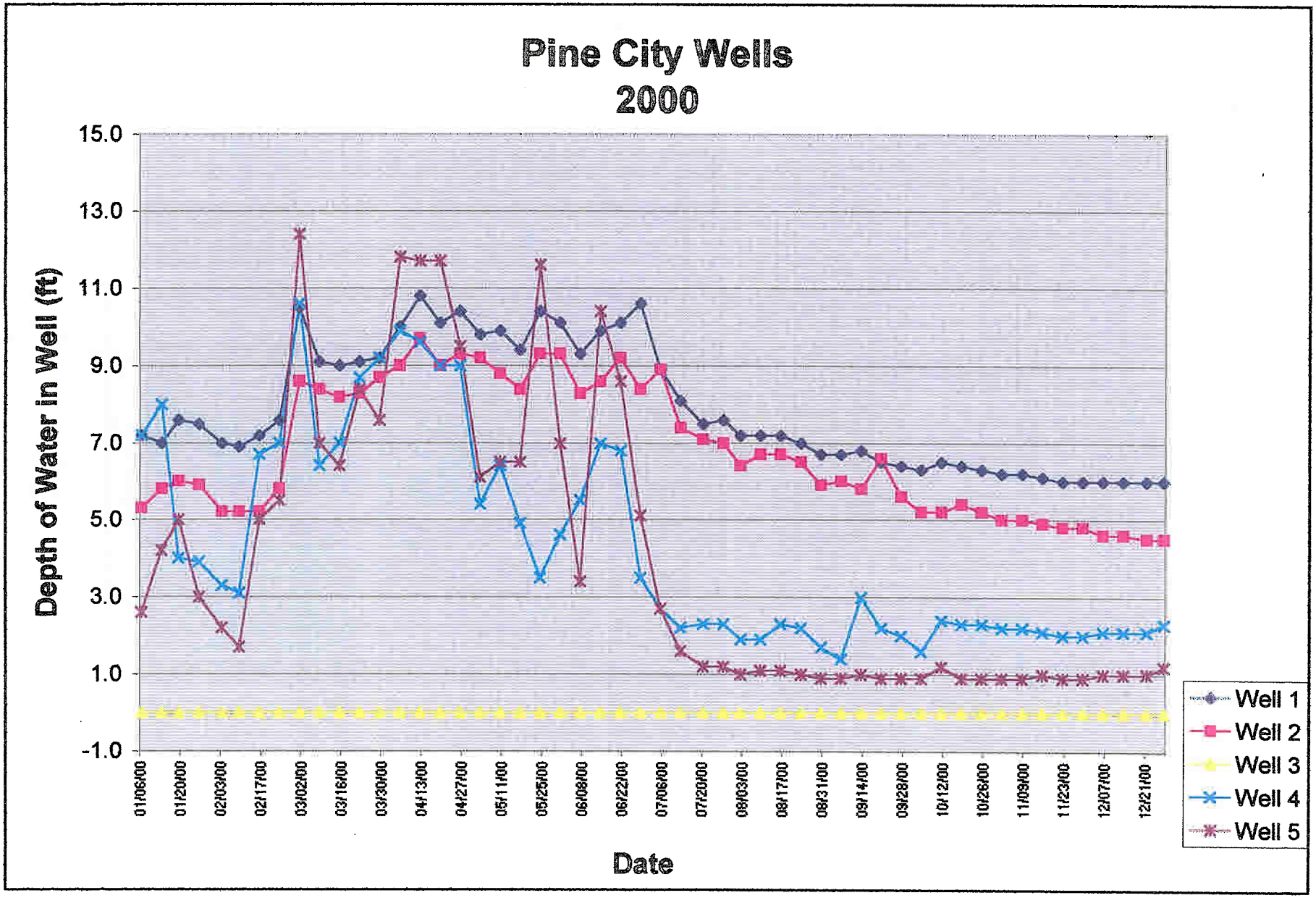


Figure 18. Groundwater Levels



HAZARDS

Natural and man-made hazards threaten both the human population and property in the Seeley Creek watershed. The principle hazards, which are addressed most extensively in this plan, are those that result from flooding and bank erosion along the watershed's many streams and drainage ways. Additional hazards include severe weather events, drought, wildfire, landslides, earthquakes, hazardous material releases, environmental contamination, and terrorism.

Flood Hazards

Flooding is a serious problem in the Seeley Creek watershed. Of the respondents to the watershed survey, 50.4% are very concerned or somewhat concerned about flooding where they live. Only 19.5% indicate that their house is located in a floodplain (17.1% don't know). Respondents reported being affected by flooding in the following ways:

Loss of property—11.6% very much; 18.1% some; 13.1% not very much; 56.7% not at all; 0.6% don't know

Loss of income for an extended time—5.9% very much; 9.2% some; 8.6% not very much; 74.2% not at all; 2.1% don't know

Illness or injury to yourself or a member of your immediate family—4.2% affected very much; 3.9% affected some; 7.1% not very much; 81.5% not at all; 3.3% don't know

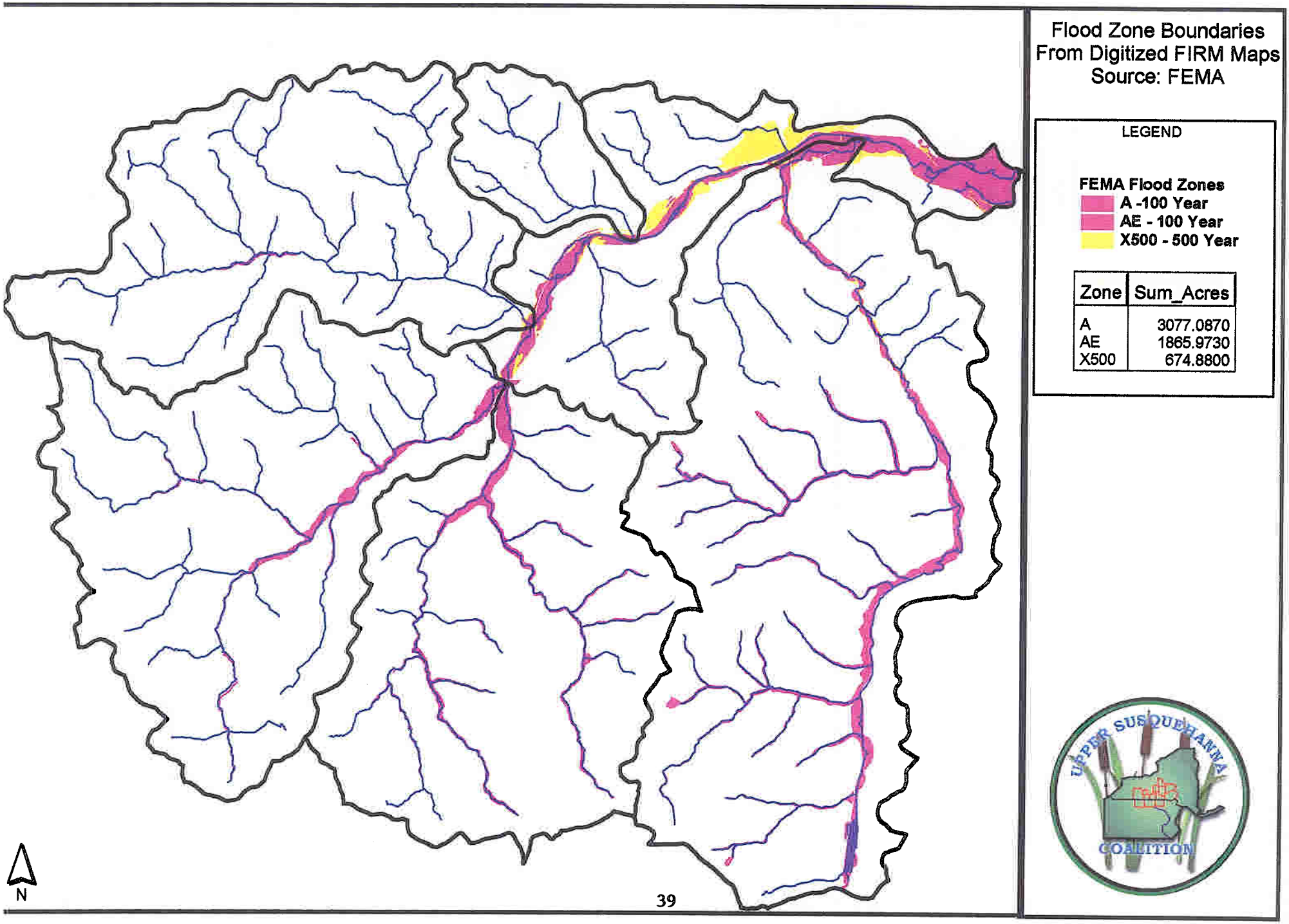
The Seeley Creek watershed has repeatedly experienced severe flooding. Major flood events occurred in May 1946, June 1972 (Hurricane Agnes), September1975 (Hurricane Eloise), June1976 ("Fathers' Day Flood"), April 1993 ("Blizzard of '93" snowmelt), August 1994 (Hurricane Beryl), January 1996 (snowmelt and heavy rain), and November 1996 (heavy rain). In addition to these major floods, many additional heavy rainfall events have caused localized drainage problems, ponding, streambank erosion, and other difficulties.

The floodplains delineated by the Federal Emergency Management Agency are shown in Figure 19. Local laws enacted by each municipality regulate development within these mapped 100-year floodplains. The floodplain development standards are intended to insure that new development in these areas is protected from flood damages and does not cause damage to other areas. In most areas of the watershed, this mapped floodplain is undeveloped or sparsely developed. The mapped 100-year floodplains constitute about 2% of the watershed area.

Significant flood hazards exist in areas that are not mapped as 100-year floodplains. The potential for flooding from many of the smaller tributary streams was not evaluated when the Flood Insurance Rate Maps were prepared. Yet these streams have floodplains, many of which pose serious flood hazards. Flooding from these smaller tributaries often results from the formation of debris dams that block flow within the channel, particularly at bridges and culverts. Local laws for flood damage prevention do not regulate development along streams that lack delineated floodplains.

Additional un-mapped flood hazards occur on alluvial fans that have developed where high gradient (steep) tributaries enter the flat valleys of the major streams. These tributaries

Figure 19. **Seeley Creek Watershed - Flood Zones**



carry high sediment loads down the steep sections, but are no longer able to transport this sediment when the gradient decreases in the larger valleys. Sand and gravel are deposited, eventually forcing the stream to change its course. Over a period of many decades, this process results in the accumulation of a large fan-shaped mound of sediment, called an alluvial fan. These are tempting sites to develop, because they are relatively flat areas that are elevated above the floodplain of the main stream in the valley. However, the streams that formed and cross these alluvial fans are naturally unstable. They frequently overflow their banks, accumulate sediment within the channel, and are prone to changing course. Existing development on alluvial fans has been plagued by repetitive flooding problems. The hamlet of Pine City is located on the alluvial fan formed by Dry Run Creek and includes approximately 80 homes that routinely experience flooding of cellars and adjacent property. Chronic flooding is also a problem in the hamlet of Millerton, which is located on an alluvial fan in the Hammond Creek valley.

In the Town of Ashland, Seeley Creek flooded a developed area outside of the Seeley Creek watershed in August 1994, January 1996, and November 1996. During each of these events, water from Seeley Creek was diverted by a large tree jam ("the size of a two story house") that blocked the main channel, diverting water into an overflow channel that was unable to contain the flow. Floodwater breached a berm, flowed across an agricultural field, and backed up behind an elevated railroad bed. During each of the three flood events, the railroad bed breached or overflowed, releasing a wall of water that flooded numerous residential and commercial structures. During the August 1994 (Hurricane Beryl) event, this flooding resulted in a release of hazardous materials stored at a business. In addition, a train (that could not be recalled in time) crossed the damaged section of track, posing a serious risk of derailment. In 1997, the debris dam was removed and the channel of Seeley Creek was reconstructed at this location.

Overland flooding and ponding problems occur when excess runoff is not carried in a defined channel. It leads to flood damages when structures are improperly sited and stormwater runoff is not properly managed at development sites. Alteration of natural drainage patterns has contributed to sedimentation and flooding problems as several locations in the Seeley Creek watershed. Additional problems are experienced in areas where development has occurred in flat areas with poorly drained soils. The natural ponding of runoff at these sites results in frequent and prolonged flooding, with water depths typically less than two feet. In some areas, these ponding problems are compounded by groundwater flooding due to a high water table.

Groundwater can cause flooding when water below the surface of the ground seeps through basement walls, backs up through basement drains, or impairs septic systems. Groundwater occurs close to the surface in many developed areas within the Seeley Creek watershed, particularly in the flat alluvial valleys of the larger streams. Because groundwater levels are difficult to monitor and are subject to natural fluctuations, these problems are not always apparent when property is purchased or developed. The Town of Southport has established 5 groundwater-monitoring wells in the Pine City area where many houses experience frequent flooding of basements and the lower floors of split-level structures. This information is used to discourage additional below-grade development in these areas. It can also be used to alert residents when the water table approaches the shallow levels at which they experience problems.

A flood control levee along 2.7 miles of Seeley Creek provides flood protection to a densely developed area north of the creek in the Town of Southport. The New York State Department of Transportation has recently modified this levee for construction of the Elmira Arterial South Extension. This reconstruction involved straightening of the creek and construction of an elevated highway within the floodplain. This is expected to increase the flood hazard on the opposite side of Seeley Creek. This modification to the levee protection has not yet been tested by a high water event.

Areas with identified flooding and streambank erosion problems are shown in Figure 20. The Town of Southport and Town Ashland have both prepared *Flood Mitigation Action Plans,* which identify flood hazards, document flood problem areas, set goals, evaluate possible solutions, and propose specific measures that will be implemented to mitigate future flood damages.

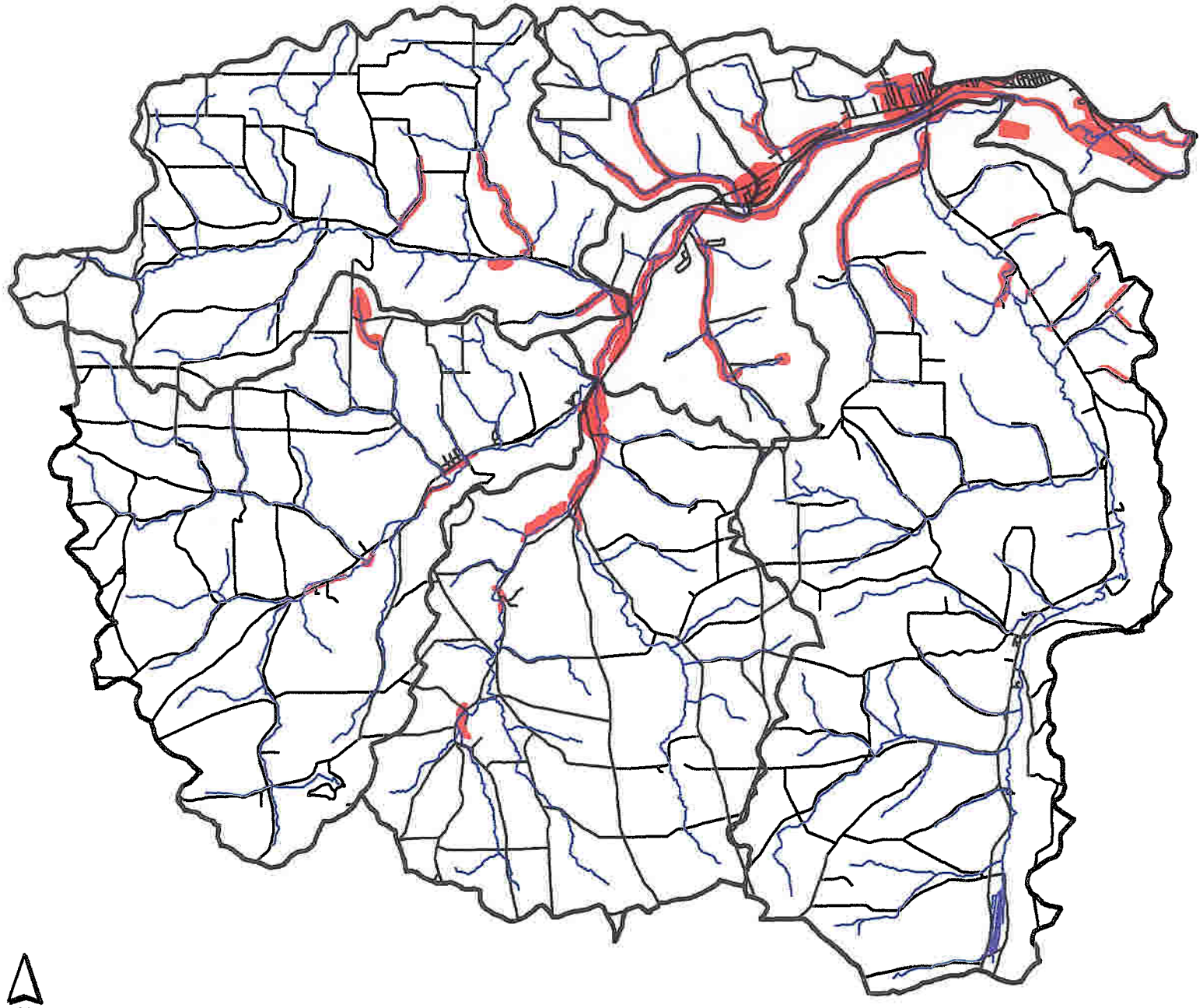
Streambank Erosion

Erosion of streambanks and the subsequent deposition of eroded materials are major concerns in the Seeley Creek watershed. The severity of these problems is due, in part, to the widespread occurrence of poorly consolidated glacial deposits, which are particularly susceptible to erosive forces. Modification of stream channels and floodplains has also contributed to increased erosive forces along many streams. These erosional processes are accelerated during flood events. Bank erosion leads to the loss of lawns and agricultural land. It can undermine buildings, roads, and bridges or expose pipelines and septic systems. Severe erosion also degrades riparian and aquatic habitat. Accelerated erosion of banks loosens large volumes of material that are subsequently deposited within stream and river channels, limiting the capacity for carrying water. Eroded material that is carried downstream contributes to increased deposition rates in downstream reservoirs and the Chesapeake Bay. Although bank erosion and channel migration are natural processes, they can be accelerated by human activities.

There are numerous examples of damage caused by streambank erosion throughout the Seeley Creek watershed. A severe incident occurred in the Webb Mills area (Town of Southport), where the November 1996 flood caused up to 60 feet of streambank erosion, undermining one building, exposing one septic system, and seriously altering many back yards. The Chemung County Soil and Water Conservation District cost estimate for restoring this site is $925,000. In 1997, the New York State Department of Transportation spent $270,000 realigning another reach of Seeley Creek to protect Highway 328 near Pine City. A gasoline pipeline, located south of Webb Mills, was exposed by down cutting of Seeley Creek during the November 1996 flood. This pipeline, carrying 750 gallons of gasoline per minute, was left exposed to possible rupture for about two months until it was replaced at a greater depth. Another pipeline located near the Pennsylvania Avenue Bridge in Pine City was exposed in the August 1994 flood. Debris dams form from trees that fall into the channel when the bank erodes. In 1997, the Town of Southport spent $87,000 removing trees from the creek to protect roads and houses from additional damage.

Ninety-six percent of the respondents to the Seeley Creek watershed survey indicated that streambank erosion is a very important (76.0%) or somewhat important (19.6%) problem facing Seeley Creek.

Figure 20. **Seeley Creek Watershed - Flood Problem Areas**



Flood Problem Areas

LEGEND

Flood Problem Areas

N

Dam Failure

The majority of the manmade dams in the Seeley Creek watershed are constructed of earth fill. Inadequate design and maintenance of these structures can result in seepage or overtopping, which may cause dam failure. Other dams exist because of natural phenomena, such as landslides or the work of beavers. Large dams require dam safety permits from the state. The watershed includes four permitted dams in New York State and none in Pennsylvania (see Table 6 and Figure 21). Three wetland projects planned for construction in the Clark Hollow subwatershed in 2002 will require New York State Dam Permits. In the event of a dam failure, the sudden release of water could cause flash flooding. Because the dams in the Seeley Creek watershed are relatively small structures with low hazard classification, the impacts are likely to be highly localized. However, the impacts of a dam failure, particularly during a flood event, can be locally severe and could occur with little or no advanced warning.

The lower portion of the Seeley Creek watershed, in the Chemung Valley, could be subject to devastation from catastrophic releases of water from the Tioga, Hammond, or Cowanesque Dams in the Tioga River Basin. The travel time for such and event would be 11 or more hours. The possibility of such an occurrence is considered to be extremely remote.

Hurricane

Inland flooding from hurricanes can be a major threat to areas hundreds of miles from the coast as intense rain falls from these huge tropical air masses. This is the case in the Seeley Creek watershed where hurricanes have historically caused intense rains and severe flooding. Most notable was Hurricane Agnes in 1972, which caused floods of record throughout the Susquehanna Basin. More recently Hurricane Beryl caused flash flooding in the Seeley Creek watershed in August 1994.

Tornado

A tornado is a great threat to life and usually causes catastrophic damage to property within its path. Due to the large amount of damage tornadoes cause in a relatively short amount of time, they are considered one of the most destructive natural hazards. Tornados have historically caused extensive damage in New York and Pennsylvania and are thus a reasonable concern within the Seeley Creek watershed. Because of the advancements of tracking equipment, such as Doppler radar, warnings may be provided well before a credible worst-case event strikes.

Lightning

Lightning associated with thunderstorms may occur within the Seeley Creek watershed. The predictability of lightning strike occurrence is imprecise and efforts for mitigation on a structure-by-structure basis are contained in the building codes for New York and Pennsylvania.

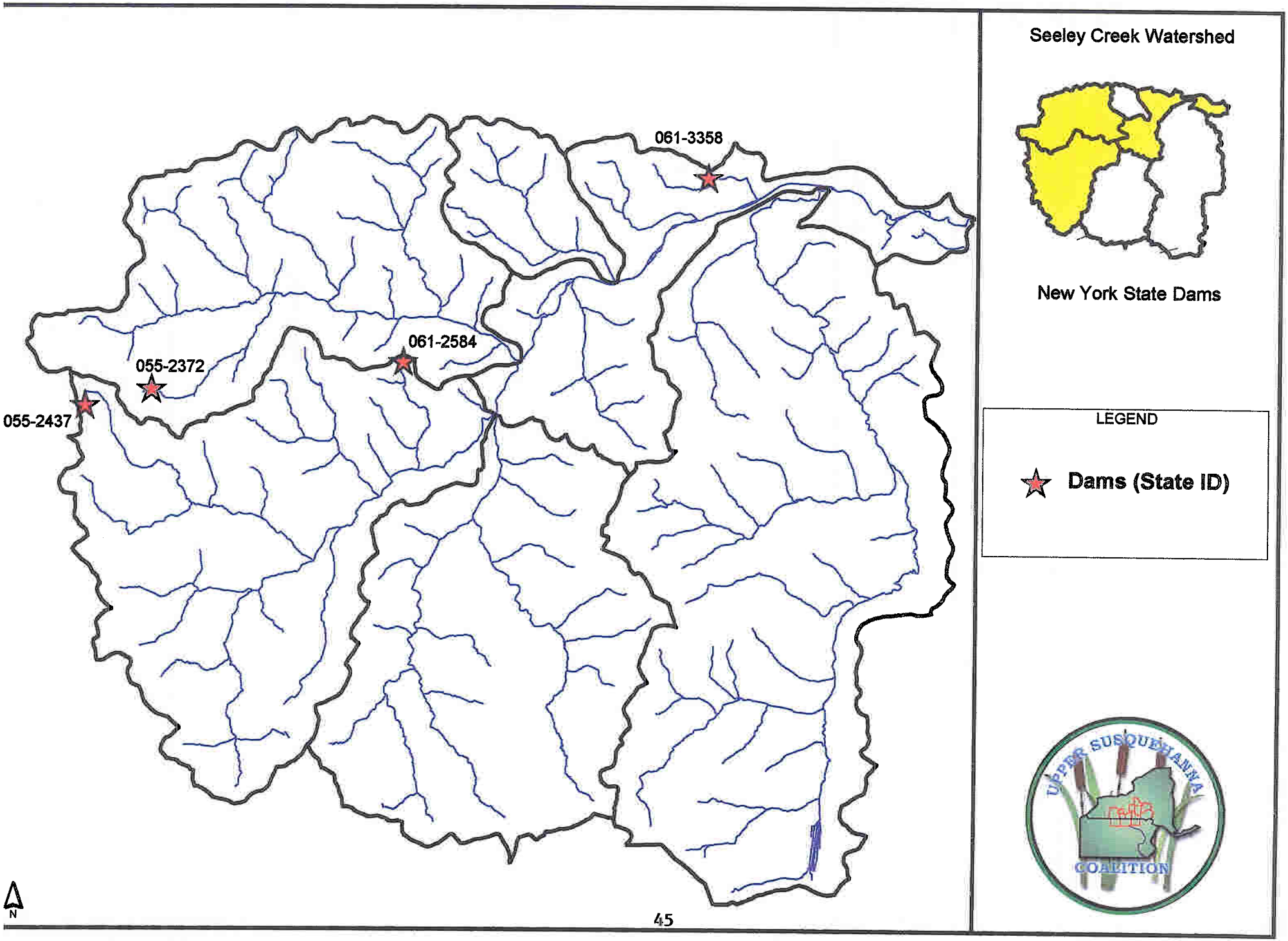
Severe Winter Storm

Although the Seeley Creek watershed is accustomed to dealing with winter weather, heavy snowfall or ice storms can exceed the normal capacity of highway departments and emergency crews.

Table 6
State Permitted Dams in the Seeley Creek Watershed

State ID	Stream	Dam Name	Town	Latitude	Longitude	Dam Type	Dam Height	Surface Area	Hazard Class	Year Com-pleted
055-2372	Birch Creek (tributary of Mudlick Creek)	Palmer-Braster-Early-Mayer Dam	Caton	42° 0' 17"	77° 0' 45"	Earth	6 feet	21 acres	Low	1955
055-2437	Tributary to Alder Run (tributary of Hammond Creek)	Hollenbeck & Wilkins Pond Dam	Caton	42° 0' 2"	77° 2' 0"	Earth	7 feet	25 acres	Low	1956
061-2584	Tributary to Hammond Creek	Ruth Lewert Dam	Southport	42° 0' 45"	76° 56' 0"	Earth	10 feet	2 acres	Low	1957
061-3358	Tributary to Mountain View Creek (tributary of Lower Seeley Cr.)	Carl Farmer Dam	Southport	42° 3' 27"	76° 50' 18"	Earth	12 feet	2 acres	Low	1965

Figure 21. **Seeley Creek Watershed - New York State Permitted Dams**



Drought

The Seeley Creek watershed normally possesses an adequate water supply with sufficient annual precipitation. However, periods of drought have occurred. In 1998 and 1999, significant shortfalls in snow and rain led to the Susquehanna River Basin's worst drought in more than 30 years.

During a drought, shortages of potable water can cause serious threats to public health and sanitation, but the historical record lacks instances of significant serious injury or death due to drought conditions. Agriculture faces major losses when adequate soil moisture cannot be maintained and when sufficient water is not available for livestock. Private and public water supply wells can fail. Other private property can be damaged from lack of moisture and possible wildfires. Increasingly severe restrictions on nonessential water uses may result in reduced revenues for some businesses and industry. Aquatic habitat and wildlife populations can be severely impacted by drought conditions.

Wildfire

The Seeley Creek watershed is located in an area with a history of wildfire. Although these events lack the severity of those in the western U.S., wildfires can pose a threat to life and property. The risk of wildfire is greatest during periods of drought. Most forest fires are started by people through negligent behavior. If heavy rains follow a major forest fire, other natural disasters can occur, including landslides, mudflows, and floods.

Landslide

The steep topography in the Seeley Creek watershed, combined with the presence of poorly consolidated glacial deposits results in landslide prone areas within the watershed. Of particular concern is the active landslide on the east side of Seeley Creek near Pine City. The exposed scarp is currently ¼ mile long and approximately 200 feet high. This landslide is steadily depositing sediment into the creek and poses a serious threat of catastrophic failure, which would displace flow in Seeley Creek. If this catastrophe occurs, it could flood an area containing approximately 250 residences.

Other landslide hazard areas in the watershed have not been identified and documented. It is advisable that any development or timber harvesting on the steep slope areas include an evaluation of the potential to destabilize the slope and induce landslides.

Earthquake

There have been few recorded earthquakes in the vicinity of the Seeley Creek watershed. However, in February 2001, parts of Steuben County were rocked by a series of 4 earthquakes. These events had magnitudes ranging from 2.1 to 2.9 on the Richter scale and caused only minor damage.

In 1993, the New York State Earthquake Code Advisory Committee assigned Peak Ground Acceleration Values to each region of New York State for use in building codes. The Peak Ground Acceleration Value earthquake has a 10% probability of occurring over a 50-year period or a 100% probability over 500 years. For planning purposes it is believed to be the appropriate choice for a credible worst-case event. The Peak Ground Acceleration Value

assigned to Steuben and Chemung Counties is 0.09g for "average soil conditions." This is the lowest earthquake risk in New York State and corresponds to a Richter Scale earthquake magnitude somewhat greater than 5, for which damage would be slight. The ground acceleration of an earthquake can be amplified by unconsolidated and soft soils, so the worst-case event in areas with glacial or alluvial deposits, could be a magnitude 6 earthquake. The description of an earthquake measuring 6 on the Richter Scale is: "Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well-build ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticeable when driving car."

Earthquakes can cause buildings to collapse and disrupted utilities. In addition, an earthquake can trigger landslides, fire, flash floods, levee failure, dam failure, transportation accidents, hazardous material releases, and fires. Although the potential exists for a damaging earthquake in the Seeley Creek watershed, the probability of serious earthquake damage is low. The recommended mitigation consists of enforcing existing building codes.

Hazardous Material Releases

The Seeley Creek watershed has the potential for accidents involving petro-chemicals and other hazardous materials, including radioactive materials. This risk includes in-transit releases (e.g., highways) and fixed sites where hazardous materials are used or stored. Accidents involving hazardous materials may result in fire, explosion, or the release of toxic fumes. The risk of flooding of highways, secondary roads, and stationary sites increases both the likelihood of a hazardous material spill and the potential dispersion of contaminants.

Flooding from Seeley Creek (diverted out of the watershed in the Town of Ashland) contributed to a serious hazardous material spill during the Hurricane Beryl flood in August of 1994. Flooding resulted in the release and dispersal of hazardous chemicals that were stored at a business. The cleanup expenses exceeded $500,000.

Hazardous contaminants are located within the Seeley Creek floodplain at the McInerny Farm Hazardous Waste Disposal Site in the Town of Southport. Although this site was remediated, subsequent monitoring has identified additional contamination. The New York State Department of Environmental Conservation is pursuing the implementation of additional clean up activities. Recent channel alterations upstream of this site (NYS Department of Transportation, Elmira Arterial South Extension project, 2000-01) have increased the concern that channel adjustments may cause erosion in areas containing hazardous materials.

Point Source Water Pollution

Point source water pollution comes from a distinct location or point, such as a sewer or factory pipe. The most common point sources are municipal wastewater treatment works and industries. At the present time, there are no known point source discharges into Seeley Creek or its tributaries.

Non-point Source Water Pollution

In contrast to distinct point sources, non-point sources of water pollution are diffuse, coming from an area or from scattered locations. Cumulatively, they contribute significantly to water quality degradation. Non-point sources include:

- atmospheric deposition;
- eroding streambanks or road cuts;
- leaching landfills or storage sites;
- leaking underground storage tanks and septic systems;
- runoff from construction sites, mines, highways, urban areas, and agricultural fields; and
- re-suspension of contaminated sediments from the bottoms of lakes and rivers.

Because they are diffuse, non-point sources are difficult to control, but are major contributors to water quality impairment.

The principal non-point source pollutants that have been documented in Seeley Creek are sediments and associated nutrients (nitrogen and phosphates). The most likely source is erosion from streambanks, road ditches, construction sites, poorly constructed logging roads, and agricultural operations. This eroded sediment is washed into surface waters by precipitation and may carry pollutants such as oil, pesticides, and fertilizers. Excess sediment impairs fish habitat and can contribute to flooding by altering stream flow patterns.

Recent trends toward high-density hog farming in Pennsylvania and New York raise concerns about animal waste pollution from these operations. The animals are raised in large enclosed facilities. The impact of the wastes generated at such facilities is a matter of ongoing investigation. There is currently one such operation in the Seeley Creek watershed (near Daggett) and another has been proposed. Odor problems have occurred at the existing facility (leading to closure of a nearby bed-and-breakfast business). Additional concerns revolve around the potential for surface water contamination from the land spreading of manure. Because of the need for year-round disposal of large volumes of animal waste, area residents are concerned that this land application will not be conducted in a manner that adequately protects water quality. The Town of Southport is evaluating the potential for local regulation of livestock operations.

Groundwater Contamination

Private groundwater supply wells are the primary source of water supply for most of the Seeley Creek watershed. Remediation of groundwater contamination is quite costly, so emphasis needs to be placed on prevention. The principle threats to groundwater supplies include onsite wastewater systems, contaminated stormwater runoff, chemical spills, and leaking storage tanks.

Improperly maintained septic systems can result in the release of pathogens and high levels on nutrients into groundwater. This can be harmful when this contamination gets into wells, streams, and lakes. Well testing in Jackson Township has documented groundwater contamination that is attributed to failing on-site systems. These results led the Pennsylvania Department of Environmental Protection to mandate municipal sewage treatment for the State Route 328 corridor along Hammond Creek. Similar problems likely occur elsewhere in the watershed as well.

Deterioration of underground storage tanks can cause contamination of soil and groundwater. Underground petroleum storage tanks are present at each of gas station in the watershed.

Terrorism

Although the Seeley Creek watershed has not experienced any terrorist incidents, an ongoing commitment to law enforcement and emergency preparedness is needed to minimize the likelihood and severity of such an occurrence.

OPPORTUNITIES FOR MITIGATION, RESTORATION, AND PROTECTION

The Seeley Creek watershed offers many opportunities for protecting citizens from hazards (hazard mitigation), improving hydrologic conditions (watershed and stream restoration), and protecting existing water quality (watershed protection). Comprehensive management of the watershed and its hazards requires simultaneous implementation of a variety of measures throughout the watershed. These opportunities for achieving the vision of the Seeley Creek Watershed Association are evaluated below.

Public Information

Land use decisions made every day by people within the Seeley Creek watershed have a significant impact on natural resources. Those decisions range from forest management to lawn care to the disposal of household hazardous waste. Further progress in environmental protection requires the active and informed involvement of residents, businesses, and municipal officials.

A majority of the respondents to the Seeley Creek watershed survey (71.3%) indicated a need to know more about watershed issues relating to the Seeley Creek watershed. Residents, businesses, and public officials are more likely to make wise decisions when they understand how those decisions relate to the hazards they face and the environmental health of the watershed. Additional information will help those involved in purchasing property, managing land, planning development, and living within the watershed.

RECOMMENDATIONS:

- Provide the public with flood hazard information. An information campaign can provide residents of flood-prone areas with pertinent information about the hazards, what to do when a flood occurs, and measures that can be taken to protect against flood damage. This can include posting of Flood Insurance Rate Maps, distribution of brochures, direct mailing to flood prone residents, newsletter articles, presentations, and other means of disseminating information.
- Improve hazard disclosure in real estate transactions. The Commonwealth of Pennsylvania requires the disclosure of hazard information during real estate transactions. In New York, such disclosures are not mandatory, but some real estate agents voluntarily use a "Seller's Disclosure of Property Condition" form. Chemung County developed an excellent brochure entitled, "Investigating Potential Water and Flood Control Problems Before You Buy or Build." It provides a checklist of natural resource questions that should be investigated prior to investing in a piece of property and information about where to find the answers to those

questions. This resource should be aggressively distributed to those in the housing market. Those watershed areas outside of Chemung County are strongly encouraged to develop and distribute similar information.

- Post road signs identifying streams and watershed boundaries. Signs placed at stream crossings (indicating the stream name) and at watershed boundaries ("Entering the Seeley Creek Watershed") can increase the public's awareness of the watershed and its water resources.
- Increase environmental education efforts. Efforts by various organizations to educate both children and adults about environmental issues should be supported. Watershed-specific efforts can include: continued distribution of Seeley Creek watershed coloring books and placemats, publication of a watershed newsletter, press releases, media events, individual assistance to property owners, etc.

Public Involvement

The Seeley Creek Watershed Association has had difficulties attracting and maintaining active members to work together toward watershed objectives. However, of the respondents to the Seeley Creek watershed survey, 29.4 % expressed a willingness to attend an annual meeting of the Seeley Creek Watershed Association (plus 45.2% maybe/depends) and 10.4% expressed a willingness to attend the Association's monthly meetings (plus 46.8% maybe/depends). In response to the question, "Would you be willing to volunteer to help with a Seeley Creek watershed management project?" 11.0% answered "yes" and 43.5% answered "maybe/depends." This indicates that the watershed does contain concerned citizens with an interest in watershed issues. The challenge facing the Association is, therefore, to effectively inspire participation and coordinate efforts.

RECOMMENDATIONS:

- Increase recreational access to Seeley Creek and its tributaries. People are more likely to become actively involved in restoration and protection of resources from which they benefit directly. Toward this end, an effort should be made to identify potential sites for streamside parks and public fishing access.
- Increase visibility of the Seeley Creek Watershed Association. It is expected that the next flood event will result in a resurgence of public interest in the Seeley Creek Watershed Association. In the absence of such an event, the Association can increase its public visibility by: publicizing meetings, publishing an newsletter, distributing additional Seeley Creek watershed placemats, providing libraries and the media with copies of this watershed plan, participation in municipal planning efforts, and active involvement in public events (such as Earth Day activities).

Assessment and Documentation

High quality data form sound bases for determining the severity of problems and identifying the highest priority locations for implementation projects. Although many types of data are presently available for the Seeley Creek watershed, most of the data sets are limited to portions of the watershed. In order to enhance the planning and implementation of projects in the Seeley Creek watershed, it is recommended that (1) existing assessment programs be expanded to encompass the entire watershed, (2) existing data be incorporated into digital databases, and (3) additional data be collected.

RECOMMENDATIONS:

- Digitize soil survey maps. Digitizing of soil survey map information will enhance the ability to use soil information to guide land use decisions. Once the soil types are in digital form, this information can be viewed in conjunction with other data layers, which will enhance planning efforts, selection of project sites, etc. This usefulness can be demonstrated once the recompiled soils in the New York portion of the watershed have been digitized. Pennsylvania portions of the watershed require both recompiling and digitizing.
- Develop precise topographic data using LIDAR. The LIDAR (Light Detection and Ranging) technology enables development of highly precise topographic maps that have sufficient detail (15 cm accuracy) to be used for floodplain mapping, flood inundation mapping, and wetland engineering designs. It is proposed that LIDAR images be obtained for the entire watershed. The Town of Southport and Chemung County are pursuing funding for LIDAR imaging of the Chemung County portion of the watershed.
- Complete roadside drainage assessment. An assessment of drainage problems from dirt and gravel roads has been completed for the Pennsylvania portion of the Seeley Creek watershed. The GIS-based assessment tool generates a numerical site assessment score for ranking the severity of each identified drainage problem. Additional assessment of paved roads in Pennsylvania and all roads in the New York portion of the watershed would enable watershed-wide prioritization of restoration projects for roadside drainage.
- Assess riparian buffer vegetation. Riparian vegetation along streams serves to protect water quality and reduce threats to development (which is less susceptible to flooding and erosion threats if it is located farther from the streams). An assessment of riparian buffer vegetation along both sides of all streams throughout the watershed can be conducted using existing air photos and digital land use data, followed by field verification.
- Conduct geomorphic assessment of streams. The stream classification and assessment system presented by David Rosgen (*Applied River Morphology*, 1996) begins with a Level I assessment of the stream's pattern, slope, and dimensions to determine the general geomorphic type of each stream reach ("A" through "G"). A Level I assessment is recommended for the entire watershed. This can be followed by quantitative assessment of the geomorphic characteristics and stability of selected stream reaches (using Rosgen Level II and Level III procedures). These geomorphic assessments would enable more detailed evaluation of the sources of impairment and identification of restoration priorities.
- Complete stream segment assessment and erosion inventory. Visual assessment and erosion data have been collected for some stream reaches. When comparable data are collected for the remainder of the watershed, potential restoration projects can be prioritized on a watershed-wide basis.
- Conduct water quality monitoring. Ongoing water quality monitoring can indicate problems, identify sources of pollution, and provide the documentation needed for corrective measures. It is recommended that the current water quality monitoring efforts (by the Susquehanna River Basin Commission, NYS Department of Environmental Conservation, and Chemung County Water Quality Strategy Committee) be continued and that plans for a water quality assessment in the Pennsylvania portion of the watershed be pursued. Periodic presentation of these findings to the Watershed Association would enhance the local understanding and utilization of this information. If sufficient resources exist, expansion of these monitoring efforts may be warranted (particularly in areas where land use indicates that water quality may be threatened).

- Collect additional hydrologic data. It is recommended that the network of data loggers that have been installed to monitor stream stage and rainfall be maintained and expanded. In addition, velocity profiles should be collected at each stream gauge site (under a range of flow conditions) and used to develop rating curves. Rating curves enable determination of the discharge (water volume) associated with observed stream stages (water height). This will enable calibration of the Seeley Creek hydrologic model.

Land Use Planning

The way we plan the physical layout and use of land in our communities is fundamental to environmentally sound development as well as to sustainable economic development. Without planning, decision makers will continue to allow people to position their homes and business unwisely. Land use planning is a tool that can balance the community's need to protect its citizens from catastrophes and environmental degradation with the rights of citizens to live and work where they please. Rather than incorporating mitigation efforts as an afterthought to development, communities must establish a sound land use strategy that starts with hazard mitigation. Many of the environmental problems that arise from unwise development can be prevented in the Seeley Creek watershed by initiating land use planning now, while most of the watershed is sparsely developed.

The majority of the respondents to the Seeley Creek watershed survey recognize the relationship between land use practices and flooding. In response to questions about the causes of flooding, 73% indicated that housing and business development are very important or somewhat important; and 72% indicated that paved areas like roads and parking lots are very important or somewhat important.

RECOMMENDATIONS:

- Provide hazard and watershed information to local policy makers. In order to develop and implement sound land use plans, it is necessary for local policy makers to have a solid understanding of watershed issues as they relate to land use practices. Watershed and land use education efforts should target elected officials, planning boards, comprehensive planning committees, code enforcement officers, and other local leaders.
- Incorporate hazard mitigation objectives into comprehensive planning efforts. Many municipalities in the Seeley Creek watershed are currently involved in the comprehensive planning process. Comprehensive plans can be used to protect environmental resources and keep people and property out of areas that are subject to natural and technological hazards. It is recommended that all of the municipalities in the watershed incorporate water quality, flooding, streambank erosion, and other hazards into comprehensive plans for their communities.
- Incorporate the goal of "no adverse impact" into municipal land use planning. Construction anywhere in the watershed can increase the risk of flooding to other properties, even those that have never flooded in the past. Most current development standards do not fully consider the adverse impact of new development on other properties within the watershed or on future flooding potential. In order to prevent escalation of flood damages, municipal land use plans and regulations should be based on the management criterion that adverse impacts will only be allowed to the extent that they are offset by mitigation.

- Incorporate hazard mitigation measures into zoning ordinances. Land use planning has traditionally been accomplished through zoning ordinances, which identify districts that allow only similar uses. Some of the techniques through which zoning ordinances can address environmental and natural hazard concerns include: regulating development density, encouraging cluster development (to increase open space and reduce infrastructure requirements), incorporating stream setback provisions, establishing conservation districts in environmentally sensitive and high risk areas, steep slope provisions (including a requirement that landslide potential be evaluated prior to development on steep slopes), incorporating stormwater management standards, and incorporating erosion and sediment control standards. It is recommended that these provisions be evaluated and incorporated, as appropriate, into existing and proposed zoning ordinances.
- Incorporate hazard mitigation measures into subdivision and development/site plan review regulations. Municipal or county subdivision laws regulate the process by which vacant land or farmland is prepared for other uses by dividing larger parcels into smaller ones. The regulations deal with street design, the shape of lots, reservation of land for recreation areas, standards for street construction, etc. Conservation and risk reduction provisions that can be incorporated include: preservation of special features (wetlands, streams, historic spots, exceptional views, etc.), provision of favorable building sites on all lots (to avoid building in floodways, wetlands, etc.), open space requirements, maintaining natural drainage, and maintaining unfragmented habitat. Similar provisions can be included into site plan review or development review regulations that are applied to major projects under single ownership. It is recommended that these provisions be evaluated and incorporated, as appropriate, into existing and proposed regulations for subdivision, site plan review, and development review.

Stormwater Management and Erosion Control

Land use practices influence the flow of stormwater runoff and can contribute to flooding problems when stormwater is not appropriately managed. Land use changes that can alter stormwater characteristics include: grading, development, altered agricultural practices, and timber harvesting. The removal of vegetative cover generally increases the amount of water that reaches the ground surface and the amount that runs off into nearby drainage ways. Pavement, roofs, and other impervious surfaces block the infiltration of water into the ground, thus increasing the amount of surface runoff. Smooth surfaces also increase the speed with which runoff reaches the streams and can thus increase the peak flow amounts. Roads, driveways, agricultural drains, and skid trails can divert the flow of water from previous patterns. Flooding and erosion problems result when existing roadside ditches, culverts, and other drainage ways are unable to accommodate the increased flow or altered flow patterns.

Uncontrolled erosion and sediment from development sites can cause damage to surrounding areas and pollution of waterways. When soil is exposed it is susceptible to erosion by wind and water. Sediment that is washed into downstream waters may destroy fish habitat through blanketing of fish spawning and feeding areas and elimination of certain food organisms. Nutrients and toxic substances attached to sediment particles also degrade the water quality. Sound management practices can reduce the erosion potential from development and construction projects.

The cumulative effect of individual land development projects scattered throughout a watershed can dramatically impact flooding conditions and water quality. Implementation of stormwater management and erosion control practices can offset, reduce, or protect against the impacts of development. Stormwater management practices include: extended detention dry basins, wet ponds, constructed wetlands, oil-water separators, vegetated swales, filter strips, infiltration basins and trenches, porous pavement, and urban forestry. Erosion and sediment control practices include: runoff control (diversions and waterways), soil stabilization (vegetative and non-vegetative cover), and sediment control (sediment filters and basins).

Stormwater management and erosion control for construction projects is regulated under the federal Clean Water Act (SPDES permits in New York, NPDES permits in Pennsylvania). These regulations currently require permit coverage for construction projects that disturb five or more acres of vegetation. This threshold will decrease to one acre of disturbance in 2003. Some of the New York portions of the watershed will also be subject to additional stormwater management requirements due to the Municipal Separate Storm Sewer System (MS4) regulations. Municipalities can enact additional local regulations to impose higher standards and/or to increase local involvement in oversight and enforcement.

RECOMMENDATIONS:

- Prepare stormwater management plan for the Seeley Creek watershed. The best management practices for controlling stormwater runoff will vary from one area to another and even from one part of the watershed to another. In order to address local conditions, the Commonwealth of Pennsylvania has initiated a process of watershed-based stormwater management planning. Each plan developed under this program includes a technical manual (which recommends the best management practices to be initiated within the watershed), an overall plan, and a model ordinance. Once the plan is complete, all watershed municipalities enact the model ordinance to implement the standards and criteria in the plan. It is recommended that a stormwater management plan be prepared for the Seeley Creek watershed to enable land use decisions and stormwater management practices to be implemented in a manner that efficiently manages runoff throughout the watershed.
- Enact municipal stormwater management regulations. In the absence of a watershed stormwater management plan (recommended above), the standards for stormwater management for development should prevent any net increase in the rate of stormwater runoff from a site subsequent to development. Once a watershed stormwater management plan is prepared, local ordinances should be adopted that require management of stormwater in a manner consistent with the recommendations and hydrologic analysis in the plan.
- Enact municipal erosion and sediment control regulations. Erosion and sediment control standards can be incorporated into a stormwater management ordinance or other land use regulations.
- Encourage implementation of good stormwater management and erosion control practices. Municipal officials should take an active role in improving stormwater management and erosion control practices by: (1) educating developers, (2) providing technical assistance, (3) reviewing stormwater pollution prevention plans, and (4) monitoring compliance with those plans. Active municipal involvement with these issues can improve the management practices that are used during development, even if the municipality chooses not to enact local regulations for stormwater management and sediment control,

- Insure maintenance of stormwater management structures. Long-term maintenance is required for any drainage swales, detention ponds or other structures that are built to manage stormwater runoff from development sites. Municipalities should evaluate and implement appropriate mechanisms for insuring routine inspection and maintenance of these structures.

Sustainable Agriculture, Forestry, and Landscaping Practices

Healthy soil is like a sponge, biologically active and porous, filtering nutrients and water for all plants and animals. Sustainable forestry and agricultural practices are those that protect and enhance the health of the soil. Water quality is also protected by using landscaping practices that avoid improper application of fertilizers and pesticides, preserve native vegetation, encourage infiltration, and limit concentration of surface runoff.

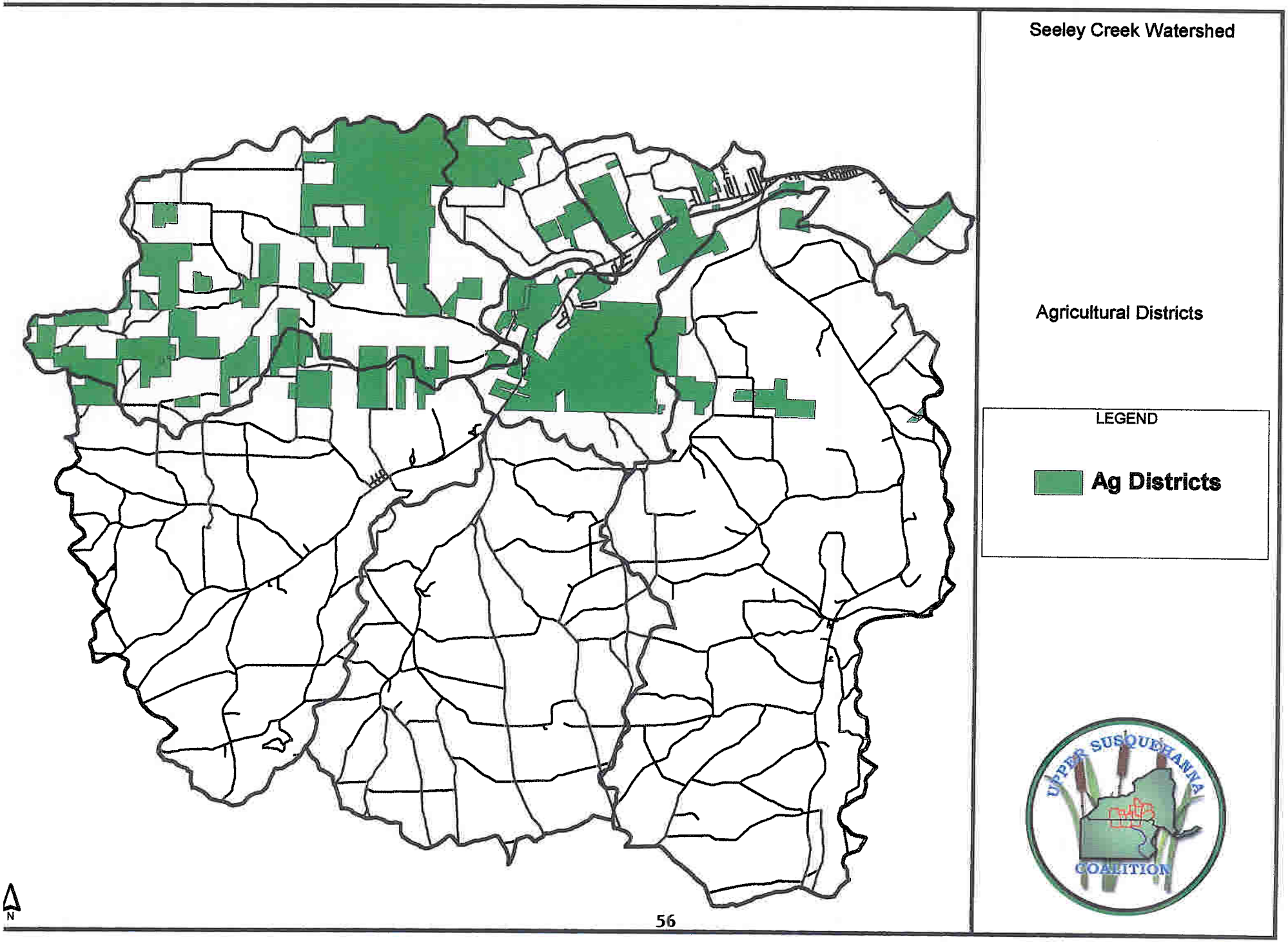
The majority of the agricultural land in the watershed is utilized for pasture and hay production (35 % of the watershed), with row crops grown on 3% of the watershed. Both Pennsylvania and New York have programs that help farmers who want to continue in agriculture to do so. The watershed areas that are included in New York State's agricultural districting program are shown in Figure 22. Eighty percent of the respondents to the Seeley Creek watershed survey consider farm practices to be a very important or somewhat important cause of flooding. Good agricultural management practices include: nutrient management, contour farming, conservation tillage, terracing, critical area planting, sediment basins, filter strips, waste storage management, intensive rotational grazing, barnyard runoff management, silage leachate management, riparian buffers, streambank protection, and integrated pest management.

The majority of the steep slopes in the Seeley Creek watershed are forested. Timber harvesting on these steep hillsides can result in significant erosion problems, or even landslides, if good drainage and erosion control practices are not utilized. Eighty-three percent of the survey respondents consider logging of forested areas to be a very important or somewhat important cause of flooding. Best management practices for forestland include: forest management planning (to identify and implement management goals), streamside management measures, streambank protection, management of roads and skid trails (layout, construction, and restoration), fire management, re-vegetation of disturbed areas, and forest wetland management. Professional foresters can provide technical assistance with implementation of good forest management measures.

RECOMMENDATIONS:

- Provide technical assistance for conservation practices on farms. In order to be both economic and effective, agricultural management practices must fit within a comprehensive farm management plan. New York state is encouraging improved farm practices through their voluntary Agricultural Environmental Management (AEM) Program. Technical assistance is available to help farmers evaluate and improve their operations. Farmers are encouraged to implement management practices that reduce sediment, nutrient, and pathogen loadings. Similar assistance is provided in Pennsylvania through the Conservation Districts and the Natural Resources Conservation Service.

Figure 22. **Seeley Creek Watershed - NYS Agricultural Districts**



- Develop and implement comprehensive nutrient management plans. Correct management of nutrients on the farm is the most important management practice for maintaining high water quality in streams. Comprehensive nutrient management planning is required for large livestock operations that are classified as Concentrated Animal Feeding Operations. This planning is valuable for any farm operation in order to insure that excess nutrients are not being applied to the soil. Conservation districts should continue their active role in assisting farmers with nutrient management planning, extending this planning effort to smaller farms for which it is not required. When possible, financial assistance should be provided.
- Provide financial assistance for improved agricultural management practices. The U.S. Department of Agriculture has a number of programs that provide financial assistance with implementation of agricultural best management practices. In the Pennsylvania portions of the watershed cost sharing for agricultural projects is also available through the Chesapeake Bay Program and the Pennsylvania Growing Greener Program. The county conservation districts and Natural Resources Conservation Service provide local assistance with these programs.
- Evaluate effectiveness of state regulation of livestock operations. Both New York and Pennsylvania regulate large livestock operations according to Concentrated Animal Feeding Operations (CAFO) requirements. Concerned citizens and local governments can monitor the effectiveness of these regulations in protecting water quality and other community concerns. Additional local regulations can be considered to control the locations of hog farms and other livestock operations. This is currently being considered in the Town of Southport.
- Distribute information about best management practices for timber harvesting. The Chemung County Soil and Water Conservation District has prepared a booklet entitled *Best Management Practices During Timber Harvesting Operations*. Municipalities should make an ongoing effort to distribute this booklet (or similar information) to property owners who plan to harvest timber. The Towns of Ashland and Southport have timber harvesting ordinances, which enable them to target educational information (and thus prevent the need for enforcement actions). A model ordinance that is being prepared by the Steuben County Environmental Management Council requires registration of timber harvesting operations, distribution of educational information, and notification of adjacent property owners.
- Encourage reforestation. Forests intercept and utilize more rainfall than other types of vegetation, reducing the surface runoff from forested land. The owners of denuded hillsides that are not in agricultural production should be encouraged to replant these areas in native tree species. The availability of plant materials and technical assistance from Conservation Districts should be advertised.
- Consider tax incentives for conservation practices. The Seeley Creek watershed survey asked watershed residents, "Would you support or oppose tax incentives for citizens who adopt conservation practices?" Of the respondents 69% support this suggestion; 9% oppose it. This suggestion should be evaluated, particularly with regard to property tax assessment of protected wetlands and riparian buffer zones.
- Distribute information about sustainable landscape practices. Information about pesticide/herbicide application, integrated pest management, erosion control, and other sustainable landscaping practices can be distributed at municipal offices, conservation district offices, and retail outlets for gardening products.

Infrastructure Maintenance and Improvements

Transportation and transmission corridors are located throughout the Seeley Creek watershed. The roadside drainage along the watershed's 334 miles of roads is more extensive than the natural drainage in the 227 miles of streams. Inadequate water management along this infrastructure can have a significant impact on stream stability and flooding.

RECOMMENDATIONS:

- Improve road drainage. The road drainage assessments conducted as part of Pennsylvania's Dirt and Gravel Road Pollution Prevention Program identified and prioritized 35.93 miles of problem areas within the Seeley Creek watershed (see Figure 8 above). In areas for which road drainage problems have been assessed, implementation efforts should target the highest priority sites. When roads, ditches, and culverts are damaged due to drainage and flooding problems, every effort should be made to mitigate the problem when repairs are made. It is also recommended that highway departments continue to include drainage improvements in their routine maintenance activities. This includes the use of recommended procedures for ditch maintenance and stabilization (to reduce the susceptibility to erosion).

Management of Hazardous Materials

In order to avoid the high costs of remediating environmental contamination, attention should be paid to proper management and disposal of hazardous substances and effective response to spill incidents.

RECOMMENDATIONS:

- Assist with proper disposal of hazardous materials. County programs are in place for periodic collection and disposal of hazardous materials. Continuation and expansion of these programs is needed to reduce the storage and improper disposal of hazardous substances by households, farmers, public institutions, and businesses.
- Maintain spill response capability. When hazardous materials are released to the environment, damages can be minimized by effective containment and cleanup. Ongoing attention to training and data maintenance are needed to insure rapid response to hazardous material releases by well-trained and well-equipped emergency personnel.
- Remediate McInerny Farm Hazardous Waste Disposal Site. Additional remediation is required to prevent the release of hazardous contaminants at the McInerny Farm Hazardous Waste Disposal Site in the Town of Southport.

Improved Sewage Disposal

One of the most important activities that many watershed residents can take to protect water resources is to properly maintain their septic systems. The steps required to insure that an existing septic system works well are relatively simple and inexpensive. Yet failure to maintain septic systems is a common problem that frequently leads to costly replacement projects or continued use of inadequate systems. The majority of the Seeley Creek survey respondents recognized a need to improve sewage disposal in the Seeley Creek watershed. 79% responded that upgrading of septic systems is very important (53.2%) or somewhat important (25.6%); 70% responded that installing public sewerage is very important (49.7%) or somewhat important (19.9%).

RECOMMENDATIONS:

- Educate residents about septic system maintenance. To prevent problems for homeowners and to minimize water quality impacts, it is crucial that homeowners maintain their septic systems. The public health departments for the watershed should expand their efforts to provide homeowners with information about the installation and maintenance of septic systems.
- Provide septic system training for enforcement personnel. Depending on the location, municipal building officials or county health departments are responsible for enforcing septic system codes and following through on violations. Those responsible for enforcing septic system codes should attend formal training programs.
- Consider funding incentives for septic system improvements. In a largely rural and economically challenged region, it is difficult to tell people they have to spend money on a new septic system or improvements to an existing system. Local officials should evaluate the recommendation of cost-breaks to owners for having their systems pumped or repaired.
- Complete Jackson Township sewer project. Completion of the Jackson Township sewer project will significantly improve sewage disposal practices along Hammond Creek. This project consists of 4,400 feet of main sewer line (from Jackson Summit to the Tioga-Bradford County line) and a sewage treatment plant located east of Millerton. The project will serve 283 houses and businesses, which will be required to connect to the system. The treatment plant will have the capacity to treat 80-100,000 gallons per day. The $4.5 million cost of this project is funded in part by the U.S. Department of Agriculture Rural Utility Services. The anticipated completion date of this project is in 2003.
- Seek funding to extend municipal sewer and water to Pine City and Webb Mills. The recommendation to extend municipal sewer and water service into Pine City and Webb Mills should be pursued. Opposition at public meetings centered on the costs that would be borne by the property owners. Funding assistance should be sought in order to protect water quality and insure safe drinking water supplies.

Wetland Protection, Restoration, and Construction

Wetlands are important elements of a watershed because they serve as the link between land and water resources. The multiple benefits of wetlands include: flood attenuation, stormwater control, wildlife habitat, pollution absorption, groundwater recharge, aesthetics, education, and recreation. In the last 200 years, approximately half of the wetlands in New York and Pennsylvania have been filled, drained, and converted to other uses. A recent understanding of the value and functions of wetlands has led to efforts to protect those that remain and replace some that have been lost.

In the Seeley Creek watershed, attention has focused on the flood protection benefits of wetlands. They function as natural sponges that trap and slowly release surface water. Trees, root mats, and other wetland vegetation also slow the speed of flood waters, distributing them more slowly over the floodplain. This combined water storage and braking action lowers flood heights and reduces erosion. Wetlands within and downstream of developed areas are particularly valuable, counteracting the increased rate and volume of surface water runoff from pavement and buildings. The Seeley Creek Watershed Association and county conservation districts have identified wetland preservation and restoration as a cost-effective means of local flood control. Although the flood control benefits of each individual wetland may be small, the

cumulative impact of a large number of wetlands can significantly decrease the flooding impacts downstream.

The majority of the respondents to the Seeley Creek watershed survey indicated that creating/conserving wetlands is an effective way to reduce flooding (44.2% very effective, 33.6% somewhat effective). In response to the question, "If funds were available to help you, would you be interested in constructing wetlands on your property?" The responses were:

Yes—15.7%
Maybe/depends—22.7%
No—50.4%
Don't know—11.1%

The Chemung Basin Wetland Program is a local initiative to restore and construct wetlands at suitable sites throughout the Chemung Basin. As part of this program, the Seeley Creek watershed was assigned a high priority ranking for wetland creation projects (Wetland Creation Priorities of the Chemung Basin Wetland Program, coordinated by the Upper Susquehanna Coalition, October 2001). Prioritizing the Seeley Creek subwatersheds using the same criteria leads to high and medium priorities for all subwatersheds (see Table 7). The priority ranking (from highest to lowest) is:

- Upper Seeley Creek—High
- Hammond Creek—High
- Dry Run—High
- Lower Seeley Creek—High
- Mudlick Creek—Medium
- South Creek—Medium

It should be noted that a lower priority ranking does not preclude assigning a high priority to specific sites or areas within these subwatersheds, particularly if localized conditions are not typical of the entire subwatershed. Although the Mudlick Creek subwatershed is given a medium ranking overall, the Clark Hollow portion of this subwatershed is considered to be a high priority for establishing wetlands to attenuate flooding and bank erosion along Clark Hollow Creek. This is supported by the Seeley Creek hydrologic model, which indicates that the highest concentration of runoff in the Mudlick subwatershed (highest discharge volume per drainage area) is in the Clark Hollow drainage area.

RECOMMENDATIONS:

- Compile registry of potential wetland creation/restoration sites. Expand on the wetland inventory information compiled by the Upper Susquehanna Coalition by visiting the identified wetland creation sites (see Figure 11, above). Additional areas that should be evaluated are those with low slopes, as indicated on Figure 23. The "Wetland Project Site Information" sheet developed for the Chemung Basin Wetland Program provides a consistent format for documenting relevant information about each potential wetland project site. It may be desirable to pursue this process gradually, one subwatershed at a time, so that interested property owners do not experience an unreasonably long delay between initial contact and project implementation. Subwatershed priorities are indicated in Table 7. The Seeley Creek watershed hydrologic model can be used to develop additional priorities by calculating the anticipated flood storage benefits of proposed projects.

Table 7
Subwatershed Priorities
For Wetland Creation and Protection

	Lower Seeley Creek	South Creek	Dry Run	Mudlick Creek	Hammond Creek	Upper Seeley Creek	TOTAL
Watershed Acres	9,657	28,472	3,122	15,154	18,809	17,313	**92,527**
National Wetland Inventory:							
Palustrine Wetland Acres	104	477	20	450	327	176	**1,555**
Lacustrine Wetland Acres	0	0	0	0	0	0	**0**
Riverine Wetland Acres	154	17	0	1	1	11	**185**
TOTAL Wetland Acres	258	494	20	451	329	187	**1,740**
% Wetlands	2.7%	1.7%	0.6%	3.0%	1.7%	1.1%	**1.9%**
Land Use:							
Urban Acres	97	49	7	1	9	5	**168**
% Urban	1.0%	0.2%	0.2%	0.0%	0.0%	0.0%	**0.2%**
Agricultural Acres	2,061	8,715	681	5,066	8,963	8,902	**34,388**
% Agriculture	21.3%	30.6%	21.8%	33.4%	47.7%	51.4%	**37.2%**
Problems:							
Flood Problems	High	Low	High	High	High	High	**High**
Erosion Problems	High	Medium	High	Medium	High	High	**High**
Slopes Suitable for Wetlands:							
Acres with 0-1% Slope	1,501	474	41	415	354	230	**3,014**
Acres with 1-3% Slope	1,259	2,613	243	2,144	2,207	1,831	**11,557**
% with 0-3% Slope	29%	11%	9%	17%	14%	12%	**16%**
Wetland Priority*	**High**	**Medium**	**High**	**Medium**	**High**	**High**	**High**

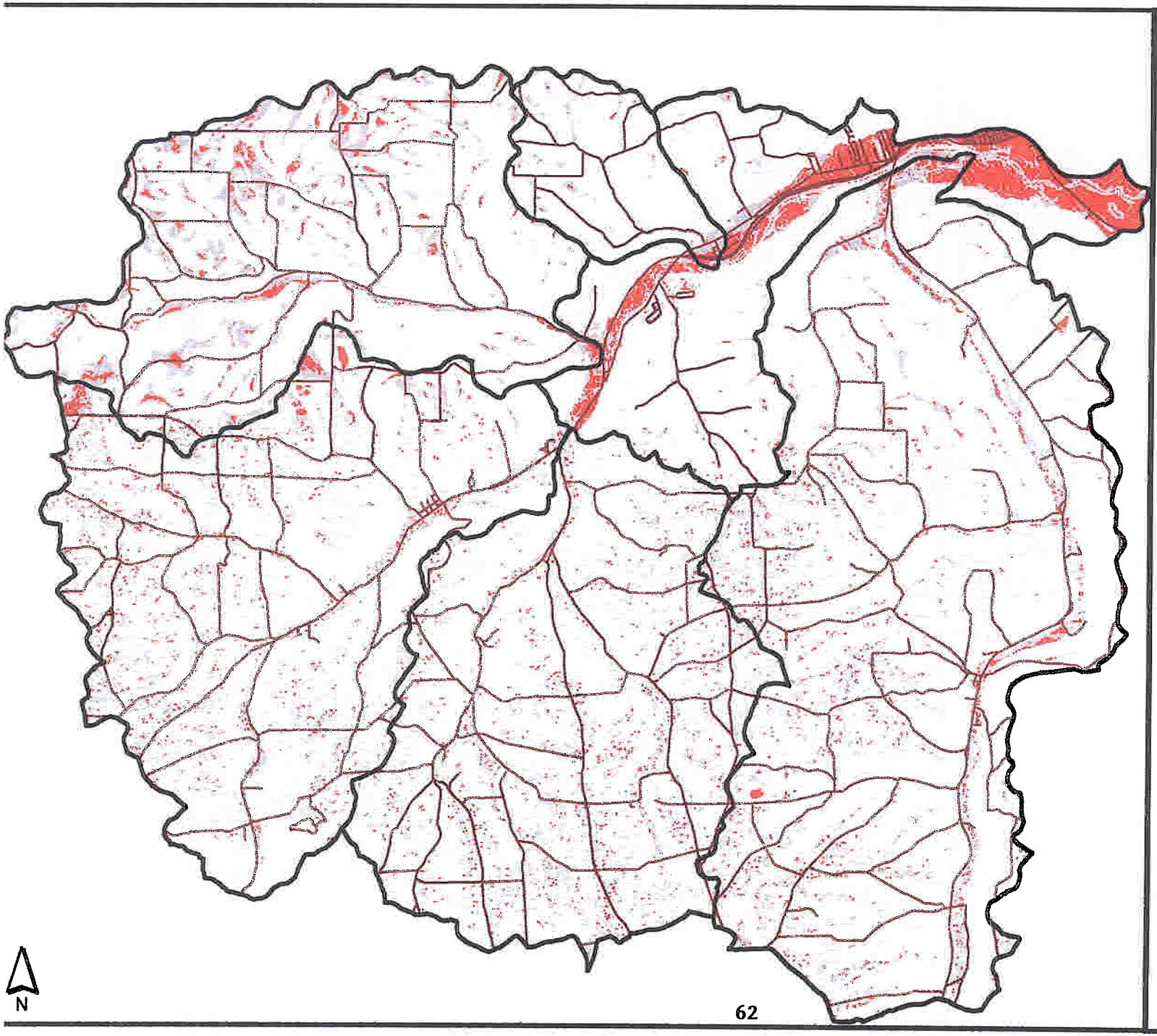
*The following criteria were used to prioritize subwatersheds for wetland creation and protection projects.

High: Two or more of the following criteria are met:
- Existing lakes and wetlands (from NWI) constitute less than 2% of the watershed area
- Flooding problems are rated high
- Erosion problems are rated high
- Urban land use exceeds 5% of the watershed
- Agricultural land use exceeds 40% of the watershed

Medium: Of the remaining subwatersheds, three or more of the following criteria are met:
- Existing lakes and wetlands (from NWI) constitute less than 4% of the watershed area
- Flooding problems are rated medium or high
- Erosion problems are rated medium or high
- Urban land use exceeds 2% of the watershed
- Agricultural land use exceeds 25% of the watershed

Low: Three or more of the following criteria are met:
- Existing lakes and wetlands (from NWI) constitute more than 4% of the watershed area
- Flooding problems are rated low
- Erosion problems are rated low
- Urban land use is less than 2% of the watershed
- Agricultural land use is less than 25% of the watershed

Figure 23. **Seeley Creek Watershed - Slope**



Percent Slope
From USGS Digital
Elevation Models
Source: USGS

LEGEND

Percent Slope
- **0-1 % slope**
- **1-3% slope**
- **>3% slope**
- **No Data**

Percentslope	Acres
0-1	3041.1313
1-3	10373.2562
3-8	40442.6849
8-12	21545.9438
12-20	14052.9984
>20	3036.4602

N

- Implement wetland creation/enhancement projects. Three wetlands are scheduled for construction in the Clark Hollow subwatershed in 2003 (funded by the Natural Resources Conservation Service Wetland Reserve Program). The Chemung County Soil and Water Conservation District has also secured funding from the New York State Department of Environmental Conservation for construction of additional wetlands in the New York portion of the watershed. It is anticipated that this funding will enable project design for approximately 30 wetlands and construction of the highest priority projects. Funding should be pursued for additional implementation projects and for expansion of this program into the Pennsylvania parts of the watershed. These projects can include groundwater recharge areas that are located on well-drained soils where ponding may only occur on a temporary basis.
- Acquire property or conservation easements for sensitive wetland areas. Conservation easements involve the purchase of development rights from property owners to conserve an existing land use considered desirable to the community. Of the respondents to the watershed survey, 49% would support a conservation easement program in the Seeley Creek area and 12% would oppose such a program. The Chemung Valley Conservancy is a newly formed organization that can accept property, manage it for conservation, and allow recreational use. They are in the process of obtaining 5013-C status so that donated property will be considered a charitable contribution (for tax purposes). This organization can insure long-term preservation of wetlands by accepting property donations or conservation easements on wetland property. The Finger Lakes Land Trust also acquires property or conservation easements to preserve sensitive locations in New York.
- Incorporate wetland protection into local land use controls. Wetland protection features can be incorporated into local land use controls. Zoning regulations can include wetlands in conservation districts, in which most types of development are prohibited. Wetlands can also be defined as "unbuildable," to insure that alternate building sites are available on each subdivided parcel.

Riparian Buffers

Forests, perennial grasses, and wetland vegetation once surrounded streams in the Seeley Creek watershed. This vegetation is crucial to protecting and enhancing water resources. The benefits of riparian buffers include: protecting streambanks from erosion, slowing water during a flood, providing food and habitat for wildlife, filtering pollution from surface runoff, and providing shade that helps regulate water temperatures. An additional benefit is that forested streamside areas do not contain buildings or other development that is subject to flooding and threatened by streambank erosion. These valuable functions can be restored by reestablishing vegetated buffers in areas where the streams are now bordered by pastures, cropland, and lawns.

The Chesapeake Bay Program has established goals for the preservation and re-establishment of forested and grassed riparian buffers along rivers and streams throughout the Chesapeake Bay drainage area.

RECOMMENDATIONS:

- Prioritize riparian buffer restoration sites. It is recommended that buffer assessment, streambank erosion assessment, and Level I assessment data be used to identify high priority stream reaches for establishing riparian buffer vegetation. Priority will be given to stream reaches in which: (1) existing buffer vegetation is poor, (2) streambank erosion is severe,

and (3) stream types are responsive to vegetative influence on the channel stability (especially C, DA, and E in the Rosgen classification system).

- Assist property owners with management of riparian areas. The owners of streamside property are often unaware of the benefits of native vegetation in riparian buffer areas. Outreach efforts can provide them with information and technical assistance for improved management of riparian areas. The Conservation Districts should continue their ongoing practice of providing technical assistance and plant materials for establishing appropriate riparian buffer vegetation. The Conservation Reserve Program of the Natural Resources Conservation Service can provide farmers with financial assistance for establishing stream buffers on agricultural land and providing alternate water sources for livestock. In Pennsylvania, the Growing Greener grant program can also provide financial assistance for alternate water supplies and riparian buffers.
- Adopt stream setback requirements. Stream setback requirements in local land use regulations can prevent construction of buildings within 50 or 100 feet of any streambank. They can also require site plan review for any grading, clearing, or other disturbance within the stream buffer area. These provisions serve both to protect development from the hazards of flooding and erosion and to protect existing natural features in the riparian zone. Watershed residents are unlikely to oppose stream setback requirements. Of the respondents to the Seeley Creek watershed survey only 1.5% considered it safe to build within 50 feet of a stream and 6.5% considered it safe to build between 50 and 100 feet from a stream.
- Acquire property or conservation easements for sensitive riparian areas. Local governments or other organizations can permanently protect riparian areas by acquiring riparian property or acquiring conservation easements to riparian areas. The not-for-profit Chemung Valley Conservancy can accept donated property or easements, manage the land for conservation, and allow recreational use of the property. The Finger Lakes Land Trust also places a high priority on conservation easements and other mechanisms for preserving riparian areas in New York State.

Floodplain Management

Floodplains are the relatively low areas adjacent to rivers, lakes, and streams that are periodically inundated. Floodplain lands and adjacent waters, including wetlands, combine to form a complex, dynamic physical and biological system that supports a multitude of water resources. Undeveloped floodplains provide the Seeley Creek watershed with natural flood and erosion control, natural water filtering processes, a wide variety of habitats for plant and animal communities, places for recreation, etc. Another benefit of undeveloped floodplains is that they do not contain buildings and other development that is subject to flood damage. The best flood protection occurs when development is located outside of the flood-prone areas. Seventy-five percent of the respondents to the Seeley Creek watershed survey indicated that land use regulations to minimize building in floodplains are a very effective or somewhat effective solution to flooding.

Development within the 100-year floodplains delineated on Flood Insurance Rate Maps (see Figure 19 above) is regulated by local laws enacted by each municipality in the watershed. However, not all flood-prone areas are included in the designation of 100-year floodplain. Development on alluvial fans and along small streams for which no floodplains were delineated is also at risk of flooding and erosion damage.

RECOMMENDATIONS:

- Enforce floodplain development regulations. Local floodplain development regulations are intended to insure that new development is protected from flood damages and does not cause damage to other areas. Training for local elected officials and building officials would enable them to more effectively enforce these development standards.
- Adopt stream setback requirements. Stream setback requirements in local land use regulations can prevent development close to streams for which no 100-year floodplains have been delineated. A 50- or 100-foot stream setback would encompass the active floodplain of most of these small streams. This also provides a buffer zone to protect development from streambank erosion.
- Adopt building standards for alluvial fans. Municipalities can delineate alluvial fans on a map and adopt building standards for development in these areas. These standards could prohibit basements, require first floor elevation or floodproofing, require use of flood resistant construction materials, require adequate drainage paths around the structure, and require adequate foundation design.
- Update Flood Insurance Rate Maps. Recent flood events have illustrated the inaccuracies of the existing floodplain maps, on which floodplain development standards are based. Updated maps should utilize improved hydrology and accurate topographic data (from LIDAR). In addition, the maps should be in a digital format that can be utilized with other digital data layers.
- Protect and restore the natural functions of floodplains. Floodplain protection, restoration and enhancement efforts should be focused on increasing the capacity of the floodplain to safely handle water during major precipitation events. Adequate floodplain conveyance is necessary on all properties through which a stream passes, whether privately or publicly owned. This will require educational outreach to property owners, many of whom would prefer for their land to remain dry.

Floodproofing, Elevation, or Removal of Flood-prone Buildings

In many flood-prone areas, existing development suffers repeated damage. Property protection activities are those measures that reduce flood losses to property that is presently located in harm's way. Effective procedures include the removal of property from the hazard area, demolition of structures, elevation of buildings, and floodproofing. Unless the costs associated with recurring flood damages are quite high, floodproofing is likely to be the most cost-effective solution. Floodproofing is any method of making a building resistant to flood damage. Floodproofing strategies are particularly appropriate at sites that experience moderate flooding (i.e., shallow water, low velocity, and short duration). Some buildings can be protected against low level flooding by completely sealing the structure against the entry of water, called "dry" floodproofing. An alternate strategy is "wet" floodproofing, which focuses on minimizing damage to the interior of a building when water does enter (by elevating utilities, anchoring fuel tanks, etc.).

RECOMMENDATIONS:

- Provide technical assistance for floodproofing measures. Residents and businesses in flood-prone areas should be encouraged to undertake appropriate floodproofing measures. Particular emphasis should be placed on low-cost options, such as removal of items from

basement areas and protection of utilities. Municipal building officials can provide valuable assistance by recommending floodproofing alternatives, particularly after flood events.

- Provide financial assistance for floodproofing measures. Municipalities can assist property owners interested in implementing floodproofing measures by sponsoring a grant application or referring low-income residents to sources of housing rehabilitation assistance.

Flood Control Structures

Respondents to the Seeley Creek watershed survey tended to prefer structural solutions to flooding (dikes and dams) to the non-structural options presented (wetland conservation and land use regulation). There are presently no flood-control dams in the watershed. Urbanized areas of the Town of Southport are currently protected by a U.S. Army Corps of Engineers flood control levee. In 1968, the U.S. Department of Agriculture identified four potential reservoir sites in the Seeley Creek watershed (see Table 8). None of these structures were built.

RECOMMENDATIONS:

- Investigate small-scale flood protection alternatives. Major dam or levee projects in the Seeley Creek watershed are unlikely to meet the benefit-cost criteria for federal and state funding. However, opportunities may exist for small-scale diversion structures, detention basins, retention basins, or other structures. In particular, the proposed reservoir sites indicated in Table 8 should be evaluated.
- Maintain and protect flood control structures. The NYS Department of Environmental Conservation is responsible for maintenance of the existing flood control levees in the Town or Southport. Ongoing protection and maintenance of these structures is essential to insure proper functioning during flood events. Some of these levees have been damaged by off road vehicles and other prohibited activities. Local residents, officials, and law enforcement personnel can assist with the education and enforcement efforts needed to protect these structures.

Drainage System Maintenance

Removal of sediment and debris from man-made drainage structures (ditches, culverts, bridges, detention ponds, etc.) is often necessary to maintain the design capacity of these structures. In some cases the removal of trees and debris from streams is also warranted (particularly in developed areas). The removal of sediment and gravel from natural stream channels has also been done, but is at best a temporary measure and has the potential to aggravate problems by creating unstable stream morphologies.

Much of the debris that accumulates in streams and drainage ways consists of trees, branches, and other natural materials. However, in some areas problems result from dumping of yard wastes and other material. The storage of loose material on streambanks can also contribute to problems if it washes into the stream during a flood. The Town of Southport has addressed the dumping of material into a paved drainage ditch (by Chapel Park) by enacting a local ordinance to prohibit dumping in that drainage way.

More that 90% of the respondents to the Seeley Creek watershed survey indicated that "clearing debris from the stream" is an effective solution for restoring portions of Seeley Creek (61.8% very effective, 29.3% somewhat effective).

Table 8
Proposed Reservoir Sites

Sub-watershed	Project Location	Municipality	Site #	Drainage Area	Flood Storage Capacity	Permanent Pool	Dam Height
South Creek	Roaring Run Creek; 41° 58' 51" N; 76° 50' 53" W	Wells	42-1	0.9 sq. miles	144 acre feet	29 acres	35 feet
Upper Seeley Creek	Beckwith Creek; 41° 57' 18" N; 76° 53' 30" W	Wells	42-2	3.8 sq. miles	608 acre feet	70 acres	64 feet
Upper Seeley Creek	Seeley Creek; 41° 56' 19" N; 76° 55' 31" W	Jackson	42-3	3.9 sq. miles	624 acre feet	98 acres	54 feet
Mudlick Creek	Mudlick Creek; 42° 01' 40" N; 76° 57' 55" W	Southport	42-6	11.3 sq. miles	2,215 acre feet	235 acres	72 feet

Source: Inventory of Potential Upstream Reservoir Sites, Susquehanna River Basin, prepared by U.S. Department of Agriculture, February 1968.

RECOMMENDATIONS:

- Encourage individual property owners to assume stream maintenance responsibilities. The owners of property crossed or bordered by streams should be encouraged to assume responsibility of stream management and maintenance. This includes: not dumping debris into the creeks, not storing loose materials on the streambank (where it may wash into the stream during a flood), periodic inspection to identify debris problems, removal of debris from the creek near developed areas (where it is likely to contribute to flooding or bank erosion problems), obtaining any necessary permits, and insuring that any stream projects will not adversely affect other properties. The municipalities and county conservation districts can provide property owners both technical and logistical assistance with stream management.
- Implement municipal inspection and maintenance of streams. The municipalities should assume responsibility for routine inspection of streams and drainage ways that are located near roads and in developed areas. When debris problems or other maintenance needs are identified, the municipality can resolve these problems or refer them to the appropriate individuals for resolution (property owner, county highway department, state department of transportation, etc.). When technical assistance or a permit is required for resolution of the problem, assistance should be sought from the county conservation district. Follow-up inspections will insure that the identified problems have been resolved. The Town of Southport has developed and adopted a Stormwater Drainage Maintenance Plan. The other municipalities may choose to develop a similar plan or to implement inspection and maintenance activities in an informal manner. The Chemung County Soil and Water Conservation District has acquired a firewood processor and a portable sawmill to facilitate utilization of trees that are removed from streams.

Streambank Protection and Natural Stream Restoration

Restoring streambanks was the highest ranked recommendation for protecting Seeley Creek's health in the watershed survey (64.1% very important, 26.2% somewhat important). The traditional method of protecting streambanks from erosion is to armor the banks with rock riprap. In many cases, this is an effective, but costly, technique. Biotechnology methods have also been used successfully for reducing streambank erosion. This involves planting of willows and other plants so that their root systems will hold the soil in place.

Natural stream channel design is an approach to stream restoration that uses stable natural channel reaches as a blueprint or template for re-creating stable conditions in disturbed stream systems. The project design accounts for the stream's ability to transport both water and sediment. The desired channel geometry can be established by re-grading the channel and stabilized with in-stream structures such as rock vanes, cross-vanes, and root-wads. A successful natural stream channel design will achieve sediment transport, habitat enhancement, and bank and channel stabilization.

Natural stream design is a relatively new approach to stream restoration in Pennsylvania and New York. Conservation professionals associated with Seeley Creek are hopeful that this approach will provide more lasting solutions than have been achieved by previous efforts (rock riprap to stabilize eroding banks, gravel removal to enhance flow capacity, etc.). Natural stream restoration is being implemented in an adjacent watershed (Bentley Creek), where some restored

reaches have functioned well and other reaches have failed. These failures are attributed to shortcuts that were taken to expedite the data collection, project design, and construction phases of the project. In addition, there has not yet been enough effort made to identify and monitor local reference reaches to use as the blueprints for restoration designs.

Although natural stream restoration techniques are a relatively new approach to stream management in the Seeley Creek area, a majority of the respondents to the Seeley Creek watershed survey indicated that "natural stream design to let the stream take its natural course" is an effective solution for restoring portions of Seeley Creek (36.4% very effective, 30.1% somewhat effective).

RECOMMENDATIONS:

- Prioritize stream restoration sites. Use stream assessment data to identify and prioritize high priority stream reaches for implementation of stream restoration projects. Priority will be given to stream reaches in which: (1) adjacent development is threatened, (2) streambank erosion is severe, and (3) stream types have a low potential for natural recovery (especially A, D, F, and G in the Rosgen classification system). Although many high priority sites have already been identified, they have not been prioritized on a watershed-wide basis.
- Collect reference reach data by stream type. The design of natural stream channel restoration projects is based on the measured dimensions of stable stream systems of the same morphological types as the impaired reaches. Prior to widespread implementation of this restoration approach, it will be necessary to identify stable reference reaches in and near the Seeley Creek watershed. These stable reaches should be surveyed and monitored.
- Stabilize high priority stream channels and banks. The restoration of impaired stream reaches and stabilization of eroding streambanks should emphasize natural channel design practices to facilitate flow, transport sediment, minimize bank erosion, and reduce stream channel migration. However, natural stream channel design must allow for the integration of "unnatural" design features (traditional hard-engineering) in areas where adjacent land uses restrict efforts to work with a new or existing floodplain. Stream reaches already identified as high priority for restoration include: (1) Seeley Creek near Pine City, where erosion can undercut an existing landslide, (2) Seeley Creek from the Webb Mills bridge downstream to the Pennsylvania Avenue bridge, where development is threatened, (3) Dry Run Creek near Peacefield Road, where the stream assessment data collected in 2001 identified severe erosion (see Figure 15 above), and other sites.
- Seek opportunities for small-scale water detention. Small-scale detention of runoff in small streams and drainage ways can reduce flood peaks by delaying the flow of water. Techniques for accomplishing this include: building detention ponds (to control runoff from development), establishing floodplain vegetation (to reduce the velocity of floodplain flow), establishing riparian wetlands (to store and slow floodplain flow), installing drop structures, and stabilizing natural debris dams (to slow in-stream flow).

Flood Warning and Emergency Response

Reliable and timely flood warnings enable residents, businesses, and governmental units to carry out emergency measures to reduce the risks of loss of life, to protect valuable property (either by its removal from the flood area or securing it from water damage), and to provide emergency services. Sufficient warning is the greatest defense against loss of life during a flood.

The National Weather Service (NWS) and the county emergency management offices disseminate flood warnings in the Seeley Creek watershed. The National Weather Service prepares daily flash flood guidance information, which provides an indication of the approximate 1-, 3-, 6-, 12-, and 24-hour rainfall needed to begin small stream flooding. When the predicted or observed precipitation approaches these values, flood warning and emergency response activities are initiated. Real-time rainfall information in the Seeley Creek watershed comes from the NWS Doppler Weather Radar, an automated climate station located on Kinner Hill (in the Town of Southport), and observations by volunteer rain gauge readers. The Kinner Hill climate station is part of a network of precipitation gauges owned and operated by Environmental Emergency Services of Chemung and Steuben Counties. Data from this gauge is fed by telemetry to the Flood Warning Service Emergency Operations Center (in the City of Corning Fire Department) and to the NWS office in Binghamton. This gauge is part of the NWS IFLOWS (Integrated Flood Observation and Warning System) rain gauge network and will be included in the data that are posted on the Internet.

RECOMMENDATIONS:

- Complete and enhance hydrologic model. Hydrologic modeling can provide information about travel times of peak flood conditions that is valuable for planning flood response activities. It is recommended that the Seeley Creek hydrologic model (being developed by the Town of Southport Drainage Officer) be completed and refined. The South Creek subwatershed should be integrated into the existing model. In addition, the model should be calibrated using rainfall and stream discharge information from actual storm events. A summary of peak travel time estimates should be provided to emergency personnel and highway departments throughout the watershed.
- Implement an emergency notification system. The Town of Southport has developed a telephone database for properties along Seeley Creek and its tributaries. It is their intention to contract with an automated telephone service to notify each of these residents and businesses when flash flooding is anticipated. The Town is currently seeking $2-3,000 for implementation of a telephone notification system for the Town of Southport. It is recommended that this flash flood warning system be implemented for the entire watershed.
- Install stream level gauges. The Town of Southport plans to paint staff gauges on bridges over South Creek and Seeley Creek. By monitoring water levels at these locations, Town staff will be able to develop a better understanding of the stream levels at which flooding problems occur. If additional staff gauges are also placed in upstream locations, it will enable development of relationships between upstream and downstream flood peaks.
- Expand precipitation gauge network. Additional precipitation information can aid in the timely forecasting of flash flood conditions. Opportunities for one or more additional automated gauges should be explored. Additional volunteers should be recruited for the National Weather Service rain gauge reader network. These volunteers notify the National Weather Service when heavy precipitation has occurred (in addition to providing monthly reports of daily precipitation totals).
- Update emergency plans. The emergency plan for each municipality, county, and critical facility should be reviewed annually to insure that the information and procedures are accurate and up to date.

IMPLEMENTATION OF THIS STRATEGIC PLAN

Restoration and preservation of Seeley Creek and the quality of life throughout the watershed requires implementation of diverse mitigation and protection measures. This plan does not establish overall priorities among the many recommendations detailed above. It is recognized that many different priorities exist among the diverse group of stakeholders whose efforts are required to implement this plan. These stakeholders and partners include: residents, land owners, planning organizations, conservation groups, agricultural concerns, health departments, emergency service providers, sportsmen, business interests, highway departments, elected officials, and others. Each of these individuals, agencies, and organizations should focus its efforts on those implementation measures that fall within its objectives, expertise, and authority. In addition, each unit of government must place the highest priority on those measures that will provide the most benefit to their constituents. Comprehensive watershed management requires coordinated implementation of many different priority projects that address a diverse array needs and concerns throughout the watershed.

Integrated management of the watershed requires communication and coordination among the many involved entities. The Seeley Creek Watershed Association is ideally suited to facilitate this coordination of management and remediation measures. Unfortunately this association does not currently have the active participation of many of the relevant partners. Efforts should be made to revitalize this organization and increase participation. If this is unsuccessful, coordination and communication can occur through individual contacts and personal communication.

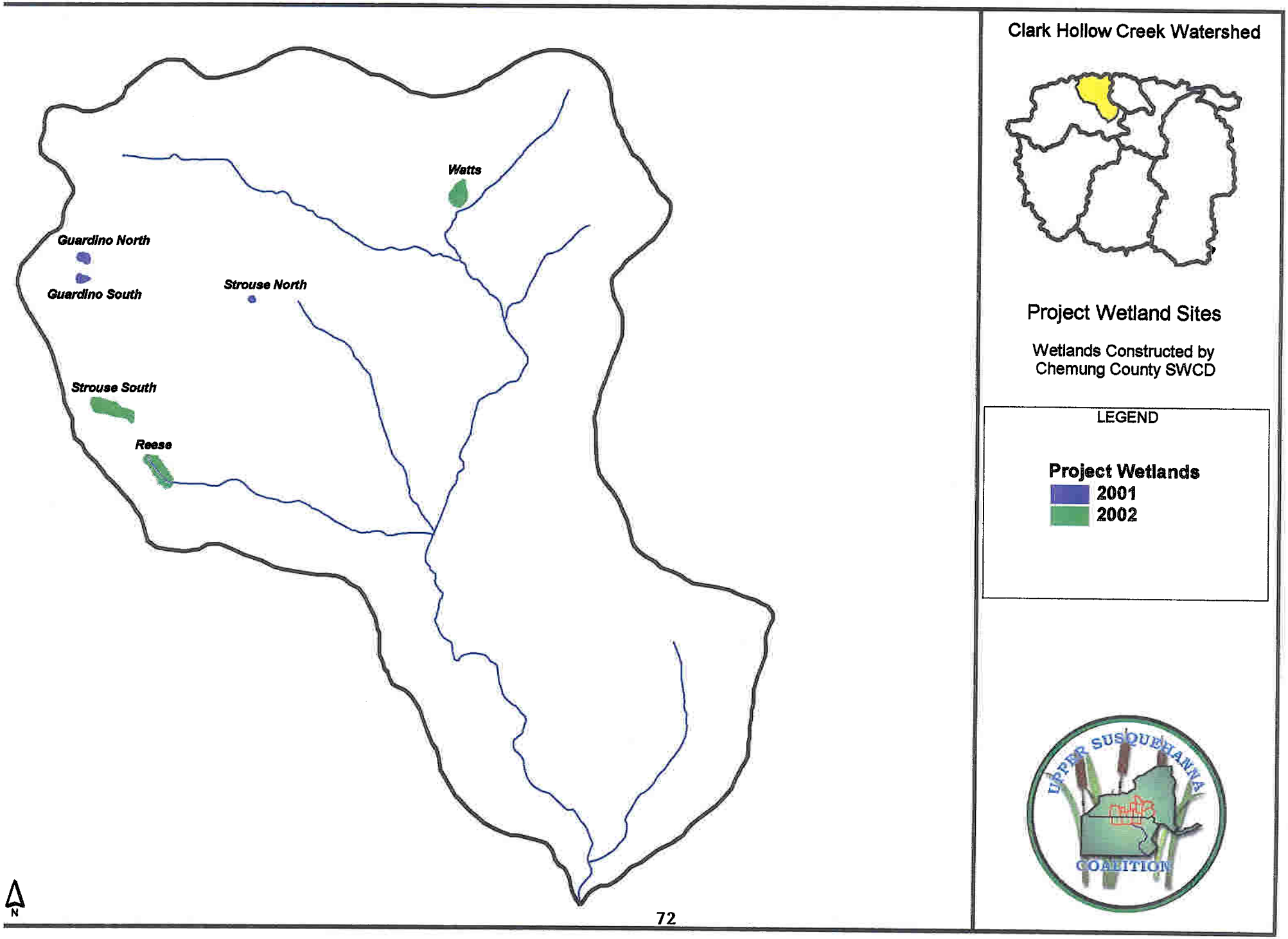
As a practical matter, the highest implementation priority will be given to those recommendations for which funding, personnel, and political support are currently available. For other recommendations, efforts should be made to increase the capability for implementation. This can include grant writing, public outreach, review of local codes, etc.

Demonstration Projects

Many of the recommendations for the Seeley Creek watershed have been implemented in some parts of the watershed or in neighboring areas. Demonstration projects that can be used for education and planning include:

* Created wetlands. Two flood attenuation wetlands were constructed on private property in the Dry Run Creek subwatershed in 2000. The designs include open water, wetland habitat, and capacity for flood storage. In the Clark Hollow Creek subwatershed, three wetland projects were implemented in 2001 and three more are planned for 2002 (see Figure 24). These sites can be visited with property owner permission.
* Vortex weirs or cross veins. The Town of Southport has installed several vortex weir structures in Bird Creek. These are in-stream rock structures that provide grade control and streambank protection.

Figure 24. **Seeley Creek Watershed - Clark Hollow Creek Sub-Watershed Project Wetlands**



* Natural stream restoration in Bentley Creek. Natural stream restoration techniques have been implemented along 1-½ miles of Bentley Creek in Pennsylvania, with additional restoration planned for the remaining reaches of the main stem. The Bentley Creek watershed is located east of the Seeley Creek watershed (in Bradford County, Pennsylvania, and Chemung County, New York). It provides a good area for observing natural stream restoration practices. This restoration has not been completely successful and, therefore, offers an opportunity to learn from the mistakes that were made, as well as a chance to observe successfully restored stream reaches.
* Sample ordinances. The county and regional planning boards and commissions can provide recommendations, technical assistance, sample plans, and sample ordinances to assist with land use planning and regulations.