TROUT BROOK WATERSHED BACKGROUND REPORT

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Trout Brook Watershed Background Report

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Introduction

In order to gain a better understanding of a particular watershed and the fluvial processes that occur within its boundaries, many aspects must be examined. Compiling historical and current data is a critical step in determining what natural and anthropogenic influences are causing changes and impairments to the watershed. These factors are also important in determining which remediation techniques, if any, are the most beneficial for the area. Topography, soil distribution, soil erodibility, hydrology and geology all impact and are impacted by changes within a watershed. Land use, including agriculture, land development and land alteration, are also factors that must be taken into account when studying a watershed.

The purpose of this report is to present to the general public and any interested party a complete and in depth review of the history and background of aspects that are related to the Trout Brook watershed. This document is produced in accordance with the Upper Susquehanna Coalition's NFWF I-4 project (#49592), which aims to identify and implement cost effective floodplain and stream channel improvements. This project aims to engage local landowners and municipalities to promote community awareness and understanding of flooding and stream stability. The information collected for this report has come from numerous sources including the Upper Susquehanna Coalition (USC), Susquehanna River Basin Commission (SRBC), USDA Natural Resource Conservation Service (NRCS), United States Department of Environmental Protection (EPA), US Census Bureau, Federal Emergency Management Agency (FEMA), New York State Department of Environmental Conservation (NYS DEC), US Geological Survey (USGS), National Oceanic & Atmospheric Administration (NOAA), Cornell University, EPA, NYS Department of Transportation (NYS DOT) , U.S. Army Corp of Engineers, U.S. Fish and Wildlife Services and the Southern Tier Central Regional Planning and Development Board.

Background

A watershed is defined as an area of land that drains into a stream, river, lake or other waterway system. Watershed characteristics are not only important to water quality, but are directly related to the fluvial processes (stream) that allow the water to drain from the basin. Streams, rivers and other waterways provide essential habitat and water distribution.

Rivers and streams are dynamic and naturally migrate over time. Streams react to changes in the watershed and should eventually create their stable dimension and slope. Environmental stress placed on a watershed by humans or other natural events can alter the stability, pattern or profile of the channel causing the stream to become unstable or impaired. Instability can cause an increase in sediment deposition to occur (aggradation), as well as scouring of the streambed (degradation). These changes, along with excessive erosion of stream banks, can lead to stream impairment. Channel instability can result in a change in total sediment load carried by the stream which leads to further aggradation (deposition) and degradation (erosion).

All impacts within the watershed must be considered whether it is direct human impacts or more discrete natural changes over time. These impacts may be exacerbated by a large storm event or may not be obvious until they are further examined. Studying an entire watershed, upstream and downstream from any particular point, allows for a more comprehensive understanding of the changes the watershed has gone through or may encounter in the future.

Flooding is the most frequent natural disaster in Central New York and the Northeastern United States. During a flood, water that has overtopped the main stream channel will flow onto the floodplain. A floodplain is a relatively flat area adjacent to a stream that extends to the valley walls that contain the stream. Flooding is a natural process and is essential to stream health. When water from a stream channel overtops its banks onto the floodplain, it dissipates energy and reduces erosion within the channel. While flooding may pose a risk to buildings, infrastructure, crops, and lives; floods also deposit clay and silt onto floodplains making them fertile areas for agricultural development. Flooding may occur for many reasons including intense or long-term rain fall, snowmelt, dam or stream bank failure, or increased runoff from storm sewers and urban surfaces.

Physical Description

New York State is broken into 17 different watersheds with Trout Brook (HUC12-020501020401) being in the Upper Susquehanna Watershed which eventually drains into the Chesapeake Bay. In the New York portion of the Upper Susquehanna Watershed, there are approximately 17,000 miles of streams; 72 of which being Trout Brook and its tributaries.

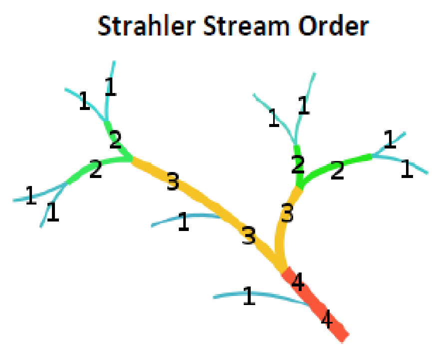
Tributaries

The Trout Brook watershed is completely within Cortland County and has a drainage area of 40.2 square miles (25,722 acres) where it empties into the Tioughnioga River. The watershed can be broken into two main streams (Trout Brook and Smith Brook) with four larger tributaries: Pritchard Brook, North Brook, Maybury Brook and Mosquito Creek as well as numerous other small tributaries. The watershed also includes small wetland areas, farm ponds and natural springs that feed into the drainage area. The streams of the Trout Brook watershed are broken down by drainage area, total length and sub-basins in Table 1: Trout Brook Sub-Basins and Areas.

Trout Brook Sub-Basins	Watershed Area (mi²)	Stream Length (mi)	% of Watershed
Pritchard Brook	2.35	4.12	5.8
North Brook (Tributary A)	6.05	12.45	15.1
Tributary B (Unnamed)	1.59	2.34	4.0
Maybury Brook (Tributary C)	4.01	6.94	10.0
Tributary D (Unnamed)	1.38	2.25	3.4
Mosquito Creek (Tributary E)	3.86	6.32	9.6
Tributary F (Unnamed)	2.19	4.71	5.4
Smith Brook	9.29	14.95	23.1
Trout Brook and Minor Tributaries	9.48	17.4	23.6
TOTAL	**40.19**	**71.48**	

Table 1: Trout Brook Sub-Basins and Areas

Stream Order



Stream order classification is the process of numbering a stream (or ordering) based on where the stream originates within a watershed and based on the other streams that it encounters. A stream that has no input upstream of its beginning is considered the headwaters and a first order stream. Any stream confluence of two streams of the same order then changes the downstream segment to the next highest stream order. For example, if two first order streams come together, the remaining downstream segment is then considered second order and so on. This system of stream ordering was developed by Arthur Newell Strahler in 1952.

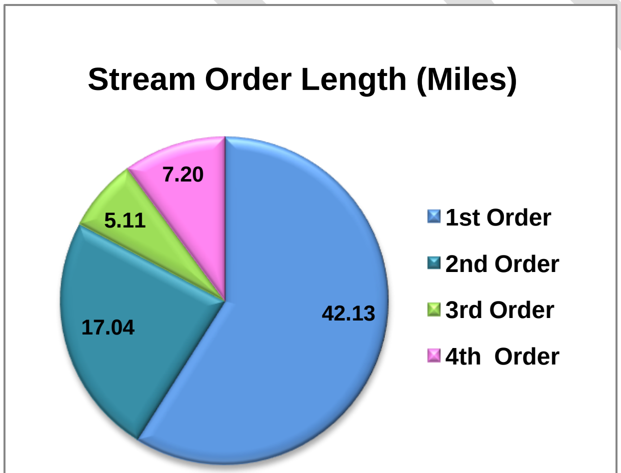


Figure 1: Trout Brook Stream Order Lengths

Within the Trout Brook watershed, there are many stream confluences that change the order of the stream system. The total length of first order streams is 42.1 miles (59.0% of the total stream length). Second order streams make up 17.0 miles (23.8% of the total stream length), third order streams 5.1 miles (7.1% of the total stream length) and fourth order streams 7.2 miles (10.1% of the total stream length) (shown in Figure 1: Trout Brook Stream Order Lengths). It is important to understand the order of streams to determine drainage area, headwater location and other factors that are used in studying a watershed.

Classification of Waters

The Trout Brook watershed has been classified as a Class C stream which means the best use for the waterway is for fishing as set forth by the NYS Department of Environmental Conservation (DEC). There are areas within the watershed that also have a Standard of T or TS. The lower portion of Trout Brook from above the Village of McGraw to the Tioughnioga River is also considered navigable by the DEC.

All waters of the state are provided a class and standard designation based on existing or expected best usage of each water or waterway segment by NYS DEC.

- The classification AA or A is assigned to waters used as a source of drinking water.
- Classification B indicates a best usage for swimming and other contact recreation, but not for drinking water.
- Classification C indicates a best usage of fishing and suitable for non - contact activities.
- The lowest classification and standard is D indicates a best usage of fishing, but these waters will not support fish propagation.

Waters with classifications A, B, and C may also have a standard of (T), indicating that it may support a trout population, or trout spawning (TS). Special requirements apply to sustain these waters that support these valuable and sensitive fisheries resources.

Hydrology

Hydrology is the study of water movement, distribution, occurrence and its properties. The science of hydrology compares all of these aspects to one another and defines how they interact with the environment throughout all phases of the hydrological cycle. The hydrologic cycle, better known as the water cycle, is the process by which water moves from the surface of the earth, into the atmosphere and then back to the surface. This cycle is highlighted in three stages: evaporation, transpiration and precipitation. Climatic changes including rainfall intensity and storm events also play a role in the functioning of the hydrologic cycle.

Understanding the hydrology of the Trout Brook watershed is a very important part of understanding the watershed as a whole. The movement of water through the watershed influences the stability of its streams, wetlands and floodplains. There are many pathways that water takes as it travels across the landscape. The importance of groundwater is often overlooked, but in fact we are incredibly dependent upon water that moves beneath the Earth's surface. A vast majority of residents in Cortland County get water from wells (aquifer) compared to other areas which use lakes and reservoirs. People further downstream from

Trout Brook, in the Susquehanna River watershed, use the Susquehanna River as a drinking water supply after treatment.

Currently and historically, there are no stream flow gauging stations in the Trout Brook watershed. The Susquehanna River Basin Commission (SRBC) does have a Remote Water Quality Monitoring Station which is part of a larger network throughout northern Pennsylvania and New York within the Susquehanna River watershed. The Trout Brook real time monitoring station collects temperature, pH, conductivity, turbidity and dissolved oxygen. SRBC's mission is to enhance public welfare through comprehensive planning, water supply allocation, and management of the water resources of the Susquehanna River Basin.

The below watershed information was calculated by the USGS StreamStats program. This program calculates the watershed size from a particular point, estimated flows for various storm events, as well as bankfull storm and channel dimension information.

Bankfull Statistics Flow Report [Bankfull Region 5 SIR2009 5144]

PII: Prediction Interval-Lower, Plu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PII	Plu
Bankfull Area	226	ft^2	115	442
Bankfull Depth	3.25	ft	1.71	6.17
Bankfull Streamflow	1070	ft^3/s	304	3760
Bankfull Width	70.9	ft	35.1	143

Peak-Flow Statistics Parameters [2006 Full Region 4]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	40.2	square miles	0.61	3941
SLOPERATIO	Slope Ratio NY	0.079	dimensionless	0.006	0.438
STORAGE	Percent Storage	0.43	percent	0	7.75
MAR	Mean Annual Runoff in inches	25.8	inches	19.84	26.09

Peak-Flow Statistics Flow Report [2006 Full Region 4]

PII: Prediction Interval-Lower, Plu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SE	SEp	Equiv. Yrs.
1.25 Year Peak Flood	1350	ft^3/s	29.4	29.4	3.1
1.5 Year Peak Flood	1620	ft^3/s	28.8	28.8	2.6
2 Year Peak Flood	1950	ft^3/s	27.9	27.9	2.5
5 Year Peak Flood	2810	ft^3/s	24.7	24.7	4.2
10 Year Peak Flood	3400	ft^3/s	23.1	23.1	6.5
25 Year Peak Flood	4180	ft^3/s	22	22	9.9
50 Year Peak Flood	4770	ft^3/s	21.6	21.6	12.6
100 Year Peak Flood	5390	ft^3/s	21.6	21.6	15
200 Year Peak Flood	6000	ft^3/s	21.7	21.7	17.1
500 Year Peak Flood	6820	ft^3/s	22.4	22.4	19.4

Table 2: USGS StreamStats for Trout Brook showing estimated storm event flows and dimensions

Climate

New York State experiences a four season climate that is dictated by weather patterns that move across the country. The Trout Brook watershed is located in Central New York and is affected by numerous weather systems that sweep easterly across the Great Lakes and Northward up the east coast. During the winter months, the Great Lakes provide a large source of moisture leading to heavy snow storms. Some of these storms have the ability to drop large amounts of snow and ice in the area. The spring provides numerous heavy rain events some of which cause flash floods and multiple high water events each year. The water levels in the watershed are dependent upon these rain events and snow melt for recharge and consistency to maintain flow.

The summer months in upstate New York are warm and humid. Due to these warmer temperatures, the atmosphere has the capacity to hold more water in the vapor state. The fall months are more moderate and tend to have more rain events than in the summer but less than in the spring. Weather systems typically move easterly across the United States bringing weather patterns with alternating high-low pressure systems. These systems have the ability to change the weather daily as well as bring along numerous storm fronts throughout the year. Table 3 shows historical climate data for Cortland County from 1981-2010.

Historical Climatic Data for Cortland County 1981-2010 (°F)							
Month	Average Daily Temp	Average Minimum Temp	Average Maximum Temp	Average Precipitation (in.)	Average Snowfall (in.)	Heating Degree Days	Cooling Degree Days
January	22.6	14.9	30.3	2.62	22.4	1314	0
February	24.5	15.7	33.3	2.47	19.4	1134	0
March	32.3	23.3	41.3	3.07	14	1014	0
April	45	35	55.1	3.17	3.8	601	2
May	56.5	45.7	67.4	3.25	0	286	24
June	65.8	55.2	76.5	4.01	0	76	102
July	70.1	59.5	80.7	3.94	0	17	175
August	68.5	57.3	79.8	3.07	0	33	143
September	59.9	48.9	71	3.78	0	190	38
October	49	38.9	59.1	3.37	0.4	498	2
November	39	31.3	46.8	3.47	9.3	779	0
December	28.3	21.6	35	3.43	21	1138	0
Year	46.8	37.3	56.4	39.65	90.3	7080	486

Table 3: Climatic Data Cortland County (Data collected at the Cortland, NY NOAA weather station)

Geology

The local geology and soils distributed throughout the Trout Brook watershed directly affect the behavioral characteristics of the drainage basin. The structure and composition of the geologic features directly influence the characteristics of the drainage basin as well. Erosion, stability, and drainage are functions of the soil properties.

During the late Devonian Period (358.9-419.2 million years ago); a shallow marine sea covered the region. The sedimentary deposits of the shallow marine sea (Catskill Delta) formed the siltstone and shale bedrock which is part of the larger Alleghany Plateau. The Alleghany Plateau was formed by uplift during the late Cenozoic, (66 million years ago to present). After this uplift, streams drained north towards Lake Ontario.

More recently, this region was subjected to multiple glaciation events during the Pleistocene Epoch, otherwise known as the Ice Age (1.6-0.1 million years ago). During peak glaciations, the narrow valleys, previously formed by the dissection of streams, were broadened and deepened to form U-shaped valleys. The glaciation events deposited glacial till throughout the Trout Brook watershed. Till is typically a non-stratified mass of unsorted debris that contains angular particles composed of a wide variety of rock types.

After peak glaciation, the watershed was subject to deglaciation (retreat of glacier) which deposited vast amounts of outwash deposits of sand and gravel within the valley walls 14 thousand years ago. Deglaciation also deposited large amounts of lacustrine (lake) deposits of silt as a result of the glacier blocking the North-South draining valleys. The damming caused by the glacier resulted in the erosion of the drainage divides to the south, making the previously north draining basins now drain south.

The siltstone and shale bedrock is exposed along some road cuts and steep valley walls and range from 1-3 meters in thickness. The exposed shale is significantly weathered and consists of many joints that decrease in abundance with depth. Overlying the shale and siltstone bedrock are the peak glacial deposits of till. The deposited till is a non-stratified mixture of clay, silt, sand, gravel, and boulders that vary in thickness and permeability.

Within the valleys above the peak glacial deposits of till are lacustrine deposits of silt and clay varying in thickness (27-47 meters) and pinch out towards the valley walls. Overlaying the lacustrine sediments are outwash sands and gravels. These deposits are well-sorted, stratified sands and gravels deposited from glacial fluvial action beyond the margin of the active glacier. There are variable amounts of silt contained within these deposits and typically range in thickness from 1-10 meters.

These glacial events have created numerous aquifers that have become the sole water source for the residents, farms and businesses that are within the watershed.

Aquifer and Groundwater

Throughout the Tioughnioga River valley and tributaries in Cortland County, there lay two underground aquifers that flow like a river. The upper aquifer is unconfined (hydraulically connected to surface water) and consists of sand and gravel. This is a productive aquifer and is the principal water supply for most residents and communities in Cortland County and the Trout Brook watershed. The unconfined aquifer varies in depth ranging from 1 to 155 feet thick. In some locations in the valleys, surface water from rain or streams travels into this layer (aquifer recharge). In other locations, this aquifer also helps feed streams throughout the summer (aquifer discharge). Below the unconfined aquifer is a confining layer of denser material which limits movement (recharge) to the confined aquifer. The confined aquifer also varies in depth but has been found to be up to 170 feet thick. Figures 2 and 3 show an example of the configuration of the aquifers and how they interact with surface water. The two aquifers are sometimes connected as the confining layer has gaps, usually at the valley edge. The unconfined aquifer is much more vulnerable because of the shallow depth to water and high soil permeability.

The unconfined aquifer has been designated by the NYSDEC as a Primary Aquifer and by the U.S. Environmental Protection Agency (EPA) as a Sole Source Aquifer (SSA). Designation by the EPA affords protection to the aquifer under the Safe Drinking Water Act. According to the EPA, these designations are given to an aquifer when it "supplies at least fifty percent (50%) of

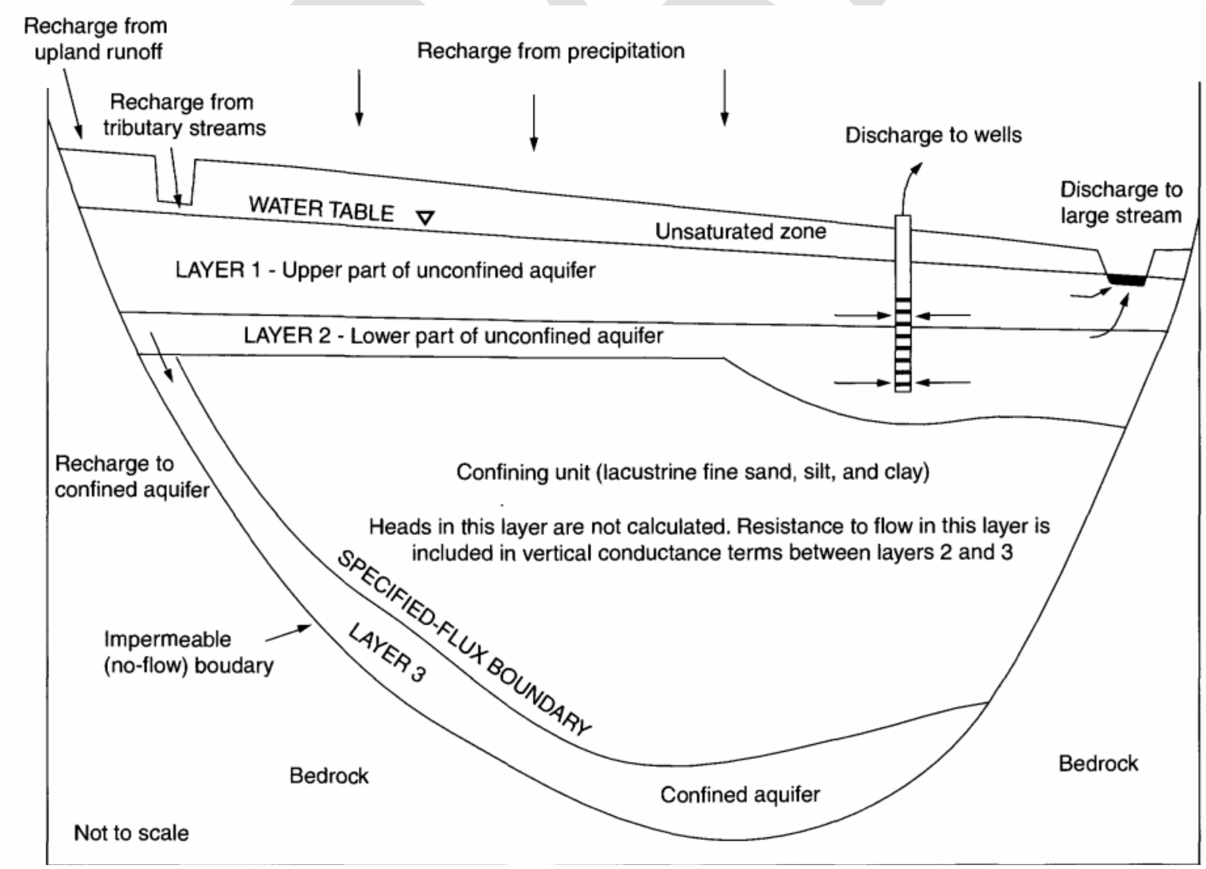


Figure 2: Conceptual model of ground-water flow in a glacial-aquifer system in Cortland, NY

the drinking water consumed in the area overlying the aquifer" and when there is no alternative drinking water source(s) which could "physically, legally, and economically supply all those who depend upon the aquifer for drinking water." SSA designation is one tool to protect drinking water supplies in areas with few or no alternative sources to the ground water resource, and where if contamination occurred, using an alternative source would be extremely expensive." There are relatively few EPA- designated SSAs in Upstate New York. A permit is required from the EPA for any federally-assisted project that could potentially contaminate the SSA.

Local municipalities have regulations protecting the aquifer and requiring a permit for development activities as well. The Village of McGraw has created a Groundwater Protection Overlay District, which is considered a Critical Environmental Area. Regulations to protect the village water supply define activities that are allowed and restrict developments that would threaten the aquifer. The protected groundwater area includes the valley and some of the contributing area to the aquifer up gradient of the municipally-owned wells. The Village of McGraw uses approximately 90,000 gallons per day. The Town of Cortlandville has created an Aquifer Protection District to protect their portion of the SSA. Cortlandville also has adopted regulations/restrictions for other primary aquifer, principal aquifer, tributary watershed (recharge), and wellhead protection areas.

Although groundwater can seem out of sight and out of mind, it is a valuable and vulnerable resource on which a significant portion of the residents in the Trout Brook watershed depend on for their drinking water.

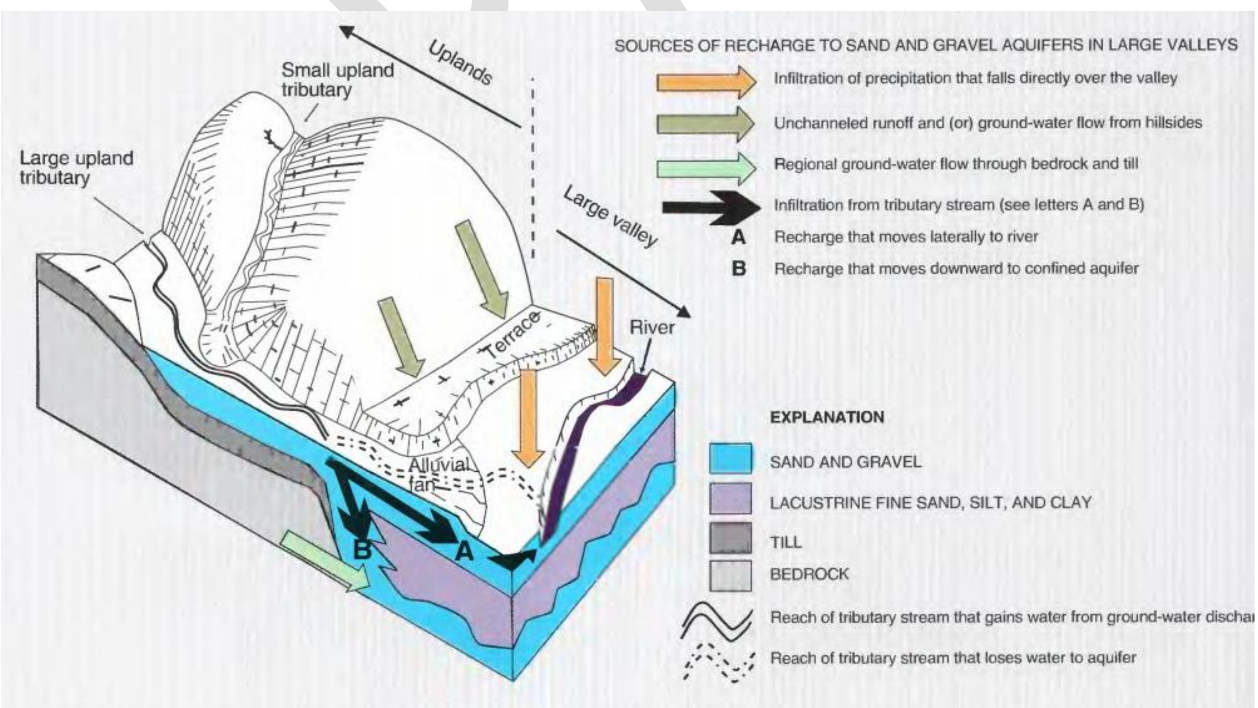
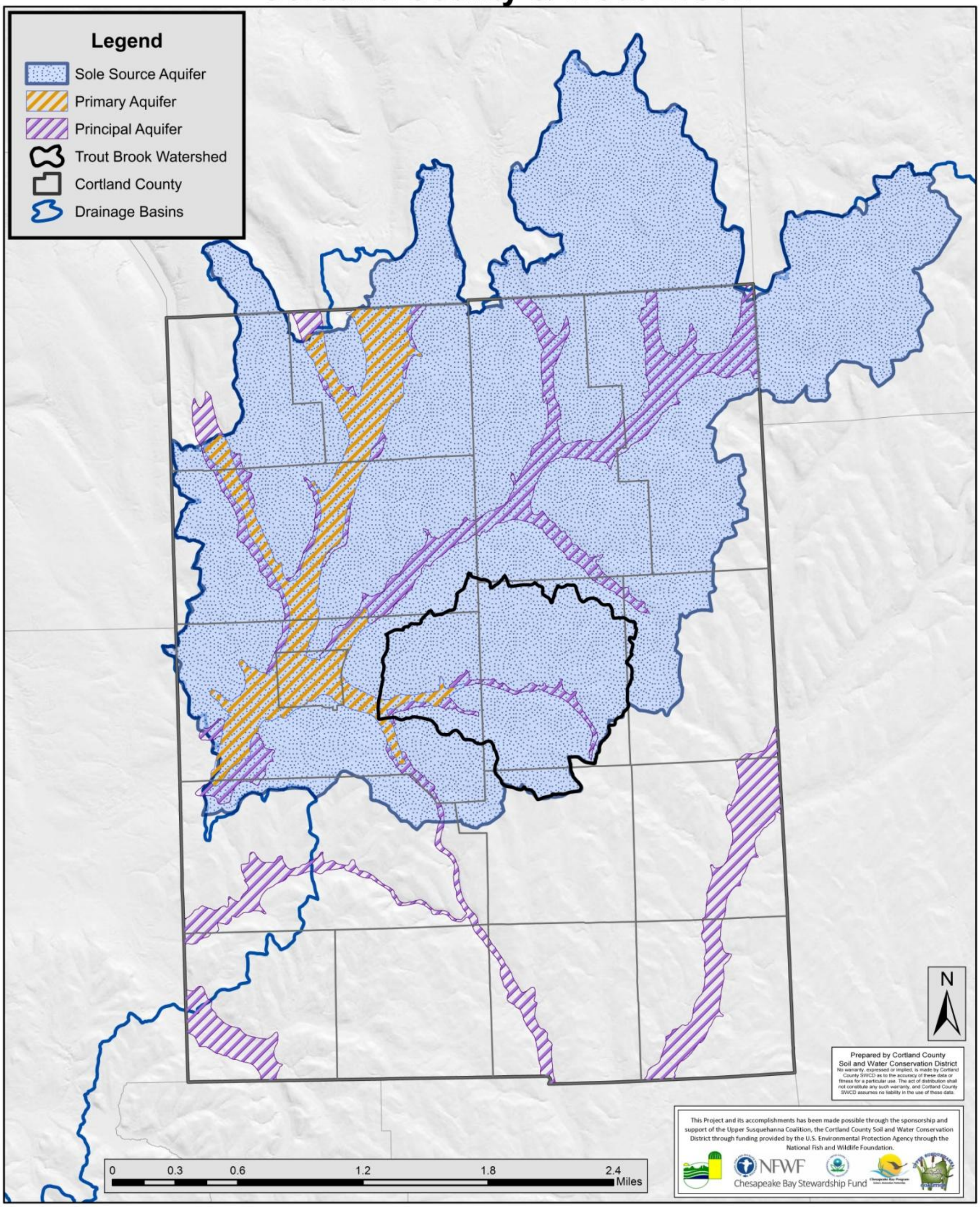


Figure 3: Sources of recharge to the glacial-aquifer system at Cortland County, NY

Sole Source, Primary & Principal Aquifers
Cortland County & Trout Brook



Soils

Soil identification plays a large role in surveying a watershed. Each soil type has a different hydraulic conductivity associated with it, and most soils are not found in the same areas. There are specific soils that have a higher importance when determining good or bad agricultural land and there are specific soils used to determine whether or not an area is considered a wetland. The indicators help ecologists, farmers and residential planners make the determinations needed to ensure proper land use and protection of areas that are of high value.

Table 4 below shows the breakdown of each soil type, acreage and percent of watershed that is found within the Trout Brook watershed. The most common found soil type is Ontusia channery silt loam, 2 to 8 percent slopes. This soil type makes up over 11% of the watershed and is considered a soil type of farmland importance by New York State. Table 5 details hydric soils of the watershed.

Map Unit Symbol	Map Unit Name	Acres	Percent	Square Miles
33A	Halsey mucky silt loam, 0 to 3 percent slopes	4.99	0.02	0.01
46A	Red Hook silt loam, 0 to 3 percent slopes	6.88	0.03	0.01
125D	Howard gravelly loam, 15 to 25 percent slopes	12.89	0.05	0.02
53B	Bath-Valois complex, 3 to 8 percent slopes	13.35	0.05	0.02
122B	Palmyra gravelly silt loam, 3 to 8 percent slopes	13.98	0.05	0.02
25C	Chenango gravelly silt loam, 8 to 15 percent slopes	14.93	0.06	0.02
125A	Howard gravelly loam, 0 to 3 percent slopes	16.7	0.06	0.03
76B	Tuller silt loam, 2 to 8 percent slopes	18.36	0.07	0.03
10A	Deposit gravelly silt loam, 0 to 3 percent slopes, occasionally flooded	21.23	0.08	0.03
34A	Fredon silt loam, 0 to 3 percent slopes	27.39	0.11	0.04
77A	Chippewa silt loam, 0 to 3 percent slopes	29.24	0.11	0.05
28A	Scio silt loam, 0 to 4 percent slopes	31.41	0.12	0.05
63B	Mardin channery silt loam, 3 to 8 percent slopes, slightly acid	32.54	0.13	0.05
210A	Phelps gravelly silt loam, 0 to 3 percent slopes	34.12	0.13	0.05
92A	Catden-Natchaug complex, 0 to 2 percent slopes	34.16	0.13	0.05
125C	Howard gravelly loam, 8 to 15 percent slopes	49.77	0.19	0.08
53C	Valois-Howard complex, 8 to 15 percent slopes	60.24	0.23	0.09
73B	Tuller silt loam, 2 to 8 percent slopes, cool phase	63.31	0.25	0.10
9A	Trestle gravelly silt loam, 0 to 3 percent slopes, occasionally flooded	65.75	0.26	0.10
22A	Allard silt loam, 0 to 4 percent slopes	67.18	0.26	0.10
124D	Lewbath channery silt loam, 15 to 25 percent slopes	67.25	0.26	0.11
75A	Alden silt loam, 0 to 3 percent slopes	70.69	0.27	0.11
126D	Ontusia channery silt loam, 15 to 25 percent slopes	74.1	0.29	0.12
52D	Valois channery silt loam, 15 to 25 percent slopes	79.41	0.31	0.12
124B	Lewbath channery silt loam, 3 to 8 percent slopes	83.2	0.32	0.13
124C	Lewbath channery silt loam, 8 to 15 percent slopes	84.09	0.33	0.13
53D	Valois-Howard complex, 15 to 25 percent slopes	86.84	0.34	0.14

Table 4: Soil types and areas for Trout Brook Watershed

Map Unit Symbol	Map Unit Name	Acres	Percent	Square Miles
25B	Chenango gravelly silt loam, 3 to 8 percent slopes	87.25	0.34	0.14
177A	Norchip silt loam, 0 to 3 percent slopes	89.33	0.35	0.14
6A	Wayland-Natchaug complex, 0 to 2 percent slopes, frequently flooded	89.91	0.35	0.14
52C	Valois channery silt loam, 8 to 15 percent slopes	93.75	0.36	0.15
W	Water	96.62	0.38	0.15
68D	Volusia channery silt loam, 15 to 25 percent slopes	106.63	0.41	0.17
53E	Valois and Howard gravelly loams, 25 to 40 percent slopes	114.24	0.44	0.18
134B	Bath channery silt loam, 3 to 8 percent slopes	125.17	0.49	0.20
125B	Howard gravelly loam, 3 to 8 percent slopes	126.94	0.49	0.20
52E	Valois channery silt loam, 25 to 40 percent slopes	139.85	0.54	0.22
7A	Geneseo silt loam, 0 to 3 percent slopes, occasionally flooded	155.83	0.61	0.24
69B	Erie silt loam, 2 to 8 percent slopes	156.07	0.61	0.24
25A	Chenango gravelly silt loam, 0 to 3 percent slopes	166.83	0.65	0.26
179B	Lordstown-Arnot complex, 3 to 8 percent slopes	169.21	0.66	0.26
69C	Erie silt loam, 8 to 15 percent slopes	179.05	0.70	0.28
134D	Bath channery silt loam, 15 to 25 percent slopes	191.66	0.75	0.30
5A	frequently flooded	194.15	0.75	0.30
134C	Bath channery silt loam, 8 to 15 percent slopes	206.32	0.80	0.32
63C	Mardin channery silt loam, 8 to 15 percent slopes, slightly acid	218.63	0.85	0.34
26B	Chenango channery silt loam, fan, 2 to 8 percent slopes	227.3	0.88	0.36
179C	Lordstown channery silt loam, 8 to 15 percent slopes	236	0.92	0.37
11A	Hemlock silt loam, 0 to 3 percent slopes, occasionally flooded	261.79	1.02	0.41
77B	Chippewa silt loam, 3 to 8 percent slopes	272.81	1.06	0.43
133E	Bath and Mardin soils, 25 to 40 percent slopes	304.91	1.19	0.48
177B	Norchip silt loam, 3 to 8 percent slopes	325.06	1.26	0.51
171F	Cadosia-Lordstown complex, 25 to 70 percent slopes, very stony	372.23	1.45	0.58
162D	Willdin channery silt loam, 15 to 25 percent slopes	373.35	1.45	0.58
1A	Udifluvents-Fluvaquents Complex, 0 to 3 percent slopes, frequently flooded	476.92	1.85	0.75
71F	Rockrift-Mongaup complex, 25 to 70 percent slopes, very stony	607.18	2.36	0.95
171D	Lordstown channery silt loam, 15 to 25 percent slopes, very stony	639	2.48	1.00
62B	Mardin channery silt loam, 2 to 8 percent slopes	723.37	2.81	1.13
68B	Volusia channery silt loam, 2 to 8 percent slopes	884.76	3.44	1.38
62D	Mardin channery silt loam, 15 to 25 percent slopes	937.71	3.65	1.47
162B	Willdin channery silt loam, 3 to 8 percent slopes	1207.47	4.69	1.89
162C	Willdin channery silt loam, 8 to 15 percent slopes	1223.1	4.76	1.91
68C	Volusia channery silt loam, 8 to 15 percent slopes	1275.92	4.96	1.99
79C	Mongaup channery silt loam, 8 to 15 percent slopes	1370.63	5.33	2.14
71D	Mongaup channery silt loam, 15 to 25 percent slopes, very stony	1622.89	6.31	2.54
79B	Mongaup-Hawksnest complex, 3 to 8 percent slopes	1655.79	6.44	2.59
62C	Mardin channery silt loam, 8 to 15 percent slopes	1739.62	6.76	2.72
126C	Ontusia channery silt loam, 8 to 15 percent slopes	2231.13	8.67	3.49
126B	Ontusia channery silt loam, 2 to 8 percent slopes	2881.64	11.20	4.50
	TOTALS	25722.02	100.00	40.19

Table 4 Continued: Soil types and areas for Trout Brook Watershed

Map Unit Symbol	Map Unit Name	Acres	Square Miles	Percent of Watershed	Hydric Group	Hydric Category
33A	Halsey mucky silt loam, 0 to 3 percent slopes	4.99	0.008	0.02	B/D	Hydric
75A	Alden silt loam, 0 to 3 percent slopes	70.69	0.110	0.27	C/D	Hydric
92A	Catden-Natchaug complex, 0 to 2 percent slopes	34.16	0.053	0.13	A/D (Cat), B/D (Natch)	Hydric
5A	Wayland soils complex, 0 to 3 percent slopes, frequently flooded	194.15	0.303	0.75	B/D	Predominantly Hydric
6A	Wayland-Natchaug complex, 0 to 2 percent slopes, frequently flooded	89.91	0.140	0.35	B/D	Predominantly Hydric
34A	Fredon silt loam, 0 to 3 percent slopes	27.39	0.043	0.11	B/D	Predominantly Hydric
77A	Chippewa silt loam, 0 to 3 percent slopes	29.24	0.046	0.11	D	Predominantly Hydric
77B	Chippewa silt loam, 3 to 8 percent slopes	272.81	0.426	1.06	D	Predominantly Hydric
177A	Norchip silt loam, 0 to 3 percent slopes	89.33	0.140	0.35	D	Predominantly Hydric
177B	Norchip silt loam, 3 to 8 percent slopes	325.06	0.508	1.26	D	Predominantly Hydric
1A	Udifluvents-Fluvaquents Complex, 0 to 3 percent slop	476.92	0.745	1.85	A/D	Partially Hydric
28A	Scio silt loam, 0 to 4 percent slopes	31.41	0.049	0.12	B/D	Predominantly Non-Hydric
46A	Red Hook silt loam, 0 to 3 percent slopes	6.88	0.011	0.03	B/D	Predominantly Non-Hydric
68B	Volusia channery silt loam, 2 to 8 percent slopes	884.76	1.382	3.44	D	Predominantly Non-Hydric
68C	Volusia channery silt loam, 8 to 15 percent slopes	1,275.92	1.994	4.96	D	Predominantly Non-Hydric
68D	Volusia channery silt loam, 15 to 25 percent slopes	106.63	0.167	0.41	D	Predominantly Non-Hydric
69B	Erie silt loam, 2 to 8 percent slopes	156.07	0.244	0.61	D	Predominantly Non-Hydric
69C	Erie silt loam, 8 to 15 percent slopes	179.05	0.280	0.70	D	Predominantly Non-Hydric
73B	Tuller silt loam, 2 to 8 percent slopes, cool phase	63.31	0.099	0.25	D	Predominantly Non-Hydric
76B	Tuller silt loam, 2 to 8 percent slopes	18.36	0.029	0.07	D	Predominantly Non-Hydric
126B	Ontusia channery silt loam, 2 to 8 percent slopes	2,881.64	4.503	11.20	D	Predominantly Non-Hydric
126C	Ontusia channery silt loam, 8 to 15 percent slopes	2,231.13	3.486	8.67	D	Predominantly Non-Hydric
126D	Ontusia channery silt loam, 15 to 25 percent slopes	74.10	0.116	0.29	D	Predominantly Non-Hydric
	Hydric Soils Area	9,523.91	14.881	37%		
	Total Area	25,722.02	40.191			

Table 5: Hydric soils for the Trout Brook Watershed. Soils that have potential hydric inclusions have been included in this chart.

Floodplains

Floodplains are low lying areas adjacent to streams and other waterways that provide numerous functions critical to having a functioning and healthy stream system. They act as a sponge by soaking up, slowing down and storing flood waters during high water events while also filtering out sediment, nutrients and other contaminants. They are dynamic features of the landscape that are easily disrupted and overlooked as they aren't often thought about until they are engaged.

When the floodplain is engaged, the stream is able to divert its energy so that accelerated erosion and other damage does not occur. Floodplains provide protection to human infrastructure like bridges, homes and roadways by slowing the velocity of the floodwater as it crosses the rough surface of the land. As the water changes width and speed it begins to lose energy, and it lessens the potential for flood damage. This reduction in velocity promotes infiltration and increases ground water recharge.

Floodplains are unique areas that provide habitat to many organisms. Microbes, insects, beavers, deer and many species of birds rely on floodplains. These semi-wet areas are also very important to waterfowl which rely on the floodplains as breeding grounds and access points to other wetland areas. It is important to remember that not all floodplains are the same and each of them offer different biological opportunities based on location.

Floodplains can easily be altered to the point where the stream no longer has the ability to engage them, which is known as floodplain disconnection. Floodplain disconnection can be caused naturally during flood events or by human construction and development.

As floodplains are encroached upon and their size decreased, their ability to function and provide flood protection is also reduced. When development occurs on floodplains, the likelihood of flood damage goes up dramatically. Large storm events can cause severe damage to infrastructure within a floodplain, so it is important floodplains stay undeveloped and fully-functioning. This is especially important to consider in a rapidly changing climate that will likely lead to more frequent and more severe storms in the future.

Within the Trout Brook Watershed, there are approximately 430 acres of identified and mapped Federal Emergency Management Administration (FEMA) 100 year floodplains (1% chance happening annually). These floodplains account for about 1.54% of the total watershed. Not all floodplains have been mapped by FEMA which tends to focus on larger stream systems or urban areas. A current map (2010) of the 100 year floodplains has been added to this document (p. 56).

Local municipalities are required to adopt and enforce floodplain management standards put out by FEMA and the Federal National Flood Insurance Program (NFIP) in order to participate in the NFIP program. The goal of the program is to create safer, stronger and more resilient communities while reducing flood risk and lessening disaster damages. This program sets minimum standards for municipalities to follow to help reduce future flood impacts (building construction, stream setbacks, etc.). Municipal participation allows constituents to purchase NFIP flood insurance and qualifies them for post flood Federal emergency assistance. Participation in this program also qualifies communities to apply for a number of grant programs to mitigate future flood events.

Flooding & Damages

On average, there are approximately 5,000 floods a year in the US, making flooding the most common natural disaster. This is true for New York and the Northeast which climatologists have nicknamed “flood alley”. It is predicted that we will get more frequent and larger storm events in the future. The importance of preserving and restoring function to floodplains is becoming more widely accepted and practiced.

Although flood waters themselves damage a lot of property, the true cost of flooding is hard to quantify. Often floods cause stream instability and excessive erosion lasting for many years after a flood event. Excess erosion releases sediment which takes energy for the streams to transport. When the stream cannot move the excess sediment, it is deposited. Deposition leads to the stream meandering into new places which are often easily eroded sands and gravels. Some erosion is naturally occurring but large storm events can introduce large amounts of sediment and nutrients into our streams that takes the stream many years to recover from. The cleanup and stream instability lasting for many years after the flood is hard to quantify. Historically, most floods occur during the summer (thunderstorm) months but rain/thaw events during the winter have also been common. According to the New York State Hazard Mitigation Plan, between 1960 and 2012, there have been 62 recorded flood events in Cortland County with over $32,000,000 in property damages. The average annual flood loss for Cortland County is $70,875.

County wide there are approximately 1,071 residences within the 100 year floodplain, with 589 NFIP policies and 87 repetitive loss properties. The Village of McGraw has 30 properties with NFIP policies but many more are not enrolled (approximately 90 properties total). Since 1978, a total of $324,925 has been paid out in 30 repair 30 claims. Only 21% of the Town of Cortlandville is in the Trout Brook watershed. The Trout Brook portion of Cortlandville is rural and sparsely populated. The Town of Cortlandville has 35 properties with NFIP policies, with approximately 15 residences within the 100 year floodplain of Trout Brook. Since 1978, a total of $329,988 has been paid out in repairs for 30 claims.

According to historical newspaper articles, large and damaging flood events can be traced as far back as 1863. Smith Brook was hit much harder than other tributaries in the 1930’s and

1980's which may have set the stage for erosion issues seen today. Flood damages along Mosquito Creek and Trout Brook have been significant as well.

Remnants of mill ponds in operation from the 1800's through the early 1900's can be seen throughout the watershed. These dams held back gravel and sediment that still contribute to excess sediment moving through the system. A few studies looked at tributaries in the Upper Susquehanna watershed in New York and Pennsylvania that found sediments deposited from mill ponds in New York did not have a large impact on stream functions compared to those in Pennsylvania. A majority of the structures in New York were small wooden structures prone to failure during high water with current erosion of glacial till being the predominant sediment source. Trout Brook did have a number of larger mills and dams, which surprisingly were situated in stream reaches that are still very unstable. Many of these reaches have some of the highest erosions rates in the watershed.

Reforestation efforts in the early 1900's may have helped describe why flood damages were reduced and why winter floods decreased in the 1940's. Reforestation efforts helped to slow spring melting/thaw, and promoted infiltration.

Records indicate a proposal to build two reservoirs and dams in the Town of Solon (Upper Smith Brook and Upper Trout Brook) after flooding in 1969. The Army Corps of Engineers advised McGraw to ask for money from New York State to help alleviate flooding downstream. This idea was greatly opposed by many landowners and constituents due to loss of homes, prime agricultural lands, tax levy and a disruption of the landscape. The proposed Trout Brook (184 acres) and Smith Brook (130 acres) reservoirs would have cost an estimated $740,000. Ultimately the proposal didn't move forward. The dam would have been constructed similar to Whitney Point which was built in response to flooding in 1935.

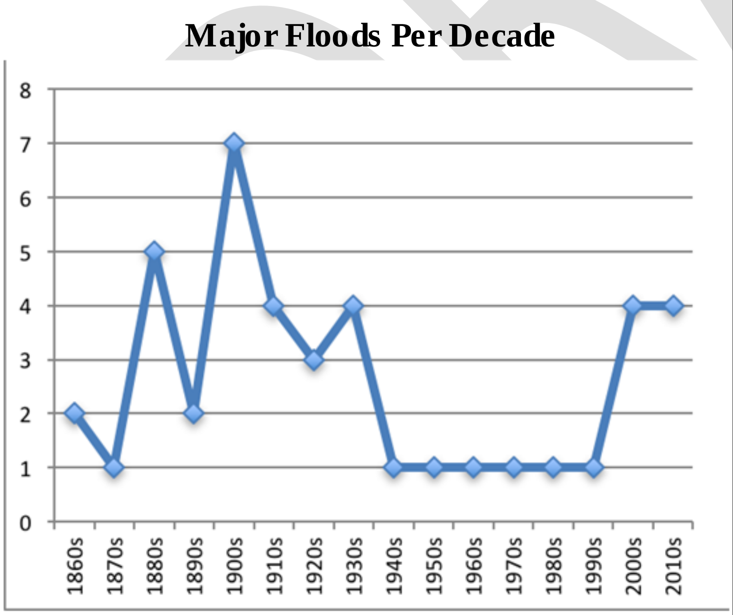


Figure 5: Major Floods Per Decade (Cortland County)

Figures 4 shows the number of major flood events per historical newspaper reports in Cortland County and Figure 5 shows incidents of flooding damages over time for the various tributaries to Trout Brook which was created after searching through old newspaper articles. Green shaded lines are in the Upper Trout brook watershed and blue is lower Trout Brook.

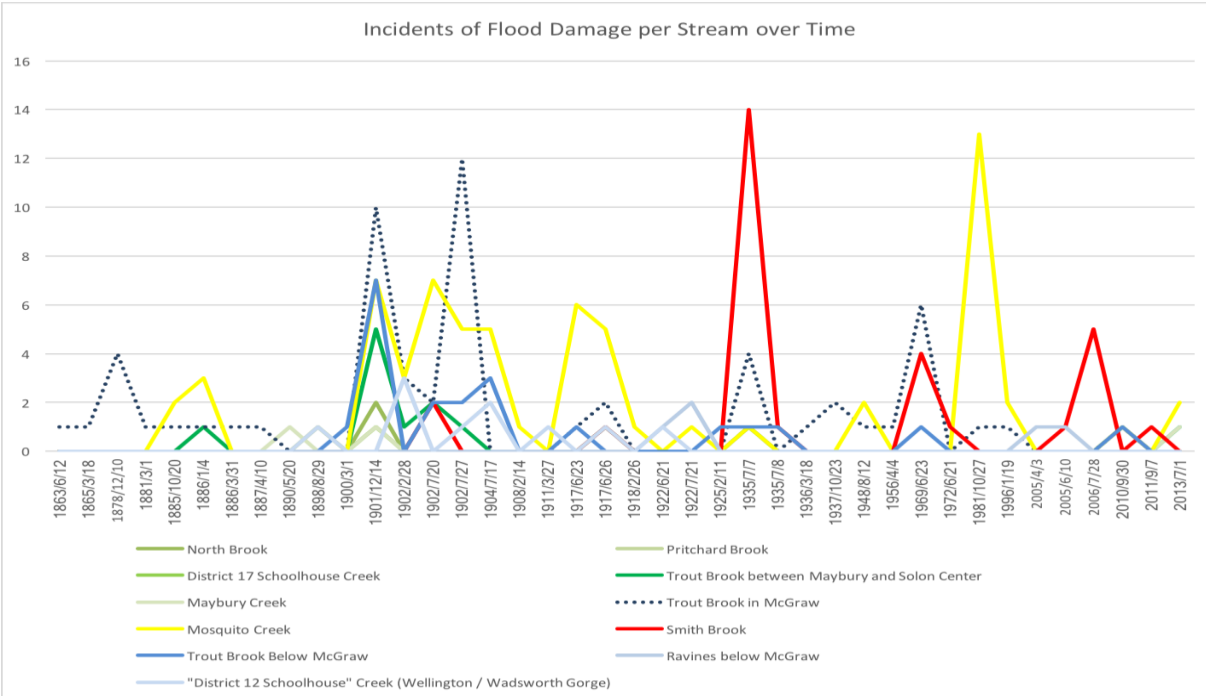


Figure 4: Flood events per stream

Wetlands

Wetlands are a vital part of all watersheds. For this reason, they are protected at the federal and state levels. The Clean Water Act, Section 404, outlines the federal regulations pertaining to wetlands. In New York, wetlands are protected under the Freshwater Wetlands Act (1975). This legislation is detailed in the Environmental Conservation Law, Article 24: Freshwater Wetlands.

Wetlands are locations where upland areas merge with aquatic areas. Wetland is a term that encompasses numerous aquatic environments that includes but is not limited to marshes, bogs, sloughs, wet meadows and flats that have reoccurring flooding. Wetlands can be defined as those areas that are inundated or 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 (U.S. Army Corp of Engineers Wetlands Delineation Manual, 1987). Wetlands benefit all aquatic and terrestrial ecosystems by:

- Providing flood and storm water control through hydrological absorption and having large storage capacity for excess water.
- Increasing wildlife habitat by providing nesting, breeding, feeding grounds and cover for an abundance of wildlife including migratory waterfowl and birds of prey.

- Acting as a protection area for subsurface water resources and are valuable to watersheds for their ability to recharge groundwater supplies.
- Providing areas for recreational and educational experiences for everyone to enjoy including activities like hunting, fishing, camping, research and bird watching.
- Providing water filtration for the surrounding watershed by removing harmful pollutants and excess nutrients which would eventually be passed down stream.

The US Fish and Wildlife Service tracks wetlands nationwide through a program called the National Wetlands Inventory (NWI). The NWI has been collecting wetland geospatial data for the United States since the 1970s. This data is compiled for use in wetland mapping for numerous agencies. According to the NWI, there are approximately 468 acres of wetlands within the Trout Brook watershed. These NWI wetlands account for 1.68% of the watershed.

Wildlife

The Trout Brook watershed shares similar characteristics with much of central New York and the typical hill and valley topography. The vast forestlands and nearby agricultural lands provide plenty of food and habitat to support thriving populations of white tail deer and turkey. In recent years, black bears have been spotted more frequently within Cortland County. These sightings are likely to increase as well. Bald Eagles have also been nesting in the area more frequently with a documented nesting site just 6 miles south of the confluence of Trout Brook with the Tioughnioga River. Trapping has steadily decreased in the last 20 years but many of the prized game such as raccoon, coyote, muskrat, beaver, and red fox are still prevalent. According to the 2017-2018 NYS DEC Pelt Sealing Summary, 17 fisher were reportedly trapped in Cortland County, two of which from the Town of Solon.

State and private forests in this area support breeding sharp-shinned hawks and Cooper's hawks along with a diversity of forest songbirds. There are numerous wetland complexes and bottomland forests that support many wetland dependant species such as the breeding pied-billed grebe, a threatened bird in New York State. The Taylor Valley Management Unit extends into the Trout Brook watershed in the Eastern portion of the watershed. The Breeding Bird Atlas predicted and confirmed 123 bird species breeding in the Taylor Valley Management Unit and surrounding areas. Two of the species are threatened (Bald eagle and the pied billed grebe) with numerous species of special concern (Cooper's hawk, Northern goshawk, red-shouldered hawk, sharp-shinned hawk, and osprey).

The Amphibian and Reptile Atlas Project was a ten-year survey, conducted by the DEC that was designed to document the geographic distribution of New York's amphibians and reptiles. The project predicts 28 species of amphibians and reptiles on or in the vicinity of the Taylor Valley Management Unit.

The New York State Gap Analysis Program (habitat condition and wildlife analysis) confirmed or predicted 52 mammalian species on or in the vicinity of the Taylor Valley Management Unit. The Indiana Myotis or Indiana bat is predicted on or in the vicinity of the Unit and is listed as endangered by both the State and the Federal government. This bat hibernates in caves or mines and forages near water. While in their summer range, the Indiana bat prefers to roost under the bark of living or dead trees.

The New York Natural Heritage Program has identified the pied-billed grebe and Jacob's ladder on Taylor Valley State Forest. In New York State the pied-billed grebe is classified as a threatened species and Jacob's ladder is classified as a rare plant.

Fisheries Management

The health of a watershed also effects the fish populations within the watershed. Studying fish populations and diversity over time can help identify possible issues or locations of problems in the watershed. Having a healthy fishery can provide recreation opportunities for residents and contribute to tourism.

Trout Brook itself is too small of a watershed to have a fisheries management plan specifically for that watershed. Brook trout and brown trout (1910-1988) have historically been stocked throughout the watershed. The most recent fisheries survey documented brook trout throughout much of the headwaters and brown trout primarily in the lower portions of the watershed with many other non-gamefish species throughout. Other such species include: blacknose, longnose and redsided dace, creek chub, common shiner, eastern stonerollers, cutlip minnows, margined madtom, mottled sculpin, johnny darter, white suckers, brown bullhead, and tessellated darters. The trout species currently found in the watershed are naturalized fish with self-sustaining (spawning) populations. Trout species continually move upstream and downstream throughout the year to find optimal water temperatures and food sources (macroinvertebrate information is discussed later in this document). Brown trout likely migrate between Trout Brook and the Tioughnioga River to find cooler water in summer months and also to spawn in the fall. The most recent survey (1998) also found burbot in the lower portions of the watershed which is considered a game fish by some anglers.

According to NYS DEC Fisheries Biologists, Trout Brook has the potential to sustain a more robust trout fishery but would require a significant amount of stream and habitat rehabilitation throughout the watershed. Installing stream buffers, restoring stream connectivity and stabilizing eroding streambanks would certainly help Trout Brook from an ecological standpoint.

Cortland SWCD and other trained individuals recently completed an assessment of all road-stream culverts in the Trout Brook watershed using the North Atlantic Aquatic Connectivity

Collaborative protocol. The assessment examined and scored each culvert according to how passable the culvert is by aquatic organisms. Road crossings are usually designed to move water quickly past the crossing often without consideration of the impacts on aquatic organisms. Movement throughout the watershed is vital to many species, however, culverts can prohibit this movement and fragment populations.

Agriculture

Agriculture including row crops, grains and pasturing is a significant land use within the watershed. The Trout Brook watershed has a diverse agricultural industry ranging from dairy, crop/grain, beef, horse, vegetable and many other smaller operations.

The first European settlers to come to the area arrived around 1800. Their agricultural practices consisted mostly of subsistence farming. The availability of transportation didn't begin until the mid-1820s and therefore marketing crops and goods wasn't a possibility. After much of the woodland had been cleared for lumber and making potash in the late 1800's, the surrounding hillsides were used to graze cattle. Cattle were bought in large numbers to be transported to the Hudson Valley and downstate markets. Cleared lands were also used for crop production, though they weren't very productive. According to an 1855 Census Map there were 2,465 farms with 4,773 families in Cortland County. There were 5,728 horses, 36,628 cattle, 38,660 sheep and 10,211 pigs reported in Cortland County. An estimated 1,530 tons of butter and cheese were produced along with 260 tons of maple sugar. Wheat, Rye, corn, potatoes, peas, beans, hay, flax and even hops were also grown.

The amount of land used for agriculture in the Upper Susquehanna Basin has been reduced from about 92% of the total land cover in 1900 to 27% in 2002. Agricultural practices and technology has changed as well. As smaller farms have been consolidated into larger units, cropland diversity has decreased as row crop monocultures have become the dominant agricultural land-use practice.

Today, the agricultural industry is still thriving and is the largest industry in Cortland County. According to the 2012 United States Census of Agriculture, there are approximately 270 farms directly employing 528 people with many more who provide agricultural support. An estimated 894 horses, 700 sheep and 1,112 poultry reside in Cortland County. The total population of cattle and calves is 23,239 with 10,351 milk cows and 1,279 beef cows. Annually 28.7 million gallons of milk are produced in the County which equals 123,410 tons of milk produced. Maple syrup is still a large agricultural commodity with 32,853 gallons or 181 tons produced annually. The average size of a farm in Cortland County is 222 acres and the average market value of farm products sold per farm is $121,422. The total number of animals, farms and farmers has decreased over time, but with modern practices, agricultural producers are more efficient.

After a number of large storm events in the 1950’s and 1960’s, a number of best management practices (BMP) were installed in the Trout Brook watershed. One representative from the Cortland County Agriculture Stabilization and Conservation Committee noted in 1971, "Erosion causing stream sedimentation (deposition) is our most serious conservation problem in the county." It was recognized that erosion and deposition was a major contributor to flooding. Many conservation practices such as permanent cover crops, strip cropping and ponds were put in place to reduce flooding further downstream. These same BMP’s and many others are still used today to help reduce erosion, reduce runoff and hold back stormwater on the landscape to reduce downstream impacts.

Through programs such as Agricultural Environmental Management (AEM), Cortland County Farmland Protection Plan, and numerous programs by the Soil and Water Conservation District and United States Department of Agriculture (USDA)/Natural Resource Conservation Service (NRCS), soil conservation practices and agricultural BMPs have been installed throughout the watershed. Best management practices are put in place to reduce soil and nutrients from running off to our waterways and to promote good stewardship of agriculture lands.

The Trout and Smith Brook valleys have very rich soils that are considered important agricultural lands. New York State has identified certain soil types as agricultural soils of statewide importance (Table 6) and prime agricultural soils (Table 7). These designations are given to soils that are productive and important to preserve for agricultural use. These categorizations are used in determining land value, state tax deductions and identifying productive farming locations. Soils of statewide importance and prime agricultural soils in the Trout Brook watershed can be seen in Tables 6 and 7 below. The most common soil type that is classified as farmland of statewide importance is Ontusia channery silt loam (2-8% slopes); it accounts for 11.2 % of the entire watershed. The most common soil type that is classified as prime farmland is Mongaup-Hawksnest complex (3 to 8% percent slopes); this soil type accounts for 6.44% of the entire watershed.

Map Unit Symbol	Map Unit Name	Percent of Area	Acres	Miles^2
25C	Chenango gravelly silt loam, 8 to 15 percent slopes	0.06	15	0.02
53C	Valois-Howard complex, 8 to 15 percent slopes	0.23	60	0.09
62B	Mardin channery silt loam, 2 to 8 percent slopes	2.81	723	1.13
62C	Mardin channery silt loam, 8 to 15 percent slopes	6.76	1740	2.72
63B	Mardin channery silt loam, 3 to 8 percent slopes, slightly acid	0.13	33	0.05
63C	Mardin channery silt loam, 8 to 15 percent slopes, slightly acid	0.85	219	0.34
68B	Volusia channery silt loam, 2 to 8 percent slopes	3.44	885	1.38
68C	Volusia channery silt loam, 8 to 15 percent slopes	4.96	1276	1.99
69B	Erie silt loam, 2 to 8 percent slopes	0.61	156	0.24
69C	Erie silt loam, 8 to 15 percent slopes	0.70	179	0.28
73B	Tuller silt loam, 2 to 8 percent slopes, cool phase	0.25	63	0.10
76B	Tuller silt loam, 2 to 8 percent slopes	0.07	18	0.03
77A	Chippewa silt loam, 0 to 3 percent slopes	0.11	29	0.05
77B	Chippewa silt loam, 3 to 8 percent slopes	1.06	273	0.43
79C	Mongaup channery silt loam, 8 to 15 percent slopes	5.33	1371	2.14
124C	Lewbath channery silt loam, 8 to 15 percent slopes	0.33	84	0.13
125C	Howard gravelly loam, 8 to 15 percent slopes	0.19	50	0.08
126B	Ontusia channery silt loam, 2 to 8 percent slopes	11.20	2882	4.50
126C	Ontusia channery silt loam, 8 to 15 percent slopes	8.67	2231	3.49
134C	Bath channery silt loam, 8 to 15 percent slopes	0.80	206	0.32
162B	Willdin channery silt loam, 3 to 8 percent slopes	4.69	1207	1.89
162C	Willdin channery silt loam, 8 to 15 percent slopes	4.76	1223	1.91
177A	Norchip silt loam, 0 to 3 percent slopes	0.35	89	0.14
177B	Norchip silt loam, 3 to 8 percent slopes	1.26	325	0.51
179C	Lordstown channery silt loam, 8 to 15 percent slopes	0.92	236	0.37
Totals (as compared to watershed)		60.54	15573.39	24.33

Table 6: Agricultural Soils of Statewide Importance

Map Unit Symbol	Map Unit Name	Percent of Area	Acres	Miles^2
7A	Geneseo silt loam, 0 to 3 percent slopes, occasionally flooded	0.61	156	0.24
9A	Trestle gravelly silt loam, 0 to 3 percent slopes, occasionally flooded	0.26	66	0.10
10A	Deposit gravelly silt loam, 0 to 3 percent slopes, occasionally flooded	0.08	21	0.03
11A	Hemlock silt loam, 0 to 3 percent slopes, occasionally flooded	1.02	262	0.41
22A	Allard silt loam, 0 to 4 percent slopes	0.26	67	0.10
25A	Chenango gravelly silt loam, 0 to 3 percent slopes	0.65	167	0.26
25B	Chenango gravelly silt loam, 3 to 8 percent slopes	0.34	87	0.14
26B	Chenango channery silt loam, fan, 2 to 8 percent slopes	0.88	227	0.36
28A	Scio silt loam, 0 to 4 percent slopes	0.12	31	0.05
46A	Red Hook silt loam, 0 to 3 percent slopes	0.03	7	0.01
53B	Bath-Valois complex, 3 to 8 percent slopes	0.05	13	0.02
79B	Mongaup-Hawksnest complex, 3 to 8 percent slopes	6.44	1656	2.59
122B	Palmyra gravelly silt loam, 3 to 8 percent slopes	0.05	14	0.02
124B	Lewbath channery silt loam, 3 to 8 percent slopes	0.32	83	0.13
125A	Howard gravelly loam, 0 to 3 percent slopes	0.06	17	0.03
125B	Howard gravelly loam, 3 to 8 percent slopes	0.49	127	0.20
134B	Bath channery silt loam, 3 to 8 percent slopes	0.49	125	0.20
179B	Lordstown-Arnot complex, 3 to 8 percent slopes	0.66	169	0.26
210A	Phelps gravelly silt loam, 0 to 3 percent slopes	0.13	34	0.05
Totals (as compared to watershed)		12.95	3329.91	5.20

Table 7: Prime Agricultural Soils

Land Use and Land Cover

Land use and land cover both tell us different things about the landscape. Land use describes how the land is used and land cover describes what is on the landscape. Land use is described on a parcel scale, so just because a property is given a residential land use doesn't mean that the entire property is used as residential. For example, a 20 acre property's land use may be considered residential land use but the land cover breakdown is 16 acres woodland, 2 acres grassland, .5 acre developed, and 1.5 acre water. Each tells us something slightly different about the landscape.

Land use is determined by how the property is used which could include residential, woodland, commercial, agricultural etc. Land use designations have implications on how landowners are allowed to use the land and can tell you how the landscape may change in the future. Each property has one land use designation which may require changing with your local assessor or planning department if you plan on changing how the property is used. The largest land uses in the Trout Brook watershed are residential and agricultural lands which together make up 63% of the watershed land use.

Land cover spatially describes what is on the landscape such as woodland, pasture, water, wetlands etc. and can give you information about how the landscape performs. The types of land cover that can be found within Trout Brook watershed ranges from forested/shrub land to commercial, industrial, and recreational to name a few. Land cover impacts how water and nutrients travel over the landscape.

During the 1800's this region was severely deforested due to high demand for lumber in growing cities such as New York City (Photo 1). Due to the cost of transporting lumber, much of the woodland was burned to create potash at local asheries. Potash was used in fertilizer and was even shipped to the United Kingdom to make explosives. Cleared lands were then farmed but were not very productive. Flooding increased in the late 1800's which is not surprising given that runoff and sediment increase after deforestation.

In the early 1900's there was a huge effort to replant the landscape through the Civilian Conservation Corps. Reforestation efforts were also undergone by local landowners. In the 1920's, Merton Bean, planted upwards of 100,000 maple saplings in the upper Trout Brook watershed with the help of the Cortland County Sportsmen's Association. This effort won Bean and the Association many statewide awards and recognition for the large scale tree planting efforts in the 1920's and 1930's. Historical aerial photographs from the 1930's show much reforestation but you can clearly see that they are young forests. Reforestation efforts were also supported and assisted by a number of families who owned large pieces of land as well as other sportsmen's clubs who saw the value in woodlots for hunting.

Photo 1: Pritchard Brook/Solon showing level of deforestation

The Trout Brook watershed as well as much of Central New York has gone through major changes in the landscape. There is now more forested land than there has been in the last 200 years. Land use and land cover will always be in flux. We now have a much better understanding of how changes in the landscape can affect our downstream neighbors as well as our waterways.

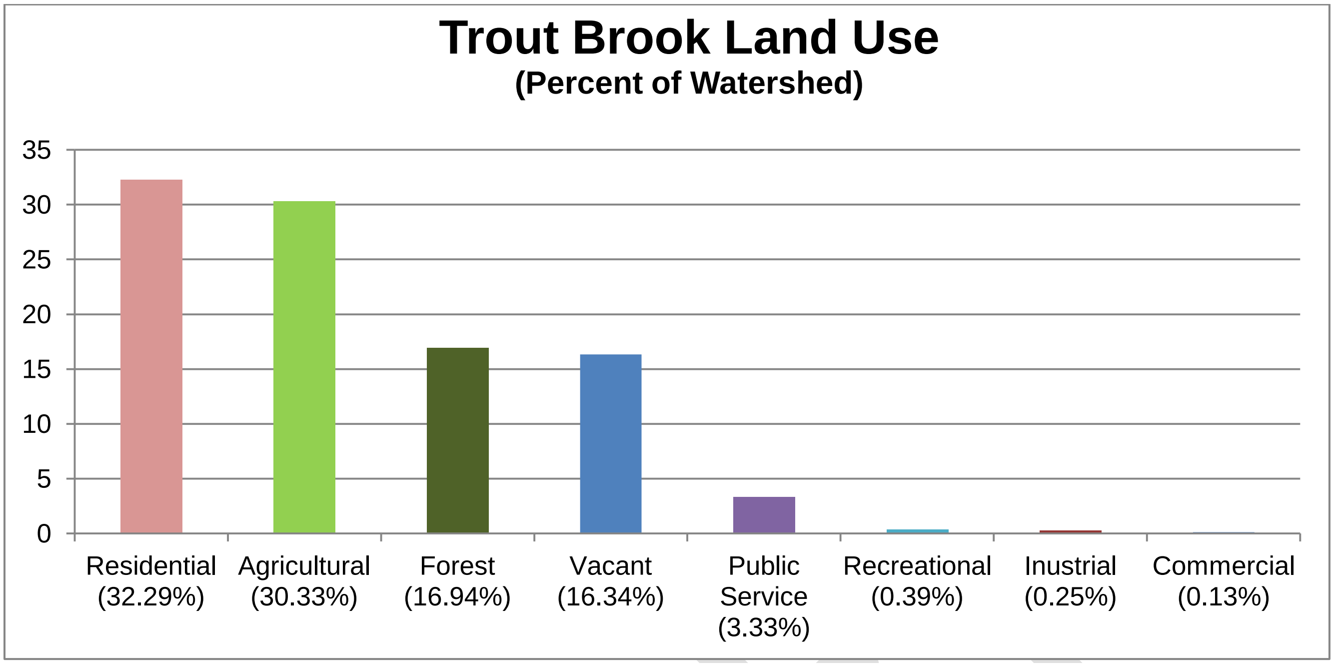


Figure 6: Trout Brook Land Use (data obtained from Cortland County Tax Rolls)

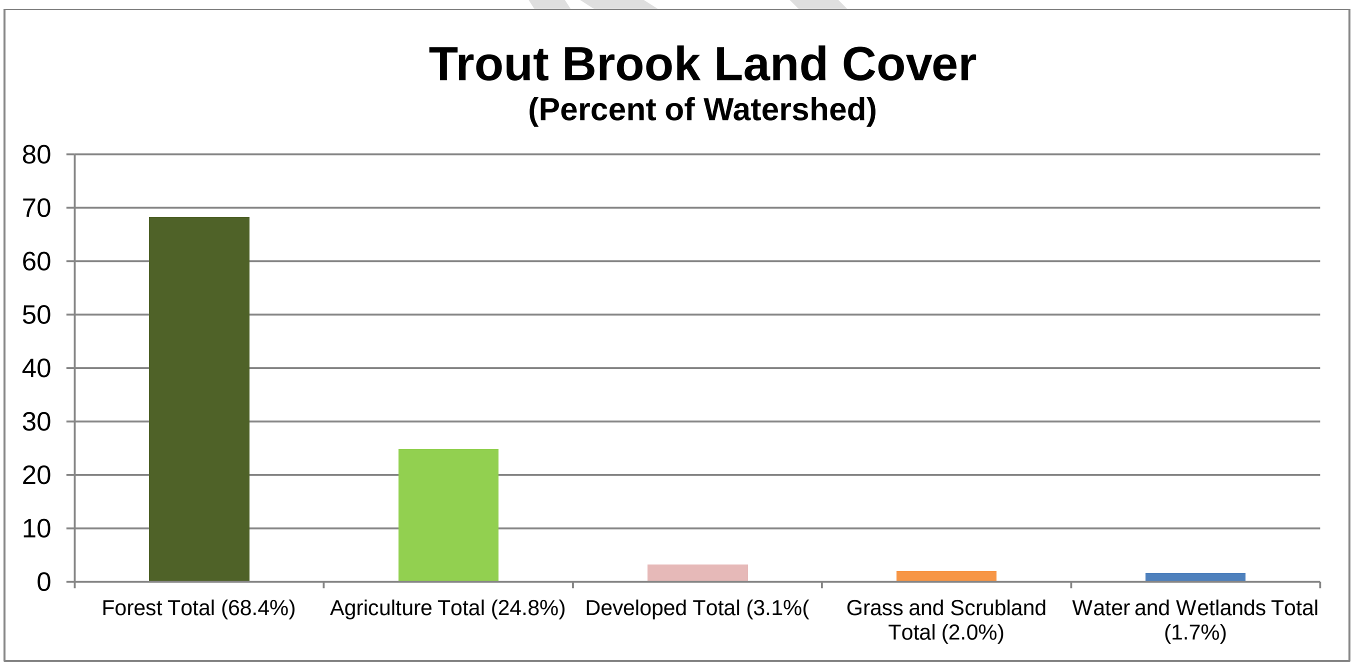


Figure 7: Trout Brook Land Cover (data obtained from National Land Cover Database 2011 (MLRC.gov))

Trout Brook Watershed Land Cover

Land Cover Class	Percent	Acres	Square Miles
Developed (open space)	2.6	723.76	1.13
Developed (low intensity)	0.48	133.45	0.21
Developed (moderate intensity)	0.05	15.12	0.02
Developed (high intensity)	0	1.33	0
Developed Total	**3.14**	**873.67**	**1.37**
Barren Land	0.11	30.47	0.05
Deciduous Forest	31.48	8759.8	13.69
Evergreen Forest	13.19	3669.04	5.73
Mixed Forest	23.63	6576.52	10.28
Forest Total	**68.3**	**19005.36**	**29.7**
Shrub/Scrub	1.18	329.18	0.51
Grassland/Herbaceous	0.85	237.54	0.37
Grass and Scrubland Total	**2.04**	**566.73**	**0.89**
Pasture/Hay	23.32	6488.67	10.14
Cultivated Crops	1.52	392.79	0.61
Agriculture Total	**24.84**	**6881.46**	**10.75**
Woody Wetlands	1.13	314.28	0.49
Herbaceous Wetlands	0.26	73.4	0.11
Water	0.29	80.74	0.13
Water and Wetlands Total	**1.68**	**468.42**	**0.73**
Total		**27826.11**	**43.48**

Table 8: Trout Brook Land Cover (data obtained from National Land Cover Database 2011 (MLRC.gov))

Although residential (32.29%) and agricultural (30.33%) lands are the largest land uses in the watershed (Figure 6), the largest land cover is forest (68.4%) (Figure 7). Each one of these land use and land cover types affects the watershed and how water travels through the system. Table 8 breaks down land cover types into broad categories and detailed land uses.

The largest category of land use in the watershed is forested (68.4% or 19,005.4 acres) which is similar to the New York State average (60%). A majority of the forest land is owned by private landowners with large portions also owned by NYS DEC. All state forest lands in this watershed are managed by NYS DEC with plans being developed by their staff. Examples of stewardship plans include forestry, habitat/wildlife and recreation. On private lands, there are a number of individuals who have developed Forestry Stewardship Plans with consultation with a NYS DEC forester. Active stewardship plans help protect our great forest resource as well as the wildlife, water resources and the watershed functions they provide. There are a number of other stewardship/conservation plans for agricultural lands and wetlands being implemented within the watershed. Approximately 15% of the watershed is under a formal stewardship plan.

The second largest land cover type in the watershed is agriculture (24.8% or 6,881.5 acres). There are numerous farms within the watershed that range from small vegetable or livestock farms (less than 10 acres), to larger farms consisting of over 800 acres. Agricultural operations include dairy, crop, vegetable, goat/sheep and beef operations. Each of these types of operations impact how water moves across the landscape. Agricultural producers typically own and are stewards of the largest amount of land in this region.

Residential/developed land use comes in as the third largest land use in the watershed (160 acres). This number accounts for the total amount of acreage occupied by residential buildings and maintained yards. It does not include privately owned woodlots or fallow fields; those are covered under the vegetated section. Residential land use is an important component in watershed studies because they can act as a pollution source and they a higher priority to protect than other land uses. If a stream migrates into a wooded area, people aren't terribly concerned compared to if it migrates towards a residence. Homes built on floodplains and in the path of migrating streams face a higher risk of damage during flood and erosion events.

Commercial/Industrial land use accounts for the smallest portion of the Trout Brook watershed (0.25% or 69.6 acres). Residential and commercial land can lead to accelerated runoff due to increased amounts of impervious surfaces. Storm water is collected and travels across in parking lots, on roof tops and along roads. The runoff can carry large amounts of sediment laden with chemicals and debris. The runoff then enters the streams altering the water quality and biological stability of the stream.

Land Use Regulations

Land use regulations are set by counties and municipalities in order to protect certain land areas and regulate the activities done on others. The Cortland County Planning Department works with cities, towns and cooperating agencies within the county to set plans for land use regulation suggestions.

The Town of Cortlandville originally adopted zoning in 1950 and adopted a Comprehensive Plan in 1977. In order to address pressure from new development, the Town utilizes a special use permit and site plan review to monitor and control development. The Town also has set wellhead protection areas/zoning and an Aquifer Protection District to help protect groundwater resources. The various wellhead protection zones are based on travel time for pollutants to reach the wells with the closest areas being protected the most.

The Village of McGraw zoning began in 1966 and adopted a Comprehensive Plan in 2006. The Village has adopted a Groundwater Protection Overlay District where protection of groundwater resources is essential for public water supply sources as the Village of McGraw has a number of municipal water supply wells in the Trout Brook valley. There are two wellhead protection areas and one aquifer protection area which limits use and activities in both areas. The Villages Zoning regulations also have provisions for site plan review.

The Town of Solon adopted a Comprehensive Plan in 1980. The Town has zoning regulations and subdivision control but does not have site plan review.

Census

The watershed is primarily comprised of two towns, Cortlandville and Solon as well as the Village of McGraw. Solon comprises over 63% of the watershed. Information collected from the 2010 US Census reports a population of 1,053 for the Village of McGraw, a population of 1,079 in the Town of Solon, and 8,509 in Cortlandville. The total number of housing units for the three towns is 440, 444, and 3,587 respectively. The average per capita income for the watershed is $28,020 (McGraw $24,193, Solon $23,244 and Cortlandville $29,100). The average per capita income for New York State is $30,948 and nationally it is $27,334. Not all of the Town of Cortlandville or Solon are completely within the Trout Brook watershed. Portions of the towns of Homer, Truxton, Taylor and Freetown are within the watershed.

Socio-Economics

The Trout Brook watershed consists of mostly a rural farming community with a small urban area in the Village of McGraw. The majority of residents travel to the City of Cortland and surrounding areas for work. Some residents travel north or south on Route 81/ NY13 to Syracuse, Binghamton or Ithaca. There are a few local businesses in the village of McGraw and Polkville providing convenience services, a few small restaurants as well as small industry.

Transportation

The Trout Brook watershed can be divided in two by NY Route 41 (Trout Brook) and McGraw Marathon Road (Smith Brook). The total length of roads within the watershed is 108.34 miles 8.21 of which are unpaved.

The vast network of roads directly and indirectly impacts our streams and waterways. Pavement and concrete surfaces are impervious and divert water into road shoulders or ditches instead of into the ground. Ditches quickly convey water along with pollutants that may have been on the roadway away from roadways, and often outlet directly into streams.

The unpaved, dirt, and gravel roadways within the watershed wind mostly through State Forest lands owned by the New York State Department of Environmental Conservation (NYSDEC) which provide the public access to hiking, hunting, fishing and other outdoor recreational activities. Taylor Valley and Baker Schoolhouse State Forests have unpaved roads. According to the NYSDEC Bureau of State Land Management Unpaved Forest Road Handbook, there are a few ways to decrease the amount of erosion and sediment introduction to streams near unpaved forest access roads. They are as follows:

- Roads should not be constructed in stream channels.
- A filter strip of at least 150 feet should be maintained where possible between a road and the paralleling stream.
- To minimize siltation, road crossings should be made at right angles (90°) to the stream.
- Proper construction techniques and close attention to drainage design will decrease possibility of future erosion.

An abandoned railroad bed runs alongside Trout Brook and Route 41. The Delaware Lackawanna & Western Railroad operated a passenger train service connecting Cincinnatus with Polkville. The railway also connected passengers to the City of Cortland and to the Lehigh Valley Railroad (South Cortland). The train, named “Gee Whiz”, stopped running in 1960 after the railroad went bankrupt, and the tracks were removed shortly after. Many of the railroad crossings that were abandoned have since been damaged by storm events. The railroad bed, which closely follows Trout Brook, acts as a berm throughout much of the watershed and disconnects it from some of its floodplain. Trout Brook, from the Village of McGraw to the confluence of the Tioughnioga River, is considered a navigable waterway by the DEC but is not listed as a transportation route (commercial).

There are numerous bridges and culverts that cross the streams of the watershed. Many of our roadways were constructed in the valleys along waterways because it’s easier to build on flat ground. Most culverts are installed and designed to quickly move water through the area. Undersized or poorly installed culverts can exacerbate erosion, often without regard to the organisms that live in the water that depend on moving upstream or downstream throughout the seasons. Due to limited funding, many crossings are undersized and can serve as a significant barrier to aquatic organisms.

All road-stream crossings in the Trout Brook watershed have been assessed by Cortland SWCD or other trained individuals using the NAACC protocol. This protocol looks primarily at the passability of crossings by aquatic organisms and assigns a score to each crossing. Data collected was also put into a model created by Cornell University to estimate the maximum storm event the culvert can pass. Culvert condition data was also collected. Scores were given for each of the 3 outputs to then prioritize repairs or replacement.

Water Quality

Water quality information is vital to determining the health and overall status of a watershed. Trout Brook is primarily rural but does contain some urbanized portions in the Village of

McGraw. Most of the watershed is forested or used for agriculture. When examining water quality, investigators may look at the chemical qualities of the water and/or examine biological indicators.

Rural and urban watersheds both contribute to water quality degradation with different pollution sources. Pollutants are typically divided into two categories according to where they originate. Point source pollution can be traced back to a single place or outlet such as a pipe or drain. Point sources may be regulated by Federal (Environmental Protection Agency) and State (NYS DEC) agencies under the National Pollutant Discharge Elimination System (NPDES) and State Pollutant Discharge Elimination System (SPDES) programs. Non-point pollution sources are hard to trace back to a single point and are more cumulative in their impacts compared to point sources. Examples of non-point sources include eroding streambanks (sediment) or fertilizer applied by homeowners (nutrients) and agricultural producers (nutrients, pesticides, bacteria). General sources of point and non-point pollution are listed in Table 9 below by contaminant type.

There are a few regulated point sources or facilities in the watershed including: the Cortland County Landfill (Solid Waste Facility/NYS Superfund Site), Pit Stop Travel Center and Polkville Crushed Stone (SPDES).

The Cortland County landfill is a NYS DEC regulated Solid Waste Facility that has been in operation since the 1940's. A portion of the facility is currently active while other portions have been capped (closed) or remediated (NYS Superfund Program). Groundwater and other possible pollutant sources at the facility are monitored for a variety of contaminants quarterly

	Point Sources		**Nonpoint Sources**	
Contaminant	**Rural**	**Urban**	**Rural**	**Urban**
Sediment	mining operation	construction sites	cropland, eroding streambanks	eroding streambanks, construction sites
Nutrients	waste lagoons, manure storage facilities	wastewater treatment plants, storm outfalls	barnyards, manure storage & application	parks, yards, golf courses, construction sites
Pesticides			cropland	parks, yards, golf courses
Oil, grease, metals & other contaminants, salts		storm outfalls	roads	roads, parking lots
Fecal bacteria	manure storage facilities	wastewater treatment plants, storm outfalls	septic systems, barnyards, manure application, livestock	pet waste
Emerging contaminants	industrial facilities	industrial facilities, wastewater treatment plants	septic systems	

Table 9: Water quality data for Trout Brook at McGraw, NY collected by USGS (1970, 1972, 2016).

and reported to NYSDEC. Concentrations of contaminants from the remediated and closed portions have been decreasing since the site was properly capped and remediated. Capping limits infiltration of surface water and precipitation thus reducing contaminant concentrations leaving the site through groundwater.

Pit Stop Travel Center and Polkville Crushed Stone are the only two registered SPDES/NPDES permitted discharge sites located in the Trout Brook watershed (Polkville).

Non-point source pollution is not always easy to quantify or qualify because the impacts are cumulative and are spread throughout the watershed. Trout Brook, like many New York watersheds, has gone through many large storm events which have increased erosion and sediment that the streams are reacting to. Some erosion is naturally occurring but large storm events can introduce large amounts of sediment and nutrients into our streams that takes the stream many years to recover from.

According to the Cortland County Water Quality Strategy, local water quality concerns include; stormwater runoff from construction, urban runoff, agricultural runoff, hydrologic modification (flooding and streambank erosion), on-site wastewater (septic system), deicing agent storage and application, and improper disposal of hazardous waste. The strategy outlines how each of these impacts Cortland County as well as outlines current and future activities to address the concern.

Water Quality Assessment Data for Trout Brook

Assessment of water quality for a waterbody may include collection and chemical analysis of water samples and/or the use of macroinvertebrate organisms as an indirect indicator of water quality. Macroinvertebrates are small aquatic insects that can only live under certain conditions depending on species and pollution tolerance. Water samples may be taken during wet and/or dry conditions depending on the specific goals of the assessment. Sampling during wet conditions is appropriate if water quality concerns relate to precipitation-delivered pollutants such as non-point sources of nutrients and sediment. Sampling during dry conditions provides a better assessment of background conditions or the effects of chronic point-source pollution. Sampling and comparison of results under both conditions can also be useful.

Important chemical properties of water include temperature, dissolved oxygen concentration, specific conductance, hardness, pH and turbidity (light scattering ability affecting light transmission through the water column). Biological properties include presence of fecal bacteria (indicating presence of human and animal waste).

Chemical Data

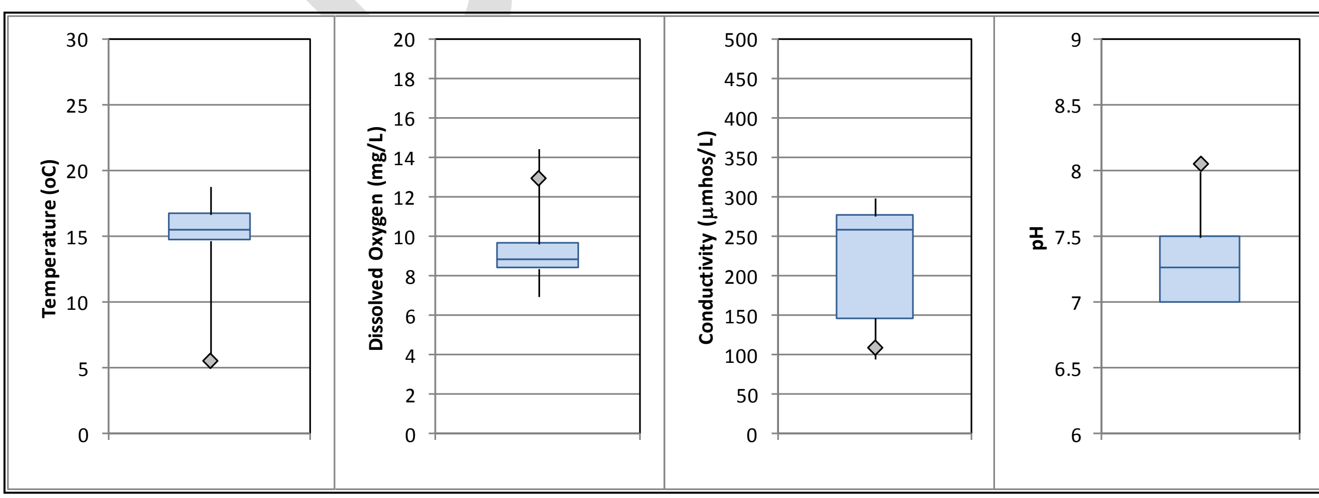
In 1970, 1972 and 2016, the USGS sampled Trout Brook at McGraw, NY (Table 10; *USGS WQ 1970, 1972; USGS WQ 2016*). The 1970-72 site was in the village of McGraw and the 2016 site was approximately 0.5 mi downstream of the earlier site.

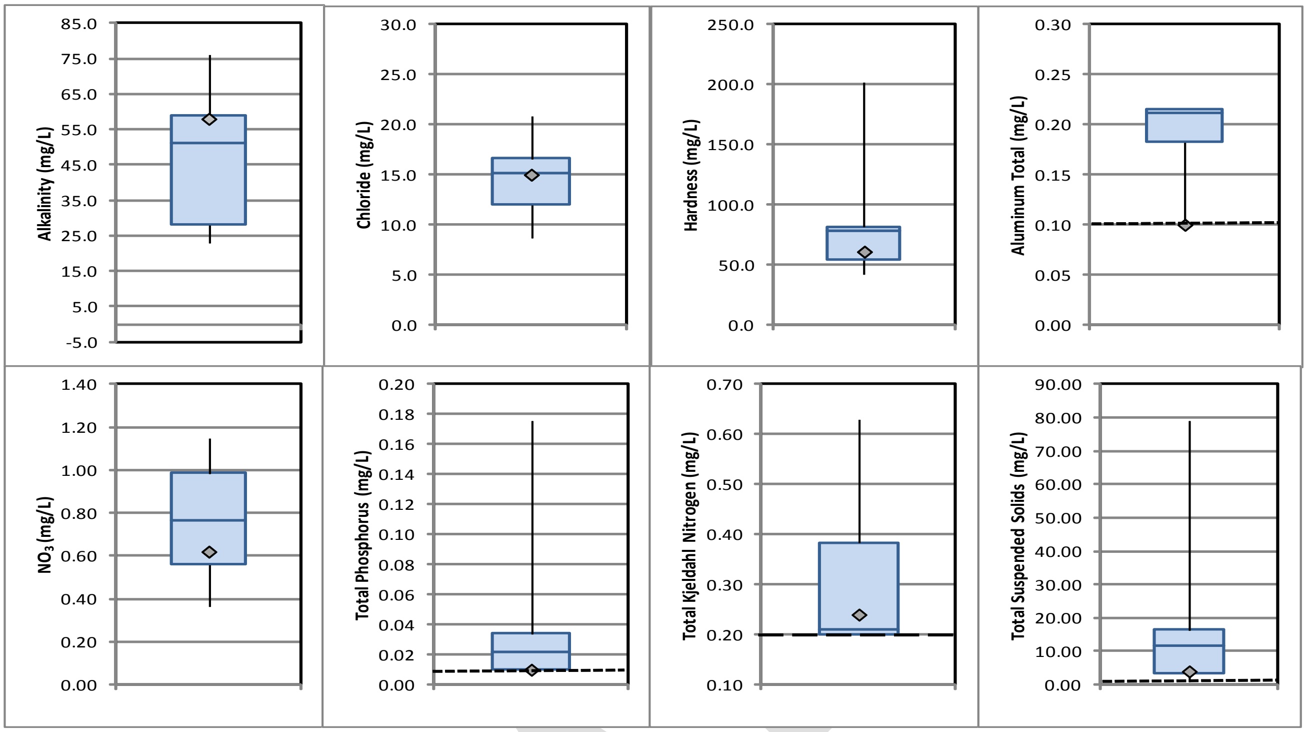
	Date	Temperature (°C)	Specific Conductance (umS/cm)	Dissolved oxygen (mg/L)	pH	NH_3 as N (mg/L)	NO_2 as N (mg/L)	NO_3 as N (mg/L)	Total phophorus (mg/L)	ortho phosphate as P (mg/L)	Organic carbon (mg/L)	Hardness (mg/L)	Magnesium (mg/L)	Na (mg/L)	Cl (mg/L)	SO_4 (mg/L)	Methyl Hg (ng/L)	Hg (ng/L)	TSS (mg/L)
South St. McGraw	8/10/70		207		7.4			1.04				82			12.0				
	6/15/72	20.0	154		7.7			0.70				66			7.5				
Downstream of McGraw off Elm St.	7/13/16	20.0	292	9.0		< 0.01	0.001	0.333	0.013	< 0.004	1.5	109	4.77	18.1	30.0	6.5			1.0
	7/27/16	18.6	287	7.7		< 0.01	0.002	0.380	0.007	< 0.004	1.6	111	4.67	17.5	28.3	6.3	< 0.04	0.73	< 0.5
	8/3/16	18.8	308	7.9	8.0	< 0.01	0.003	0.373	0.006	< 0.004	1.7	119	5.38	19.3	31.8	6.7	< 0.04	0.68	1.0

Table 10: Water quality data for Trout Brook at McGraw, NY collected by USGS (1970, 1972, 2016).

From 2000-2001, the Cortland County Soil and Water Conservation District (SWCD) conducted multiple water quality sampling rounds at 19 sites in the Tioughnioga River basin, including Trout Brook at McGraw, NY. Samples collected during the first 8 rounds were analyzed for field parameters (temperature, dissolved oxygen, pH, and specific conductance), conventional pollutants (alkalinity, chloride, hardness, and total suspended solids), metals (Al, Cd, Cu, Pb, Mg, Ni, Zn) and nutrients (total phosphorus, Kjeldahl nitrogen, and nitrate). Samples collected from the final 11 rounds were analyzed for only the field parameters. Not all sites were sampled during each round. Field and laboratory parameter data for Trout Brook are summarized in Figures 7 and 8, respectively (N=9 sampling rounds, box plot data). Metals data are summarized in Table 11.

SWCD conducted a follow-up sampling round in November, 2017, under dry conditions (Figures 7 and 8, gray diamond data; Table 11). Because 2017 results include only dry weather/November sampling, these data may not be directly comparable to box plot results for 2000-01 (wet and dry sampling, March - October sampling).





dashed line is detection limit, much of 2017 data below detection limit

dashed line is detection limit, much of 2001-02 data below detection limit

Figure 8: Laboratory data Trout Brook at McGraw (box plot is 2000-2001, diamond in November 2017)

	WQ Standard mg/L	6/22/00	6/29/00	8/17/00	9/13/00	4/4/01	4/9/01	4/19/01	5/23/01	12/18/01	11/28/17
Aluminum											
Dissolved	0.1					**0.217**	**0.331**	< 0.04	0.062	0.029	
Total		0.215	0.208	0.105	0.215						< 0.10
Cadmium											
Dissolved	0.002*					< 0.005	< 0.005	< 0.005	< 0.005	< 0.001	
Total		< 0.005	< 0.005	< 0.005	< 0.005						
Copper											
Dissolved	0.007*					**0.011**	**0.024**	**0.023**	**0.012**	< 0.01	
Total		< 0.01	< 0.01	< 0.01	0.020						
Lead											
Dissolved	0.003*					< 0.005	< 0.005	**0.013**	< 0.005	< 0.001	
Total		< 0.005	< 0.005	< 0.005	< 0.005						
Magnesium											
Total	--									2.300	
Nickel											
Dissolved	0.04*					< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	
Total		< 0.01	< 0.01	< 0.01	< 0.01						
Zinc											
Dissolved	0.07*					0.031	**0.048**	0.045	0.039	< 0.01	
Total		0.037	0.091	< 0.01	0.018						

* WQS is dependent on water hardness. Value given is for chronic toxicity based on mean hardness = 80 mg/L

0.XX exceeds water quality standard

Table 11: Metals concentration (mg/L) in water samples from Trout Brook at Rt. 11.

SRBC maintains a real time monitoring station near the lower end of the Trout Brook watershed in McGraw, NY, as part of their Remote Water Quality Monitoring Network (RWQMN). Real-time data and historical records are accessible online through their remote water quality monitoring network and are summarized in Table 11. Minimum values are most likely missing data; however, this could not be verified as raw data could were not available from the SRBC website.

Parameter	Units	# Samples	Mean	Maximum	Minimum	Std Deviation
Temperature	°C	606275	9.37	54.52	9.37	7.44
Specific Conductivity	mS/cm	606275	0.174	0.486	0.000	0.064
pH		606275	7.70	9.62	1.28	0.48
Turbidity	NTU	606275	26.1	999.9	0.0	89.9
Dissolved Oxygen	mg/L	606275	10.97	16.00	0.00	3.01

Table 12: Summarized water quality statistics SRBC real time monitoring station 2008-2018 McGraw, NY.

Macroinvertebrate Data

Macroinvertebrates are the near the bottom of the aquatic food chain and therefore play an important role in aquatic system health. Macroinvertebrates are fairly simple to sample but also give you a quick measure of water quality at that location as well as the long term health of the stream. The presence or absence of various species can quickly indicate stream health, possible types of pollutants and serve as the base for species further up the food chain. Each species differ in their tolerance of water pollution and the types of pollutants they can tolerate. After a disturbance (flood or stream dries up), macroinvertebrates can quickly re-colonize and react to a number of stream changes.

The NYSDEC Waterbody Inventory/Priority Waterbody List (PWL/WI) assessment separates Trout Brook into two reaches (upper and lower). The report for the lower reach is based on 2003 macroinvertebrate sampling that indicated no known impacts. This assessment is an improvement from the previous report from 1997 which showed slight impacts. The report for the Upper reach reports no original data but references the downstream macroinvertebrate sample as evidence of unimpacted conditions in the upper reach as well. A 1999 assessment cited in the report identifies concerns with sedimentation from eroding stream and road banks that apparently are insufficient to degrade water quality.

The Susquehanna River Basin Commission has sampled two sites on Trout Brook (Near Route 81 and in Village of McGraw) multiple times from 1984 to 2013. The most recent data (lower 2007, upper 2013) was evaluated using *NYSDEC WAVE Syst* analysis. Both sites showed no known impact at the time of sampling. Sites near these were sampled by NYSDEC

WAVE program volunteers in 2016. Analysis of these macroinvertebrate samples also indicated that no known impact was present at either site.

Water Quality Conclusions

Based on examination of data available for the watershed, the water quality of Trout Brook does not appear to be impacted as no major problems are indicated. Nitrate levels appear somewhat elevated compared to the SRBC NO_3 level of concern (1.0 mg/L; SRBC 2007) based on the SWCD and USGS (1970 only) data, but do not exceed the NYSDEC water quality standard of 10 mg/L for nitrate (NYSDEC 2018). Comparison of the USGS data for the two time periods sampled suggests that road salts may be affecting water quality of Trout Brook. Conductivity, hardness, and especially chloride appear elevated in the 2016 samples relative to the data from the early 1970s. In the SWCD data, chloride, hardness and conductivity are also elevated relative to the USGS 1970s data, but do not increase between 2000-01 and 2017.

Chesapeake Bay Total Maximum Daily Load (TMDL)

Water Traveling through Trout Brook eventually reaches the Chesapeake Bay where water quality has been steadily decreasing. In 2010, the EPA established a Chesapeake Bay (Bay) Total Maximum Daily Load (TMDL) which was in response to poor water quality and insufficient progress to restore the Bay.

According to the Chesapeake Bay TMDL Fact Sheet, “TMDL is the calculation of the maximum amount of pollution a body of water can receive and still meet state water quality standards. Water quality standards are designed to ensure waterways meet a national primary goal of being swimmable and fishable... The Bay and its rivers are overweight with nitrogen, phosphorus and sediment from agricultural operations, urban and suburban runoff, wastewater, airborne contaminants and other sources. Excess nutrients and sediment lead to murky water and algae blooms, which block sunlight from reaching and sustaining underwater Bay grasses. Murky water and algae blooms also create low levels of oxygen for aquatic life, such as fish, crabs and oysters.” Currently, individual states have been tasked with reaching reductions set by the EPA. New York, being the headwaters of the Chesapeake Bay, has good water quality but still has been tasked with helping reduce contributing nutrients.

The TMDL identifies the necessary pollution reductions from major sources of nitrogen, phosphorus and sediment across the Bay jurisdictions and sets pollution limits necessary to meet water quality standards. NYS DEC and the Upper Susquehanna Coalition have developed a Watershed Implementation Plan which has set goals for a number of best management practices to be installed in the watershed to achieve nutrient reduction goals. Reducing local nutrient inputs will have some effects on the health of the Chesapeake Bay but will also benefit our local water quality as well.

Watershed Assessment

Cortland SWCD Staff completed a watershed assessment where approximately ___ miles of streams were assessed. During the assessment staff noted and recorded issues such as streambank erosion, head cuts, blockages, berms/floodplain disconnection, excess gravel etc. as well as various conservation opportunities. Data was collected for erosion sites using the Bank Erodibility Hazard Index, which later gave us estimated sediment lost and erosion rates for those particular streambanks. Buffer opportunities, instability causes and adjacent land uses were also recorded for use later on. We wanted to be sure to not only capture issues that were observed but also to record opportunities for conservation work later on.

After analyzing field assessment data for the watershed, it was estimated that approximately 64,500 tons of sediment a year are lost from eroding streambanks with approximately 13.6 miles of streambanks that are eroding. It is difficult to tease out how much of this erosion is typical for this watershed and natural compared to what is excessive. Smith brook has some of the highest erosion rates in the watershed, which given the tall eroding banks, is not a surprise. For each erosion site, adjacent land to the erosion was noted. Below is a table showing various land uses adjacent to eroding streambanks with the estimated lengths and tons of sediment lost a year (Table 13).

Conclusion

The Trout Brook watershed has undergone many changes. As a whole, the watershed is healthier than it has been in quite some time but there is certainly more that can be done. By far, the largest concerns for this watershed are flooding and associated damages such as streambank erosion and sediment moving through the stream system. Reducing these impacts can likely be achieved by protecting and enhancing stream function and giving the stream room to flood and dissipate its energy.

Flooding will continue to be a threat to property as long as residences are within the floodplain. Throughout New York State, the valleys were settled because they are flat, land is productive, and because water is easily accessible. With the changing climate, we are seeing more frequent and larger storm events as well as an increase in flooding. In order to positively mitigate these impacts, other means of reducing flood impacts should be considered. One such consideration could be to adopt and follow stricter floodplain regulations to limit development in the floodplain. Giving streams room to flood onto a functioning floodplain without homes or structures would be one way to flood proof our communities. Recognizing and protecting floodplains is a practice often overlooked. Making sure streams have room to access their floodplain when they are needed is very important. We cannot change the weather but we certainly can change how we prepare for it.

There is a need for secure funding for communities to be proactive to these problems. Installing flood retention in the headwaters to hold back flood waters and release them slowly may also help reduce flood damages. There will always be benefits and downfalls to any of these options.

Streambank erosion was by far the most visible issue after completing the stream assessment. Impacts from streambank erosion affect more than just the actively eroding streambank. Excess gravel released into the stream system continually gets deposited and re-deposited downstream. Excessive deposition causes the stream to meander more often causing erosion of other streambanks. The cost of erosion is compounded as stabilization of actively eroding streambanks is expensive as is the cost to remove/manage gravel downstream. Restoring function and access to floodplains provides streams a place to spread out flood waters and can lower stream forces thus allowing the stream to stabilize itself. Once streams find a stable stream slope, sinuosity and dimension they can stabilize themselves but with a majority of development and infrastructure in the valleys, the final stable location might not be socially acceptable.

It will take a comprehensive effort to start chipping away at the complicated issues faced in the watershed. In the past, these efforts have been addressed on an individual basis. Information in this report and gained from completing stream and culvert assessments, will help secure funding to systematically address issues in the watershed.

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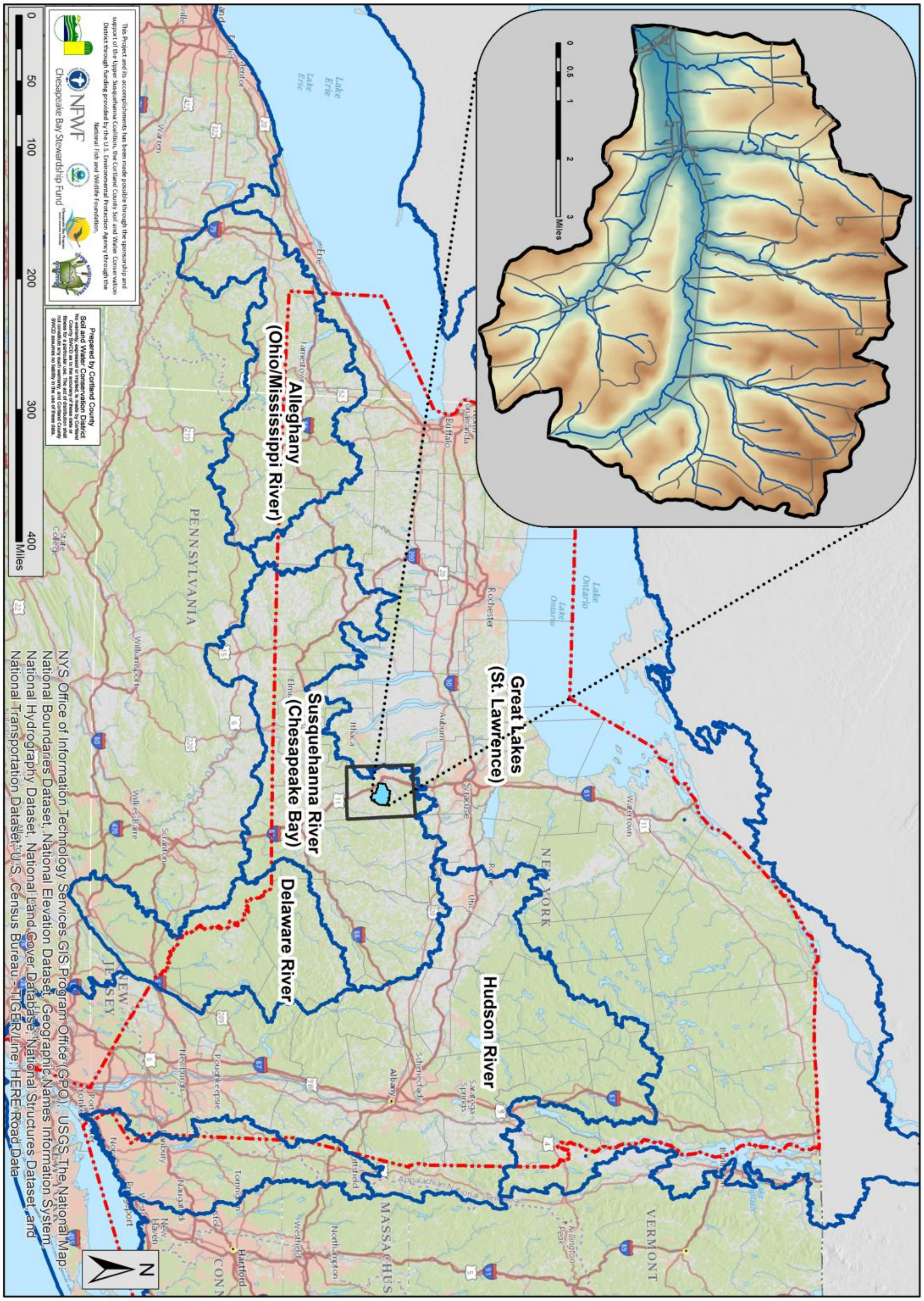
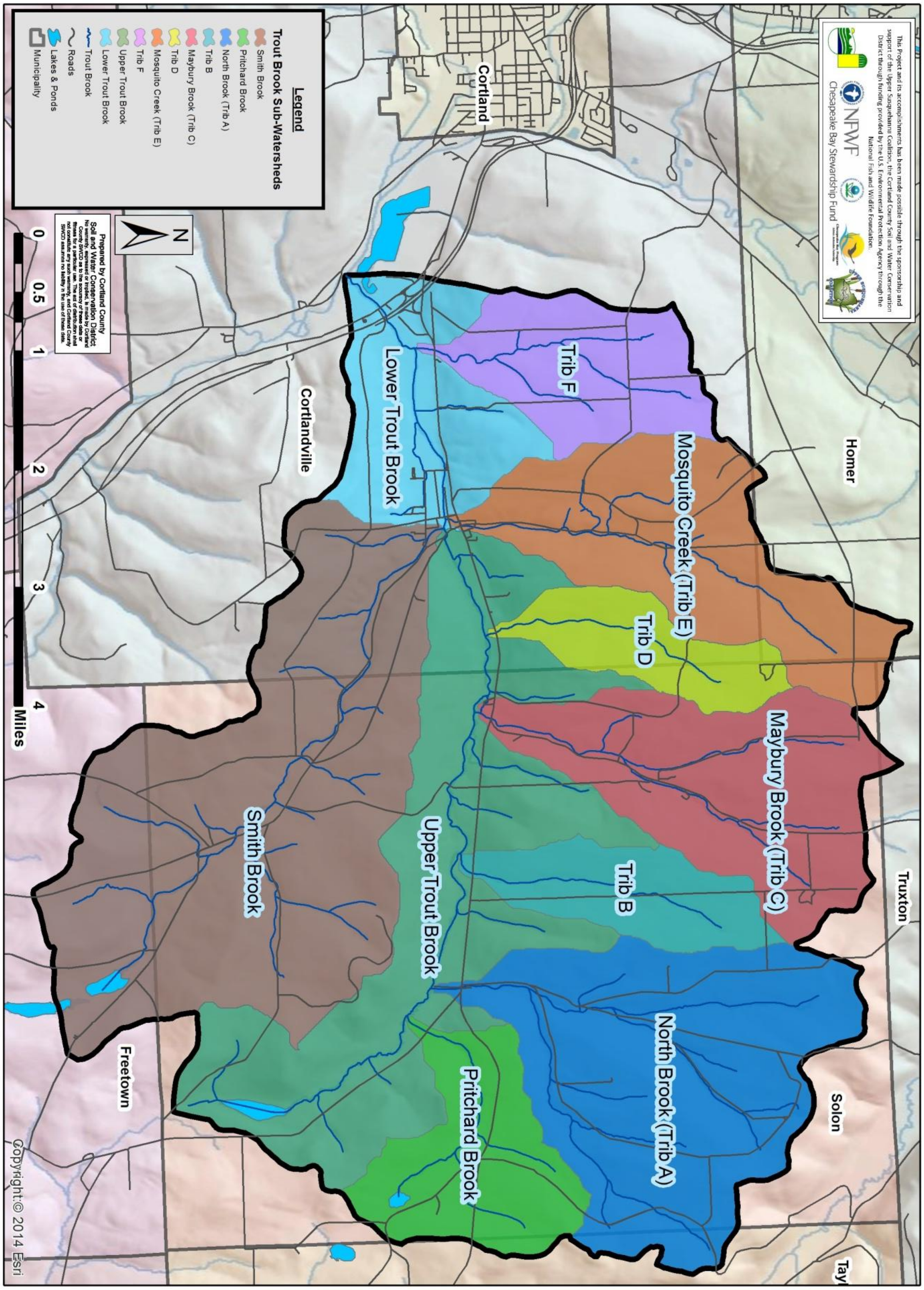
Drainage Basin Map of New York State
Trout Brook Location




Trout Brook Watershed - USC I4 Project
Sub-Watersheds
Legend
Trout Brook Sub-Watersheds
Smith Brook
Pritchard Brook
North Brook (Trib A)
Trib B
Maybury Brook (Trib C)
Trib D
Mosquito Creek (Trib E)
Trib F
Lower Trout Brook
Upper Trout Brook
Trout Brook
Roads
Lakes & Ponds
Municipality
N
Prepared by Cortland County Soil and Water Conservation District
0
0.5
1
2
3
4
Miles
Cortland
Cortlandville
Homer
Truxton
Solon
Freetown
Trib F
Lower Trout Brook
Mosquito Creek (Trib E)
Trib D
Maybury Brook (Trib C)
Trib B
Smith Brook
Upper Trout Brook
North Brook (Trib A)
Pritchard Brook
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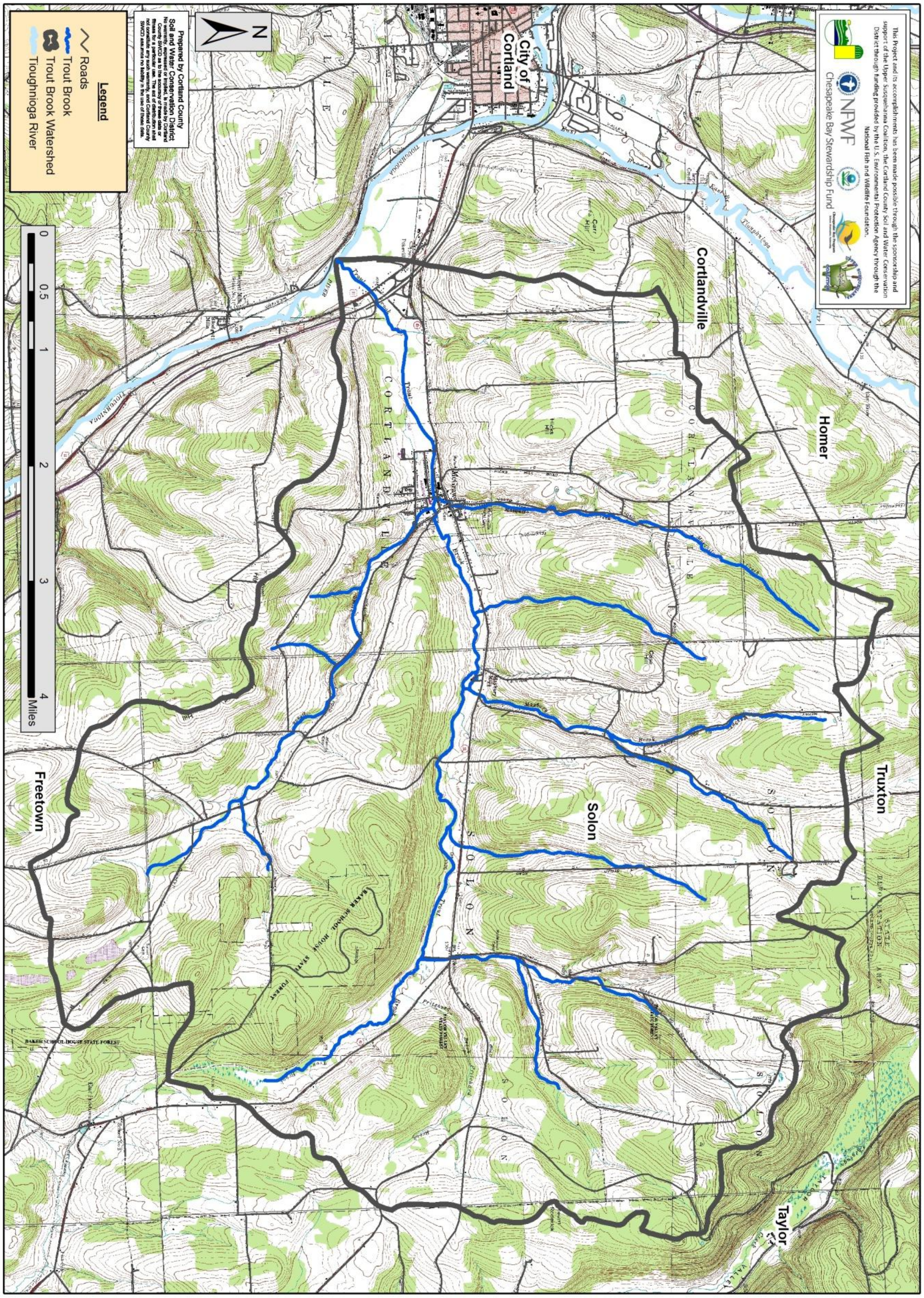
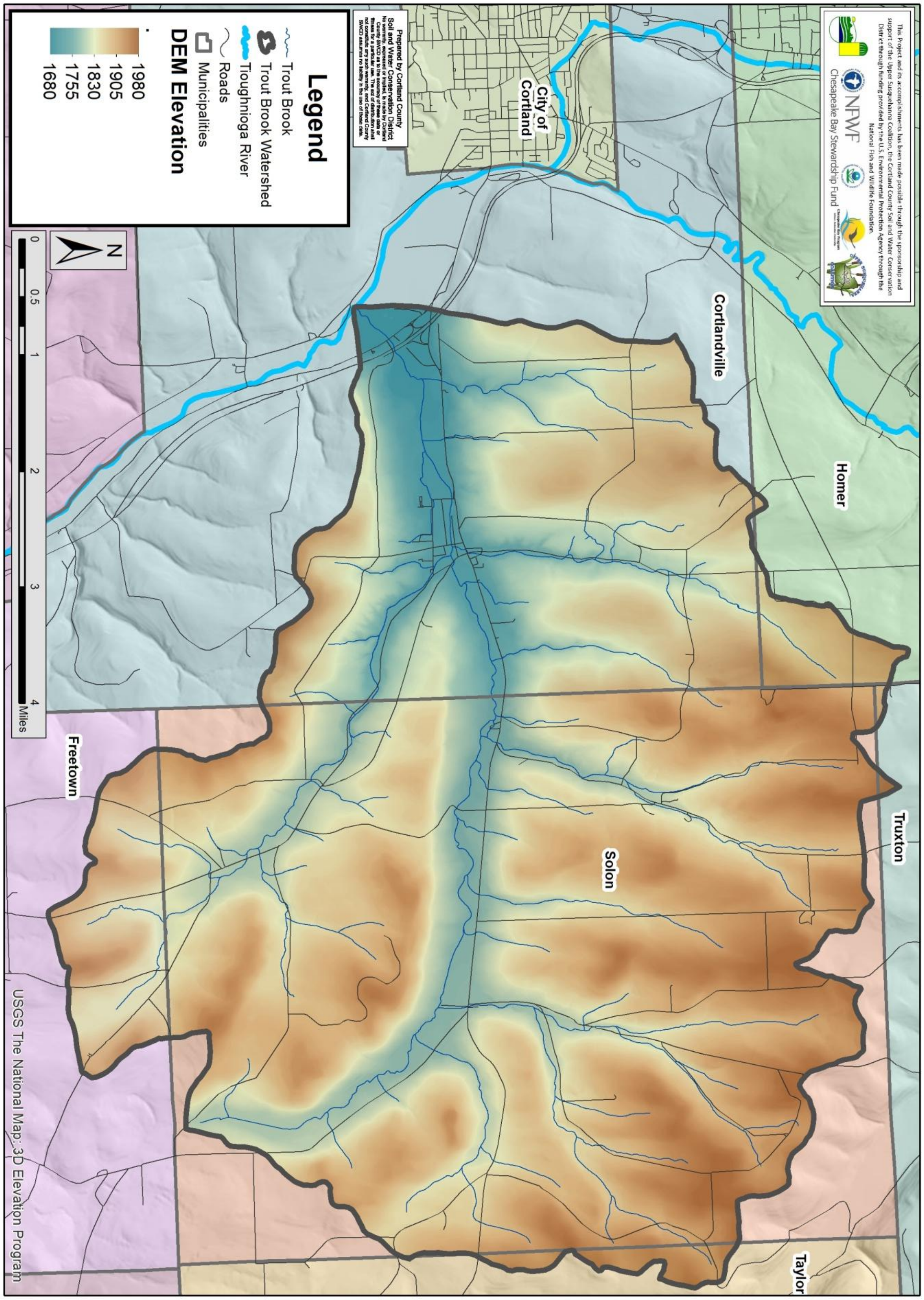
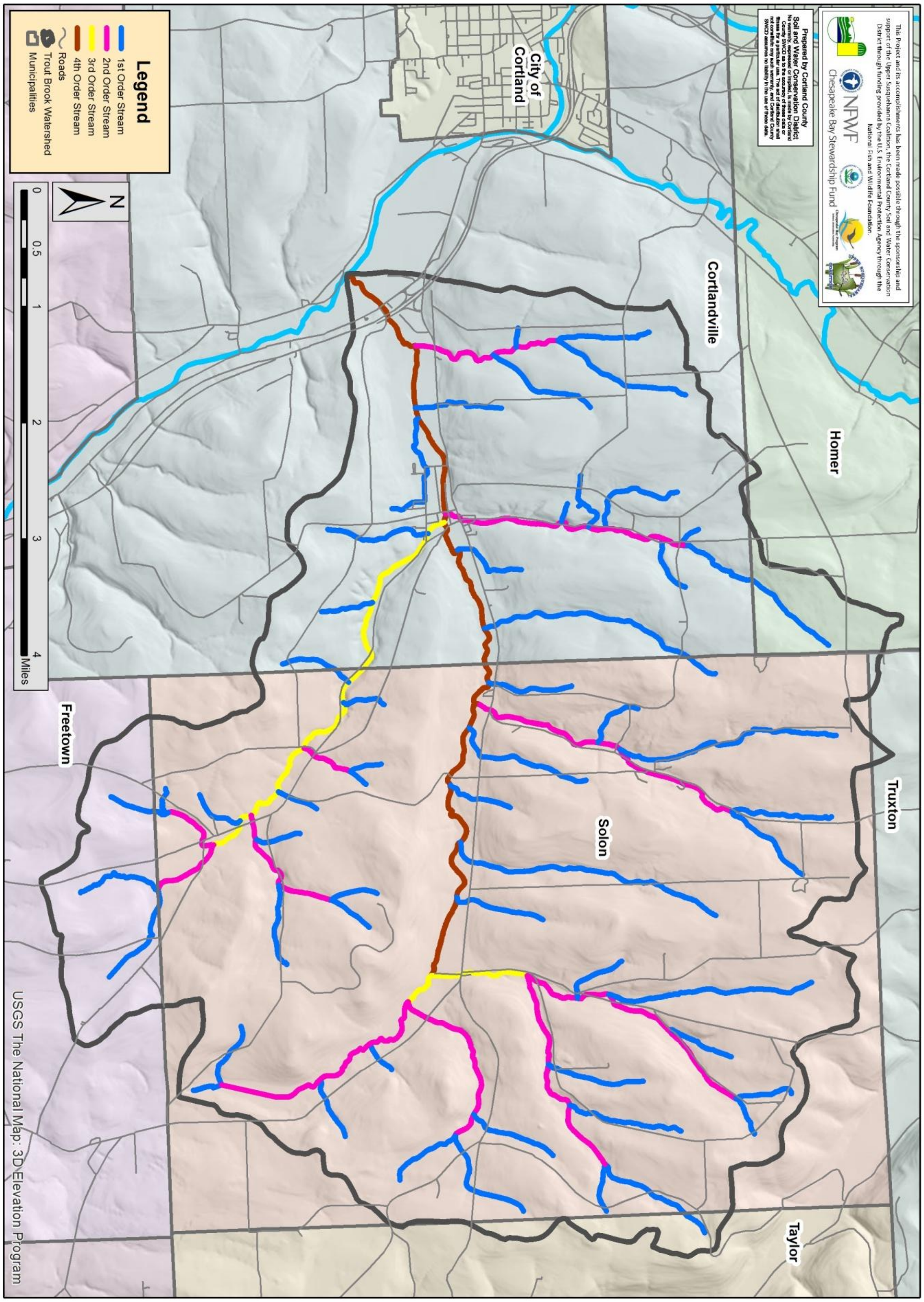
Trout Brook Watershed - USC I4 Project
USGS Topography Map

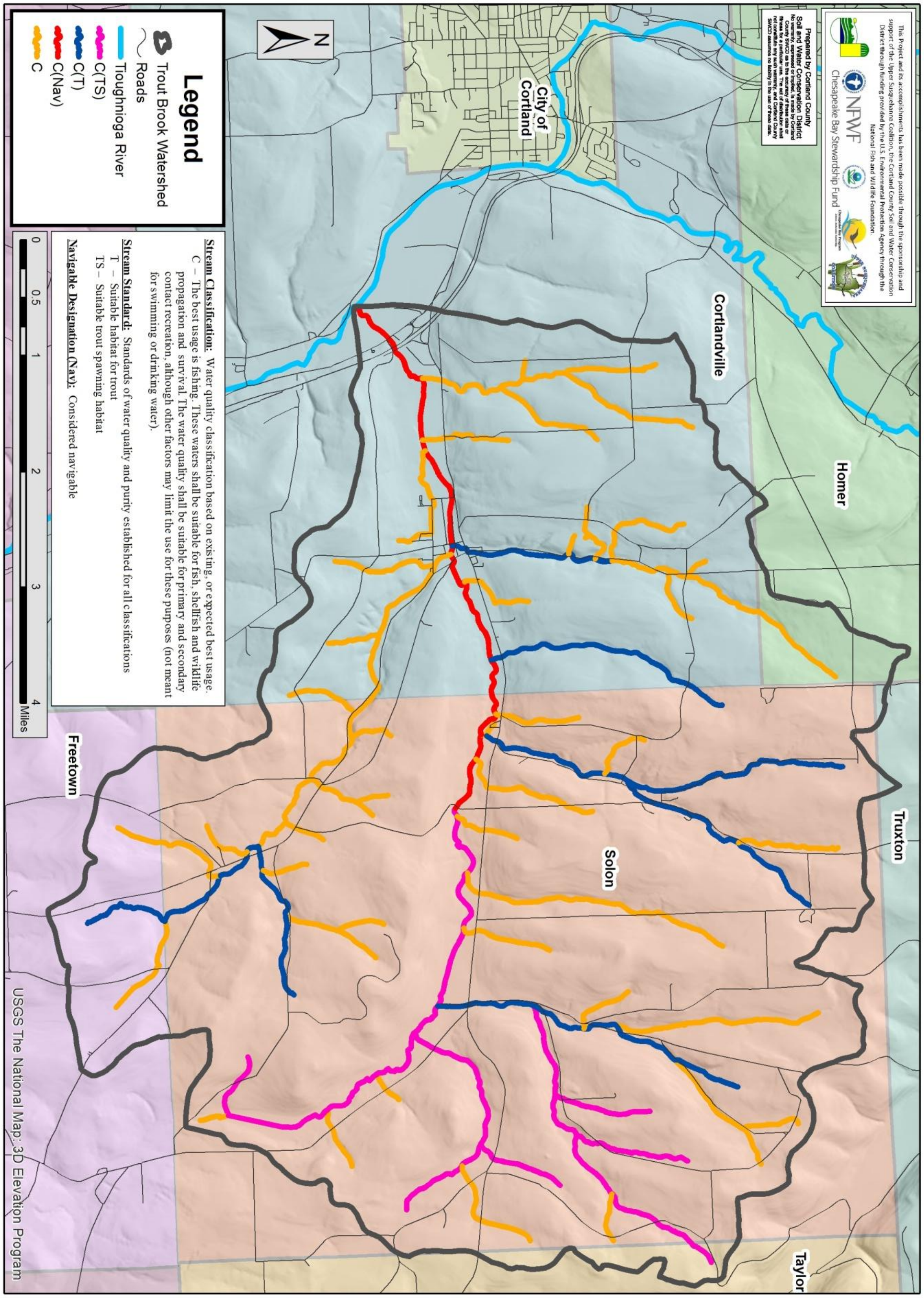


Trout Brook Watershed - USC I4 Project Digital Elevation Model (DEM)

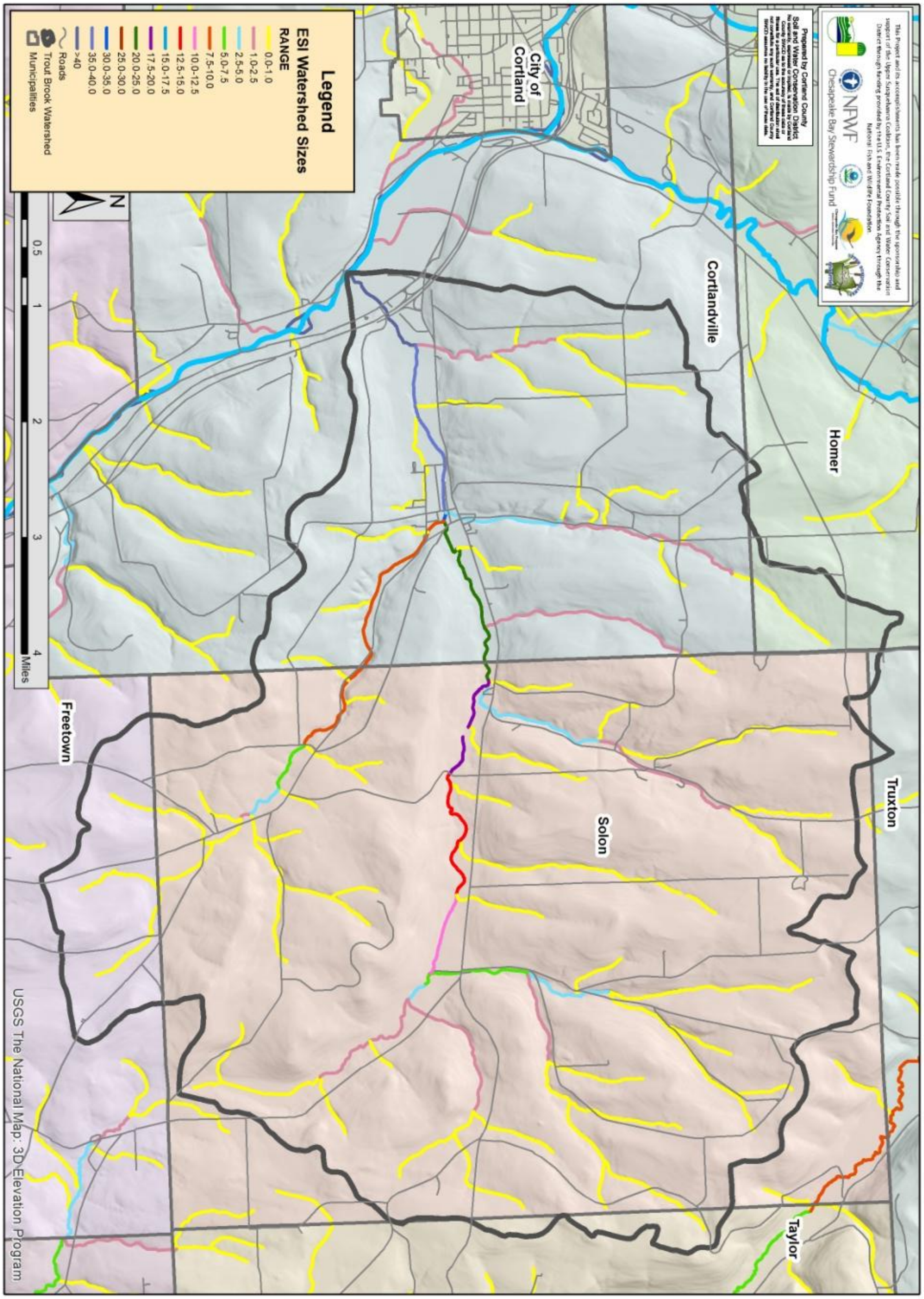


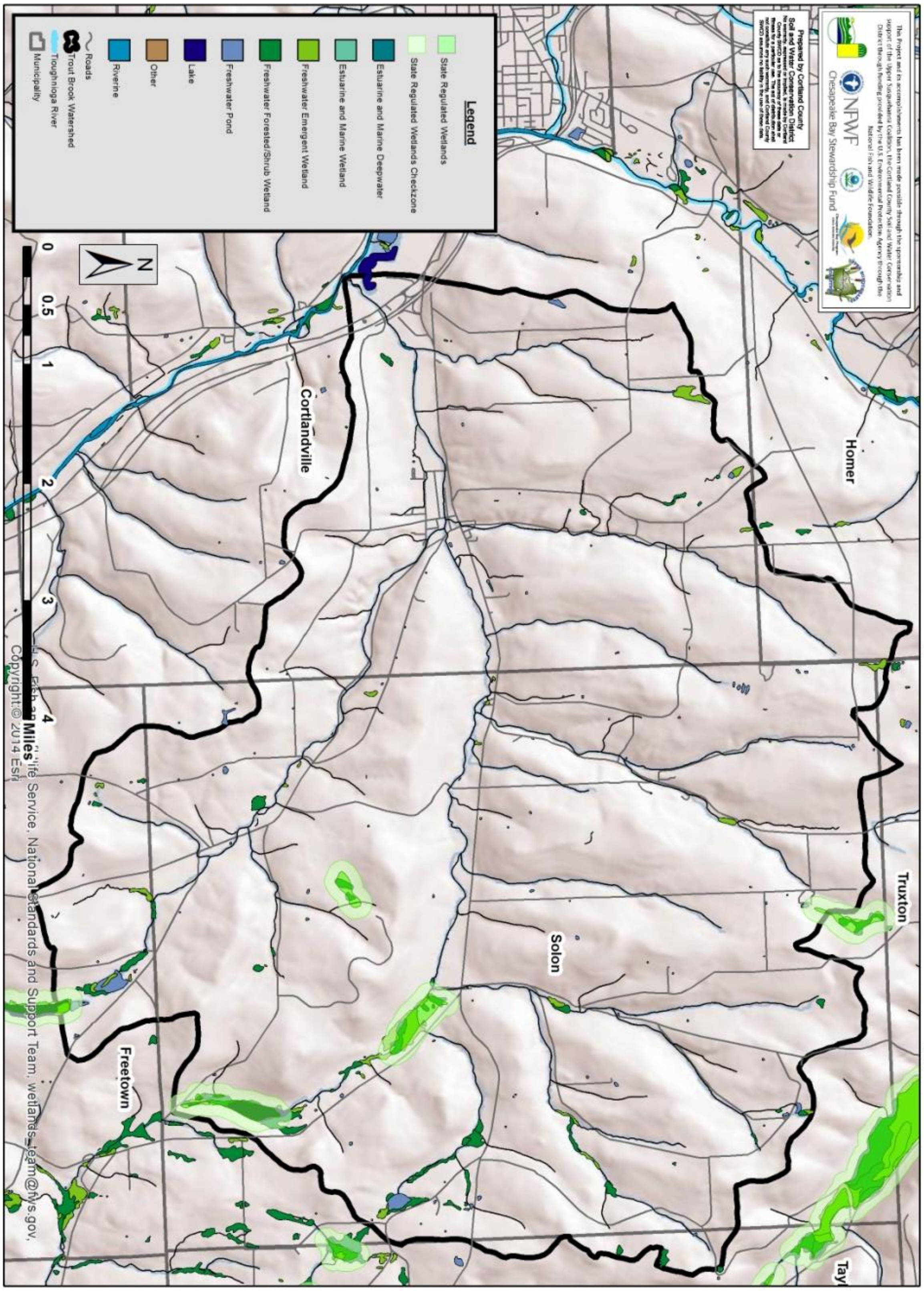
Trout Brook Watershed - USC I4 Project Stream Order




Trout Brook Watershed - USC I4 Project
NYS DEC Stream Classification
Legend
Trout Brook Watershed
Roads
Tioughnioga River
C(TS)
C(T)
C(Nav)
C
Stream Classification: Water quality classification based on existing, or expected best usage.
C – The best usage is fishing. These waters shall be suitable for fish, shellfish and wildlife propagation and survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes (not meant for swimming or drinking water).
Stream Standard: Standards of water quality and purity established for all classifications
T – Suitable habitat for trout
TS – Suitable trout spawning habitat
Navigable Designation (Nav): Considered navigable
0 0.5 1 2 3 4 Miles
N
City of Cortland
Cortlandville
Homer
Freetown
Solon
Truxton
Taylor
Chesapeake Bay Stewardship Fund
NFWF
USGS The National Map: 3D Elevation Program

Trout Brook Watershed - USC I4 Project Watershed Sizes




Trout Brook Watershed - USC I4 Project
NYS DEC & Federal Wetlands (National Wetland Inventory)
Legend
State Regulated Wetlands
State Regulated Wetlands Checkzone
Estuarine and Marine Deepwater
Estuarine and Marine Wetland
Freshwater Emergent Wetland
Freshwater Forested/Shrub Wetland
Freshwater Pond
Lake
Other
Riverine
Roads
Trout Brook Watershed
Tioughnioga River
Municipality
Prepared by Cortland County Soil and Water Conservation District
NFWF
Chesapeake Bay Stewardship Fund
N
0 0.5 1 2 3 4 Miles
Homer
Cortlandville
Truxton
Solon
Freetown
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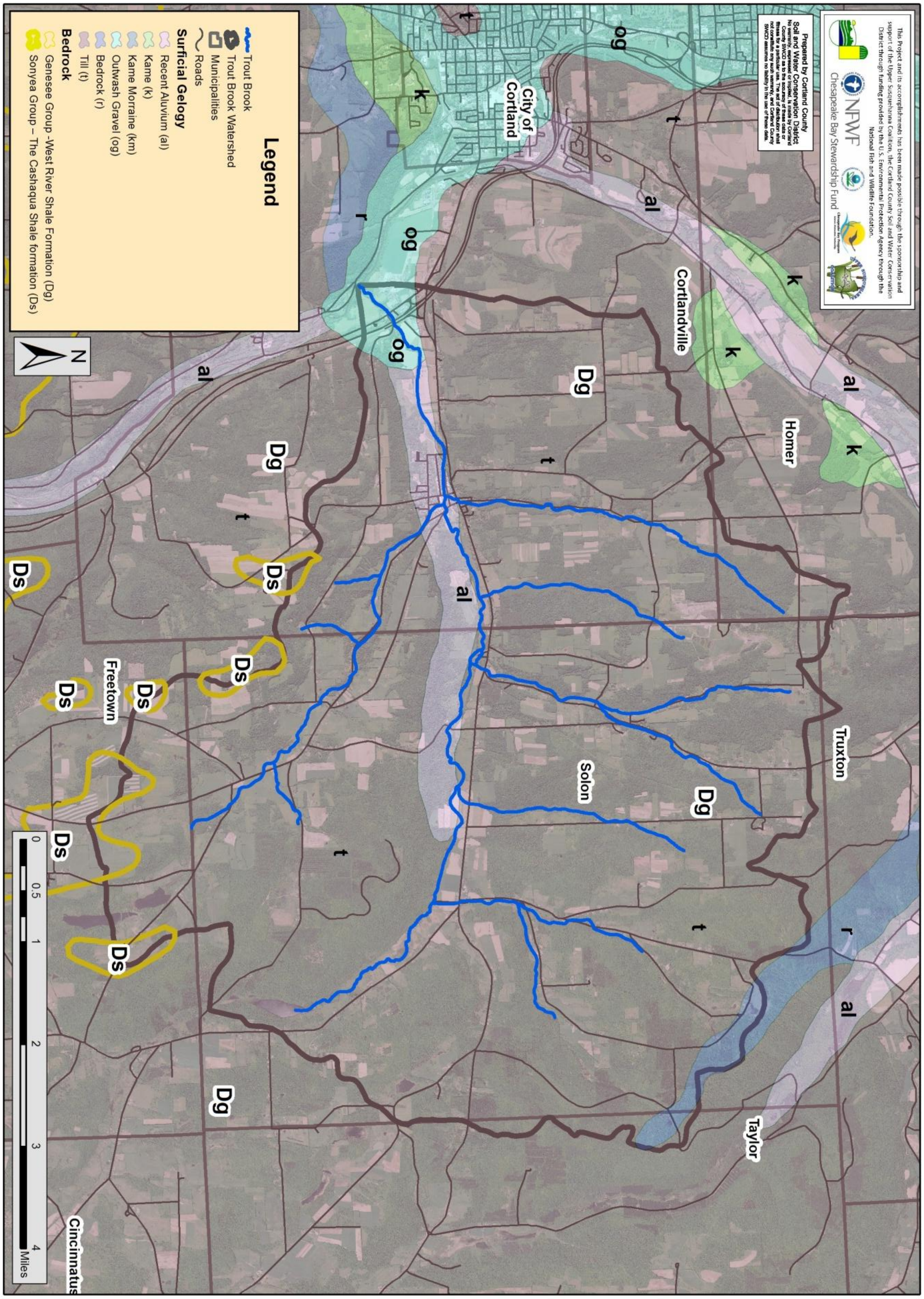
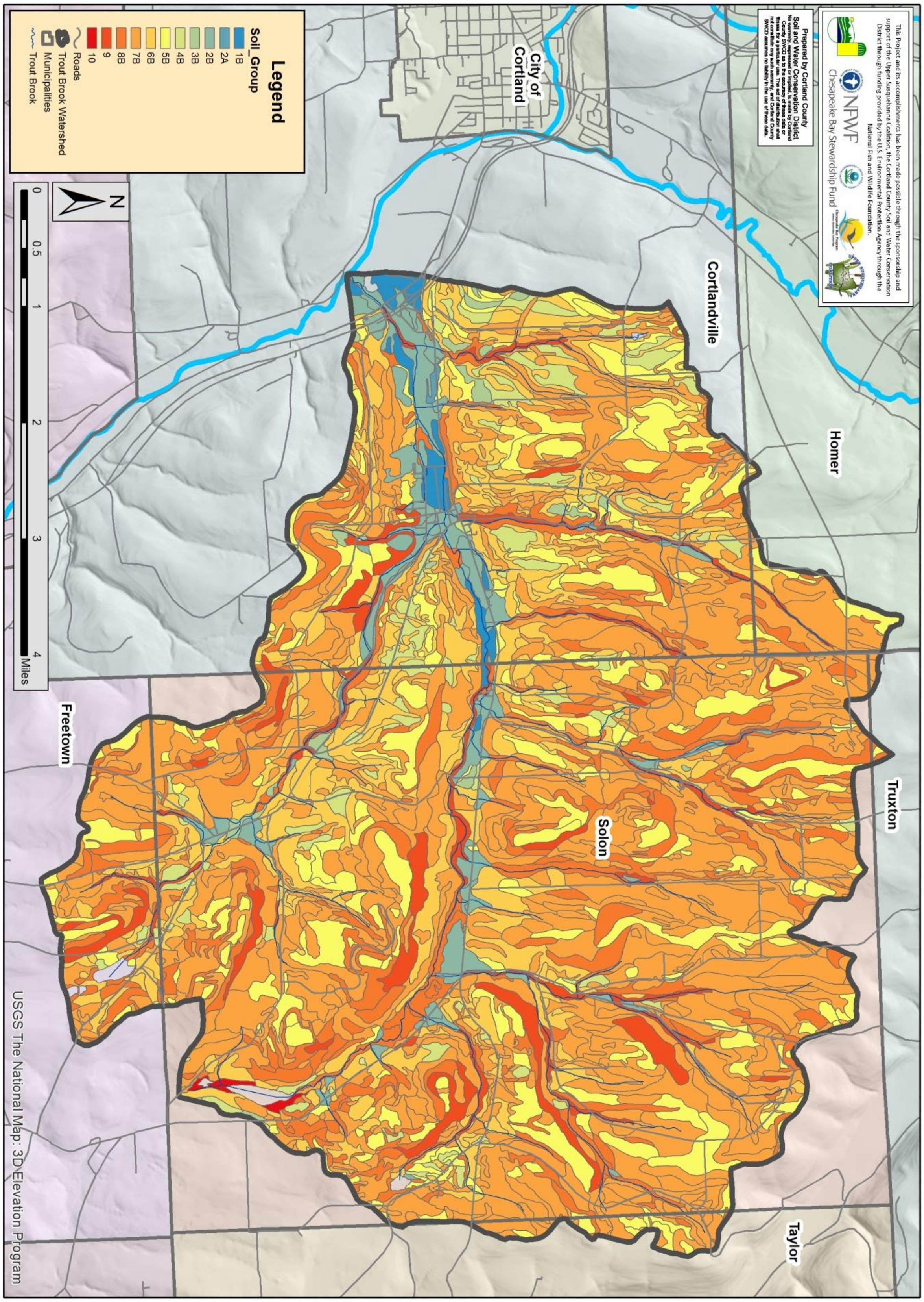
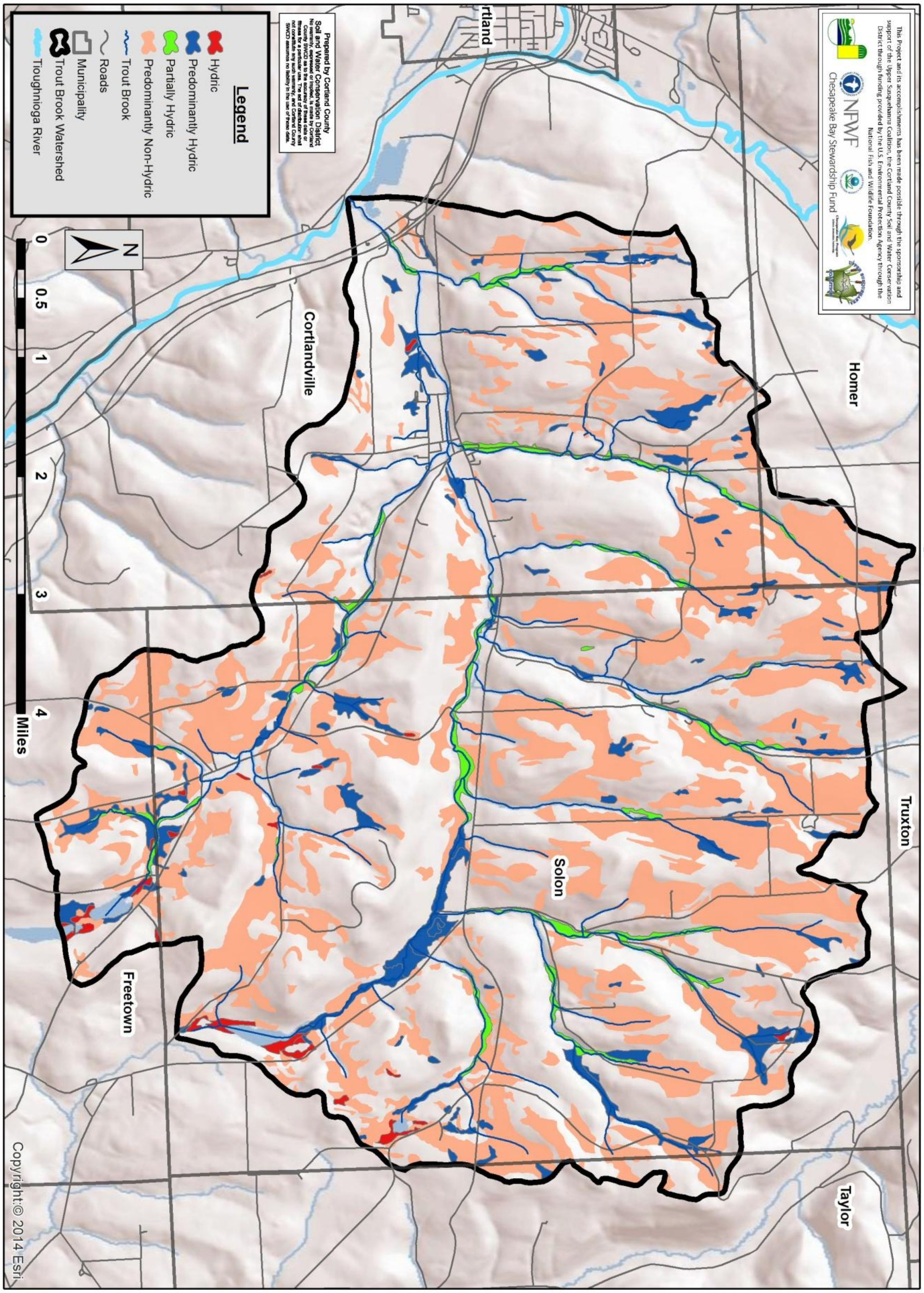

Trout Brook Watershed - USC I4 Project
Surficial and Bedrock Geology
Legend
Trout Brook
Trout Brook Watershed
Municipalities
Roads
Surficial Gelogy
Recent Aluvium (al)
Kame (k)
Kame Morraine (km)
Outwash Gravel (og)
Bedrock (r)
Till (t)
Bedrock
Genesee Group -West River Shale Formation (Dg)
Sonyea Group – The Cashaqua Shale formation (Ds)
N
0 0.5 1 2 3 4 Miles
City of Cortland
Cortlandville
Homer
Truxton
Solon
Freetown
Taylor
Cincinnatus
Chesapeake Bay Stewardship Fund
NFWF



Trout Brook Watershed - USC I4 Project Soil Groups


Trout Brook Watershed - USC I4 Project
Hydric Soils
This Project and its accomplishments has been made possible through the sponsorship and support of the Upper Susquehanna Coalition, the Cortland County Soil and Water Conservation District through funding provided by the U.S. Environmental Protection Agency through the National Fish and Wildlife Foundation.
NFWF
Chesapeake Bay Stewardship Fund
Prepared by Cortland County Soil and Water Conservation District
Legend
Hydric
Predominantly Hydric
Partially Hydric
Predominantly Non-Hydric
Trout Brook
Roads
Municipality
Trout Brook Watershed
Tioughnioga River
N
0
0.5
1
2
3
4
Miles
rtland
Cortlandville
Homer
Truxton
Solon
Freetown
Taylor
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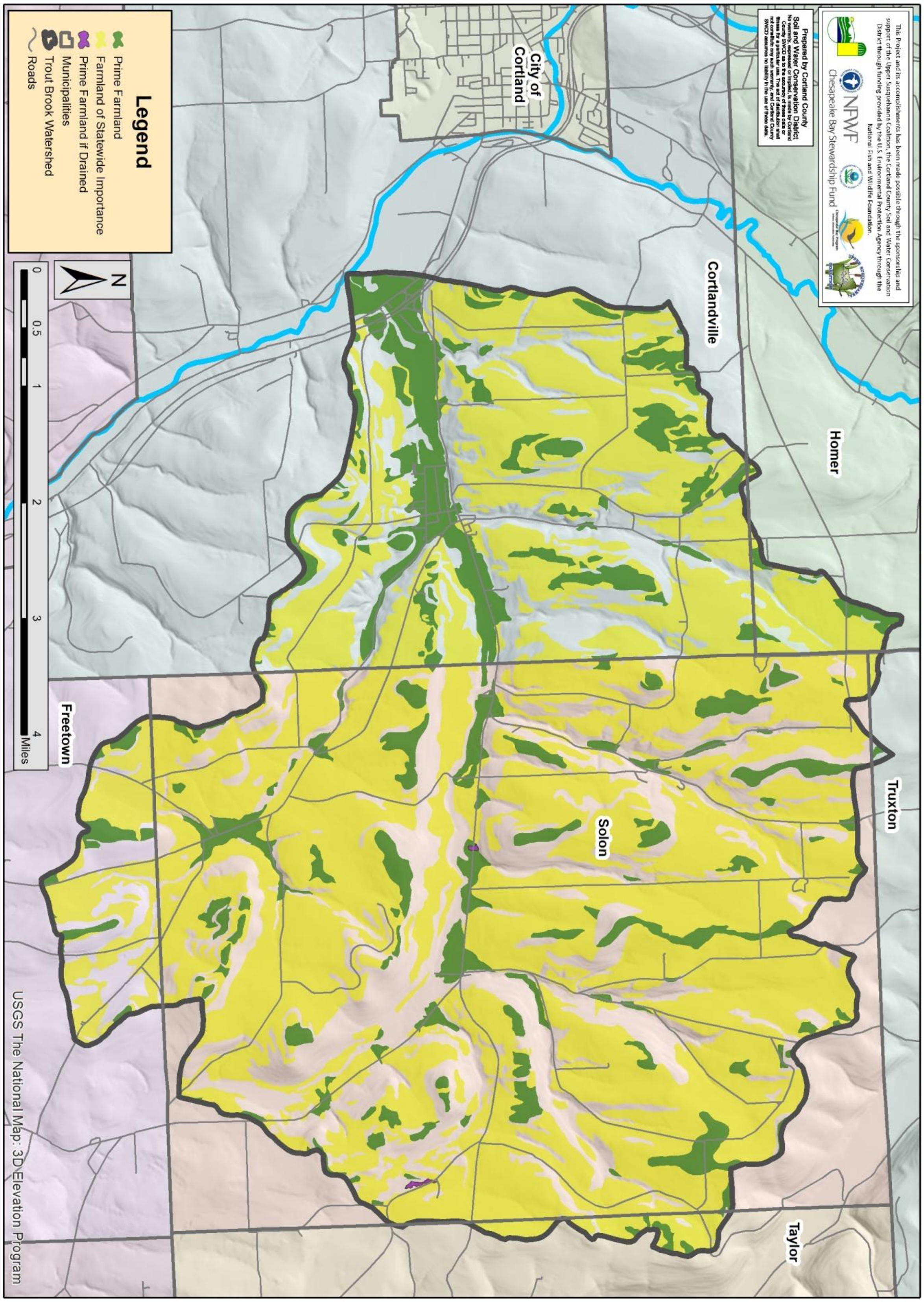
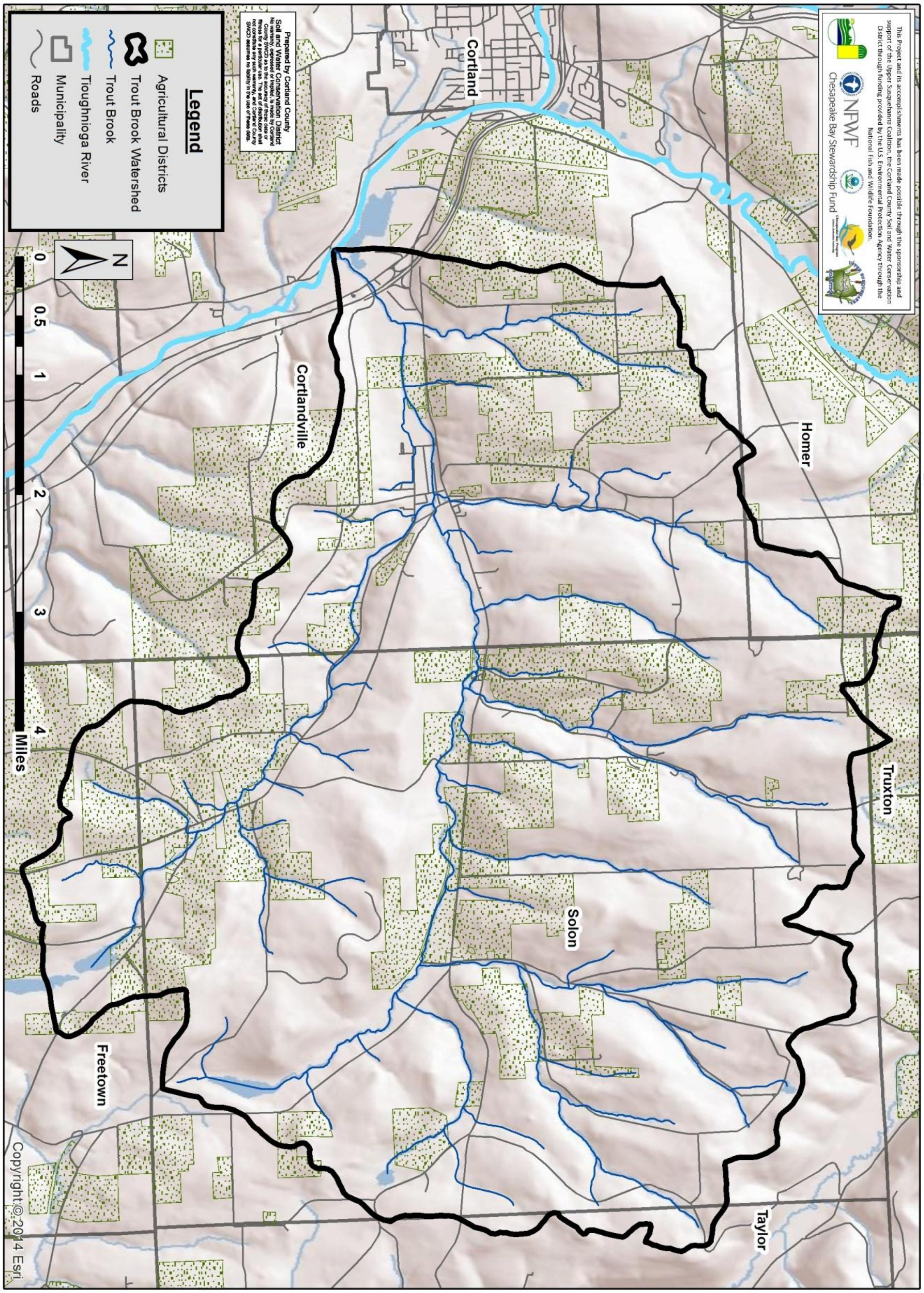
Trout Brook Watershed - USC I4 Project
Prime and Farmland of Statewide Importance




Trout Brook Watershed
Agricultural Districts
Legend
Agricultural Districts
Trout Brook Watershed
Trout Brook
Tioughnioga River
Municipality
Roads
N
0
0.5
1
2
3
4
Miles
Cortland
Cortlandville
Homer
Truxton
Solon
Freetown
Taylor
Prepared by Cortland County Soil and Water Conservation District
NFWF
Chesapeake Bay Stewardship Fund
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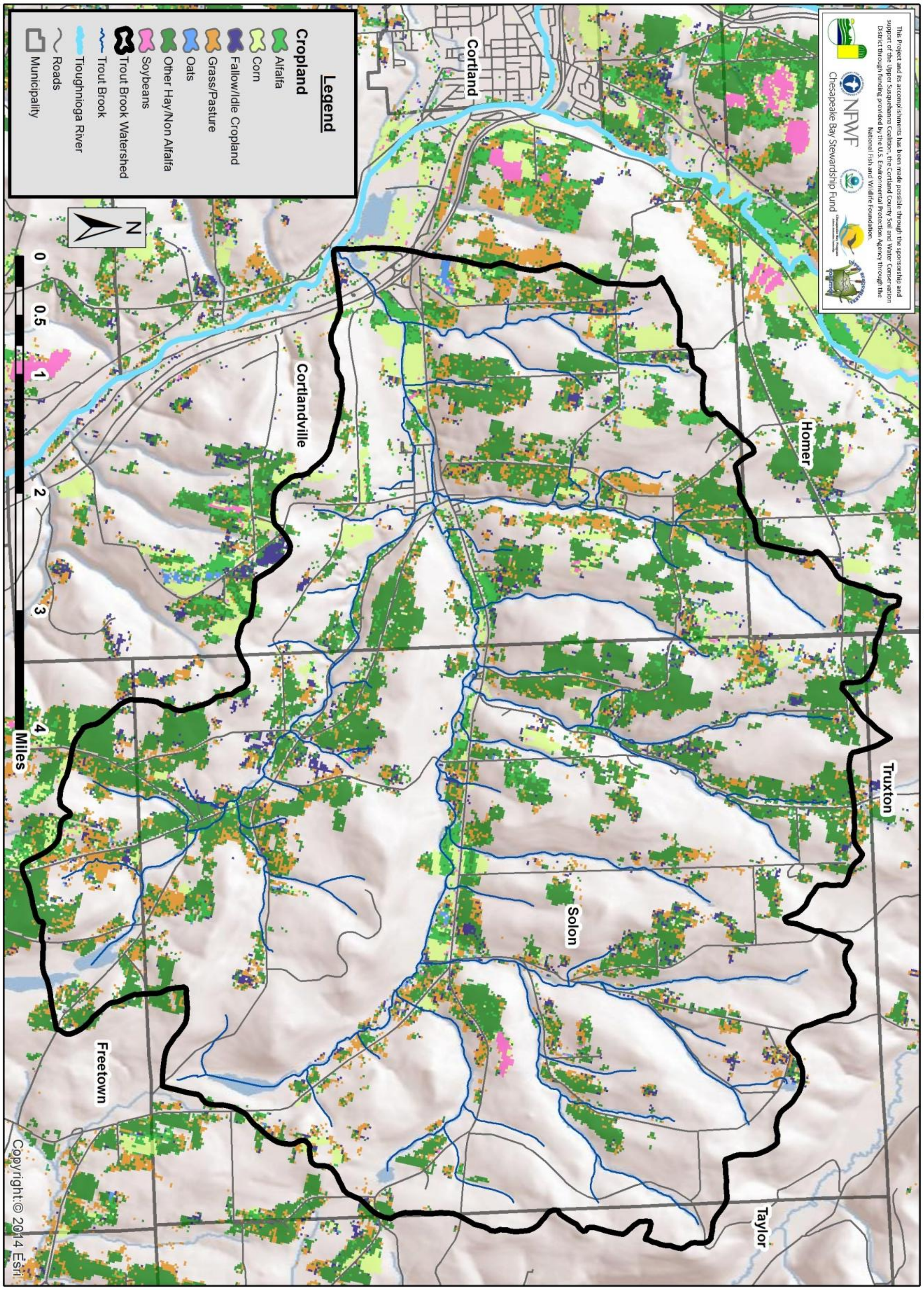
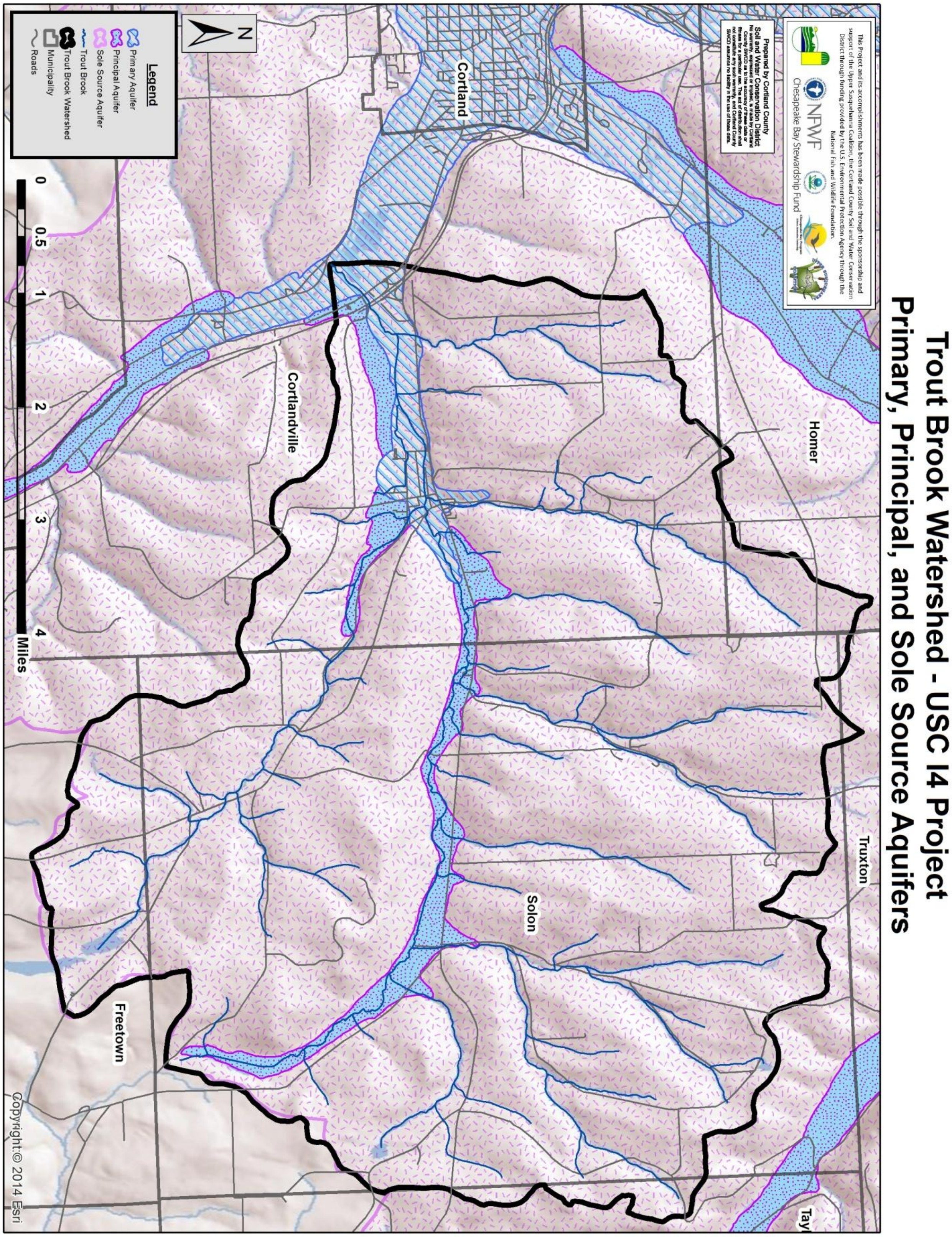
Trout Brook Watershed Cropland




Trout Brook Watershed - USC I4 Project
Primary, Principal, and Sole Source Aquifers
Legend
Primary Aquifer
Principal Aquifer
Sole Source Aquifer
Trout Brook
Trout Brook Watershed
Municipality
Roads
N
0 0.5 1 2 3 4 Miles
Cortland
Homer
Cortlandville
Truxton
Solon
Freetown
Tay
Prepared by Cortland County Soil and Water Conservation District
NFWF
Chesapeake Bay Stewardship Fund
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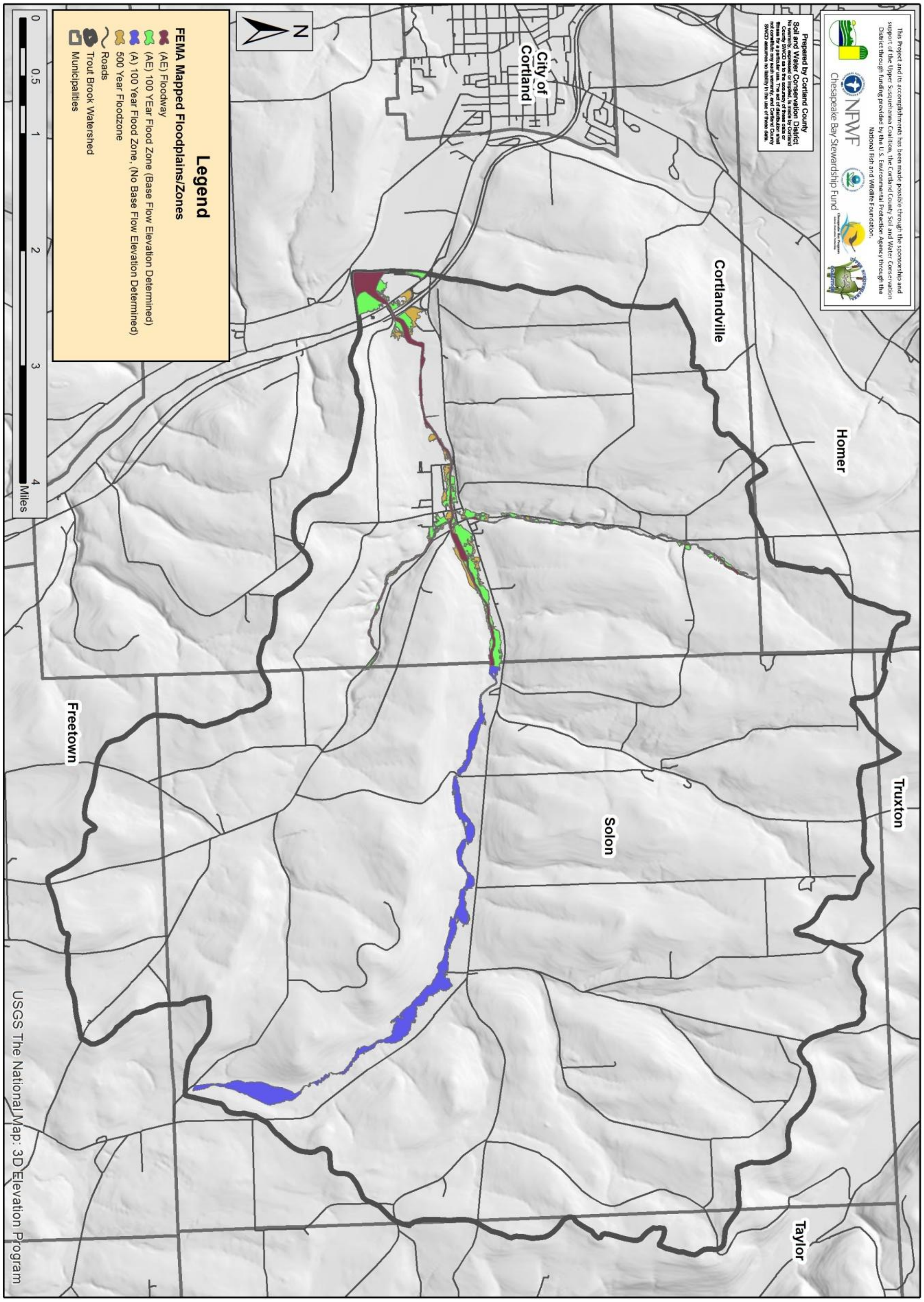
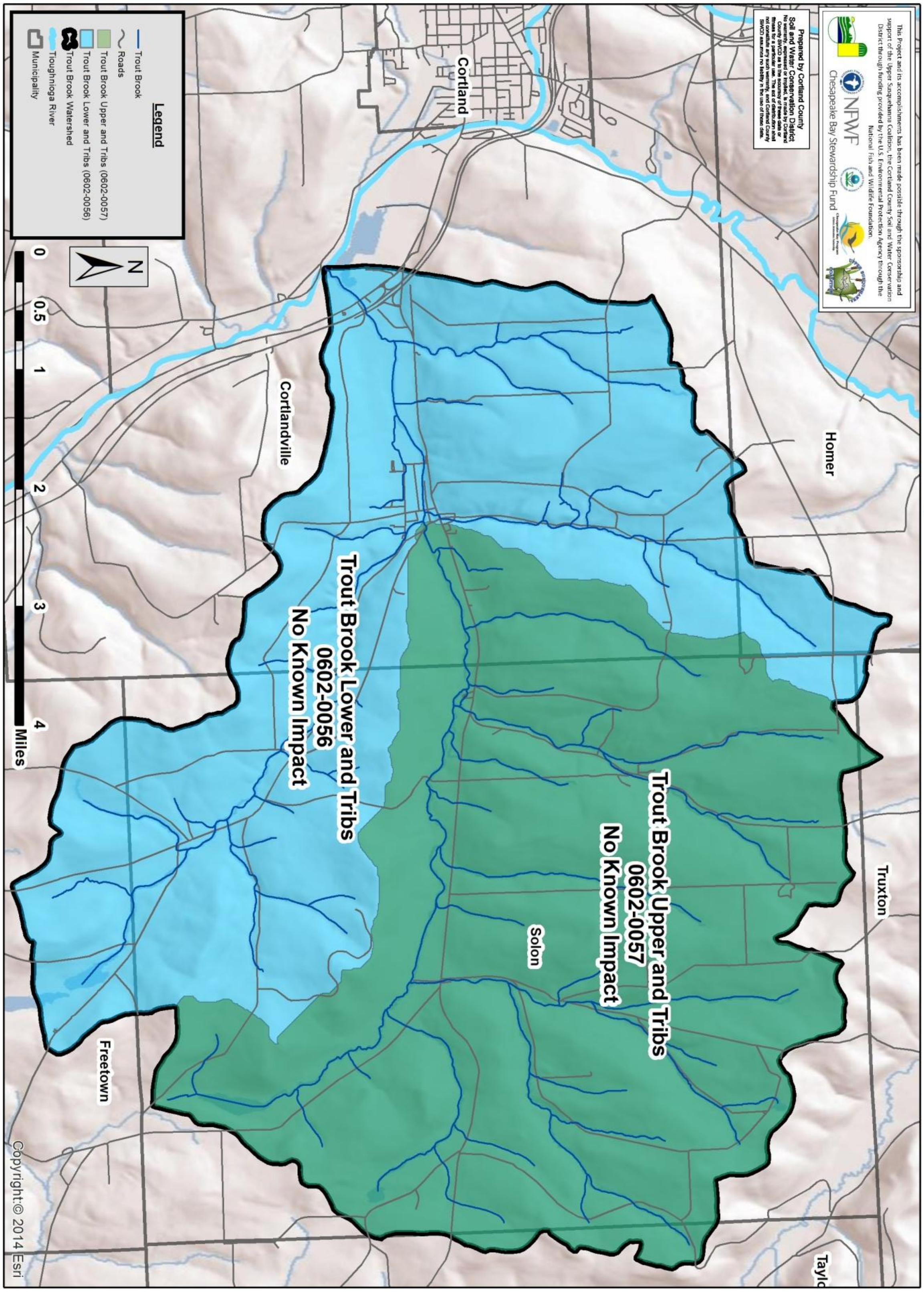
Trout Brook Watershed - USC I4 Project FEMA Mapped Floodplains




Trout Brook Watershed - USC I4 Project
NYS Priority Waterbodies List Sections
Trout Brook Upper and Tribs
0602-0057
No Known Impact
Trout Brook Lower and Tribs
0602-0056
No Known Impact
Cortland
Homer
Cortlandville
Truxton
Solon
Freetown
Legend
Trout Brook
Roads
Trout Brook Upper and Tribs (0602-0057)
Trout Brook Lower and Tribs (0602-0056)
Trout Brook Watershed
Tioughnioga River
Municipality
Prepared by Cortland County Soil and Water Conservation District
N
0
0.5
1
2
3
4
Miles
Chesapeake Bay Stewardship Fund
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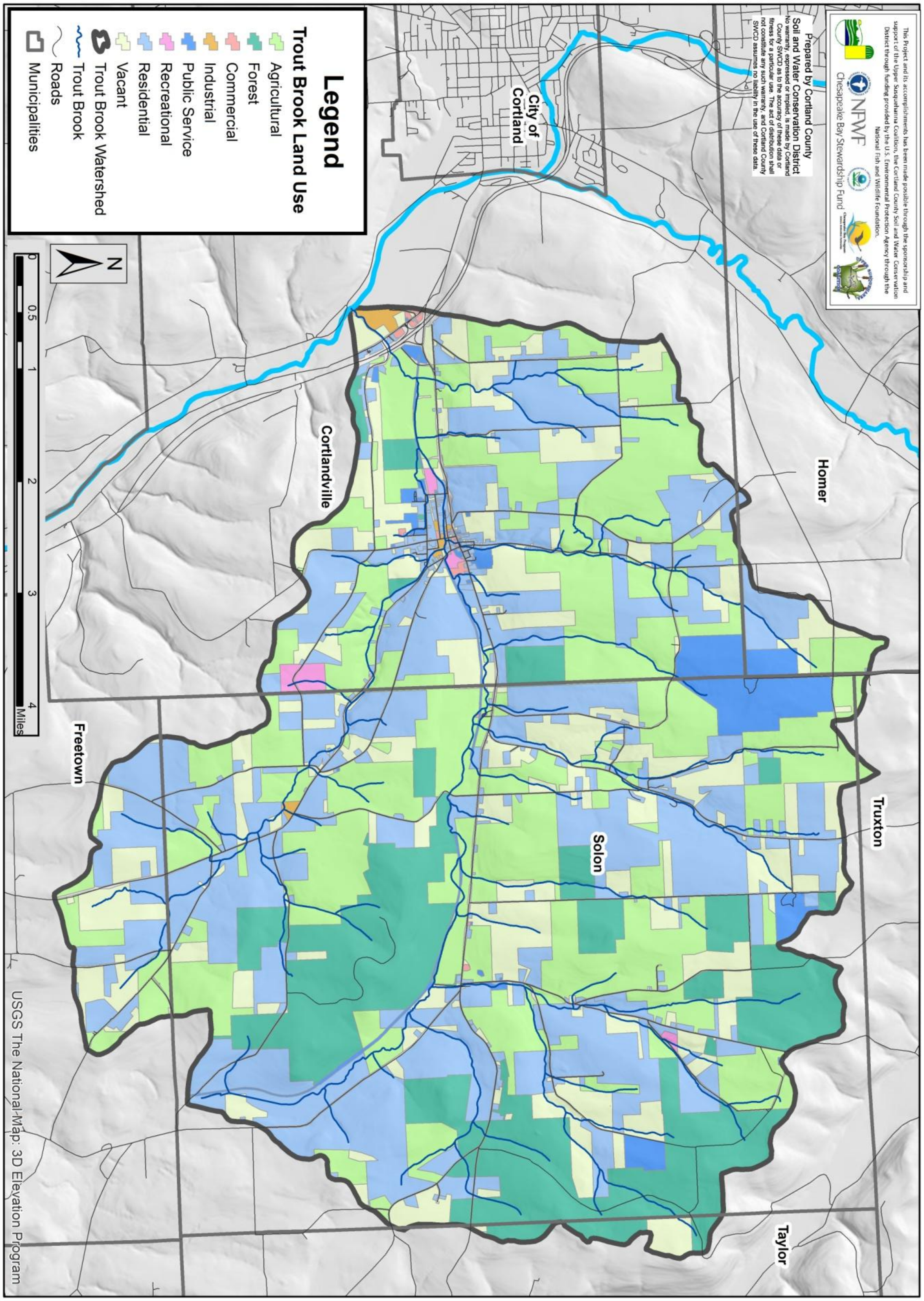
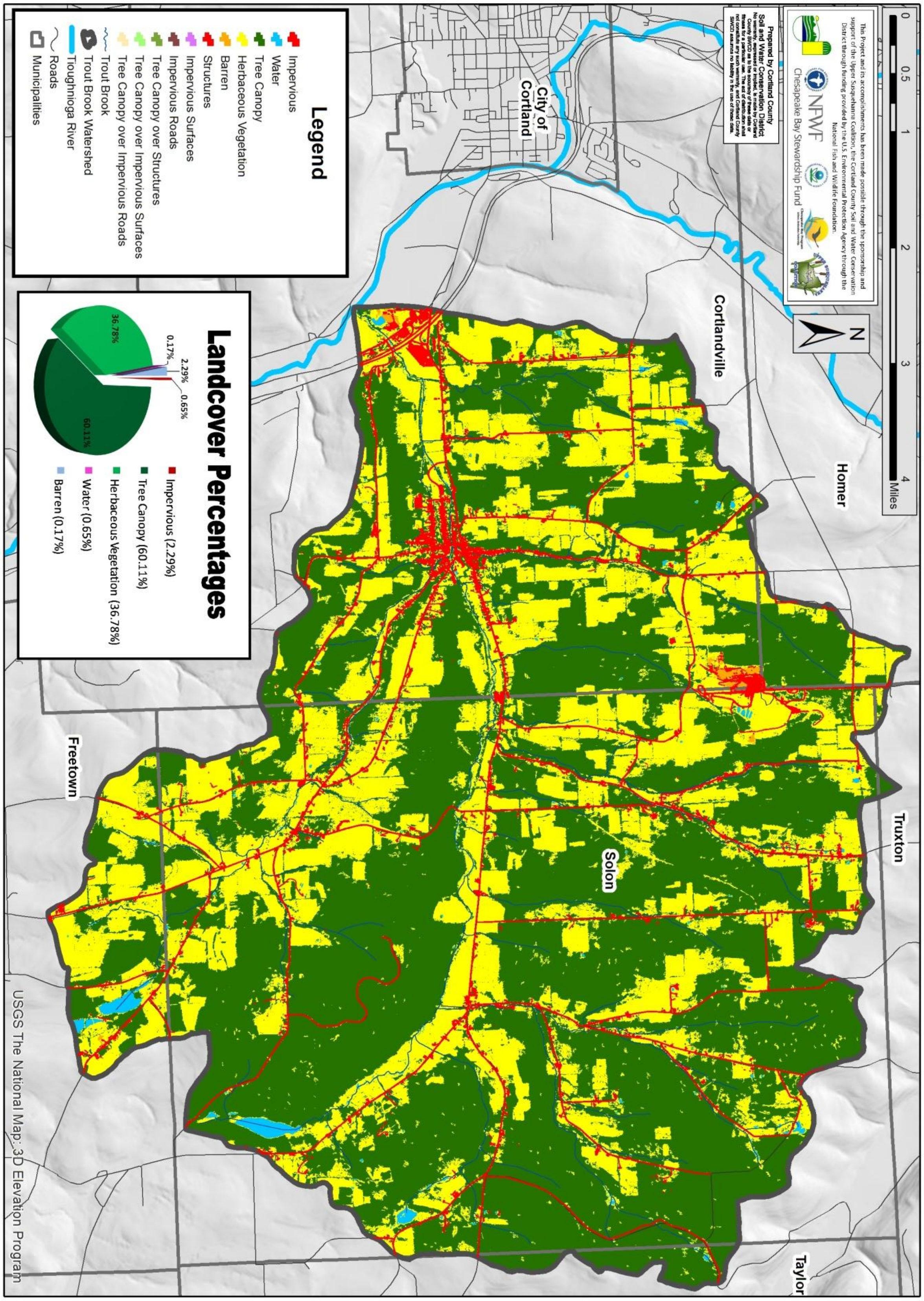
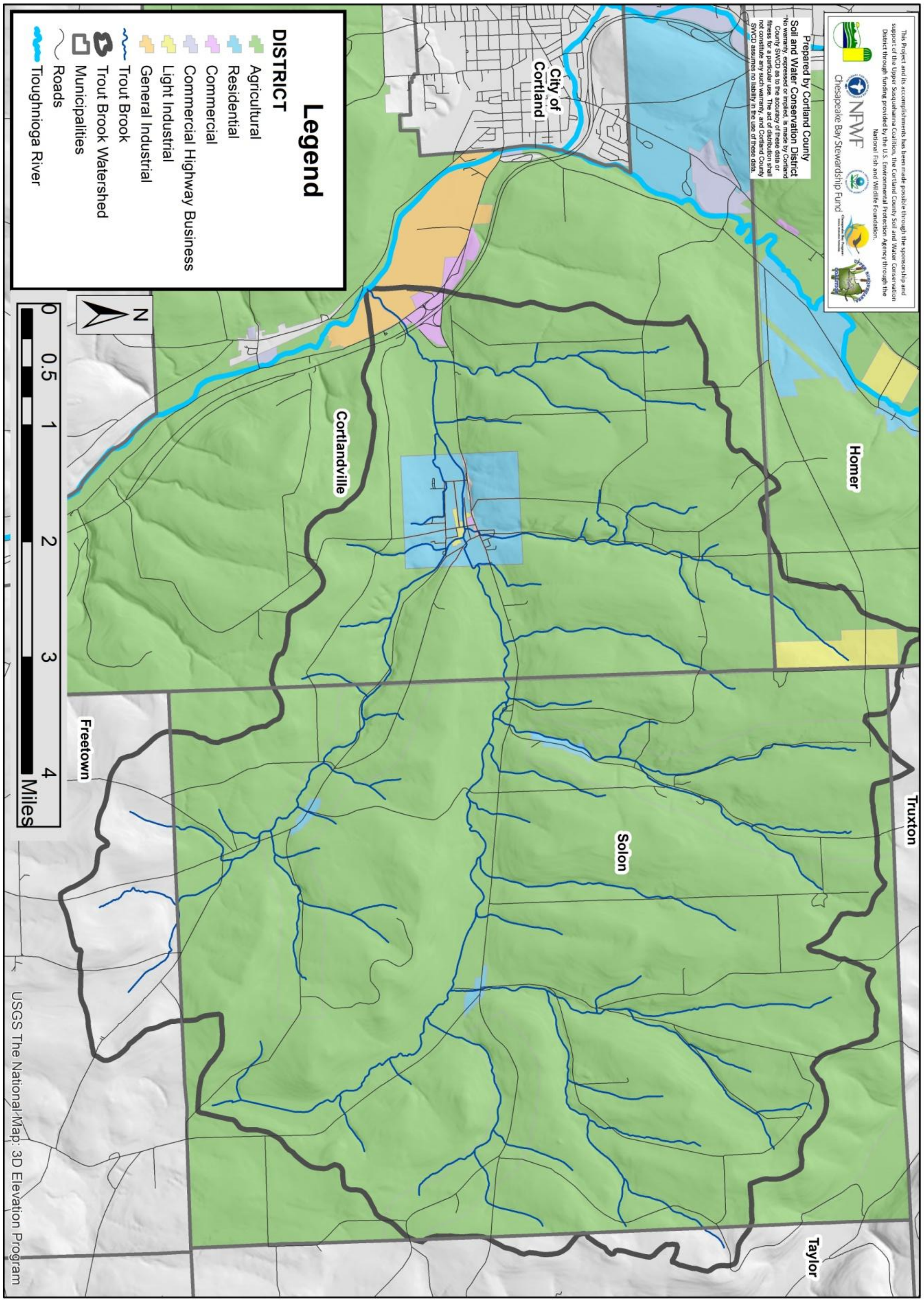
Trout Brook Watershed - USC I4 Project Land Use

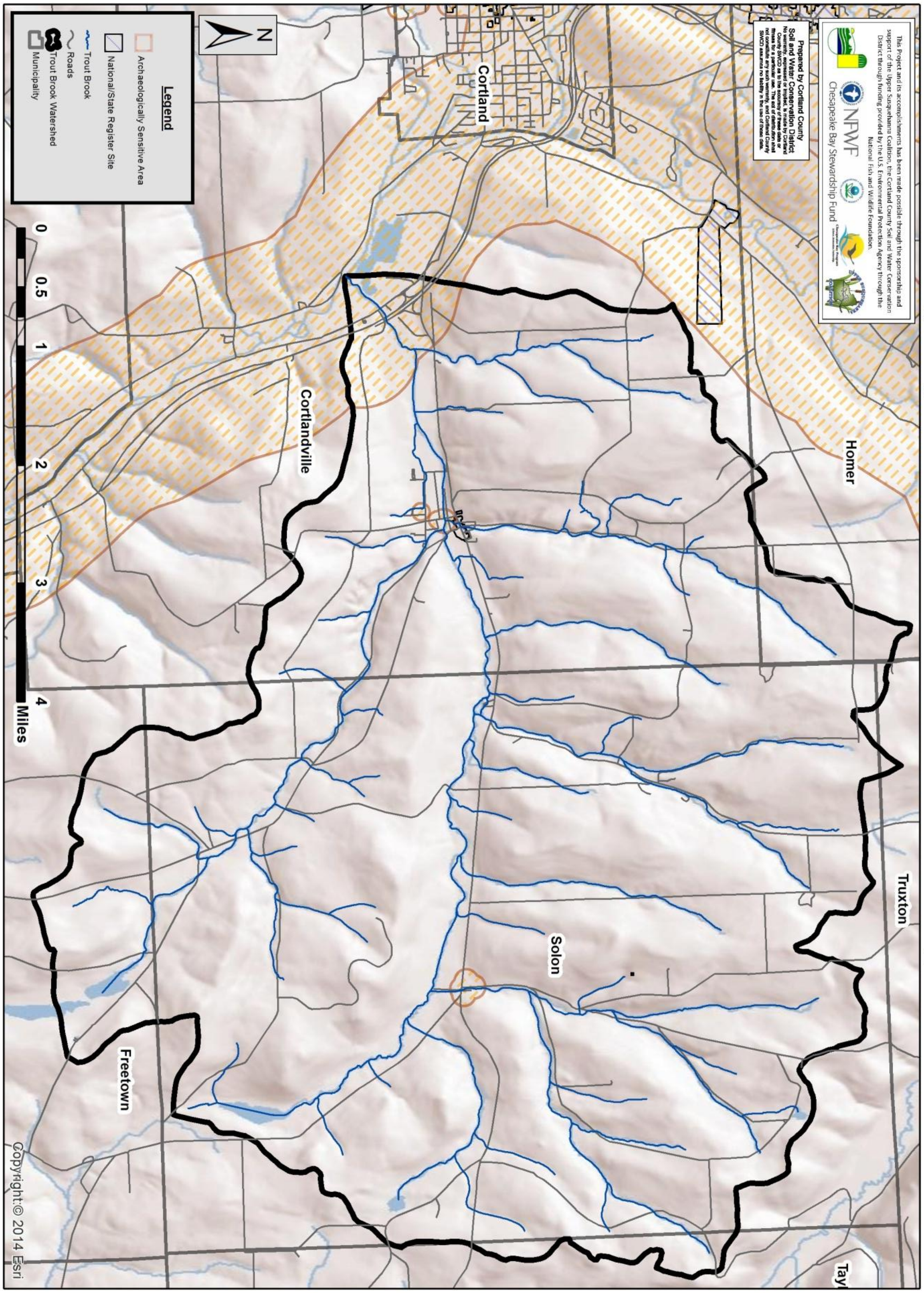




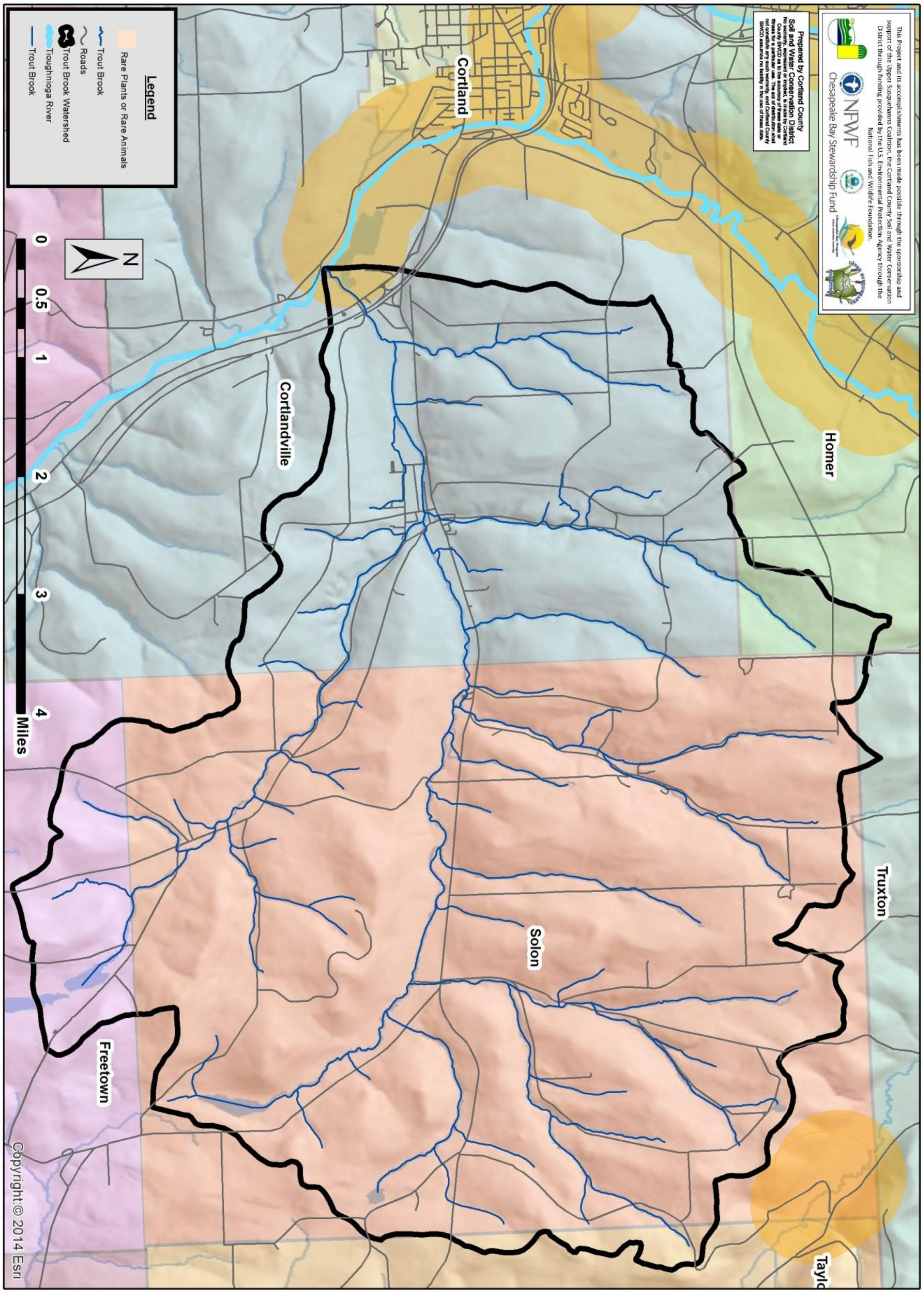
Trout Brook Watershed - USC I4 Project Landcover

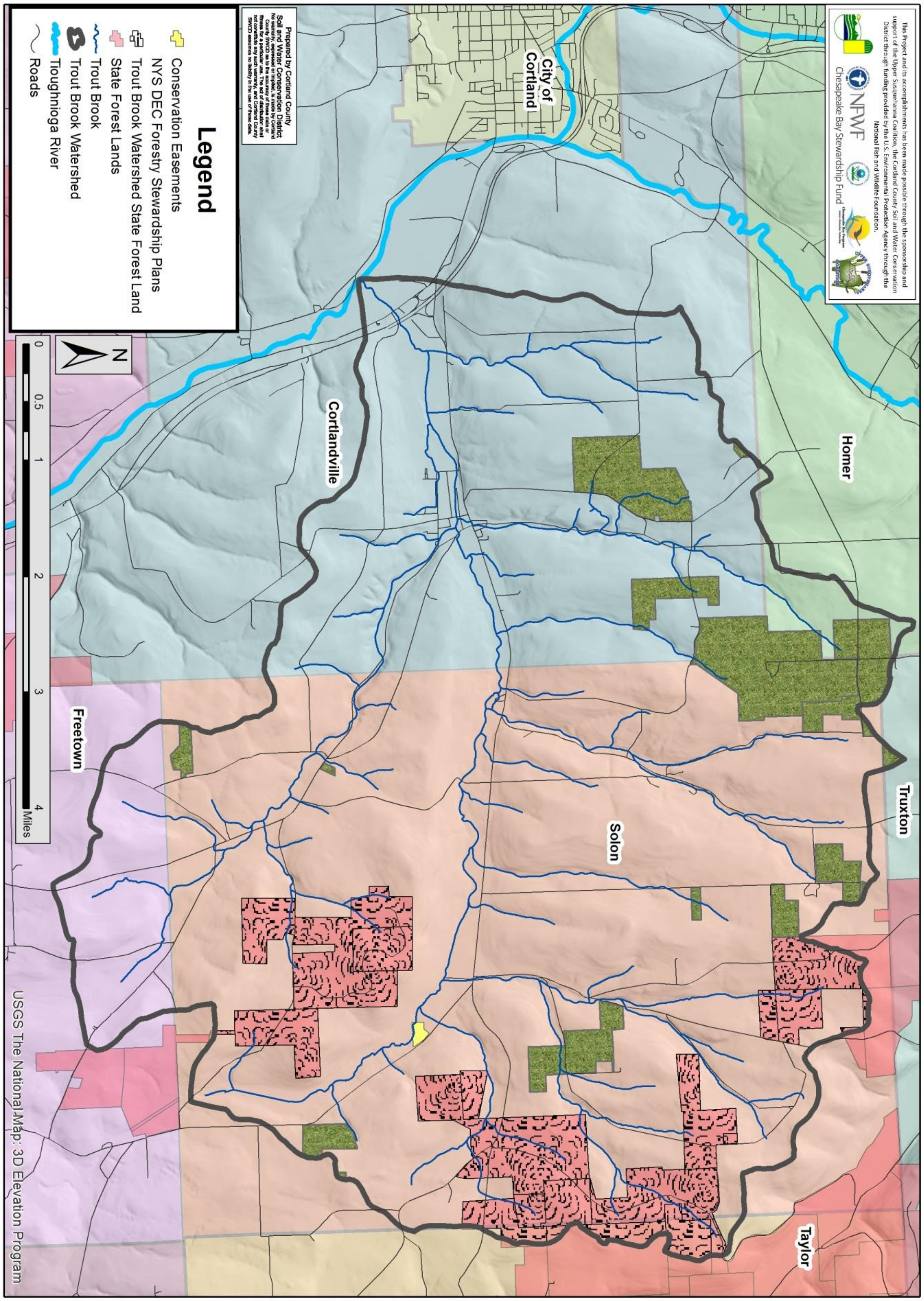
Drainage Basin Map of New York State
Trout Brook Town Zoning

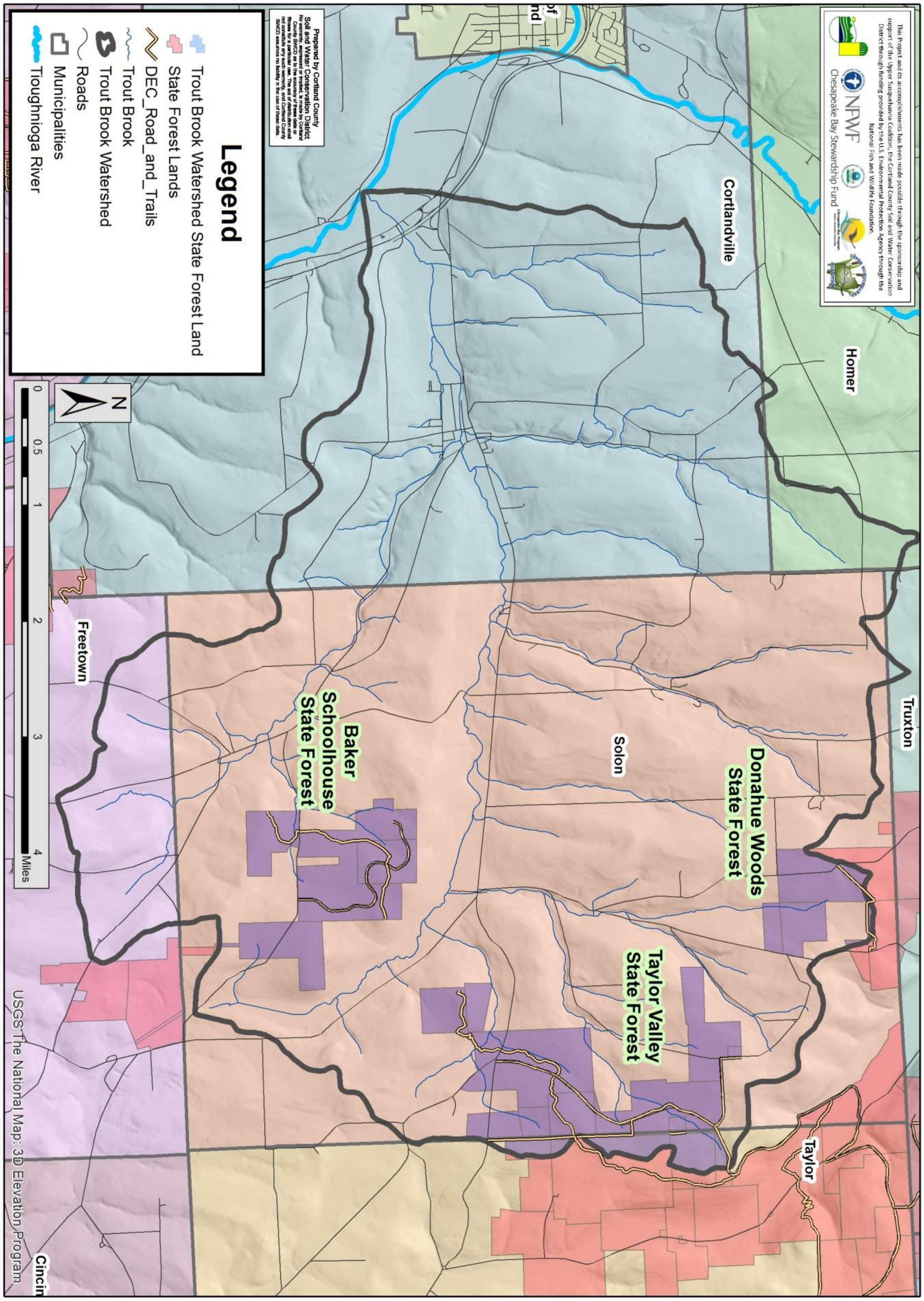




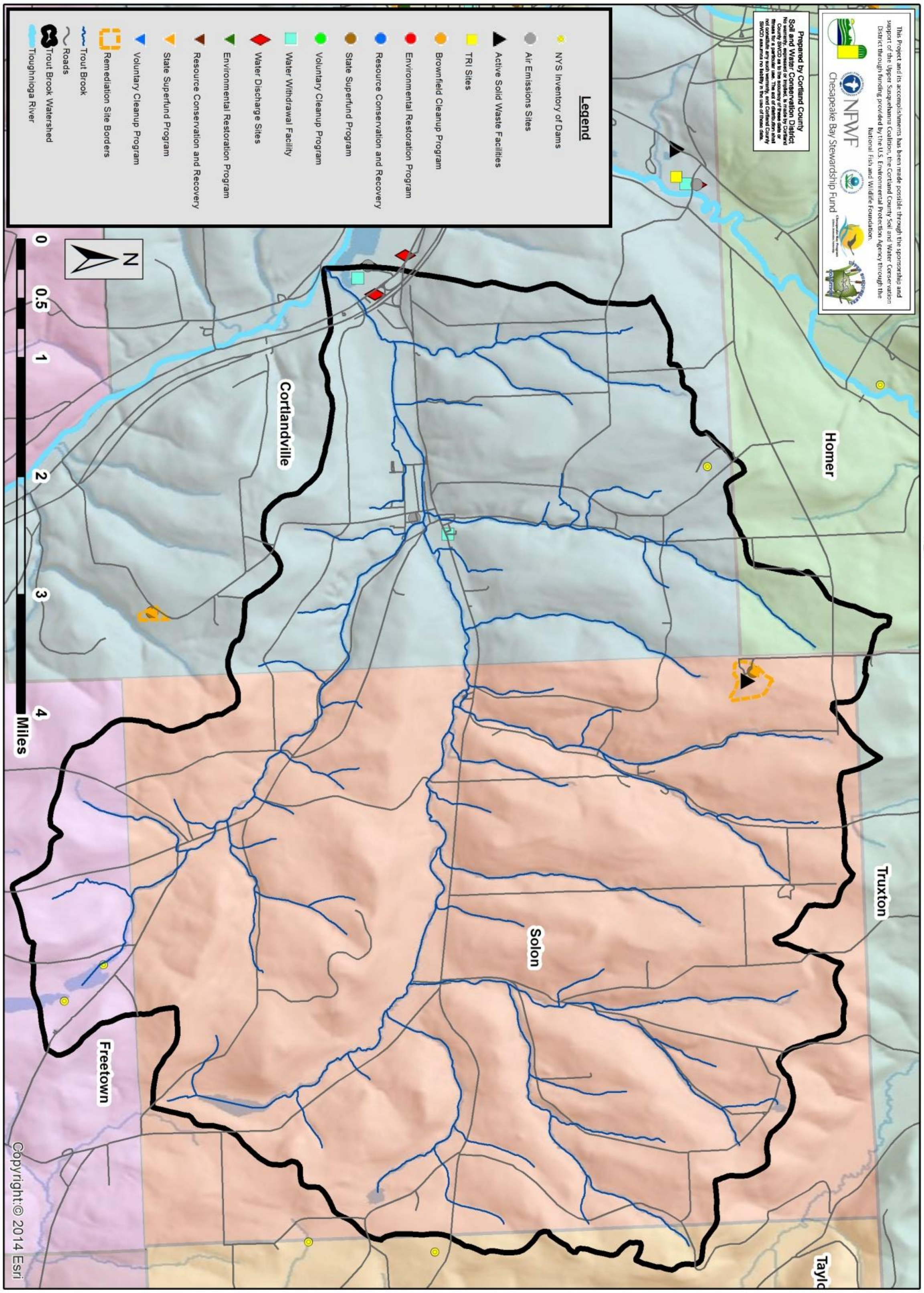
Trout Brook Watershed - USC I4 Project
Archeologically Sensitive Areas & National/State Register Sites

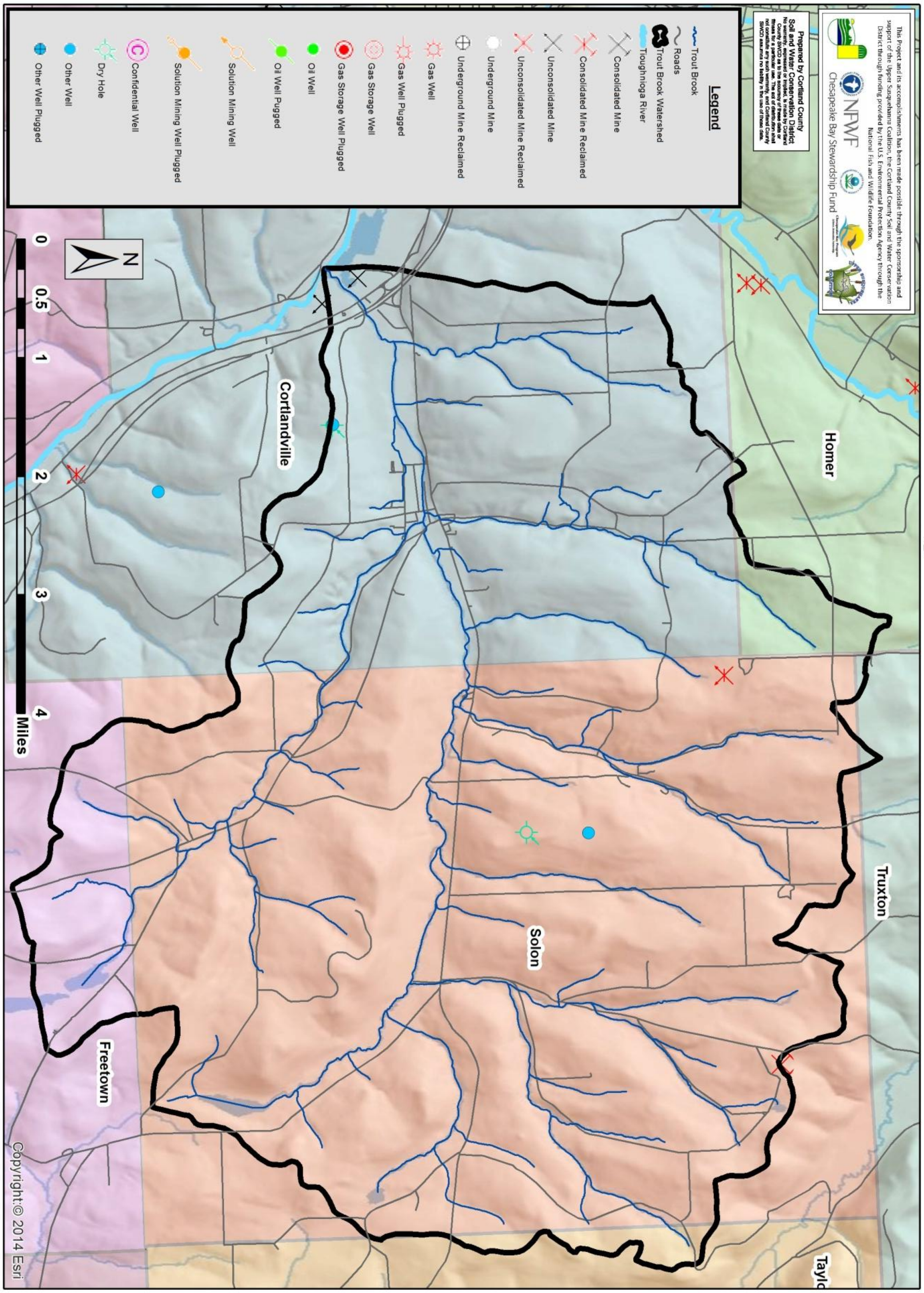

Trout Brook Watershed - USC I4 Project
NY Natural Heritage Program - Vicinity of Rare Plant or Animal Species
Legend
Rare Plants or Rare Animals
Trout Brook
Roads
Trout Brook Watershed
Tioughnioga River
Trout Brook
N
0
0.5
1
2
3
4
Miles
Prepared by Cortland County Soil and Water Conservation District
Cortland
Homer
Cortlandville
Truxton
Solon
Freetown
Copyright:© 2014 Esri


Trout Brook Watershed - USC I4 Project
Conservation Plans, Easements & Protected Lands
National Fish and Wildlife Foundation.
NFWF
Chesapeake Bay Stewardship Fund
City of Cortland
Homer
Cortlandville
Truxton
Solon
Freetown
Taylor
Prepared by Cortland County Soil and Water Conservation District
Legend
Conservation Easements
NYS DEC Forestry Stewardship Plans
Trout Brook Watershed State Forest Land
State Forest Lands
Trout Brook
Trout Brook Watershed
Tioughnioga River
Roads
N
0
0.5
1
2
3
4
Miles
USGS The National Map: 3D Elevation Program


Trout Brook Watershed - USC I4 Project
NYS DEC Forest Lands and Roads
Legend
Trout Brook Watershed State Forest Land
State Forest Lands
DEC_Road_and_Trails
Trout Brook
Trout Brook Watershed
Roads
Municipalities
Tioughnioga River
Prepared by Cortland County Soil and Water Conservation District
Chesapeake Bay Stewardship Fund
N
0 0.5 1 2 3 4 Miles
Cortlandville
Homer
Truxton
Solon
Freetown
Taylor
Donahue Woods State Forest
Baker Schoolhouse State Forest
Taylor Valley State Forest
USGS The National Map: 3D Elevation Program

Trout Brook Watershed - USC I4 Project
NYS DEC Regulated Facilities/Sites




Trout Brook Watershed - USC I4 Project
NYS DEC Regulated Facilities/Sites
Legend
Trout Brook
Roads
Trout Brook Watershed
Tioughnioga River
Consolidated Mine
Consolidated Mine Reclaimed
Unconsolidated Mine
Unconsolidated Mine Reclaimed
Underground Mine
Underground Mine Reclaimed
Gas Well
Gas Well Plugged
Gas Storage Well
Gas Storage Well Plugged
Oil Well
Oil Well Pugged
Solution Mining Well
Solution Mining Well Plugged
Confidential Well
Dry Hole
Other Well
Other Well Plugged
Prepared by Cortland County Soil and Water Conservation District
Chesapeake Bay Stewardship Fund
NFWF
Homer
Cortlandville
Truxton
Solon
Freetown
N
0
0.5
1
2
3
4
Miles
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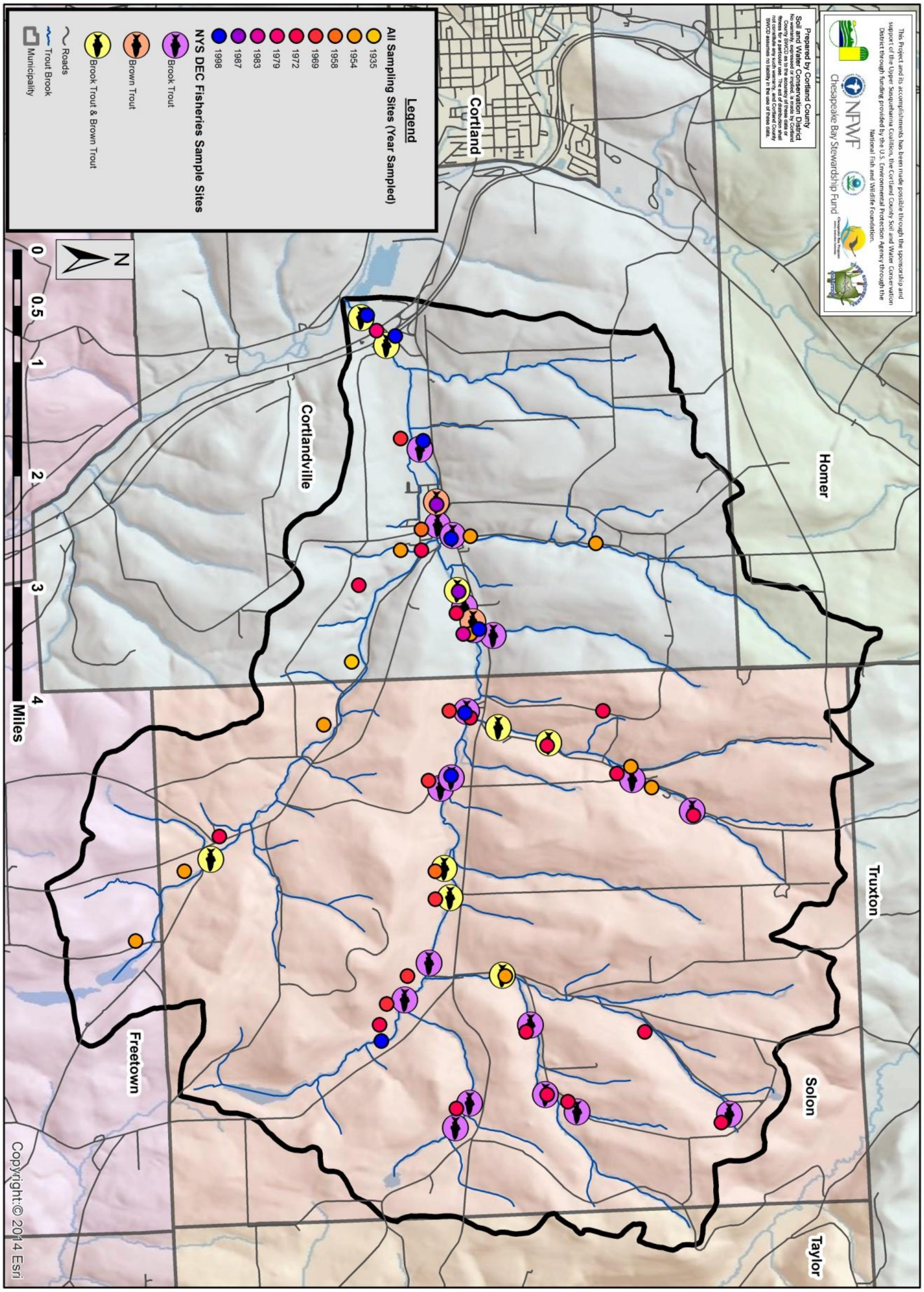
Trout Brook Watershed - USC I4 Project
NYS DEC Fisheries Sampling Sites
Legend
All Sampling Sites (Year Sampled)
1935
1954
1958
1969
1972
1979
1983
1987
1998
NYS DEC Fisheries Sample Sites
Brook Trout
Brown Trout
Brook Trout & Brown Trout
Roads
Trout Brook
Municipality
N
0
0.5
1
2
3
4
Miles
Cortland
Homer
Cortlandville
Truxton
Solon
Freetown
Taylor
This Project and its accomplishments has been made possible through the sponsorship and support of the Upper Susquehanna Coalition, the Cortland County Soil and Water Conservation District through funding provided by the U.S. Environmental Protection Agency through the National Fish and Wildlife Foundation.
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Chesapeake Bay Stewardship Fund
Prepared by Cortland County Soil and Water Conservation District
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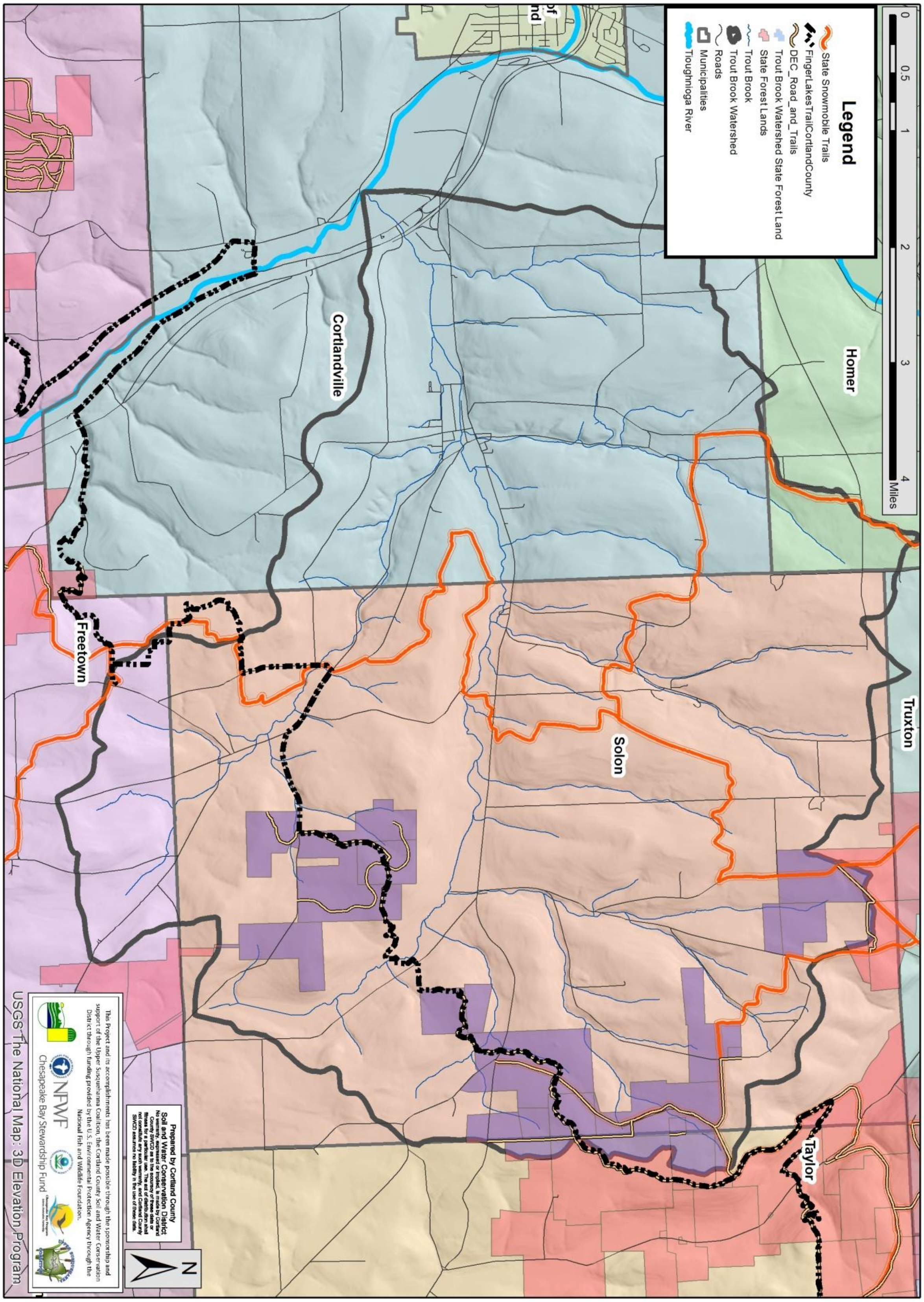
Trout Brook Watershed - USC I4 Project
Hiking Trails, Snowmobile Trails and NYS DEC Forest Lands



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