



SALISBURY TOWNSHIP NATURAL RESOURCE INVENTORY

**FINAL REPORT
JUNE 2011**



**SALISBURY TOWNSHIP
NATURAL RESOURCE INVENTORY**

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Reasons to protect **SALISBURY TOWNSHIP**

Salisbury Township, at only 11 square miles, is the smallest township in Lehigh County. And yet, for its small size, the township contains some of the county's most critical natural resources. Located right in the center of the nationally significant Highlands region, containing the headwaters to both the Saucon and Trout Creeks, and home to great biodiversity and rare habitat types, Salisbury Township is a jewel of great ecological value. Salisbury Township also contains headwaters to the Little Lehigh Creek, a heritage trout fishing stream and source of drinking water to the City of Allentown. The township is a stopping point for a wide variety of migratory birds, and summer home and breeding and nesting grounds to others. Tiny seeps and springs on the steep slopes of South Mountain feed wetlands and vernal pools, supporting the springtime breeding activities of many different types of reptiles and amphibians.

Protecting these critical resources against the threats posed by development, invasive plants, habitat fragmentation, and climate change is neither a simple or easy task. First, the existing resources must be described, and strategies developed to protect those resources, or, where appropriate, intervene to restore them to their previous condition. Tools available to carry out protection and restoration include regulatory measures, such as protection provisions in the Zoning Ordinance and SALDO, and also include direct, on-the-ground projects such as habitat restoration and invasive plant removal.

This Natural Resources Inventory was undertaken to provide background materials for the decision-makers of the Township to use in determining the appropriate measures to take to protect, preserve, and enhance the precious natural and environmental resources of Salisbury Township.



The title page features a background image of a forest with green leaves and tree trunks. Overlaid on this image is the title "SALISBURY TOWNSHIP NATURAL RESOURCE INVENTORY" in a large, bold, black, sans-serif font, centered horizontally.

SALISBURY TOWNSHIP NATURAL RESOURCE INVENTORY

ACKNOWLEDGEMENTS

This study could not have been completed without the significant assistance of Rick Wiltraut and Bill Sweeney of Jacobsburg State Park, Pennsylvania Department of Conservation and Natural Resources (DCNR), who provided invaluable expertise in bird, amphibian, and plant identification. Tim Dugan of DCNR Forestry also provided significant assistance with plant and tree identification. This project was guided by the Salisbury Township EAC and by the Salisbury Township staff, which provided input into the study goals and helped gain landowner access to private properties. Field work was assisted by Richard Niesenbaum of Muhlenberg College. Funding to carry out this project was provided by Salisbury Township.

PREFACE

This study was undertaken primarily to ensure the more accurate mapping, description, and location of the township's water resources, and to provide specific recommendations to protect these resources. Although plant and animal communities were included in this study, full documentation of ecosystem communities was not the primary intention of this effort. This study is not intended to replace or substitute for work already done by the Nature Conservancy for the Lehigh Valley Planning Commission (LVPC) contained within their 2005 Lehigh and Northampton County Natural Areas Inventory Update. The 2005 Update modifies the original study, done in 1999.

South Mountain has been studied in depth in the past, and particular areas of ecological sensitivity already identified and mapped. This information is included as **Map: LVPC Natural Areas Inventory Sites**. This study focuses on information not already detailed in previous efforts. Specifically, this includes a focus on the existing condition of the Township's streams, historic and current land use analysis, forest age analysis, and location of un-mapped tributaries and springs, seeps, and vernal pools. As part of this study, a migratory bird survey was also carried out.

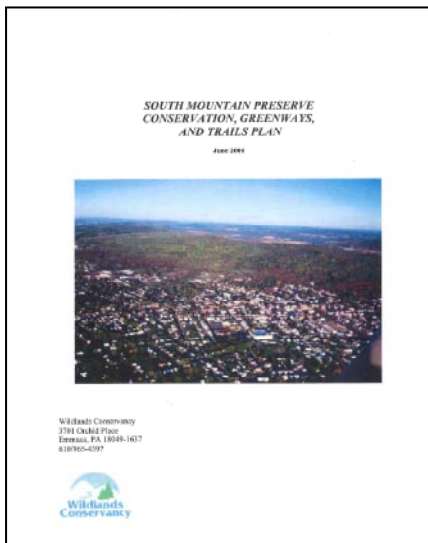
STUDY PURPOSE

This study was initiated primarily out of concern for more effectively protecting the Township's water resources. In particular, several recent development projects had brought to light the limits of protection that currently exist for the township's water resources, and a goal was formed to improve the level and effectiveness of natural resource protection. Specifically cited were springs, seeps, isolated wetlands, vernal pools, and unmapped headwaters streams. At the same time, associated with these water features are critical habitat areas used by migratory birds and by terrestrial wildlife, such as amphibians and reptiles. Further, concerns had also been raised about the location of threatened and endangered plant species within the township, some likely to be associated with the above-listed headwaters hydrology features.

PREVIOUS STUDIES ON THE NATURAL RESOURCES OF SALISBURY TOWNSHIP

Below are summarized some of the more recent and critical studies that form the background of natural resource work done on the South Mountain area of Salisbury Township. This is not an exhaustive list of available materials, but contains only the most critical and valuable resources.

South Mountain Preserve Conservation, Greenways, and Trails Plan Wildlands Conservancy, 2006



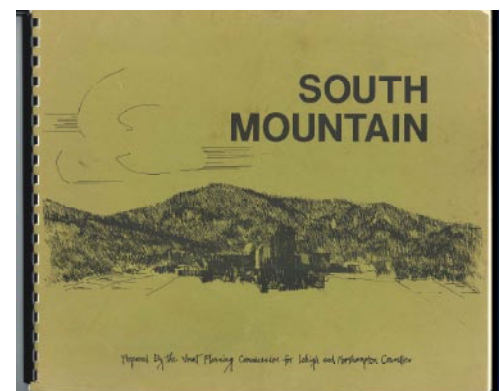
This in-depth report documented the environmental, natural, historical, recreational, ecological and geologic resources of the 305-acre South Mountain Preserve property in Salisbury Township and Emmaus Borough. This Plan contains essential background information on the general ecological conditions of the South Mountain area, and summarizes many pressing threats and issues that confront the future health of this preserved land.

The exhaustive plant and animal inventory done of this property, alongside the 1999 study done by the Planning Commission, provides the baseline against which future ecological inventory studies can be compared. The Preserve study inventoried birds, reptiles and amphibians, and plants, and thoroughly described the different habitat types found and their importance.

Summary of Report Recommendations: This report contains a wide variety of recommendations concerning maintenance, recreational uses in the preserve, and others aimed at reducing forest fragmentation and the effects of invasive plants and adjacent development. Recommendations in this report focus on the management of this particular property.

South Mountain Lehigh Valley Planning Commission, 1977

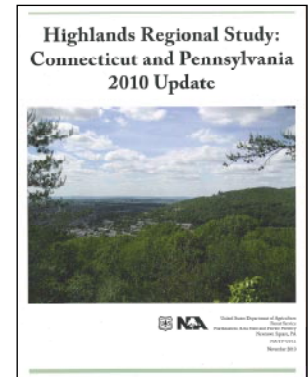
This report inventoried the natural and social environments of South Mountain, determined the development constraints and special values that are present, and evaluated those in light of existing plans and regulations. This study cites existing well conditions. The Surface Water section (pp. 24-25) of this study describes the situation in Salisbury Township where there are many more existing streams than exist on the United States Geological Survey maps. The Ground Water section, pages 21-22, describes the unique configuration of seeps and springs on the steep side slopes disappearing into limestone aquifers at the base of the mountain.



Summary of Report Recommendations: Avoid large-scale and high-density residential development along South Mountain; including not extending existing sewer and water lines, and protecting steep slopes. Protect the open space value of the area through acquisition; develop appropriate recreation facilities such as hiking trails. Ensure that, whatever development does take place reflects the value of the South Mountain area. Develop innovative strategies for the protection of South Mountain.

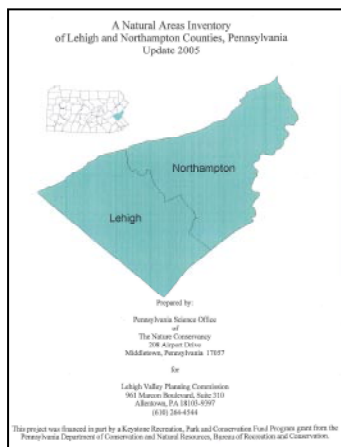
Highlands Regional Study: Connecticut and Pennsylvania 2010 Update United States Department of Agriculture, Forest Service

This recent study reviews the Conservation Values Assessment of the Pennsylvania and Connecticut portions of the Highlands Region. The PA Highlands contains all or portions of Dauphin, York, Lancaster, Lebanon, Berks, Lehigh, Northampton, Bucks, Montgomery, and Chester Counties. The resources assessed were: agriculture, recreation, forest, biology, and water. Account was taken of trends in population migration and development. This study does not concentrate on any of the individual municipalities in the Highlands region, so information specific to Salisbury Township is lacking. However, one Highlands focus area, the Delaware Palisades, includes South Mountain. This area ranks highest for its water, forest, and biological resources.



Report Recommendations: This report contains generalized conservation strategies (“Reach Out and Inform,” “Monitor Landscapes and Resources”) but no site-specific measures are listed.

A Natural Areas Inventory of Lehigh and Northampton Counties, Pennsylvania Lehigh Valley Planning Commission, 1999, update 2005

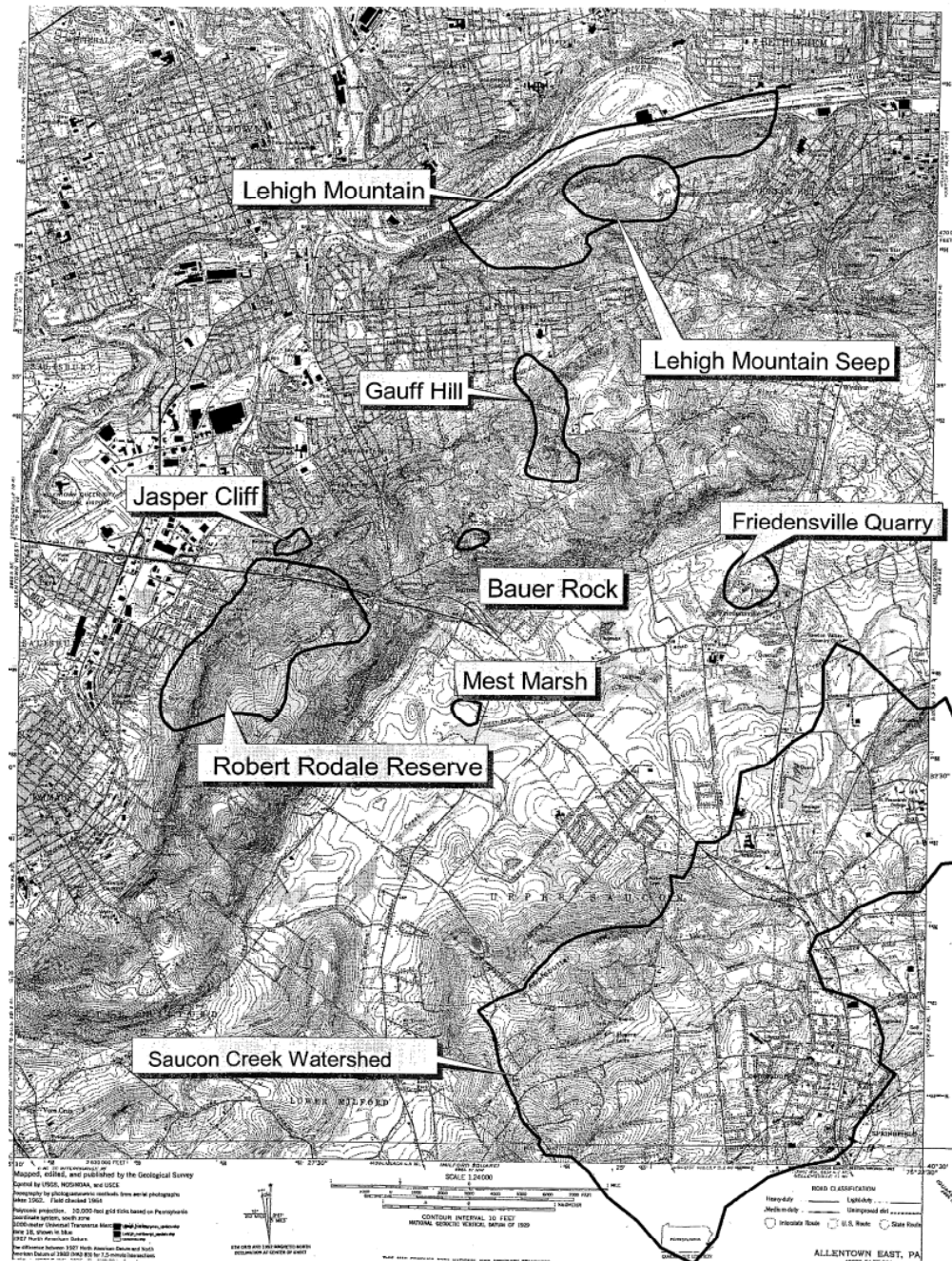


The natural resource inventory was prepared by the staff of the Pennsylvania Science Office of The Nature Conservancy. Extensive field work was done for this study, and a thorough list compiled of both plant and animal species. The inventory gives general information on the locations of rare, threatened, and endangered species and of the highest quality natural areas in the Lehigh Valley, with four sites along South Mountain in Salisbury Township listed.

- The first site described is the Robert Rodale Reserve, jointly owned by the Wildlands Conservancy and the City of Allentown. The second site in Salisbury Township is the Lehigh Mountain Seeps, located on the slope down towards the Lehigh River. Both are examples of Northern Appalachian Circumneutral Seeps Natural Communities. These two sites are critical because the seeps, along with the accompanying vernal pools, forest, small streams, and rock outcrops, provide critical high-quality habitat for a wide variety of plant and animal species. This habitat type is known for having a high level of biodiversity. Both sites contain a population of Lettuceleaf Saxifrage, which was recently removed from the endangered species list. This plant species is threatened by competition from invasive herbaceous plants and shrubs.
- Gauff Hill is a wetland area that also contains a population of the Lettuce Saxifrage. The recommendation for this site is to maintain a forested corridor in the area of the hill.

- Lehigh Mountain is a locally significant area, a second growth forest occurring on the north slope of the Lehigh River. Lehigh Mountain supports a large number of nesting and migratory bird species, and provides good reptile and amphibian habitat. The main recommendation for protection of Lehigh Mountain is to avoid fragmentation and protection from invasive plant infestations.

Below is a map from the report displaying the locations of the natural areas in Salisbury Township; these natural areas can also be found on [Map: LVPC Natural Areas Inventory Sites](#).



Salisbury Township Bird Studies

There is a great deal of information available about bird activity in the Lehigh Valley. Two resources recommended in the Wildlands' Preserve Study are *Birds of the Lehigh Valley* (Saenger, Malt, and Crilley, 2002), and *The Lehigh Valley, A Natural and Environmental History* (Halma and Oplinger, 2001).

A breeding bird inventory was conducted at the Preserve in 2004, and is included in the Pennsylvania Breeding Bird Atlas. Information on the 2nd Atlas is located at <http://bird.atlasing.org/Atlas/PA/>, a web site powered by the Cornell University Laboratory of Ornithology.



Female redwing blackbird

SALISBURY TOWNSHIP NATURAL RESOURCE INVENTORY

REPORT HIGHLIGHTS

This study was undertaken to determine the state and condition of the natural resources in Salisbury Township, and to develop recommendations for their preservation and restoration. The study focused on two main goals: to identify and locate **hydrologic resources** which are not currently adequately protected by existing regulations and policies, and to develop recommendations for the Township decision-makers to use in identifying **future environmental resource protection and restoration projects**. Major highlights of this report include the following:

- Many previously unmapped *seeps, springs, and headwaters streams* have been mapped and field verified. The township can use this mapped information to protect these water features, and to predict the locations of others in areas where the field staff did not have access as part of this study.
- *Existing regulations and definitions* in other municipalities being used to protect headwaters hydrology features were researched, and the wording and feature definitions provided.
- *Invasive plants* are rapidly colonizing the township's forest and park areas, and are threatening habitat value significantly. This study contains mapped locations of problem invasive plant areas.
- *Potential stream restoration and enhancement projects* have been located along the Trout Creek. These projects are of varying size and scope and the list of recommended projects can be used by the township and by environmental groups to improve the quality of the Trout Creek.
- *Migratory bird habitat enhancement projects* have been located and described.
- Recommendations have been developed for adding environmental and habitat value to each of *the township owned parks and public school properties*. These recommendations can be used by local community groups and by the township parks and recreation committee to develop projects.

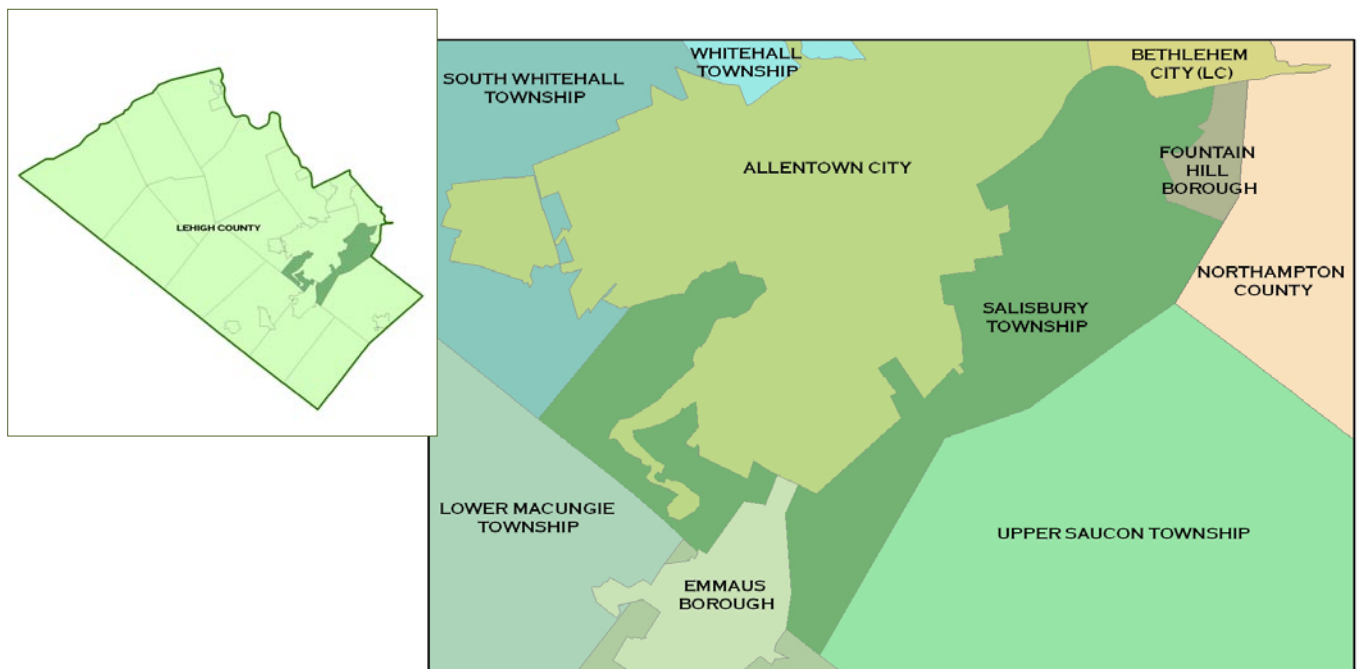
STUDY COMPONENTS

This study contained a number of components. Each will be described in detail under the appropriate section heading.

1. Introduction and Background
 - Location
2. Land Resources
 - Physiography
 - Historical Land Use Analysis
 - Flora & Fauna
 - Ecological Corridor
3. Urban Resources
 - Township Park and School Property Environmental Condition Site Analysis
4. Water Resources
 - Hydrography Analysis
 - Visual Assessment of the Trout Creek
 - Water quality and macroinvertebrate data collection from the Trout Creek
5. Regulations and Definitions

LOCATION

Salisbury Township is located in Lehigh County, Pennsylvania. The Township is divided into two geographically unconnected segments, separated by the City of Allentown. The western portion of the township is generally more urbanized, although a section of the eastern segment of the township, running along Emmaus Avenue, is also highly urbanized. The eastern portion is located along South Mountain, and is bounded by the Lehigh River to the north.





LAND RESOURCES

PHYSIOGRAPHY

Geology

The geology of Salisbury Township is comprised of the upper and lower plate of a Blue Ridge Province thrust fault, with the granite, gneiss, and amphibolites of pre-Cambrian age forming the erosion resistant rocks of South Mountain. The Cambrian limestone and dolomite formations form the valley bottom. Along the base of the South Mountain, iron mines and jasper cliffs are found in the Hardystone Quarzite Formation. See [Map: Geology](#).

The township streams largely flow through the limestone areas, which erode more easily and therefore form the valley bottoms. Although in many places in the Lehigh Valley limestone areas are heavily sinkhole-prone, this effect is ameliorated in Salisbury Township by the fact that the limestone areas are the most urbanized and thus largely covered with impervious surfacing.

Topography

The topography of the Township varies from the flat-lying valley area of the western portion of the township, to the steep hills of South Mountain. The elevation differences between the valley bottom area (elevation 225 feet) to the top of the highest peak in the township along South Mountain (elevation 1025 feet) is 800 feet. [Map: Topography](#) shows the variation in the township topography.

Soils

The specific soil characteristics of a watershed are extremely important in determining the land use and runoff patterns in a watershed. Soils have widely varying characteristics in factors such as nutrient levels and drainage rates. These soil characteristics determine what types of land use activities are suitable in different locations (i.e., crops, pasture, recreational trails or fields and development). The rate at which water infiltrates into soils also has a significant impact on watershed runoff patterns. Soils with high infiltration rates, such as sandy soils, produce less overland runoff; soils high in clay are typically less permeable, and will produce more runoff.

[Map: Soils](#) shows the considerable variety of soils in Salisbury Township. Along South Mountain, the Gladstone soil predominates. This soil is derived from the similarly-aged igneous and metamorphic rocks comprising the mountain ridge. “Urban” soils cover the limestone areas, except the area directly adjacent to the Lehigh River, where sandy soils have been deposited by the Lehigh River.

Soil Limitations

Soil limitations can affect all kinds of uses, from agriculture to industry. The NRCS – Natural Resource Conservation Service, a Federal Agency, maintains a database of soils for the entire United States. This database, accessible to the public through the Web Soil Survey, lists specific limitations for most possible land uses, on a site specific basis. This resource should be consulted before any proposed activity is approved on any parcel in the Township, to determine what specific limitations pertain to any given parcel. Maps are included that show the most common natural resource protection concerns: [depth to bedrock](#), [depth to seasonal high water table](#), and [slope](#). These maps are general; site specific maps should always be consulted for any proposed project.

LAND USE ANALYSIS

Aerial Photo Study

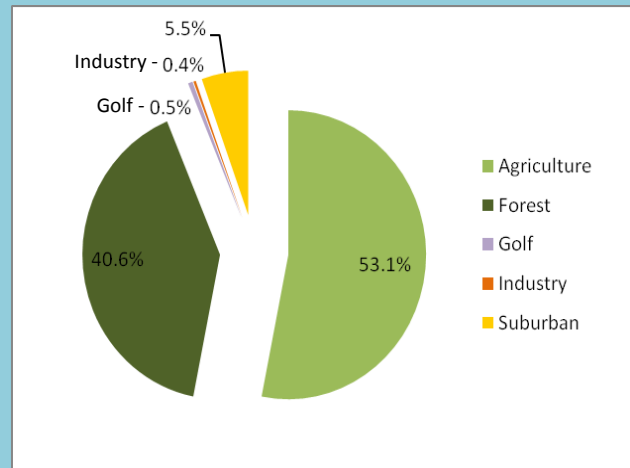
Land use has changed dramatically throughout the Lehigh Valley region over the past century. Aerial photography is available from Penn Pilot for the area starting back in the late 1930's; these aerial photos document how conditions have changed over the past 80 or so years. To carry out the analysis of the change in land uses in Salisbury Township over the past near-century, the historical aerial photos were geo-referenced and analyzed for land use. The results are land use layers reflecting the uses in 1938, 1971, and 2005. Aerial photo maps and their corresponding land use layers are included.

Land uses were broken down by category based upon what was visible in the historical air photos: agriculture, forest, industry, suburban, highway, golf, commercial, and urban.

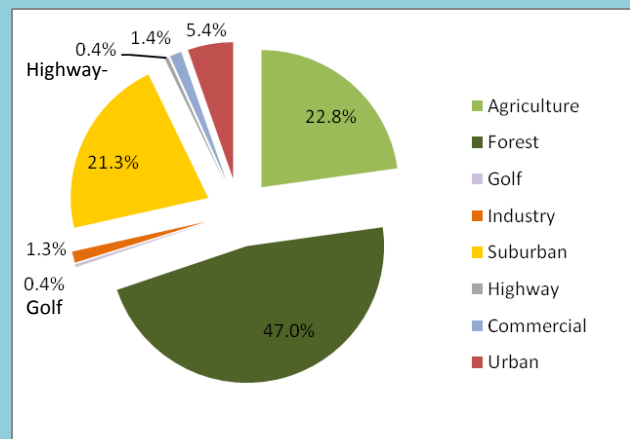
One of the major changes that has taken place over the entire Lehigh Valley is the conversion of farm fields to urban and suburban development, and Salisbury Township is no exception. The Land Use maps show that what was almost entirely agriculture and forest in 1938 had substantially transformed into industry, suburban and urban development by 2005. However, over those seventy years, there was also an increase in the total acreage of forested lands in the township.

The overall decrease in agriculture and increase in suburban land use and forest is documented in the land use analysis, but what is less obvious is whether this change has had a positive or negative effect on overall stream quality. In 1938, agricultural lands were farmed primarily with conventional practices, utilizing fertilizers, pesticides and herbicides with little in the way of soil conservation practices. As can easily be seen on the aerial photos of the time, tilling often went right to

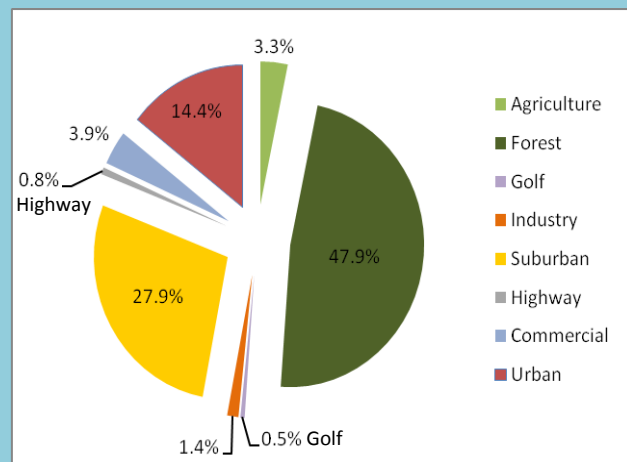
1938 LAND USE PERCENTAGES



1971 LAND USE PERCENTAGES



2005 LAND USE PERCENTAGES



the edge of the stream. Uncontrolled agricultural runoff from the 50% of the township in agriculture would have contributed chemicals and sediment in large quantities to the streams.

Agricultural lands have been largely overtaken by suburban development and also by reforestation. Suburban development contributes different pollutants to the streams than agriculture: contaminants to groundwater from septic systems, runoff from roads such as motor oil and road salts, and household chemicals washed down the drain. The sheer volume of runoff from all the additional impervious surfaces is substantial, as well, and can have well-documented negative impacts on streams. However, agricultural lands, while not as impervious as roads and rooftops, are often not particularly effective at infiltrating rainwater. So the shift from agricultural lands to suburban development does not, by itself, necessarily create obvious conditions for water quality degradation.

Forest Land Cover

One of the facts that is often found most surprising is that there is a greater percentage of forest land in Pennsylvania now – almost 60%, than there was early on in the twentieth century – only 30%. This overall net increase in forest land was caused by widespread logging of old-growth forests in the 1890's and early 1900's, where logged areas were left to re-grow. Subsequent abandonment of farming has also led to reforestation where previously farmed fields returned to forest through natural succession.

Salisbury Township is no exception to this trend. In 1938, as evidenced from analysis of historical aerial photos, about 40% of the township was forested. By 1971 this percentage had increased to 47%, and as of 2005, to 48%. This represents an increase of over 500 acres of forest.

Because most of the harvesting activities in the late 19th and early 20th centuries happened over a relatively short period of time, most of the trees that regenerated in the areas forested today are similar in age – between 80 and 120 years. For further information on the state of Pennsylvania's forests, see the State of the Forest, published by the PADCNr, Forestry Department, in 2004:

http://www.dcnr.state.pa.us/forestry/documents/pa_dcnr_fia.pdf

Forest Age Analysis

Map: Forest Integrity shows the age of the forest lands in Salisbury Township. Those areas that are forested today that were wooded in the 1938 photographs are forests that are older than 70 years. Some forest lands appear on the 1971 aerial photos, and are still forested today, but were not forested in 1938. Those forests are between 40 and 70 years old. Areas do not show up as forested until the 2005 aerial photos; these forests are less than 40 years old. As can be seen from the Forest Age map, the majority of the forests in the township are older than 70 years.



Younger forest with invasive plant species dominating the understory

Condition of Forests in Salisbury Township

All of the Township's forests – indeed, nearly all of Pennsylvania's forests – are second and third-growth forests. Some small inclusions of old-growth forest still remain in isolated pockets, but they are rare. This means that the forest stands that we see today were cut down at least once, and sometimes twice, over the past several hundred years since this area was originally settled by Europeans. The forests of today differ significantly from the original "Penn's Woods" that blanketed the landscape many hundred years ago. Some of these changes are due to disease: the Chestnut blight and Dutch elm disease. Valuable hardwoods, such as cherry and oak, are selectively cut, leaving behind less valuable species such as tulip poplar.

Other factors that influence forest health are the dense deer populations that arose after large predators, such as mountain lions, were largely wiped out. Deer in many areas browse the understory so heavily that the natural tree regeneration that sustained forest regrowth before settlement can no longer function. Invasive plants, in other areas, completely choke out the native understory, and overstory.

In spite of all these pressures, many of Salisbury Township's forest interiors contain a healthy mix of native trees, understory shrubs, and herbaceous plants, a reflection of a healthy native plant community. These forest areas can reasonably be expected to continue to grow naturally, and sustain a healthy mix of plant and animal species for the future of the Township. However, the influence of invasive species and the heavy browsing pressure of deer will continue to exert significant pressure. Without putting in place deer exclosures, and carrying out aggressive invasive species removal, these factors will play an important role in shaping the future of the Township's forests.



15 year old deer exclosure; photo from the Wisconsin Council on Forestry



Older forest with low frequency of invasive plant species

Threats to Forest Lands

Near the forest edges, along trails and power lines, and near parks, invasive plants threaten to take over the native forests. "Invasive plants" are those not originally from the Pennsylvania ecosystem that have no natural predators here and thus spread rapidly and choke out native trees, grasses, and shrubs. Non-native invasive plants are most commonly introduced through soil disturbance; thus, forests that have recently been timbered, and younger forests are more heavily affected.

Examples of the non-native invasives found in Salisbury Township are included as **Insert: Common Invasive Plants**. A comprehensive listing of all invasive plants found during field work is within the **DCNR Terrestrial Plant List**. Invasive plants are denoted by *NNI (Non-Native Invasive).

Recommendation: On a pilot project basis, take on the removal of invasive plants and replacement with natives, working to establish healthy native plant communities. Substantial resources exist about the best methods for dealing with different types of invasive plant communities; Pennsylvania State Cooperative Extension Service and the Pennsylvania Department of Conservation and Natural Resources both are actively involved in researching the control of invasive species in Pennsylvania.

Recommendation: To preserve long-term forest integrity and minimize the introduction of invasive species, it is recommended that all forest parcel landowners be contacted about developing a Forest Stewardship Plan through the PADCNr.

Common Invasive Plants **SALISBURY TOWNSHIP**

Pictures from National Park Service, unless otherwise noted



Purple Loosestrife



Japanese Knotweed



Garlic Mustard



Multiflora Rose



Oriental Bittersweet



Tree of Heaven



Norway Maple (photo by E. Frederick)



Japanese hops



Japanese honeysuckle

Controlling Invasive Plants

Japanese stiltgrass



Invasive plants are those which spread rapidly and out-compete the plants native to an area. Usually, but not always, invasive plants are native to other continents, most commonly Asia and Europe. Most invasive plants were brought to this country intentionally, for landscaping. At some point, these plants escaped cultivation and began to spread. Invasive plants cause serious problems for native habitats by replacing native plants that provide food for native Pennsylvania insects, birds, mammals, amphibians, and reptiles.

Strategies for controlling individual invasive plants are rapidly evolving. Generally, mechanical means (cutting, hand pulling) can be used for small infestations, while larger problems are treated with a combination of mechanical and chemical controls. Site conditions also play a role in determining the removal strategy – a streamside site may call for a different method than a hilltop site. Extensive research into the best means for controlling individual species are ongoing. The latest research is available through Penn State Cooperative Extension's website, and through the website of the Department of Conservation and Natural Resources.

When planning an invasive plant removal project, consult with available experts to determine the current, best method appropriate for the individual site being considered.

Useful Websites:

Directory of Invasive Weeds of the Northeast

<http://extension.psu.edu/weeds/extension-info/invasive-plants>

Invasive Exotic Plants in Pennsylvania

<http://www.dcnr.state.pa.us/forestry/invasivetutorial/List.htm>

FLORA & FAUNA

Conservation and Private Land Field Surveys

Field surveys were carried out on both private and public lands in the township. A field team walked the sites during the spring bird migration season; the team consisted of experts in forestry, amphibian and plant identification, birding, and hydrology. No species of Pennsylvania special concern were located during the surveys.

Birds

South Mountain contains excellent bird habitat. **Map: Field Notes** shows the three major areas where bird surveys were carried out, and the accompanying lists contain the birds identified in these sites. The forest edge ecotones – the interface between forest and meadow – are particularly critical for many species of migratory songbird. Many opportunities exist within Salisbury Township to improve this habitat type, through the removal of invasive species in open areas, such as power lines, and the planting of native meadows. **On Map: Field Notes**, the power lines are noted; bird habitat creation projects are possible along all these easements.

Recommendation: Work with the power companies and private landowners to remove invasive plants and create open-meadow habitat along the power line easements.

Plant Life

Map: Field Notes breaks down the areas surveyed into 3 major areas. Lists of plants and trees located in these areas accompany the map. Surveys were conducted in grassy meadows, early successional scrub-shrub woodlands, and mature forest. Generally speaking, the forests along South Mountain can be characterized as a Northern Red Oak forest community, gradually shifting down slope becoming a more mesic forest where the soil structure increases. The forest adjacent to the Lehigh River is a classic floodplain forest.

Amphibians

In several vernal pools and wetlands throughout the field survey area, a variety of amphibian eggs were found. Among the types found were spotted salamanders and wood frogs. American toads, Eastern grey tree frogs and spring peppers were also observed during field work. For a more detailed herpetological report, please see the Wildlands Conservancy's *South Mountain Preserve Conservation, Greenways and Trails Plan*. The listing can be found on the web at <http://wildlandspa.org/PDF/preserve/Appendices%20A-B.pdf>



Dead man's fingers



Spotted Salamander egg sacks

Endangered & Threatened Species

The following text and maps were provided by the Ecological Services Department of PA DCNR. This narrative and the accompanying charts and maps are inserted exactly as they were provided to the Lehigh County Conservation District for this report.

Ecological Service Department Report

In Salisbury Township, there are currently nine (9) records of Species of Special Concern (SOSC). Scientific and common species names have been listed below. The current status of SOSC in Pennsylvania can be found in the accompanying report (Table 1). Descriptions of preferred habitat, and habitat conditions in which species were found locally, are provided in our report.

Table 1: Plant Species of Special Concern (SOSC) in Salisbury Township, Lehigh County, Pennsylvania. Species rank and status definitions are available through the Pennsylvania Natural Heritage Program (<http://www.naturalheritage.state.pa.us>).

Salisbury Township			
Species Name	Common Name	Pennsylvania Current Status	Pennsylvania Proposed Status
<i>Cyperus schweinitzii</i>	Schweinitz's Flatsedge	Rare	Rare
<i>Carex tetanica</i>	Rigid Sedge	Threatened	Threatened
<i>Lathyrus palustris</i>	Marsh Pea	Tentatively Undetermined	Endangered
<i>Cuscuta campestris</i>	Western Field Dodder	Not Currently Listed	Threatened
<i>Arabis hirsuta</i>	Western Hairy Rock-cress	Tentatively Undetermined	Endangered
<i>Parnassia glauca</i>	Carolina Grass-of- parnassus	Endangered	Endangered
<i>Myriophyllum sibiricum</i>	Northern Water-milfoil	Endangered	Endangered
<i>Amaranthus cannabinus</i>	Waterhemp Ragweed	Rare	Rare
<i>Deschampsia cespitosa</i>	Tufted Hairgrass	Not Currently Listed	Threatened

Additionally, two (2) Ecological Communities of Special Concern have been noted in Salisbury Township: these include an Erosional Remnant (2 occurrences) as well as a Northern Appalachian Circumneutral Seep Community (2 occurrences). The Northern Appalachian Circumneutral Seep Communities and Erosional Remnants are found in Salisbury Township. Detailed descriptions of each Ecological Community can also be found in the accompanying report (below).

Plant Species of Special Concern (SOSC)

Information regarding plant species' wetland indicator status, preferred habitat, flowering time, and last date of observation (year-mo.-day) have been provided below. Also, habitat in which species were found locally has also been described. Detailed taxonomic information for each species is available upon request.

Cyperus schweinitzii (Schweinitz's Flatsedge): FACU; prefers dry or moist sand flats or dunes; flower/fruit mid summer-early fall. *Local Habitat-* Salisbury, 1969-08-20: no habitat information available

Carex tetanica (Rigid sedge): FACW; prefers calcareous wet meadows and swales; flowers in summer. *Local Habitat-* Salisbury, 1954-06-01: found in a marshy meadow; habitat where species was found (locally) thought to have been destroyed sometime prior to 1993.

Lathyrus palustris (Marsh Pea): FACW+; prefers shores, moist meadows, sand plains, swamps and thickets; flowers June-Aug. *Local Habitat-* Salisbury, 1956-06-26: found in a meadow;

Cuscuta campestris (Western field Dodder): indicator status n/a; prefers thickets and waste ground, parasitic on various wild and cultivated hosts including alfalfa and clover; flowers June-Sept., fruits Jul-Oct. *Local Habitat-* Salisbury, 1959-07-06: found in a meadow.

Arabis hirsute (Western Hairy Rock-cress): FACU; prefers woods, banks or rock ledges, usually on limestone, or dry cliffs & ledges of calcareous shale or limestone; flowers late May-June. *Local Habitat-* Salisbury, 1997-05-06: found on a power-line row, dominated by shrubs; specimen found in open light (scattered throughout row) on dry, sandstone substrate.

Parnassia glauca (Carolina Grass-of-parnassus): OBL; prefers boggy meadows or seeps, on calcareous soils; flowers Aug.-Sept.; *Local Habitat-* Salisbury, 1959-09-11: no habitat information available;

Myriophyllum sibiricum (Northern Water-milfoil): OBL; prefers still waters of rivers, lakes, ponds and marshes; *Local Habitat-* Salisbury, 1965-07-19: found in a river.

Deschampsia cespitosa (Tufted Hairgrass): FACW; prefers serpentine barrens, sandy shores, and thickets; flowers late May – June; *Local Habitat-* Salisbury, 1954-06-01: found in a marshy area of an open meadow.

Amaranthus cannabinus (Waterhemp Ragweed): OBL; prefers uppermost zone of freshwater intertidal marshes; flowers from July-Sept; *Local Habitat-* Salisbury, 1980-08-26: found within a developed area along a canal, and along railroad tracks.

Potential Habitat Types (see associated maps)

Potential habitat types for all local SOSCs have been constructed, and are provided on accompanying maps. These habitat types are specific to this information request, and apply to only Salisbury township. National Wetlands Inventory Data, aerial photography, soils information, and local/preferred habitat types for local SOSCs were used to construct these maps. Below, we have provided a brief characterization of these habitat types. Note: these are hypothesized community types; these have not been ground-truthed.

Riparian Forests and Potential Floodplains: These habitats have been delineated using stream, soils, and wetland data. Species that could be located in this habitat type include *Eleocharis intermedia* (matted spike-rush), *Cyperus schweinitzii* (Schweinitz's Flatsedge), *Deschampsia cespitosa* (Tufted Hairgrass), *Parnassia glauca* (Carolina Grass-of-parnassus), *Carex tetanica* (Rigid sedge), and/or

Lathyrus palustris (Marsh Pea). Note that riparian and potential floodplain areas identified in these townships include forested areas, habitats adjacent to active (rotational) agricultural lands, and/or urbanized areas: without full habitat assessments of these areas, it is difficult to confirm or refute their status as viable, potential habitat for the above listed species. Note that these areas can only be considered ‘potential floodplains’, as flood history for these townships has not been investigated.

Rivers and Shores: This habitat includes and is adjacent to major waterways (i.e. Lehigh River). Species that could be found in this habitat include *Amaranthus cannabinus* (Waterhemp Ragweed) and *Myriophyllum sibiricum* (Northern Water-milfoil). Species of the Riparian Forests and Potential Floodplains community type could also be found in wetland areas surrounding major rivers or waterbodies.

Wet Meadow: This habitat includes hydric soils and/or NWI wetlands that may or may not be found along major waterways, smaller streams, or developed areas. Species that could be found in this area include *Carex tetanica* (Rigid sedge), *Parnassia glauca* (Carolina Grass-of-parnassus), *Lathyrus palustris* (Marsh Pea), and *Cuscuta campestris* (Western field Dodder; if disturbance conditions are present). Notice the overlap between Riparian and Upland disturbed habitat types (see maps).

Upland Disturbed: These habitats include roadside areas and disturbed areas along rights-of-ways. Species that could be found in this habitat include *Cuscuta campestris* (Western field Dodder) and *Arabis hirsute* (Western Hairy Rock-cress), or *Cyperus schweinitzii* (Schweinitz's Flatsedge).

Ecological Communities of Special Concern (EOSC)

In addition to potential habitat, ecological communities of special concern found within Salisbury Township. For data security reasons, these communities have not been depicted. However, you may consult the County Natural Heritage Inventory for Lehigh County for details on biologically diverse areas and communities within Salisbury Township. Descriptions of the ecological communities are provided below.

Northern Appalachian Circumneutral Seep Community

1. Last observed on 1997-06-05: site is a series of seeps emerging at different elevations on mid-upper sections of a forested slope; seeps merge into a stream that passes through the area; seeps dominated by skunk cabbage, sensitive fern, and other species.
2. Last observed on 1997-04-15: A 2-3 acre seep community; seeps scattered through an upland mixed oak forest; seeps flow over a rocky substrate on a gentle slope, with spicebush and skunk cabbage occurring in wetter areas.

Erosional Remnant(s)

1. Last observed in 1979: found in Hardyston Formation/Cambrian Age; only known occurrence of Jasper in the formation of PA.
2. Last observed in 1979: a mass of dark and light-banded Pockuck Gneiss of Precambrian Age rising about 40ft. above the ridgeline. The Gneiss is a more resistant rock than that surrounding it, thus it is well exposed.

SalisburyTownship, Potential HabitatTypes for Plant Species of Special Concern.

Map provided to the Lehigh County
Conservation District by the
Ecological Services Department of
the PA DCNR

SOUTH WHITEHALL

SOUTH WHITEHALL

Lehigh

SALISBURY

LOWER MACUNGIE

UPPER MILFORD

EMMAUS

SALISBURY

Streams

Roads

Potential Habitat Types

Moist Forests

Riparian Forests and Potential Floodplains

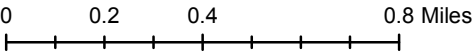
River and Shores

Upland Disturbed

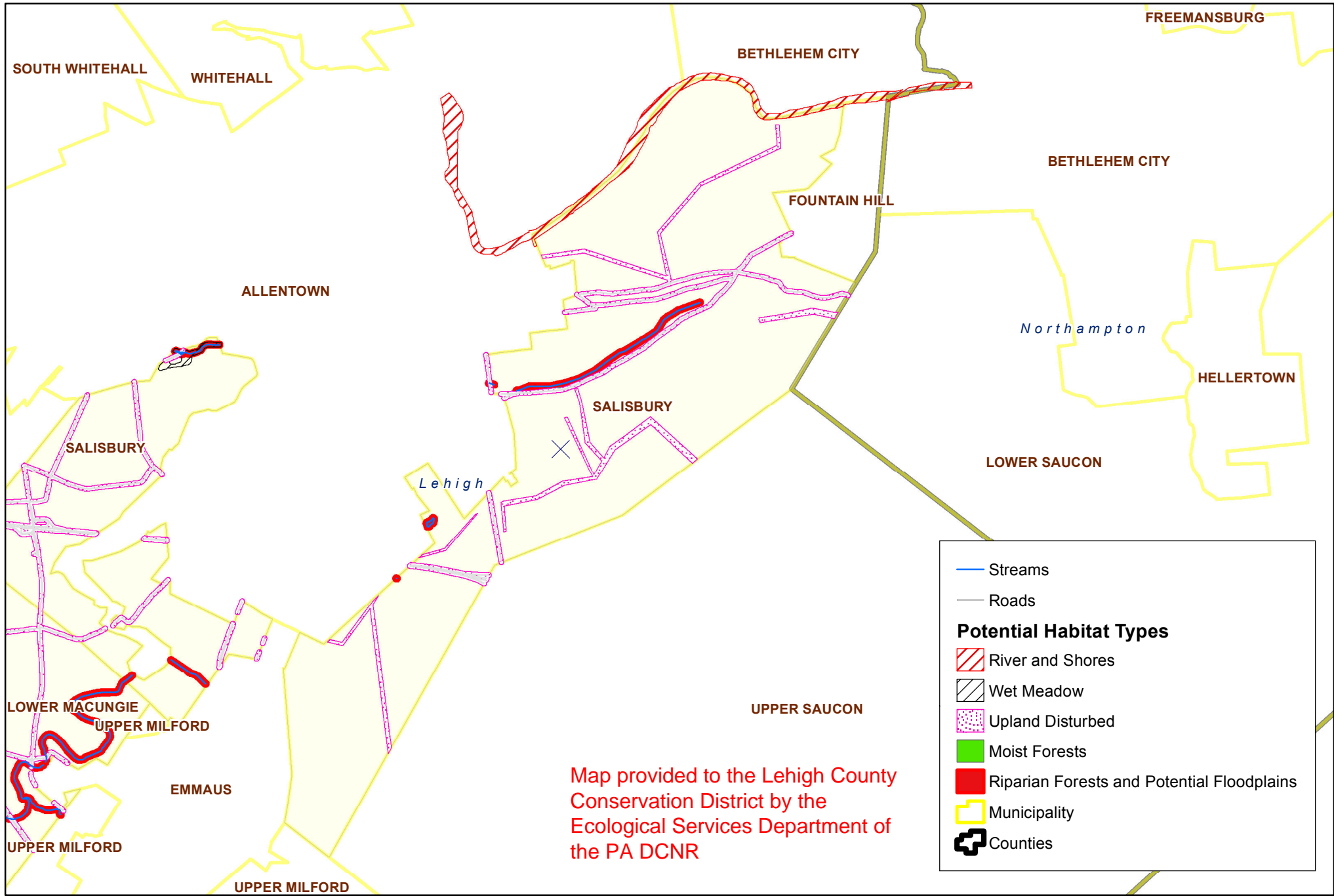
Wet Meadow

Municipality

Counties



SalisburyTownship, Potential HabitatTypes for Plant Species of Special Concern.



Map provided to the Lehigh County
Conservation District by the
Ecological Services Department of
the PA DCNR

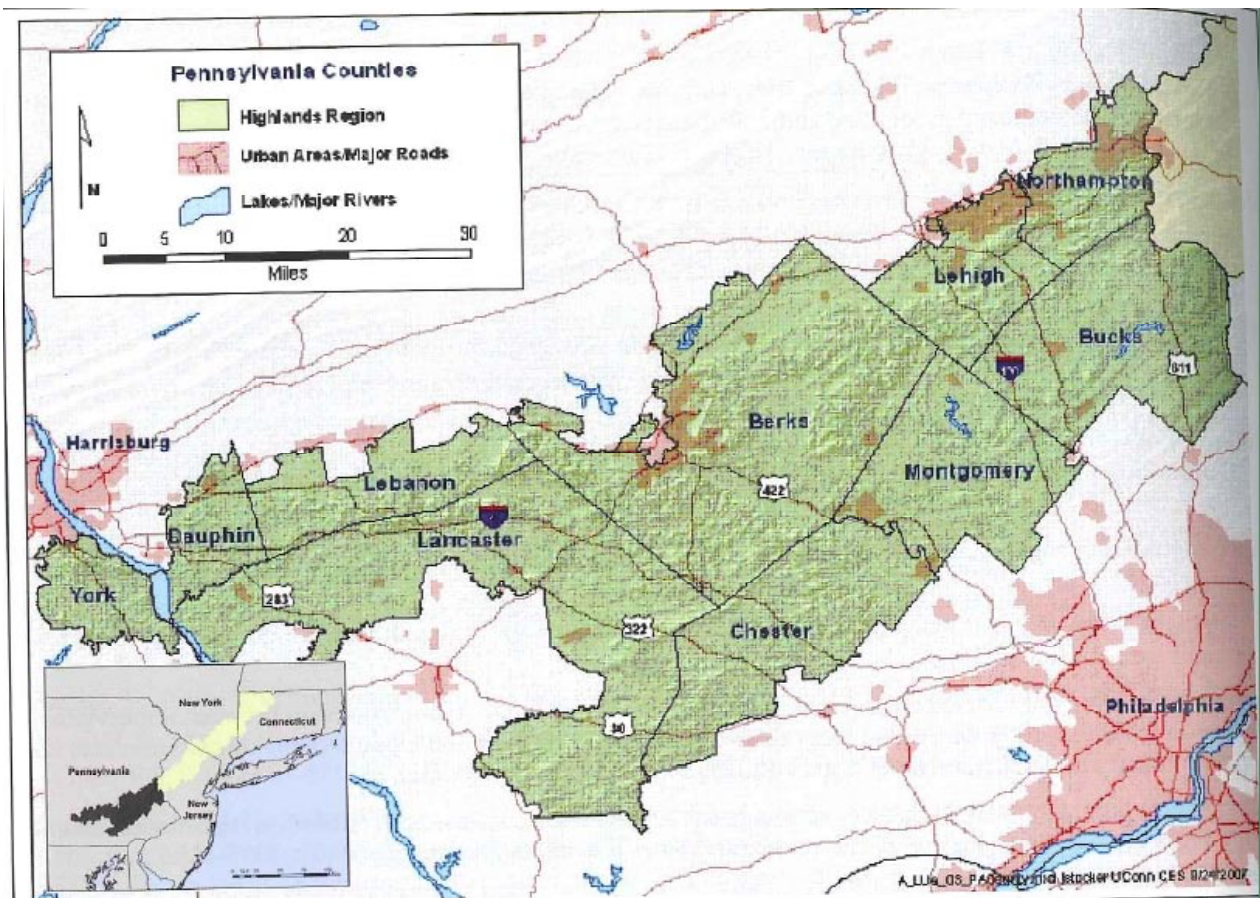


ECOLOGICAL CORRIDOR

Highlands Region

Salisbury Township is located in the Highlands Region, an area of particular conservation focus crossing through Connecticut, New Jersey, New York and Pennsylvania. This high ground is located within the Appalachian Mountain region. The Highlands region is generally forested, and provides essential migration corridors and habitat for both birds and terrestrial animals. It also contains critical watershed areas, with clean water emerging from springs and seeps on steep hill and mountain slopes to supply water to urbanized areas of Pennsylvania. The Highlands is protected by the Highlands Conservation Act of 2004, which recognized the Highlands area as having national significance, and authorized considerable funding for technical assistance and land acquisition in the area. Portions of Salisbury Township are part of the Highlands Region South Mountain Conservation Project, which focuses critical resources on land preservation and conservation.

For more information on the Highlands Region, visit the website of the Highlands Coalition:
<http://www.highlandscoalition.org/>.



Map from the Highlands Regional Study by the USDA Forest Service: The Pennsylvania Highlands cover 1,382,693 acres, comprising 174 municipalities in 10 counties.

Land Conservation

A significant portion of the land on South Mountain has been conserved, either through direct purchase of the land by the township or by a conservation organization, or through placement of a conservation easement. **Map: Protected Areas** shows which parcels are currently in conservation, and the nature of the ownership or easement that protects them.

Land Conservation Priorities

Although a substantial amount of land has already been preserved along the environmentally sensitive South Mountain, there remain many opportunities for further land protections to be put in place. Of the approximately 3,000 acres of South Mountain in Salisbury Township, nearly 480 of them are protected. Many of the parcels that are not currently protected would be prime candidates for conservation easements, particularly larger parcels (greater than 5 acres) or parcels contiguous with already preserved properties. Additionally, properties with high-priority natural features, such as springs, seeps, and vernal pools, may also be considered.

Critical lands to be targeted for protection include those adjacent to already protected lands, to create continuous habitat and wildlife migration corridors. Additionally, those lands that contain headwater springs and seeps directly upslope from the origins of the Township streams may also be considered critical. **Map: Protected Areas**, included in the next section of this report, shows general areas where headwater hydrology feature protection would be critical.



WATER RESOURCES

Hydrology

Salisbury Township contains portions of three watersheds: the Little Lehigh Creek, the Saucon Creek, and the Lehigh River. The Trout Creek, the major stream flowing through the township, is a tributary to the Little Lehigh Creek. Map – Existing Mapped and Predicted Hydrography shows the existing “blue line” streams that show up on the USGS quadrangle maps. It also shows the results of the analysis of where unmapped streams are expected to be found. This is discussed in further detail, below.

Water Resources

Maintaining and improving the health of the Township’s water resources was a major goal of this study. To accomplish this over the long term, this study undertook two major tasks: to assess the current condition of the streams that flow through the Township, and to locate and map, to the degree possible, the unmapped springs, seeps, and headwater streams. These tasks were chosen because protection of water resources is generally dependant on two factors under current state, federal, and local regulations and laws: 1) the current conditions of the water body, and 2) accurate mapping of the features.

Current Conditions

For each water body in Pennsylvania, there is a “designated use.” This is the water quality standard that the Pennsylvania Department of Environmental Protection (PADEP) expects that water body to meet. Salisbury Township divides into three separate watersheds, draining into the Little Lehigh Creek, the Saucon Creek, and directly into the Lehigh River (**Map: Stream Designated Uses and Impairment**). The largest stream flowing through the township is the Trout Creek, which is a direct tributary to the Little Lehigh Creek. Apart from the Trout Creek, all the other streams in the township are small, headwaters tributaries. The Designated Uses and Impairment Map shows the designation of all the streams in the Township. The Little Lehigh Creek (including its tributary Trout Creek), and all the headwaters streams draining into the Little Lehigh, are designated High Quality Cold Water Fishery. The Black River, tributary to Saucon Creek, and several other small headwaters tributaries to the Saucon Creek, are designated Cold Water Fishery, as are the direct tributaries to the Lehigh River. The Lehigh River itself is designated Warm Water Fishery

Each of these designated uses carries with it specific water quality standards that the water body is expected to meet. Additionally, each agency that regulates streams in Pennsylvania applies its regulations differently depending upon the designated use of the receiving watershed. Therefore, a project being proposed in the watershed of the Lehigh River, a Warm Water Fishery, would be held to different standards than a project proposed in the watershed of the Little Lehigh Creek, a High-Quality Cold Water Fishery. For example, a housing development proposed in the Little Lehigh watershed might need to treat the water leaving the site to ensure it meets the high standard for that stream, whereas a project in the watershed of the Lehigh River might not need to meet such a stringent standard.

Each water body in the Commonwealth is evaluated regularly to determine if it meets the standards appropriate for its Designated Use. If it is determined not to meet those standards, it is designated as “Impaired.” A cause and source are assigned for the impairment, based upon the judgment of the assessor as to what is causing the stream to fall below standards.

The **Designated uses and Impairment Map** shows that several of the streams flowing through Salisbury Township have been listed as “impaired.” Additionally, the portion of the Lehigh River that flows adjacent has also tentatively been listed as impaired. For each of these, the cause is siltation, and the source is urban runoff. This impairment clearly indicates that historical urbanization has negatively impacted the Township’s streams.

Recommendation: In the contributing watersheds to the township’s impaired stream segments, additional protections could be put in place to ensure that new development does not further impact already degraded streams. These protections could include riparian buffer planting and restoration requirements, setbacks, and infiltration BMP’s.

HYDROGRAPHY ANALYSIS

Unmapped Water Features

While larger streams are well-mapped on the USGS Quadrangle Maps (“blue line streams”), it is often the case that headwaters hydrology features such as springs and seeps, and small headwaters streams, are not mapped. Vernal pools – depressions in the landscape that fill with snow-melt in the spring and dry up in the summer – are never mapped. Since laws and regulations aimed at protecting these features depend upon knowing where they are located, finding and mapping as many of these small features as possible was one goal of this study.

Method

Modeling: In order to locate un-mapped tributaries, seeps, and springs, an analysis was carried out of the Digital Elevation Models on ArcGIS. This analysis shows how the model predicts where tributaries are likely to be found, based upon drainage areas of certain sizes. A portion of the raw data for the urban area of the township shows the raw data generated by this model.

Field Work

Based upon the predictions, field work is carried out to determine whether these features exist where they are predicted to.



The picture on the left displays a predicted stream in an urban setting that was not confirmed in the field; the picture on the right displays a headwater stream along the mountain that was verified by staff.

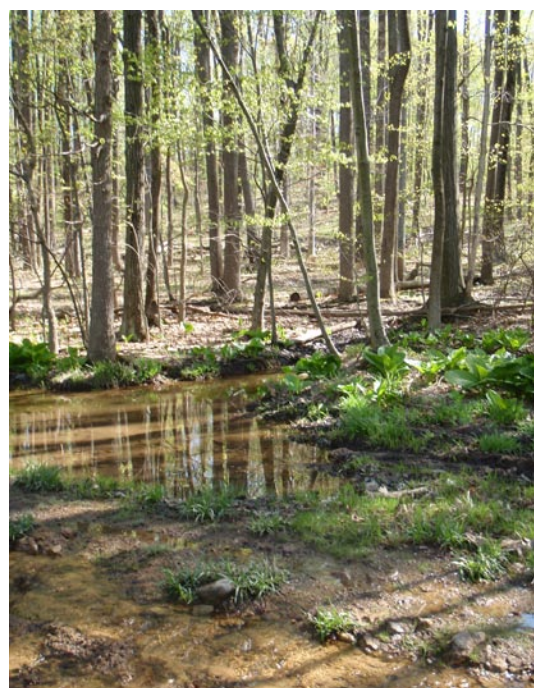
As can be seen in **Map: Predicted and Existing Hydrography**, for example, in the urbanized area of the township, very few of the predicted streams were actually found on the ground, and none of the drainages that were found flowed year-round. In contrast, in the steeper, wooded areas, most of the predicted streams were located. Feeding these streams were many springs and seeps. Where property access was available, these springs and seeps were mapped as well. Since some of the field work was done in the late spring, vernal pools were also mapped where they were found. However, a more comprehensive study could be done to better identify vernal pools in the township.

Recommendation: Create a mailer to be sent out to targeted landowners on hillside and streamside properties where vernal pools are likely, describing their physical features and functions. Landowners would be invited to contact the township about their vernal pools, and have them listed for future protection.

Recommendation: Create a taskforce to evaluate the condition of the identified vernal pools. During NRI fieldwork, several vernal pools were found to be heavily impacted by silt. The siltation is deleterious as it prevents oxygen from entering salamander and frog egg sacks. To restore these pools, when the pool dries out, the silt can be removed with a shovel. Trees should also be planted and leaves can be incorporated in the interim to provide cover and shade. In order to carry out this project, natural resource professionals should be consulted.

Data Interpretation: The **Predicted and Existing Hydrography Map** clearly delineates the mapped tributaries and headwaters springs and seeps, and the properties to which the field crew had access. On the adjacent properties where access was not available, it is possible to predict with some certainty that springs and seeps are likely to exist in similar patterns with similar densities. It is necessary to caution that these are only predictions; field visits would be necessary to determine where such features exist on any given site. There is considerable variability from site to site. Note the difference in density of springs and seeps from the southern portion of the Township, where they are abundant on the mountainside, to the northern portion along the slope down to the Lehigh River, where they are much less dense.

In the urbanized areas, very few flowing streams were found. This is due to the long-term effects of impervious surfaces, and alteration of drainage patterns to put in businesses, houses, roads, and parking lots. With little water seeping into the ground, springs will dry up. And where streams and drainages are diverted into underground culverts and storm drains, streams are not fed year round. By contrast, in the relatively undeveloped forest areas, springs, seeps, small wetlands, and headwaters streams are abundant.



Vernal pool disturbed by ATV traffic.

Resource Protection: Springs, seeps, wetlands and headwaters streams are the capillaries of the stream system. Without flows into these features, larger streams down slope will dry up, and water quality will be negatively impacted. Wetlands, in particular, serve as the “kidneys of the landscape,” filtering out pollutants that reach them, and sending cleaner water back into the stream system. All of these features are protected, to varying degrees, by federal and state regulations, but there are significant gaps in the protection afforded by these laws and regulations. The gaps are particularly significant for headwaters features not directly connected to a major stream system – for example, a mountainside spring or seep that does not drain directly into a perennial stream, or a wetland associated with an intermittent stream. Those features particularly vulnerable to gaps in state and federal protection are:

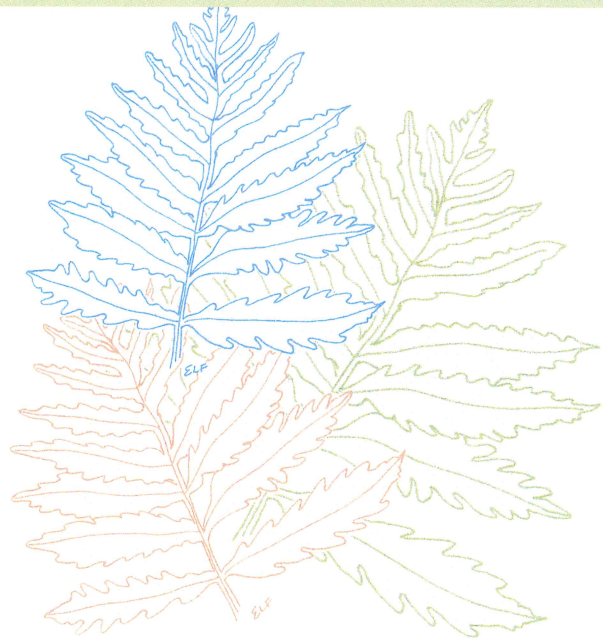
- Springs – areas where groundwater emerges to the surface naturally
- Seeps – similar to springs, but where the groundwater emerges over a larger area.
- Vernal Pools (depressions that fill with water in the early spring and then dry up)
- Isolated wetlands (those not connected to a stream or other body of flowing water)

For these features, the most effective way to protect them is at the municipal level, by enacting municipal ordinances that put into place specific regulations targeted at maintaining the integrity of these features.

Recommendation: Enact protections that protect these features. Include clear definitions of each feature in both the Zoning Ordinance and SALDO.



Seeps surrounded by skunk cabbage



STREAM VISUAL ASSESSMENT

Background and Method

As part of this study, a full visual assessment was carried out on the main stem of the Trout Creek as it flows through Salisbury Township. To accomplish this, the stream was broken down into 14 reaches, using aerial photos to determine reach breaks where they would be visible on the ground. Reaches were an average of 850 feet long, for a total of 2.3 miles. **Map: Trout Creek Visual Assessment** shows the breakdown of the reaches. The entire stream assessment is included at the end of this report; recommendations that apply to specific reaches are included in the data sheet for that reach.



The visual assessment protocol used was generally based upon the USDA/NRCS Stream Visual Assessment Protocol, with modifications to the method so that it is easier for volunteers to use. Additions were made to the standard protocol to collect data on the material on the stream bed, and in the stream banks, which will assist with future stream and flood plain restoration projects. The visual assessment protocol used an excellent/good/fair/poor rating scale for certain parameters, and asked for a narrative explanation of others. A copy of the assessment sheet is included at the end of

this section.

The parameters scored on a rating scale were: stream alteration, riparian zone, floodplain access/channel incision, canopy cover, nutrient enrichment, and in-stream fish and invertebrate habitat.

Stream Alteration This described the degree to which the stream has been visibly altered or confined by human activity. Bridge crossings, retaining walls, dams, dykes, or rip-rap banks are all considered alterations.

Riparian Zone Condition Ideally, all streams should be protected by a forested meadow or riparian buffer of full-height (i.e., not mowed) trees or meadow grasses. This buffer protects the stream from overland runoff, removes pollutants such as nutrients and silt, and stabilizes the banks with deep, thick root systems. There was quite a bit of variability in the riparian zone condition along the Trout Creek, from excellent (a buffer over twice as wide as the stream is) to poor (stream bank mowed to the edge or paved). Where ratings were “fair” and “poor,” opportunities exist for improving the buffer condition.



According to recent regulations put in place by the PADEP, all streams are best protected by a stream buffer of at least one hundred and fifty feet (150').

Recommendation: Where riparian buffers are less than “excellent,” contact landowners with information about the benefits of riparian buffers and resources available to encourage their installation.



Typical extent of bank erosion throughout the reaches of the Trout Creek

Floodplain Access/Channel Incision A channel in a natural condition has low banks, less than a foot or so high, allowing the channel to easily access its flood plain during storm flows. When channels are deeply incised, there is enormous erosion pressure on the banks during flood flows, as fast-moving storm water cannot reach the flood plain, spread out, and slow down. The majority of the Trout Creek had banks 3 feet in height, with little chance for flood waters to spread out and abate.

Recommendation: Regrade the banks where possible, creating shallow, vegetated banks.

Canopy cover is the extent to which the stream is shaded by overhanging trees. This shading is important, since it keeps the water cool, which is important for cold-water species of fish, such as trout. Canopy cover for the Trout Creek is good to excellent throughout the township.

Nutrient enrichment describes the amount of aquatic vegetation on the stream bed, and on the rocks on the stream bottom. The amount of aquatic vegetation generally reflects the amount of nutrients in the stream – nitrogen, and phosphorous. Sources of nutrients include lawn and farm fertilizers, poorly functioning septic systems, manure on fields, and sewage treatment plant discharges. Throughout the Trout Creek in Salisbury Township, the rating is “good,” indicating that there is some nutrient enrichment, but it is not excessive. It is important to note,

however, that there is a township-wide problem with the dumping of lawn waste along stream banks. Grass clippings disposed of into the stream will decompose, releasing nitrogen into the stream. This can contribute significantly to nutrient enrichment.



Lawn clipping found along the banks of the Trout Creek

Recommendation: Through mailings and educational sessions, instruct landowners to take yard waste to compost center rather than dumping waste on banks of Trout Creek

Fish and macroinvertebrate habitat include riffles, thick root mats, leaf packs, logs and other woody debris, overhanging vegetation, pools, boulders, undercut banks, and any habitat improvement structures built as part of a stream improvement project. This parameter measures how much habitat there is for both fish, and the aquatic insects that the fish eat, such as mayfly larvae. Except in the headwaters area, the habitat is good or excellent. Where desired, habitat improvements can be made through simple projects which can be carried out by community groups.

Recommendation: Develop and put in place fish and macroinvertebrate habitat improvement projects at noted locations on the Trout Creek. Improvement projects would incorporate a variety of habitat creation and stabilization techniques.

In addition, the assessment examined the degree of stream bottom sedimentation. A stream in a natural condition will have a bottom comprised of large gravel and small boulders. When the stream bottom is largely covered with fine sediment (silt and mud), habitat for fish and aquatic macroinvertebrates is degraded.

Many segments of the Trout Creek showed significant amounts of stream bottom sedimentation. The most likely cause of this twofold: excessive stormwater runoff from urbanizing areas with inadequate stormwater controls, and erosion of steep stream banks.

Recommendation: Salisbury Township should consider investing in a Township-wide stormwater retrofit plan, which would examine all the areas where presently uncontrolled runoff could be treated and infiltrated back into the ground, or taken up by plants.

Recommendation: Develop plans for streambank stabilization projects and the planting of native riparian buffers on all the stream segments that rate as “fair” or “poor,” to control stream bottom sedimentation.



The visual assessment made note of where invasive plants were a significant issue along the Trout Creek. Japanese Knotweed was the most significant invasive plant present.

Recommendation: Carry out a stream-wide Japanese knotweed control program, contacting affected landowners with information on controlling the plant and strategies for removal and replanting. This program would have to start with the headwaters to avoid re-colonizing the knotweed from upstream

Japanese knotweed is the dominant plant species



Trout Creek Stream Visual Assessment Protocol

Evaluator(s): _____ Owners Name: _____

Organization: _____ Reach ID: _____

Date: _____

Weather conditions today: _____

Approximate width of the stream: _____

Stream Alteration (man-made changes to the stream)

- ☐ **Excellent** Natural channel, currently no structures: bridges, retaining walls, dams, weirs, dikes or riprap.
- ☐ **Good** Single bridge at upstream end of reach, 1 structure present, riprap along less than 25% of the reach.
- ☐ **Fair** Altered channel; 25% - 50% of the reach with riprap and/channelization, 2 structures present.
- ☐ **Poor** Greater than 50% of the reach with riprap or channelization, 3+ structures present.

Riparian Zone

- ☐ **Excellent** Natural vegetation (vs. a manicured lawn) extends at least 2 stream widths on each side.
- ☐ **Good** Natural vegetation extends at least one stream width on each side.
- ☐ **Fair** Natural vegetation extends less than half of the stream width on each side.
- ☐ **Poor** Streambank edge is mowed grass, pavement, or concrete; filtering function is severely compromised.

Note: Small disturbances are acceptable if they do not reduce the filtering capacity (i.e. a path to access the stream).

Floodplain Access/Channel Incision

- ☐ **Excellent** Channel is not incised. Both banks are low, allowing the channel to easily access its floodplain or there is minimal erosion or incision (less than 1ft) on an outside bend.
- ☐ **Good** Limited channel incision (1-2ft on outside bends) with adequate access to floodplain.
- ☐ **Fair** Floodplain access is moderately restricted by actively eroding, unvegetated banks (2-3ft).
- ☐ **Poor** Channel is deeply incised (>3ft) and unvegetated. Floodplain is inaccessible. Some straight reaches and inside edges of bends are actively eroding as well as outside bends (overhanging vegetation at top of bare bank, numerous mature trees falling into stream annually, numerous slope failures apparent).

Canopy Cover

- ☐ **Excellent** >75% of water surface throughout reach is shaded.
- ☐ **Good** >50% shaded in reach.
- ☐ **Fair** 20 to 50% shaded.
- ☐ **Poor** <20% of water surface in reach shaded.

Nutrient Enrichment

- ☐ **Excellent** Little algal growth on stream substrates.
- ☐ **Good** Moderate algal growth on stream substrates.
- ☐ **Fair** Overabundance of algal growth on stream substrates.
- ☐ **Poor** Severe algal blooms create thick algal mats in stream.

Remember to take photos of the reach facing upstream. Photograph any unique features, discharge pipes, and/or areas of concern.

Barriers to Fish Movement

- ☐ There is NO barrier blocking the movement of fish
- ☐ There is a barrier

Approximately how high is the barrier?

Is the barrier natural or man-made?

Instream Fish Cover/Invertebrate Habitat

Circle which habitat types are present in significant amounts (1 stick does not = a significant amount!):

Riffles	Logs/woody debris	Deep pools (2 times deeper than the prevailing water depth)
Thick root mats	Overhanging vegetation	Boulders/Cobble
Leaf packs	Isolated /backwater pools	Undercut banks
	Dense macrophyte beds	Habitat improvement structures

- ☐ **Excellent** 8 to 10 habitat types present in the reach.
- ☐ **Good** 5 to 7 habitat types.
- ☐ **Fair** 3 to 4 habitat types.
- ☐ **Poor** 1 to 2 habitat types present in the reach.

Describe the structure of the reach. How many riffles are there? Where are the riffles located (i.e. on a bend or a straight section)? Approximately how long is each riffle? How deep is the deepest pool?

Describe the material along the stream bottom in riffles, runs, glides and unvegetated bars (i.e. boulder, cobble, gravel, sand, silt, mud).

Describe the degree of sedimentation. Are the riffles completely buried by sediment or are the gravel/cobble particles relatively uncovered? Is there mud over the entire bottom?

Are there stands of invasive plant species (i.e. purple loosestrife, Japanese knotweed, tree of heaven)? If so, how extensive is the problem?

In your opinion, are there any severe problems or unusual areas? What might be the cause?

Are there any recommendations that you can think of to improve the conditions of this reach?

Other Notes (Are there good fishing pools? Nice stretches for kayaking? Birding opportunities?):

WATER QUALITY DATA

Chemical Water Quality Data

Concurrently with this study, a separate study, funding by the PADEP, was being carried out on the Little Lehigh Creek and its major tributaries. The water quality data collected as part of this study included four water quality samples – one in dry weather, and three in wet weather, taken near the mouth of Trout Creek. Although the sample site was located outside Salisbury Township in the City of Allentown, the results are indicative of the water quality immediately upstream in Salisbury Township. See [Map: Water Quality Sampling Locations](#).

Macroinvertebrate Sampling

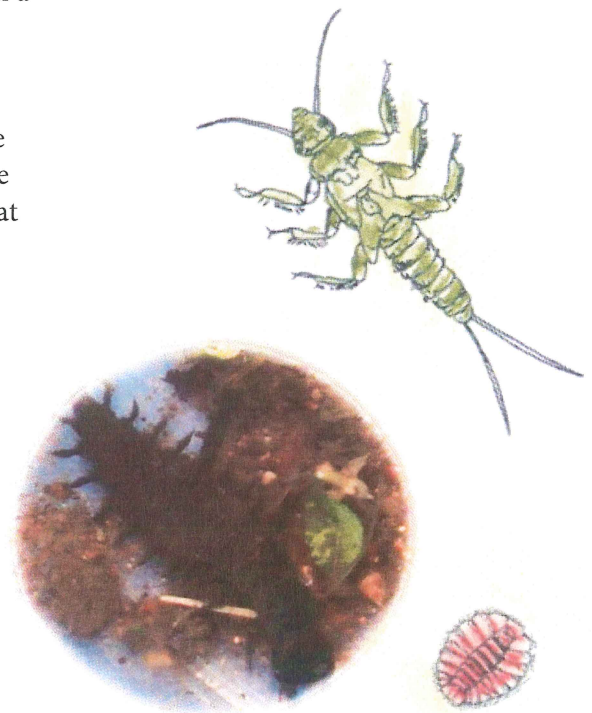
As part of the study mentioned above, macroinvertebrate samples were also taken at the mouth of the Trout Creek. Additionally, samples had been taken by the PADEP in 2005. Samples from this year (2010) showed that the Trout Creek, at its mouth, was severely impaired.

Although stream impairment can be decided based upon chemical water quality testing, the most common way for the condition of a stream to be determined is through using macroinvertebrate samples. Aquatic macroinvertebrates live in the stream for long periods, and have widely varying tolerances to water pollution and habitat conditions. Therefore, by sampling what “bugs” are found in the stream, aquatic entomologists (insect biologists) can determine stream health.

The data from the 2010 macroinvertebrate sampling on Trout Creek is provided at the end of this report. This data shows which species were found, and in what numbers. Along with other testing carried out in 2005, a determination was made that the downstream portions of the Trout Creek is impaired due to siltation and habitat loss. The upper, forested portions were in a healthy condition.

Sampling done in June of 2005 was carried out as part of the PADEP’s Instream Comprehensive Evaluation program. Five locations were sampled - three on Trout Creek and two on the tributaries. In addition to macroinvertebrate sampling, habitat assessments of in-stream and riparian conditions were also conducted at each location. Based on this evaluation, the following results were determined:

- All three sampling stations of Trout Creek demonstrated low overall diversity and sensitivity and were dominated by pollution tolerant groups. These samples all scored below biological impairment levels.
- The upper unnamed tributary showed relatively high diversity and sensitivity of macroinvertebrates and was overall above the biological impairment threshold. The location sampled had good stream bank stability and appears to be in a largely forested watershed.



- Similar to Trout Creek, the lower unnamed tributary was of low sensitivity and dominated by tolerant groups. This sample also indicated biological impairment, with moderate sedimentation and bank erosion, and cobblestone which were embedded with sediment and difficult to dislodge.

[The preceding summary of the PADEP findings provided by the Northeastern Regional Office field biologist at the request of Lehigh County Conservation District staff.]

Chemical Water Quality Data

Two types of water quality samples were taken during the course of this study. First, in accordance with the PADEP ICE (Instream Comprehensive Evaluation) protocol, three stormwater samples and one dry weather sample were taken near the mouth of the Trout Creek. These samples showed a typical urban stream with no indication of chemical water quality impairment.

Samples were also taken of the tributary to Trout Creek that flows through Laubach Park, upstream and downstream of the pond. Neither of those samples indicated impairment.

The lab and field chemistry data from these samples is provided at the end of this report.

DEFINITIONS AND REGULATORY EXCERPTS

Definitions

[From Pennridge Regional Model Ordinance, supplied by the Bucks County Planning Commission—unless otherwise noted]

Environmentally Sensitive Areas: Areas which include features which are sensitive to land disturbance activities and development, such as steep slopes, ponds, lakes, streams, stream corridors, springs, wetlands, hydric soils, prime farmland soils, highly erodible lands, vernal pools, floodplains, riparian buffer areas, significant stands of native, mature, and/or otherwise important vegetation, existing wellhead protection areas, aquifer recharge areas, areas of karst topography, geologic fractures, quarries and former landfill areas.

Hydrologic Budget: A hydrologic budget for a given area describes the relationship between precipitation, surface runoff, groundwater recharge, groundwater discharge and the change in groundwater storage. In general, to ensure an adequate water supply over the long term, groundwater discharge through streams and well pumping should not exceed groundwater recharge. Some temporary depletion of groundwater storage is acceptable during dry periods, provided that this loss can be replaced by recharge following the event.

Hydrologic Regime, Natural: The hydrologic cycle or balance that sustains quality and quantity of stormwater, base flow, storage, and groundwater supplies under natural conditions.

Natural Hydrologic Regime: The balance between rainfall, surface runoff, infiltration and evapotranspiration under predevelopment conditions of a site or watershed.

Natural Recharge Area: Undisturbed surface area or depression where stormwater collects, and a portion of which infiltrates and replenishes the underground and groundwater.

Recharge: The replenishment of groundwater through the infiltration of rainfall, other surface waters, or land application of water or treated wastewater.

Recharge Area: An area where water is able to seep into the ground and replenish an aquifer because no confining layer is present.

Vernal Pond: Seasonal depressional wetlands that are covered by shallow water for variable periods from winter to spring, but may be completely dry for most of the summer and fall.

Vernal Ponds: Temporary ponds of water that may or may not contain vegetation. These areas are no more than 120 feet wide and 300 feet long and are utilized by numerous species of wildlife. These ponds are usually dry in summer and early fall and begin collecting water in the fall with carryover into spring. Not all vernal ponds are wetlands. [Source – Barrett Township, Monroe County]

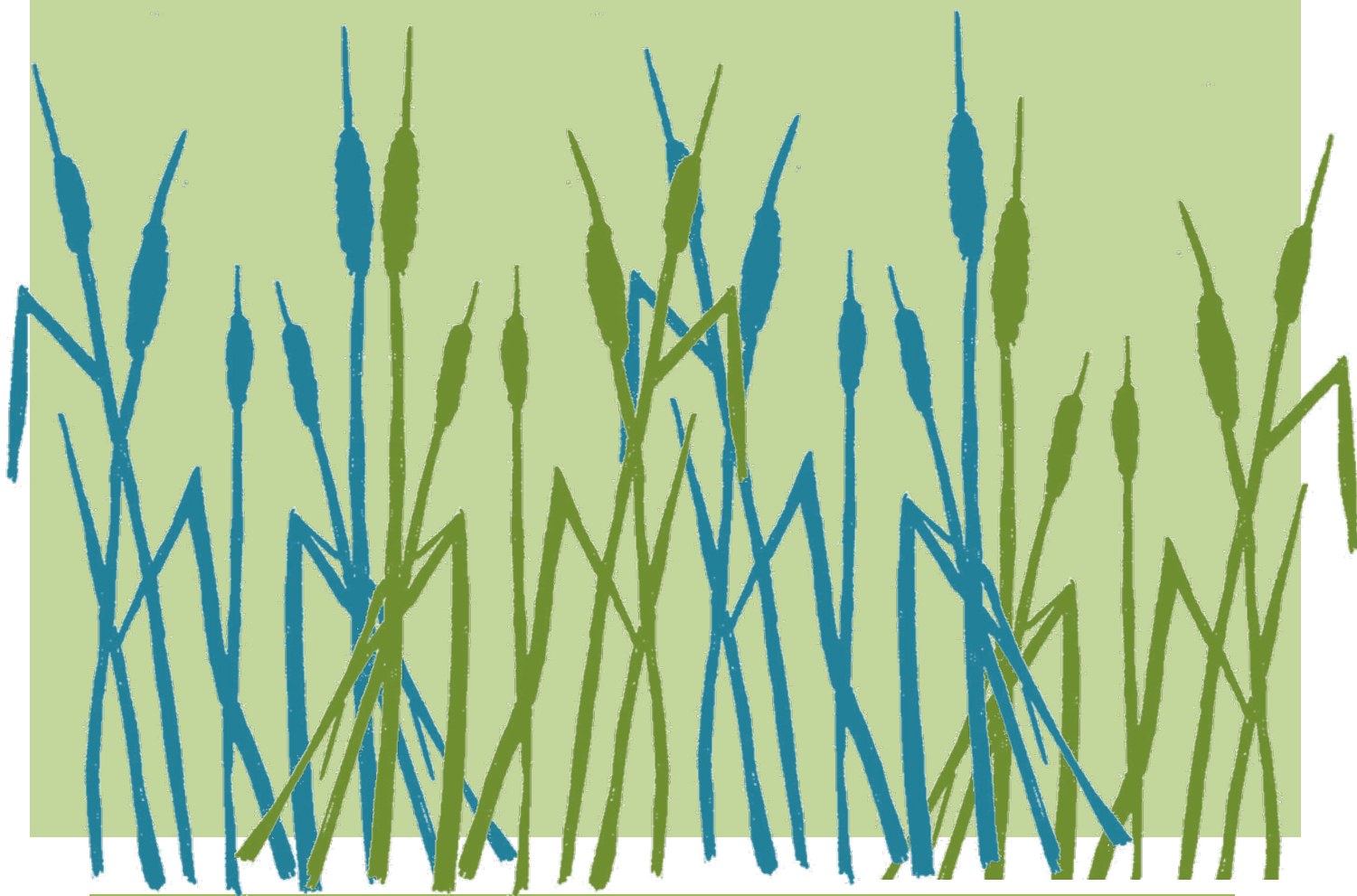
Vernal Pond Margin Area: A border surrounding a vernal pond measured from the boundary of the vernal pond. For the purposes of regulation, the vernal pond margin is one hundred feet (100') if it is

not also a wetland, and one hundred fifty feet (150') if it is also a wetland. [Source – Barrett Township, Monroe County]

Wetlands: Those areas that are inundated and saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions, including swamps, marshes, bogs, or similar areas.

Wetlands Buffers: Area of protection around a wetland within which specific development, construction, and other human activities are prohibited.

Woodland: A tree mass or plant community in which tree species are dominant or co-dominant, the branches of the trees form a complete, or nearly complete, aerial canopy. For the purposes of this Ordinance, the extent of any woodland plant community or any part thereof shall be measured from the outer-most drip line of all the trees in the community. Woodland shall include any area where timber has been harvested within the previous three years and/or woodland disturbance has occurred within the previous three years which would have met the definition of woodland prior to timbering or disturbance. Woodlands do not include orchards or old fields.



Regulations

From the Chatham County, North Carolina Water Protection Ordinance, updated November 15, 2010

Seeps and Springs. For purposes of this Ordinance, seeps and springs are areas where groundwater intersects at or near to the ground surface either seasonally or permanently. These areas may or may not be considered jurisdictional by federal (ACoE) standards. Due to the broad variability in the size, number, location, connectivity, condition and other natural characteristics of seeps and springs, one or more of the following conditions must apply:

- a. Hydrophytic vegetation must be dominant. This is judged by the greater areal cover of plants (rooted in the putative seep or spring) with indicator status of obligate wetland (OBL) or facultative wetland (FACW) compared to the areal cover of plants (rooted in the putative seep or spring) with indicator status of upland (UPL) or facultative upland (FACU). Plants with facultative (FAC) indicator status are not considered. This definition may be summarized by the following formula: $(OBL + FACW) > (UPL + FACU)$. See Wetland Plants List.³
- b. The seep or spring is considered a water of the State of North Carolina by the NCDWQ.
- c. The seep or spring meets the criteria of a wetland based on the 1987 U.S. Army Corps of Engineers Manual.
- d. The seep or spring has surface water present seasonally or permanently.

From the Pennridge Regional Model Ordinance

Wetland Delineation: When the National Wetlands Inventory (NWI) Maps indicate wetlands on a site or when a site contains hydric soils or an area with a predominance of wetlands vegetation, an on-site investigation shall be conducted to determine if wetlands are present on the site. One of the following methods shall be used to delineate wetlands:

- A. Wetland boundaries shall be delineated through an on-site assessment which shall be conducted by a professional soil scientist or others of demonstrated qualifications. Such a person shall certify that the methods used correctly reflect currently accepted technical concepts, including the presence of wetlands vegetation, hydric soils and/or hydrologic indicators. A study shall be submitted with sufficient detail to allow a thorough review by the municipality. The study must be approved by the Municipality. Or,
- B. A wetlands delineation validated by the U.S. Army Corps of Engineers. In the event that a wetlands delineation validated by the U.S. Army Corps of Engineers is shown to vary from a wetlands boundary derived from Section 402.A. above, the Corps delineation shall govern.

URBAN RESOURCES

Urban Areas

In addition to the rich natural resources located on South Mountain, Salisbury Township has many urban parks that serve the Township's residents with opportunities to visit playgrounds, take walks on trails, and play sports on ball fields. For most Township residents, these parks are their primary outdoor exposure. However, most parks are primarily mowed grass and manicured landscaping. While this is appropriate in an urban park setting, it is possible that more habitat and educational value could be incorporated into the Township parks. For location of the township parks, and the school district owned properties, see [Map: Parks and Schools](#).

Environmental practices in place in Lehigh County parks.



A vegetated buffer around a pond improves water quality and reduces the amount of Canada Geese frequenting the park. This picture was taken in Pranco Park.

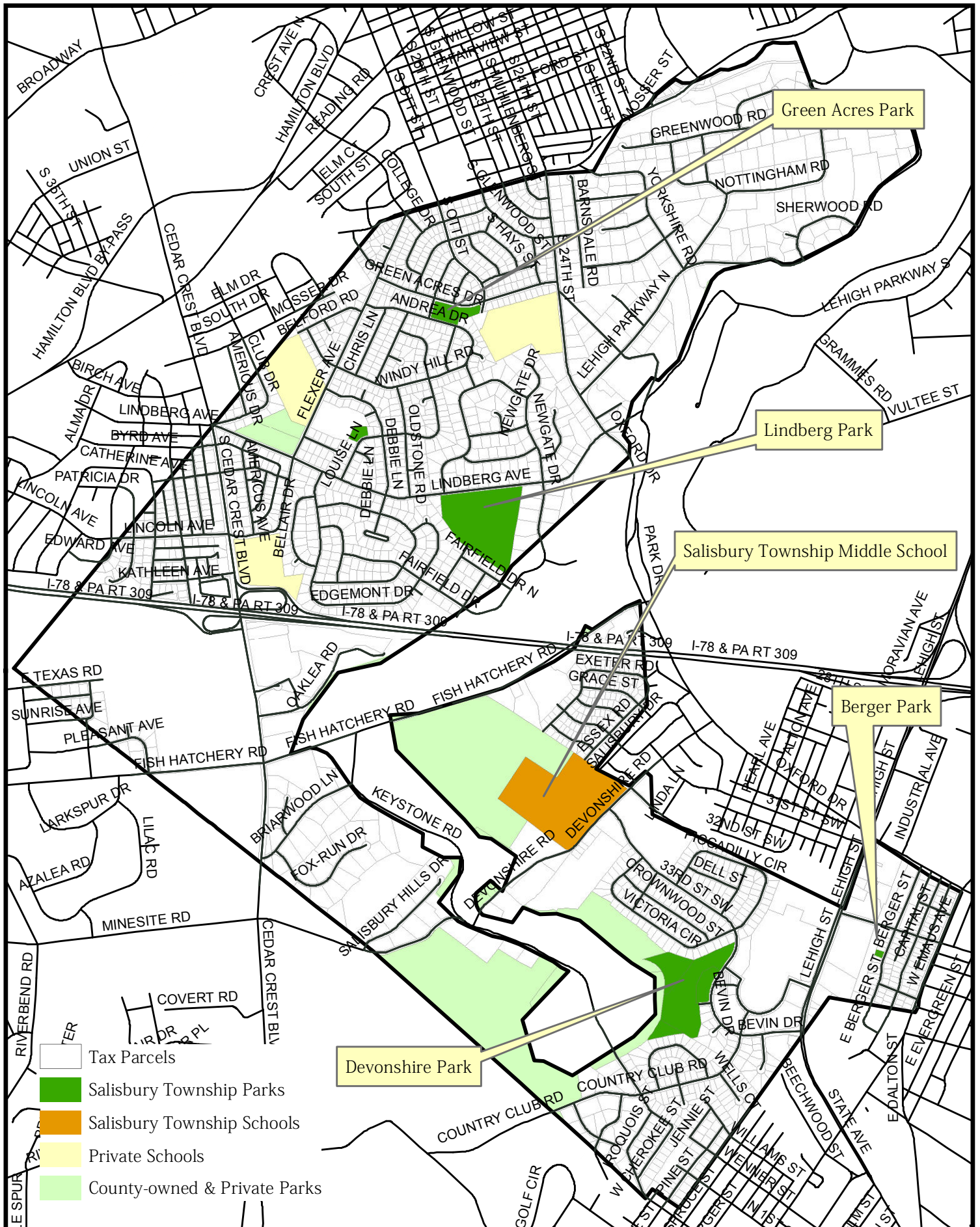


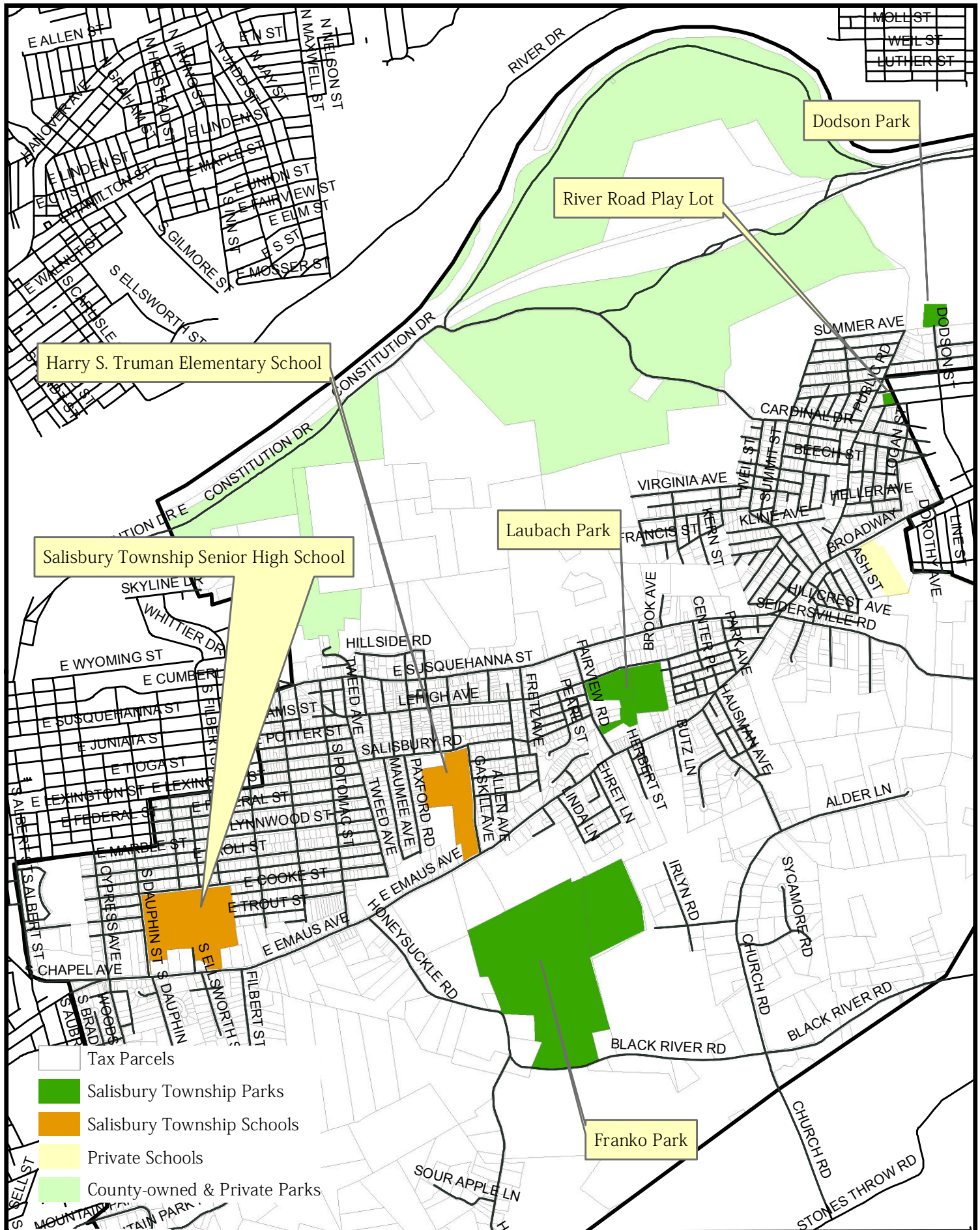
Riparian buffer project at Emmaus Community Park

Township Park and School Property Environmental Condition Site Analysis

As part of this project, each of the Township Parks and School Properties were visited, and an analysis was completed of their current environmental condition. Suggestions were developed as to ways in which more environmental awareness and habitat value could be added to the schools and parks for migratory birds. Educationally signed bird and butterfly gardens were suggested in many parks as an opportunity to engage the local community and inform the public about environmental issues.

IN THE FOLLOWING PAGES, THE COLOR OF THE BULLET ALONGSIDE EACH RECOMMENDATION CORRESPONDS TO THE AREA OF REFERENCE, DELIMITED ON THE AERIAL PHOTOGRAPH ON THE PROPERTY.





SALISBURY TOWNSHIP

Eastern Parks & Schools



DEVONSHIRE PARK



OBSERVATIONS

- The two mapped streams traversing the park have dry beds
- Multiflora rose and oriental bittersweet dominate the vegetation along the stream corridors
- There are several unused areas in lawn grass that could be utilized for native wildflower plantings and educational displays.

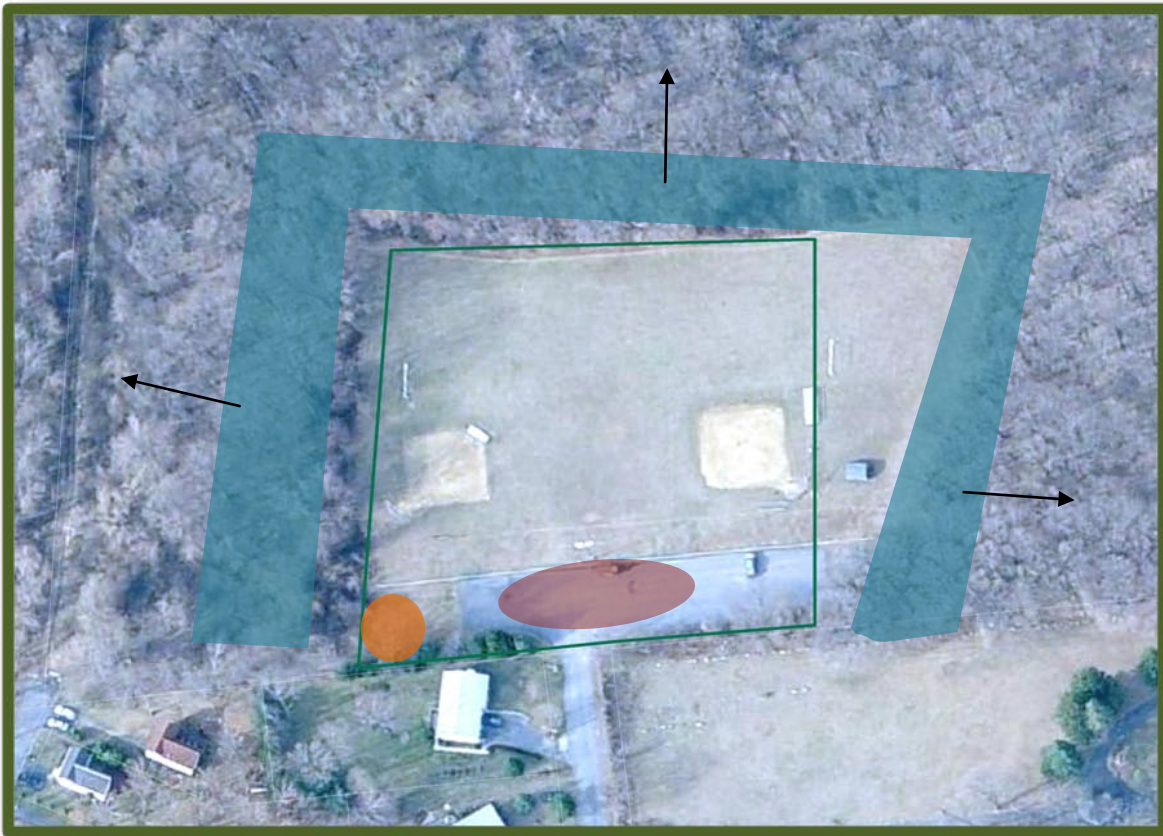
GENERAL RECOMMENDATIONS

- Reduce mowing and create wildflower gardens where possible.
- Ensure that all replacement landscaping trees are native.
- Plant additional trees for shade

SITE SPECIFIC RECOMMENDATIONS

- Remove multiflora rose and oriental bittersweet from stream corridors

DODSON PARK



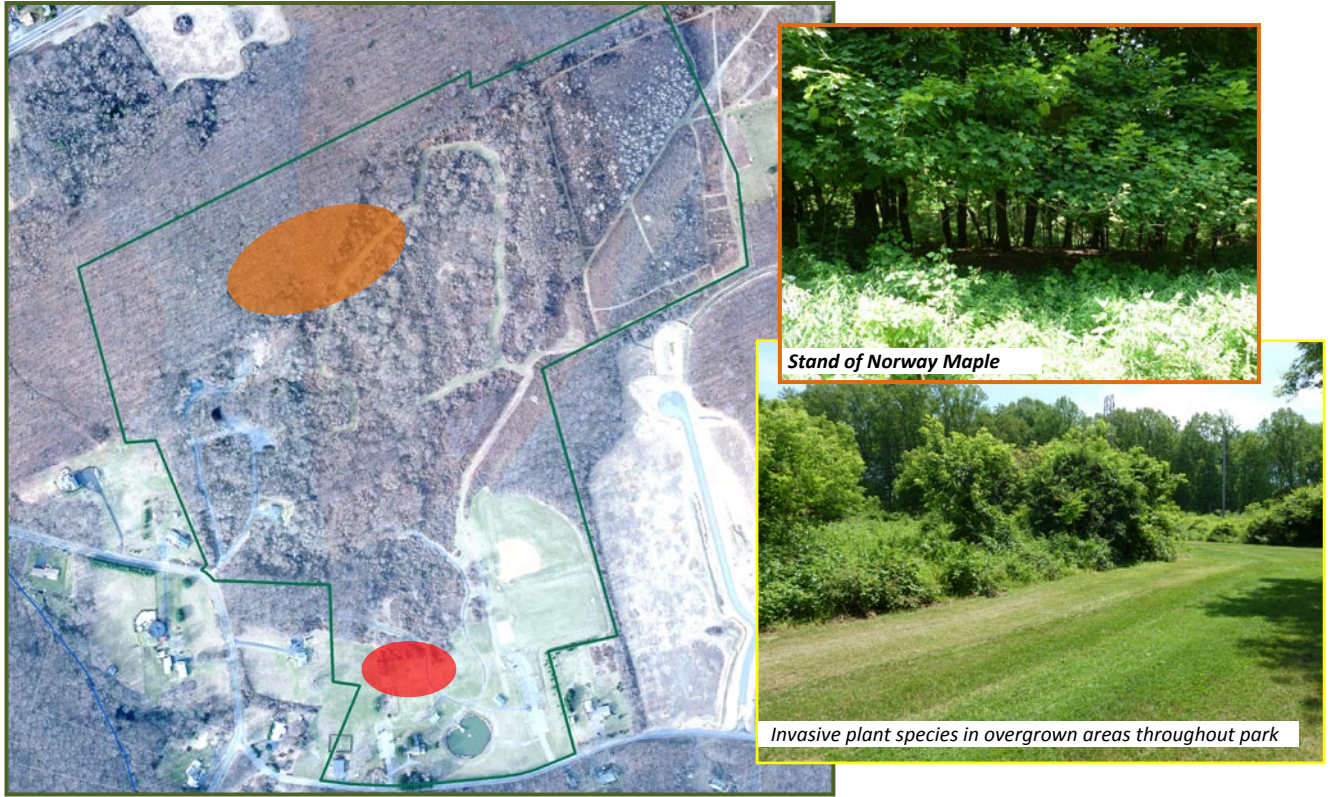
OBSERVATIONS

- The surrounding Lehigh County land contains invasive plants: Norway maple, multiflora rose, garlic mustard, Japanese barberry, Japanese knotweed, Japanese stilt grass, Oriental bittersweet, Oriental privet, burning bush, Dames rocket
- Very little understory in the forest alongside the park

SITE SPECIFIC RECOMMENDATIONS

- Create butterfly garden/native plant meadow on grass area on the left side of the parking lot.
- Consider using pervious pavement to re-pave the parking lot
- There is a substantial amount of invasive plant species surrounding the park on Lehigh County land that should be addressed. In specific, girdling Norway maples, which comprise nearly 40% of the canopy, would be a good project for boy scouts. The trees should be girdled to allow other trees to regenerate in the area; a cut about 1" to 1.5" should kill the tree. This would be an easy, ideal scout project

FRANKO PARK



OBSERVATIONS

- Heavy presence of invasive plant species throughout the park. Species include Tree of Heaven, Canada thistle, crown vetch, garlic mustard, Norway maple, Oriental bittersweet, and multiflora rose.
- The majority of the park was most likely farmed in the past; however the wooded area behind baseball field was probably not utilized for crops due to the rocky soil, but for grazing. The understory in this area is almost entirely invasive, with oriental bittersweet and multiflora rose being the most prevalent. Spicebush is the only native.

GENERAL RECOMMENDATIONS

- This park is currently overrun by invasive plant species. Remove invasive plants in areas throughout the park and create habitat with native vegetation (warm season grasses, wildflowers, shrubs).
- Keep some areas in field succession; this habitat is very important for migratory birds.
- Quickly remove tree of heaven throughout the park before it spreads; it is still manageable at this point

SITE SPECIFIC RECOMMENDATIONS

- Create community garden site or plant warm season grasses (little bluestem, big bluestem, Indian grass) for bird habitat in the lawn area near the parking lot.
- Girdle stand of Norway maple and replace with tulip poplar.

GREEN ACRES PARK



OBSERVATIONS

- Large lawn areas in the park have opportunities for naturalized areas and educational signage.

GENERAL RECOMMENDATIONS

- Ensure that all replacement landscaping trees are native

SITE SPECIFIC RECOMMENDATIONS

- Turn all or portions of unused lawn area into wildflower meadow with educational signage

LAUBACH PARK



OBSERVATIONS

- Presence of invasive plant species along Trout Creek, predominantly Japanese knotweed and multiflora rose.
- Trout Creek has severe undercuts as it passes through park property, but no structures in jeopardy
- There is an unnamed headwater stream draining off Lehigh Mountain that is fed into a storm drain that crosses Susquehanna Street and feeds the pond in the park.
- The Township currently mows to the edge of the pond and there is a substantial population of Canadian Geese.
- Park contains a fair diversity of trees.

GENERAL RECOMMENDATIONS

- Several unused lawn areas could be utilized to create wildflower meadow/butterfly garden
- Consider Tree ID signs.

SITE SPECIFIC RECOMMENDATIONS

- Remove invasive plants along Trout Creek banks and replace with native species.
- Reduce mowing around the edges of the pond and create access paths that zigzag through native vegetation to decrease the number of Canadian geese and improve water quality.



LINDBERG PARK



OBSERVATIONS

- There is a diversity of tree species along walking paths and unused lawn areas.

RECOMMENDATIONS

- Consider Tree Identification signs throughout the park.
- Create small, wildflower meadows in out-of-play areas.

LOUISE LANE PARK



OBSERVATIONS

- Park only contains play lot and benches, but there is room to enhance the park with native plantings and educational displays

GENERAL RECOMMENDATIONS

- Create butterfly garden with educational signage in unused lawn areas
- Ensure replacement landscaping trees are native

RIVER ROAD PLAY LOT



OBSERVATIONS

- Considerable flow coming out of pipe near edge of park

GENERAL RECOMMENDATIONS

- Plant additional native trees for shade
- Ensure that replacement landscaping trees are native

SITE SPECIFIC RECOMMENDATIONS

- Create wildflower meadow or butterfly garden along slope
- Create vegetated strip along fence line to slow storm water drainage

SCHOOLS

OBSERVATIONS

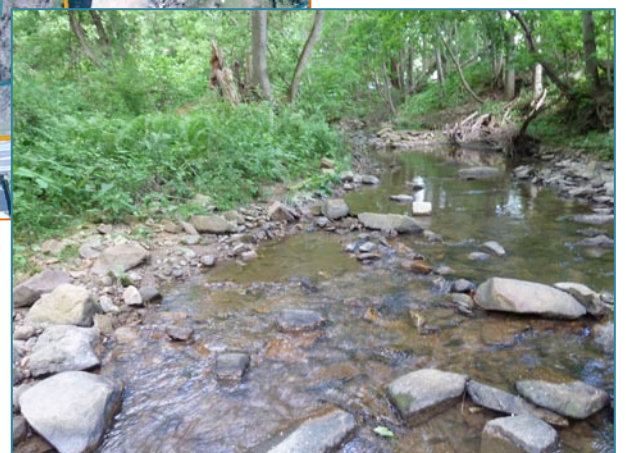
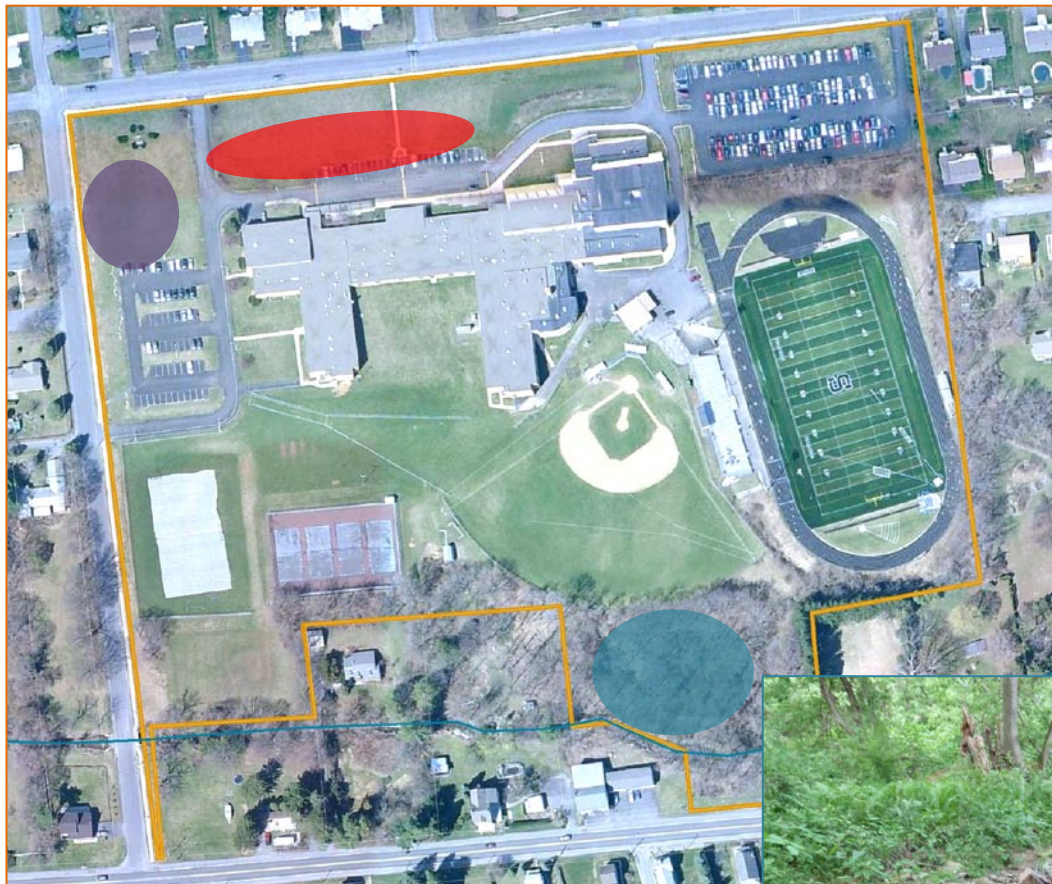
All of the Salisbury Township School grounds have excellent areas for naturalization, which would not only provide habit, but more importantly, provide great outdoor classrooms and learning experiences for the students.

RECOMMENDATIONS

Recommended Management practices include:

- Butterfly or vegetable garden
- Low growing wildflower meadow
- Invasive plant removal
- Stream restoration project & riparian buffer planting

Salisbury Township Senior High School



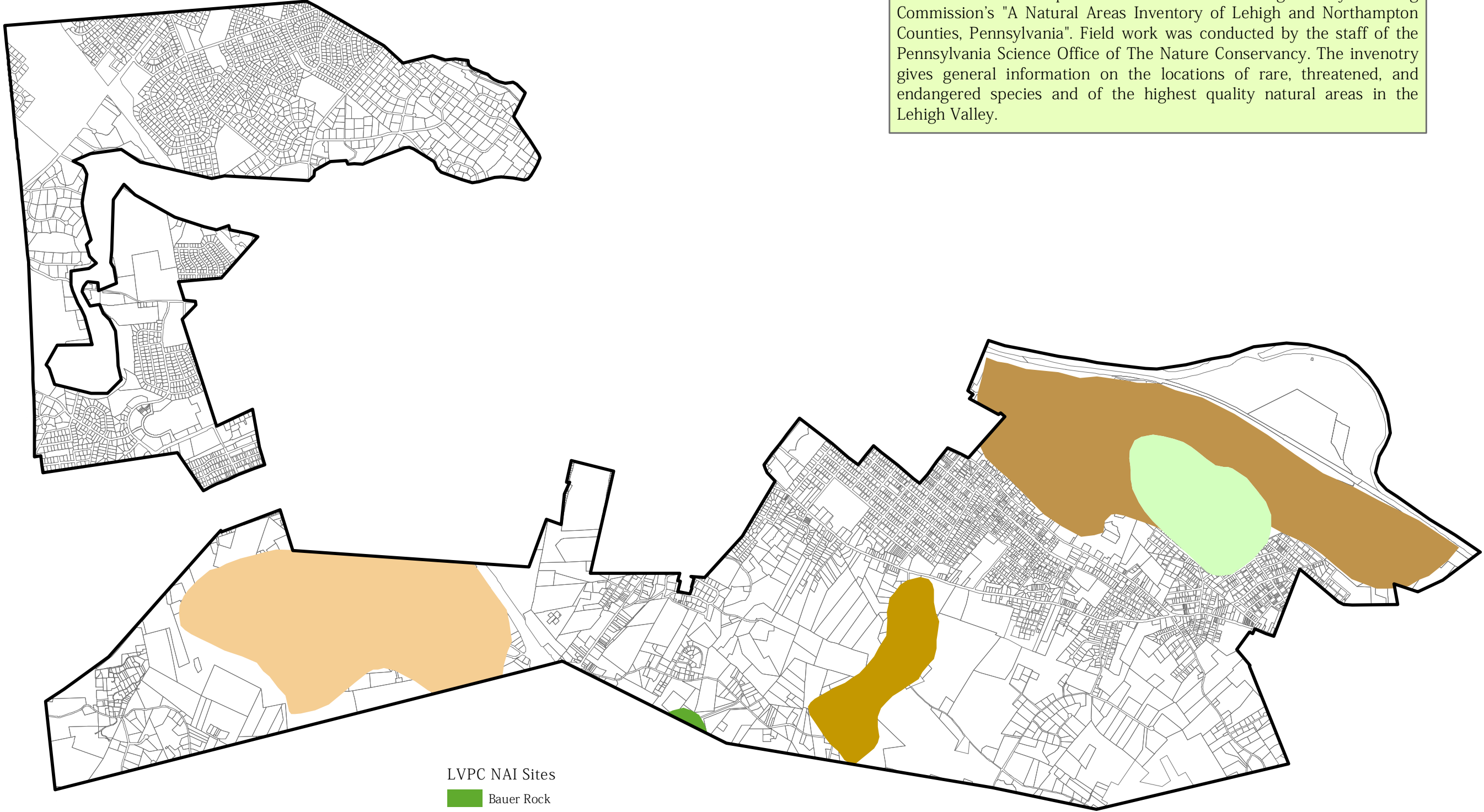
Harry S. Truman Elementary School



Salisbury Township Middle School & Western Salisbury Elementary School



The sites on this map were identified in the Lehigh Valley Planning Commission's "A Natural Areas Inventory of Lehigh and Northampton Counties, Pennsylvania". Field work was conducted by the staff of the Pennsylvania Science Office of The Nature Conservancy. The inventory gives general information on the locations of rare, threatened, and endangered species and of the highest quality natural areas in the Lehigh Valley.

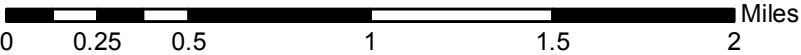


- LVPC NAI Sites
- Bauer Rock
 - Gauff Hill
 - Lehigh Mountain
 - Lehigh Mountain Seeps
 - Robert Rodale Reserve

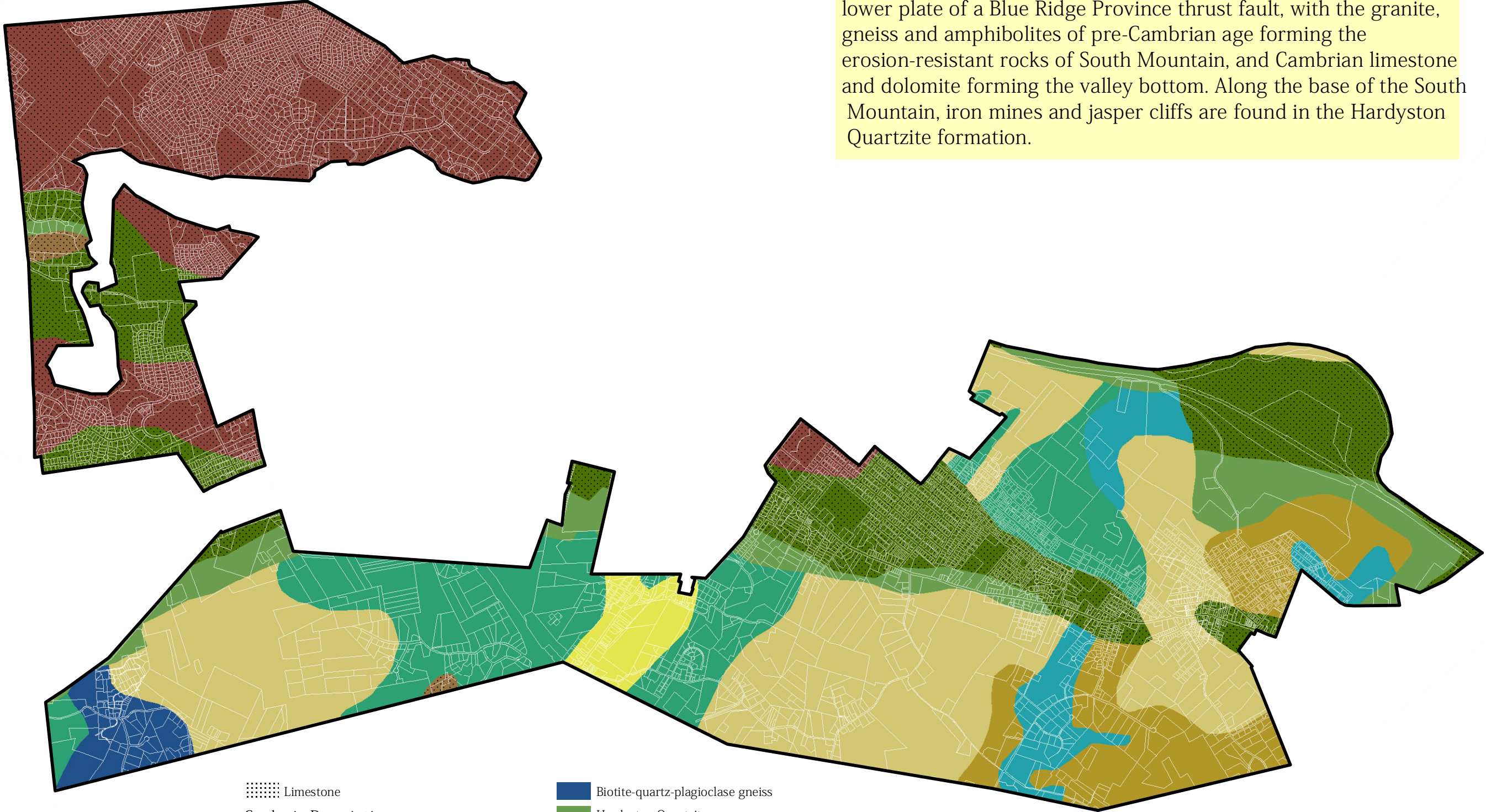



SALISBURY TOWNSHIP


Lehigh Valley Planning Commission Natural Areas Inventory Sites





The geology of Salisbury Township is comprised of the upper and lower plate of a Blue Ridge Province thrust fault, with the granite, gneiss and amphibolites of pre-Cambrian age forming the erosion-resistant rocks of South Mountain, and Cambrian limestone and dolomite forming the valley bottom. Along the base of the South Mountain, iron mines and jasper cliffs are found in the Hardyston Quartzite formation.





- 


Limestone
- 


Biotite-quartz-plagioclase gneiss
- 


Alaskite, microperthitic and microantiperthitic
- 


Hardyston Quartzite
- 


Allentown Dolomite
- 

Hornblende granite and associated biotite granite
- 

Amphibolitic migmatite and related hybrid rocks
- 

Jacksonburg Limestone
- 

Amphibolite
- 

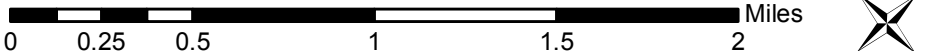
Leithsville Formation
- 

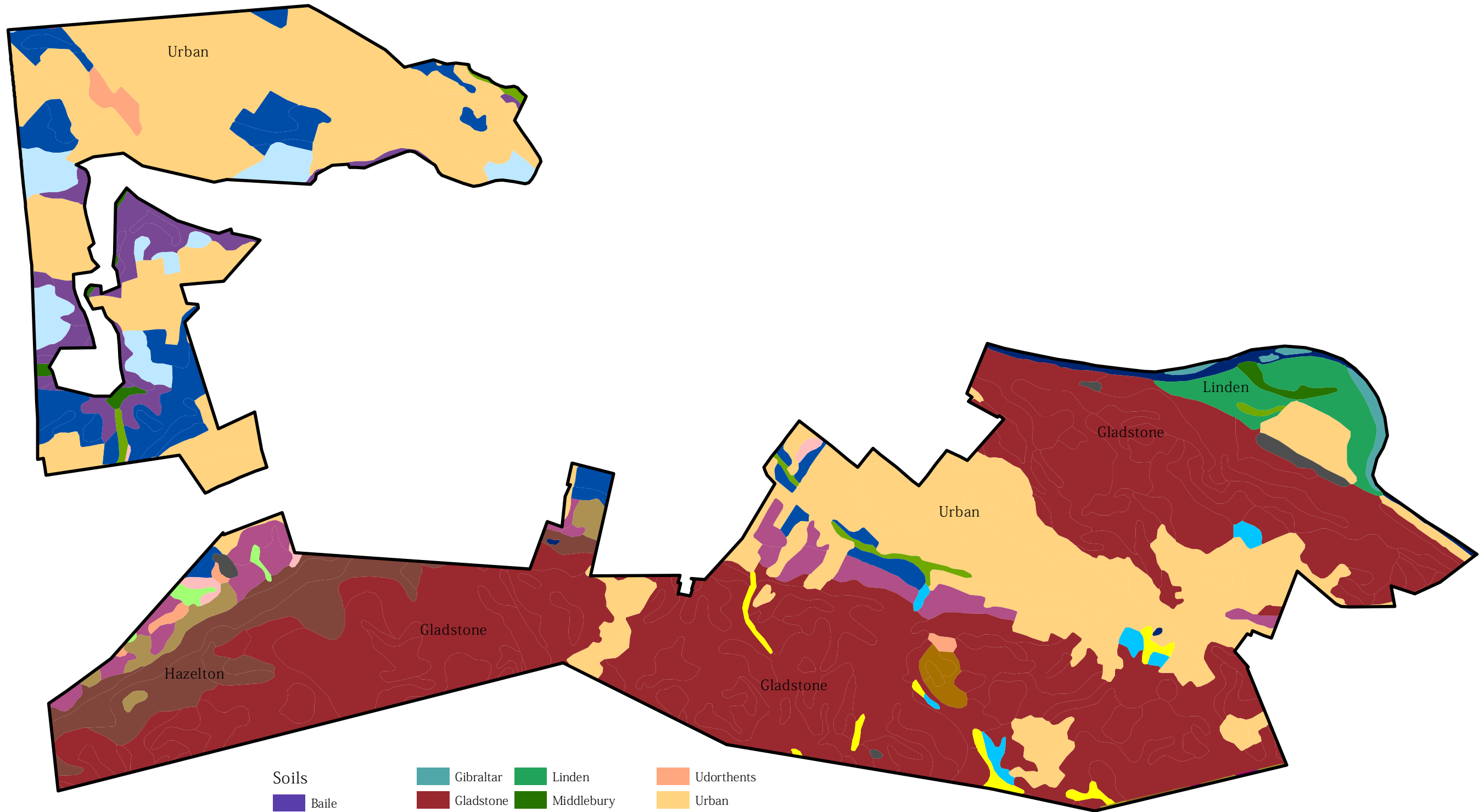
Potassic feldspar gneiss



SALISBURY TOWNSHIP

Geology

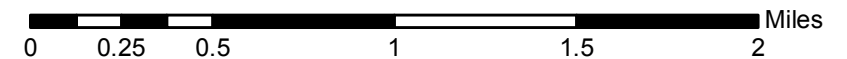


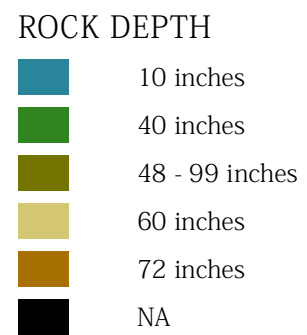
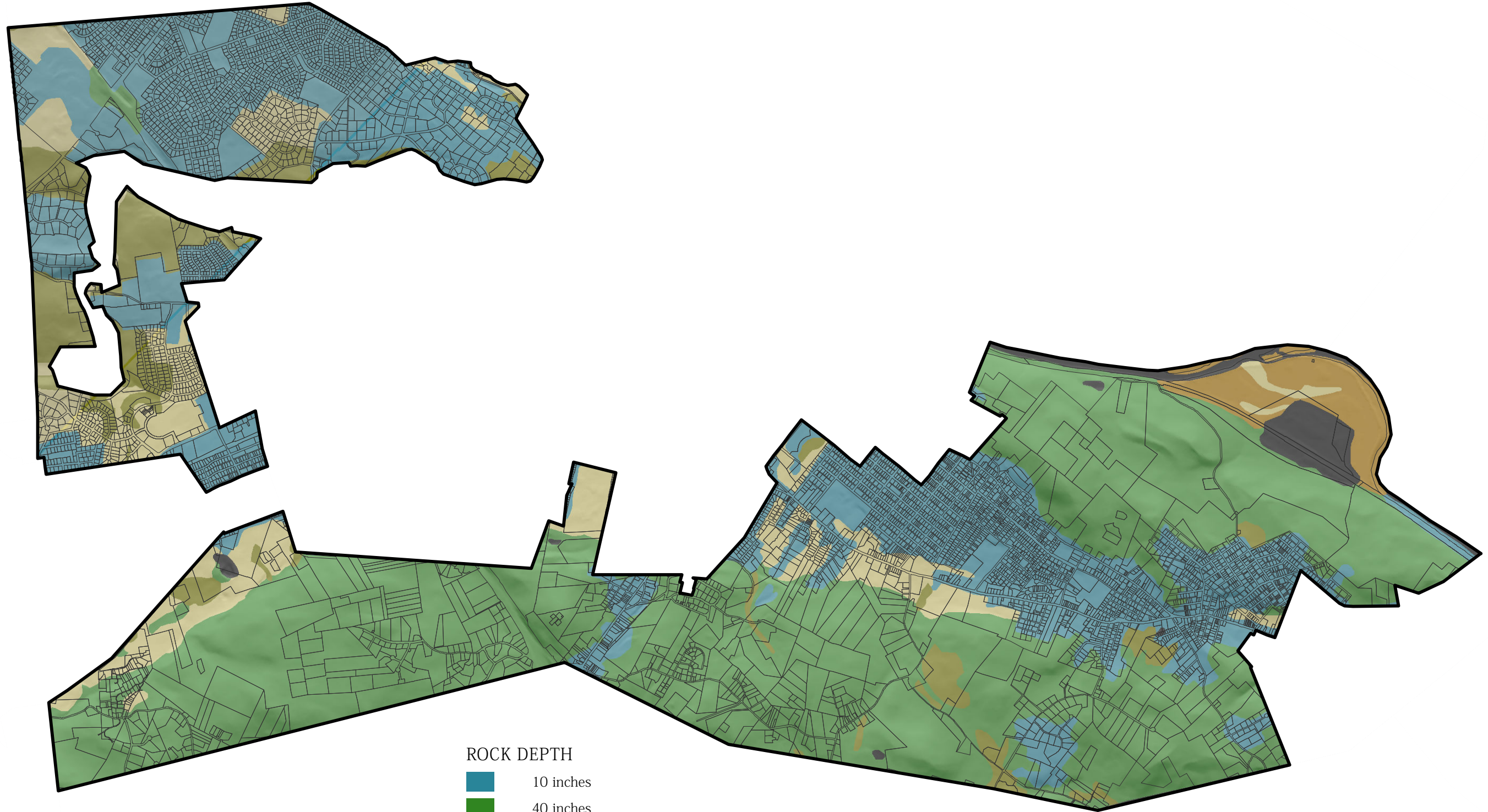


Soils			
Baile	Gibraltar	Linden	Udorthents
Clarksburg	Gladstone	Middlebury	Urban
Conestoga	Glenville	Murrill	Urbana
Conestoga-Holling	Hazleton	Neshaminy	Washington
Duffield	Hollinger	Quarries	Water
Duffield-Ryder	Holly	Thorndale-Penlaw	
	Laidig	Towhee	



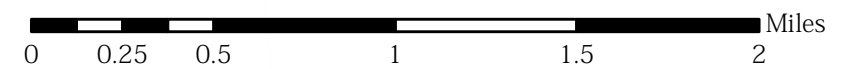
SALISBURY TOWNSHIP Soils

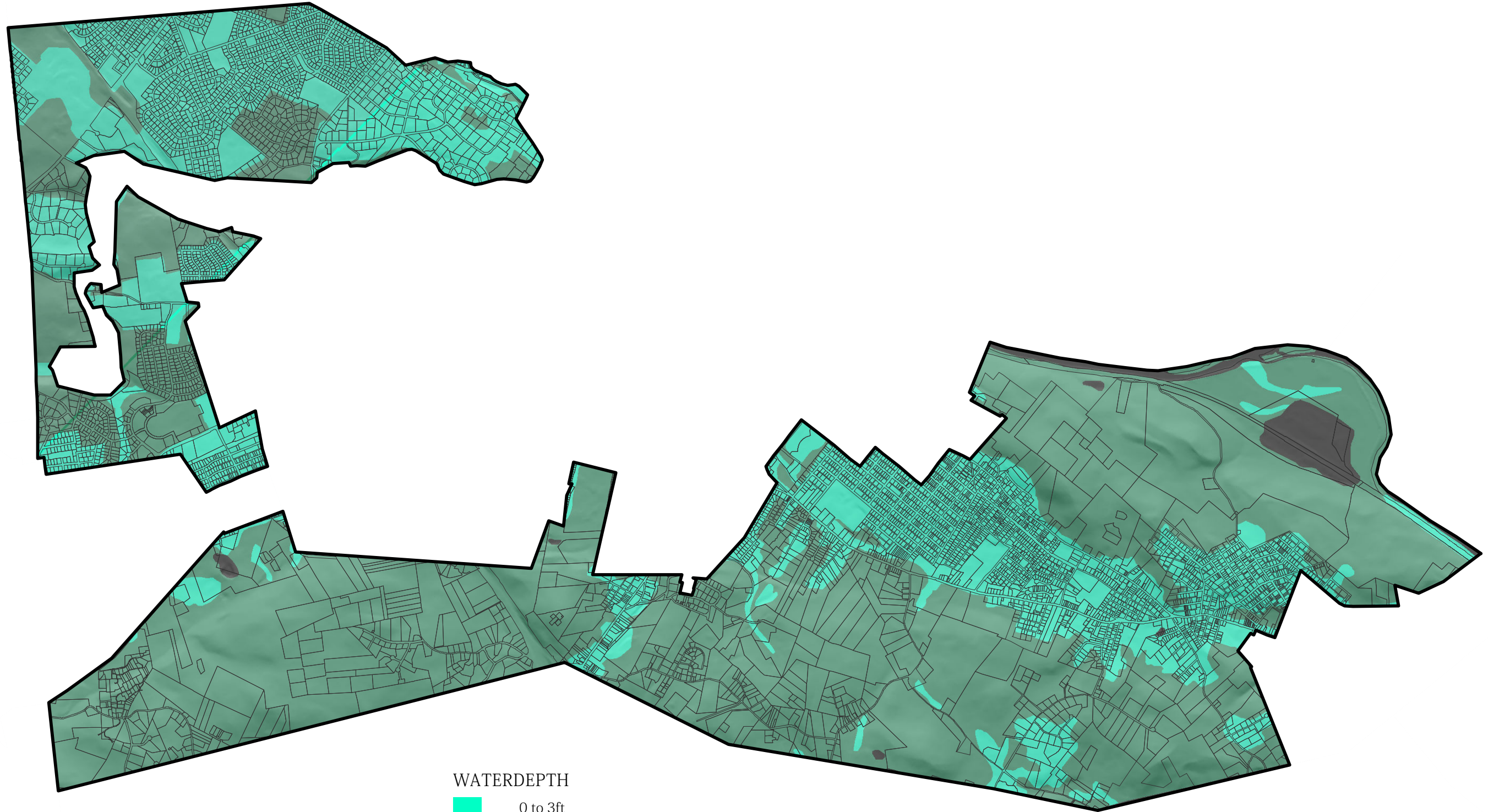




SALISBURY TOWNSHIP

Depth to Bedrock





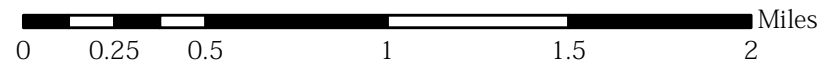
WATERDEPTH

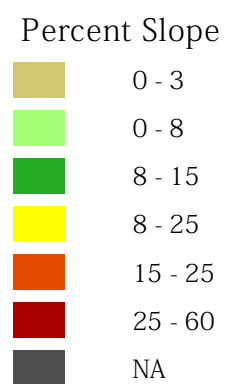
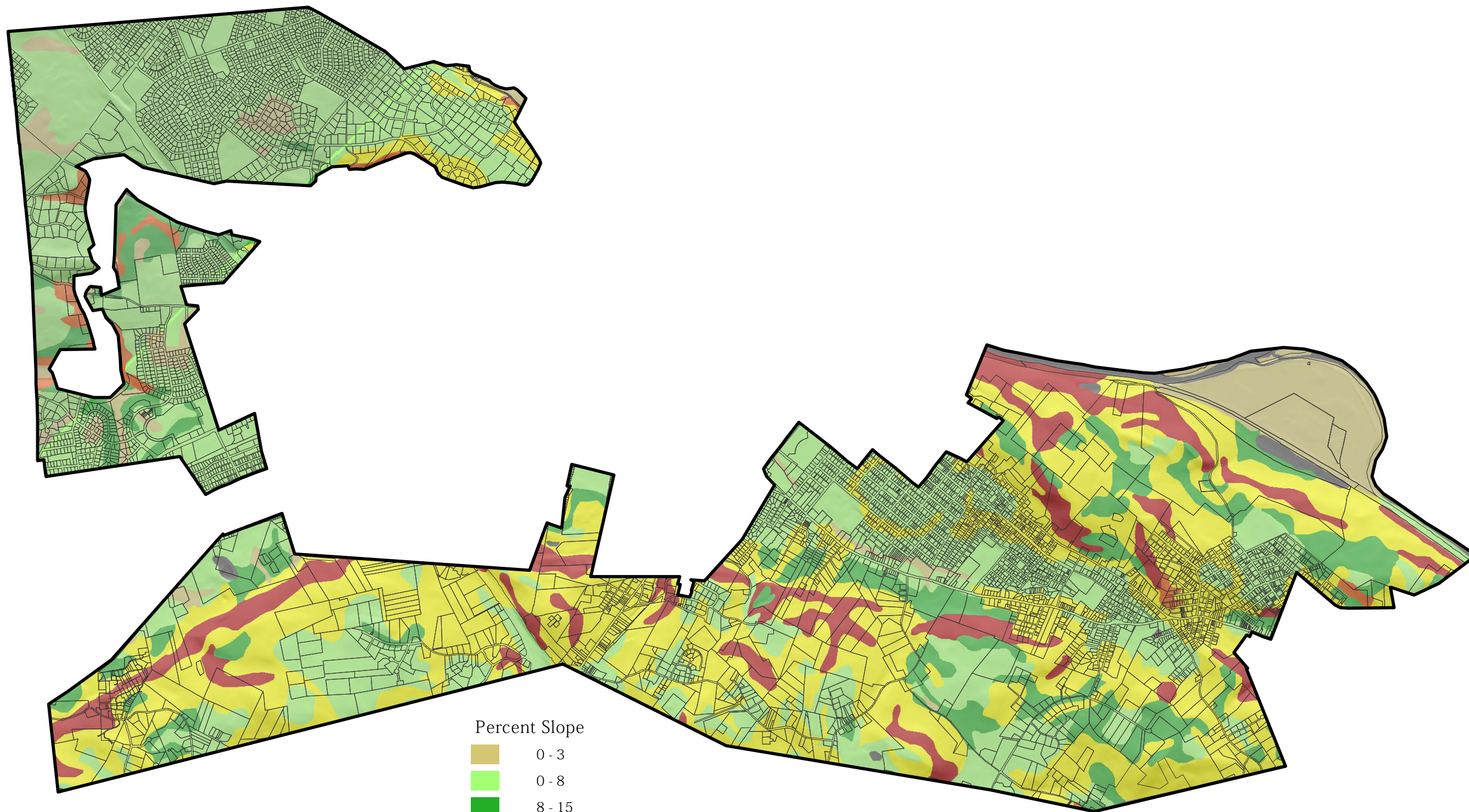
0 to 3ft
3 to 6ft
NA



SALISBURY TOWNSHIP

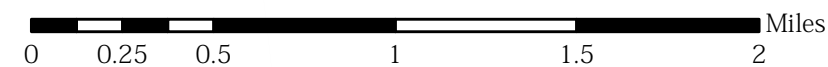
Depth to Water Table







SALISBURY TOWNSHIP

Slope



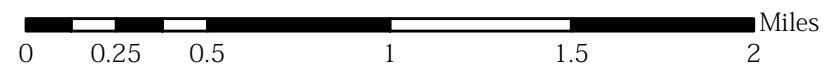


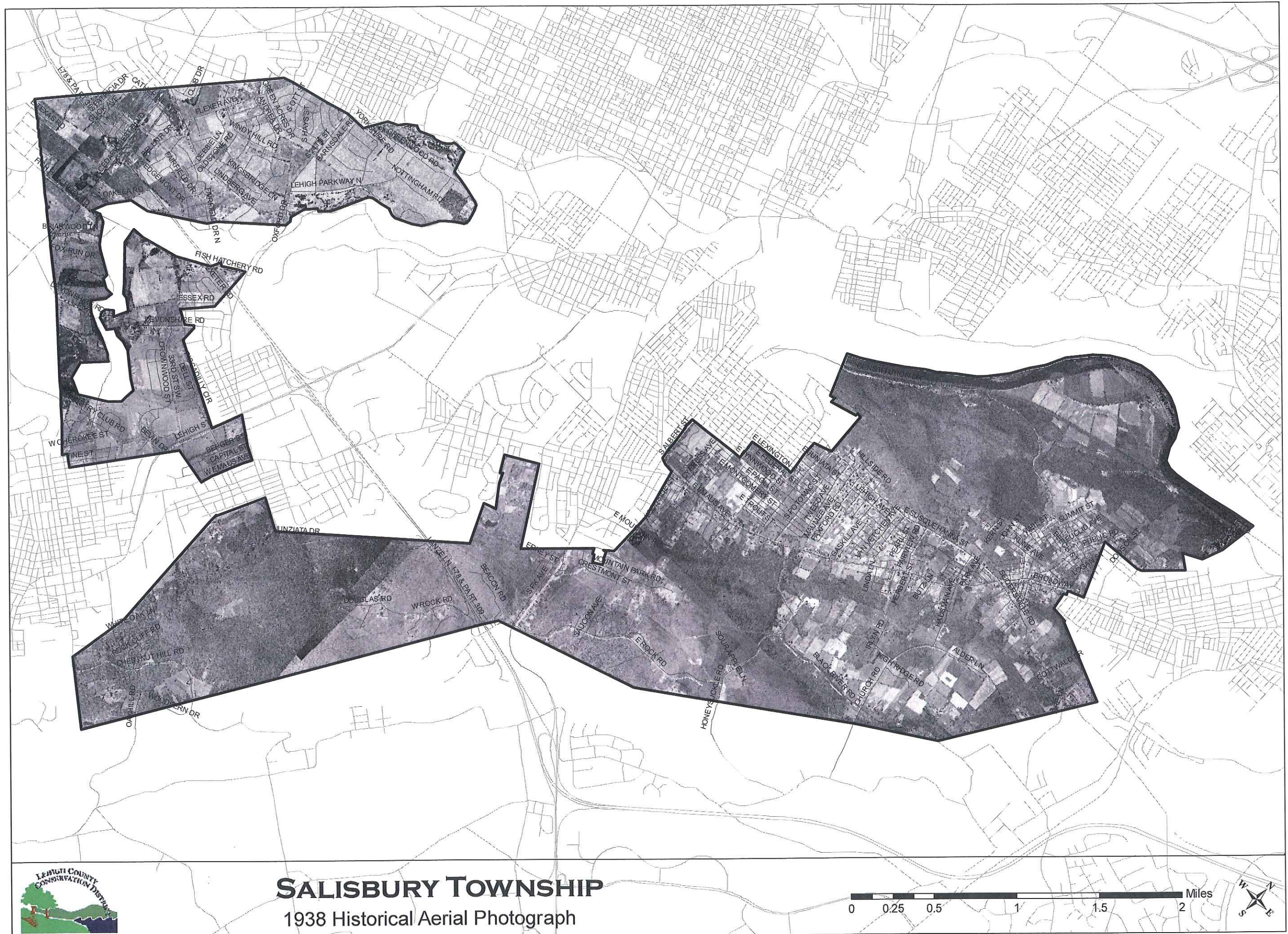
 Tax Parcels
Elevation (feet)
 High : 1025
Low : 225

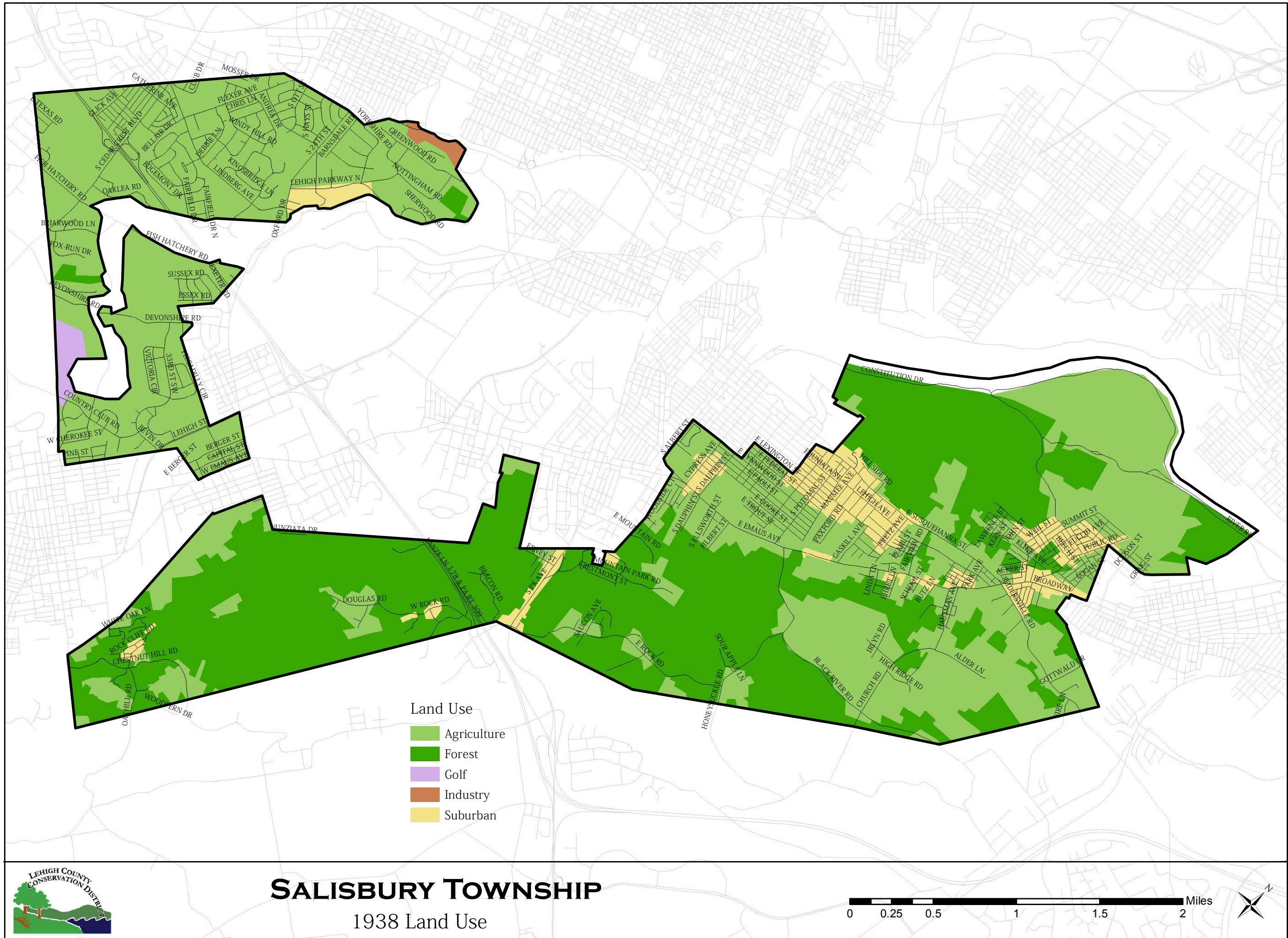


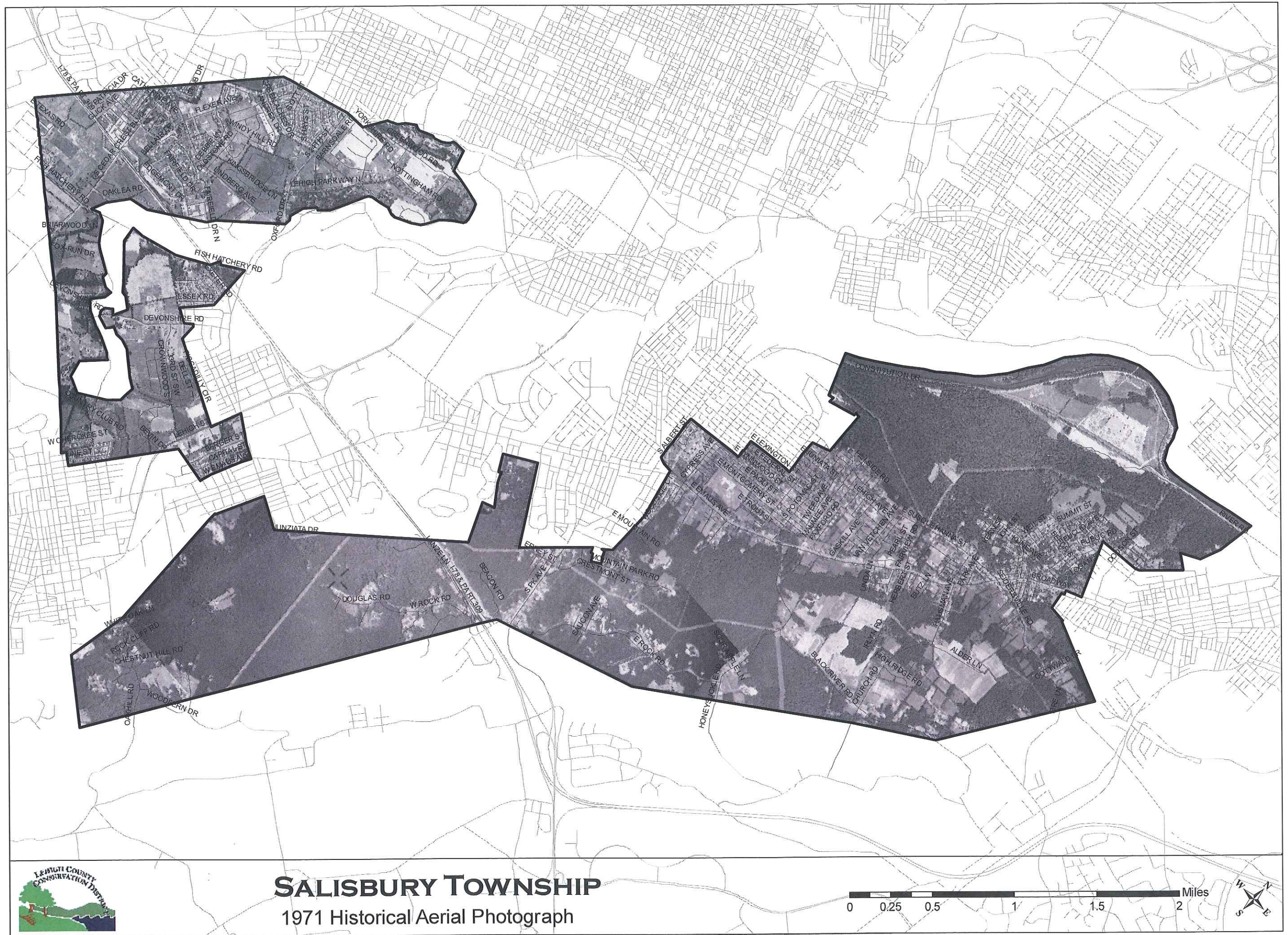
SALISBURY TOWNSHIP

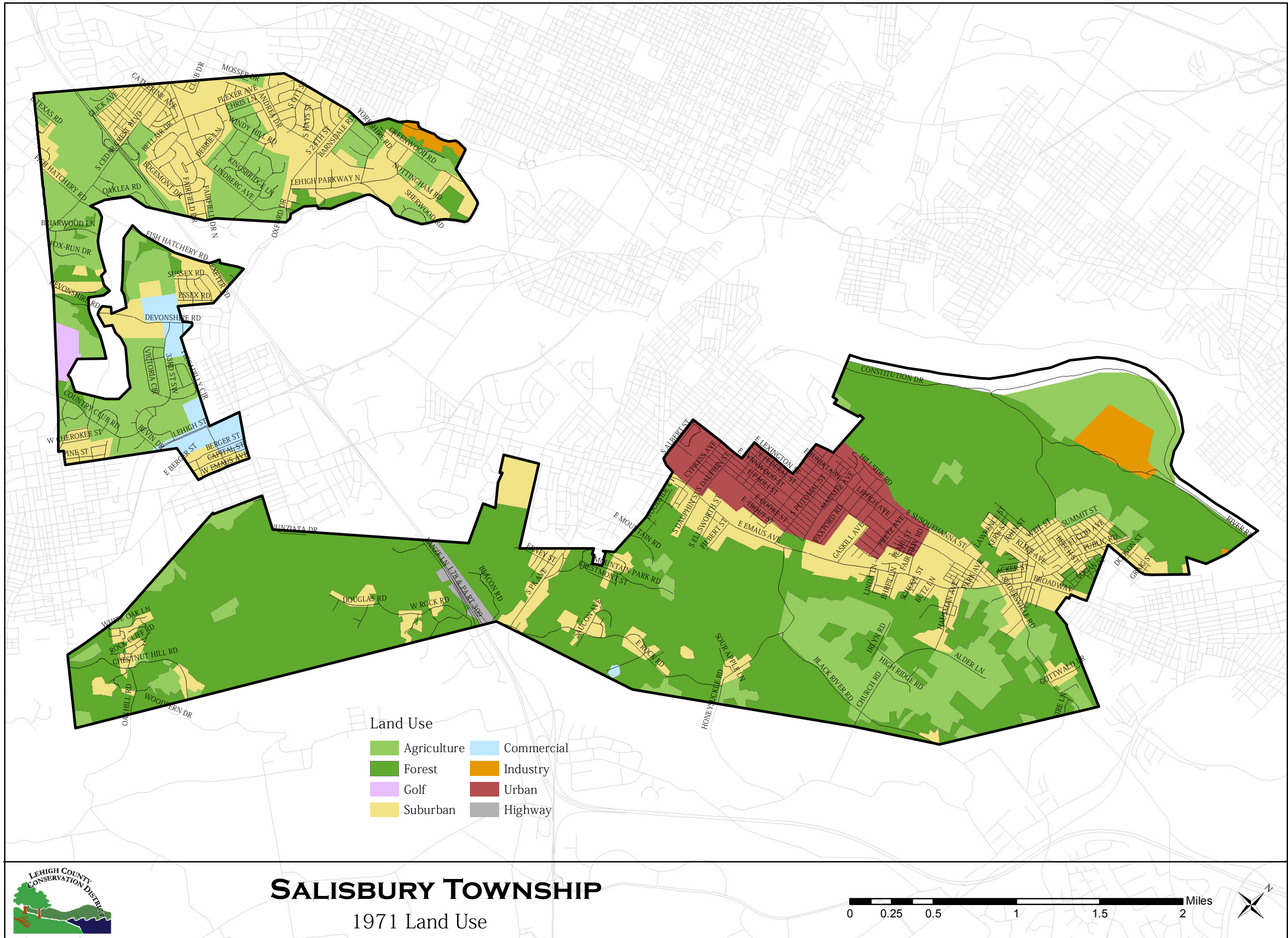
Topography



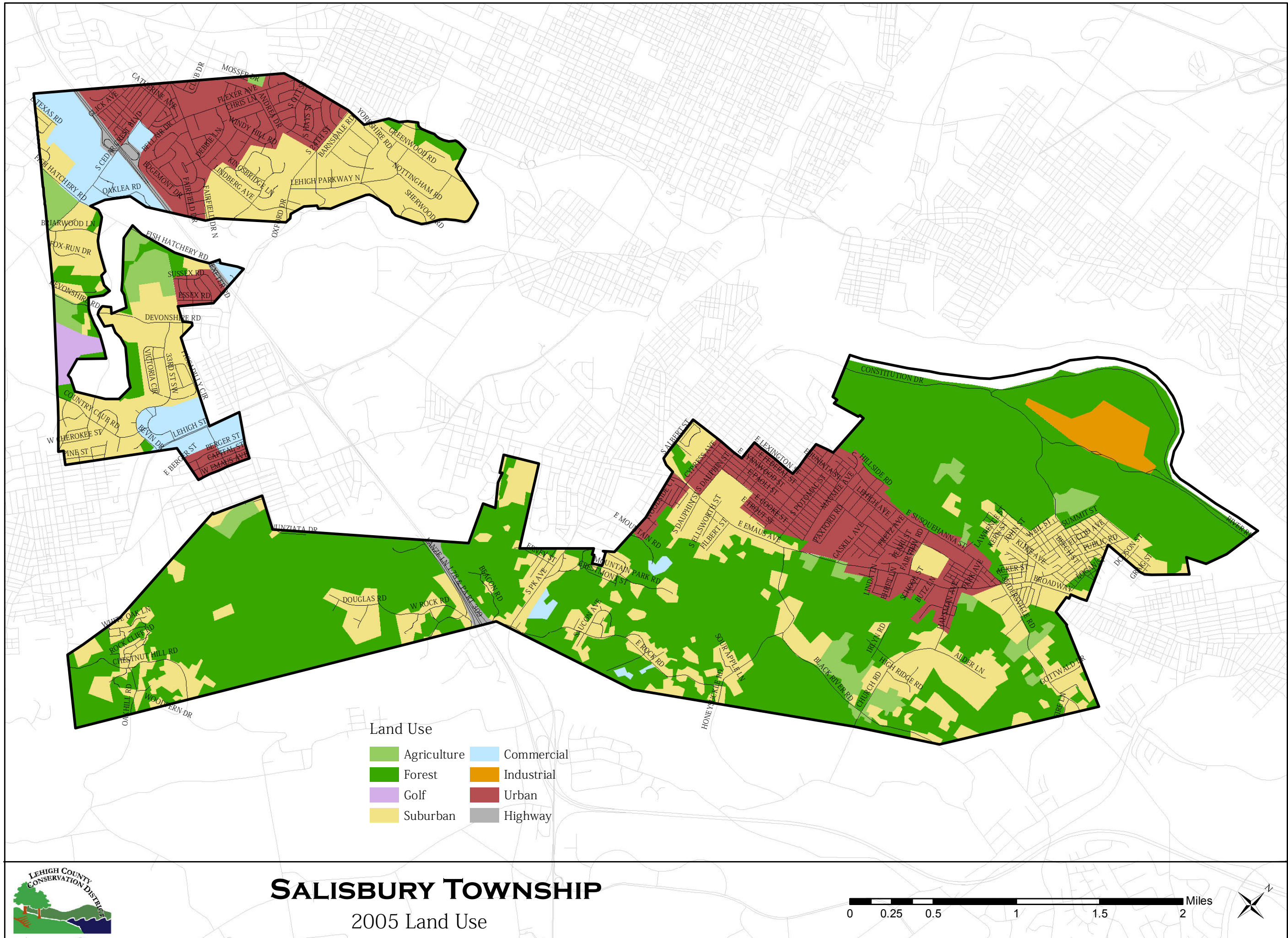




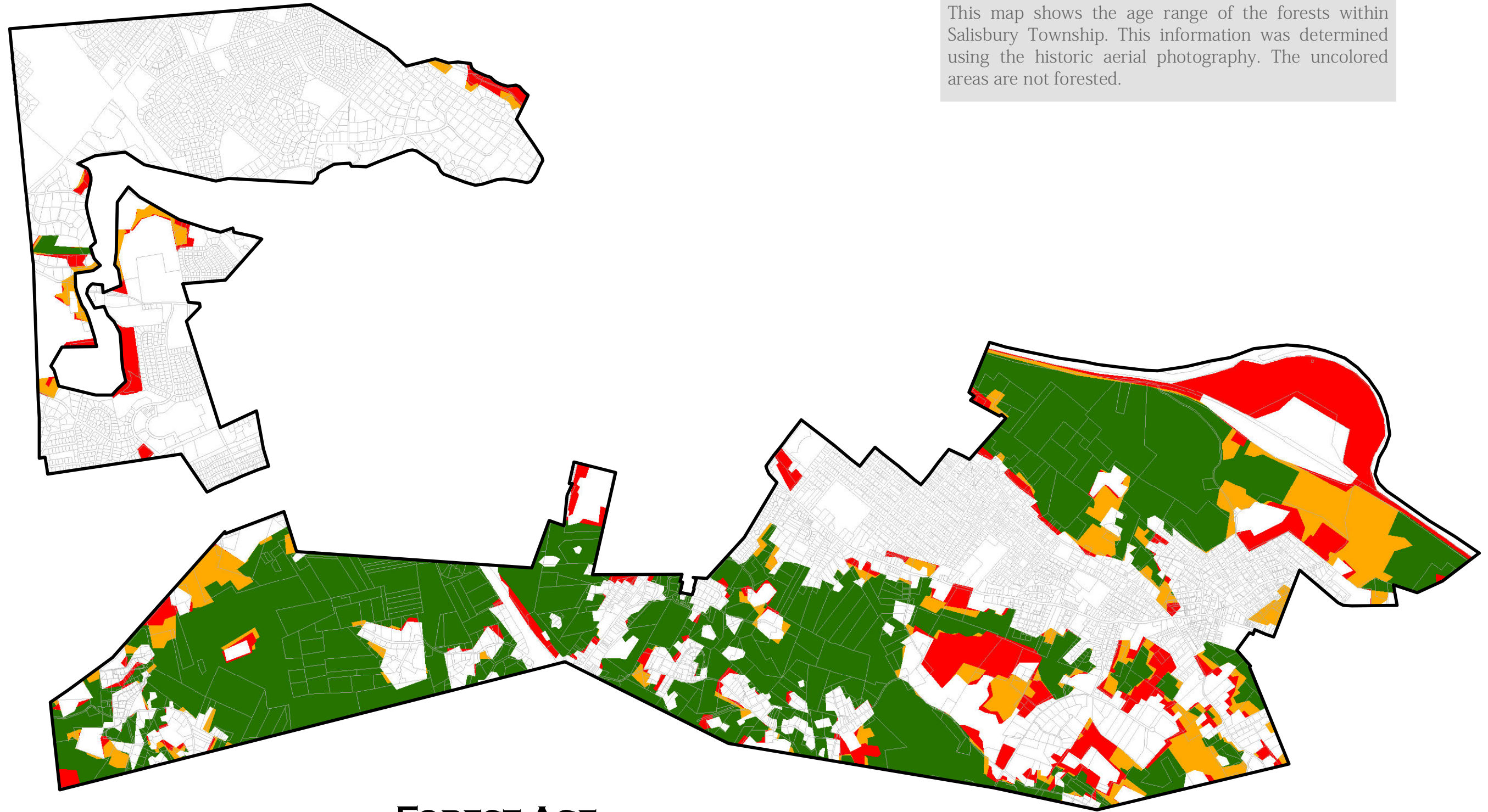








This map shows the age range of the forests within Salisbury Township. This information was determined using the historic aerial photography. The uncolored areas are not forested.

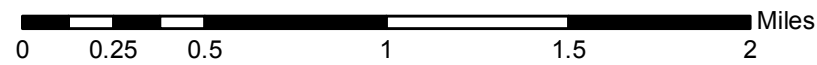


FOREST AGE

Over 70 years 40 to 70 years Less than 40 years

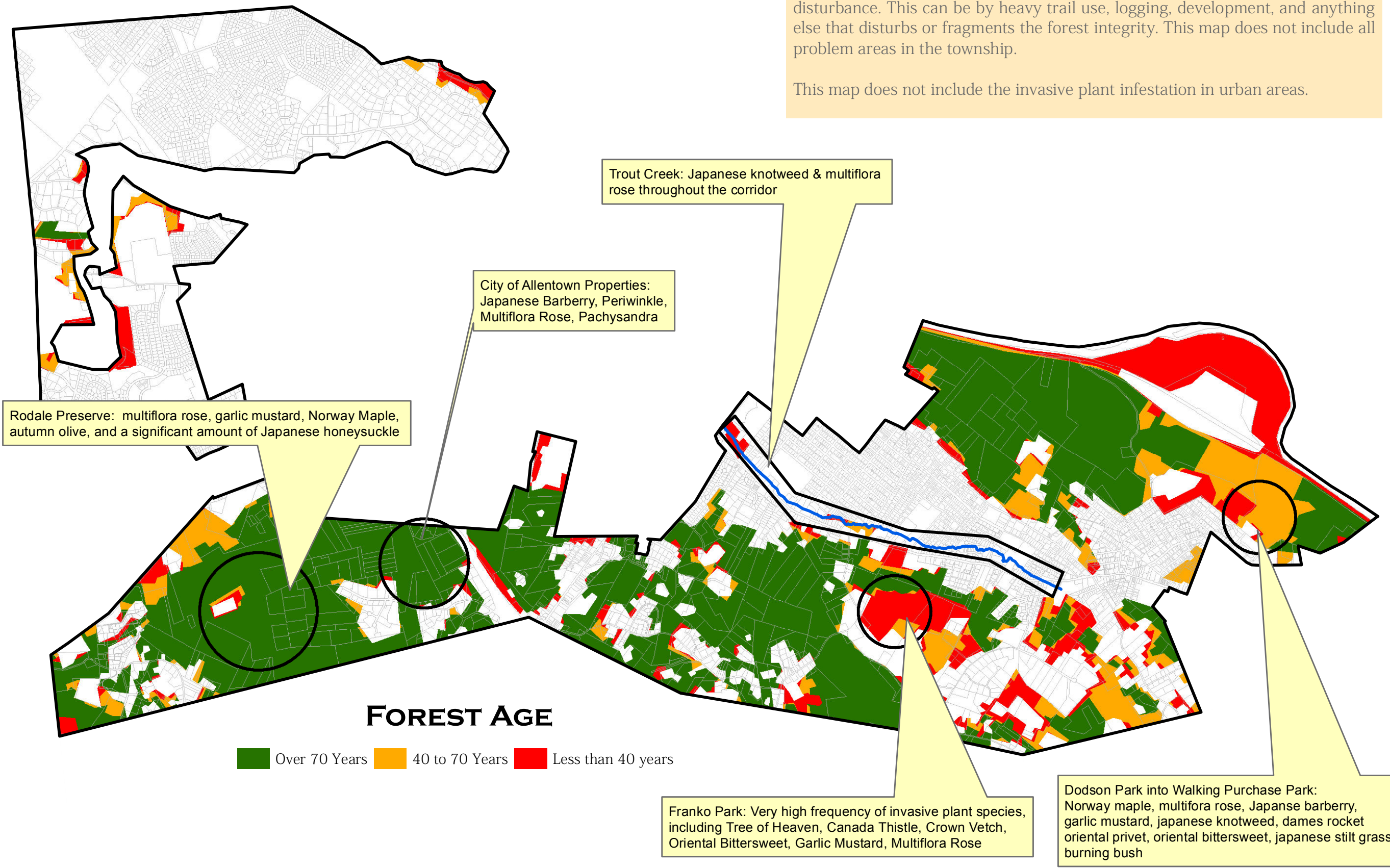


SALISBURY TOWNSHIP
Forest Age



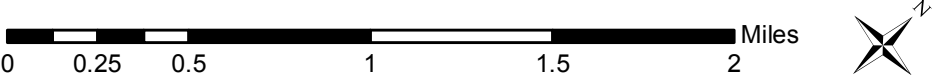
This map highlights a few known invasive plant problem areas within Salisbury Township's forests. Invasive plants are usually introduced into forests through disturbance. This can be by heavy trail use, logging, development, and anything else that disturbs or fragments the forest integrity. This map does not include all problem areas in the township.

This map does not include the invasive plant infestation in urban areas.

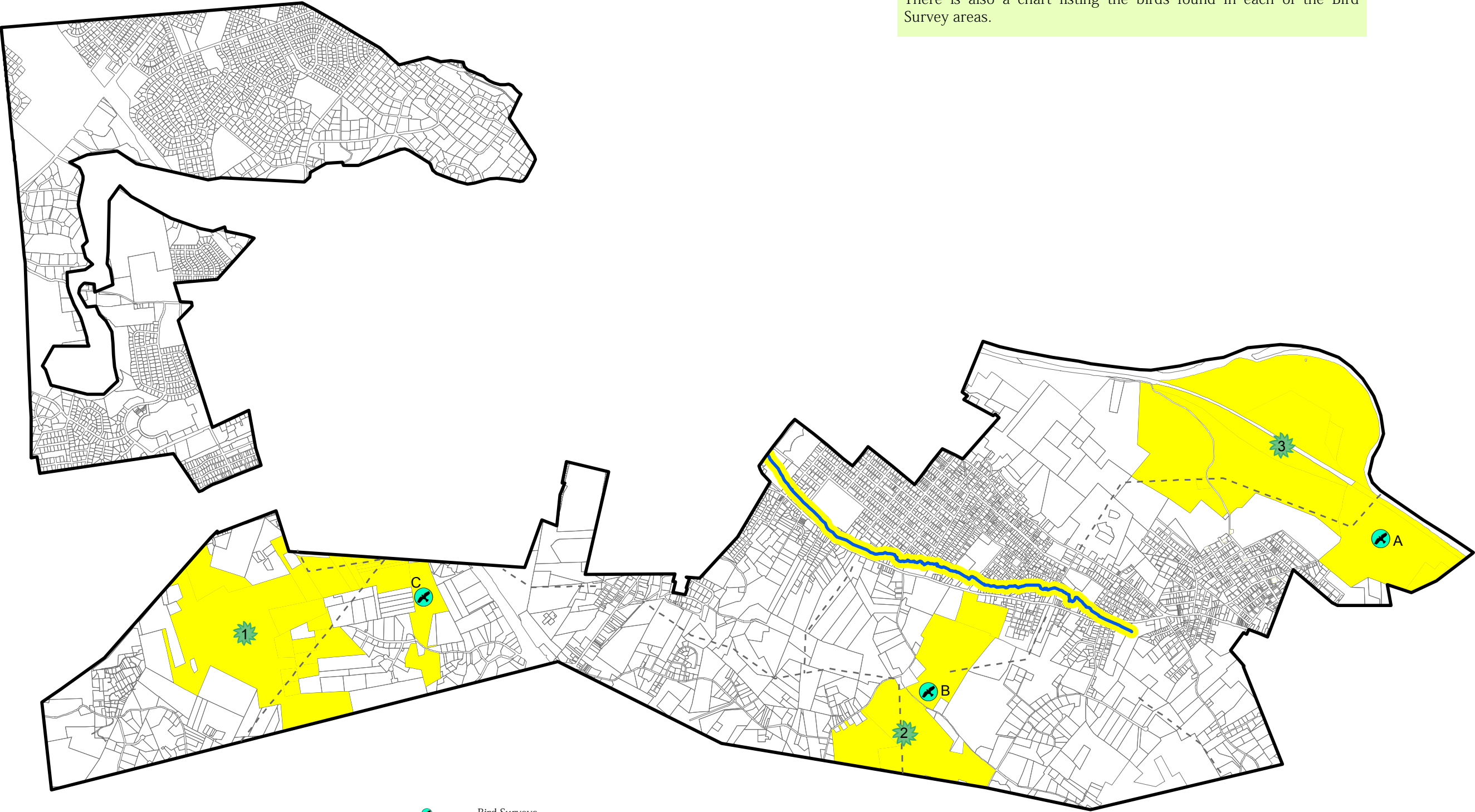






SALISBURY TOWNSHIP

Invasive Plants in Forests and Stream Corridors



The Focus Areas labeled on this map correspond to the Salisbury Township Field Team Plant and Forest Notes on the following pages. There is also a chart listing the birds found in each of the Bird Survey areas.

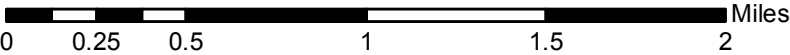


-  Bird Surveys
-  Power Line Cuts
-  Tax Parcels
-  Focus Areas



SALISBURY TOWNSHIP

Field Notes



Salisbury Township Field Team Plant and Forest Notes

Area 1 May 2010

American basswood/Linden tree	Helleborne orchid	rattlesnake fern
American Chestnut	Hickory	Sassafras
Ash	jack in the pulpit	Sebolds Viburnum
bedstraw	Japanese Barberry	Sensitive fern
beech	Japanese honeysuckle	silver maple
black birch	Japanese knotweed	solomon's seal
Black cohosh	Jet bead	spicebush
black walnut	jewel weed	stilt grass
Blackhaw viburnum	lady's thumb	Stinging nettle
Blood Root	maiden hair fern	Swamp white oak
box elder maple	may apples	Sweet Cecily
Burning Bush	milkweed	Sycamore maple
Christmas fern	Mock Orange	Tulip Poplar
Dame's rocket	multiflora rose	Violets
Deadman's fingers	Native Hydrangea	Virginia creeper
Early Meadow Rue	northern red oak	Virginia knotweed
false ginseng	Norway maple	White Ash
fleabane	Oriental bittersweet	white wood aster
garlic mustard	Oriental Privet	Wild ginger
Grape vines	posion ivy	wine berries
Green Ash	prickly ash	Wood anemone
green briar	princess tree	wood nettle



Area 2 - April 2010

Beach fern	Garlic Mustard	phragmites
Bedstraw	Golden rod	Pickeral weed
Black Cherry	Hawthorn tree	poison ivy
blackhaw viburnum	Hayscented fern	Raspberries
Box elder maple	Honey Locust	Sasparilla
Braken fern, grows like a tree	Horsetail	Sassafras
Butter Cup	Japanese barberry	skunk cabbage
Canada mayflower	Japanese bittersweet	Spicebush
Canada Thistle	Kidney leaved buttercup	Striped pipssissiwa
Christmas fern	Low bush blueberry	Swamp azalea
Cinnamon fern	Maiden Hair fern	Tree of Heaven
Crown vetch	May apple	Tulip poplar
Dewberry	Multiflora rose	Virginia creeper
Dogbane aka Indian hemp	Native azalea, pinkster bloom	white oak
False Ginseng	New York fern	Wineberries
False hellebore	Northern bedstraw/gallium	Yarrow
Gallium	Norway Maple	Yellow eyed grass
Garlic Mustard	ox eye daisies	



Area 3 - April 2010		
American Beech	Heavy spicebush	Sedges
American Chestnut	Heppatica aka liverwort	Sensitive fern
American hornbeam	Horsetail	Service berry
arrowwood	Indian Cucumber	Shagbark hickory
autumn olive	Jack in the pulpit	Showy Orchis
Beach fern	Japanese barberry	Skunk cabbage
Bellwort	Japanese honeysuckle	Solomon's seal
Black Birch	jewelweed	spicebush
black cherry	lady's thumb	stinging nettle
Black Cohosh	Lion's Foot	Sugar maple
Black haw viburnum	Maiden hair fern	sumac
Blood root	Maple leaf viburnum	Swamp White oak
Boneset	May apple	Tickseed
Burning bush	Meadow rue	Trillium
Canada thistle	Mullein	Tulip poplar
Chestnut oak	Multiflora rose	Virginia creeper
Chinkapin oak	Nodding trillium	White pine
Christmas fern	Norway Maple	wild geranium
Dutchman's pipe vine	Pachysandra	Canada Mayflower
Elderberry	Periwinkle	wild pink azalea
False ginseng	Phragmites	Witch hazel
false hellebore	Poison Ivy	Witch hazel (heavy)
flowering dogwood	Raspberries	Wood anemone
garlic mustard	rattle snake fern	wood aster
Golden ragwort	red maple	Wooly blue violet
Grape vine	rhododendron	New York ferns
hayscented ferns	Rue anemone	
Heavy spicebush	scarlet oak	



Salisbury Township Bird Survey , May 28th, 2010

Area A

Dodson Park	Below park downslope	Along the power line	Across RR tracks alongside the Lehigh River
Cedar Waxwing	Red-bellied woodpecker	Magnolia warbler	Fish crow
Grey Catbird	White breasted nuthatch	Baltimore oriole	Eastern Kingbird
Northern Cardinal	Blue Jay	Eastern wood pewee	Baltimore oriole nest
American Robin	Downy Woodpecker	Canada Warbler	Scarlet tanager
House Wren	Red-eyed vireo	Black Poll Warbler	Redstart
Great Crested Flycatcher	Scarlet Tanager	Rose-breasted grosbeak	Pewee
Ovenbird	Tufted Titmouse	Pileated woodpecker	Robin
American Redstart		Veery	Catbird
Song Sparrow		Common yellow-throat	Yellow warbler
House Finch			Cowbird
Rufus-sided Towee		Near Railroad:	Red-Eyed vireo
Chimney Swift		Black-capped chickadee	Hairy Woodpecker
			Pileated woodpecker

Area B

Franco Park and adjoining private properties	
Robin	Canada goose
Barn Swallow	House finch
Mockingbird	Baltimore oriole
Yellow Warbler	Catbird
Tree Swallow	Song sparrow
Kingbird	Cedar waxwing
Turkey Vulture	Common yellowthroat
Redwinged blackbird	Willow flycatcher
Chipping sparrow	Wood thrush
Yellow shafted flicker	Red-eyed vireo
	Veery
	Northern Cardinal
	Downy woodpecker
	Chestnut-sided warbler
	Scarlet tanager
	Field sparrow
	American crow
	Morning dove
	Chimney swift

Area C

City of Allentown Property and adjoining private properties.	
Ruby throated hummingbird	Veery
Scarlet tanager	Eastern wood pewee
Downy Woodpecker	Tufted titmouse
Robin	Towee
White-breasted nuthatch	Common yellow-throat
Ovenbird	Blue jay
Wood thrush	Red-bellied woodpecker
Red-eyed vireo	Yellow-throated vireo
Rose-breasted grosbeak	
	Red admiral butterfly (not a bird, but what the heck?)



Salisbury Township
TERRESTRIAL PLANT INVENTORY
 Compiled by the PA DCNR

FERNS

Common Names	Scientific Names
Northern Maidenhair	<i>Adiantum pedatum</i>
Hay-scented Fern	<i>Dennstaedtia punctilobula</i>
Marginal Wood Fern	<i>Dryopteris marginalis</i>
Christmas Fern	<i>Polystichum acrostichoides</i>
Common Polypody	<i>Polypodium vulgare</i>
Bracken Fern	<i>Pteridium aquilinum</i>
Cinnamon Fern	<i>Osmunda cinnamomea</i>
Royal Fern	<i>Osmunda regalis</i>
Interrupted Fern	<i>Osmunda claytoniana</i>
Sensitive Fern	<i>Onoclea sensibilis</i>
Rattlesnake Fern	<i>Botrychium virginianum</i>

WILDFLOWERS

Common Name	Scientific Names
Dwarf ginseng	<i>Panax trifolius</i>
Jack In The Pulpit	<i>Arisaema triphyllum</i>
Skunk Cabbage	<i>Symplocarpus foetidus</i>
Greenbrier	<i>Smilax rotundifolia</i>
Helleborine orchid * NN	<i>Epipactis helleborine</i>
Mugwort * NNI	<i>Artemisia vulgaris</i>
Peppergrass	<i>Lepidium ruderales</i>
Lamb's Quarters * NN	<i>Chenopodium album</i>
Stinging Nettle	<i>Urtica dioica</i>
False Nettle	<i>Boehmeria cylindrica</i>
Annual Wormwood	<i>Artemisia annua</i>
Orange Day Lily * NNI	<i>Hemerocallis fulva</i>
Orange Jewelweed	<i>Impatiens capensis</i>
Yellow Jewelweed	<i>Impatiens pallida</i>
Common Milkweed	<i>Asclepias syriaca</i>
Intermediate Dogbane	<i>Apocynum medium</i>
Showy Tick-trefoil	<i>Desmodium canadense</i>
Pointed-leaved Tick-trefoil	<i>Desmodium glutinosum</i>
Hoary Tick-trefoil	<i>Desmodium canadense</i>
Indian Pipes	<i>Monotropa uniflora</i>
Spotted Wintergreen	<i>Chimaphila maculata</i>
Partridgeberry	<i>Mitchella repens</i>

Deptford Pink * NN
 Dame's Rocket * NNI
 Wild Geranium
 Mayapple
 Musk Mallow * NN
 Panicked Tick-trefoil
 White Vervain
 Ox-eye Daisy * NN
 Daisy Fleabane
 Dandelion # NN
 Yellow Goat's Beard NNI
 Black-eyed Susan
 Green-headed Coneflower
 Thin-leaved Coneflower
 Woodland Sunflower
 White Wood Aster
 Teasel # NN
 Prickly Lettuce
 Common Ragweed
 Cinquefoil
 Common Mullein # NN
 Moth Mullein # NN
 New England Aster
 Common Nightshade # NN
 Horse Nettle
 Indian Tobacco
 Great Lobelia
 Square-stemmed Monkey
 Flower
 Cardinal Flower
 Turtleshead
 Clearweed
 Bugleweed # NN
 Asiatic Dayflower # NN
 Vipers Bugloss # NN
 Spotted Joe Pye Weed
 Hollow Joe Pye Weed
 Bladder Campion # NN
 White Clover # NN
 Red Clover # NN
 Multiflora Rose * NNI
 Wild Lily of the Valley
 Solomon's Seal
 False Solomon's Seal
 False Hellebore
 Dog Violet
 Marsh Blue Violet
 Downy Yellow Violet

Dianthus armeria
 Hesperis matronalis
 Geranium maculatum
 Podophyllum peltatum
 Malva moschata
 Desmodium paniculatum
 Verbena articulata
 Chrysanthemum leucanthemum
 Erigeron aquilifolia
 Taraxacum officinale
 Tragopogon pratensis
 Rudbeckia hirta
 Rudbeckia laciniata
 Rudbeckia troloba
 Helianthus divaricatus
 Aster divaricatus
 Dipsacus sylvestris
 Lactuca scariola
 Ambrosia artemisiifolia
 Potentilla sp.
 Verbascum thapsus
 Verbascum blattaria
 Aster novae-angliae
 Solanum dulcamara
 Solanum carolinense
 Lobelia inflata
 Lobelia siphilitica

Mimulus ringius
 Lobelia cardinalis
 Chelidonium glabra
 Pilea pumila
 Lyreopus virginicus
 Commelina communis
 Echium vulgare
 Eupatorium maculatum
 Eupatorium dubium
 Silene vulgaris
 Trifolium repens
 Trifolium pratense
 Rosa multiflora
 Maianthemum canadense
 Polygonatum biflorum
 Smilacina racemosa
 Veratrum viride
 Viola conspersa
 Viola cucullata
 Viola pubescens

Swamp Buttercup
 Bulbous Buttercup * NN
 Bloodroot
 Star of Bethlehem * NN
 Spring Beauty
 Liverleaf
 Black cohosh
 Nodding trillium
 Showy orchis
 Pink ladyslipper
 Trout Lily
 Periwinkle * NN
 Bluets
 Rue Anenome
 Moneywort * NN
 Spotted St. John's Wort
 Spikenard
 Herb Robert * NN
 Ground Ivy * NNI
 Blue-eyed Grass
 Common Wood Sorrel
 Virgin's Bower
 Common Evening Primrose
 Water Cress
 Butter and Eggs * NN
 Tall Meadow Rue
 Foxglove Beardtonque
 Common Chickweed
 Crown Vetch * NNI
 Cut-leaved Toothwort
 Bedstraw
 Motherwort * NN
 Heal-all * NN
 Catnip * NN
 Horsebalm
 Wild Bergamot
 Purple Loosestrife * NNI
 Fringed Loosestrife
 Wild Garlic
 Yarrow *NN
 Great Burdock
 Spotted Knapweed * NNI
 Chicory * NN
 Black Raspberry
 White Avens
 Yellow Avens
 Agrimony
 Coltsfoot NNI

Ranunculus septentrionalis
 Ranunculus bulbosa
 Sanquinaria canadensis
 Ornithogalum umbellatum
 Claytonia caroliniana
 Hepatica nobilis
 Cimicifuga racemosa
 trillium cernunum
 Galearis spectabilis
 Cypripedium acaule
 Erythronium americanum
 Vinca minor
 Houstonia caerulea
 Amenonella thalictroides
 Lysimachia nummularia
 Hypericum punctatum
 Aralia racemosa
 Geranium robertianum
 Glechoma hederacea
 Sisyrinchium sp.
 Oxalis montana
 Clematis virginiana
 Oenothera biennis
 Nasturium officinale
 Linaria vulgaris
 Thalictrum polygamum
 Penstemon digitalis
 Stellaria media
 Coronilla varia
 Dentaria laciniata
 Galium sp.
 Leonurus cardiaca
 Prunella vulgaris
 Nepeta cataria
 Collinsonia canadensis
 Monarda fistulosa
 Lythrum salicaria
 Lysimachia ciliata
 Allium ceruum
 Achillea millefolium
 Arctium lappa
 Centaurea maculosa
 Cichorium intybus
 Rubus occidentalis
 Geum canadense
 Geum aleppicum
 Agrimonia sp.
 Tussilago farfara

Boneset
 White Snakeroot
 Queen Anne's Lace NNI
 Black Snakeroot
 White Baneberry
 Pokeweed
 Common Plantain * NN
 Wintergreen
 Sweet Cicely
 Garlic Mustard * NNI
 Golden Alexander
 Spiderwort
 Pale Smartweed
 Halberd-leaved Tearthumb
 Arrow-leaved Tearthumb
 Biennial Gaura
 White Wild Licorice
 Wild stonecrop
 Bull Thistle * NNI
 Pasture Thistle
 Garden Phlox
 Japanese Honeysuckle
 Whorled Loosestrife
 Self-heal * NN
 Tall Goldenrod
 Sweet Goldenrod
 Rough-leaved Goldenrod
 Lance-leaved Goldenrod
 Virginia Knotweed

Eupatorium perfoliatum
 Eupatorium rugosum
 Daucus carota
 Sanicula marilandica
 Actaea pachypoda
 Phytolacca americana
 Plantago major
 Gaultheria hispidula
 Osmorhiza claytonia
 Alliaria officinales
 Zizia aurea
 Tradescantia virginiana
 Polygonum lapathifolium
 Polygonum arifolium
 Polygonum saggitatum
 Gaura biennis
 Galium circaezans
 Sedum ternatum
 Cirsium vulgare
 Cirsium pumilum
 Phlox paniculata
 Lonicera japonica
 Lysmachia quadrifolia
 Prunella vulgaris
 Solidago altissima
 Solidago odora
 Solidago patula
 Solidago grammifolia
 Tovura virginiana

TREES AND SHRUBS

Common Names

Eastern White Pine
 Eastern Hemlock
 Eastern Red Cedar
 Pitch Pine
 Red-osier Dogwood
 Flowering Dogwood
 Eastern Redbud
 Bigtooth Aspen
 Northern Catalpa
 Empress tree
 Gray Birch
 Sweet Birch
 Hackberry

Scientific Names

Pinus strobus
 Tsuga canadensis
 Juniperus virginiana
 Pinus rigida
 Cornus stolonifera
 Cornus florida
 Cercis canadensis
 Populus grandidentata
 Catalpa speciosa
 Paulownia tomentosa
 Betula populifolia
 Betula lenta
 Cetus occidentalis

Red Mulberry
 White Mulberry * NN
 American Chestnut
 American Beech
 Black Cherry
 Slippery Elm
 Black Willow
 Chestnut Oak
 White Oak
 Black Oak
 Scarlet Oak
 Northern Red Oak
 Silver Maple
 Red Maple
 Norway Maple * NNI
 Yellow Poplar
 Sycamore
 Black Locust
 Shagbark Hickory
 Mockernut Hickory
 White Ash
 Green/ Red Ash
 Sassafras
 Boxelder
 Black Walnut
 Smooth Sumac
 Staghorn Sumac
 Tree Of Heaven * NNI
 Spicebush
 American elderberry
 Eastern Hophornbeam
 Witch Hazel
 Princess Tree *NNI

Morus rubra
 Morus alba
 Castanea dentata
 Fagus grandifolia
 Prunus serotina
 Ulnus rubra
 Salix nigra
 Quercus montana
 Quercus alba
 Quercus velutina
 Quercus coccinea
 Quercus rubra
 Acer saccharinum
 Acer rubrum
 Acer platanoides
 Liriodendron tulipifera
 Platanus occidentalis
 Robinia pseudoacacia
 Carya ovata
 Carya tomentosa
 Fraxinus americana
 Fraxinus pennsylvanica
 Sassafras albidum
 Acer negunda
 Juglans nigra
 Rhus glabra
 Rhus typhina
 Ailanthus altissima
 Lindera benzoin
 Sambucus canadensis
 Ostrya virginiana
 Hamamelis virginiana
 Paulonia

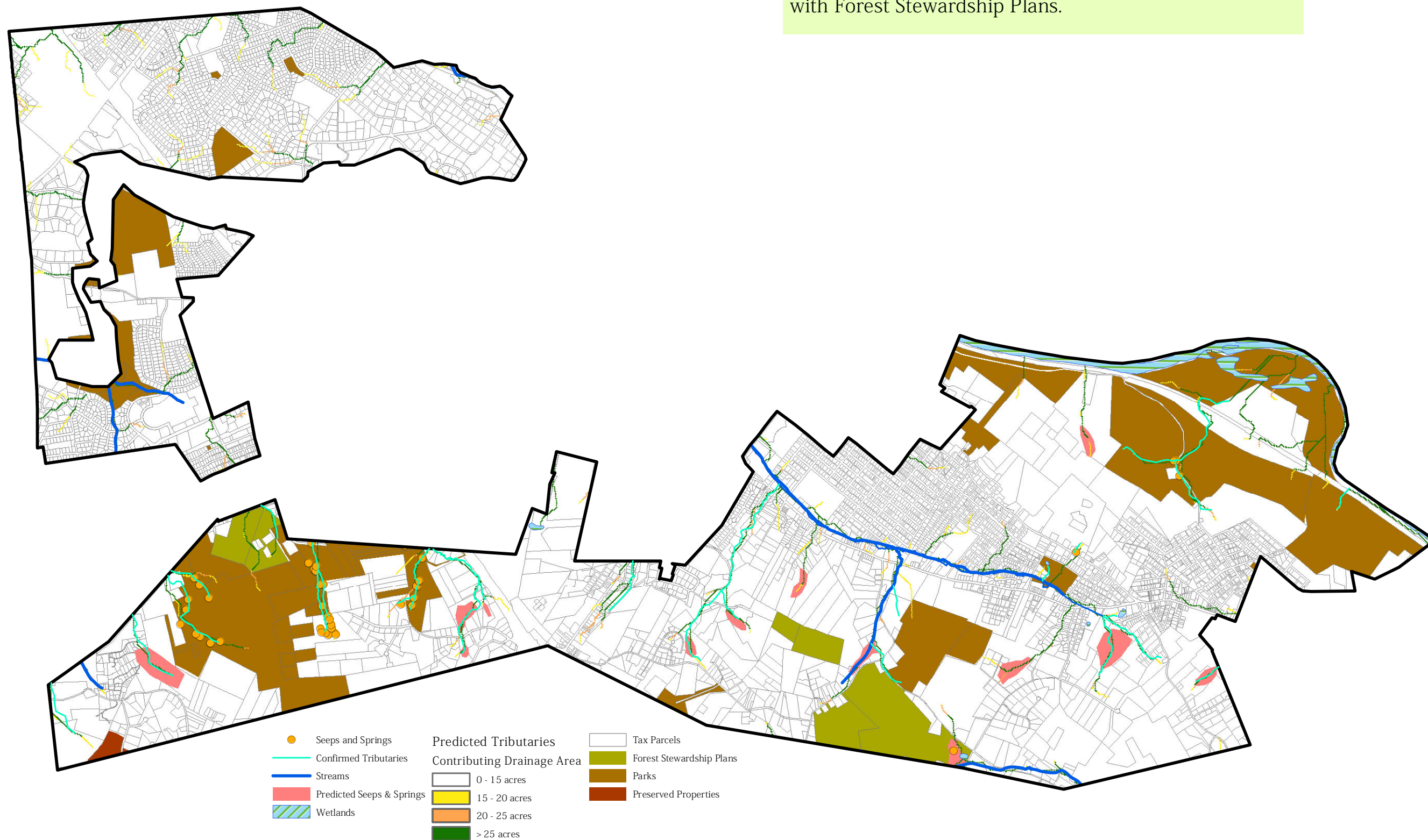
SPECIES OF SPECIAL CONCERN

One found, (not listed) but others probably present in south Mountain area.

NNI: Non-Native Invasive

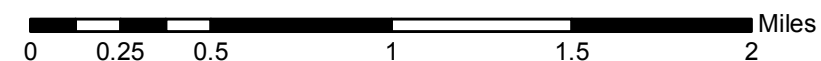
NN: Non-Native

This map contains protected areas within the Salisbury Township. These "protected" areas include parks, lands preserved by the Wildlands Conservancy, and properties with Forest Stewardship Plans.



SALISBURY TOWNSHIP

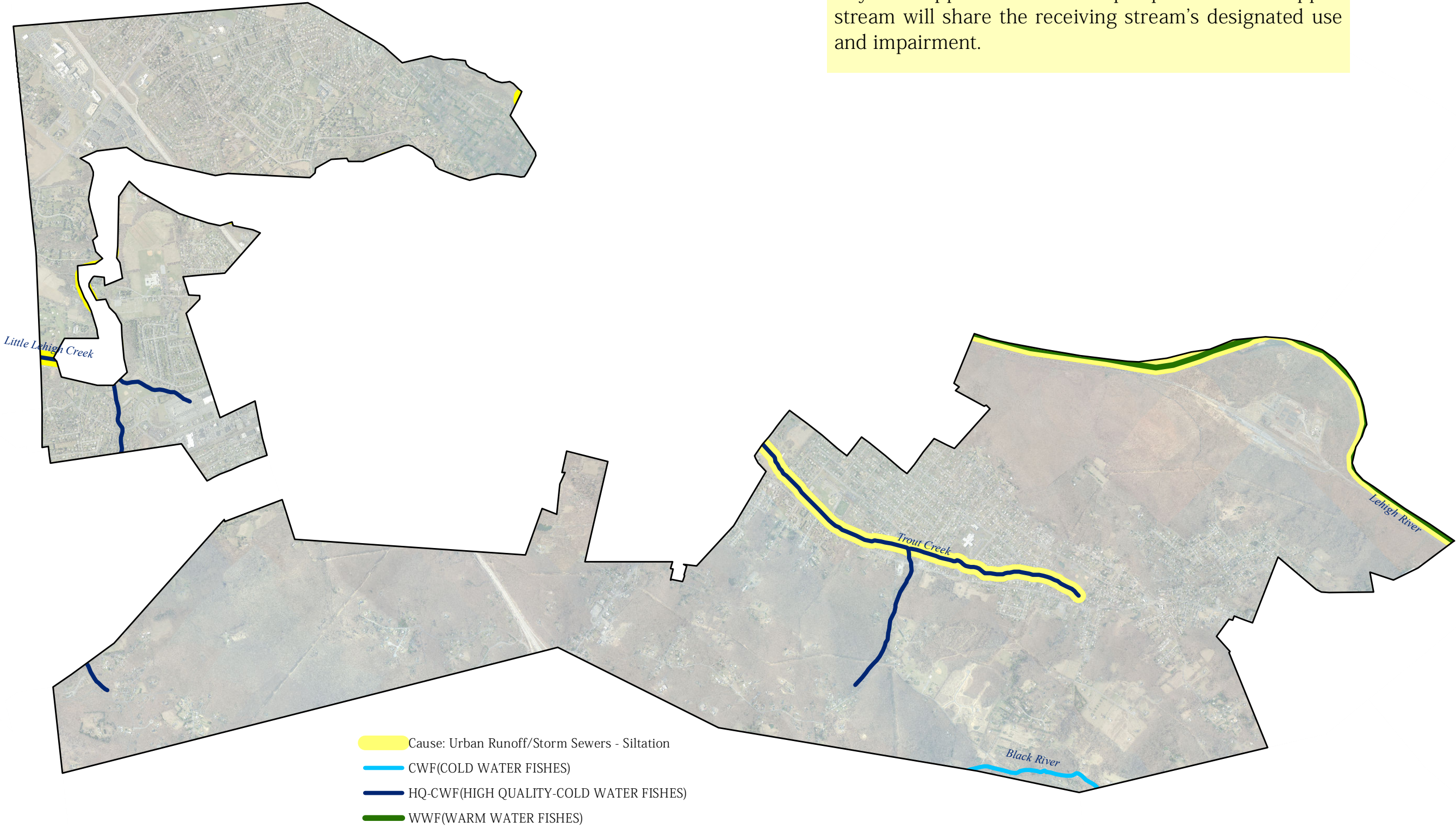
Protected Areas



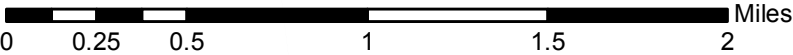
The parks identified in this map are park properties solely owned by Salisbury Township. The school parcels represent public schools; private schools were not evaluated in this study.



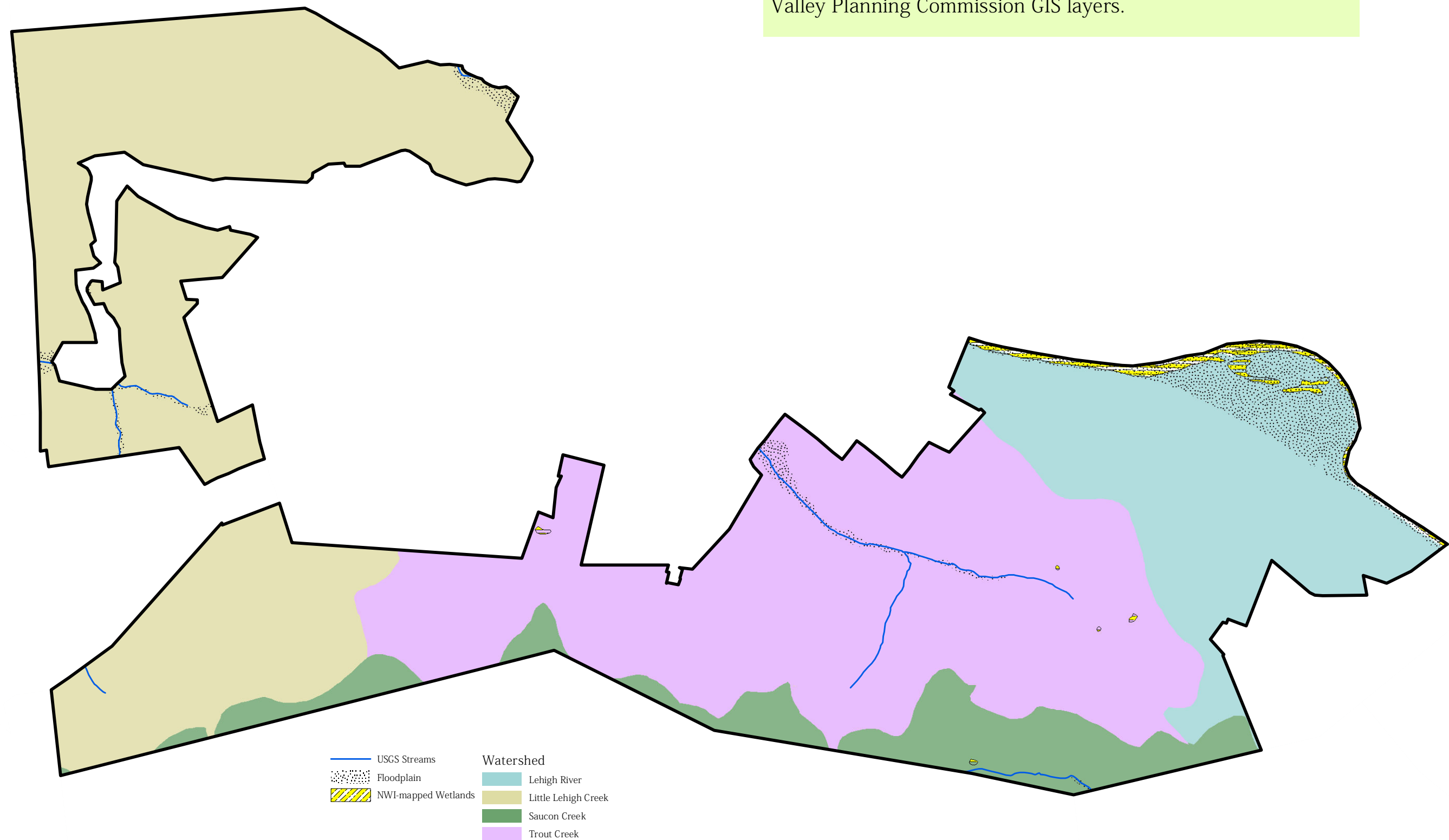
This map contains the designated uses and impairment status of the mapped streams in Salisbury Township. Any unmapped tributaries upslope from a mapped stream will share the receiving stream's designated use and impairment.



SALISBURY TOWNSHIP
Stream Designated Uses & Impairments



This map contains "officially" mapped streams identified by the United States Geologic Survey (USGS) and wetlands identified by the National Wetland Inventory (NWI) sourced from Lehigh Valley Planning Commission GIS layers.

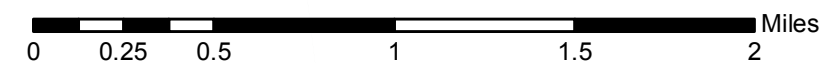


- | | |
|-----------------------|---------------------|
| — USGS Streams | Watershed |
| ···· Floodplain | Lehigh River |
| ▨ NWI-mapped Wetlands | Little Lehigh Creek |
| | Saucon Creek |
| | Trout Creek |



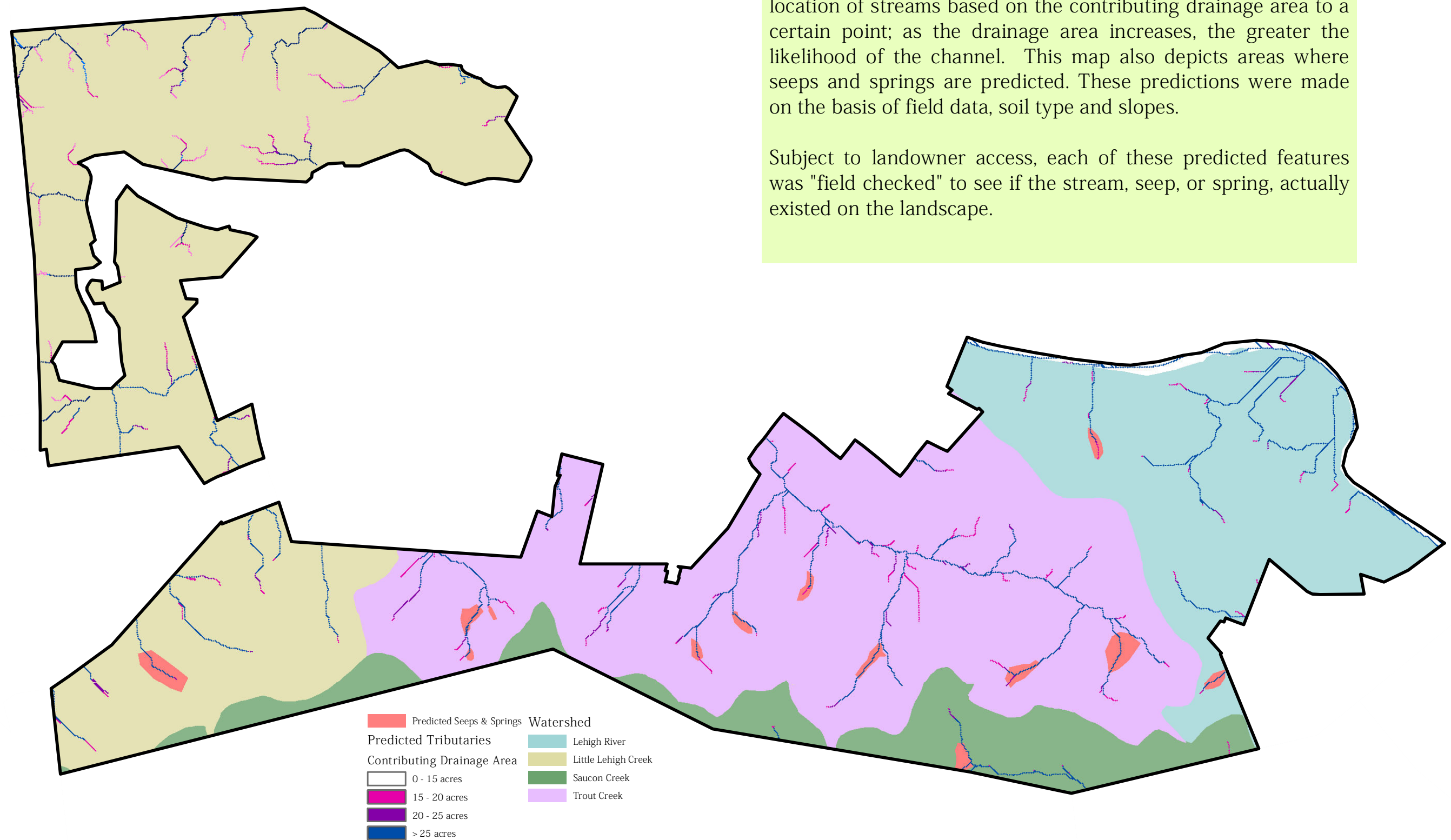
SALISBURY TOWNSHIP

Officially Mapped Hydrography

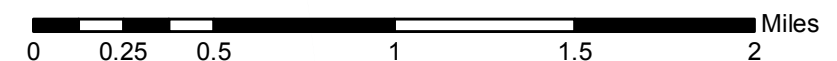


This map displays where streams are predicted to exist based upon a computerized analysis of the Digital Elevation Models (DEM) of Salisbury Township. The model predicts the estimated location of streams based on the contributing drainage area to a certain point; as the drainage area increases, the greater the likelihood of the channel. This map also depicts areas where seeps and springs are predicted. These predictions were made on the basis of field data, soil type and slopes.

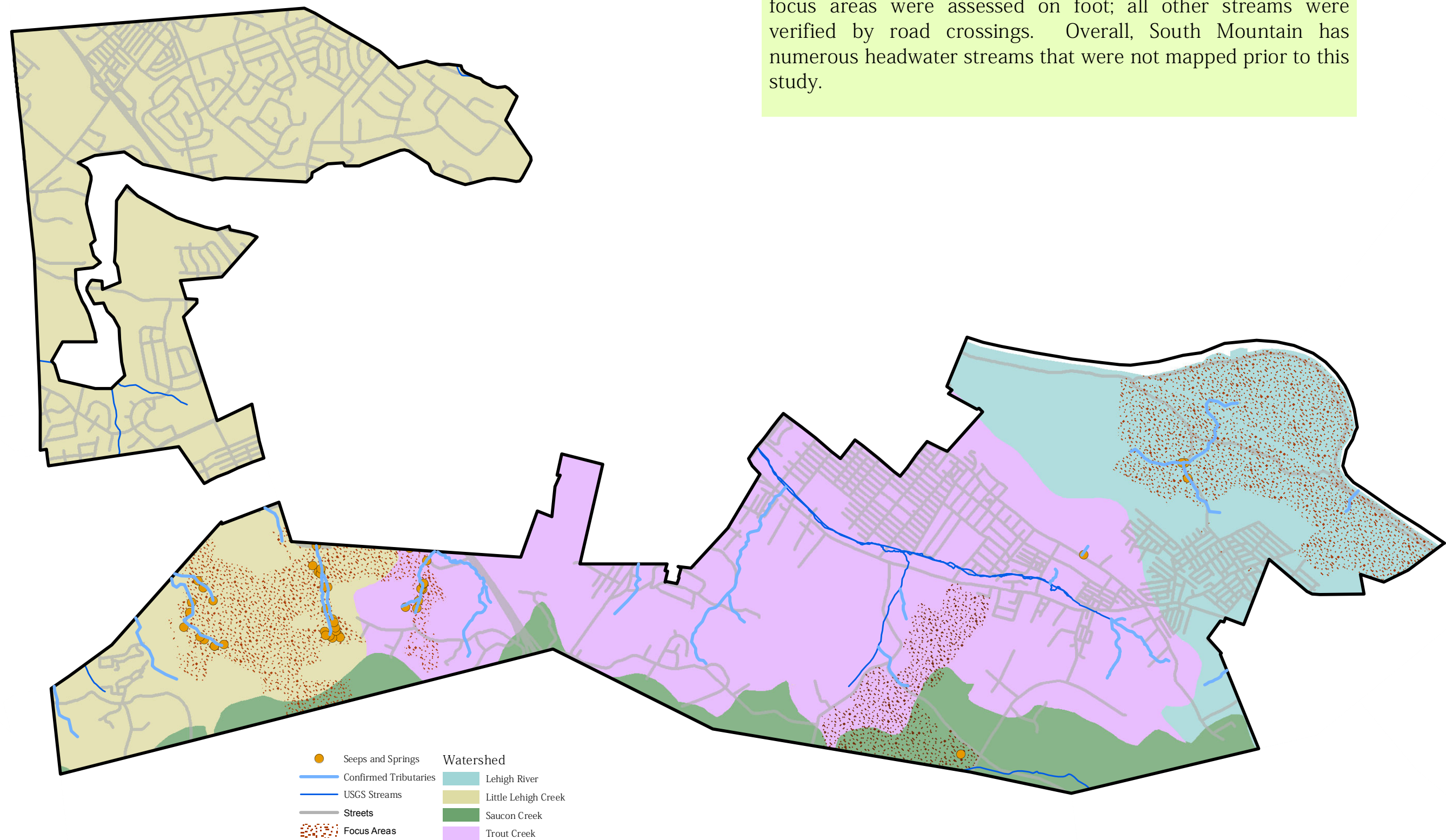
Subject to landowner access, each of these predicted features was "field checked" to see if the stream, seep, or spring, actually existed on the landscape.



SALISBURY TOWNSHIP Predicted Hydrography

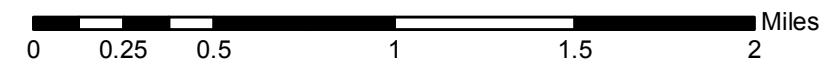


Subject to landowner access, each predicted stream, seep, and spring was confirmed in the field. Confirmed features are identified on this map. Streams and seeps within the highlighted focus areas were assessed on foot; all other streams were verified by road crossings. Overall, South Mountain has numerous headwater streams that were not mapped prior to this study.



SALISBURY TOWNSHIP

Field-verified Hydrography

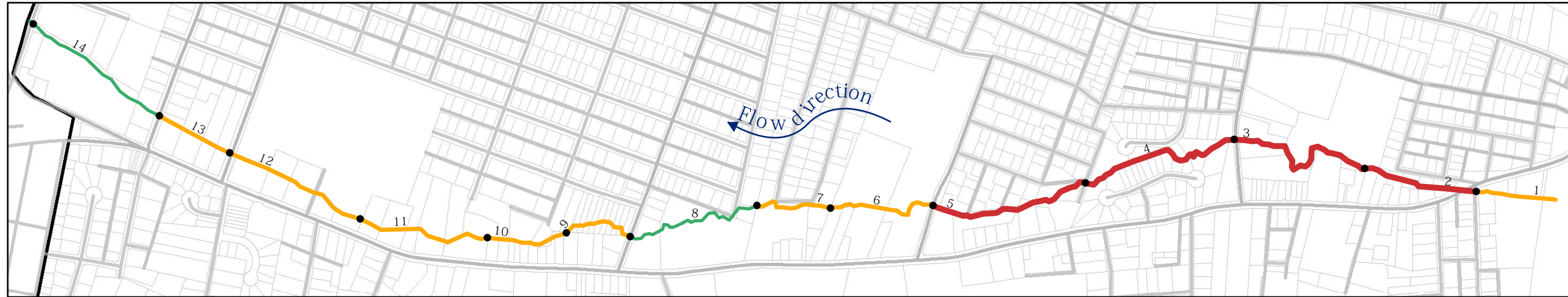


Riparian Zone Condition



The numbers along each stream segment correspond to the reach identification numbers in the visual assessment data sheets.

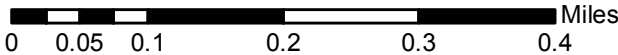
Floodplain Access



Hydrologic Alteration



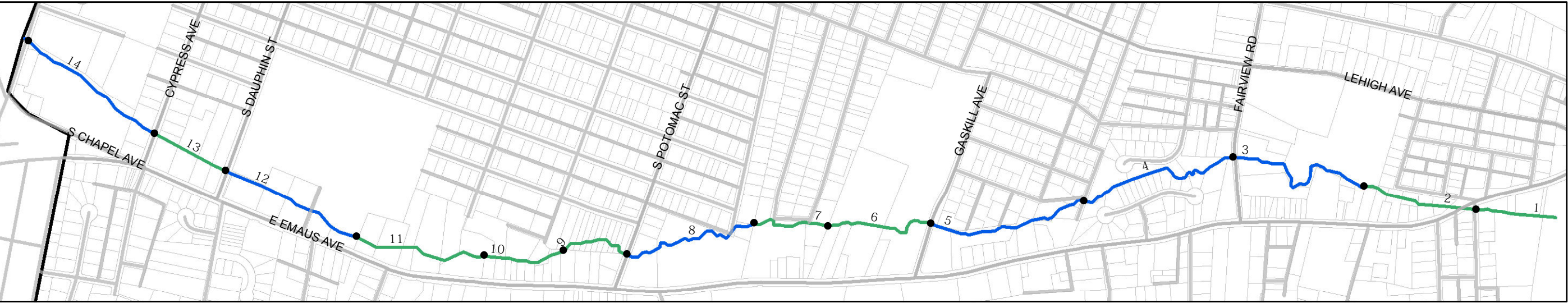
SALISBURY TOWNSHIP
Trout Creek Visual Assessment



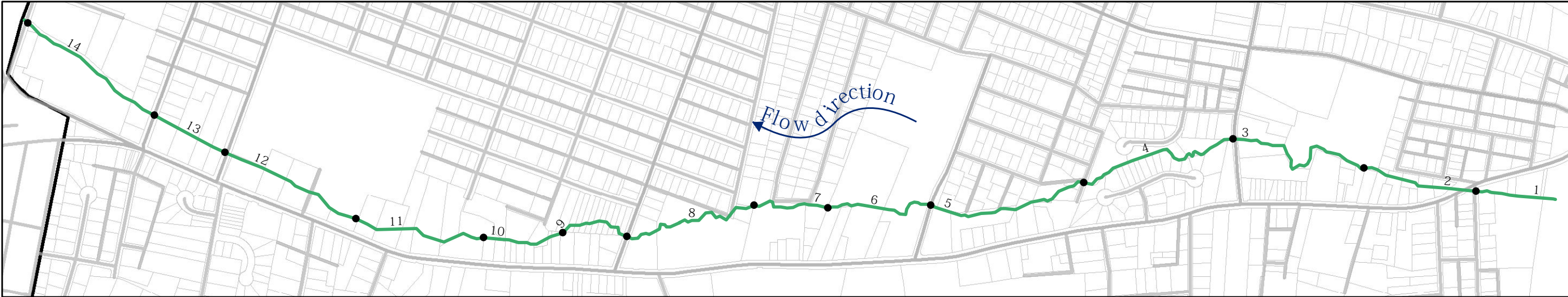
Scores — Excellent — Good — Fair — Poor



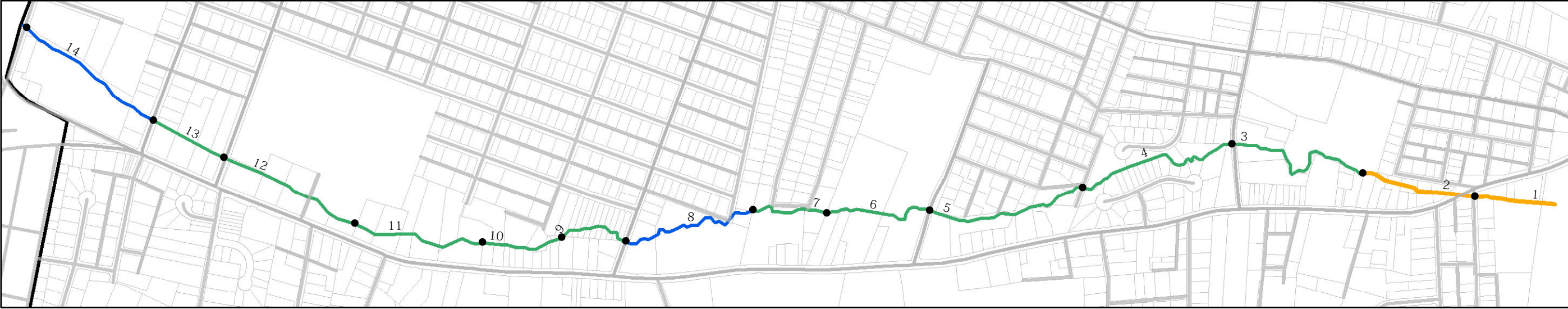
Canopy Cover



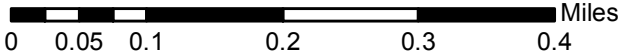
Nutrient Enrichment



Fish & Macroinvertebrate Habitat



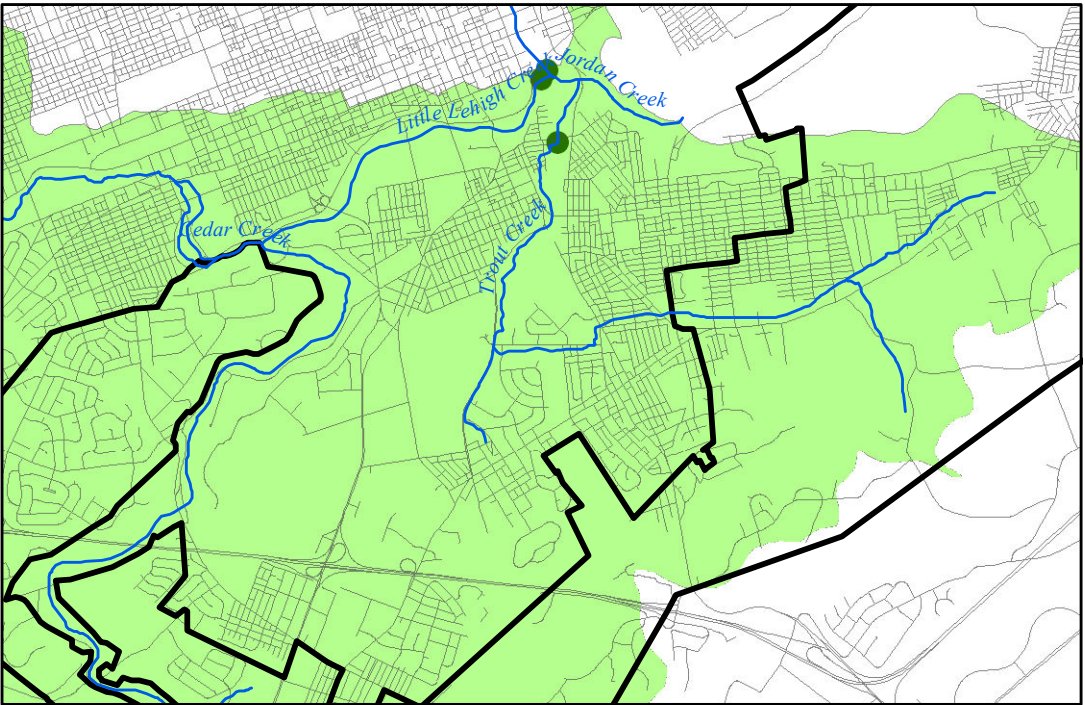
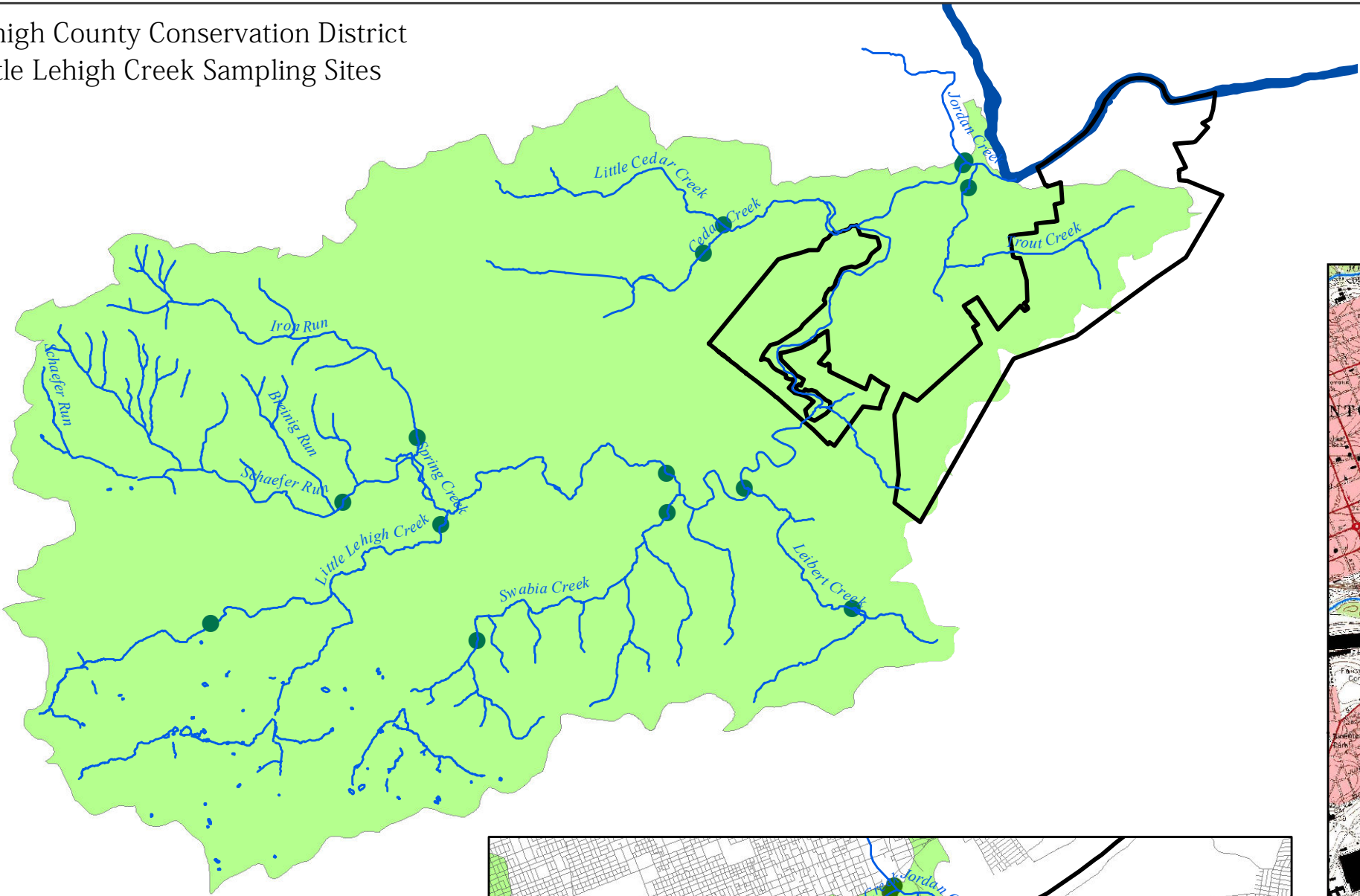
SALISBURY TOWNSHIP
Trout Creek Visual Assessment



Scores — Excellent — Good — Fair

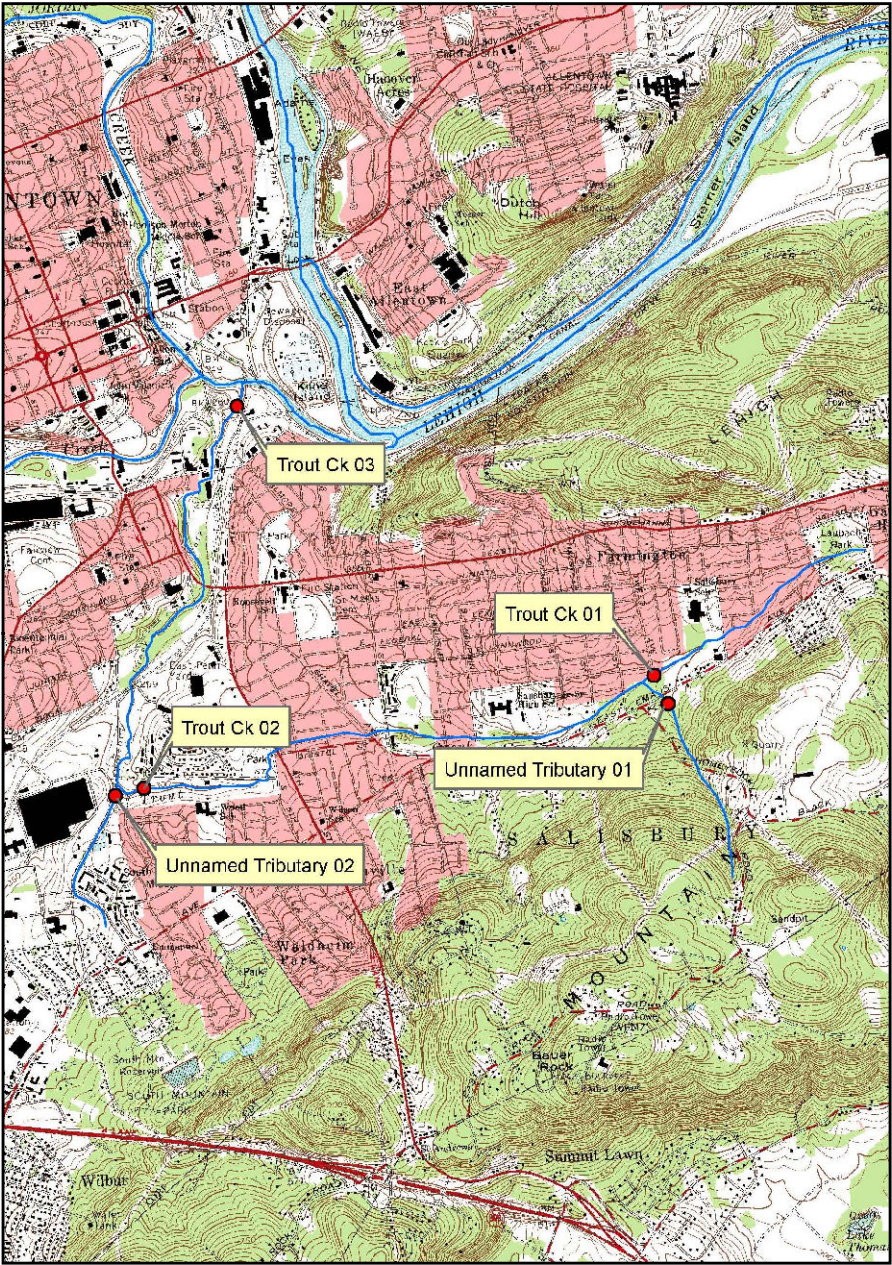


Lehigh County Conservation District
 Little Lehigh Creek Sampling Sites



- Sample Sites
- Streams
- ▭ Salisbury Township Boundary
- ▭ Rivers
- ▭ Little Lehigh Creek Watershed

PA DEP Sampling Sites



SALISBURY TOWNSHIP
 Water Quality Sampling Locations



SUPPLEMENTARY WATER QUALITY DATA

The following pages contain macroinvertebrate and water quality data for the Trout Creek.

Station: 13 SWRC#20	Sample Type: Kick in Riffles	Sample Name: Trout Creek Auburn Street	Subsample Fraction 4/28	Sample Date: April 2010 4/13/2010	Time of Sample: N/A 3:34
---------------------------	---------------------------------	----------------------------------------------	-------------------------------	-----------------------------------------	--------------------------------

Code Count	Tally	Taxon
1		Ephemeroptera
40		Siphonurus sp.
39		Isonychia sp.
2		Baetidae
63	63	Baetis
374		Centroptilum sp.
5		Pseudocloeon sp.
459		Heterocloeon
863		Acentrella
41		Tricorythodes sp.
42		Leptohyphes
7		Brachycercus sp.
8		Caenis sp.
988		Plauditus
9		Ephemera sp.
10		Hexagenia sp.
2465		Ephoron
36		Anthopotomus sp.
32		Leptophlebia sp.
510		Choroterpes
11		Ephemerellidae
19		Serratella sp.
2608		Teloganopsis sp.
2607		Serratella
23		Heptageniidae
462		Heptagenia grp.
24		Heptagenia
29		Maccaffertium sp.
463		Leucrocuta sp.
26		Nixe sp.
27		Rhithrogena sp.
520		Stenacron sp.
29		Stenonema sp.
48		Aeshnidae
53		Neurocordulia sp.
55		Gomphidae
56		Dromogomphus sp.
71		Ischnura sp.
72		Argia

Code Count	Tally	Taxon
57		Gomphus sp.
58		Libellulidae
62		Macromia sp.
63		Zygoptera
69		Coenagrionidae
70		Anomalagrion/Ischnura grp.
78		Plecoptera
86		Perlidae
87		Acroeneuria sp.
95		Agneta sp.
93		Paragnetina
91		Neoperla
1119		Pteronarcys
218		Corixidae
112		Corydalidae
2213		Corydalus
114		Nigronia sp.
117		Sialis sp.
477		Climacia sp.
121		Trichoptera
125		Glossosomatidae
127		Protophila sp.
149		Philopotamidae
150		Chimarra
629		Lype sp.
489		Psychomyia sp.
151		Polycentropodidae
154		Neureclipsis sp.
155		Nyctiophylax sp.
156		Phylocentropus sp.
157		Polycentropus sp.
128	2	Hydropsychidae
129	3	Cheumatopsyche sp.
514		Macrostemum sp.
9	9	Hydropsyche sp.

Data recorded by MCB on Aug 22 2010
this is a QA/QC sample these are QA/QC counts

Reviewed by _____ on _____ 2010
Computer entry by _____ on _____ 2010

Station:	Sample Type:	Sample Name:	Subsample Fraction	Sample Date:	Time of Sample:
13	Kick in Riffles	Trout Crk	4/28	April 2010	N/A
SWRC 20		Auburn Street		4/13/2010	3:34

Code	Count	Tally	Taxon
132			Hydroptilidae
133			Hydroptila sp.
488			Leucotrichia sp.
139			Leptoceridae
140			Ceraclea sp.
145			Oecetis sp.
146			Trienodes sp.
573			Mystacides sp.
138			Lepidostoma sp.
148			Pycnopsyche sp.
540			Neophylax sp.
123			Brachycentrus sp.
689			Helicopsyche
242			Petrophila sp.
171			Laccobius sp.
172			Tropisternus sp.
191			Dineutus sp.
192			Gyrinus sp.
193			Berosus sp.
2184			Psephenus sp.
743			Anchytarsus
190			Peltodytes
173			Elmidae
360			Ancyronyx
175			Dubiraphia sp.
359			Macronychus
493			Microcylloepus sp.
180			Optioservus sp.
981	2	2	Optioservus/Oulimnius
576			Promoresia
183			Stenelmis
243			Diptera
497			Blepharicera
244			Ceratopogonidae
245			Bezzia grp.
305			Empididae
366			Chelifera sp.
306			Hemerodromia sp.

Code	Count	Tally	Taxon
252			Simuliidae
253	6	6	Simulium sp.
907			Prosimulium sp.
258			Tabanus sp.
261			Tipulidae
263	6	6	Antocha sp.
498			Dicranota sp.
499			Erioptera sp.
500			Limonia sp.
501			Ormosia sp.
265	74	74	Chironomidae
444	3	3	Amphipoda
508			Gammaridae
317			Gammarus
509			Asellidae
318			Asellus
382	7	7	Isopoda
328	1	1	Acar
454			Bivalvia
329			Corbicula sp.
330			Sphaerium sp.
331			Unionidae
332			Gastropoda
507			Ancylidae (limpets)
348			Hirudinea (Leeches)
358			Helobdella sp.
389			Planariidae
347			Nematoda
349	91	91	Oligochaeta
739			Nemertea

Data recorded by MCB on Aug 22 2010
 this is a QA/QC sample these are QA/QC counts

Reviewed by _____ on _____ 2010
 Computer entry by _____ on _____ 2010

LAB ID: 39-00401
LAB ID: 08-00380

Benchmark Analytics, Inc.

4777 Saucon Creek Road
Center Valley, PA 18034

Phone: (610) 974-8100
Fax: (610) 974-8104

Work Order: 10081468

Laubach Park Tributary

SEND DATA TO:

NAME: Rebecca Kennedy
COMPANY: Lehigh County Conservation
ADDRESS: Lehigh County Agricultural Center, Suite 102
4184 Dorney Park Road
Allentown, PA 18104

WO#: 10081468

PAGE: 1 of 1

PO#:

PWS ID#

PHONE: (610) 391-9583
FAX: (610) 391-1131

TEST REPORT

Salisbury Township NRI

RECEIVED FOR LAB BY: MAK

DATE: 08/09/2010 15:55

Page 1 of 1

SAMPLE: TC1 Trout Creek Upstream

Lab ID: 10081468-001A

Grab

SAMPLED BY: Client

Sample Time: 08/09/2010 15:30

Test	Result	Method	Reg. Limit	Analysis Start	Analysis End	Analyst *
Ammonia-N	< 0.05 mg/L	EPA 350.1		08/11/10 9:10	08/11/10	SKK-CV
Nitrogen, Nitrate-Nitrite	0.62 mg/L	EPA 353.2		08/13/10 10:05	08/13/10	SKK-CV
Phosphorus	< 0.05 mg/L	SM4500P BE		08/12/10 10:05	08/12/10	VHL-CV
Nitrogen, Kjeldahl, Total	< 0.5 mg/L	EPA 351.2		08/11/10 12:50	08/13/10	SKK-CV

SAMPLE: TC2 Trout Creek Downstream

Lab ID: 10081468-002A

Grab

SAMPLED BY: Client

Sample Time: 08/09/2010 15:30

Test	Result	Method	Reg. Limit	Analysis Start	Analysis End	Analyst *
Ammonia-N	< 0.05 mg/L	EPA 350.1		08/11/10 9:10	08/11/10	SKK-CV
Nitrogen, Nitrate-Nitrite	0.02 mg/L	EPA 353.2		08/13/10 10:05	08/13/10	SKK-CV
Phosphorus	< 0.05 mg/L	SM4500P BE		08/12/10 10:05	08/12/10	VHL-CV
Nitrogen, Kjeldahl, Total	1.0 mg/L	EPA 351.2		08/11/10 12:50	08/13/10	SKK-CV

REMARKS:

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless otherwise noted on the Analytical Report.

* CV = Benchmark Analytics, Inc. Center Valley, PA; SA = Benchmark Analytics, Inc. Sayre, PA

MANAGER

Chir Mela

DATE: 8/16/2010

Trout Creek Water Quality Data

Baseflow																
Date	Time	Temperature (°C)	pH	pHmV (mV)	ORP (mV)	Conductivity (mS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	TDS (g/L)	Salinity (ppt)	TSS	Ammonia-N	Ortho-P	Phosphorus	P Dissolved	
12/8/2009	2:39 PM	9.11	8.8	-62	270	0.592	1.2	10.47	0.379	0.3	< 5	< 0.05	< 0.05	< 0.05	< 0.05	
Storm Event																
Date	Time	Temperature (°C)	pH	pHmV (mV)	ORP (mV)	Conductivity (mS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	TDS (g/L)	Salinity (ppt)	TSS	Ammonia-N	Ortho-P	Phosphorus	Dissolved P	
8/13/2010	10:49 AM	17.15	8.25	-60	219	0.551	4.4	10.99	0.352	0.3	<5	<0.05	<0.05	<0.05	<0.05	
9/28/2010	2:10 PM	21.1	8.19	-47	219	0.17	39.3	8.78	0.111	0.1	12	<0.05	<0.05	0.06	<0.05	
9/30/2010	12:55 PM	19.5	8.26	-51	195	0.239	183	8.5	0.155	0.1	150	0.06	0.014	0.15	0.08	

BIRDS OF THE LEHIGH RIVER AREA

The following pages contain lists of birds identified by Mark Boyd, from the Lehigh Valley Audubon Society, in Lehigh Canal Park, Walking Purchase Park and Lehigh Mountain.

BIRDS OF THE LEHIGH RIVER AREA - ALLENTOWN AND SALISBURY TOWNSHIP
LEHIGH CANAL PARK, WALKING PURCHASE PARK, LEHIGH MOUNTAIN
 Compiled by Mark R. Boyd

Most birds are migratory, therefore their seasonal occurrence is coded as follows:

SEASON

Sp Spring March - May
S Summer June - August
F Fall September - November
W Winter December - February

Relative Abundance and Status

a abundant a species which is very numerous
c common likely to be seen or heard in suitable habitat
u uncommon present, but not likely to be seen or heard
o occasional seen or heard only a few times during the season
r rare may be present, but not every year
 * birds known to nest in or near the area
 ** irregular, presumed, or recent former breeder

	Sp	S	F	W
Waterfowl				
Snow Goose	o		o	o
Cackling Goose				r
Canada Goose*	a	a	a	a
Tundra Swan			r	
Wood Duck*	c	u	u	
Gadwall				r
American Wigeon	r			
American Black Duck	o		o	o
Mallard*	a	a	a	a
Northern Pintail			r	
Ring-necked Duck				r
Lesser Scaup	r		r	r
Black Scoter			r	
Bufflehead	r		r	r
Common Goldeneye				r
Hooded Merganser	r		r	r
Common Merganser*	c	c	c	c
Ruddy Duck			r	
Upland Game Birds				
Ring-necked Pheasant	r	r	r	r
Wild Turkey*	u	u	u	u
Loons to Cormorants				
Common Loon			o	
Pied-billed Grebe	r	r	r	
Red-necked Grebe	r			r
Double-crested Cormorant	c	r	o	r
Great Cormorant			r	

Bitterns to Vultures

Great Blue Heron**	u	u	u	u
Great Egret	r	o	r	
Green Heron**	u	u	u	
Black-crowned Night-Heron		r		
Black Vulture**	u	u	u	u
Turkey Vulture*	c	c	c	c

Diurnal Raptors

Osprey**	u	o	u	
Bald Eagle**	u		u	u
Northern Harrier	r		r	r
Sharp-shinned Hawk	u		u	u
Cooper's Hawk*	u	u	u	u
Broad-winged Hawk	o		o	
Red-tailed Hawk*	c	u	c	c
American Kestrel	o		o	o
Merlin			o	r
Peregrine Falcon*	o	o	o	o

Rails to Cranes

None

Shorebirds

Killdeer*	c	c	u	
Spotted Sandpiper*	c	c	u	
Solitary Sandpiper	o		r	
Semipalmated Sandpiper		r		
Least Sandpiper		r		
Pectoral Sandpiper		r		
Stilt Sandpiper		r		
American Woodcock*	u	u	u	

Gulls and Terns

Ring-billed Gull	o		o	c
Herring Gull	o		o	c
Lesser Black-backed Gull	o		o	c
Glaucous Gull				r
Great Black-backed Gull				r
Least Tern		r		

Pigeons to Woodpeckers

Rock Pigeon	c	c	c	c
Mourning Dove	c	c	c	c
Yellow-billed Cuckoo*	u	u		
Eastern Screech-Owl*	u	u	u	u
Great Horned Owl*	u	u	u	u
Northern Saw-whet Owl			r	r
Common Nighthawk**	u	u	u	
Chimney Swift*	c	c	c	
Ruby-throated Hummingbird*	u	u	u	
Belted Kingfisher*	u	u	u	u
Red-bellied Woodpecker*	c	c	c	c
Yellow-bellied Sapsucker	u		u	u
Downy Woodpecker*	c	c	c	c
Hairy Woodpecker*	u	u	u	u
Northern Flicker*	c	c	c	c
Pileated Woodpecker*	o	o	o	o

Flycatchers to Vireos

Olive-sided Flycatcher	r		
Eastern Wood-Pewee*	c	c	c
Yellow-bellied Flycatcher	r		
Willow Flycatcher	r		
Least Flycatcher	r		
Eastern Phoebe*	c	u	c
Great Crested Flycatcher*	u	u	u
Eastern Kingbird*	c	c	c
White-eyed Vireo*	u	u	u
Yellow-throated Vireo	u	r	o
Blue-headed Vireo	u		o
Warbling Vireo*	c	u	u
Philadelphia Vireo	r		r
Red-eyed Vireo*	c	c	c

Jays to Wrens

Blue Jay*	c	c	c	c
American Crow*	c	c	c	a
Fish Crow	o		o	o
Common Raven	r			
Tree Swallow*	c	u	c	
Northern Rough-winged Swallow*	c	a	a	r
Bank Swallow**	o	r	o	
Cliff Swallow	r			
Barn Swallow*	c	c	c	
Black-capped Chickadee*	c	c	c	c
Tufted Titmouse*	c	c	c	c
Red-breasted Nuthatch	o		o	o
White-breasted Nuthatch*	c	c	c	c
Brown Creeper	u		u	u
Carolina Wren*	c	c	c	c
House Wren*	c	c	c	
Winter Wren	o		o	o
Marsh Wren			r	

Kinglets to Waxwings

Golden-crowned Kinglet	u		u	u
Ruby-crowned Kinglet	u		u	r
Blue-gray Gnatcatcher*	c	c	u	
Eastern Bluebird	r		r	
Veery*	u	u	u	
Gray-cheeked Thrush	r			
Bicknell's Thrush	r			
Swainson's Thrush	o		r	
Hermit Thrush	u		u	o
Wood Thrush*	c	c	c	
American Robin*	a	a	a	c
Gray Catbird*	a	a	c	r
Northern Mockingbird*	c	c	c	c
Brown Thrasher*	u	u	u	
European Starling*	a	a	a	a
Cedar Waxwing*	c	c	c	c

Warblers				
Blue-winged Warbler*	o	o		
Tennessee Warbler	u		u	
Nashville Warbler	u		u	
Northern Parula	u		u	
Yellow Warbler*	c	c	u	
Chestnut-sided Warbler	u		u	
Magnolia Warbler	u		u	
Cape May Warbler	u		u	
Black-throated Blue Warbler	u		u	
Yellow-rumped Warbler	c		c	r
Black-throated Green Warbler	c		c	
Blackburnian Warbler	u		u	
Yellow-throated Warbler**	u	u		
Palm Warbler	c		u	
Bay-breasted Warbler	u		u	
Blackpoll Warbler	c		u	
Cerulean Warbler	u			
Black-and-white Warbler**	c	u	c	
American Redstart*	c	c	c	
Prothonotary Warbler			r	
Worm-eating Warbler*	c	u		
Ovenbird*	c	u	u	
Northern Waterthrush	r		r	
Louisiana Waterthrush**	u	u	o	
Kentucky Warbler	r			
Mourning Warbler	u		u	
Common Yellowthroat*	c	c	u	
Hooded Warbler	u		u	
Wilson's Warbler	r		r	
Tanagers to Buntings				
Scarlet Tanager*	c	c	u	
Eastern Towhee*	c	c	c	r
American Tree Sparrow	o		o	o
Chipping Sparrow*	c	c	c	
Field Sparrow**	o	o	o	r
Savannah Sparrow			r	
Fox Sparrow	u		u	
Song Sparrow*	c	c	c	c
Lincoln's Sparrow			r	
Swamp Sparrow			o	
White-throated Sparrow	c		c	c
White-crowned Sparrow				o
Dark-eyed Junco	c		c	c
Northern Cardinal*	c	c	c	c
Rose-breasted Grosbeak*	u	u	u	
Indigo Bunting*	u	u	u	
Blackbirds to Finches				
Red-winged Blackbird*	c	c	c	r
Common Grackle*	c	c	c	r
Brown-headed Cowbird*	c	c	c	r
Orchard Oriole*	u	u	u	
Baltimore Oriole*	c	c	u	
Purple Finch			r	
House Finch*	u	u	u	u
Pine Siskin				r
American Goldfinch*	c	c	c	u
Old World Sparrows				
House Sparrow*	c	c	c	c