Final Engineering Report

Lake Waccabuc Engineering Study
Wastewater Issues and Solutions

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NE IW PCC

Prepared for

Town of Lewisboro

11 Main Street
South Salem, New York

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Barton&Loguidice

Lake Waccabuc Engineering Study: Wastewater Issues and Solutions
Town of Lewisboro, Westchester County

Final Engineering Report

December 1, 2021

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EXECUTIVE SUMMARY

Wastewater management in the Study Area has been managed to date using on-site septic systems that are maintained by property owners. Many of the homes in the Study Area were constructed in the early 1900's as small seasonal cottages, located in close proximity to both Lake Waccabuc and one another. Years of sampling data has shown that the concentration of phosphorus in Lake Waccabuc has increased over time. Lake Waccabuc is now in a mesotrophic state, experiences frequent algae blooms, and has a high vulnerability for invasive species. There is also the concern that Lake Waccabuc ultimately drains into the Cross River Reservoir, which is a NYCDEP water supply. A nutrient loading modeling effort was completed to determine the magnitude of phosphorus loading from septic systems within the Study Area, which estimated a range of septic derived phosphorus contributions between approximately 9 and 1,074 lbs./year, accounting for approximately 10% to 92% of the total modeled external annual phosphorus load to Lake Waccabuc depending on the number of user defined septic system failures included within the model. To build upon existing Lake Waccabuc water quality data sources and to support the nutrient load model completed for the study, water quality field monitoring and sampling was conducted in July 2021 which observed water quality indicator concentrations consistent with a eutrophic condition. The results of this study have concluded that the aging and archaic on-site septic systems in the Study Area are a major contributor of phosphorus to Lake Waccabuc.

The Town of Lewisboro retained the services of Barton & Loguidice, D.P.C. (B&L) to prepare an engineering report to evaluate potential impacts of on-site septic systems on water quality in Lake Waccabuc, as well as to evaluate opportunities to correct poorly functioning individual septic systems through various replacement alternatives. Seven (7) alternatives were analyzed as part of this study. These alternatives ranged from replacing individual on-site septic systems, collecting and conveying the sewage to an existing plant miles away from treatment, and constructing a new water resource recovery facility (WRRF) in and around the Study Area. It is recommended that a new WRRF be constructed at the Benedict Road site to initially treat the Eastern Region of the Study Area. The total anticipated project cost is $17,200,000 and is projected to reduce the number of failing and poorly functioning septic systems by 67% and remove between 4% and 62% of the phosphorus load to Lake Waccabuc depending on the number of confirmed failing systems within the Eastern Region of the Study Area. The cost to include replacement of failing and poorly functioning individual septic systems for the remainder of the Study Area, with phosphorus treatment systems where needed, would be an additional $2,700,000. The facility has the potential for expansion should any of the remaining properties within the Study Area be included. If the WRRF at the Benedict Road site were constructed for the entire Study Area, it would cost $27,900,000.

ABBREVIATIONS

ADD	Average Daily Demand
BMP	Best Management Practice
BOD_5	Biochemical Oxygen Demand (5-day)
C	Celsius
CCI	Construction Cost Index (ENR)
cfs	Cubic feet per second
CT	Concentration x time
CWSRF	Clean Water State Revolving Fund
DEC	New York State Department of Environmental Conservation
DMR	Discharge Monitoring Report
DO	Dissolved oxygen
DOT	New York State Department of Transportation
ECL	Environmental Conservation Law
EDU	Equivalent Dwelling Unit
EFC	New York State Environmental Facilities Corporation
ENR	Engineering News-Record
EPA	United States Environmental Protection Agency
F	Fahrenheit
fps	Feet per second
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
gpd	Gallons per day
GML	General Municipal Law
gpm	Gallons per minute
HGL	Hydraulic Grade Line
hp	Horsepower
HPGN	High Precision Geodetic Network (1998)
IUP	Intended Use Plan
ISO	Insurance Services Office
LF	Linear feet
MHI	Median Household Income
MGD	Million gallons per day
NAD83	North American Datum (1983)
NAVD88	North American Vertical Datum (1988)
NPSHa	Net positive suction head available

ABBREVIATIONS (cont'd)

NPSHr	Net positive suction head required
NEIWPCC	New England Interstate Water Pollution Control Commission
NYCDEP	New York City Department of Environmental Protection
NYSCC	New York State Canal Corporation
NYSDOH	New York State Department of Health
NYSOPRHP	New York State Office of Parks, Recreation, and Historic Preservation
MBR	Membrane Bioreactor
OMB	Office of Management and Budget
PAC	Powdered activated carbon
PACl	Polyaluminum chloride
PER	Preliminary Engineering Report
PHF	Peak Hourly Flow
ppm	Parts per million
psig	Pounds per square inch (gauge)
Q	Volumetric flow rate (gpm, MGD)
SBR	Sequencing Batch Reactor
scfm	Standard cubic feet per minute (68 degrees F and 1 atmosphere)
SEQR	State Environmental Quality Review
SPDES	State Pollutant Discharge Elimination System
SWPPP	Storm Water Pollution Prevention Plan
TDH	Total dynamic head
TSS	Total suspended solids
USACE	United States Army Corps of Engineers
USDA NRCS	United States Department of Agriculture, National Resources Conservation Service
USFWS	United States Fish and Wildlife Service
WRRF	Water Resource Recovery Facility

1.0 INTRODUCTION

1.1. Authorization

On December 30, 2020 the Town of Lewisboro retained the services of Barton & Loguidice, D.P.C. (B&L) to prepare an engineering report to evaluate potential impacts of on-site wastewater disposal systems (i.e. septic systems) on water quality in Lake Waccabuc (the Lake), as well as to evaluate opportunities to correct poorly functioning individual septic systems through various replacement alternatives. This report describes different alternatives for the Town to implement a new wastewater system strategy, whether the strategy be a private, public, or hybrid system alternative. This Engineering Report has been prepared in accordance with New York State Environmental Facilities Corporation (NYSEFC), New York City Department of Environmental Protection (DEP) and New England Interstate Water Pollution Control Commission (NEIWPCC) guidance for municipal wastewater infrastructure projects.

1.2. Background

Lake Waccabuc, located in the Town of Lewisboro, Westchester County, NY, is approximately 128 acres in area and includes over three miles of shoreline. Lake Waccabuc has a maximum depth of 46.6 feet and a mean depth of 23.9 feet, with a retention time of 0.76 years.

Several prior studies have been conducted associated with Lake Waccabuc watershed management and water quality trends. The following key documents were utilized as part of this Engineering Study:

- "State of the Lakes: 2004/2005 Water Quality of Lake Rippowam, Lake Oscaleta, and Lake Waccabuc" dated April 2006 (Cedar Eden)
- "Town-wide Comprehensive Lakes Management Plan" dated February 2009 (Ecologic)
- "Lake & Watershed Management Plan: Lakes Rippowam, Oscaleta & Waccabuc" dated November 2019 (Cedar Eden)
- Citizen Statewide Lake Assessment Program (CSLAP) data from 2006 to 2020

These prior studies identify a trend of eutrophication within Lake Waccabuc, in which nutrient enrichment within the Lake results in an increase in biological productivity, reduction in available dissolved oxygen, and water quality degradation. Water quality data observed from 2006-2020 indicates the Lake is currently in a mesotrophic state (moderately productive) and trending toward a eutrophic state (highly productive). This trend in the trophic status of the Lake has led to problematic aquatic vegetation growth and a high susceptibility to harmful algal blooms (HABs), which threatens the Lake's water quality, recreation value, and sustainability, and in turn, threatens the local economy and biodiversity. As a relatively shallow lake with a mean depth of 24 feet and retention time of less than one year, the lake is prone to water quality issues associated with nutrient loadings from wastewater and stormwater contaminants. These same factors, however, indicate that the Lake would respond quickly to properly implemented improvement strategies.

The Town does not currently have a publicly owned sanitary sewer collection and treatment system in this area. Instead, it consists of individual on-site systems that are maintained by the property owners. Many of these systems have failed or are assumed to be failing based on our evaluation criteria. Considering the proximity of potentially failing septic systems to the Lake, a public sewer and treatment system would be an appropriate solution to serve the properties within the Study Area. The Study Area, consisting of drainage areas directly contributing runoff to Lake Waccabuc, is illustrated on Figure 1-1 (Topographic) and Figure 1-2 (Aerial).

This study includes an evaluation of alternatives and a specific plan, including replacement of individual on-site septic systems, construction of community septic systems, and various public sewer collection system and wastewater treatment alternatives to accommodate the need for replacing the failing on-site septic systems and improving the water quality within Lake Waccabuc. Lake Waccabuc is a critical environmental, recreational and drinking water resource for properties within the Study Area, therefore it is crucial to replace the failing septic systems to provide the residents of Lewisboro with a safe and functional lake.

1.3. Scope of Work

Generally, the scope of services for this Engineering Study is as follows:

- Develop a Quality Assurance Program Plan (QAPP) to define the data quality objectives and project procedures to ensure proposed recommendations are based on justifiable parameters
- Assess the existing water quality condition of Lake Waccabuc through nutrient load modeling, field water quality sampling and monitoring, and review of existing data and previous studies
- Assess sites within the Study Area for existing conditions and potential alternatives for individual on-site septic systems, cluster/community treatment, and new wastewater public collection and treatment system alternatives
- Provide opportunities for public involvement through various methods of public outreach, and public information meetings
- Present findings and recommendations through development of a draft and final Engineering Report and associated deliverables

2.0 ENVIRONMENTAL SETTINGS

The Town of Lewisboro does not currently have a publicly owned sanitary sewer collection and treatment system within the Study Area. Instead, it consists of individual on-site septic systems that are maintained by the property owners. Many of these systems have failed or are failing. Considering the proximity of densely developed residential areas within the Study Area to the Lake and the potential for failing septic systems, upgrades are needed to existing wastewater infrastructure to help improve the water quality of Lake Waccabuc. This study includes an evaluation of existing water quality conditions and sources of nutrient loading, as well as an evaluation of alternatives for proposed upgrades to the existing on-site residential septic systems.

2.1. Site Information

2.1.1. Location

The Town of Lewisboro is located in the northeast quadrant of Westchester County, New York. Figure 2-1 shows the general project location in New York State. Nearby communities consist of the Town of North Salem, NY to the north, the Town of Somers, NY to the west, the Towns of Bedford and Pound Ridge, NY to the south, and the Town of Ridgefield, CT to the east. Topographic and aerial Study Area location maps are provided as Figure 1-1 and Figure 1-2, respectively, following the report text.

Figure 2-1: Project Location Map

2.1.1. Study Area

The Study Area includes the areas directly contributing runoff to Lake Waccabuc, as shown on Figure 1-1 and Figure 1-2. The location of the Study Area in Westchester County is shown in Figure 2-2. Lake Waccabuc receives discharge from the upstream watersheds of Lake Rippowam and Lake Oscaleta, however the Study Area evaluated for this project does not include these upstream lake areas. Contributing drainage areas within the Study Area vary in geologic conditions (*e.g.,* soil type, depth to bedrock, groundwater level, and slope). The physical and environmental characteristics were evaluated within the Study Area in order to better understand the impacts of the hydrologic cycle on water quality within Lake Waccabuc.

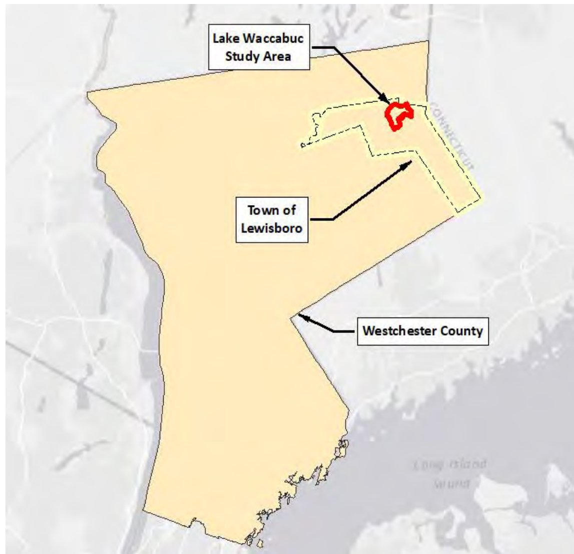


Figure 2-2: Study Area Location Map

Slopes within the Study Area are highly variable. Generally, the steeper the slope, the shorter the time of concentration is, which produces a higher peak flow. Higher peak flows result in limited infiltration and settling of pollutant loads. Additionally, higher peak flows result in a greater potential for soil erosion, which may increase the load of nutrient rich sediment to the receiving waterbody. Within the Study Area, steeper slopes are generally located along the northern boundary of the Lake. Instances of slopes exceeding 15% are also present immediately south of the Lake in the central and western central reaches of the shoreline, as well as between Post Office Road and Perch Bay Road. More moderate slopes are present within the eastern and southwestern extents of the Study Area. A topographic map is included as Figure 1-1, following the report text.

2.1.2. Land Use and Zoning

Land use is important to the drainage area's hydrologic cycle as it has one of the greatest impacts on water quality. More urbanized land usage generally relates to more impervious covers, resulting in higher stormwater runoff discharge rates, thus preventing attenuation and filtration of nutrients and sediments. More ruralized land usage generally relates to more pervious covers, resulting in lower peak flows and increased nutrient and sediment filtration. However, some ruralized land usage such as farming and livestock operations have higher than typical nutrient runoff loads. Within the Study Area, land use varies with population density. In general, the primary land use within the Study Area is residential land. Vacant land is present primarily within the northern central portion of the project area. The Waccabuc Country Club Golf Course, located within the southwestern portion of the project area, and the Beach Club House, located on Lake Waccabuc, are classified as recreation and entertainment land use. The local post office, Mead Memorial Chapel, Old Pond Road tennis court, Long Pond Preserve, and Old Field Preserve are all classified as community services lands. Rippowam Preserve, which does not contain any trails, is classified as wild lands. Property classes, adapted from parcel data obtained from the Town of Lewisboro, are presented in Figure 2-3, following the report text. A copy of the 1985 Town of Lewisboro zoning map is included as Appendix A.

Land cover is also important to the drainage hydrologic cycle, exerting considerable influence on the chemical, physical, and biological characteristics of waterbodies. Land cover classifies the vegetation (or lack thereof) covering the ground. Removing the natural vegetation due to human activities reduces the soil's ability to filter nutrients and sediments, resulting in increased amounts of runoff and pollution. Within the Study Area, land cover varies with population density, where more impervious cover types are generally located within residential areas with higher intensity development such as immediately northeast of the Lake, as well as areas south of the Lake Waccabuc shoreline in the southwestern portion of the Study Area. More pervious cover types consisting primarily of forested lands generally make up the remainder of the Study Area. In general, the Study Area does not include substantial areas of agricultural land. Land cover, as defined by the 2011 National Land Cover Database, is presented in Figure 2-4.

2.1.3. Number of Properties and Population Served

There are approximately 285 homes in the Study Area. The population for the Watershed Study Area is estimated to be 2,321 people based on the number of homes, as shown in Table 2-1.

Table 2-1: Study Area Estimated Population

Number of Homes	285
Persons Per Household*	2.7
Total	770

*2015-2019 Census Bureau QuickFacts for Town of Lewisboro

2.1.4. Existing Utilities and Water Service

The Town of Lewisboro has two existing sewer districts at either end of Town: Oakridge and Wild Oaks. There is currently no public sanitary sewer collection system or public water distribution system in the Study Area. The nearest sanitary sewer collection system is owned by the Town of Ridgefield, Connecticut, approximately 5 miles away. The nearest public water distribution system is a community well owned by the Twin Lakes Water Works. This water distribution system serves residents located between Lake Rippowam and Lake Oscaleta, just east of the Study Area. A figure of nearby groundwater aquifers, provided in Figure 2-5 following the report text, shows there are no aquifers in the Study Area.

2.1.5. Geologic Conditions

Preliminary screening conducted through the USDA Web Soil Survey identified the type of soils found in the project area. The soils throughout the project area primarily consists of Paxton fine sandy loam, 3 to 8 percent slopes (PnB, 19.0%), Woodbridge loam, 3 to 8 percent slopes (WdB, 14.6%), and Chatfield-Hollis-Rock outcrop complex, 15 to 35 percent slopes (HrF, 14.5%) (Web Soil Survey, 2021). A full list of soils located within the project area is provided in Appendix B.

Soils are classified into hydrologic soil groups (HSG) to indicate the minimum rate of infiltration, or rate at which water enters the soil at soil surface, for bare soil after prolonged wetting. HSG's consist of Groups A, B, C, and D soils. Group A soils have the lowest runoff potential and highest infiltration rates, whereas Group D soils have the highest runoff potential and lowest infiltration rates. If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that, in their natural condition, are in group D are assigned to dual classes. Soils with high runoff potential and low infiltration rates promote surface runoff and limit settling of pollutant loads, which leads to a greater potential for conveyance of nutrients to receiving waters. Soil properties and qualities are summarized for each drainage area in Table 2-2. Also included in this table are the number of homes and percentage of homes in each HSG within the Study Area. A soils map is included in Figure 2-6 illustrating the variance in soils throughout the Study Area. The majority of the Study Area consists of Group C (27.4%), Group C/D (18.4%), or Group D (27.6%) soils, all of which exhibit higher runoff potential and lower infiltration rates. 53.6% of the homes in the Study Area fall into one of these three groups.

Table 2-2: Hydrologic Soil Groups

HSG	Acres in Study Area	Percent of Study Area	Number of Homes	Percent of Homes
A/D	6.9	0.9%	1	0.4%
B	171.2	21.8%	119	41.8%
B/D	31	3.9%	12	4.2%
C	215.2	27.4%	79	27.7%
C/D	144.3	18.4%	40	14.0%
D	217	27.6%	34	11.9%

The depth to bedrock or other restrictive layers impacts the hydrologic cycle within a watershed by limiting subsurface infiltration and reducing filtration of subsurface flows. Approximate depths to lithic bedrock are included on Figure 2-7 (gSSURGO, 2016). According to data obtained by the Soil Survey Database, no portions of the Study Area are anticipated to have a depth to bedrock less than one foot, although bedrock is anticipated to be present between depths of one to three feet within the western and central portions of the Study Area, as well as along the south central portion and a part of the southeastern shoreline. Densic material, another classification of restrictive layer which consists of a dense, cemented soil horizon can also limit infiltration and subsurface flow. Approximate depths to densic material are included on Figure 2-8 (gSSURGO, 2016), following the report text. Densic material is assumed to be present between depths of one and three feet within the southwestern portion of the Study Area, as well as along the eastern extent of South Shore Drive. It is not anticipated that densic material is present at depths less than one foot within the Study Area. Anticipated depths to any restrictive area, as reported by the Soil Survey Database, are illustrated on Figure 2-9 (gSSURGO, 2016), following the report text.

2.1.6. Environmental Resources

The New York State Department of Environmental Conservation (NYSDEC) Environmental Resource Mapper (ERM) was reviewed for the presence of natural resources within the Study Area. Multiple NYSDEC-mapped wetlands are located within the Study Area, including within the eastern and southwestern extents. Wetlands mapped by the NYSDEC and their regulated 100-foot adjacent areas are shown on Figure 2-10, following the report text. In addition to NYSDEC-mapped wetlands, multiple wetlands mapped by the U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) are located within the Study Area. Locations of wetlands mapped by the USFWS NWI are provided on Figure 2-11, following the report text.

The USFWS Information for Planning and Consultation (IPaC) website reported the federally endangered Indiana bat (*Myotis sodalis*) and the federally threatened bog turtle (*Clemmys muhlenbergii*) for the Study Area. Additionally, ERM reported that the project area is within the vicinity of rare dragonflies and rare plants. The New York Natural Heritage Program would be consulted following alternative selection to determine potential impacts to rare or State-protected species. A copy of the ERM results and the IPaC report and can be found in Appendix C and Appendix D, respectively.

2.1.7. Cultural and Historical Resources

A preliminary screening through the New York State Historic Preservation Office (SHPO) Cultural Resource Information System (CRIS) indicated that the entirety of the Study Area is located within archaeologically sensitive areas, as shown in Figure 2-12. Additionally, the Lake Waccabuc Historic District (National Register #NR06612) is located within the southwest portion of the Study Area, including numerous buildings listed on the National Register of Historic Places. Project information would be formally submitted to SHPO during the design phase. It is anticipated that all recommendations made by SHPO would be followed to ensure that the proposed project would not result in an adverse impact on archaeological or historic resources.

Figure 2-12 CRIS Mapping of Study Area

2.1.8. Floodplain Considerations

A floodplain by definition is a nearly flat plain near a waterbody that is naturally subject to flooding. These areas have the potential to offer significant nutrient filtration. Floodplains exist within the Study Area, as indicated by the Federal Emergency Management Agency (FEMA) Federal Insurance Rate Mapping (FIRMs), originating immediately adjacent to the entirety of the Lake shoreline, as well as within an extensive floodplain area to the north and south of the Lake Waccabuc Inlet. The 100-year floodplain areas are illustrated in Figure 2-13 (FEMA, 1996). No 500-year floodplain areas are located within or immediately adjacent to the Study Area.

The FEMA FIRM, which includes the Study Area, is shown on Figure 2-14, below. This figure shows the FEMA Flood Zone designations, which may be more susceptible to flooding. Zone A designates waterbodies and surrounding area that have no base flood elevations determined and are special flood hazard areas where the chance of flooding in any year is 1%. Zone X designates locations which have been determined to be outside the 0.2% annual chance floodplain. For choosing a location and determining where proposed alternatives would be located, it is important to keep facilities out of the floodplain so the equipment would be protected.

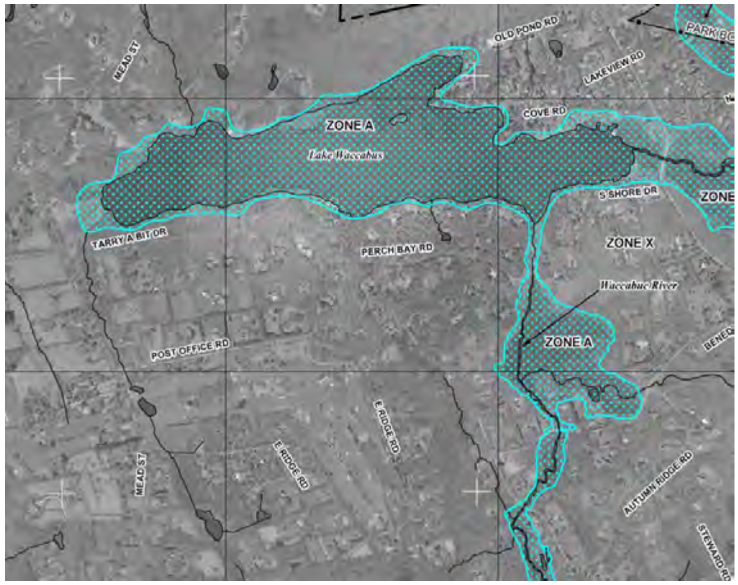


Figure 2-14: Study Area FEMA FIRM

2.1.9. Agricultural Districts

The Study Area does not include any properties that are part of Westchester County Agricultural Districts. Figure 2-15, below, shows the location of the nearest agricultural district (shown in green), which is located west of the Study Area limits (shown in red).

Figure 2-15: Study Area FEMA FIRM

2.1.10. Environmental Justice Areas

Screening through the NYSDEC Webmap of Potential Environmental Justice (EJ) Areas has identified that this project is not located in a potential environmental justice area.

As shown in Figure 2-16 below, there are no potential environmental justice areas (shown in purple) in the Study Area or the Town of Lewisboro.

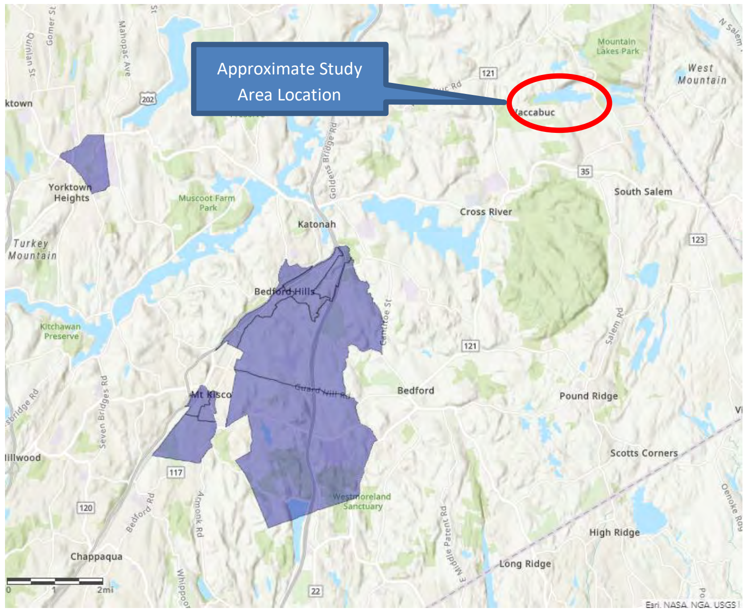


Figure 2-16: Environmental Justice Area Map

2.2. Ownership and Service Area

The Town of Lewisboro has two existing sewer districts at either end of Town: Oakridge and Wild Oaks. There is also a community septic system in the Hamlet of Cross River that serves the Meadows at Cross River and Michelle Estates. There is currently no public sanitary sewer collection or treatment system in or adjacent to the Study Area. Wastewater has traditionally been managed using individual, private, on-site systems with annual reports of failures.

2.2.1. Presence of Outside Users

As there is no existing community or public sewer system, there are no outside users at this time.

2.2.2. Industrial Users

There are no industrial facilities located within the proposed Study Area. The Town has no intention at this time of accepting hauled waste from industrial facilities that are located outside of the proposed Study Area.

2.2.3. Population Trends and Projected Growth

Census data indicates that the Town of Lewisboro has seen a 0.03% population increase between 2000 and 2017, summarized in Table 2-3.

Table 2-3: Town Population Data Taken from U.S. Census

Town	2010 Population (Decennial Census)	2019* Population
Lewisboro	12,411	12,741

*ACS – American Community Survey 5-year estimate.

The population within the Town and within the Study Area is assumed to remain steady over time, with minimal growth.

2.2.4. Anticipated Development

There is no significant development of land anticipated within the Study Area. The few vacant parcels located within the Study Area are generally not developable due to steep slopes and/or other environmental considerations.

3.0 EXISTING FACILITIES AND PRESENT CONDITIONS

3.1. Description and History

Wastewater management in the Study Area has been managed to date using individual on-site septic systems that are maintained by property owners. Many of the homes in the Study Area were constructed in the early 1900’s as small seasonal cottages, located in close proximity to both Lake Waccabuc and one another. Over time, numerous homes were upgraded: those without plumbing installed septic systems, and expansions were completed to accommodate more people. Now an issue has arisen where aging and outdated septic systems are failing or likely to be poorly functioning.

To determine the general age of on-site septic systems in the Study Area, it was assumed that septic systems were installed the same year that the houses were constructed. Building construction dates were obtained from the Town of Lewisboro Assessor’s office. This data was then supplemented with information from a community survey that was distributed to the Study Area residents in April 2021, as well as records of septic system replacements provided by the Westchester County Department of Health (WCDOH). The general results of the April 2021 survey are provided in Appendix D. Of the estimated 283 on-site septic systems in the Study Area, the following is assumed:

- 183 are 50 years or older,
- 49 are 30 to 49 years old, and
- 51 are 29 years or younger.

A map depicting the age distribution of on-site septic systems within the Study Area is provided as Figure 3-1.

Based on septic pump-out data provided by Westchester County, tanks that have had maintenance completed since 2006 have been identified as septic tanks, cesspools, seepage pits, or other. “Other” could be used to classify holding tanks, but could also be used as a generic label for unknown tanks. In the Study Area, the following have been identified:

- 212 septic tanks,
- 6 cesspools,
- 3 seepage pits, and
- 15 other.

Figure 3-2A shows the distribution of on-site septic system types as found in the WCDOH pump-out data. Results from the April 2021 Community Survey showed some slight discrepancies with this data and are shown in Figure 3-2B.

3.2. Current and Future Projects in the Study Area

Currently there are no projects proposed within the Study Area. If the recommended improvements from this engineering report are not constructed than the individual property owners would need to replace their failing on-site septic systems.

3.3. Permit Conditions and Effluent Discharge Limits
The Town currently does not have any effluent discharge permit requirements for the Study Area.

3.4. Compliance Issues
There are no existing publicly owned sanitary sewer collection and treatment systems within the Study Area, therefore the Town does not have an applicable State Pollutant Discharge Elimination System (SPDES) permit. See Section 4.3 of this report with regards to septic failures documented by Westchester County Department of Health.

3.5. Estimated Existing Flows
The estimated existing wastewater flow for the Study Area is approximately 128,000 gallons per day. This flow was determined using standards provided by the 2014 *New York State Design Standards for Intermediate Sized Wastewater Treatment Systems*. The Study Area flows are provided in Appendix E.

For residential homes, the flow was determined by number of bedrooms and the age of the home. This information was provided by the Town of Lewisboro Assessor. Per discussions with DEP on October 26, 2021, 130 gpd/bedroom was used to estimate flow for all residential homes in the Study Area. There are four non-residential facilities in the Study Area: the post office, the Waccabuc Country Club (WCC) golf course, the WCC Beach Club House, and Mead Memorial Chapel. The post office flow was determined based on the square footage of the building. The WCC golf course has their own water resource recovery facility (WRRF) and was, therefore, not included in the total existing flow of the Study Area. The flow from the WCC Beach Club House was determined based off of the total number of people present for a typical day. The Mead Memorial Chapel does not currently have a septic system.

3.6. Design Flows and Waste Loads
The estimated average daily flow for evaluation of a wastewater management solution is 128,000 gallons per day. This flow was determined using standards provided by the 2014 *New York State Design Standards for Intermediate Sized Wastewater Treatment Systems*. The Study Area flow calculations are provided in Appendix E.

A description of how each type of flow was determined is provided in Section 3.5, above. The Mead Memorial Chapel, which is a family chapel used for religious and community events, does not currently have a septic system. The design flow for this facility was determined using the number of seats at the chapel. Given that the chapel does not function like a traditional church, it was assumed to act more as an event venue. All currently vacant parcels are assumed to be undevelopable and are therefore not included in the total design flow.

The maximum day flow and loads were determined by applying a 2.0 factor of safety to the average daily flow. Similarly, the peak hour flow was determined by applying a 4.0 factor of safety to the average daily flow. The average 5-day biochemical oxygen demand (BOD_5) and total suspended solids (TSS) were determined based on the estimated population for the Study Area (provided in Section 2.2.3 of this report) and applying factors from the 2014 *Ten State Standards for Wastewater Facilities*. The average phosphorus concentration was determined by taking the average of the residential wastewater range provided in the 2014 *New York State Design Standards for Intermediate Sized Wastewater Treatment Systems*. The estimated flows and loads are shown in Table 3-1.

Table 3-1: Estimated Flows and Loads

Parameter	Design Capacity
Flow (mgd):	
Annual Average:	0.128 MGD
Max Day[1]:	0.256 MGD
Peak Hour[2]:	0.512 MGD
BOD_5 (lb/day):	
Average[3]:	170
Max Day[1]:	340
TSS (lb/day):	
Average[4]:	193
Max Day[1]:	386
Total Phosphorous (mg/l):	
Average[5]:	9

1. Calculated as average value x 2 peak factor.
2. Calculated as average value x 4 peak factor.
3. Calculated assuming 0.22 lb BOD_5/capita-day, per 2014 Ten State Standards.
4. Calculated assuming 0.25 lb TSS/capita-day per, 2014 Ten State Standards.
5. Calculated as average of 6 – 12 mg/l range for residential wastewater, provided by 2014 NYS Design Standards for Intermediate Sized Wastewater Treatment Systems

3.7. Existing Energy Consumption

There are no existing publicly owned sanitary sewer collection and treatment systems within the Study Area.

3.8. History of Damage

There are no existing publicly owned sanitary sewer collection and treatment systems within the Study Area. Flood impacts on existing on-site septic systems are discussed in Section 4.1.6 of this report.

3.9. Unit Process

There are no existing publicly owned sanitary sewer collection and treatment systems within the Study Area. For more information on the condition of existing on-site septic systems, see Section 4.0 of this report.

4.0 ENVIRONMENTAL CONDITIONS

4.1. Septic Suitability

Based on soil data from the USDA NRCS (United States Department of Agriculture, National Resources Conservation Service), the entirety of the Study Area is classified as either "Somewhat Limited" or "Very Limited" for septic suitability, with respect to soil types, slopes, depths to groundwater, and depths to bedrock. A map depicting septic suitability for parcels in the Study Area is provided as Figure 4-1. In addition to soil data, the density of homes on small parcels concentrated in the eastern portion of the Study Area further restricts the suitability for properly functioning septic systems. Figure 4-2 provides a map of properties that potentially cannot support a conventional septic system, as described in further detail in the following sections.

4.1.1. Parcel Size

Parcel size is a severely limiting factor to a septic system for many properties in the Study Area. The homes on the eastern side of Lake Waccabuc were constructed both in close proximity to the Lake, as well as to each other. With no available public water supply, all but approximately 17 homes use private wells as a drinking water source. The remaining 17 homes include 14 homes that draw drinking water directly from Lake Waccabuc and 3 homes that have outhouses and so are assumed to not have running water. Separation distances from individual on-site septic systems to wells, buildings, property lines, and waterbodies are necessary to ensure system performance, allow adequate space for repairs, and reduce undesirable effects of underground sewage flow and dispersion.

According to the NYSDOH Appendix 75-A, Wastewater Treatment Standards – Residential Onsite Systems, the required separation distances from a septic system absorption field to a private well is 100-feet, to a home is 20-feet, and to a property line is 10-feet. Additionally, when septic system absorption fields are located up-gradient and in the direct path of surface water drainage toward a well, the closest edge of the absorption field must be at least 200-feet away from the well. Based on these separation distance requirements and the average home size on the properties, all properties with a parcel size less than half an acre were considered inadequate to support a properly functioning septic system. Figure 4-3 depicts all 139 properties in the Study Area with a parcel size less than half an acre.

Per the NYSDOH Appendix 75-A, Wastewater Treatment Standards – Residential Onsite Systems, the required separation distance between a septic system absorption field and a waterbody or wetland is 100-feet. Many homes directly on Lake Waccabuc, as well as those on nearby influent streams and wetlands, are within this 100-foot buffer and were therefore also considered inadequate to support a properly functioning septic system. Approximately 86 homes are located within this 100-foot buffer.

4.1.2. Soil Types

Section 3.6 briefly discussed the importance of hydrologic soil groups and infiltration rates on septic system suitability. NYSDOH Appendix 75-A specifies that soils with very rapid percolation rates (faster than one minute per inch) are not suitable for subsurface wastewater absorption systems unless the site is modified by blending with a less permeable soil. Percolation rates greater than 60 minutes per inch are considered very slow and are similarly not suitable for subsurface wastewater treatment. Historical percolation test data and USGS soil classification suggest that most of the developed Study Area contains soils types with percolation rates that are generally acceptable for septic systems, with some properties on the northern part of the Lake having poorly draining soils.

4.1.3. Slopes

The Study Area contains portions of land with slopes of 15-25%. Steep slopes limit the available capacity within the soil to accept the wastewater, which can lead to surfacing of the wastewater along the slope. Additionally, the flow of groundwater located within steeply sloped areas tends to be higher than surrounding areas. This means wastewater that isn't fully treated when it reaches the groundwater table would be transported more quickly to the nearest surface water body, allowing less time for further treatment to occur. According to NYSDOH Appendix 75-A, slopes greater than 15% are considered unacceptable for individual on-site septic systems. As such, all properties with significant portions of steep slopes greater than 15% were identified as inadequate for supporting a septic system.

4.1.4. Depth to Groundwater

Sections 75-A.4.c.2 and 75-A.8.b.1 of the New York State Public Health Code requires a minimum separation of two feet between the bottom of the drainfield and the groundwater table and four feet between the soil surface and the groundwater table. These separation distances are required to ensure proper physical and biological treatment of the wastewater by microbes in unsaturated soils, as well as providing the time required for bacteria in the wastewater to die-off and viruses to become inactivated. A map depicting depths to groundwater on each parcel is included in Figure 4-4. Most of the area north of the Lake have a depth to groundwater greater than five feet indicating acceptable conditions for septic suitability, however portions of the area east of the Lake and much of the area South of the Lake have a groundwater depth of less than three feet. The shallow groundwater depths indicate existing on-site septic systems in these areas may not meet current Health Code requirements.

4.1.5. Depth to Bedrock

Section 75-A.4.c.2 and 75-A.8.b.1 of the New York State Public Health Code requires a minimum of four feet of useable soil be available over impermeable deposits, such as clay or bedrock. These separation distances are required for two reasons: one, these conditions are generally considered to be impermeable to water, so shallow bedrock could indicate that there is not sufficient soil present to accept the wastewater and could lead to surface or septic system failure; and two, if shallow bedrock has a fracture, untreated wastewater can enter the fracture and travel quickly, potentially to a waterbody, before it is fully treated. As discussed in Section 2.1.5, bedrock is anticipated to be present at depths between one and three feet generally in the area north of the Lake and mid-south of the Lake.

Septic systems installed above a drinking water aquifer may require a greater separation distance to bedrock. As stated in Section 2.1.4 of this report, no aquifers are present in the Study Area so these requirements were not further investigated.

4.1.6. Floodplains

As mentioned in Section 2.1.8, the FEMA 100-year floodplain includes areas immediately adjacent to the shoreline of Lake Waccabuc, as well as an extensive area north and south of the Lake Waccabuc Inlet. NYSDOH Appendix 75-A states that areas lower than the 10-year flood elevation are unacceptable for septic systems. Figure 4-5 shows a 100-foot buffer of waterbodies and wetlands in the Study Area, of which the 10-year flood level is generally inside. Figure 4-5 shows that many properties surrounding the Lake, specifically in the Eastern Region cannot support an on-site septic system. (For a description of the Eastern Region, see Section 6.1 of this report.)

4.2. Inspection and Pump-Out Data

Westchester County established a database to track septic pump-outs, repairs, replacements, and new systems as part of the County Health Department's Septic Management Program, funded by East of Hudson (EOH) Water Quality Improvement Program (WQIP) in 2002 and 2008. The WCDOH database of pump-out data for properties in the County began in 2006. Of particular relevance to this investigation, the database includes pump-out dates and system type for each recorded pump-out. Pump-out dates are crucial for determining frequency of septic pump-outs to determine if septic systems are properly maintained. System type is important for identifying cesspools and seepage pits in the Study Area, which are limited in the treatment they provide. It should be noted that only septage haulers certified by Westchester County are obligated to report pump-out data to the County, and as such the database may not provide a complete scope of pump-outs in the Study Area.

A depiction of the total number of septic pump-outs per property from 2006 to 2020 is provided as Figure 4-6. Based on available data, this figure shows that 28 septic systems do not have a recorded pump-out, and another 80 have either one or two pump-outs. The three properties that have outhouses do not require pump-outs and were not considered for the figure. Five properties had more than 12 documented pump-outs and are assumed to be holding tanks. Additionally, 31 properties around the edge of the Study Area have incomplete GIS data due to the location of the Study Area boundary, and as such were excluded from the pump-out figure.

The remaining 138 applicable homes have at least three pump-outs over the 15 years of data and are assumed to be properly maintained.

The County does not have a separate record of septic system inspections. Included in the pump-out database is an indication of whether evidence of septage is present when the pump-out occurs, however, no property in the Study Area has had recorded evidence of septage.

4.3. Documented Septic Failures

The WCDOH does not maintain records of septic failures in the County. Based on conversations with the WCDOH, however, it is assumed for this investigation that all County-documented septic system repairs and replacements are a result of a septic failure. The County began recording repairs and replacement data in 2008, and over the 13 years from 2008-2020 there were a total of 26 documented cases in the Study Area. Based on this data, it was assumed that there are on average of two surface septic failures per year in the Study Area.

4.4. Water Quality Management Actions

Collection of CLSAP water quality data in Lake Waccabuc dates back to 1986. Following intermittent collection and reporting of data over the following 20 years, CSLAP reports have been provided on an annual basis since 2006. Following observations of eutrophication and water quality degradation trends, watershed management investigations were conducted in 2004 (Cedar Eden, LLC), 2009 (Ecologic, LLC) and 2019 (Cedar Eden, LLC). These studies advised the Town of Lewisboro and the Three Lakes Council on water quality trends and potential water quality improvement strategies. (The Three Lakes Council is made up of representatives from the lake associations of Lake Rippowam, Lake Oscaleta, and Lake Waccabuc.) In addition to these previous studies, the Town of Lewisboro has secured grant funding through the East of Hudson Watershed Corporation (EOHWC) for the construction of stormwater management practices (SMPs) to treat stormwater runoff eroding areas off of Tarry-A-Bit Drive. The project would include channel stabilization work in addition to construction of SMPs, which include dry swales and water retention areas.

4.5. Water Quality Measurement Criteria

Trophic status is a classification of the biological productivity of an aquatic ecosystem. The process of eutrophication is the enrichment of an aquatic ecosystem with nutrients which promote accelerated growth of submerged aquatic plants. As increased nutrient availability leads to an increase in aquatic biomass, eutrophication can catalyze a series of feedback loops in which algae and other aquatic vegetation begin to die, sink, and decompose following a bloom, resulting in a depletion of available oxygen within the hypolimnion (dense bottom layer of a waterbody, generally demarcated by the thermocline, or the depth at which a clear distinction in temperature can be observed between stratified layers of the water column). This process can result in an anoxic condition, where limited oxygen availability results in more pronounced stratification of the water column and unsuitable living conditions for aquatic organisms, leading to the formation of dead zones and associated fish kills. Stratification of the water column becomes more exaggerated during the warmer months in which temperature gradient inhibits vertical mixing within the water column. As decayed material and sediments submerge within the hypolimnion, nutrients including phosphorus are released over time and concentrate within the oxygen depleted lower waters. As vertical mixing of the water column occurs during the cooler months, these nutrients are cycled throughout the waterbody and can result in an accelerated process of eutrophication. In freshwater ecosystems, phosphorus is most often the limiting nutrient leading to increased biological productivity, and has been identified as the primary nutrient of concern for this study.

Internal loading refers to the release of phosphorus in sediments within the anoxic lower waters, a chemical process which is directly accelerated by oxygen depletion within the hypolimnion. A lake's internal phosphorus load is directly impacted by the external pollutant loads in that a larger external load provides more potential phosphorus sources to settle within the anoxic lower waters, and in turn result in a greater total internal load. Therefore, internal loading can be viewed as both a contributing source and a consequence of eutrophication. An expanded discussion of calculating internal phosphorus loads is provided in Section 4.6 of this report.

Eutrophication of an aquatic ecosystem is a naturally occurring process, however anthropogenic activities including land use change and introduction of nutrients to a watershed can expedite this process and result in nutrient loading rates that exceed the ecosystem's flushing rate. Nutrient loads within a watershed, both naturally occurring and those influenced by human activities, can enter a waterbody through a variety of mechanisms, including conveyance from point and non-point sources externally within the watershed, as well as through internal nutrient loading processes. Under existing conditions, it has been determined that the runoff of nutrients (i.e., phosphorus and nitrogen) and sediment from human activities in the watershed now exceeds Lake Waccabuc's natural capacity to dilute and purify.

Point sources include single, discernable locations of nutrient/pollutant discharges, and typically include discharges from sources such as industrial facilities, wastewater treatment facilities, and household wastewater disposal and treatment systems. Alternatively, nonpoint sources of nutrient and pollutant contributions to a waterbody result from stormwater runoff and the hydrologic cycle, and are primarily impacted by land cover and subsurface conditions. The purpose of this study is to evaluate nutrient contributions from point wastewater sources, focusing specifically on (i.e. septic systems). Therefore, although nonpoint source phosphorus contributions would be evaluated for the purpose of understanding the phosphorus budget within Lake Waccabuc, point source contributions from residential septic systems was the primary mechanism analyzed for corrective alternatives.

4.6. Phosphorus Load Contributions by Source

4.6.1. Model My Watershed Overview

The modeling analysis for the Lake Waccabuc Engineering Study was completed using the Model My Watershed (MMW), a web-based watershed modeling application which includes a Watershed Multi-Year Model. Model My Watershed provides a continuous simulation model which evaluates stormwater quality impacts using the Generalized Watershed Loading Function Enhanced (GWLF-E) model. The GWLF-E model was initially developed by Barry M. Evans, Ph.D., and his group at Penn State University for use with the MapShed desktop modeling application. The MMW Multi-Year Model utilizes regional geospatial data layers embedded within the program's web interface and provides estimated annual nutrient loadings based on 30 years of simulated water, nutrient, and sediment fluxes over a user defined Study Area.

The GWLF-E estimates external nutrient and sediment loads as a function of precipitation data, land cover, topography, soil type, soil nutrients, groundwater nitrogen, baseflow, animal farming operations, and wastewater inputs. Sources for each required dataset are as follows:

- Precipitation data: USEPA's National Climate Data (USEPA, 2006)
- Land cover: 2011 National Land Cover Database (Homer et al., 2015)
- Soil type: USDA-NRCS GSSURGO (USDA, 2016)
- Soil nitrogen: USDA National Soil Characterization Database (NSCD) (Hargrove and Luxmoore, 1998)
- Soil phosphorus: USGS (Smith et al. 2014)
- Groundwater nitrogen: USGS (Nolan and Hitt, 2006)
- Base flow: USGS (Wolock, 2003)
- Topography: National Elevation Dataset (USGS, 2009)
- Animal farming operations: USDA (USDA, 2012)
- Streams: Continental US Medium Resolution Stream Network (NHD Plus V2, 2017)
- Wastewater inputs: NYS Department of Health Records; Westchester County GIS (Westchester County, 2018, 2019, 2020, 2021)

The MMW application includes algorithms to calculate septic system loads from both properly functioning and failing/poorly functioning systems, therefore the model was utilized to evaluate a baseline condition of phosphorus and nitrogen loadings from wastewater and septic contributions based on the current number and conditions of on-site septic systems under existing conditions. Due to the differences in input variables and computation methods, direct comparison of the modeling results from this study with those from previous studies is not feasible. However, MMW serves as a valuable tool for assessing the effectiveness of various alternatives as compared to an established baseline condition.

4.6.2. Modeling Results

Baseline conditions for the modeling effort included user defined septic contributions determined through assumptions of the number of anticipated surface and subsurface septic failures present within the Study Area. For the purpose of modeling the baseline condition, a twofold approach was used to determine the anticipated range of potential phosphorus contributions from septic system failures. This approach utilized data of documented septic system surface failures, as well as an estimation of systems with a high potential for subsurface failure based on a variety of age and performance criteria. Average annual surface failures were estimated based on data from WCDOH, which served as the lower bound of the anticipated range of phosphorus loading from septic systems. In addition to observing these documented surface failures within the model, the higher bound of the estimated phosphorus loading range was determined through the addition of the estimated quantity of potential subsurface septic failures, which was estimated as a function of septic system age, maintenance records, and environmental constraints. Based on available data, septic systems falling into one or more of the following categories were determined to have a high likelihood of subsurface failure:

1) properties less than one-half acre in size;
2) properties categorized by the USDA NRCS as having very limited septic suitability (inadequate soils, shallow groundwater, shallow bedrock, and/or steep slopes);
3) septic systems within 100-feet of a waterbody or wetland;
4) septic systems estimated to be 50 years or older;
5) septic systems estimated to be 30 to 49 years old without record of regular septic pump-outs; and
6) cesspools and seepage pits.

Evaluation of this criteria resulted in a baseline condition of two surface failures and up to 213 potential subsurface failures within the Study Area. Although the total number of documented and anticipated septic system failures was delineated between surface and subsurface failures, it was confirmed with the developer of Model My Watershed that the model observes both types of septic failure as having equal potential for pollutant loads to reach receiving waters. The model output ranges for the baseline condition, including total estimated annual nutrient and sediment contributions and estimated annual nutrient and sediment contributions by source within the Study Area, are provided in Table 4-1.

Table 4-1: Modeled Nutrient and Sediment Inputs by Source

Sources	Sediment (lb)	Total Nitrogen (lb)	Total Phosphorus (lb)
Hay/Pasture	562.3	5.4	1.8
Cropland	0.0	0.0	0.0
Wooded Areas	6,387.3	103.7	11.9
Wetlands	75.4	19.4	1.1
Open Land	871.1	13.3	1.3
Barren Areas	0.0	0.0	0.0
Low-Density Mixed	175.9	3.6	0.4
Medium-Density Mixed	151.1	2.8	0.3
High-Density Mixed	16.8	0.3	0.0
Low-Density Open Space	2,965.4	60.6	6.7
Farm Animals	0.0	31.1	8.0
Stream Bank Erosion	93,258.7	119.0	30.9
Subsurface Flow	0.0	972.2	25.4
Point Sources	0.0	0.0	0.0
Septic Systems	0.0	24.6 - 2,043.5	9.3 - 1,073.9
TOTAL	**105,464.0**	**1,356.0 - 3,374.9**	**97.1 - 1,161.7**

According to the model, the Study Area is estimated to contribute between approximately 9 to 1,074 lbs./year of total phosphorus to the Lake from failing septic systems, accounting for approximately 10% to 92% of the total modeled external annual phosphorus load to Lake Waccabuc depending on the number of septic failures included in the model. These results suggest that phosphorus loading from undocumented subsurface septic system failure has the potential to be the largest contributor to the Lake Waccabuc external phosphorus load if subsurface failure is prevalent among the 213 systems deemed as having a high likelihood for failure. Anticipated phosphorus loads by source are illustrated graphically as a percentage of the total load in Figure 4-7 (minimum septic contribution) and Figure 4-8 (maximum septic contribution) below.

Figure 4-7: Modeled Phosphorus Loads by Source (Minimum Anticipated Septic Contribution)

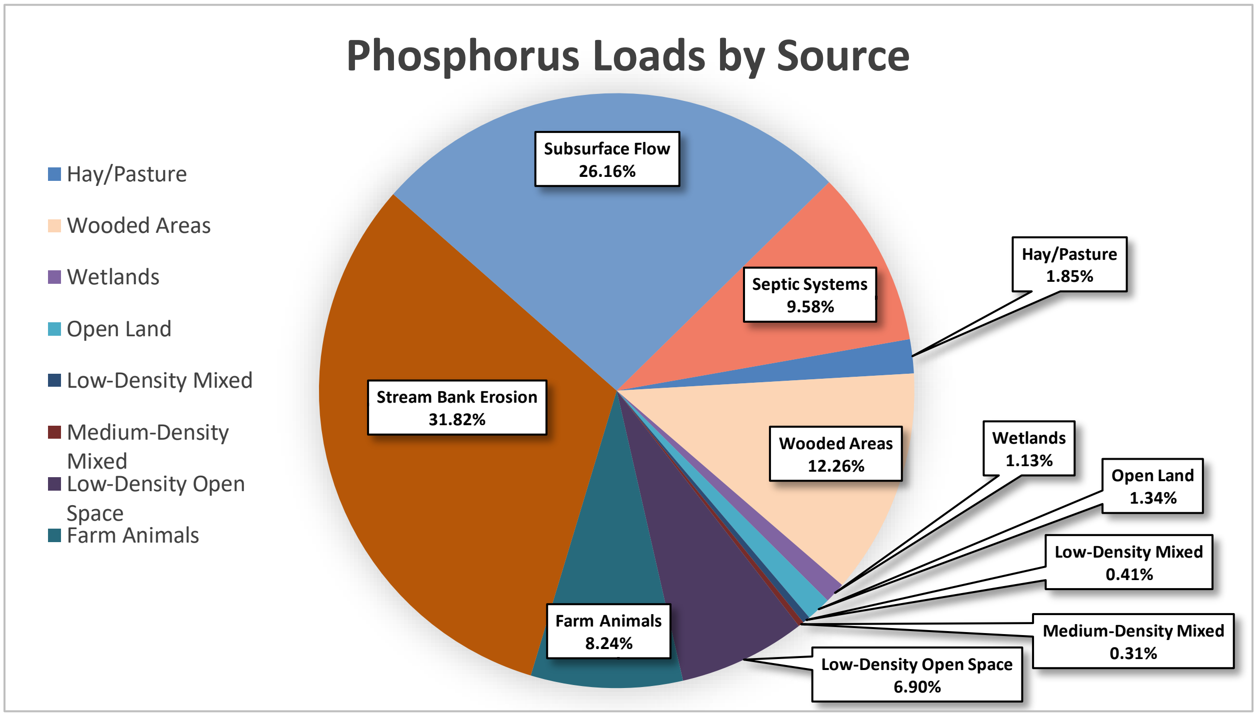
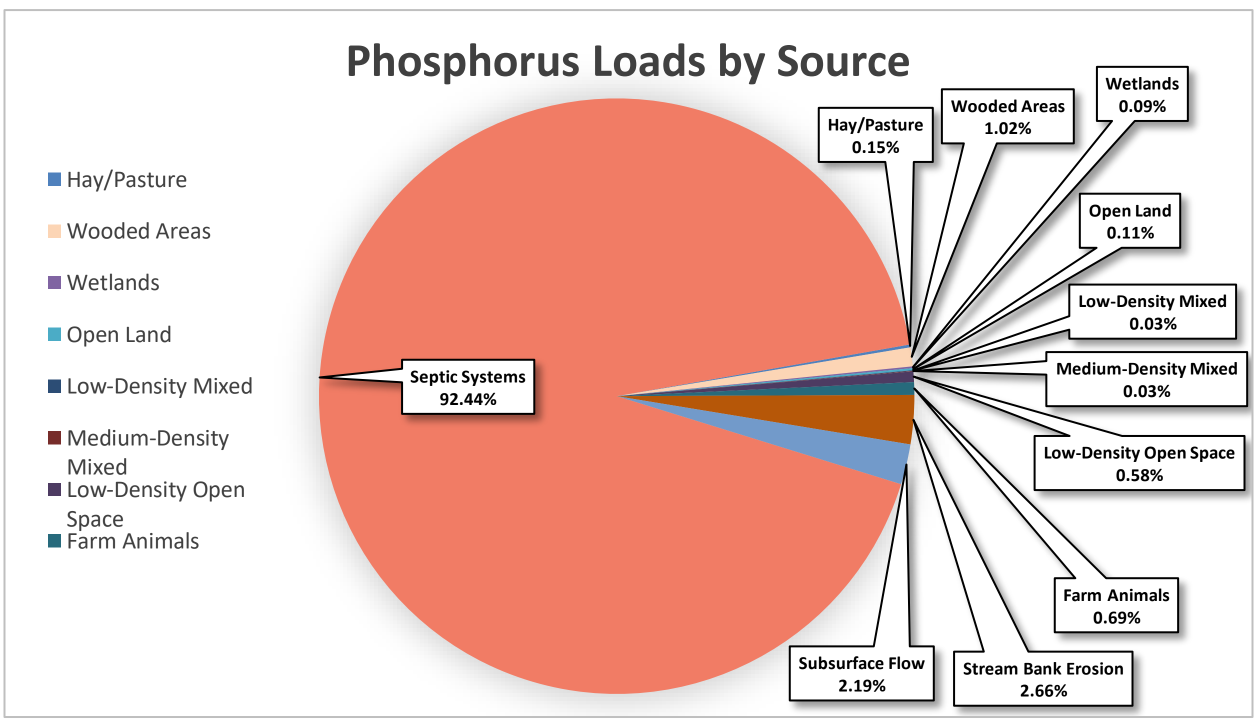


Figure 4-8: Modeled Phosphorus Loads by Source (Maximum Anticipated Septic Contribution)



Lake Waccabuc is a subbasin of the larger Cross River watershed, for which the NYSDEC has established a Total Maximum Daily Load (TMDL) for phosphorus which considers the total load from all septic systems within the contributing drainage area. The modeling results which include assumed subsurface failures from the 213 systems meeting the criteria identified above for systems with a high likelihood of failure suggest that the phosphorus contributions from septic systems within the Lake Waccabuc study are equivalent to 150% of the total septic load found for the entire Cross River watershed area, as compared to composing only 4.7% of the watershed area. This discrepancy is due to multiple factors, including but not limited to the following:

- a difference in modeling software and approach,
- the potential for septic derived phosphorus contributions to Lake Waccabuc to settle within the anoxic lower waters of the Lake before discharging to downstream resources such as the Cross River, and
- the inclusion of potential undocumented system failures to the model in addition to the two documented surface failures in order to advise prioritization of specific geographic areas during alternative selection.

The scope of the study did not include provisions for field testing and identification of confirmed septic failures within all study area parcels; therefore, although the anticipated total number of septic failures are conceptual in nature, the model provides a direct comparison of evaluating pollutant load reductions resulting from elimination of failing systems as a result of different project alternatives. The anticipated failures could be confirmed in the field during future stages of the study to advise alternative selection.

The purpose of this study is to evaluate potential opportunities for reductions in phosphorus loading within the Study Area, therefore the upstream watersheds of Lake Oscaleta and Lake Rippowam were not included in the model. It should be noted, however, that the overall Lake Waccabuc phosphorus budget includes nutrient inputs from these upstream areas, as discussed in greater detail in Section 12.5.1.

Following the establishment of baseline nutrient loading conditions, the modeling effort was duplicated to assess reductions in average annual nutrient loading from septic sources associated with each proposed alternative, as discussed in greater detail in Section 8.0.

4.6.3. Internal Loading

The internal phosphorus load generated within Lake Waccabuc was calculated in order to better understand the quantity of phosphorus contributed to the Lake through each nutrient loading mechanism. To calculate the internal phosphorus load, the difference in deep phosphorus concentration between spring and late summer was calculated and subsequently multiplied by the volume of water in the hypolimnion, which was determined during previous studies to be 1,398,107 m^3 (Cedar Eden, 2004; Ecologic, 2009). For the purpose of this calculation, spring and late summer phosphorus concentrations were determined using average concentrations from the periods of May 1 to June 11 and September 1 to September 30, respectively, observed during CSLAP monitoring for the following years: 2016, 2017, 2018, and 2020. Using these method, the estimated internal phosphorus load in Lake Waccabuc was determined to be 525.8 lbs./year. When compared with the Model My Watershed estimates of point and nonpoint source phosphorus contributions, this estimated internal load accounts for approximately 51.7% of the annual Lake Waccabuc phosphorus load.

4.7. Field Water Quality Sampling and Monitoring

To build upon the existing CSLAP data set and to support the nutrient load modeling completed for the study, water quality field monitoring and sampling was completed within Lake Waccabuc. The field monitoring effort included collection of lake water samples which were submitted for laboratory analyses, as well as *in situ* monitoring of additional paramters using a YSI ProDSS water quality meter, secchi disk, and field water quality test kits. Samples obtained for submission to the laboratory were collected using grab sampling methods in laboratory provided sampling bottles.

The primary objectives of the field water quality monitoring effort were as follows:

1) Observe general water quality indicators at various locations within Lake Waccabuc;
2) Observe indicators of HABs to determine the current trophic status of Lake Waccabuc and identify which areas have the greatest HAB potential;
3) Observe indicators of septic system influence on the water quality of Lake Waccabuc.

Shoreline sampling locations were distributed approximately evenly throughout the shoreline of Lake Waccabuc; however, locations with a higher density of residential properties, primarily located within the eastern extent of the lake, were preferentially targeted due to the increased potential for water quality impairment from wasterwater sources. All locations sampled for laboratory analysis were also subject to *in situ* monitoring; however, in order to maximize the number of sampling points for the study, sampling locations were organized into three (3) tiers (Tier 1, Tier 2, and Tier 3) depending on what analytes were determined to be most applicable to each respective sample point. Table 4-2 identifies analytes submitted for laboratory analysis for each tier of sampling, sampling locations corresponding to each tier, and rationale for tier rankings.

Table 4-2: Field Sampling Tier Descriptions and Rationale

Tier	Analytes	Approximate Location(s)	Rationale
Tier 1 (IDs: LW-1 – LW-11)	• Nitrate/Nitrite • Total Nitrogen • Total Kjeldahl Nitrogen • Dissolved Nitrate/Nitrite • Dissolved Nitrogen • Soluble Kjeldahl Nitrogen • Total Phosphorus • Soluble Phosphorus • Chlorophyll-a • Color • Fecal Coliform • Boron • Total Hardness • Ammonia • Potassium	• Near shoreline, within eastern half of Lake Waccabuc – 8 total sampling locations anticipated • Lake center, evenly distributed from west to east – 3 total sampling locations anticipated • See Figure 4-9 for approximate locations	Due to a high concentration of residential properties along the eastern half of the lake (primarily to the northeast), Tier 1 sampling locations were analyzed for general indicators of water quality and HABs (i.e., nutrients and chlorophyll-a) as well as specific indicators of septic system influence on water quality (fecal coliform, boron, total hardness, ammonia, and potassium). Three central locations within Lake Waccabuc were also analyzed for all Tier A analytes to observe differences in water quality at various depths and levels of mixing.
Tier 2 (ID: LW-12 – LW-14)	• Nitrate/Nitrite • Total Nitrogen • Total Kjeldahl Nitrogen • Dissolved Nitrate/Nitrite • Dissolved Nitrogen • Soluble Kjeldahl Nitrogen • Total Phosphorus • Soluble Phosphorus • Chlorophyll-a • Color	• Near shoreline, within western half of Lake Waccabuc – 3 total sampling locations anticipated • See Figure 4-9 for approximate locations	Sampling locations falling into Tier 2 were analyzed for general indicators of water quality and HABs (i.e., nutrients and chlorophyll-a); however, due to a lack of residential development along the western half of Lake Waccabuc, these locations were not be analyzed for specific indicators of septic system influence.
Tier 3 (ID: LW-15 – LW-16)	• Nitrate/Nitrite • Total Nitrogen • Total Kjeldahl Nitrogen • Dissolved Nitrate/Nitrite • Dissolved Nitrogen • Soluble Kjeldahl Nitrogen • Total Phosphorus • Soluble Phosphorus	• Near northern-central and southern-central shoreline of Lake Waccabuc – 2 total sampling locations anticipated • See Figure 4-9 for approximate locations	Analysis for sampling locations falling under Tier 3 were limited to nutrient concentrations only.

All data sampling was completed during two rounds of field sampling on July 7 and July 8, 2021. Through a combination of laboratory analyses and *in situ* water quality monitoring, the water quality indicators shown in Table 4-3 were tested.

Table 4-3: Field Monitoring and Sampling Parameters

Chlorophyll-a	Potassium
Fecal Coliform	Boron
Total Phosphorus	Color
Soluble Phosphorus	Temperature
Total Nitrogen	pH
Total Kjeldahl Nitrogen	Conductivity
Total NO3/NO2	Dissolved Oxygen
Soluble Nitrogen	Oxidation-Reduction Potential
Soluble Kjeldahl Nitrogen	Clarity
Soluble NO3/NO2	Turbidity
Total Hardness	Microcystins
Ammonia	Anionic detergents (surfactants)

These samples and observations were collected at the water's surface and variable depths at numerous locations within Lake Waccabuc, including near-shoreline locations and within central portions of the lake.

4.7.1 *In Situ* Monitoring Results

In situ monitoring data was collected at the water surface, as well as at a depth of up to 12 feet (or less when depth was limited) using a YSI ProDSS water quality meter, secchi disk, and field water quality test kits at all 16 monitoring locations where analytical samples were collected for laboratory submission (LW-1 – LW-16). Additional *in situ* monitoring was also conducted at four additional locations (LW-17 – LW-20) to supplement the dataset and to observe priority locations on the east side of Lake Waccabuc over both days of sampling. General limnological water quality indicators observed through *in situ* monitoring include pH, temperature, turbidity, specific conductance, dissolved oxygen, and redox potential. Water clarity observed using a secchi disk was the primary trophic status indicator collected through *in situ* methods. Test strips were utilized at all 20 locations to determine the level and distribution of microcystins, the primary toxin produced during HABs, within the Lake. Anionic detergent concentrations, an indicator of septic contribution of private household wastewater, were collected at monitoring locations LW-1 – LW-18.

A summary of *in situ* monitoring results observed during the July, 2021 Lake Waccabuc field sampling effort is provided in Table 4-4, including minimum, maximum and mean values, historical CSLAP data, and observations at LW-6 where CSLAP monitoring is conducted. Compiled *in situ* monitoring results observed during the Lake Waccabuc field sampling effort are included in Appendix F.

Table 4-4: *In Situ* Field Monitoring Results Summary

Analyte	Depth	Units	July 2021 Results			LW-6 (CSLAP Sampling Location)	CSLAP 7/6/2020	CSLAP 2020 Average
			Lowest Recorded Value	Highest Recorded Value	Mean Value			
pH	Surface	pH units	6.8	10.9	9.8	9.0	9.9	8.7
Temperature	Surface	ºC	23	28	27	26	28	26
Turbidity	Surface	NTU	2.4	8.9	5.7	6.1	N/A	N/A
Sp. Conductance	Surface	uS/cm	200	230	214	227	210	210
Redox Potential	Surface	mV	105.9	182.2	150.3	128.4	N/A	N/A
Dissolved Oxygen	Surface	mg/L	3.2	11.7	10.0	8.6	N/A	N/A
Clarity	Surface	m	0.6	1.4	1.1	0.8	1.1	1.9
Microcystins	Surface	ppb	0	5	4	5	N/A	N/A
Detergents (Anionic Surfactants)	Surface	ppb	0.00	0.50	0.25	0.25	N/A	N/A

In general, *in situ* monitoring results showed a condition generally similar to what was observed during the July 6, 2020 CSLAP monitoring effort. Observations of pH were high compared to NYS Water Quality Standards for Class A waters, however results were similar to those observed during 2020 CSLAP data. No instances of secchi disk visibility were observed below a depth of 1.4 meters, which is indicative of a eutrophic condition (less than 3 feet). Microcystin and anionic detergent test kit results indicated minor concentrations of algae toxins and detergents within Lake Waccabuc, however overserved concentrations were not indicative of health concerns or significant detergent input to the Lake.

4.7.2 Analytical Sampling Results

Water quality samples were collected from 16 locations within Lake Waccabuc and submitted for laboratory analysis in accordance with the tiers outlined in Table 4-2. Numerous indicators of general water quality were analyzed for Lake Waccabuc, as identified in Table 4-3**.** Total phosphorus and chlorophyll concentrations, both of which are primary indicators of eutrophication, were of particular importance for the purpose of this study.

A summary of analytical monitoring results observed during the July, 2021 Lake Waccabuc field sampling effort is provided in Table 4-5, including minimum, maximum and mean values, historical CSLAP data, and observations at monitoring location LW-6 where CSLAP monitoring is conducted. Compiled *in situ* monitoring results observed during the Lake Waccabuc field sampling effort are included in Appendix F.

Table 4-5: Analytical Sampling Results

Analyte	Units	NYS Water Quality Standard	July 2021 Results			LW-6 (CSLAP Sampling Location)	CSLAP 7/6/2020	CSLAP 2020 Average
			Lowest Recorded Value	Highest Recorded Value	Mean Value			
Color, Apparent	A.P.C.U	N/A	15	28	22	27	7	11.6
Nitrogen, Ammonia	mg/L	2	0.041	0.625	0.132	0.158	0.031	0.025
Nitrogen, Nitrate/Nitrite	mg/L	10	0.023	0.420	0.076	0.066	N/A	N/A
Nitrogen, Dissolved Nitrate/Nitrite	mg/L	N/A	0.023	0.320	0.043	0.024	N/A	N/A
Total Nitrogen	mg/L	10	0.96	3.20	1.28	1.20	1.24	0.86
Dissolved Nitrogen	mg/L	N/A	0.48	2.80	1.01	0.58	0.87	4.28
Nitrogen, Total Kjeldahl	mg/L	N/A	0.81	3.22	1.27	1.19	N/A	N/A
Nitrogen, Soluble Kjeldahl	mg/L	N/A	0.450	1.600	0.876	0.580	N/A	N/A
Phosphorus, Total	mg/L	0.02	0.025	0.043	0.033	0.038	0.053	0.022
Phosphorus, Soluble	mg/L	N/A	0.006	0.024	0.012	0.009	N/A	N/A
TN:TP	-	N/A	28	100	40	32	23	27
Chlorophyll A	mg/m^3	N/A	21.3	42.3	31.3	36.2	62.3	26.5
Fecal Coliform	FCU/100mL	N/A	1	90	17	90	N/A	N/A
Boron	mg/L	10	0.03	0.03	0.03	0.03	N/A	N/A
Potassium	mg/L	N/A	1.6	1.6	2.0	2.0	N/A	N/A
Total Hardness	mg/L	N/A	54.3	54.3	61.9	59.9	N/A	N/A

Average phosphorus and chlorophyll concentrations observed at the water surface during the July, 2021 field sampling effort were determined to be 0.033 mg/L and 31.3 mg/m^3, respectively. Average concentrations, maximum concentrations, and concentrations observed at the CSLAP monitoring location for both trophic status indicators were lower than those observed during July, 2020 CSLAP monitoring; however, these concentrations are still indicative of a eutrophic condition. **In general, the distribution of reported phosphorus concentrations revealed the highest concentrations were observed at the Lake Waccabuc inlet, along the southeastern shoreline to the north of South Shore Drive, and within the northwestern and western central reaches of the Lake.** Distribution of observed chlorophyll concentrations were generally consistent with that of observed phosphorus concentrations. Although spatial variation was noted for observed concentrations of trophic status indicators, interpretation of these results suggest a Lake-wide eutrophic condition.

It should be noted sampling was conducted at monitoring locations within the eastern and central portions of the Lake on July 7, 2021 (LW-1 – LW-11), while monitoring locations within with western extent of the Lake were sampled on July 8, 2021 (LW-12 –

LW-20); therefore, variability of conditions (weather, time of day, internal mixing) between sampling dates may have resulted in higher than anticipated concentrations of phosphorus and chlorophyll within more sparsely populated areas at the western end of the Lake.

4.8. Water Budget for Lake

A water budget is an estimation of the quantity and timing of all inflows and outflows to a hydrologic resource. The water budget for the Lake Waccabuc Study Area was considered in the development of wastewater infrastructure improvement alternatives in order to determine if any alternatives would have the potential to impact the existing balance of the hydrologic cycle within the Study Area. The Lake Waccabuc water budget generally includes inflow to the Lake (including inflow from upstream resources and total runoff), Lake volume, flushing rate, and retention time. None of the proposed alternatives would result in a notable change of inflow to the Lake, and any impacts to the Lake Waccabuc water budget would be negligible under all alternatives.

5.0 DEFINITION OF THE PROBLEM

Years of sampling data has shown that the concentrations of phosphorus in Lake Waccabuc have increased over time. Lake Waccabuc is now in a mesotrophic state, experiences frequent algae blooms, and has a high vulnerability for invasive species. There is also the concern that Lake Waccabuc ultimately drains into the Cross River Reservoir, which is a NYCDEP water supply. It has been hypothesized that the aging and archaic on-site septic systems in the study area are a major contributor of phosphorus to Lake Waccabuc. To address the water quality deterioration of the Lake, the Town of Lewisboro is considering various wastewater management solutions and the potential cost benefit of each.

5.1. Health, Sanitation, and Security

Failing and poorly functioning on-site septic systems can result in untreated wastewater surfacing, creating an unpleasant smell, ponded or spongy area on the property. Ponding can attract disease spreading insects. In addition, a failing septic system can cause sewage backup in the building drains or toilets, unpleasant odors around the building, and/or slow emptying drains.

Failing and poorly functioning on-site septic systems can also increase the risk of biological and nutrient contamination of groundwater and adjacent waterbodies. The majority of the properties in the study area receive their drinking water from private wells. From the April 2021 public survey (Appendix D), 4 participants reported that their well water had, at one point, been contaminated. In this same public survey, 14 participants reported that they draw their drinking water directly from Lake Waccabuc and require extensive treatment systems to do so safely. Apart from residents of the study area, there is also the health concern for the residents of New York City, due to the fact that Lake Waccabuc is part of the Cross River Watershed, which is a NYCDEP reservoir.

Figure 5-1A and Figure 5-1B show where on-site septic systems have failed within the study, as well as indicators of poorly functioning systems. These same figures also show which residents have experienced contaminated water from their wells.

Harmful algae blooms have the potential to release cyanobacteria, including microcystins, and other toxins which have the potential for negative human health impacts. It is not well understood when and why algae blooms release toxins, however contact with or consumption of these toxins, either by direct ingestion or consumption of toxin-contaminated seafood, can result in gastrointestinal illness, liver damage, and in extreme cases death.

5.2. Aging Infrastructure

Most of the septic systems within the Study Area have or would soon exceed their useful design life. Limiting structural components of an on-site septic system (septic tank, conveyance piping, and distribution boxes) have a life expectancy of about 50 years. With respect to the system as a whole, the lifespan can range from around 15 to 40+ years depending on a number of factors.

- The USEPA's *New Homebuyer's Guide to Septic Systems* (dated August 2017) states that "the average lifespan of a septic system is 15 to 40 years, but it can last longer if properly maintained."
- An article written by the Cornell Cooperative Extension titled Your Septic System: Buying or Selling a House with a Septic System (dated January 2013) states that "[septic] systems are designed to have a useful life of 20 to 30 years under the best conditions."

It is not reasonable to expect the on-site septic systems of the study area to continue to properly function without investment in maintenance and/or replacement.

5.3. Infiltration and Inflow

The Town currently does not have a sanitary sewer collection system within the Study Area.

5.4. Reasonable Growth

The Town of Lewisboro is not projected to experience growth over the next 30 years as previously discussed in Section 2.2.3 of this report. As such, the design flow for the study area does not account for growth.

5.5. Water, Energy and/or Waste Considerations

There are no existing publicly owned sanitary sewer collection and treatment systems within the Study Area; therefore, there are no current water, energy, or waste efficiency considerations.

5.6. Suitability for Continued Use

Due to poor management, age, and environmental constraints (as discussed in Section 4.0 of this report) many of the existing on-site septic systems cannot continue to be used in their current condition. Additionally, there are many instances in which the environmental constraints of a property make it unable to even support a new on-site septic system.

5.7. Storm and Flood Resiliency

Septic systems are susceptible to failing when faced with significant storms and flooding conditions. Any significant rise in the groundwater table caused by a storm can result in pollution of the groundwater table or surfacing of the untreated sewage. Flooding conditions can carry untreated sewage that has surfaced to other areas of the community, including Lake Waccabuc and its tributaries. See Section 4.1.6 for a discussion on floodplains in the study area.

5.8. Compliance with Accepted Standards

Many of the on-site septic systems do not comply with the most current version of the NYSDOH Residential Onsite Wastewater Treatment Systems Design Handbook, as discussed in Section 4.0 of this report.

6.0 EVALUATION OF TREATMENT OPTIONS

As discussed earlier in the report, the Town of Lewisboro does not currently have a sanitary sewer collection and treatment system within the Study Area. The following section evaluates the proposed wastewater management solutions and their feasibility for implementation.

6.1. Prioritization of Areas to be Served

For the purposes of this investigation, high priority parcels are those categorized by the USDA NRCS as having vary limited septic suitability (inadequate soils, shallow groundwater, shallow bedrock, and/or steep slopes), homes within 100 feet of a waterbody or wetland, and/or a parcel size smaller than half an acre. These properties are unlikely to be able to support a properly functioning conventional septic system and are the highest priority for sewer. The medium-high priority parcels include properties with septic systems more than 50 years old, cesspools, and/or seepage pits. These properties are likely poorly functioning and are targeted for septic system replacement or sewer. Medium priority parcels include properties with septic systems between 30 and 49 years old that have been pumped-out fewer than two times since 2006. Lack of pump-outs are indicative of poor septic system maintenance and the age of these systems dictates a need for further investigation and the potential for rehabilitation or sewer. Low priority parcels are properties without significant site constraints and with septic systems deemed not likely to be poorly functioning. A prioritization of areas to be served can be found in Figure 6-1.

To aid in prioritization, four (4) distinct regions were established within the study area: northwest, east, mid, and south. The northwestern region is bound by Long Pond Preserve and Lake Waccabuc to the south and vacant, steeply sloped land to the east. The eastern region is bound by Lake Waccabuc and Waccabuc River to the west. The mid region is bound by Long Pond Preserve and Lake Waccabuc to the north, Waccabuc River to the east, and the Waccabuc Country Club Golf Course to the south. The southern region is bound by Waccabuc Country Club Golf Course to the north. A map depicting the four study area regions is provided as Figure 6-2.

The most concentrated location of parcels determined to have the highest priority of needing service is found in the Eastern Region. Similarly, the region with the greatest cost-value when comparing the cost of implementing a sewer collection system in each region to the respective amounts of estimated phosphorus removed is also the Eastern Region. A summary of this cost-benefit analysis is provided in Table 6-1. The estimated amount of phosphorus removed is based on the high end of the analysis, as described in Section 4.6.2.

Table 6-1: Phosphorus Removal Cost-Benefit Summary

Study Area Region	Capital Cost of Sewer System*	Maximum Estimated Phosphorus Removed (lbs/day)	Sewer Cost/ Phosphorus Removed
Northwest	$3,100,000	42.6	$310,000
Eastern	$6,900,000	266.6	$111,000
Mid	$5,300,000	70.4	$331,000
Southern	$2,200,000	12.3	$550,000

*Cost does not include stream crossings.

The potential water quality impacts and estimated costs of the various alternatives evaluated in this study are provided in Section 8.0 and Section 9.0, respectively.

6.2. No Action

The "no-action" alternative provides a reference for comparison of other alternatives. This alternative entails that no change would be made to the existing wastewater infrastructure. Although this alternative would have the lowest initial capital cost, it would not address any deficiencies currently found with the failing and poorly functioning septic systems and therefore does not provide the Town of Lewisboro with a reliable wastewater treatment management system. Under this alternative, septic systems would continue to fail and the cost to replace these systems would only increase. In addition, the water quality of the Lake Waccabuc watershed would continue to deteriorate. This option is not recommended.

6.3. Repair or Replacement of Individual Septic Systems

Under this alternative, failing and poorly functioning on-site septic systems would be repaired or replaced, based on the needs of each system. However, septic systems that are repaired/replaced on properties with environmental constraints (shallow groundwater, shallow bedrock, steep slopes, etc.) would likely still be limited in their ability to fully treat the wastewater, as discussed in Section 4.1. Larger parcels with environmental constraints are more likely to have an available portion of suitable land to support a septic system, but the cost to construct a code-compliant system on such land could be drastically different (potentially an order of magnitude greater) than the cost of a typical on-site septic system. Given the uncertainty of such a scenario, and the unpredictability of the cost, it is assumed that only the repair/replacement of aging septic systems, cesspools, and seepage pits that are not located on sites with environmental constraints would reduce the phosphorus loading to the watershed.

In order to address the phosphorus loading that comes from properties with environmental constraints, it is recommended that enhanced treatment be implemented at these limited sites. Such systems would be installed between the septic tank and drainfield. The use of enhanced treatment would be in addition to any repairs or replacements considered to be practicable. The following sections discuss two enhanced treatment systems that were considered as part of this study.

6.3.1. Aerobic Treatment Units

Aerobic treatment units (ATUs) utilize blowers for aeration to break down organic matter and reducing nutrients. Because so much of the organic material is treated in an ATU, the typical biomat layer that forms in a drainfield would not be present, therefore the drainfield would need to be pressure-dosed, rather than gravity fed. A pressure-dosed system would require pumps. Both the use of blowers and pumps would require power and maintenance.

ATU systems are typically the most effective at treating biochemical oxygen demand (BOD_5) and nitrogen. Total suspended solids (TSS) can also be effectively treated if a filtration process is included. While biological phosphorus removal can occur through such treatment processes, the amount removed can vary. For best results, the ATU would need to be carefully monitored and operated, making it an unrealistic solution for homeowners.

6.3.2. Phosphorus Treatment Units

There are a limited number of phosphorus treatment systems on the market at this time. For the purposes of this study, the PhosRID™ system was evaluated. The PhosRID™ system passively removes phosphorus from wastewater through reductive iron dissolution and mineralization of phosphorus. The PhosRID™ system is less expensive and easier to operate and maintain since there no blowers or pumps and the only required maintenance is replacement of the tank media once every seven years.

One drawback of relying on a phosphorus treatment unit for enhanced treatment on properties with environmental constraints is that there are other pollutants within the wastewater that may not be fully treated in the ground before reaching Lake Waccabuc.

6.3.3. Recommended Enhanced Treatment System

The PhosRID™ system is less expensive and easier to operate and maintain than an ATU, however the PhosRID™ system only targets the treatment of phosphorus, so a greater number of wastewater contaminants may still reach Lake Waccabuc. Arguably, if full treatment of the wastewater prior to entering the drainfield were the goal, than the selected enhanced treatment systems should include multiple units so as to treat for the same contaminants as a WRRF: BOD_5, TSS, nitrogen, phosphorus, and bacteria. There are also contaminants of emerging concern that may require treatment at WRRFs in the near future, such as PFAS, pharmaceuticals, and micro-plastics. The more contaminants that are targeted for treatment, the more elaborate the treatment systems need to be, thus making them more expensive and difficult to maintain. If the treatment systems are not maintained, they would ultimately not work as designed, thus defeating their purpose. For the purposes of this study, the contaminant of concern, and therefor the focus of this recommendation, is phosphorus. For this reason, the PhosRID™ system was included in the evaluation of the alternative to replace or repair individual septic systems under Section 7.1 of this report.

6.4. Community Septic System (Decentralized)

Eleven (11) potential sites have been considered for the location a community septic system solution, as shown in Figure 6-3. The sites evaluated for a community septic system are larger parcels owned by various organizations with a significant amount of available land. Private homeowners with additional capacity to support wastewater from a neighboring home(s) was not evaluated on a case by case basis as part of this study. However, if individual parcels are interested in this option then the cost could be easily ascertained and other land ownership, legal and operations/maintenance agreement would need to be reviewed. The potential sites evaluated are as follows:

6.4.1. Hawley Road Vacant Parcel – Tax Parcel No. 48.-1155-5

This 67.7-acre parcel is privately owned and is located on Hawley Road, just north of the study area in North Salem. While the property is close in proximity to the study area, it is outside the Town of Lewisboro and has a significant change in elevation. This property is located approximately 150-feet above the eastern region of the study area. A community septic system at this site would require a robust sewer collection system with stainless steel piping and a pump station with odor control to overcome the change in elevation. Such a sewer collection system would have increased operations and maintenance costs. The property includes steep slopes, a pond, and a stream. The majority of useable land is already cleared.

Given standard setback requirements and assuming locations of nearby wells, approximately 106,000 square feet of this vacant land was determined to be usable space for a community septic system. Based on the NRCS soil data for the area, an assumed application rate of 0.8 gpd/ft^2 was utilized to calculate the maximum potential flow that the land could accommodate. This results in a total estimated capacity of 26,500 gpd, which includes the additional 50% required minimum reserve capacity. The estimated flow from the eastern region of the Study Area is approximately 60,000 gpd, which this site cannot support. Therefore, this site is not recommended for further evaluation.

6.4.2. Mountain Lakes Park – Tax Parcel No. 49.3-1164-8

This 55.8-acre park is owned by Westchester County and is located on Mountain Lakes Road, roughly 1 mile north of the study area in North Salem. There is a significant elevation increase of about 350-feet from the northeast corner of the Study Area to the nearest suitable location within the park, and the route is steeply sloped. A community septic system at this site would require a robust sewer collection system with stainless steel piping and a pump station with odor control to overcome the change in elevation. Associated operations and maintenance costs would be substantial. Therefore, this site is not recommended for further evaluation.

6.4.3. South Shore Drive – Tax Parcel No. CAMP-048-033D

This 24-acre parcel is owned by the South Shore Waccabuc Association and is located on South Shore Drive, off of Oscaleta Road. Located within the Study Area, the northern boundary of the property borders Lake Waccabuc. In the southeast corner of this property is approximately 5-acres of vacant forested land. The Town Engineer of Record, Kellard Sessions Consulting, identified this vacant land as potentially suitable for a community septic system to manage the wastewater of the South Shore Waccabuc Association. A copy of the assessment completed by Kellard Sessions Consulting is included as Appendix G.

Given standard setback requirements and assuming locations of nearby wells, approximately 152,400 square feet of this vacant land was determined to be usable space for a community septic system. Based on the NRCS soil data for the area, an assumed application rate of 0.8 gpd/ft^2 was utilized to calculate the maximum potential flow that the land could accommodate. This results in a total estimated capacity of 35,800 gpd, which includes the additional 50% required minimum reserve capacity. The estimated flow from the South Shore Waccabuc Association is 8,600 gpd, which results in 27,200 gpd of additional capacity. This is a viable site for further evaluation.

6.4.4. Rippowam Preserve – Tax Parcel No. 11826-001-0034

This 23.3-acre parcel is managed by Wildlife Preserves Inc. and is located on Oscaleta Road, across the street from South Shore Drive. Rippowam Preserve surrounds the stream that connects Lake Oscaleta to Lake Waccabuc and contains steep slopes and wetlands. The southern portion of the preserve is potentially suitable for an on-site wastewater treatment system, however based on setback constraints the capacity at this site is estimated to be 15,000 gpd. Restrictions of the conservation easement for this preserve are unknown. This site is not recommended for further evaluation.

6.4.5. WCC Beach Club House – Tax Parcel No. 10813-001-025A

This 6.3-acre parcel is owned by the Waccabuc Country Club and is located off of Perch Bay Road. Located within the Study Area, the northern boundary of the property borders Lake Waccabuc. The waterfront property contains the WCC Beach Club House, which is mainly used as a day camp. Much of the site contains steep slopes (15-25%), however the portion of the property close to the road is relatively flat and is outside of the 100-foot waterbody buffer. The property is anticipated to have capacity to accept flow from houses on the north side of Perch Bay Road. The estimated flow from these properties is 9,340 gpd, and the calculated capacity for the site is 19,800 gpd. This results in 10,460 gpd of additional capacity. This is a viable site for further evaluation.

6.4.6. Long Pond Preserve – Tax Parcel No. 11155-139-0025

This 35.5-acre parcel is managed by the Three Lakes Council and is located along Mead Street. Located within the Study Area, the northeast boundary of the property borders Lake Waccabuc. Long Pond Preserve has two streams that run through the property, one of which flows through a wetland. The Town is also pursuing a wetland development project on the site. The site is generally unsuitable for an onsite wastewater treatment system and is not recommended for further evaluation.

6.4.7. Mead Memorial Chapel Parking Lot – Tax Parcel No. 11155-136-0023

This 3.7-acre parcel is owned by the Mead Memorial Chapel Board of Trustees and is located along Mead Street, across the street from Mead Memorial Chapel. Approximately 7,500 square feet of the property consists of a dirt parking lot. The remainder of the property is steeply sloped, forested land. The space available is roughly one-fifth the land available at the WCC Beach Club House, and the capacity at this site is minimal. This site is not recommended for further evaluation.

6.4.8. Pine Croft Meadow Preserve – Tax Parcel No. 10802-060-0022

This 9.0-acre parcel is managed by the Westchester County Land Trust and is located along Mead Street, just north of the WCC Golf Course. A stream runs through the Pine Croft Meadow Preserve and the majority of land contains wetlands. The available land at this site is approximately 2,600 square feet in area, significantly smaller than other potential locations. The site is generally unsuitable for an on-site wastewater treatment system and is not recommended for further evaluation.

6.4.9. Waccabuc Country Club Golf Course – Tax Parcel No. 10803-054-0022

This 63.2-acre parcel is owned by the Waccabuc County Club and is located along either side of Mead Street, with the eastern side bordering East Ridge Drive. Drip dispersal was considered as a subsurface disposal method under the golf course. Drip dispersal is capable of following the contours of the golf course. Additionally, the wastewater would provide nutrient uptake to the grass over the drainfield. Based on the NRCS soil data for the area, an assumed application rate of 0.8 gpd/ft^2 was utilized to calculate the minimum amount of land required to accommodate flow from the entire Study Area. When accounting for the additional 50% required minimum reserve capacity, the minimum land requirement is about 8 acres for this site. If the zones of the drip dispersal field were limited to the fairways of a golf course, the drip dispersal field would cover approximately 3 fairways. The Waccabuc Country Club was not comfortable with the level of disturbance to the golf course that would result from the construction of such a system. It appears this site should be left open for future consideration with the country club board. This is a viable site for further evaluation, provided that an alternative solution could be agreed upon with the Waccabuc Country Club, such as serving a smaller region of the Study Area and discharging to less sensitive area of the facility, such as the driving range.

6.4.10. Old Field Preserve – Tax Parcel No. 10803-003-0021

This 97.1-acre parcel is managed by the Westchester County Land Trust and is located along Mead Street, overlapping with the southern portion of the Study Area. The property is anticipated to have capacity to accept flow from houses on the southern portion of the Study Area. The Westchester County Land Trust reviewed the conservation easement for the property and indicated that it is highly unlikely that a wastewater management solution could be implemented at the site. Thus, this site is not recommended for further evaluation.

6.4.11. Waccabuc Heights U.S. Air Traffic Control Tower – Tax Parcel No. 10803-017-0026

This 13.7-acre federally owned parcel is located 2 miles south of the Study Area on Waccabuc River Lane. There is an air traffic control tower on site and the restrictions associated with use of this property are unknown. The land surrounding the tower is not adequate to support a community septic system for the entire Study Area. Additionally, the distance from the edge of the Study Area to the site increases the required length of sewer and as a result, the overall cost of the project. Therefore, this site is not recommended for further evaluation.

6.4.12. Recommended Site

A community septic system at South Shore Drive is the most feasible, cost-effective option that can provide sewer management for a significant number of parcels. For this reason, the South Shore Drive community septic system is further evaluated under Section 7.2 of this report.

6.5. Connection to Existing Wastewater Resource Recovery Facility (Centralized)

Four (4) existing WRRFs within a 10 mile radius of the study area have been considered for connection. The potential sites evaluated are as follows:

6.5.1. Ridgefield, Connecticut

The Ridgefield, Connecticut WRRF is a 1.0 MGD plant with the nearest sewer manhole approximately 5 miles from the Study Area. Connection to this plant would require an interstate agreement. This plant was recently upgraded to double its capacity to 1.0 MGD in a wastewater treatment consolidation effort by the Town. The plant currently experiences average flows close to or at its capacity. Additionally, there is limited physical space available on the property for expansion. A second upgrade is likely not feasible, therefore, this site is not recommended for further evaluation.

6.5.2. Danbury, Connecticut

The Danbury, Connecticut WRRF is a 12 MGD plant with the nearest sewer connection approximately 10 miles from the Study Area, at the Ridgefield-Danbury border. Connection to this plant would require an interstate agreement. This plant had a capacity of 15 MGD, however a recent phosphorus limit has reduced the plant's capacity to 12 MGD. City officials indicated little to no excess capacity exists, therefore a connection to the Danbury WRRF would not be an immediate solution for the Study Area.

6.5.3. Peach Lake, New York

The Peach Lake WRRF is a 0.17 MGD plant with the nearest sewer approximately 7 miles from the Study Area. The WRRF was constructed with NYCDEP funding. This plant would likely require a significant upgrade to accept and treat the additional flows, but has the potential and space for expansion. However, funding limitations restricted eligibility for connection to the WRRF within the Peach Lake community. As per communication with NYCDEP, there is likely a process by which an approval could be considered, but there is not enough information at this time to determine if a connection is feasible and/or what the regulatory requirements would be. Therefore, it has been assumed at this time that NYCDEP would likely not allow connection from the Lake Waccabuc community to this sewer management system until the process is further defined. A concept plan and associated cost summary could be prepared in a future study if it is deemed possible to utilize this treatment plant.

6.5.4. Heritage Hills, Somers, New York

Suez Water owns and operates a 0.702 MGD WRRF approximately 10 miles from the Study Area in the Town of Somers. This plant has available capacity for the Lake Waccabuc community to connect, however Suez does not own the rights to the additional capacity. For this reason, the available capacity must be purchased, which is a separate fee from the user charges. Additionally, the sewer and pump stations that must be constructed in order to connect to the WRRF would be the responsibility of the Town.

6.5.5. Recommended Site

Connection to the Heritage Hills WRRF in the Town of Somers is the only available option at this time, therefore this alternative was further evaluated under Section 7.3 of this report.

6.6. New Water Resource Recovery Facility (Centralized)

Eight (8) potential sites have been considered for the location of the WRRF, as shown in Figure 6-4. It is assumed that none of the local preserves could be used to site a WRRF, given the restrictions of their respective conservation easements. The potential sites evaluated are as follows:

6.6.1. Hawley Road Vacant Parcel – Tax Parcel No. 48.-1155-5

This 67.7-acre parcel is privately owned and is located on Hawley Road, just north of the study area in North Salem. Much of the property is steeply sloped. The majority of useable land is already cleared. There is a stream on-site for surface discharge. After accounting for offsets to property boundaries and residential dwellings, it is anticipated that a WRRF in this location could likely support the whole study area. While the property is close in proximity to the Study Area, it is outside of the Town limits and has a significant change in elevation. This property is located approximately 150 feet above the Study Area, which would require a costly sewer collection system with stainless steel piping and a pump station with odor control to overcome the change in elevation. The addition of a pump station to the collection system would result in increased operations and maintenance costs. It appears that this land is undergoing subdivision. This site is not recommended for further consideration at this time.

6.6.2. Mountain Lakes Park – Tax Parcel No. 49.3-1164-8

This 55.8-acre park is owned by Westchester County and is located on Mountain Lakes Road, 1 mile north of the Study Area in North Salem. The park is outside of the Town limits and has a significant elevation increase of about 400-feet from the northeast corner of the Study Area to the nearest suitable location within the park. Additionally, the route is steeply sloped. Connection to a WRRF at this site would require a costly sewer collection system with stainless steel piping and potentially two pump stations with intermediate odor control to overcome the change in elevation. Associated operations and maintenance costs would be substantial. As such, this site is not recommended for further consideration at this time.

6.6.3. South Shore Drive – Tax Parcel No. CAMP-048-033D

This 24-acre parcel is owned by the South Shore Waccabuc Association and is located on South Shore Drive, off of Oscaleta Road. Located within the Study Area, the northern boundary of the property borders Lake Waccabuc. In the southeast corner of this property is 5-acres of vacant forested land. After accounting for offsets to property boundaries and residential dwellings, it is anticipated that a WRRF in this location could support the entire Study Area. The nearest stream for surface discharge is Waccabuc River, which would require an easement to run a discharge pipe through the adjacent parcel. The land would need to be leased by the South Shore Waccabuc Association. Discussions were held with members of the Association. The Association voted against the siting of the WRRF on their land.

6.6.4. Benedict Road Vacant Parcel – Tax Parcel Nos. 10804-092-0032 and 10804-093-0032

These two adjacent parcels are cumulatively 4-acre. This privately owned land has one single owner and is located on Benedict Road, just south of the Study Area. After accounting for offsets to property boundaries and residential dwellings, it is anticipated that a WRRF in this location could support a similar capacity to that of the South Shore Drive land, approximately 140,000 gpd. The Town would need to purchase the property in order to build a WRRF at this location. The nearest stream for surface discharge is a tributary of Waccabuc River, which may be accessible by the Town right-of-way (ROW) along Benedict Road. The land would need to be purchased in order to site a WRRF at this location.

6.6.5. Waccabuc Country Club Golf Course – Tax Parcel No. 10803-054-0022

This 63.2-acre parcel is owned by the Waccabuc County Club and is located along either side of Mead Street, with the eastern side bordering East Ridge Drive. The wastewater from the Waccabuc Country Club golf course and associated buildings is treated at a WRRF on-site. The existing WRRF has a permitted capacity of 8,000 gpd and discharges to a stream that is outside of the Lake Waccabuc watershed. After accounting for offsets to property boundaries and residential dwellings, it has been determined that the location of the existing WRRF cannot support an upgrade to accommodate a substantial increase in capacity. There is no other space available at the golf course that could support a community WRRF.

6.6.6. Wolf Conservation Center – Tax Parcel No. 10803-082-0021

This 8.6-acre parcel is owned by the Wolf Conservation Center and is located on Buck Run Street, 0.7 miles south of the Study Area. There is a stream that runs through the property for surface discharge. The property is steeply sloped, which is not ideal for siting a WRRF. As such, this site is not recommended for further consideration at this time.

6.6.7. Waccabuc Heights U.S. Air Traffic Control Tower – Tax Parcel No. 10803-017-0026

This 13.7-acre federally owned parcel is located 2 miles south of the Study Area on Waccabuc River Lane. There is not a stream available for surface discharge, however, subsurface discharge from the treatment plant may be feasible, given the amount of available space. There is an air traffic control tower on site and the restrictions associated with use of this property are unknown, but likely substantial. However, visibility is part of the siting process requirements of an air traffic control towner, provided under Order No. 6480.4A. This would explain why 6 acres of land is clear around the air traffic control tower. Given this understanding, it is assumed that a wastewater treatment plan could not be sited adjacent to the tower.

6.6.8. Lewisboro Elementary School – Tax Parcel No. 10805-031-0031

This 10.4-acre parcel is owned by the Katonah - Lewisboro School District and is located on Bouton Road, 3.5 miles south of the Study Area. The Truesdale Lake community is 0.5 miles to the east and is also undergoing an engineering study in which this parcel is under consideration for the siting of a community WRRF. The former Lewisboro Elementary School buildings are located on the property. Building space is currently rented out to the Town, as well as a child care facility. Projections indicate that the school will likely not be needed by the Katonah - Lewisboro School District for the foreseeable future.

The school has an existing WRRF with a permitted capacity of 10,000 gpd, which is significantly less than that of the Study Area and potentially the Truesdale Lake community. The treatment plant discharges to an intermitted stream that has been known to periodically dry up. It is assumed that NYSDEC would not allow a greater flow of discharge to this stream and that discharge would need to be directed to Waccabuc River in the Town ROW, along Bouton Road.

After accounting for offsets to property boundaries and residential dwellings, it has been determined that the existing school buildings would likely need to be demolished in order to site the community WRRF. Given the age of the buildings, it is assumed that lead, asbestos, and PCBs are present, which substantially increases demolition costs. In order to demolish the buildings, the Town would need to purchase the property from the Katonah - Lewisboro School District. Given the current condition of the buildings and the cost it would take to renovate them, it is assumed that the cost of the property is equivalent to the value of the land. Future evaluation to determine whether the buildings would need to be removed would be completed in a future phase of the project.

6.6.9. Recommended Sites

A WRRF constructed on Benedict Road discharging to the Waccabuc River tributary is the most local, feasible solution and could accommodate the entire Study Area. Figure 6-5 shows the available land for the WRRF after offsets to property boundaries and residential dwellings are applied. Given the proximity of this location to the most densely populated portion of the Study Area, it is assumed that this is one of the most cost effective solutions when focusing solely on the Lake Waccabuc community. For this reason, the proposed Benedict Road WRRF is further evaluated under Section 7.4 of this report.

In an effort to evaluate potential consolidation opportunities, a WRRF at the Lewisboro Elementary site was also recommended for further evaluation. One WRRF supporting two Study Areas of the Lewisboro community would save costs associated with operations and maintenance and would provide a greater number of users to share future cost burdens associated with the WRRF as it reaches the end of its useful life. A WRRF at Lewisboro Elementary has the available space to accommodate the flow from the entire Lake Waccabuc Study Area in addition to the 140,000 gallons per day proposed flow from the Truesdale Lake Community. Figure 6-6 shows the available land for the WRRF after offsets to property boundaries and residential dwellings are applied. A more in-depth assessment of this solution is provided in Section 7.5 of this report.

7.0 ALTERNATIVES ANALYSIS

7.1. Alternative 1 – Repair or Replacement of Individual Septic Systems

In order to repair or replace failing and poorly functioning septic systems, the Town could either form a Septic Maintenance District or establish a program in which eligible residents can receive funding to address such matters by means of a private contractor. There is already a funding program available to select properties within the Study Area if certain eligibility criteria are met. This program is discussed in detail under Section 12.2.2.4 of this report. If the Town were to form a septic maintenance district, the district residents would pay taxes towards repairs and replacements of failing and poorly functioning individual on-site septic systems, as well as routine maintenance of the systems.

The major benefit of this alternative compared to existing conditions is that property owners would have a greater incentive to replace, repair, and/or maintain their on-site septic systems. Repairs and replacements can be costly, so providing residents with a means of funding make such undertakings more economically feasible for them. As discussed in Section 4.2, WCDOH does not have septic pump-out records for 28 properties within the Study Area, despite the

Town law requiring residents to do so[1]. If funding were available, residents may be more so willing to conduct routine maintenance, thereby lessening the number of failures, as well as the number of violation notices and fines for the Town to issue.

7.1.1. Impact on Existing Facility

The existing individual on-site septic systems and holding tanks would need to be decommissioned. The new on-site septic systems would completely replace the existing systems. In situations where existing septic systems and holding tanks are located in unsuitable locations and can be moved to more suitable locations, the existing systems would be decommissioned.

7.1.2. Land Requirements

The Town would have to work with the Study Area residents to obtain access agreements for replacing or repairing existing on-site septic systems.

7.1.3. Seasonal Limits, Challenges, and Requirements

The groundwater table seasonally fluctuates, reaching its highest annual elevation in the spring and/or autumn. Septic systems are susceptible to functioning poorly or failing when the depth to groundwater is shallow. Systems that are currently located over a shallow groundwater table that cannot be moved to a more suitable location would continue to poorly function or fail.

7.1.4. Discharge Permit Requirements

There are no discharge permits required for septic systems. New on-site septic systems would be constructed to meet NYSDOH Appendix 75-A requirements to the maximum extent practicable. WCDOH would be consulted on any system that could not meet the current standards of NYSDOH Appendix 75-A.

7.1.5. Water and Energy Efficiency Measures

Many of the on-site wastewater treatment systems are fed by gravity, therefore energy efficient equipment was not included in this alternative. Water reuse or capture has not been included in this project.

7.1.6. Storm and Flood Resiliency

As discussed in Section 4.1.6, portions of the Study Area are located within the 10-year floodplain. The 10-year floodplain is within the 100-foot buffer to water bodies. Wherever possible, on-site septic systems located within the 100-foot buffer would be moved outside of the buffer.

[1] Per Chapter 183, Article I of the Lewisboro Town Code, all septic systems must be inspected a minimum of once every five years. An inspection is defined as the pump out and removal of septage from the septic system and the subsequent reporting by a septage collector that is licensed by the Westchester County Department of Health. Those in violation may receive a notice to correct the violation within 30 days from the Town Building Inspector. For every day beyond the 30-day limit, the violator may be subject to a fine. Chapter 183, Article I was adopted on April 25, 2011 in accordance with Part IX.A.3.b of the NYSDEC, MS4 General Permit GP-0-10-002.

7.1.7. Constructability and Schedule

The replacement of an individual on-site septic system typically takes a couple of weeks. Systems with a more intricate design for sites with environmental constraints could take much long. The amount of time it would take to replace all of the on-site septic systems in the determined septic district would depend on a number of factors, and could take years to complete. Constructability constraints include shallow groundwater and bedrock, steep slopes, proximity to water bodies, floodplain elevation, and wetlands. All of these constraints have been mapped to identify which areas would take additional time to construct and where environmental protection measures would be needed.

7.2. Alternative 2 – Community Septic Systems

7.2.1. Preliminary Design

Alternative 2 includes a regional lower pressure sewer system that collects wastewater from the South Shore Waccabuc Association and sends it to an on-site community septic system. The layout of this alterative is included as Figure 7-1 at the end of the report.

A low pressure sewer with grinder pump stations was selected as the most appropriate method of sewer collection, given the low lying elevation of the homes surrounding Lake Waccabuc, as well as the changing topography of the association land. Each home would be served by a grinder pump station with a 1 1/2 - inch diameter HDPE lateral force main that would convey the wastewater to the main collection system. The wastewater would then be conveyed through a 4-inch diameter HDPE force main. Power for the grinder pump stations would be provided through the existing electric service of each property. All grinder pump stations would have a generator receptacle for a portable generator connection.

The community septic system would consist of one (1) 7,000 gallon septic tank and one (1) 7,000 gallon two-compartment dosing chamber, followed by a drip dispersal drainfield. Drip dispersal was the drainfield technology selected because it can be installed at a shallow depth, allows for flexibility in shape, and can be installed between the trees of the site, thus eliminating clearing costs and preserving the site's natural resources. The size of the drainfield was determined using percolation rates obtained in the field on July 21, 2021. A copy of the field notes from the percolation testing are included in Appendix H.

7.2.2. Impact on Existing Facility

The existing individual on-site septic systems and holding tanks would need to be decommissioned. The existing infrastructure would be replaced with a grinder pump station and sewer lateral that would convey the sewage from each home to the new wastewater collection system and community septic system.

7.2.3. Land Requirements

Given that the land is owned by the South Shore Waccabuc Association and the community septic system would only serve the South Shore Waccabuc Association, there are no land requirements for this alternative. As shown in Figure 7-1, the community septic system would require a 320’ x 77’ drip dispersal absorption field and a 320’ x 77’ drip dispersal absorption field reserve space.

7.2.4. Seasonal Limits, Challenges, and Requirements

The sewer collection system conveyance piping and appurtenances would be installed below frost depth (4.5 feet) to avoid issues associated with freezing temperatures. The drip dispersal drainfield would be installed at a minimum depth of 1.5 feet, per the 2014 NYSDEC *Design Standards for Intermediate Sized Wastewater Treatment Systems.* The drip dispersal drainfield is designed to operate at such depths under freezing conditions.

The groundwater table seasonally fluctuates, reaching its highest annual elevation in the spring and/or autumn. Septic systems are susceptible to functioning poorly or failing when the depth to groundwater is shallow. As part of the detailed design process, the soils, percolation rates, and seasonal groundwater elevations would need to be more thoroughly evaluated and taken into account to avoid issues with shallow groundwater.

7.2.5. Discharge Permit Requirements

There are no discharge permits required for septic systems. The new community septic systems would be constructed to meet the requirements of the 2014 NYSDEC *Design Standards for Intermediate Sized Wastewater Treatment Systems*.

7.2.6. Water and Energy Efficiency Measures

Given the simplicity of the community septic system, energy efficiency measures were not included in this alternative. Water reuse or capture has not been included in this project.

7.2.7. Storm and Flood Resiliency

Portions of the sewer collection system lie within the 100-year flood zone. The collection system would be designed to be water-tight and the grinder pumps would be designed to account for buoyancy during conditions of flooding. The proposed location of the septic tank, dosing chamber, and drip dispersal drainfield lies outside of the 100-year flood zone.

7.2.8. Constructability and Schedule

Construction of the sewer collection system and community septic system is estimated to take 12-18 months. Constructability constraints considered include floodplain elevation and wetlands. Both have been mapped to identify which areas contain wetlands and therefore need to be protected and which areas are within the 100-year floodplain.

7.3. Alternative 3 – Connection to Existing Water Resource Recovery Facility

7.3.1. Preliminary Design

Alternative 3 includes a regional lower pressure sewer system that collects wastewater from either the entire Study Area or a portion thereof and sends it to a series of two major pump stations for conveyance to the Heritage Hills WRRF, located in Somers, New York. The layout of this alterative is included as Figure 7-2 at the end of the report text. It appears that no additional improvements are needed at the existing WRRF as the plant has sufficient capacity to accept the flows.

A low pressure sewer with grinder pump stations was selected as the most appropriate method of sewer collection, given the low lying elevation of the homes surrounding Lake Waccabuc, as well as the changing topography of the Study Area. Each home would be served by a grinder pump station with a 1 1/2 - inch diameter HDPE lateral force main that would convey the wastewater to the main collection system. The wastewater would then be conveyed through a 4-inch diameter HDPE force main to the first pump station. The sewer force main from the first pump station to the second pump station, and to the WRRF would be conveyed through a 6-inch diameter HDPE force main to reduce friction loss. All piping would be implemented utilizing directional drilling to minimum site restoration requirements. Power for the grinder pump stations would be provided through the existing electric service of each property. All grinder pump stations would have a generator receptacle for a portable generator connection.

At the main pump stations, multiple pumps shall be provided for redundancy. With one (1) pump out of service, the second pump shall have the capacity to handle the design peak hourly flow.

7.3.2. Impact on Existing Facility

The existing individual on-site septic systems and holding tanks would need to be decommissioned. The existing infrastructure would be replaced with a grinder pump and sewer lateral that would convey the sewage from each home to the new sewer collection system. The existing WRRF would likely have minimal required upgrades. The plant is designed for a flow of 0.702 MGD but currently operates at an average flow of approximately 0.3 MGD, indicating there is sufficient capacity to accept the outside wastewater. The only anticipated changes to the plant would be a greater usage of chemicals and energy.

7.3.3. Land Requirements

The Town would have to work with the Study Area residents to obtain easements for maintenance of grinder pumps and sewer laterals, as well as access agreements for decommissioning the existing on-site septic systems in the Study Area. Additionally, land would need to be acquired for the two (2) proposed pump stations that would convey the wastewater from the Study Area to the Heritage Hills WRRF. One of the pump stations would be located in or adjacent to the Study Area and the second would be located about halfway to the WRRF.

7.3.4. Seasonal Limits, Challenges, and Requirements

The sewer collection system conveyance piping and appurtenances would be installed below frost depth (4.5 feet) to avoid issues associated with freezing temperatures.

7.3.5. Discharge Permit Requirements

There would be no discharge permit requirements under this alternative.

7.3.6. Water and Energy Efficiency Measures

The pumps at the two (2) pump stations would be equipment with variable frequency drives (VFDs). Water reuse and capture has not been included in this project.

7.3.7. Storm and Flood Resiliency

Wastewater pump station structures and electrical and mechanical equipment shall be located in areas that would avoid damage by a 100-year flood. Wastewater pumping stations shall be designed to be fully operational and accessible.

7.3.8. Constructability and Schedule

Construction of the sewer collection system is estimated to take 18 months. Constructability constraints considered include floodplain elevation and wetlands. Both have been mapped to identify which areas contain wetlands and therefore need to be protected and which areas are within the 100-year floodplain.

7.4. Alternative 4A – Water Resource Recovery Facility on Benedict Road

7.4.1. Preliminary Design

As discussed in Section 6.1 of this report, the Eastern Region provides the greatest economic and environmental benefit. As such, Alternative 4A includes a lower pressure sewer system that collects wastewater from the Eastern Region of the Study Area and sends it to a WRRF located on Benedict Road with treated surface discharge to a tributary of the Waccabuc River. It should be noted that the residents located in the Eastern Region south of the South Shore Waccabuc Association are not included in the proposed sewer district since they are not listed as high or medium-high priority. (See Section 6.1 of this report for more information on prioritization of parcels within the Study Area.) The layout of this alterative is included as Figure 7-3 in the report.

A low pressure sewer with grinder pump stations was selected as the most appropriate method of sewer collection, given the low lying elevation of the homes surrounding Lake Waccabuc, as well as the changing topography of the Study Area. Each home would be served by a grinder pump station with a 1 1/2 - inch diameter HDPE lateral force main that would convey the wastewater to the main collection system. The wastewater would then be conveyed through a 4-inch diameter HDPE force main. All piping would be implemented utilizing directional drilling to minimum site restoration requirements. Power for the grinder pump stations would be provided through the existing electric service of each property. All grinder pump stations would have a generator receptacle for a portable generator connection.

Based on an approximate population of 446, the estimated average treatment loads for the Eastern Region are 98.1 lb/day of BOD_5, 112 lb/day of TSS, and 9 mg/l of total phosphorus. Treatment alternatives were evaluated based on anticipated SPDES permit limits, summarized in Section 7.4.11 of this report. The recommended main components of the WRRF are as follows:

1. Mechanically Cleaned Fine Screen
2. Manually Raked Bar Rack By-Pass
3. Manual Grit Chambers
4. Sequencing Batch Reactors
5. Disc Filters
6. UV Disinfection
7. Aerobic Digesters

The design average day capacity of the WRRF for this alternative is 60,000 gallons per day to accommodate the Eastern Region of the Study Area. However, it has been determined that the available space at the Benedict Drive property has the potential to accommodate a WRRF that could support the entire Study Area (128,000 gallons per day). With this understanding, the Town could pursue extending the sewer collection system as a future project to accommodate other properties within the Study Area, as is deemed necessary.

7.4.2. Preliminary Treatment

The proposed headworks would consist of an influent flow meter, manually raked bar rack by-pass, mechanically cleaned fine screen, and two (2) manual grit chambers. The mechanically cleaned fine screen is typically recommended by sequencing batch reactor (SBR) manufacturers because the fine screen removes materials such as rags and floatables from the system entirely.

7.4.3. Secondary Treatment Process

The SBR process is a suspended growth, continuous flow batch treatment process which utilizes a common basin to accomplish the biological treatment and settling processes. Biological treatment is achieved through the aeration cycle with the use of blowers and an aeration grid. The settling process is accomplished by turning off the aeration system and providing enough idle time for the solids to settle. The treated wastewater is then decanted from the top of the tank and the sludge is wasted from the bottom.

When comparing an SBR process with a membrane bioreactor (MBR) process, there are fewer components to an SBR system to maintain, making operation of such a system easier. While the MBR system provides a high level of treatment that does not require tertiary filtration, the MBR treatment system is more complex and energy intensive when compared to the SBR treatment system, generally making it the more expensive option, despite the required tertiary filtration for an SBR treatment system.

7.4.4. Tertiary Treatment

Disc filtration includes a low-head, vertically mounted cloth media disk featuring an automatically operated spray backwash system. Each filter is designed to backwash automatically based on water level while maintaining continuous filtration during the backwash cycle. The influent water enters the tank through the center piping and diffuses out through the filter discs. The system operates with the discs being partially submerged during filtration.

As solids accumulate on the media, a water level sensor is triggered to begin backwashing of the disc filters. Each disc rotates and is sprayed by nozzles to dislodge impurities on the filters. The backwash water is collected in a trough and pumped back up to the WRRF headworks. Approximately 1% to 3% of the effluent flow is returned to the headworks as waste backwash water.

The disc filtration system occupies a compact footprint with minimal mechanical equipment. The system does not need to be drained in order to perform any of the required maintenance or replacement of filters.

7.4.5. Disinfection

Disinfection is required for any surface water discharge. To meet the anticipated stringent chlorine residual limit, a UV disinfection system has been selected.

7.4.6. Treated Effluent Discharge

It is anticipated that the WRRF outfall would be a bank discharge outfall to a tributary of the Waccabuc River. Currently, there is no outfall and the Town would work with NYSDEC for the proper outfall approval.

7.4.7. Sludge Disposal

The sludge from the SBR basins would be pumped into two (2) aerobic digesters. The sludge would be liquid-hauled to the Westchester County WRRF with a solids concentration of 2%. Using dewatering equipment to increase the solids concentration is not recommended since this would increase the capital cost and O&M costs of the overall WRRF and would not be cost effective for this size facility.

7.4.8. Impact on Existing Facility

The existing individual on-site septic systems and holding tanks would need to be decommissioned. The existing infrastructure would be replaced with a grinder pump station and sewer lateral that would convey the sewage from each home to the new wastewater collection system and WRRF.

7.4.9. Land Requirements

The sewer collection system would largely occur in the Town right-of-way (ROW). The Town would have to work with the study area residents to obtain easements for maintenance of grinder pumps and sewer laterals, as well as access agreements for decommissioning the existing on-site septic systems in the Study Area.

The Town would also need to purchase the land for the WRRF. The two parcels that make up this site have a combined assessed value of $20,000. Assessed values within the Town of Lewisboro were established in the 1980's and represent 9.72% of market value, therefore it is assumed that the present-day assessment would be closer to $200,000. However, the two parcels were purchased by the current owner at a cost of $400,000 in 2012. For the purposes of this study, it was assumed that the cost of the land would be $400,000.

7.4.10. Seasonal Limits, Challenges, and Requirements

The sewer collection system conveyance piping and appurtenances would be installed below frost depth (4.5 feet) to avoid issues associated with freezing temperatures.

It is anticipated that the WRRF's SPDES permit would require effluent disinfection from May 1st to October 31st. However, the permit requirements are not yet known at this time.

7.4.11. Discharge Permit Requirements

The Town currently does not have any permit requirements, as stated in Section 3.3 of this report. A summary of the potential discharge limits is shown in Table 7-1. A Total Phosphorus (TP) limit was determined from the 1997 NYC Watershed Final Rules and Regulations (Amended 2010) to be a value of 0.5 mg/L, as the total flow is between 50,000 and 500,000 gpd. The remaining potential discharge limits were determined based on the NYSDEC Standards for Intermediate Sized Wastewater Treatment Systems. It is anticipated that the permit limits would be adjusted as necessary when an official SPDES permit is established.

Table 7-1: WRRF SPDES Projected Permit Summary

Parameter	Basis for Limit	Surface Discharge Anticipated Limitation
Flow	30-Day Avg Daily Flow	0.060 MGD
BOD_5[1]	30-Day Arithmetic Mean	30 mg/L
	7-Day Arithmetic Mean	45 mg/L
TSS[1]	30-Day Arithmetic Mean	30 mg/L
	7-Day Arithmetic Mean	45 mg/L
Settleable Solids[1]	Daily Max	0.1 mL/L
pH[1]	Range	6.0-9.0 S.U.
Coliform, fecal, when disinfecting[1]	30-Day Geometric Mean	200 colonies/100mL
	7-Consecutive Day Geometric Mean	400 colonies/100mL
Total Residual Chlorine[2]	Daily Max	0.02 mg/L
Ammonia[2]	Daily Max or Avg	2.2 mg/L as NH_3 in summer
		1.5 mg/L as NH_3 in summer
Total Phosphorous (TP)[3]	Daily Max	0.5 mg/L as P
Dissolved Oxygen[2]	Daily Min	7.0 mg/L

1. 2014 NYSDEC *New York State Design for Intermediate Sized Wastewater Treatment Systems*.
2. NYSDEC *Division of Water Technical and Operational Guidance Series*, (TOGS) 1.3.3 SPDES Permit Development for POTWS
3. 1997 NYSDEP *Rules and Regulations for the Protection from Contamination, Degradation and Pollution of the New York City Water Supply and Its Sources*, Amended 2019

7.4.12. Water and Energy Efficiency Measures

Energy efficient equipment would be selected to reduce the energy usage for the new sewer collection system and WRRF. Such energy efficient equipment would include: variable frequency drives (VFDs) on all of the pumps, the use of fine bubble diffusers, premium efficiency blowers with VFDs, and low-pressure, high output UV lamps. There would be no water reuse or capture included in this project.

7.4.13. Storm and Flood Resiliency

The proposed location of a new WRRF would lie outside of the 100-year flood zone. The bottom elevation of the WRRF would be designed above the 100-year flood elevation.

7.4.14. Constructability and Schedule

Construction of the sewer collection system and WRRF is estimated to take 18-24 months. The collection system and WRRF are planned to be constructed simultaneously. Constructability constraints considered include floodplain elevation and wetlands. Both have been mapped to identify which areas contain wetlands and therefore need to be protected and which areas are within the 100-year floodplain.

7.5. Alternative 4B – Water Resource Recovery Facility at Lewisboro Elementary

7.5.1. Preliminary Design

Alternative 4B includes a low pressure sewer system that collects wastewater from the entire Study Area and sends it to a WRRF located at the Lewisboro Elementary School site with treated surface discharge to Waccabuc River. The layout of this alterative is included as Figure 7-4.

A low pressure sewer with grinder pump stations was selected as the most appropriate method of sewer collection, given the low lying elevation of the homes surrounding Lake Waccabuc, as well as the changing topography of the Study Area. Each home would be served by a grinder pump station with a 1 1/2 - inch diameter HDPE lateral force main that would convey the wastewater to the main collection system. The wastewater would then be conveyed through a 4-inch diameter HDPE force main. All piping would be implemented utilizing directional drilling to minimum site restoration requirements. Power for the grinder pump stations would be provided through the existing electric service of each property. All grinder pump stations would have a generator receptacle for a portable generator connection.

Based on wastewater flows and loading projections, it is recommended that a WRRF be constructed with a design average day capacity of 128,000 gallons per day. The estimated average treatment loads are 170 lb/day of BOD_5, 193 lb/day of TSS, and 9 mg/l of total phosphorus. Treatment alternatives were evaluated based on anticipated SPDES permit limits, summarized in Section 7.4.11 of this report. The recommended main components of the WRRF are as follows:

1. Mechanically Cleaned Fine Screen
2. Manually Raked Bar Rack By-Pass
3. Manual Grit Chambers
4. Sequencing Batch Reactors
5. Disc Filters
6. UV Disinfection
7. Aerobic Digesters

7.5.2. Preliminary Treatment

The proposed headworks would consist of an influent flow meter, manually raked bar rack by-pass, mechanically cleaned fine screen, and two (2) manual grit chambers. The mechanically cleaned fine screen is typically recommended by sequencing batch reactors (SBR) manufacturers because the fine screen removes materials such as rags and floatables from the system entirely.

7.5.3. Secondary Treatment Process

The SBR process is a suspended growth, continuous flow batch treatment process which utilizes a common basin to accomplish the biological treatment and settling processes.

Biological treatment is achieved through the aeration cycle with the use of blowers and an aeration grid. The settling process is accomplished by turning off the aeration system and providing enough idle time for the solids to settle. The treated wastewater is then decanted from the top of the tank and the sludge is wasted from the bottom.

When comparing a SBR process with a membrane bioreactor (MBR) process, there are fewer components to an SBR system to maintain, making operation of such a system easier. While the MBR system provides a high level of treatment that does not require tertiary filtration, the MBR treatment system is more complex and energy intensive when compared to the SBR treatment system, generally making it the more expensive option, despite the required tertiary filtration for an SBR treatment system.

7.5.4. Tertiary Treatment

Disc filtration includes a low-head, vertically mounted cloth media disk featuring an automatically operated spray backwash system. Each filter is designed to backwash automatically based on water level while maintaining continuous filtration during the backwash cycle. The influent water enters the tank through the center piping and diffuses out through the filter discs. The system operates with the discs being partially submerged during filtration.

As solids accumulate on the media, a water level sensor is triggered to begin backwashing of the disc filters. Each disc rotates and is sprayed by nozzles to dislodge impurities on the filters. The backwash water is collected in a trough and pumped back up to the WRRF headworks. Approximately 1% to 3% of the effluent flow is returned to the headworks as waste backwash water.

The disc filtration system occupies a compact footprint with minimal mechanical equipment. The system does not need to be drained in order to perform any of the required maintenance or replacement of filters.

7.5.5. Disinfection

Disinfection is required for any surface water discharge. To meet the anticipated stringent chlorine residual limit, a UV disinfection system has been selected.

7.5.6. Treated Effluent Discharge

The stream on-site that the existing WRRF currently discharges to is such a small stream that it is assumed the NYSDEC would not permit a larger discharge flow to this stream. Therefore, it is anticipated that the WRRF outfall would be a bank discharge outfall to the Waccabuc River. Currently, there is no outfall at the proposed location and the Town would work with NYSDEC for the proper outfall approval.

7.5.7. Sludge Disposal

The sludge from the SBR basins would be pumped into two (2) aerobic digesters. The sludge would be liquid-hauled to the Westchester County WRRF with a solids concentration of 2%. Using dewatering equipment to increase the solids concentration is not recommended since this would increase the capital cost and O&M costs of the overall WRRF and would not be cost effective for a facility of this size.

7.5.8. Impact on Existing Facility

The existing individual on-site septic systems and holding tanks would need to be decommissioned. The existing infrastructure would be replaced with a grinder pump station and sewer lateral that would convey the sewage from each home to the new wastewater collection system and WRRF.

7.5.9. Land Requirements

The Town would have to work with the Study Area residents to obtain easements for maintenance of grinder pumps and sewer laterals, as well as access agreements for decommissioning the existing on-site septic systems in the Study Area.

As discussed in Section 6.6.8 of this report, it is possible that the existing buildings would need to be removed in order to make room for the WRRF. Given the age of the buildings, it is assumed that lead, asbestos, and PCBs are present, which substantially increases demolition costs. In order to demolish the buildings, the Town would need to purchase the property from the Katonah - Lewisboro School District. Given the current condition of the buildings and the cost it would take to renovate them, it is assumed that the cost of the property is equivalent to the value of the land.

As shown in Figure 7-4, the approximate land requirement for the WRRF under this alternative is 170’ x 150’. The collection system would largely occur in the Town right-of-way (ROW), with the exception of the crossing under Waccabuc River connecting Perch Bay Road with South Shore Drive. This crossing would require an easement to install sewer through the unoccupied property east of the Waccabuc River.

7.5.10. Seasonal Limits, Challenges, and Requirements

The sewer collection system conveyance piping and appurtenances would be installed below frost depth (4.5 feet) to avoid issues associated with freezing temperatures.

It is anticipated that the WRRF’s SPDES permit would require effluent disinfection from May 1st to October 31st. However, the permit requirements are not yet known at this time.

7.5.11. Discharge Permit Requirements

The Town currently does not have any permit requirements, as stated in Section 3.3 of this report. A summary of the potential discharge limits is shown in Table 7-2. A Total

Phosphorus (TP) limit was determined from the 1997 NYC Watershed Final Rules and Regulations (Amended 2010) to be a value of 0.5 mg/L, as the total flow is between 50,000 and 500,000 gpd. The remaining potential discharge limits were determined based on the NYSDEC Standards for Intermediate Sized Wastewater Treatment Systems. It is anticipated that the permit limits would be adjusted as necessary when an official SPDES permit is established.

Table 7-2: WRRF SPDES Projected Permit Summary

Parameter	Basis for Limit	Surface Discharge Anticipated Limitation
Flow	30-Day Avg Daily Flow	0.128 MGD
BOD_5[1]	30-Day Arithmetic Mean	30 mg/L
	7-Day Arithmetic Mean	45 mg/L
TSS[1]	30-Day Arithmetic Mean	30 mg/L
	7-Day Arithmetic Mean	45 mg/L
Settleable Solids[1]	Daily Max	0.1 mL/L
pH[1]	Range	6.0-9.0 S.U.
Coliform, fecal, when disinfecting[1]	30-Day Geometric Mean	200 colonies/100mL
	7-Consecutive Day Geometric Mean	400 colonies/100mL
Total Residual Chlorine[2]	Daily Max	0.02 mg/L
Ammonia[2]	Daily Max or Avg	2.2 mg/L as NH_3 in summer
		1.5 mg/L as NH_3 in summer
Total Phosphorous (TP)[3]	Daily Max	0.5 mg/L as P
Dissolved Oxygen[2]	Daily Min	7.0 mg/L

1. 2014 NYSDEC *New York State Design for Intermediate Sized Wastewater Treatment Systems*.
2. NYSDEC *Division of Water Technical and Operational Guidance Series*, (TOGS) 1.3.3 SPDES Permit Development for POTWS
3. 1997 NYSDEP *Rules and Regulations for the Protection from Contamination, Degradation and Pollution of the New York City Water Supply and Its Sources*, Amended 2019

7.5.12. Water and Energy Efficiency Measures

Energy efficient equipment would be selected to reduce energy usage at the new sewer collection system and WRRF. Such energy efficient equipment would include: variable frequency drives (VFDs) on all of the pumps, the use of fine bubble diffusers, premium efficiency blowers with VFDs, and low-pressure, high output UV lamps. There would be no water reuse or capture included in this project.

7.5.13. Storm and Flood Resiliency

The proposed location of a new WRRF would lie outside of the 100-year flood zone. The bottom elevation of the WRRF would be designed above the 100-year flood elevation.

7.5.14. Constructability and Schedule

Construction of the sewer collection system and WRRF is estimated to take 18-24 months. The collection system and WRRF are planned to be constructed simultaneously. Constructability constraints considered include floodplain elevation and wetlands. Both have been mapped to identify which areas contain wetlands and therefore need to be protected and which areas are within the 100-year floodplain.

7.6. Environmental Impacts and Mitigation Measures

7.6.1. SEQR/SERP Compliance and Overview

The project is expected to require review as a Type 1 action under the State Environmental Quality Review Act (SEQRA) for all alternatives. The SEQRA review would involve completion of the Full Environmental Assessment Form and a coordinated review with all potentially involved or interested agencies for the project. The anticipated project classification would be confirmed following alternative selection. The need for any special studies for specific areas of concern would also be identified during the next phase of the project.

7.6.2. Wetlands and Surface Waters

As discussed in Section 2.1.3 of this report, wetlands are present throughout the project area. It is anticipated that all alternatives have the potential for impacts to wetland resources or regulated 100-foot adjacent areas aside from Alternative 1 (replacement of individual septic systems) through all other alternatives reviewed. A wetland delineation would be completed during the project’s preliminary design phase to identify the boundaries of wetlands within the proposed project area for the selected alternative. Wetland impacts would likely require state and/or federal permits if the wetland resources are mapped by the NYSDEC or meet the criteria of Waters of the U.S. Potential wetland impacts resulting from Alternative 3 (connection to existing an WRRF) and Alternative 4 (new WRRF) would likely be avoided through directional drilling of sewer mains whenever possible.

Lake Waccabuc is located centrally within the Study Area, which is designated by the NYSDEC as a Class A waterbody with A standards. No impacts to Lake Waccabuc are anticipated under any of the proposed alternatives. Additionally, three NYSDEC-mapped tributaries of Lake Waccabuc are located within the Study Area, including the Lake Waccabuc inlet at the Lake’s eastern extent, as well as two more tributaries located along the western and northwestern shorelines. Each of these mapped tributaries are designated by the NYSDEC as C waters with C standards. Stream disturbances are not anticipated under alternatives proposing replacement of individual septic systems only (Alternative 1), or construction of the community septic system at South Shore (Alternative 2); however, it is anticipated that all WRRF alternatives have the potential to impact stream resources within the Study Area, as well as any stream resources intersecting collection system alignments. Potential stream impacts resulting from

Alternative 3 (connection to existing WRRF) and Alternative 4 (new WRRF) would be avoided through directional drilling of sewer mains whenever possible.

A stream delineation would be completed during the project's preliminary design phase to identify the limits of stream resources within the proposed project area for the selected alternative. Mapped waterbodies with A, AA, B, or C(T) standards are protected by the NYSDEC under Article 15 of the Environmental Conservation Law. All streams ultimately drain in to the Hudson River, a navigable waterbody regulated by the U.S. Army Corps of Engineers (USACE) under Section 10 of the Rivers and Harbors Act. Due to their connection, the streams within the project area are likely regulated by the USACE under Section 404 of the Clean Water Act as Waters of the U.S.

7.6.3. Cultural and Historic Resources

The Study Area is located almost entirely within an archaeologically sensitive area mapped by SHPO, and is also in the vicinity of properties and a historic district listed on the State and National Registers of Historic Places. Project information would be formally submitted to SHPO during the preliminary design phase. All recommendations made by SHPO would be followed to ensure that the selected alternative would not result in an adverse impact on archaeological or historic resources.

7.6.4. Environmental Permit Summary

Because the Study Area is within the Cross River Watershed, which is a New York City water supply, all evaluated alternatives must comply with NYCDEP's *Rules and Regulations for the Protection from Contamination, Degradation and Pollution of the New York City Water Supply and Its Sources*. Additionally, construction of a subsurface sewage treatment system (as included in Alternative 2), sewer collection system or extension (as included in Alternative 3 and Alternative 4), and new WRRF (as included in Alternative 4) all require review and approval by the NYCDEP. If it is determined that the discharge from a new WRRF would result in the phosphorus concentration within the Cross River Reservoir exceeding 15 micrograms per liter, then a variance would also need to be obtained from NYCDEP.

Disturbances to tributaries of Lake Waccabuc would require a Section 404 permit from the USACE and corresponding Section 401 Water Quality Certification from the NYSDEC. All tributaries of Lake Waccabuc located within the Study Area are Class C waters with C standards, therefore disturbances to these resources would not require an Article 15 stream disturbance permit from the NYSDEC. In the event that any of these stream resources are determined to be State navigable, an Article 15 excavation and fill in navigable waters permit would be required for any potential impacts. Any impacts to NYSDEC-regulated wetlands or their associated 100-foot regulated adjacent areas would require an Article 24 freshwater wetlands permit. Additionally, any impacts to federal wetlands would require a Section 404 permit from the USACE and corresponding Section 401 Water Quality Certification from the NYSDEC. It is anticipated that all alternatives have the potential to impact stream and wetland resources aside from those that are limited to the replacement of individual septic systems.

It is anticipated that all alternatives would result in greater than 1-acre of ground disturbance, therefore a NYSDEC State Pollutant Discharge Elimination System (SPDES) General Permit for Stormwater Discharges from Construction Activities (GP-0-20-001) would be required under any alternative. It is not anticipated that alternatives proposing replacement of individual septic systems only (Alternative 1), or construction of a community septic system at South Shore (Alternative 2), would require post-construction SMPs. However, it is anticipated that the development or redevelopment of traditional impervious areas associated with WRRF alternatives would be subject to post-construction SMP requirements in accordance with GP-0-20-001.

8.0 POTENTIAL WATER QUALITY IMPACTS OF ALTERNATIVES

Results of the MMW modeling effort revealed that under existing conditions, phosphorus contributions from septic systems account for between approximately 9lbs. and 1,074 lbs. of phosphorus annually based on an average of two surface septic failures and an assumed average of 213 subsurface septic failures annually within the Study Area. Under these baseline conditions, it is anticipated that phosphorus contributions from septic failures account for between 10% and 92% of the total external phosphorus load for the Study Area depending on the number of septic failures included within the model.

In order to evaluate the phosphorus load reduction potential of each proposed alternative, additional model runs were completed for each alternative by adjusting the total estimated number of surface and subsurface septic failures accordingly. For the purpose of the modeling effort, alternatives three and four were viewed collectively and appropriately segmented to show the pollutant reduction potential associated with providing wastewater collection and treatment systems for the following geographic regions of the Study Area: eastern end, mid region, northern region, southern region, and the entire Study Area. The individual alternative models were run assuming the following maximum percent corrections in total septic failures within the Study Area. The anticipated maximum percent reduction in failing septic systems under each modeling alternative are provided in Table 8-1.

Table 8-1: Maximum Percent Reduction in Number of Failing Septic Systems by Modeling Alternative

Modeling Alternative	Maximum Percent Reduction in Failing Septic Systems
1A - Replace Individual Septic Systems	19%
1B - Replace Individual Septic Systems AND Add Phosphorus Treatment for Non-Conventional Systems	100%
2A - Community Septic System for South Shore	8%
2B - Community Septic System for South Shore AND Add Phosphorus Treatment for Non-Conventional Systems	100%
3/4E - WRRF for Eastern End	67%
3/4M - WRRF for Mid Region	18%
3/4N - WRRF for Northern Region	11%
3/4S - WRRF for Southern Region	4%
3/4 - WRRF for Entire Study Area	100%

Results from each alternative model iteration are provided in Figure 8-1.

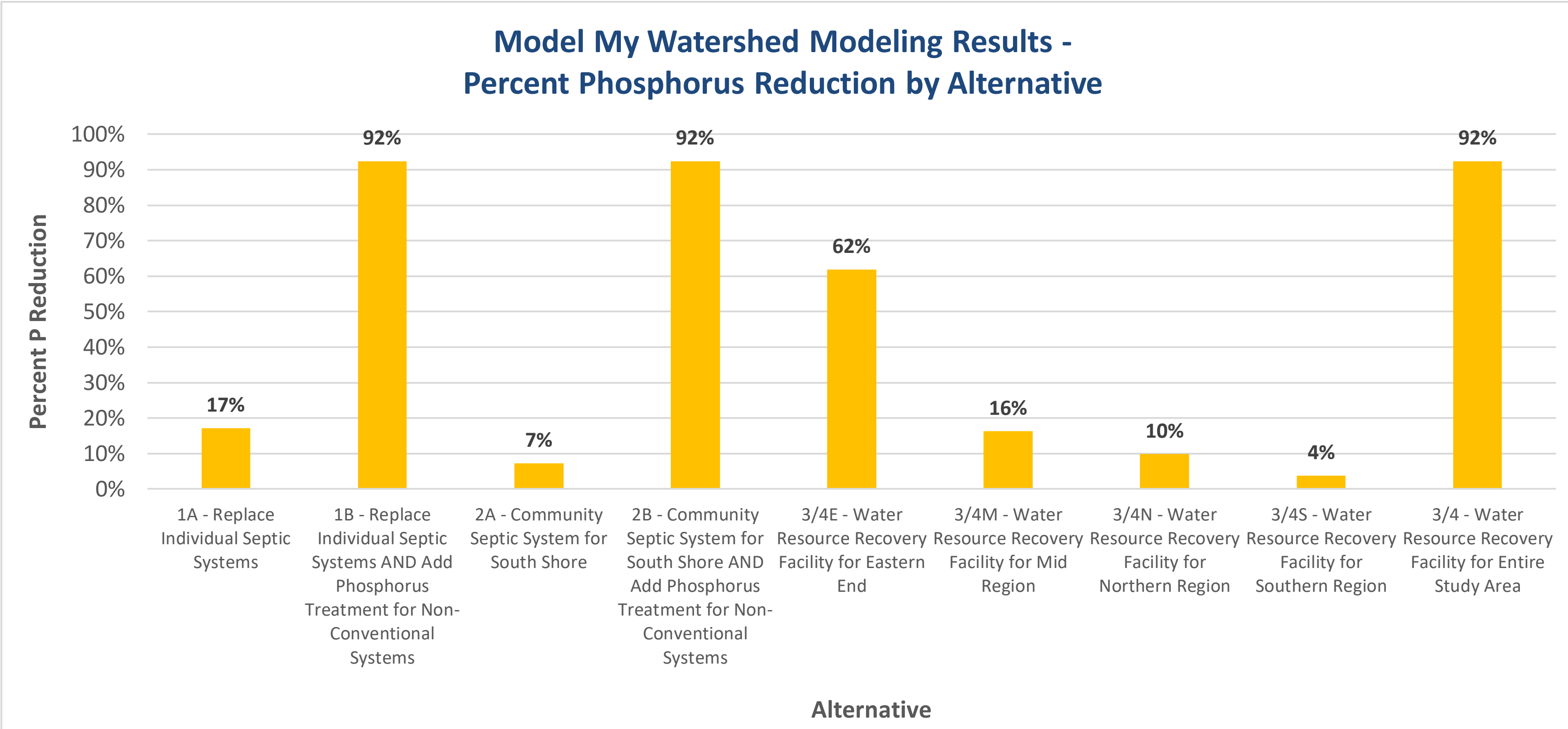


Figure 8-1: Model My Watershed Modeling Results – Maximum Percent Phosphorus Reduction by Alternative

9.0 ESTIMATED COST OF ALTERNATIVES

9.1. Alternative 1A – Replacement of Septic Systems within the Study Area

The components included in the estimate for Alternative 1A are the decommissioning of existing on-site septic systems and the installation of new on-site septic systems. Alternative 1A does not include the cost of added phosphorus treatment, which is included in Alternative 1B.

9.1.1. Project Capital Cost

The total estimated project capital cost (2021 dollars) for Alternative 1A is $5,100,000. A summary of the costs is provided in Table 9-1. A full itemized cost estimate is included in Appendix I at the conclusion of this report.

Table 9-1: Estimate of Probable Cost (Alternative 1A)

Line Item	Associated Cost
Construction Subtotal	$3,500,000
Contingency (20%)	*$700,000*
Total Construction Costs	$4,200,000
Estimated Engineering, Legal, Administration (20%)	*$900,000*
Total Estimated Project Capital Cost	**$5,100,000**

9.1.2. Anticipated O&M Cost

The anticipated annual operation and maintenance costs that each septic system owner would need to expend as a result of implementation of Alternative 1A, is $500 for septic system pump out every 5 years. Properties that cannot support a gravity-fed system would require a pump. The cost of power and maintenance for the pump is would be site dependent and is, therefore, not included in this estimate.

9.1.3. Short-Lived Assets

Short-lived assets (SLAs) are items that are likely to fail and need replacement within the standard 30-year design life of a project. These items are typically smaller assets or ancillary system assets that are more prone to heavy wear due to frequent operation. No short-lived assets were identified for Alternative 1A.

9.2. Alternative 1B – Replacement of Septic Systems and Installation of Phosphorous Treatment Systems

Alternative 1B includes the cost of Alternative 1A with the addition of individual phosphorus treatment units for properties with environmental constraints.

9.2.1. Project Capital Cost

The total estimated project capital cost (2021 dollars) for Alternative 1B is $7,700,000. A summary of the costs is provided in Table 9-2. A full itemized cost estimate is included in Appendix I at the conclusion of this report.

Table 9-2: Estimate of Probable Cost (Alternative 1B)

Line Item	Associated Cost
Construction Subtotal	$5,300,000
Contingency (20%)	*$1,100,000*
Total Construction Costs	$6,400,000
Estimated Engineering, Legal, Administration (20%)	*$1,300,000*
Total Estimated Project Capital Cost	**$7,700,000**

9.2.2. Anticipated O&M Cost

The anticipated annual operation and maintenance costs that each septic system owner would need to expend as a result of implementation of Alternative 1B, is $500 for septic system pump out every 5 years.

9.2.3. Short-Lived Assets

The short-lived asset identified for Alternative 1B is the phosphorous treatment system media replacement, which is estimated to be required every 7 years. The anticipated cost for media replacement is $2,500 per system.

9.3. Alternative 2A – Community Septic System for South Shore Association

The components included in the estimate for Alternative 2A are based on the recommendations provided in Section 7.2 of this report.

9.3.1. Project Capital Cost

The total estimated project capital cost (2021 dollars) for Alternative 2A is $1,400,000. A summary of the costs is provided in Table 9-3. A full itemized cost estimate is included in Appendix I at the conclusion of this report.

Table 9-3: Estimate of Probable Cost (Alternative 2A)

Line Item	Associated Cost
Construction Subtotal	$900,000
Contingency (20%)	*$200,000*
Total Construction Costs	$1,100,000
Estimated Engineering, Legal, Administration (20%)	*$220,000*
Total Estimated Project Capital Cost	**$1,400,000**

9.3.2. Anticipated O&M Cost

The anticipated annual operation and maintenance costs that the South Shore Waccabuc Association would need to expend as a result of implementation of Alternative 2A, is $4,200 for septic system pump out every 2 years, which could be broken down into $70 annually, per home. Additionally, it would cost each user approximately $110 per year for electrical costs associated with the grinder pumps.

9.3.3. Short-Lived Assets

The short-lived asset identified for Alternative 2A is the replacement of grinder pump station cores, which is estimated to be required every 15 years. The anticipated cost for a single core replacement is $2,200.

9.4. Alternative 2B – Community Septic System for South Shore Association with Replacement of Individual Septic Systems for Remaining Properties in Study Area

Alternative 2B includes the cost of Alternative 2A with the added cost of included Alternative 1B as a solution for the remaining properties in the study area.

9.4.1. Project Capital Cost

The total estimated project capital cost (2021 dollars) for Alternative 2B is $9,000,000. A summary of the costs is provided in Table 9-4. A full itemized cost estimate is included in Appendix I at the conclusion of this report.

Table 9-4: Estimate of Probable Cost (Alternative 2B)

Line Item	Associated Cost
Construction Subtotal	$6,200,000
Contingency (20%)	*$1,300,000*
Total Construction Costs	$7,500,000
Estimated Engineering, Legal, Administration (20%)	*$1,500,000*
Total Estimated Project Capital Cost	**$9,000,000**

9.4.2. Anticipated O&M Cost

The anticipated annual operation and maintenance costs that the South Shore Waccabuc Association would need to expend as a result of implementation of

Alternative 2B, is approximately $4,200 for septic system pump out every 2 years, which could be broken down into $70 annually, per home. Additionally, it would cost each user approximately $110 per year for electrical costs associated with the grinder pump.

The annual O&M costs that individual septic system owners would need to expend is estimated to be $500 for septic system pump out every 5 years.

9.4.3. Short-Lived Assets

The South Shore Waccabuc Association would be responsible for one short-lived asset that consists of replacing grinder pump station cores. Replacement of cores is estimated to be required every 15 years for an approximate cost of $2,200 each. Individual septic system owners would be responsible for the replacement of their phosphorous treatment system media. The media is estimated to cost $2,500 and is predicted to require replacement every 7 years.

9.5. Alternative 3 – Connection to Existing WRRF

The components included in the estimate for Alternative 3 are based on the recommendations provided in Section 7.3 of this report.

9.5.1. Project Capital Cost

The total estimated project capital cost (2021 dollars) for Alternative 3 is $43,200,000. A summary of the costs is provided in Table 9-5. A full itemized cost estimate is included in Appendix I at the conclusion of this report.

Table 9-5: Estimate of Probable Cost (Alternative 3)

Line Item	Associated Cost
Construction Subtotal	$30,000,000
Contingency (20%)	*$6,000,000*
Total Construction Costs	$36,000,000
Estimated Engineering, Legal, Administration (20%)	*$7,200,000*
Total Estimated Project Capital Cost	**$43,200,000**

9.5.2. Anticipated O&M Cost

Anticipated annual operation and maintenance costs associated with implementation of Alternative 3 are estimated to total $33,000 per year. The estimated annual O&M cost does not include a user charge from Heritage Hills. A user charge would need to be identified with an inter-municipal agreement. Additionally, it would cost each user approximately $110 per year for electrical costs associated with the grinder pumps.

9.5.3. Short-Lived Assets

Anticipated short-lived assets costs associated with the implementation of Alternative 3 are estimated to total $51,000 per year.

9.6. Alternative 4A – SBR Treatment System at South Shore to Treat Eastern Region

The components included in the estimate for Alternative 4B are based on the recommendations provided in Section 7.4 of this report.

9.6.1. Project Capital Cost

The total estimated project capital cost (2021 dollars) for Alternative 4A is $17,200,000. A summary of the costs is provided in Table 9-6. A full itemized cost estimate is included in Appendix I at the conclusion of this report.

Table 9-6: Estimate of Probable Cost (Alternative 4A)

Line Item	Associated Cost
Construction Subtotal	$11,900,000
Contingency (20%)	*$2,400,000*
Total Construction Costs	$14,300,000
Estimated Engineering, Legal, Administration (20%)	*$2,900,000*
Total Estimated Project Capital Cost	**$17,200,000**

9.6.2. Anticipated O&M Cost

Anticipated annual operation and maintenance costs associated with implementation of Alternative 4A are estimated to total $229,000 per year. Additionally, it would cost each user approximately $110 per year for electrical costs associated with the grinder pumps.

9.6.3. Short-Lived Assets

Anticipated short-lived asset costs associated with the implementation of Alternative 4A are estimated to total $34,000 per year.

9.7. Alternative 4B – SBR Treatment System at Lewisboro Elementary to Treat Entire Study Area

The components included in the estimate for Alternative 4B are based on the recommendations provided in Section 7.5 of this report.

9.7.1. Project Capital Cost

The total estimated project capital cost (2021 dollars) for Alternative 4B is $33,800,000. A summary of the costs is provided in Table 9-7. A full itemized cost estimate is included in Appendix I at the conclusion of this report.

Table 9-7: Estimate of Probable Cost (Alternative 4B)

Line Item	Associated Cost
Construction Subtotal	$23,400,000
Contingency (20%)	*$4,700,000*
Total Construction Costs	$28,100,000
Estimated Engineering, Legal, Administration (20%)	*$5,700,000*
Total Estimated Project Capital Cost	**$33,800,000**

9.7.2. Anticipated O&M Cost

Anticipated annual operation and maintenance costs associated with implementation of Alternative 4B are estimated to total $260,000 per year. Additionally, it would cost each user approximately $110 per year for electrical costs associated with the grinder pumps.

9.7.3. Short-Lived Assets

Anticipated short-lived asset costs associated with the implementation of Alternative 4B are estimated to total $50,000 per year.

10.0 PROJECT CONSIDERATIONS

10.1. Permits and Approvals

The evaluated alternatives were designed in full consideration of applicable design standards from the following documents:

- *New York State Design Standards for Intermediate Sized Wastewater Treatment Systems*, by New York State Department of Environmental Conservation, March 5, 2014
- *Recommended Standards for Wastewater Facilities, 2014 Edition* (10 States Standards) by the Great Lakes – Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers.
- *Rules and Regulations for the Protection from Contamination, Degradation and Pollution of the New York City Water Supply and Its Sources,* by New York City Department of Environmental Protection, effective May 1, 1997, amended November 29, 2019.

The proposed WRRF considered the potential SPDES permit limits detailed in Section 7.4.11 of this report. The Town should engage with NYSDEC and NYCDEP during the next phase to verify final SPDES permit discharge limits.

A summary of anticipated permits and approvals required under each alternative is provided in Table 10-1. Applicability of anticipated permits and approvals would be evaluated during the preliminary design stage of the selected alternative.

Table 10-1: Anticipated Permits and Approvals

Agency	Permit/Approval	Alternative			
		Alternative 1 – Repair or Replacement of Individual Septic Systems	Alternative 2 – Community Septic System (Decentralized)	Alternative 3 – Connection to Existing WRRF	Alternative 4 – New WRRF
NYSDEC	Article 15 Protection of Waters		✓	✓	✓
	Article 24 Freshwater Wetlands		✓	✓	✓
	Clean Water Act Section 401 WQC		✓	✓	✓
	SPDES GP-0-20-001	✓	✓	✓	✓
	SPDES Wastewater Discharge Permit			✓	✓
	Incidental Take Part 182	✓	✓	✓	✓
	SEQR	✓	✓	✓	✓
NYCDEP	Rules & Regs. of NYC Water Supply § 18-36 Wastewater Treatment Plants				✓
	Rules & Regs. of NYC Water Supply § 18-37 Sewer Systems, Sewer Connection and Discharges to Sewer Systems			✓	✓
	Rules & Regs. of NYC Water Supply § 18-38 Subsurface Sewage Treatment Systems		✓		
	Rules & Regs. of NYC Water Supply § 18-61 Variances				✓
Westchester County	Department of Health Approval	✓	✓	✓	✓
USACE	Clean Water Act Section 404		✓	✓	✓
NYSDOT	Highway Work Permit			✓	
SHPO	Cultural Resources Signoff	✓	✓	✓	✓
USFWS	Protected Species Coordination	✓	✓	✓	✓

10.2. Feasibility

10.2.1. Environmental Constraints

As discussed in Section 2.1.5 of this report, shallow bedrock (one to three feet deep) is only present in the western and central portions of the study area. Shallow bedrock is not anticipated to be an issue in the Eastern Region, where the recommended alternative is located.

As discussed in Section 7.6.2 of this report, wetlands are present throughout the project area. The recommended alternative has the potential for impacts to wetland resources and the regulated 100-foot adjacent areas. A wetland and stream delineation would be completed during the project's design phase to identify the boundaries of wetlands and limits of stream resources within the proposed project area for the selected alternative. Potential wetland and stream impacts would be avoided through directional drilling of sewer mains whenever possible.

10.2.2. Required Improvements/Decommissioning

As discussed in Section 7.4.9 of this report, the existing individual on-site septic systems and holding tanks would need to be decommissioned. The existing infrastructure would be replaced with a grinder pump station and sewer lateral that would convey the sewage from each home to the new sewer collection system and WRRF.

10.2.3. Land Requirements

As discussed in Section 7.4.9 of this report, the Town would have to work with the Study Area residents to obtain easements for maintenance of grinder pumps and sewer laterals, as well as access agreements for decommissioning the existing on-site septic systems in the Study Area.

The Town would also need to purchase the land for the WRRF.

10.2.4. Seasonal Limitations

As discussed in Section 7.4.10 of this report, the sewer collection system conveyance piping and appurtenances would be installed below frost depth (4.5 feet) to avoid issues associated with freezing temperatures. Additionally, it is anticipated that the WRRF's SPDES permit would require effluent disinfection from May 1st to October 31st. However, the permit requirements are not yet known at this time.

10.2.5. Public Support

A public participating plan was prepared and followed to keep the public informed. Under this plan, seven (7) monthly progress meetings have been held, two (2) public information meetings have been held, three (3) community surveys have been distributed, and a project website has been created and utilized to post the surveys as well as progress meeting minutes, public information meeting recordings and presentation slides, and other relevant documents.

Residents within the study area were initially contacted through port-cards and emails with a notification about the first public information meeting. This public information meeting was held virtually on April 7, 2021, due to safety concerns associated with an in-person meeting as a result of the COVID-19 pandemic. The April public information meeting was used to introduce the study to the residents of the study area and to elicit participation in community survey and crowdsourcing surveys that followed. The April 2021 community survey was used as an opportunity to learn more about the individual on-site septic systems in the area and other potential sources of nutrient pollution. The crowdsourcing survey was used to identify locations of potential pollutant sources. Results of the April 2021 community survey are discussed in Section 3.1 and Section 5.1, with a summary of the results provided in Appendix D.

On July 28, 2021 another public information meeting took place. This public information meeting was hosted in-person at the Waccabuc Country Club Carriage House, as well as virtually. The focus of this second public information meeting was to inform the public of the results of the study and to encourage participation in the following community survey. The July 2021 community survey was conducted to gauge the support of the residents in the study area for establishing a sewer or septic maintenance district. There were 82 responses, 80 of which identified as living within the Study Area. The majority of participants feel at least moderately well informed about the project with 4% not feeling well informed at all. With respect to establishing a sewer district, 73% of participants are in favor, 11% are not in favor, and 16% are indifferent. The support for a septic maintenance district is more-so split, with 50% in favor, 40% not in favor, and 10% indifferent. The July community survey results are provided in Appendix J. A summary of the results by Study Area region are provided below.

10.2.5.1 Eastern Region

When reviewing the survey responses from the Eastern Region (Cove Road, Old Pond Road, Oscaleta Road, South Shore Drive, and Twin Lakes Road), there were 59 responses. Of those responses, one person did not feel well informed about the project. With respect to establishing a sewer district, 76% of participants are in favor, 7% are not in favor, and 17% are indifferent. The support for a septic maintenance district is the same as that of the entire study area (48% in favor, 41.5% not in favor, and 10.5% indifferent).

10.2.5.2 Mid Region

When reviewing the survey responses from the Mid Region (Perch Bay Road, Post Office Road, and Tarry-A-Bit Drive), there were 21 responses. Of those responses, two people did not feel well informed about the project. With respect to establishing a sewer district, 71% of participants are in favor, 19% are not in favor, and 10% are indifferent. The support for a septic maintenance district is more-so split, with 47.5% in favor, 43% not in favor, and 9.5% indifferent.

10.2.5.3 Mead Street

There were no participants explicitly from the Northwestern Region (Patriot Pass, Powder Hill Road) or the Southern Region (East Ridge Drive), however, Mead Street runs the length of the study area, passing through the Northwestern, Mid, and Southern regions. There were 6 responses from Mead Street and all participants felt at least somewhat well informed about the project. With respect to establishing a sewer district, 50% of participants are in favor, 33% are not in favor, and 17% are indifferent. The support for a septic maintenance district was slightly higher, with 67% in favor, 33% not in favor, and 0% indifferent.

10.3. Financial Status

The Town had an estimated MHI of $158,299 and an estimated poverty rate of 4.0 percent in 2019 (American Community Survey). Currently, there are not any existing capital improvement projects underway within the Town. The Town of Lewisboro does not currently have any debt on municipal projects and does not receive any income from residents of the study area for sewer services. The Town does generate income from residents of the Oakridge and Wild Oaks sewer districts. A similar billing system would be used to bear the costs associated with operating and maintaining a new sewage collection system and WRRF.

10.4. Other Non-Monetary Factors

10.4.1. Recreational Impact

The goal of this study is to reduce the total phosphorus load to Lake Waccabuc from septic contributions in order to improve the overall water quality of the Lake. Therefore, the overall recreational impact to Lake Waccabuc and its tributaries are anticipated to be positive in nature. Positive recreational impacts are anticipated to have a direct relationship with the potential phosphorus reduction potential of each alternative. Refer to Section 8.0 for specific phosphorus reductions associated with each alternative. Appropriate erosion and sediment controls would be taken to protect all recreational stream resources.

No negative impacts to recreational activities are anticipated under any alternative. Alternative 3 (connection to existing WRRF) and Alternative 4 (New WRRF) would result in discharges of treated effluent to various stream resources, however these facilities would be designed or modified to comply with all applicable water quality standards.

10.4.2. Employment Factors

The construction of a new WRRF and collection system would create opportunities for employment. Staff would be required to operate, monitor and maintain the WRRF and sewer collection system. At a minimum, it is expected that one (1) part-time chief operator and one (1) part-time assistance would be needed to staff the proposed WRRF. With this size WRRF, the Town should consider operator sharing or contracting with a firm that performs contracted operation services.

10.4.3. Aesthetics

The proposed WRRF location is in a predominantly residential area. The WRRF would be designed to minimize aesthetic disturbance. Proposed treatment infrastructure would be contained within buildings designed to match the aesthetic character of the surrounding area to the maximum extent practicable. The air from within the WRRF would be treated prior to its release outdoors. Noise control measures would also be implemented.

A good example of a local, similarly sized facility is the WRRF that supports the Oakridge Condominiums, located at 400 Oakridge Drive in South Salem. This WRRF was designed to blend in with the neighboring buildings, as is shown in the images that follow.

Image 10-1: Oakridge Condominiums

Image 10-2: Oakridge WRRF (Adjacent to Recreational Facilities)

Image 10-3: Oakridge WRRF

10.4.4. Existing Habitat Impacts

According to the USFWS IPaC database, the Study Area is within the range of two (2) federally listed species, the Indiana bat and the bog turtle. Additionally, the NYSDEC ERM reported that the project area is within the vicinity of rare dragonflies and plants. A habitat assessment would be completed during the project's design phase to document potential suitable habitat for reported species throughout the proposed project area. If tree clearing is required for the project, it would need to be completed between November 1st and March 31st while the bats are in hibernation to avoid adverse impacts to these species. Additional coordination with the NYSDEC and USFWS would be completed during the project's design phase to assess potential impacts to listed species and their habitat. Any impacts to these species determined be adverse would require an Incidental Take Part 182 permit from the NYSDEC.

10.4.5. Wetlands

Preliminary screening has identified several potential wetland areas throughout the Study Area, including multiple NYSDEC-regulated wetlands in the areas with potential for impacts under all alternatives aside from Alternative 1 (replacement of individual septic systems). Further wetland delineation would be performed to verify the presence of wetlands on-site during final design, and the appropriate measures would be taken to protect them during construction, should any be identified. Appropriate erosion and sediment control measures would be taken to protect identified wetlands during construction.

11.0 SUMMARY AND COMPARISON OF ALTERNATIVES

11.1. Alternatives Summary

Four (4) main alternatives have been evaluated as part of this engineering study:

1. Replace/Repair Existing Individual On-site Septic Systems
    A. Repair/Replacement without Enhanced Treatment
    B. Repair/Replacement with Added Phosphorus Treatment
2. Provide Sewer to Community Septic System
    A. Community Septic System at South Shore Drive
    B. Community Septic System at South Shore with Repair/Replacement of Existing Individual On-site Septic Systems and Added Phosphorus Treatment
3. Provide Sewer to the Heritage Hill WRRF
4. Provide Sewer to a New WRRF
    A. Sewer the Eastern Region to a WRRF on Benedict Road
    B. Sewer the Entire Study Area to a WRRF at the Lewisboro Elementary School Property

11.2. Life-Cycle Cost Analysis

Table 11-1 presents a life cycle cost comparison of the seven (7) evaluated alternatives. The following assumptions and values were used in performing the analysis:

- Power Cost: $0.07/kwhr
- Life Cycle: 30 Years
- Interest Rate: 3.6%
- Present Worth Factor: 30

Table 11-1: Life Cycle Costs of Alternatives

	Present Day Annual Capital Cost[1]	Annual O&M	Annual Short-Lived Assets	Total
Alternative No. 1A	$290,000	$22,000	-	$320,000
Alternative No. 1B	$430,000	$22,000	$58,000	$510,000
Alternative No. 2A	$80,000	$2,100	$4,400	$90,000
Alternative No. 2B	$500,000	$22,000	$61,000	$590,000
Alternative No. 3	$2,380,000	$33,000	$51,000	$2,470,000
Alternative No. 4A	$950,000	$229,000	$34,000	$1,220,000
Alternative No. 4B	$1,870,000	$260,000	$50,000	$2,180,000

1. Assumes a 30-year loan with 3.6% interest, Including Collection system.

The costs summarized in Table 11-1 show that Alternative 1A, replacement of the failing and failed septic systems within the Study Area, is the most cost effective of the alternatives evaluated for the Lake Waccabuc study. However, Alternative 1A is not the most effective alternative for resolving all of the potential contamination issues experienced at Lake Waccabuc from poorly functioning individual on-site septic systems located on properties with environmental constraints. For this same reason, Alternative 1B, Alternative 2A, and Alternative 2B are also not recommended. Therefore, Alternative 4A is recommended as the most cost effective solution that provides the greatest benefit.

12.0 RECOMMENDED ALTERNATIVE

12.1. Basis of Selection

The recommended alternative is Alternative 4A: a new WRRF on Benedict Road to initially treat the Eastern Region of the Study Area. The total anticipated project cost is $17,200,000 and is projected to reduce the number of failing and poorly functioning septic systems by 70% and remove 62% of the phosphorus load to Lake Waccabuc. As a result, the total phosphorus loading to Lake Waccabuc is anticipated to be approximately 356 lb/year (161 kg/year). It is unknown how much of this load would leave the Lake and continue through the Cross River Basin and how much would remain in the sediment and biomass of the Lake. Based on the design flow of 60,000 gpd and a SPDES discharge limit of 0.5 mg/L TP, it is estimated that 91.3 lb/year (41.4 kg/year) of phosphorus would leave the new WRRF and enter the Waccabuc River. The available land at the vacant set of parcels on Benedict Road has the capacity to support an expansion, should any of the remaining portions of the Study Area be included.

12.2. Project Financing

The proposed project opinion of probable cost is $17,200,000. To finance this extensive project, a blended strategy of grants and low-interest financing is assumed.

Barton & Loguidice's services DO NOT INCLUDE advice or recommendations with respect to the issuance, structure, timing, terms, or any other aspect of municipal securities, municipal derivatives, guaranteed investment contracts, or investment strategies. Any opinions, advice, information, or recommendations provided by Barton & Loguidice are understood by the parties to be strictly engineering opinions, advice, information, or recommendations. Barton & Loguidice is not a "municipal advisor" as defined by 15 U.S.C. 78o-4 or the related rules of the Securities and Exchange Commission. The parties to whom this proposal is being provided should determine independently whether they require the services of a municipal advisor.

12.2.1. Payback Period

A payback period is not applicable to this project.

12.2.2. Preliminary Plan of Finance

There are various funding options for wastewater treatment improvement projects. Typically, core funding from government programs such as the NYSEFC CWSRF or USDA Rural Development (RD) is sought after. Both funding programs provide interest subsidies and grant funding to make municipal sewer projects affordable for the average user. If core funding is not available from these funding agencies, a long-term municipal bond may be the best option for project financing. To supplement the bond, smaller grants can be applied for through the New York State Consolidated Funding Application from programs such as the Community Development Block Grant Program. Each Town user served by the sanitary sewer system would be charged to recover the costs of the upgraded system.

12.2.2.1 Core Funding - NYSEFC

The Town of Lewisboro may list the recommended project on the 2022-2023 NYSEFC CWSRF Final Intended Use Plan (IUP) Annual List. It is not anticipated that the project would qualify for hardship financing because the Town's 2019 median household income (MHI) was $158,299, which was higher than the NYS MHI of $68,486. While the type of loan awarded to the project would not be known until the 2023 IUP development, it was assumed for this financing plan exercise that the project would qualify for subsidized interest rate to the critical nature of the project and NYSDEC and NYCDEP priorities. The subsidy typically covers half of the interest rate of the EFC market rate.

12.2.2.2 Core Funding – Rural Development

Rural Development (RD) has funding available for municipal projects for municipalities with a population of 10,000 or less. Because the Town of Lewisboro has an estimated population of 12,522, this project is believed to be ineligible for RD financing.

12.2.2.3 Core Funding – WIIA Grant

The Water Infrastructure Improvement Act (WIIA) is a grant program administered by the NYSEFC under the Clean Water Infrastructure Act (CWIA) to fund drinking water and wastewater infrastructure projects that protect public health and/or improve water quality. WIIA grants provide municipalities the lesser of 25% net eligible project cost or $5 million for projects less than $50 million or $12.5 million for projects over $50 million.

12.2.2.4 Core Funding – EOH Septic System Rehabilitation Reimbursement

The East of Hudson Septic System Rehabilitation Reimbursement Program provides reimbursement to property owners in priority portions of the NYC Watershed to assist in the cost of rehabilitating failing septic systems. In order to be eligible to receive program funds, the system must be failing or reasonably likely to fail in the near future as determined by a Qualified Inspector and serve an existing single-family or two-family primary residence. The system must be built prior to May 1, 1997 and have a design sewage flow of less than 1,000 gallons per day. Septic holding tanks built prior to May 1, 1997 are also eligible. The Study Area Watershed is a part of the Cross River Reservoir drainage basin, in which any property within 200 feet of a mapped watercourse, pond/lake, or state/federal wetland may be eligible for the program. A map showing properties within this 200-foot zone is depicted in Figure 12-1. Final eligibility determination can only be made after a financial hardship review, in which both the assessed property value of the residence is below the median assessed value of residential homes in the Town and annual household income is 400% or less of the poverty guidelines updated periodically in the Federal Register by the

US Department of Health and Human Services. Financial eligibility criteria is detailed in Appendix K.

12.2.2.5 Core Funding – Long-Term Bond

Municipalities commonly use long term bonding to finance large infrastructure projects. For the purposes of this analysis, B&L has assumed long term municipal bonding rates for water/wastewater capital projects in the proximity of 3.3% for a 15-year loan, 3.4% for a 20 year loan, and 3.6% for a 30 year loan.

12.2.3. Summary of Preliminary Funding Plan

For the purposes of this section, the costs associated with Alternative 4A were utilized. The anticipated annual debt service assumes a loan term of 30 years and an interest rate of 3.6%. The estimated annual debt service for the Town is $950,000, as shown in Table 12-1. The actual rate of financing would be determined at closing.

Table 12-1: Estimated Annual Town Debt Service

2021 Estimate Total Project Cost	$17,200,000
Assumed Interest Rate	3.6%
Assumed Loan Term	30 year
Estimated Annualized Town Cost	$950,000

There are currently two sewer districts within the Town: Oakridge and Wild Oaks. These sewer district service prices are established on an ad valorem basis, therefor service prices for the proposed sewer district were evaluated in this manner. It is assumed that grant funding would be obtained to at least partially cover project capital costs. In order to cover O&M costs, SLA reserve, and any remaining capital costs, it is anticipated that the average user within the proposed district would pay between $1,500 and $2,500 per year.

12.3. Supplemental Funding – Consolidated Funding Application (CFA)

There are various funding opportunities that are available through New York State's Consolidated Funding Application (CFA). The CFA is an avenue where applicants are able to access multiple State funding sources through one application. The eligibility criteria differs between each program, but protection of public health, protection of the environment, and/or economic development are key factors in many applications. The programs, sponsoring agencies and funding types for which this project is or may be eligible are included in Table 12-2.

Table 12-2: Summary of Key Funding Programs

Program Name	Sponsoring Agency(ies)	Funding Type
Small Cities Community Development Block Grant Program (CDBG)	Housing and Community Renewal (HCR)	Grants to $1,000,000 for public health projects; grants from $100,000 to $750,000 for projects creating jobs
Government Efficiency-Planning/Implementation	Department of State	Grant with local match
Water Quality Improvement Grant Program	New York State Department of Conservation (NYSDEC)	Up to $10M grant/max 40% of construction costs, local match of 25% for municipal systems to serve multiple properties with inadequate on-site septic systems Up to $3M grant for decentralized municipal wastewater treatment facilities for failing on-site treatment systems
Economic Development Waterfront Revitalization	Empire State Development; Appalachian Regional Commission	Grant program with local match
Climate Smart Communities Grant Program	NYSDEC	Grants up to $2M with 50% local match

12.4. Project Schedule

Following the completion of this report, the project schedule for the proposed project could be as follows:

Project Schedule Milestone Item	Schedule Date
Submit Final Engineering Report	December 2021
Complete SEQR & Environmental Review	Spring /Summer 2022
District Formation	Summer 2022
Bond Resolution	Summer 2022
Funding Applications	Summer 2022
Land Acquisition	Summer/Fall 2022
Preliminary Design Phase	Fall 2022/Spring 2023

12.5. Next Steps

In addition to the items listed in the project schedule, above, it is recommended that the Town sit down with the various funding agencies to determine how much funding may be available for the various alternatives evaluated in this study. It is also recommended that public education and engagement be continued throughout the process to obtain project support from the residents most effected by whichever alternative is selected.

Due to the limits of this study, there were certain alternative solutions that were not evaluated. As such, the following sections discuss additional future studies for consideration.

12.5.1. Lake Rippowam and Lake Oscaleta

Lake Rippowam and Lake Oscaleta (the Twin Lakes) are located immediately upstream of Lake Waccabuc. Evaluating phosphorus contributions from individual on-site septic systems with that region of the greater Lake Waccabuc watershed would be beneficial in identifying the influence of pollutant loading to Lake Waccabuc from these resources. Both Lake Oscaleta and Lake Rippowam are smaller and shallower resources than Lake Waccabuc and, therefore, have a shorter retention time of contaminants. Field monitoring results gathered during this study indicate that higher pollutant concentrations exist near the Lake Waccabuc inlet as compared to other portions of the Lake, which suggests the potential for notable upstream nutrient loading. This would indicate that it may be beneficial to include homes located adjacent to the Twin Lakes in the wastewater management solution. Given that these homes are located on small parcels, extending the sewer collection system to the Twin Lakes community would likely bring the sewer user fee down.

12.5.2. Lewisboro Elementary Property

While Alternative 4B is more expensive than Alternative 4A, this study did not evaluate the cost benefit of integrating the Truesdale Lake community into the alternative. Amending this engineering report to add Truesdale Lake into Alternative 4B may show that the Lewisboro Elementary property is a more cost effective solution for both the Lake Waccabuc and the Truesdale Lake communities.

12.5.3. Alternative Phosphorus Reduction Techniques

Alternatives evaluated for potential phosphorus load reduction opportunities during this study were limited to wastewater infrastructure improvements. The following list includes alternative phosphorus reduction techniques within the Study Area with potential for evaluation during future studies:

- Nonpoint source phosphorus contributions
- Development of a nine element watershed plan
- Mechanical harvesting and removal of aquatic biomass
- In-lake liquid alum (Aluminum Sulfate) treatment

Comments received during project crowdsourcing efforts indicated that some instances of potential contamination issues observed by Study Area residents were associated with nonpoint source stormwater pollution. The magnitude of these issues could be further investigated during future evaluations of nonpoint source phosphorus contributions to Lake Waccabuc.

13.0 CONCLUSION

Years of sampling data has shown that the concentrations of phosphorus in Lake Waccabuc have increased over time. Lake Waccabuc is now in a mesotrophic state, experiences frequent algae blooms, and has a high vulnerability for invasive species. There is also the concern that Lake Waccabuc ultimately drains into the Cross River Reservoir, which is a NYCDEP water supply. The results of our study have concluded that the aging and archaic on-site septic systems in the Study Area are a major contributor of phosphorus to Lake Waccabuc. To address the water quality deterioration of the lake, the Town of Lewisboro has considered following wastewater management solutions:

- Alternative 1 – Replacement of Individual On-site Septic Systems within the Study Area
- Alternative 2 – A Community Septic System for the South Shore Waccabuc Association
- Alternative 3 – Connection to the Heritage Hills WRRF
- Alternative 4A – Construction of a new WRRF on Benedict Road to Treat the Eastern Region of the Study Area
- Alternative 4B – Construction of a new WRRF Located at the Lewisboro Elementary Property to Treat the Entire Study Area

The recommended alternative is Alternative 4A: a new WRRF on Benedict Road to initially treat the Eastern Region of the Study Area. The total anticipated project cost is $17,200,000 and is projected to reduce the number of failing and poorly functioning septic systems by 70% and remove 55% of the phosphorus load to Lake Waccabuc. The plant would be planned for potential expansion should any of the remaining portions of the Study Area be included.

If the recommended alternative were to include replacement of failing and poorly functioning individual septic systems for the remainder of the study area, with phosphorus treatment systems where needed, it would cost an additional $2,700,000. If the WRRF on Benedict Road were constructed for the entire Study Area, it would cost $27,900,000.

A smart growth assessment was completed to ensure that improvements are designed to conform to sustainable municipal land practices. The NYS EFC Smart Growth Assessment form is attached as Appendix L. A signed Engineering Report Certification by the Professional Engineer is attached as Appendix M.

AKNOWLEDGEMENTS

Many organizations came together to make this study a success. Thank you to the Waccabuc Country Club for providing the location of the July 2021 Public Information Meeting. And thank you to the following organizations for their participation and feedback provided throughout the study:

New York City Department of Environmental Protection

New England Interstate Water Pollution Control Commission

Town of Lewisboro

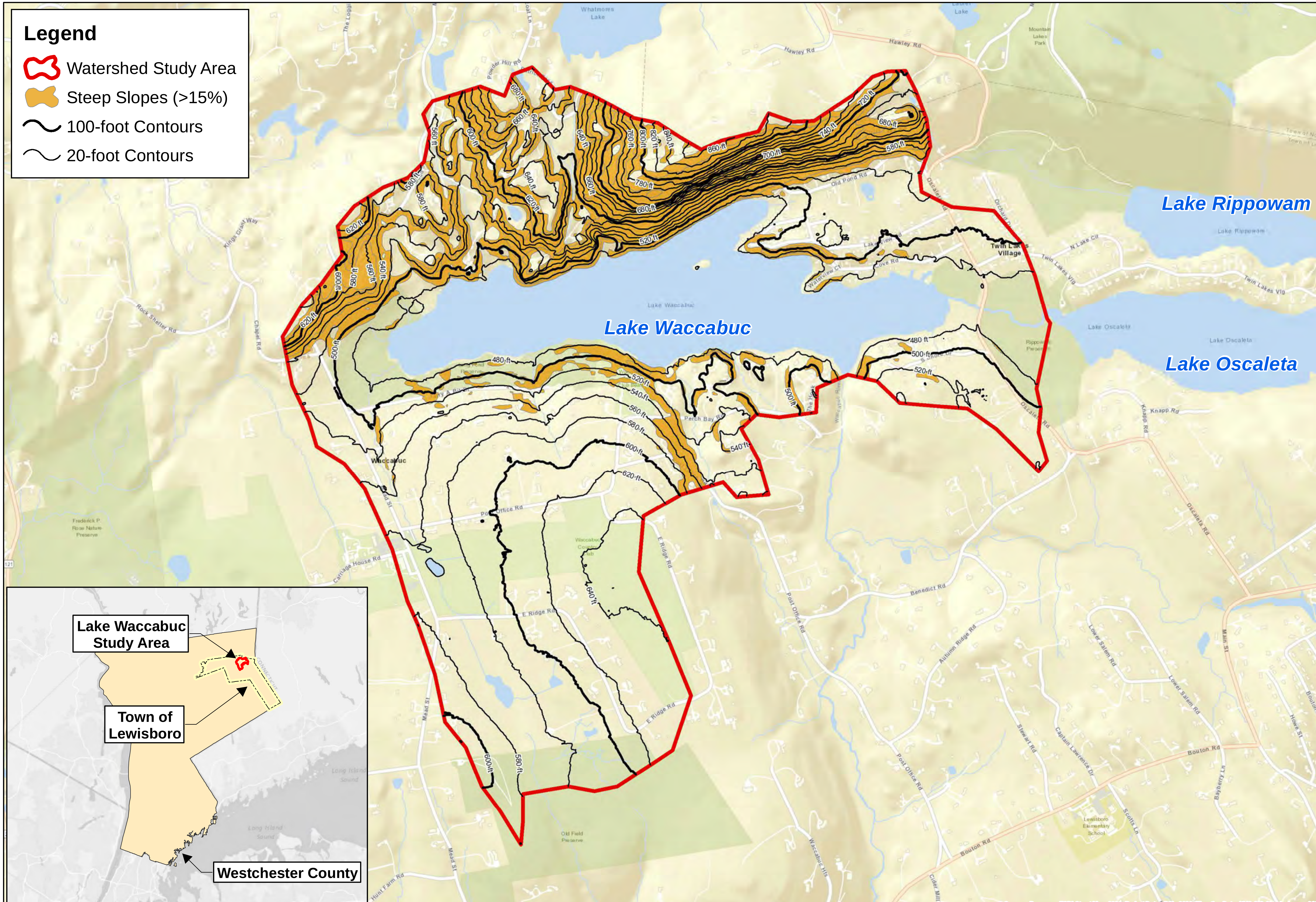
Three Lakes Council

South Shore Waccabuc Association

Lake Waccabuc Association

Lakeside Association of Lake Waccabuc

Figures



Westchester County

Town of Lewisboro

Topographic Map

August 2021

New York

Barton & Loguidice

Date

June 2021

Scale

1" = 1000'

Figure Number

1-1

Project Number

2390.001

Document Path: K:\Projects\2300\2390001\Projects\Report Figures\Figure 1 - Topographic Map.mxd

Westchester County

New York

Town of Lewisboro

Aerial Study Area Map

August 2021

Barton & Loguidice

Date

July 2021

Scale

1" = 1000'

Figure Number

1-2

Project Number

2390.001

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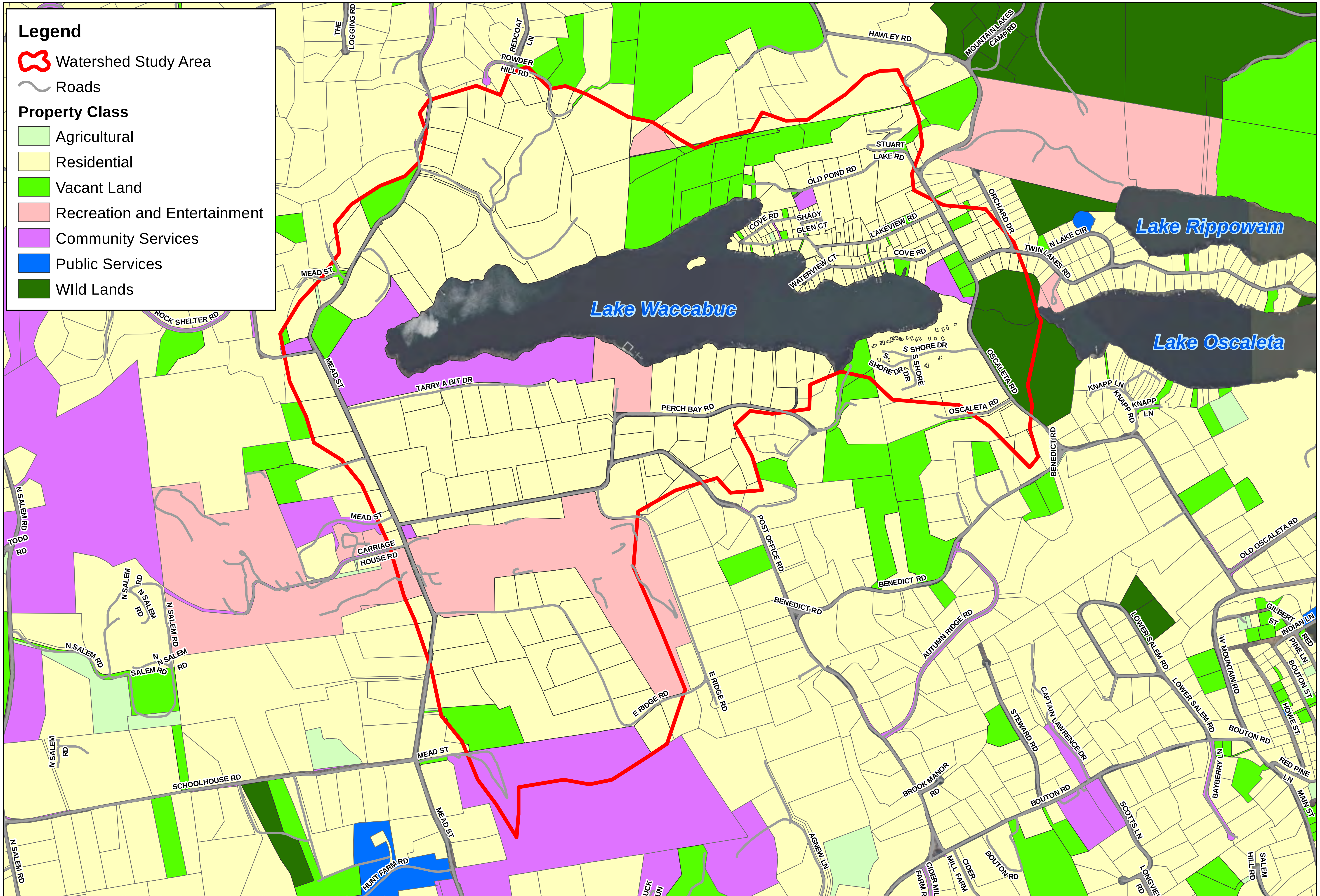

Westchester County

Town of Lewisboro

Land Use

August 2021

New York

Barton & Loguidice

Date

July 2021

Scale

1" = 1000'

Figure Number

2-3

Project Number

2390.001

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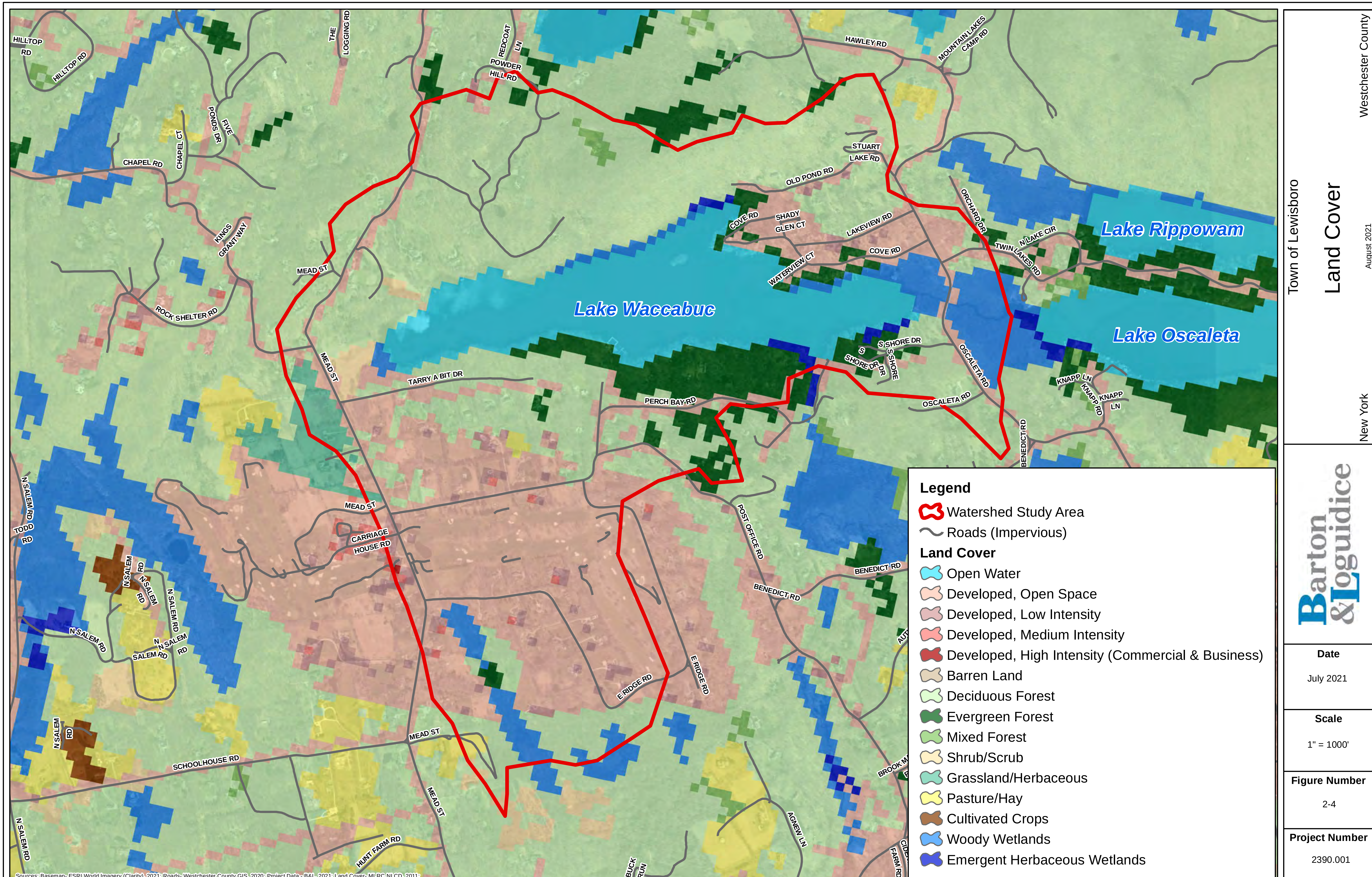

Lake Waccabuc
Lake Rippowam
Lake Oscaleta
Legend
Watershed Study Area
Roads (Impervious)
Land Cover
Open Water
Developed, Open Space
Developed, Low Intensity
Developed, Medium Intensity
Developed, High Intensity (Commercial & Business)
Barren Land
Deciduous Forest
Evergreen Forest
Mixed Forest
Shrub/Scrub
Grassland/Herbaceous
Pasture/Hay
Cultivated Crops
Woody Wetlands
Emergent Herbaceous Wetlands
Sources: Basemap- ESRI World Imagery (Clarity), 2021; Roads- Westchester County GIS, 2020; Project Data - B&L, 2021; Land Cover- MLRC NLCD, 2011;
Town of Lewisboro
Land Cover
Westchester County
August 2021
New York
Barton & Loguidice
Date
July 2021
Scale
1" = 1000'
Figure Number
2-4
Project Number
2390.001
Document Path: K:\Projects\2300\2390001\Projects\Report Figures\Figure 5 - Land Cover.mxd

Town of Lewisboro

Westchester County

New York

Aquifers

August 2021

Barton & Loguidice

Date

July 2021

Scale

1" = 1000'

Figure Number

2-5

Project Number

2390.001

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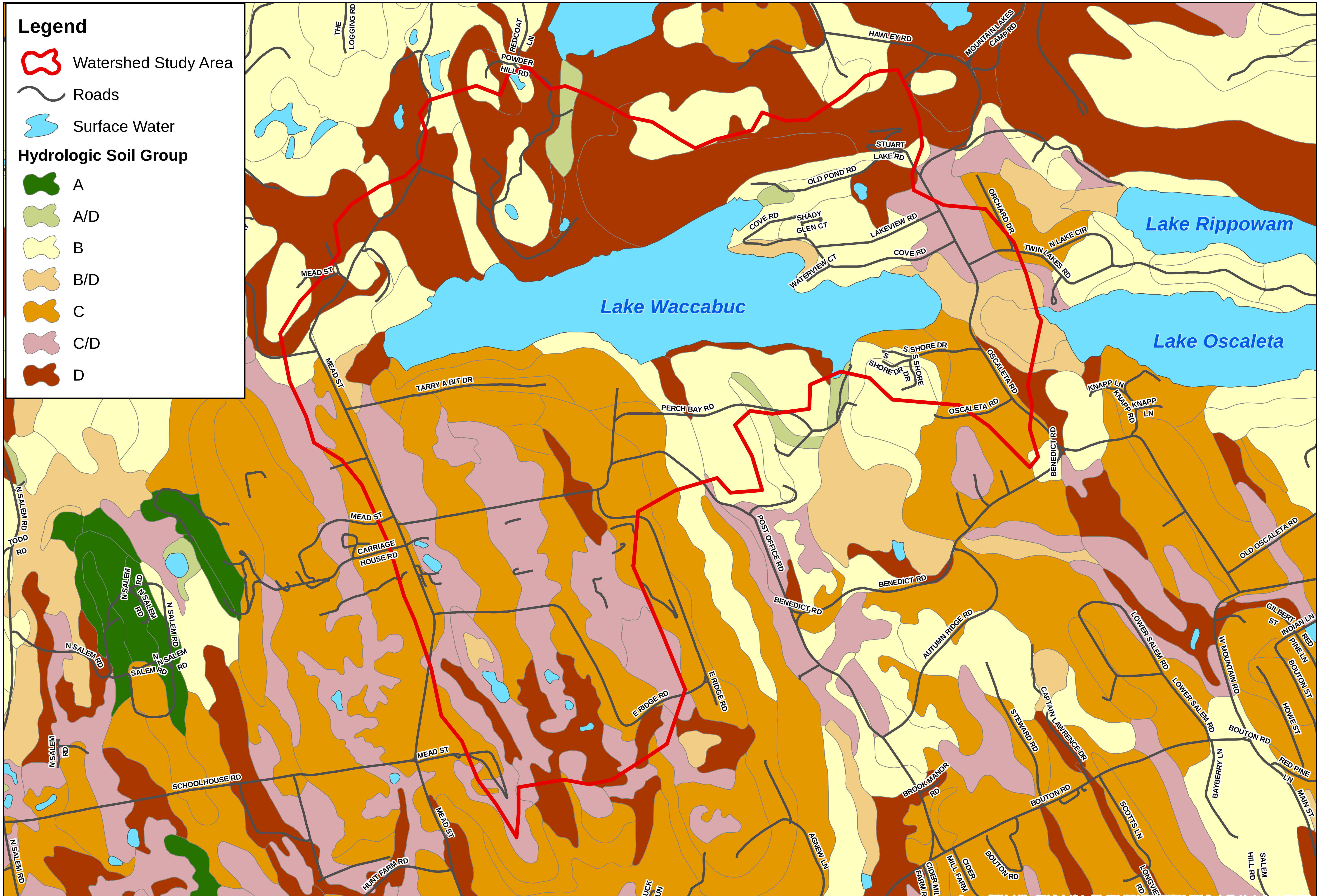

Westchester County

Town of Lewisboro

Soils Map

August 2021

New York

Barton & Loguidice

Date

July 2021

Scale

1" = 1000'

Figure Number

2-6

Project Number

2390.001

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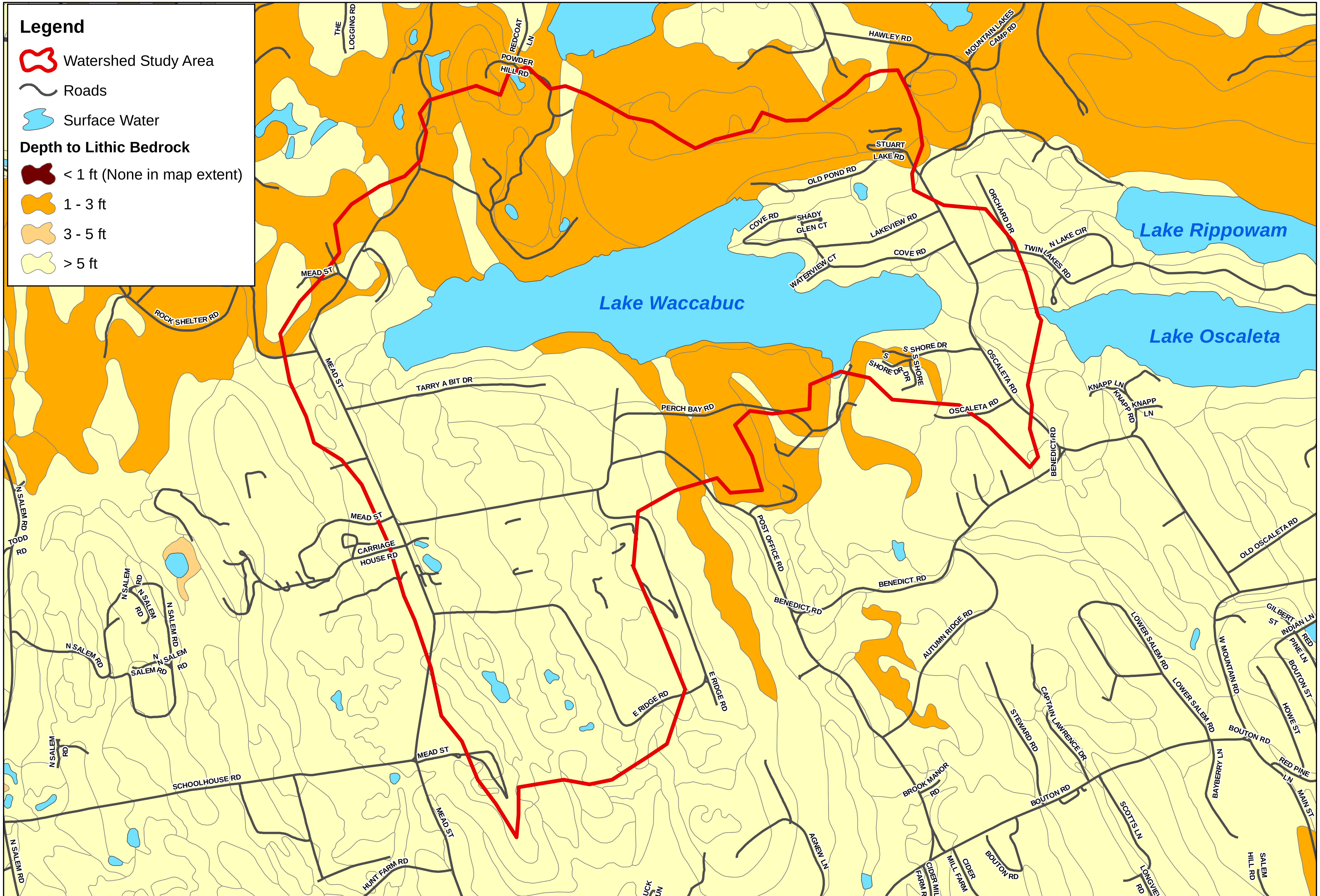

Town of Lewisboro

Depth to Lithic Bedrock

Westchester County

New York

August 2021

Barton & Loguidice

Date

June 2021

Scale

1" = 1000'

Figure Number

2-7

Project Number

2390.001

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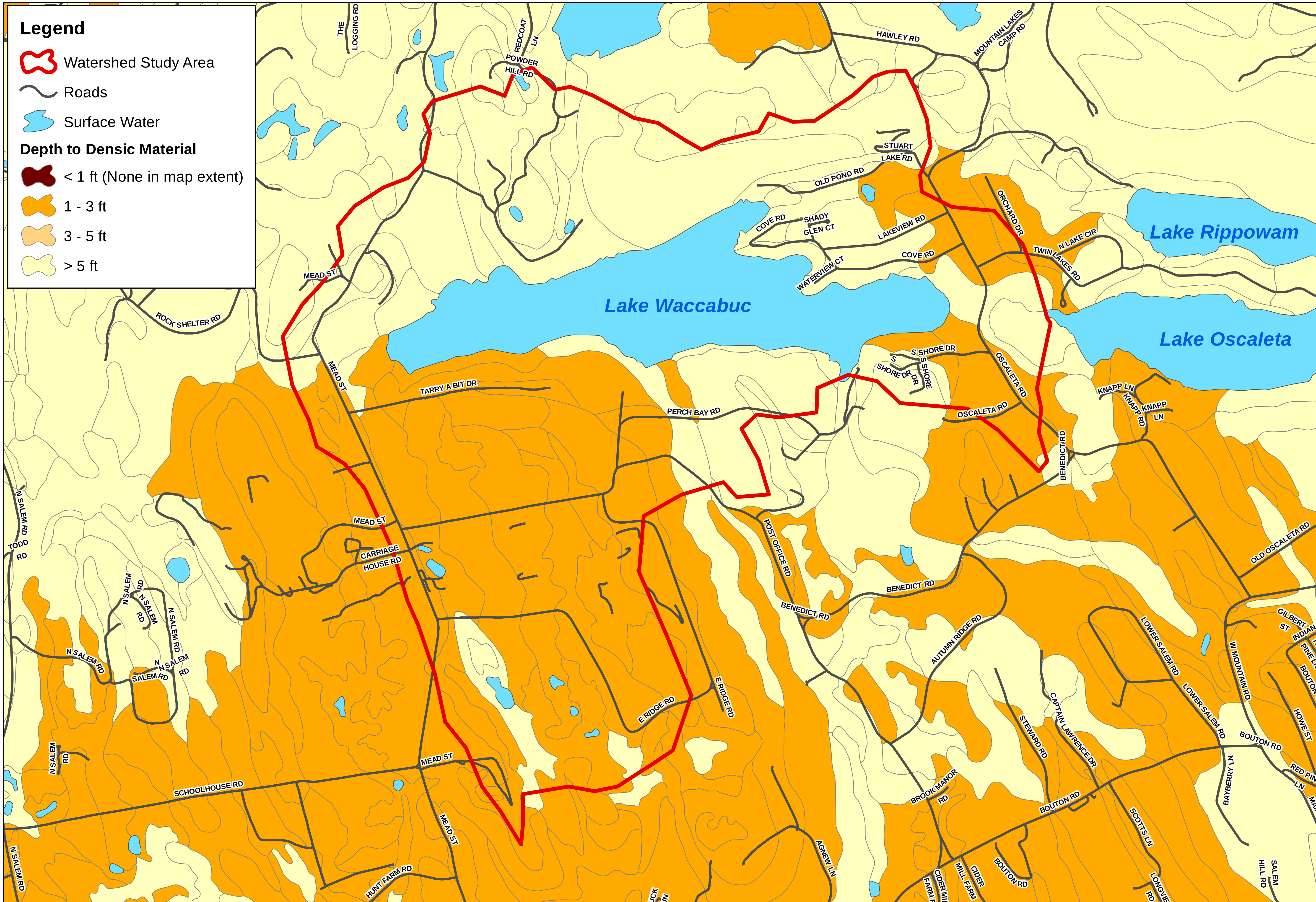

Town of Lewisboro

Westchester County

New York

Depth to Densic Material

August 2021

Barton & Loguidice

Date

June 2021

Scale

1" = 1000'

Figure Number

2-8

Project Number

2390.001

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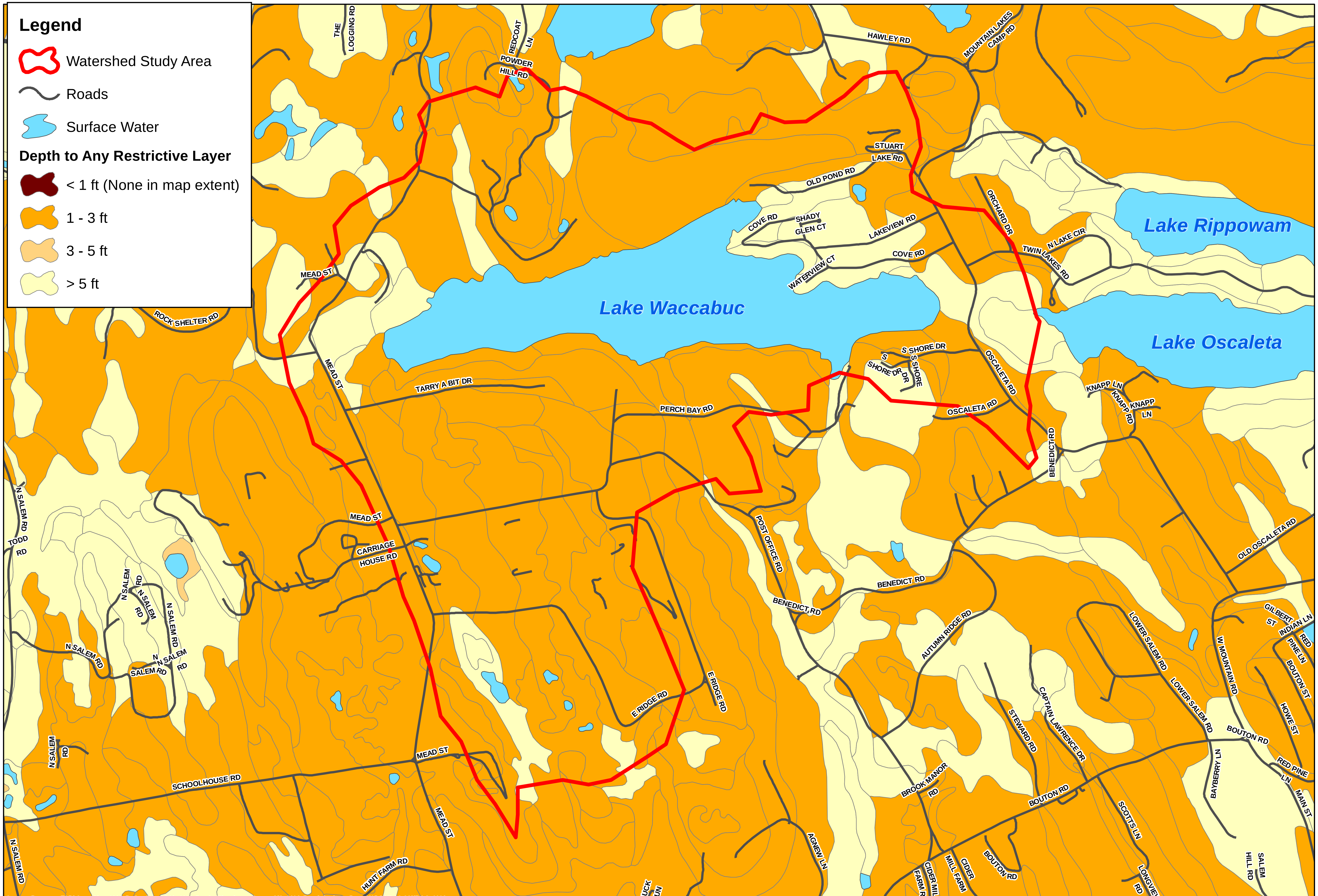

Town of Lewisboro

Depth to Any Restrictive Layer

Westchester County

New York

August 2021

Barton & Loguidice

Date

July 2021

Scale

1" = 1000'

Figure Number

2-9

Project Number

2390.001

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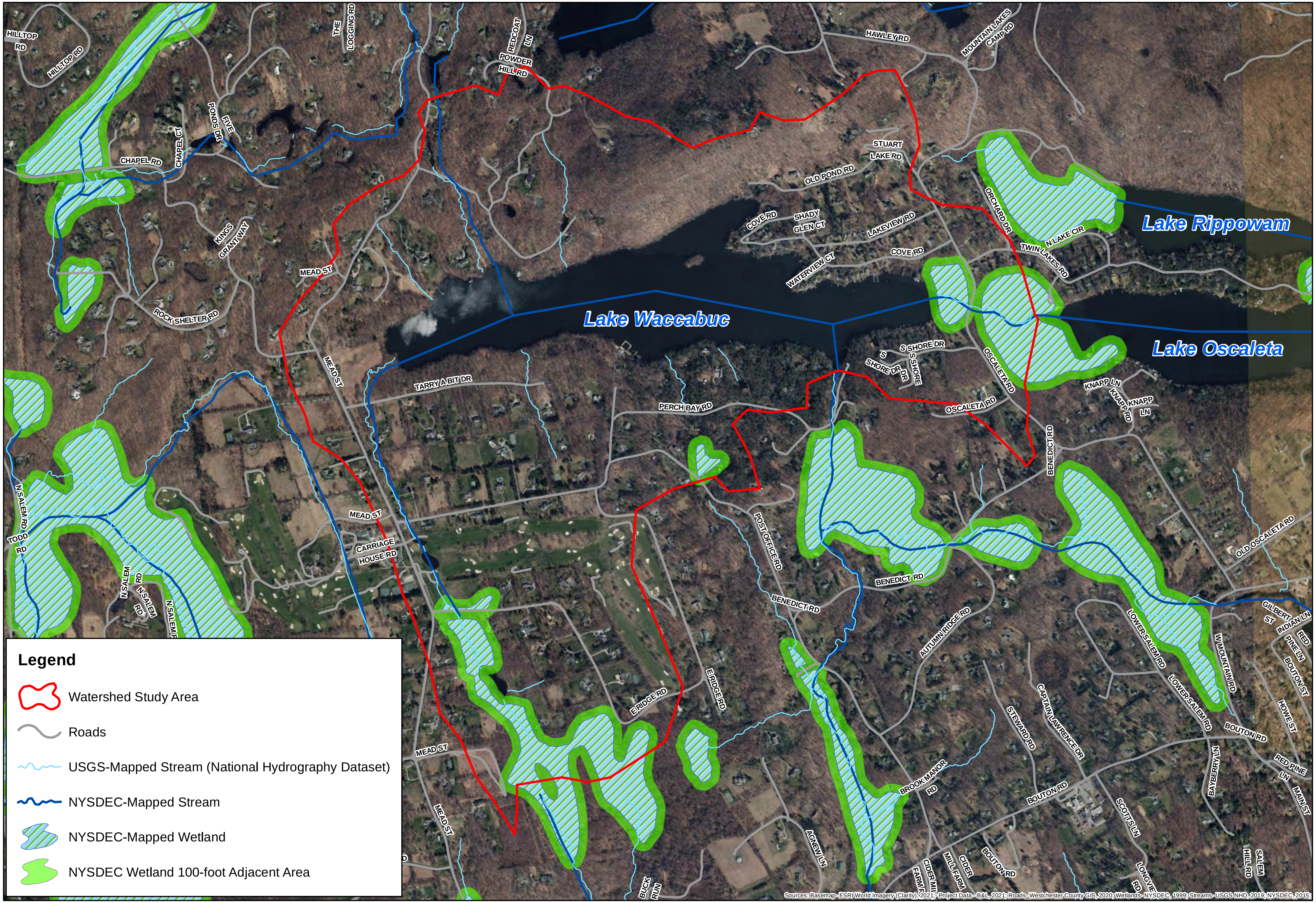

Town of Lewisboro

Mapped Resources - USGS & NYSDEC

Westchester County

New York

August 2021

Barton & Loguidice

Date

July 2021

Scale

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Figure Number

2-10

Project Number

2390.001

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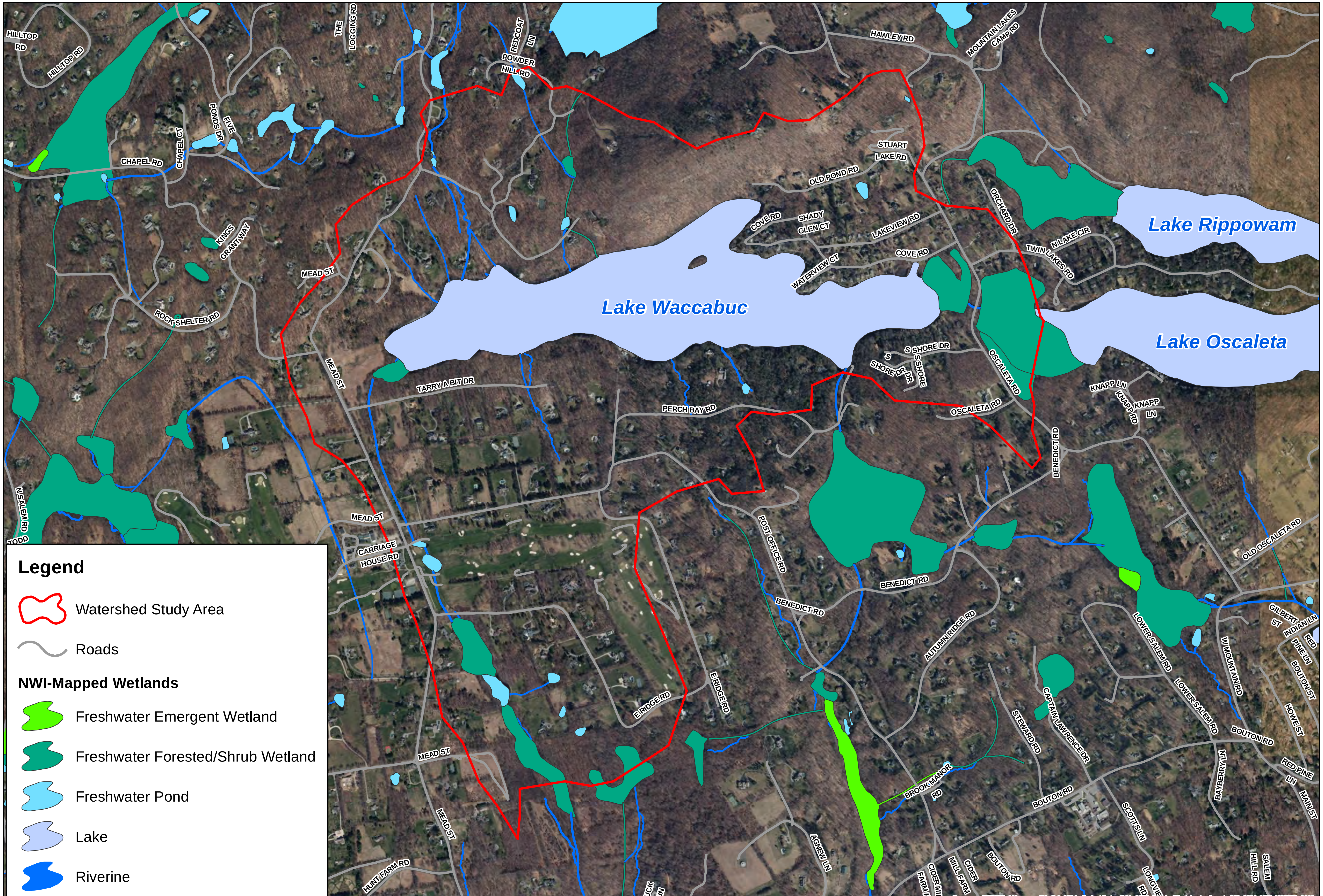

Town of Lewisboro

Mapped Resources - NWI Wetlands

Westchester County

New York

August 2021

Barton & Loguidice

Date

July 2021

Scale

1" = 1000'

Figure Number

2-11

Project Number

2390.001

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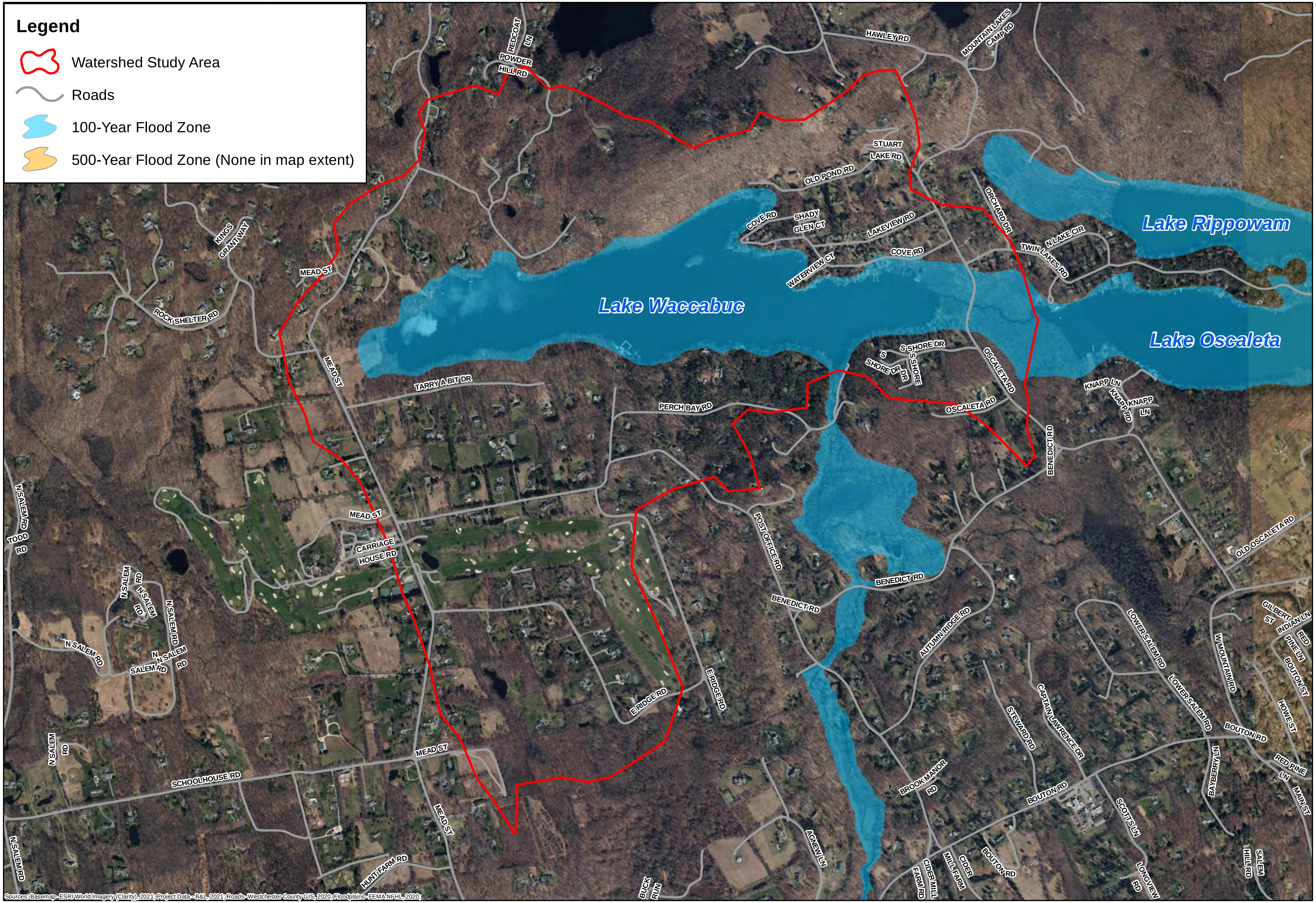

Westchester County

Town of Lewisboro

FEMA Floodplain Areas

August 2021

New York

Barton & Loguidice

Date

July 2021

Scale

1" = 1000'

Figure Number

2-13

Project Number

2390.001

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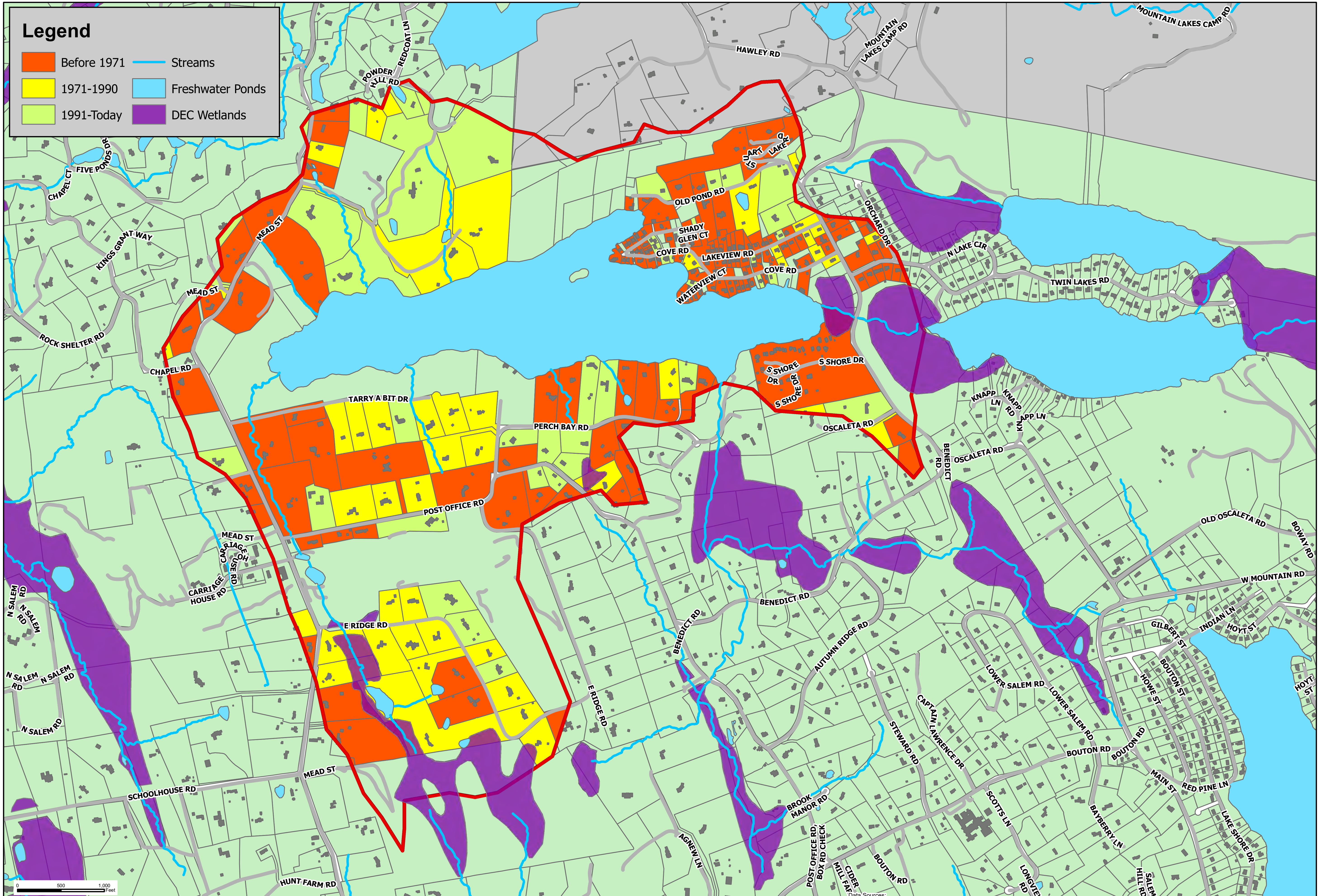


Town of Lewisboro

Septic System Effective Age

Westchester County

New York

Barton & Loguidice

Date

August 6, 2021

Scale

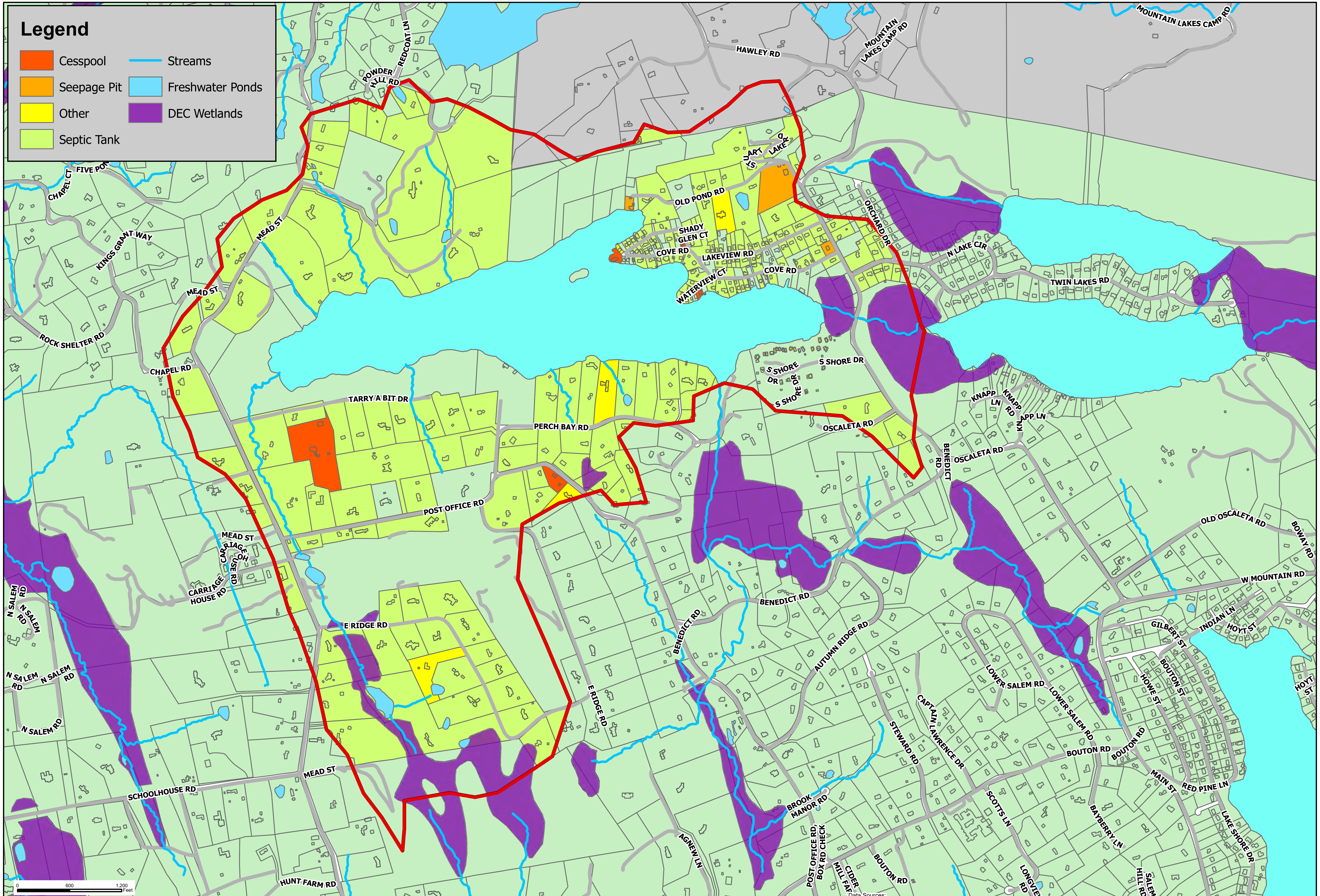
1" = 1,000'

Figure Number

3-1

Project Number

2390.001.001



Town of Lewisboro

Septic System Type (DOH)

Westchester County

New York

Barton & Loguidice

Date

August 6, 2021

Scale

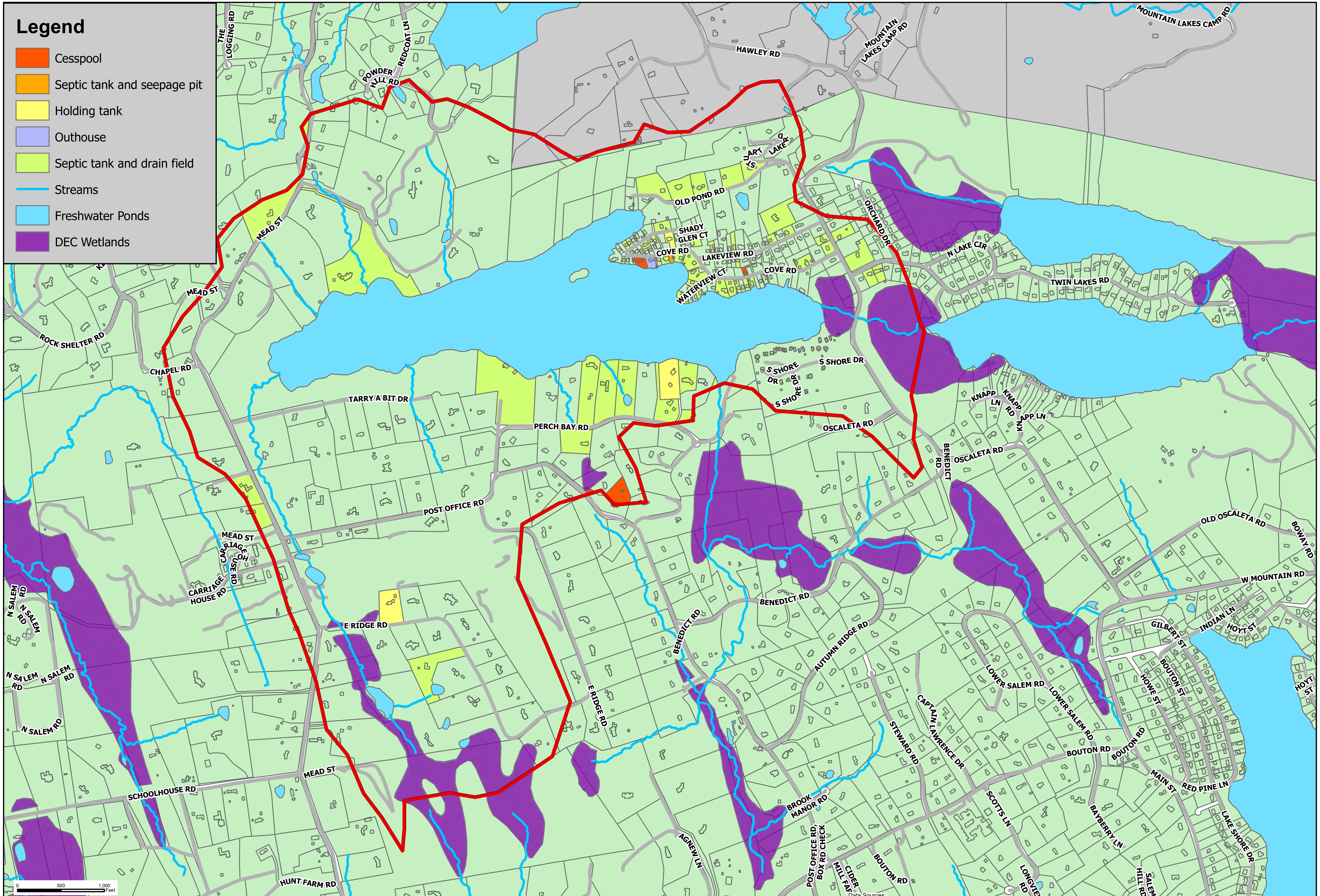
1" = 1,000'

Figure Number

3-2A

Project Number

2390.001.001



Town of Lewisboro

Septic System Type (Survey)

Westchester County

New York

Barton & Loguidice

Date

August 6, 2021

Scale

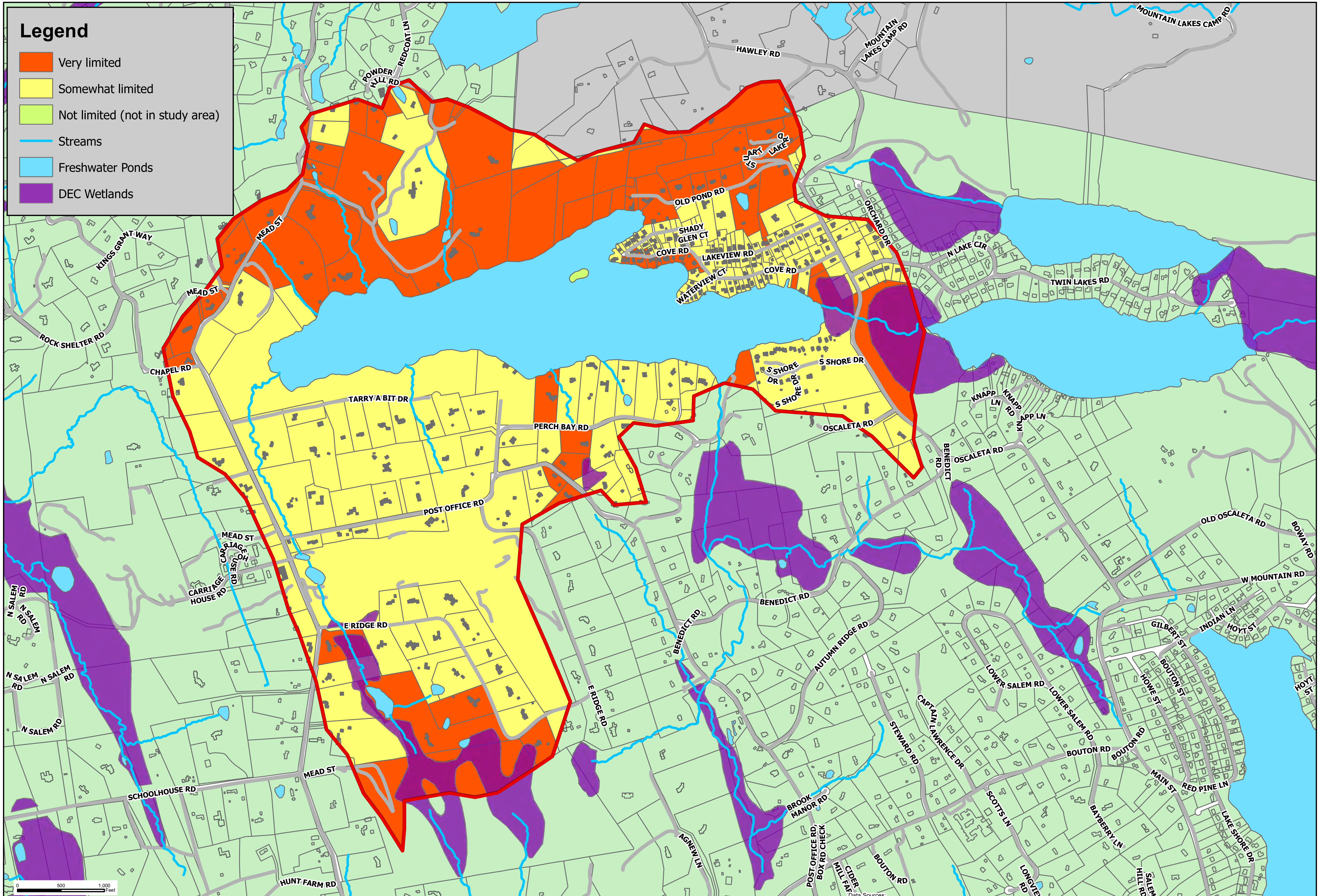
1" = 1,000'

Figure Number

3-2B

Project Number

2390.001.001



Westchester County

Town of Lewisboro

Septic Suitability of Soils

New York

Barton & Loguidice

Date

August 6, 2021

Scale

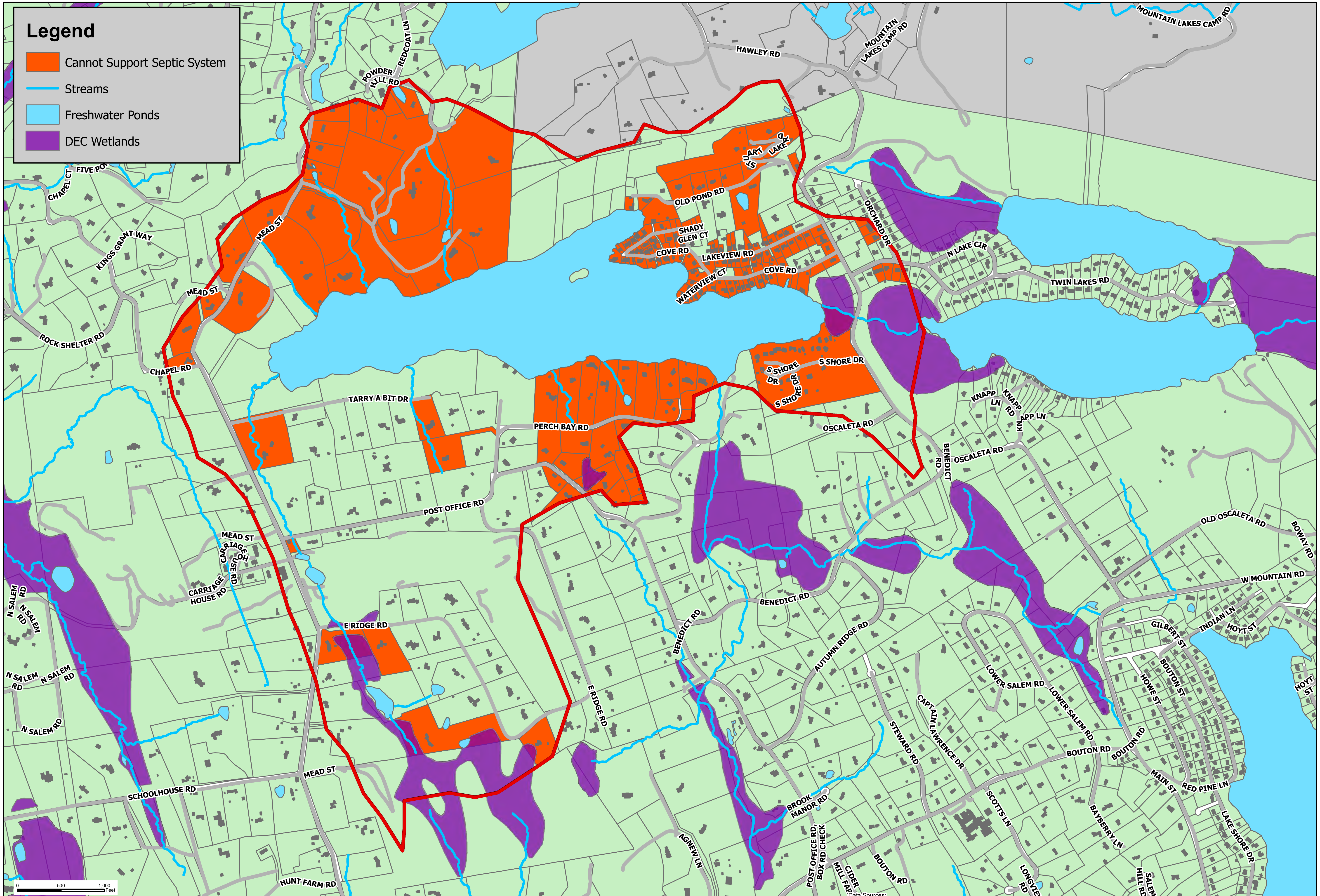
1" = 1,000'

Figure Number

4-1

Project Number

2390.001.001



Town of Lewisboro

Potentially Non-Compliant Septic Systems

Westchester County

New York

Barton & Loguidice

Date

July 28, 2021

Scale

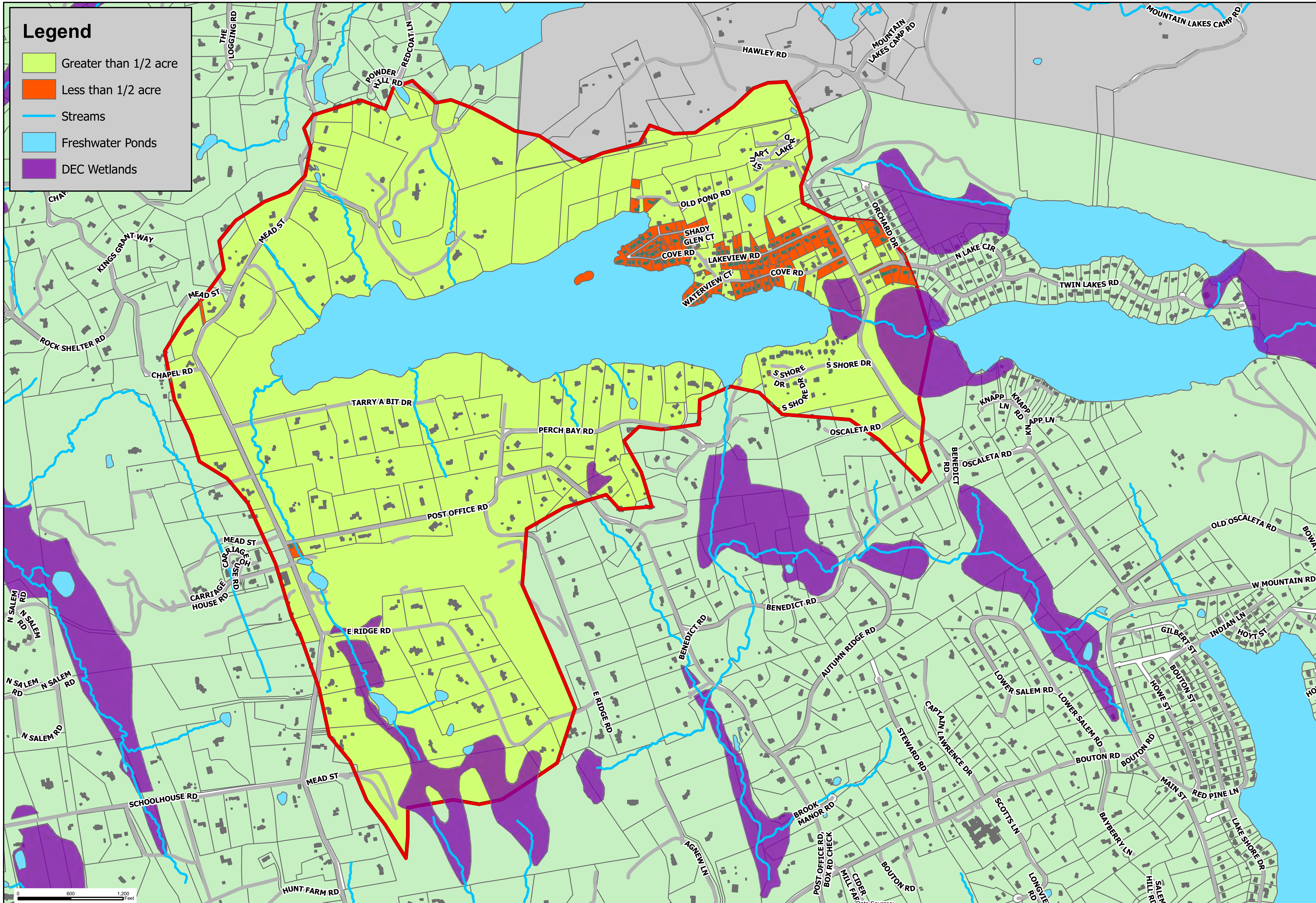
1" = 1,000'

Figure Number

4-2

Project Number

2390.001.001



Town of Lewisboro

Parcel Size

Westchester County

New York

Barton & Loguidice

Date

August 6, 2021

Scale

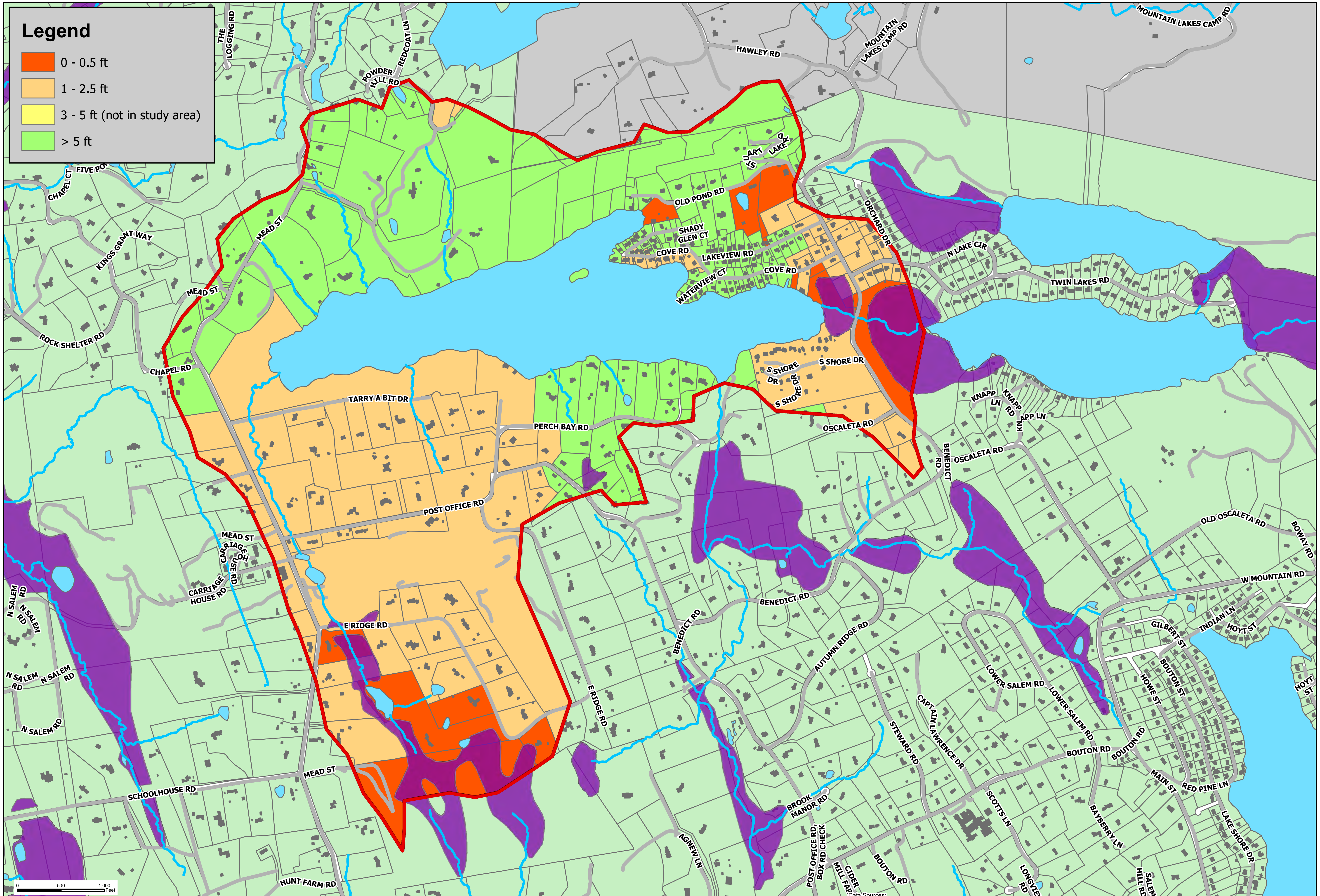
1" = 1,000'

Figure Number

4-3

Project Number

2390.001.001



Westchester County

Estimated DTGW by Parcel

Town of Lewisboro

New York

Barton & Loguidice

Date

July 31, 2021

Scale

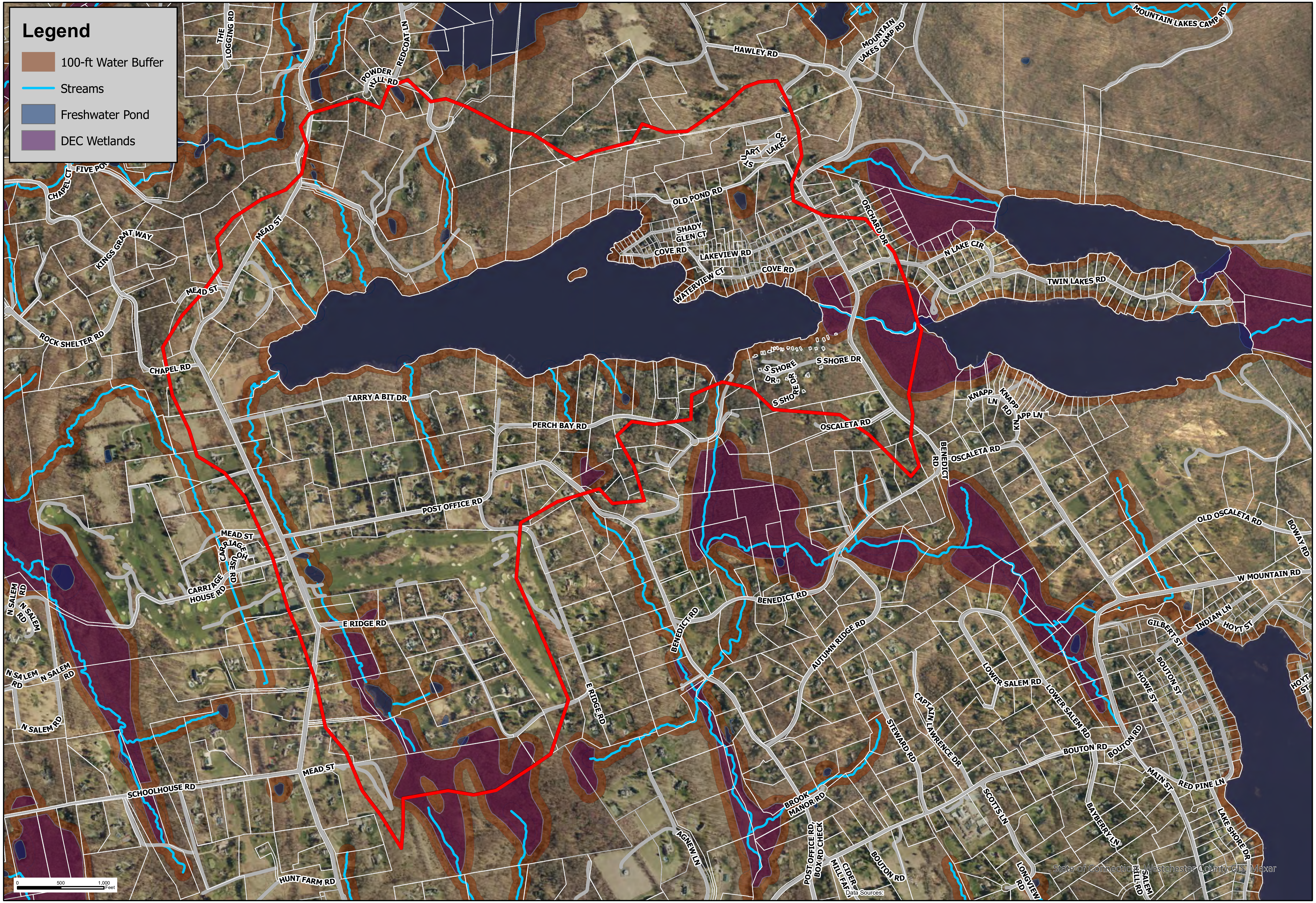
1" = 1,000'

Figure Number

4-4

Project Number

2390.001.001



Westchester County

Town of Lewisboro

100-ft Water Buffer

New York

Barton & Loguidice

Date

August 2, 2021

Scale

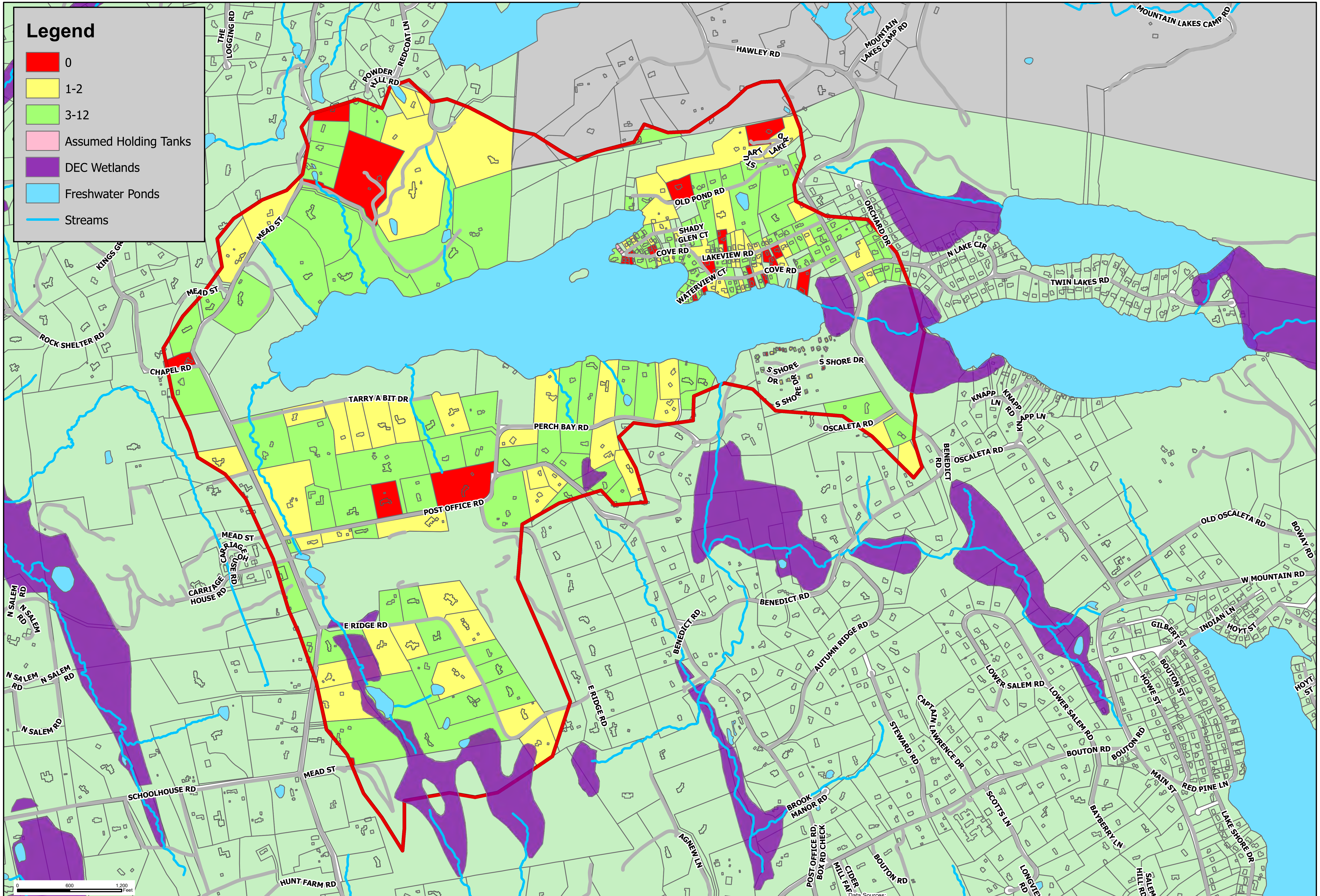
1" = 1,000'

Figure Number

4-5

Project Number

2390.001.001



Westchester County

Total Pump Outs by Parcel

Town of Lewisboro

New York

Barton & Loguidice

Date

November 2, 2021

Scale

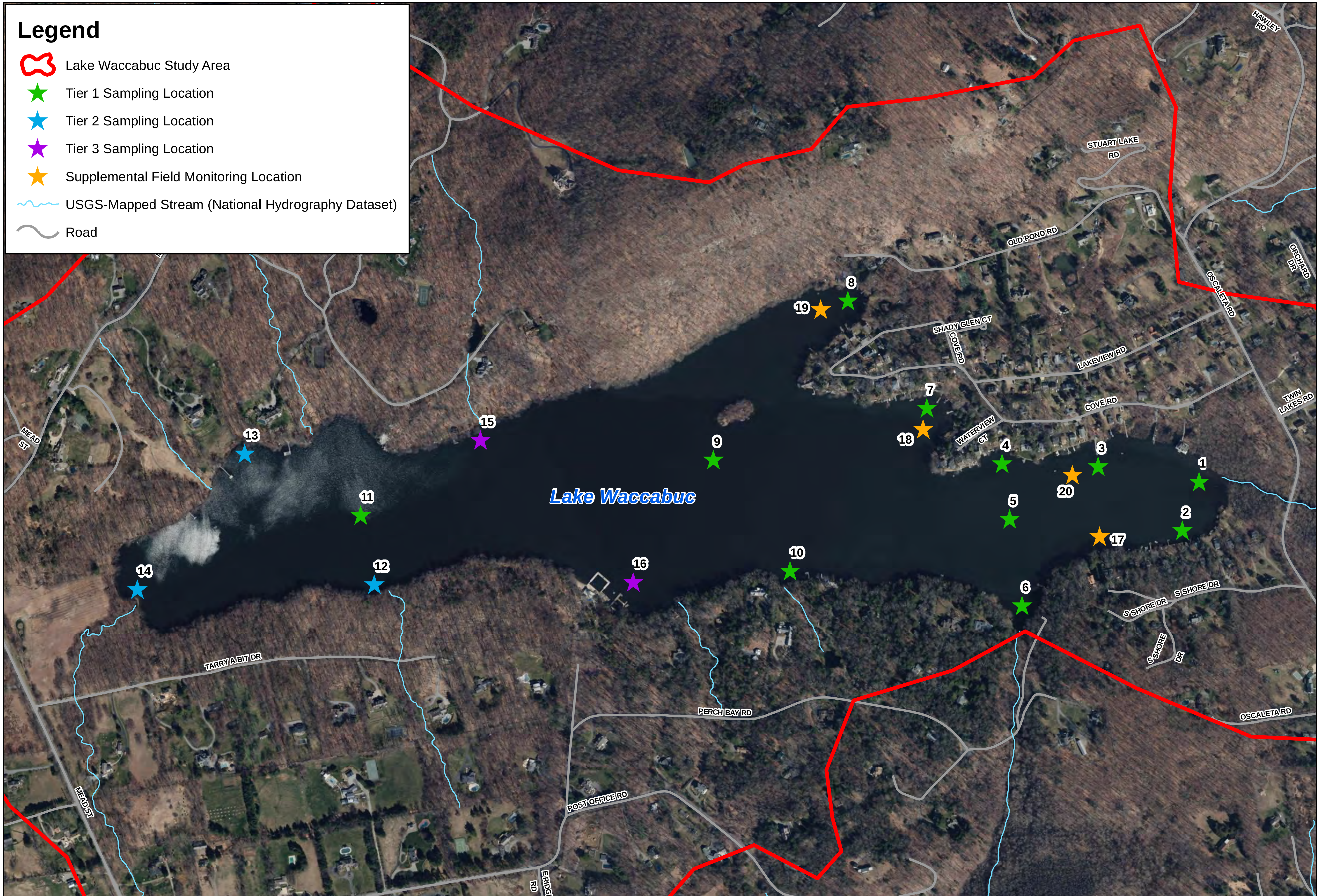
1" = 1,000'

Figure Number

4-6

Project Number

2390.001.001



Field Sampling & Monitoring Locations

Town of Lewisboro

Westchester County

New York

August 2021

Barton & Loguidice

Date

July 2021

Scale

1" = 1000'

Figure Number

4-8

Project Number

2390.001

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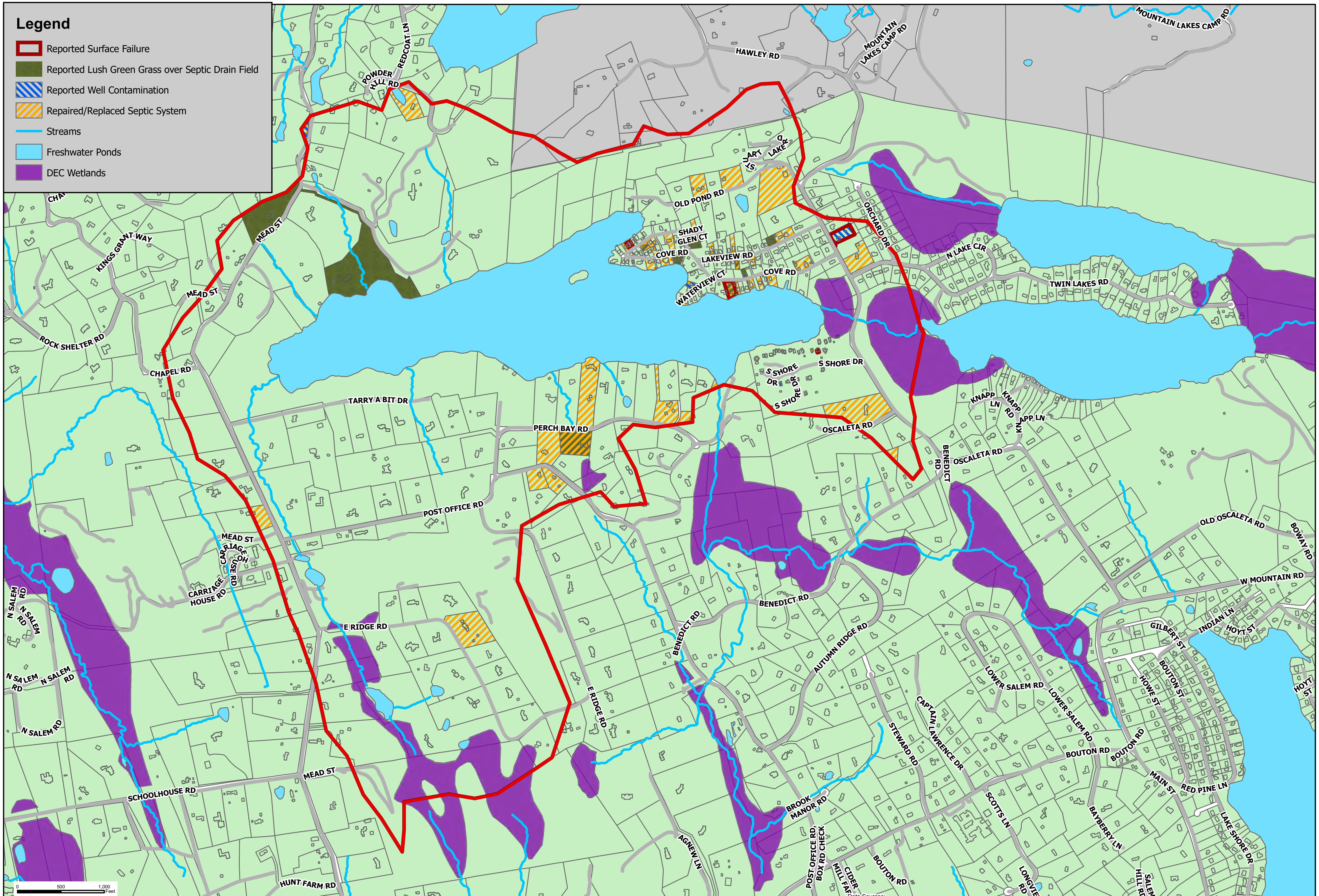


Town of Lewisboro

Septic Failures and Indicators of Failing Systems

Westchester County

New York

Barton & Loguidice

Date

August 6, 2021

Scale

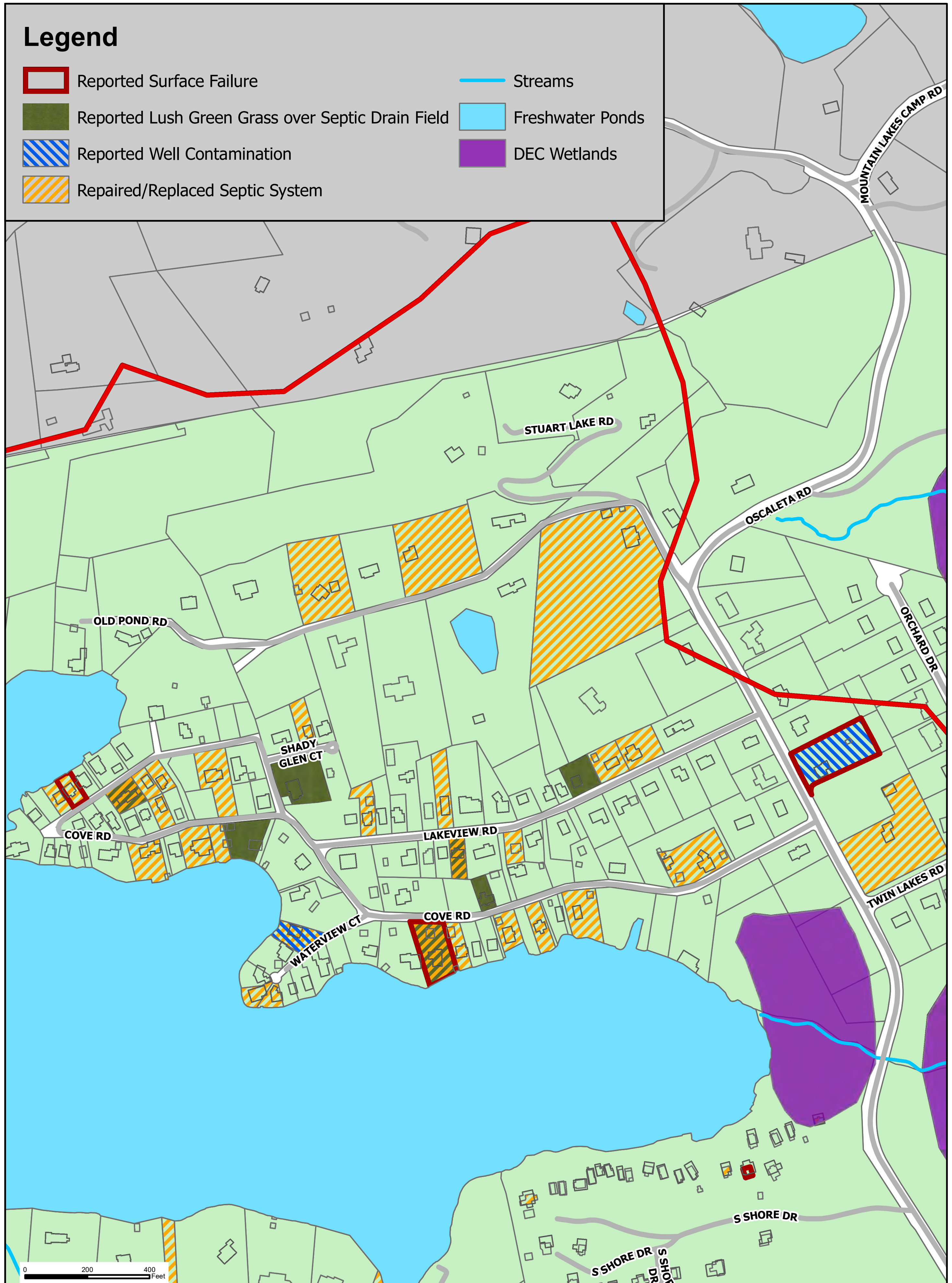
1" = 1,000'

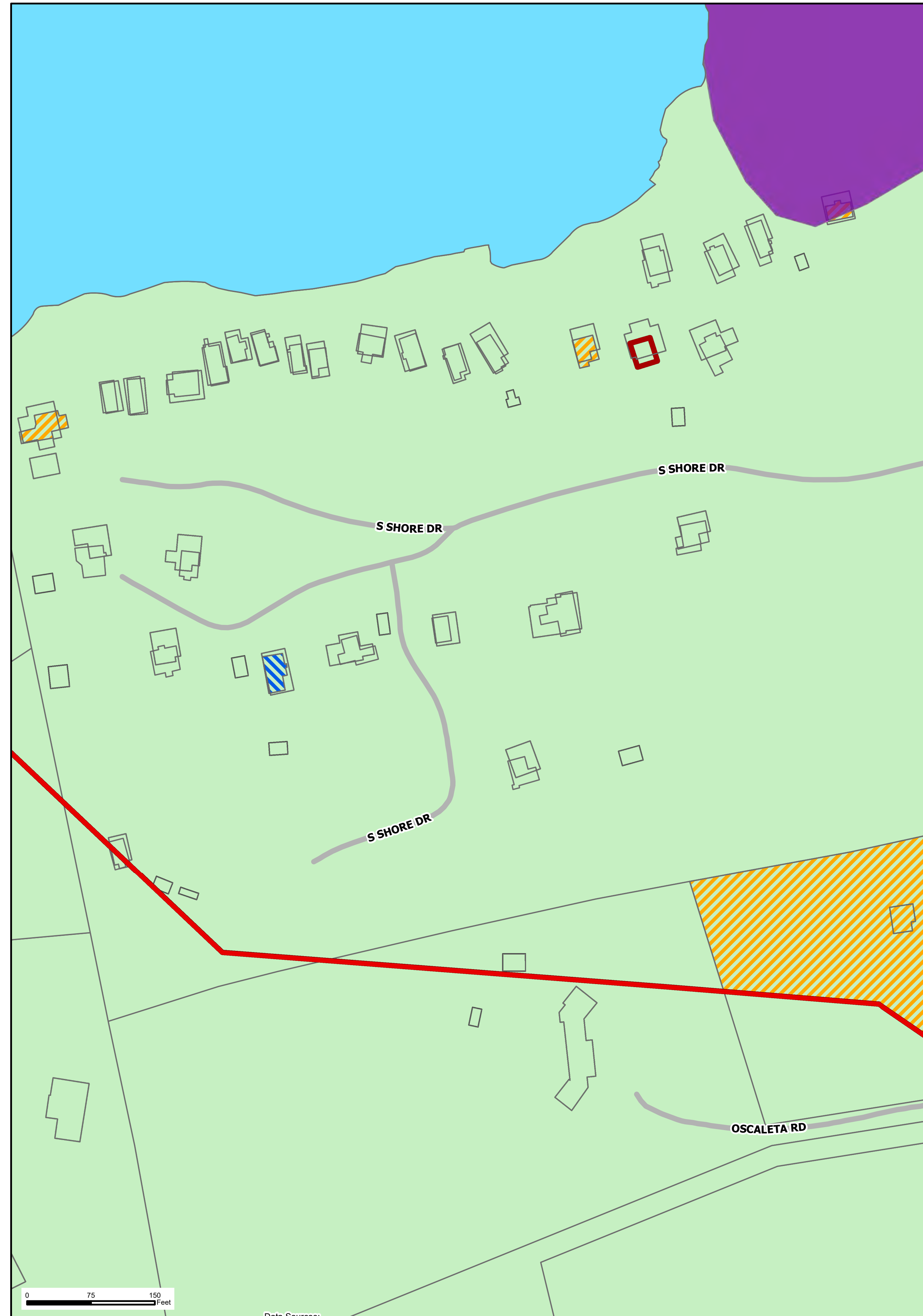
Figure Number

5-1A

Project Number

2390.001.001





Town of Lewisboro

Septic Failures and Indicators of Failing Systems (Zoomed)

Westchester County

New York

Barton & Loguidice

Date

August 6, 2021

Scale

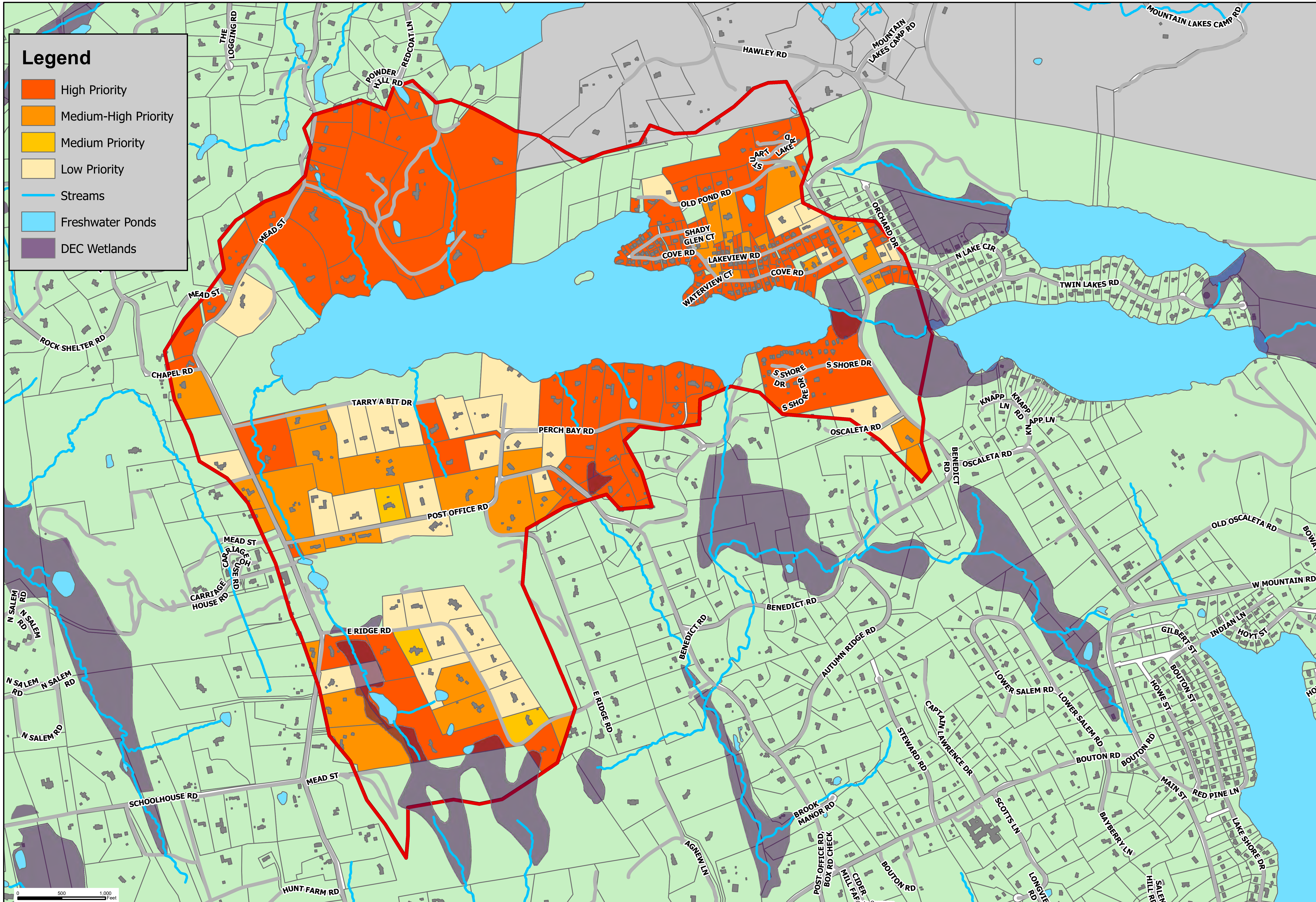
As Shown

Figure Number

5-1B

Project Number

2390.001.001



Town of Lewisboro

Wastewater Management Solution Prioritization

Westchester County

New York

Barton & Loguidice

Date

August 6, 2021

Scale

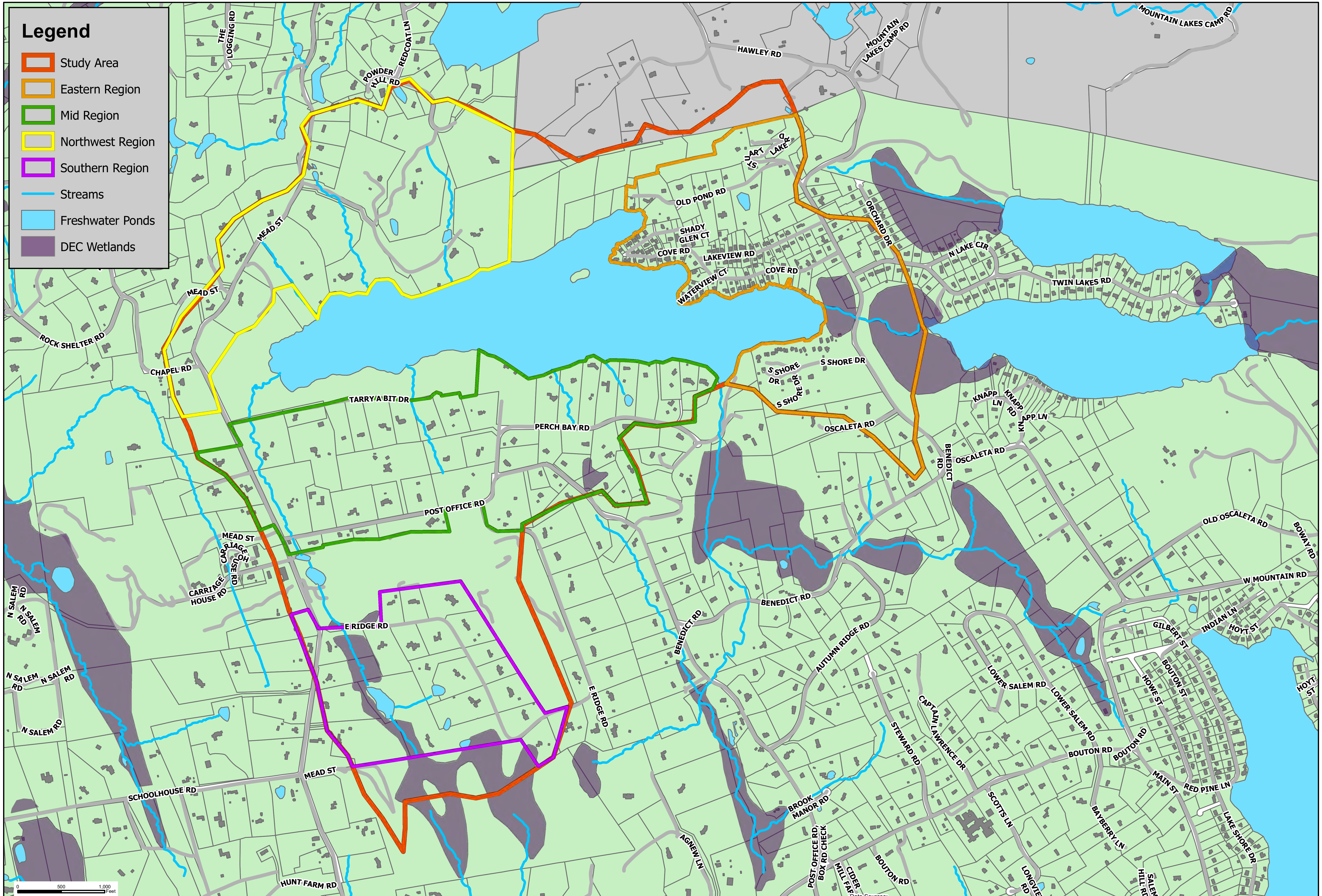
1" = 1,000'

Figure Number

6-1

Project Number

2390.001.001



Town of Lewisboro

Study Area Regions

Westchester County

New York

Barton & Loguidice

Date

August 5, 2021

Scale

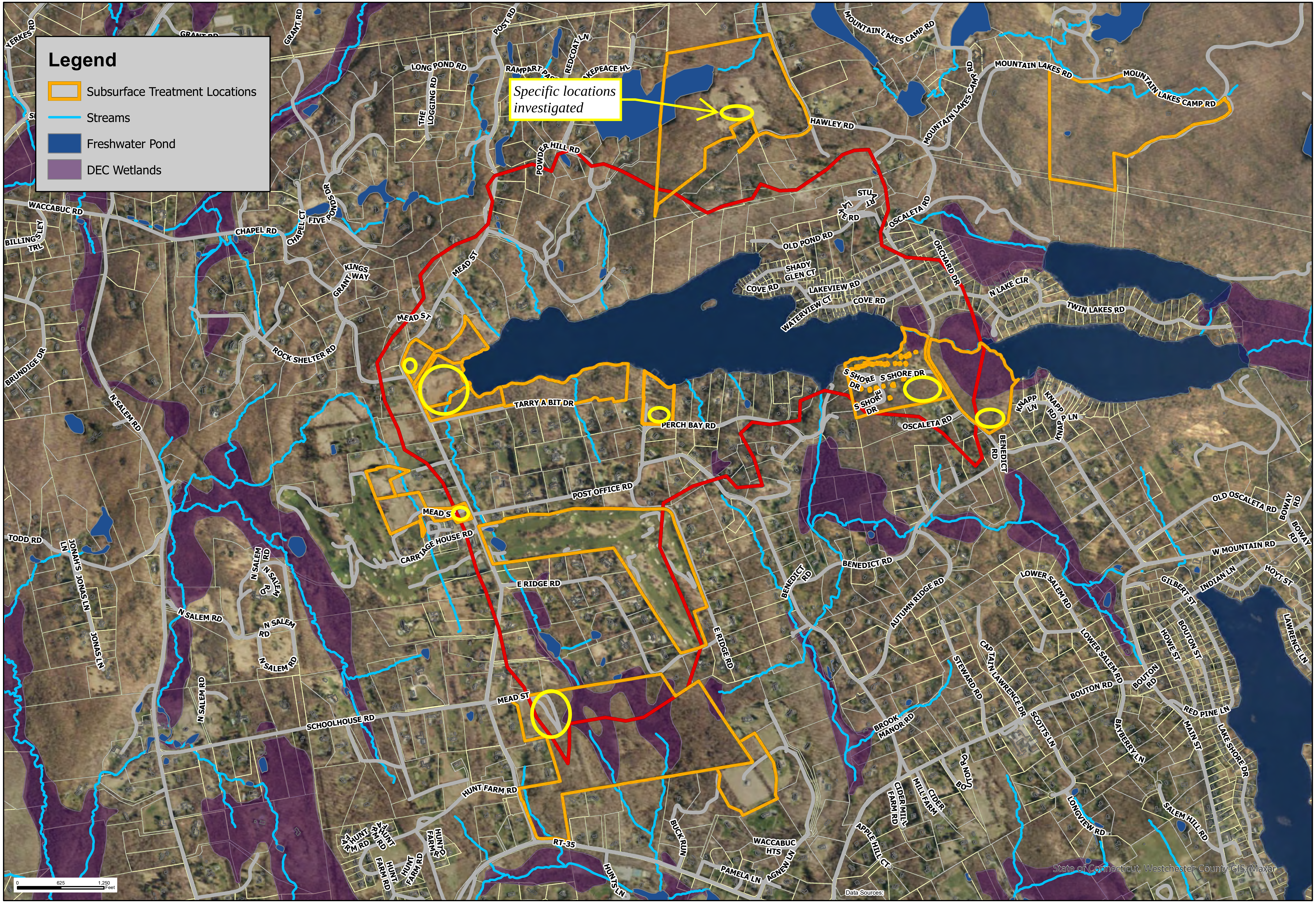
1" = 1,000'

Figure Number

6-2

Project Number

2390.001.001



Town of Lewisboro

Subsurface Treatment Locations

Westchester County
New York

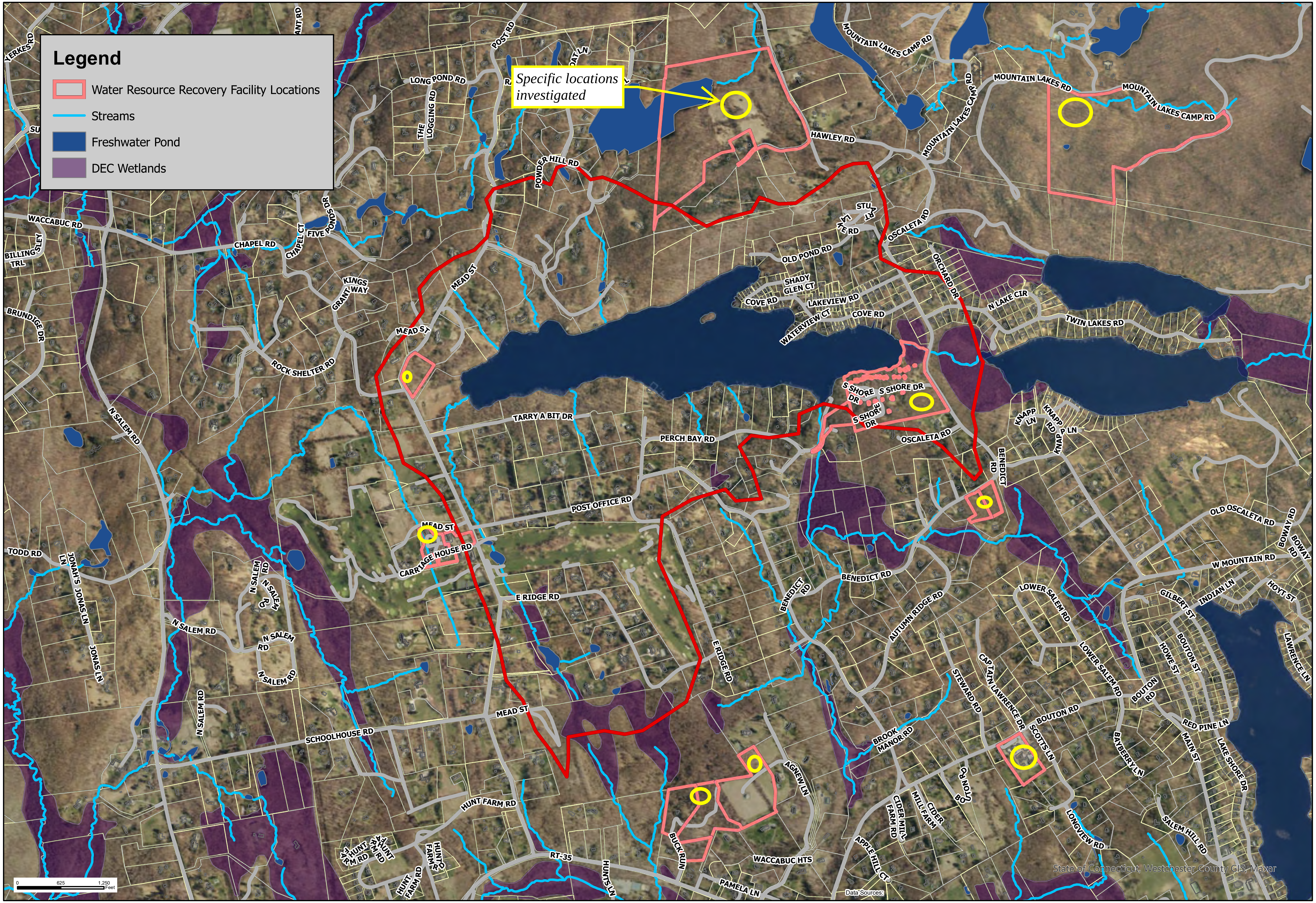
Barton & Loguidice

Date
August 5, 2021

Scale
1" = 1,250'

Figure Number
6-3

Project Number
2390.001.001



Town of Lewisboro

Water Resource Recovery Facility Locations

Westchester County

New York

Barton & Loguidice

Date

August 5, 2021

Scale

1" = 1,250'

Figure Number

6-4

Project Number

2390.001.001

REVISIONS

TOWN OF LEWISBORO
LAKE WACCABUC STUDY

ALTERNATIVE 4A
WRRF FOR EASTERN REGION ON BENEDICT ROAD

TOWN OF LEWISBORO
WESTCHESTER COUNTY, NEW YORK

B&L
Pinewood Business Center
247 Route 100
Suite 2000D
Somers, NY
10589
Barton & Loguidice, D.P.C.

Date: AUGUST, 2021
Scale: AS SHOWN
Sheet Number: 6-5
Project Number: 2390.001.001

Plotted: Nov 23, 2021 – 12:09PM SYR By: dtc
Z:\BL–Vault\ID2\18217AD2–1C71–4823–8927–99D5C4054147\0\2383000–2383999\2383772\L\L\Alternative 4 (ID 2383772).dwg

Checked by RMDS Drawn by DTC Designed by RMDS In charge of DHF

REVISIONS

TOWN OF LEWISBORO
LAKE WACCABUC STUDY

ALTERNATIVE 4A
WRRF FOR STUDY AREA AT LES

TOWN OF LEWISBORO — WESTCHESTER COUNTY, NEW YORK

B&L
Pinewood Business Center
247 Route 100
Suite 2000D
Somers, NY
10589
Barton & Loguidice, D.P.C.

Date: AUGUST, 2021
Scale: AS SHOWN
Sheet Number: 6-6
Project Number: 2390.001.001

Plotted: Nov 23, 2021 – 12:01PM SYR By: dtc
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Checked by RMPS Drawn by DTC Designed by RMDS In charge of DHF

REVISIONS

TOWN OF LEWISBORO
LAKE WACCABUC STUDY

ALTERNATIVE 2
SOUTH SHORE COMMUNITY SEPTIC SYSTEM

TOWN OF LEWISBORO
WESTCHESTER COUNTY, NEW YORK

B&L
Pinewood Business Center
247 Route 100
Suite 2000D
Somers, NY
10589
Barton & Loguidice, D.P.C.

Date: AUGUST, 2021

Scale: AS SHOWN

Sheet Number: 7-1

Project Number: 2390.001.001

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Checked by RMPS | Drawn by DTC | Designed by RMDS | In charge of DHF

REVISIONS

TOWN OF LEWISBORO
LAKE WACCABUC STUDY

ALTERNATIVE 3
CONNECTION TO HERITAGE HILLS WWTP

TOWN OF LEWISBORO
WESTCHESTER COUNTY, NEW YORK

B&L
Pinewood Business Center
247 Route 100
Suite 2000D
Somers, NY
10589
Barton & Loguidice, D.P.C.

Date: AUGUST, 2021
Scale: AS SHOWN
Figure Number: 7-2
Project Number: 2390.001.001

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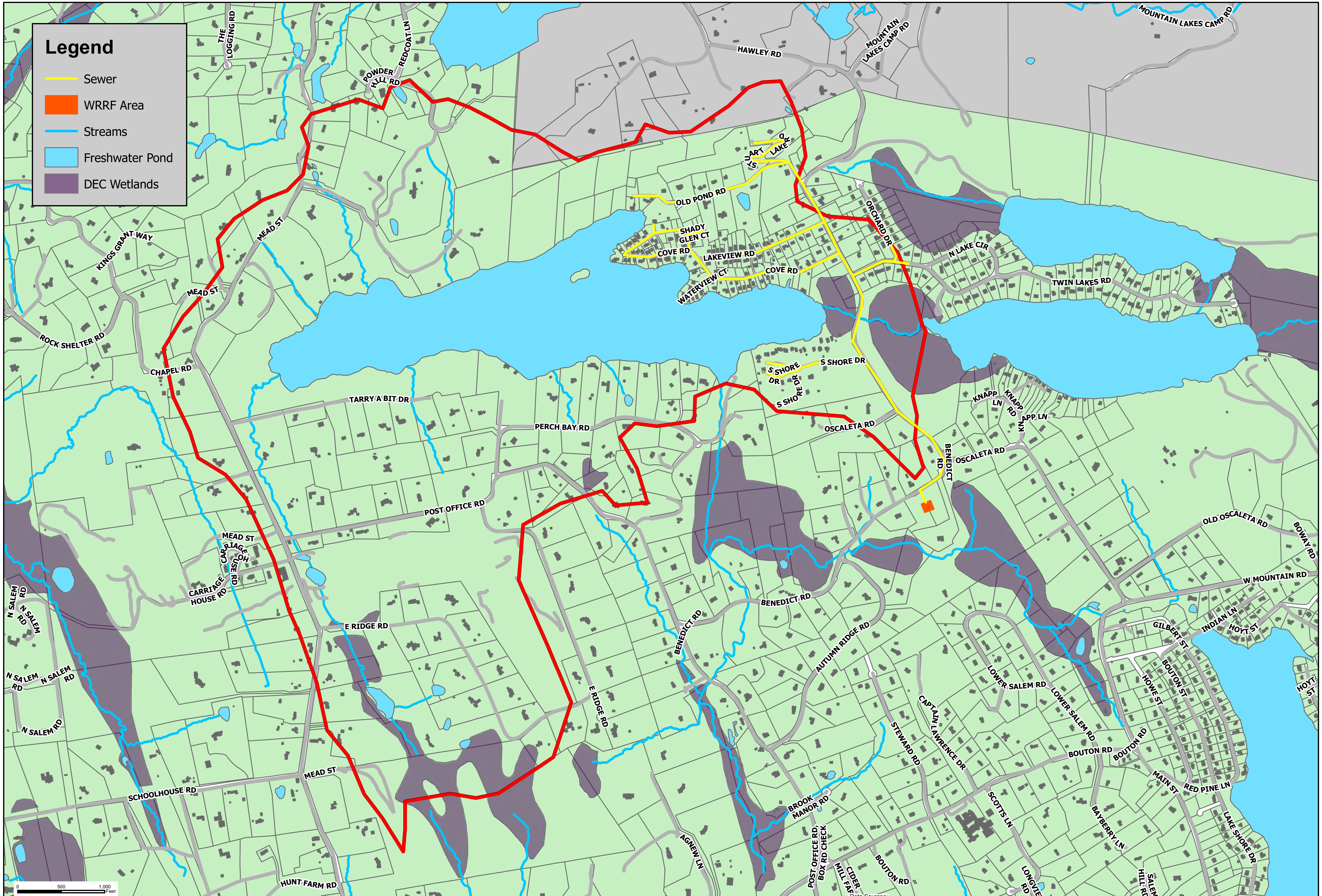
Checked by RMDS Drawn by DTC Designed by RMDS In charge of DHF



Town of Lewisboro

Alternative 4A
WRRF on Benedict Road

Westchester County

New York

Barton & Loguidice

Date

August 10, 2021

Scale

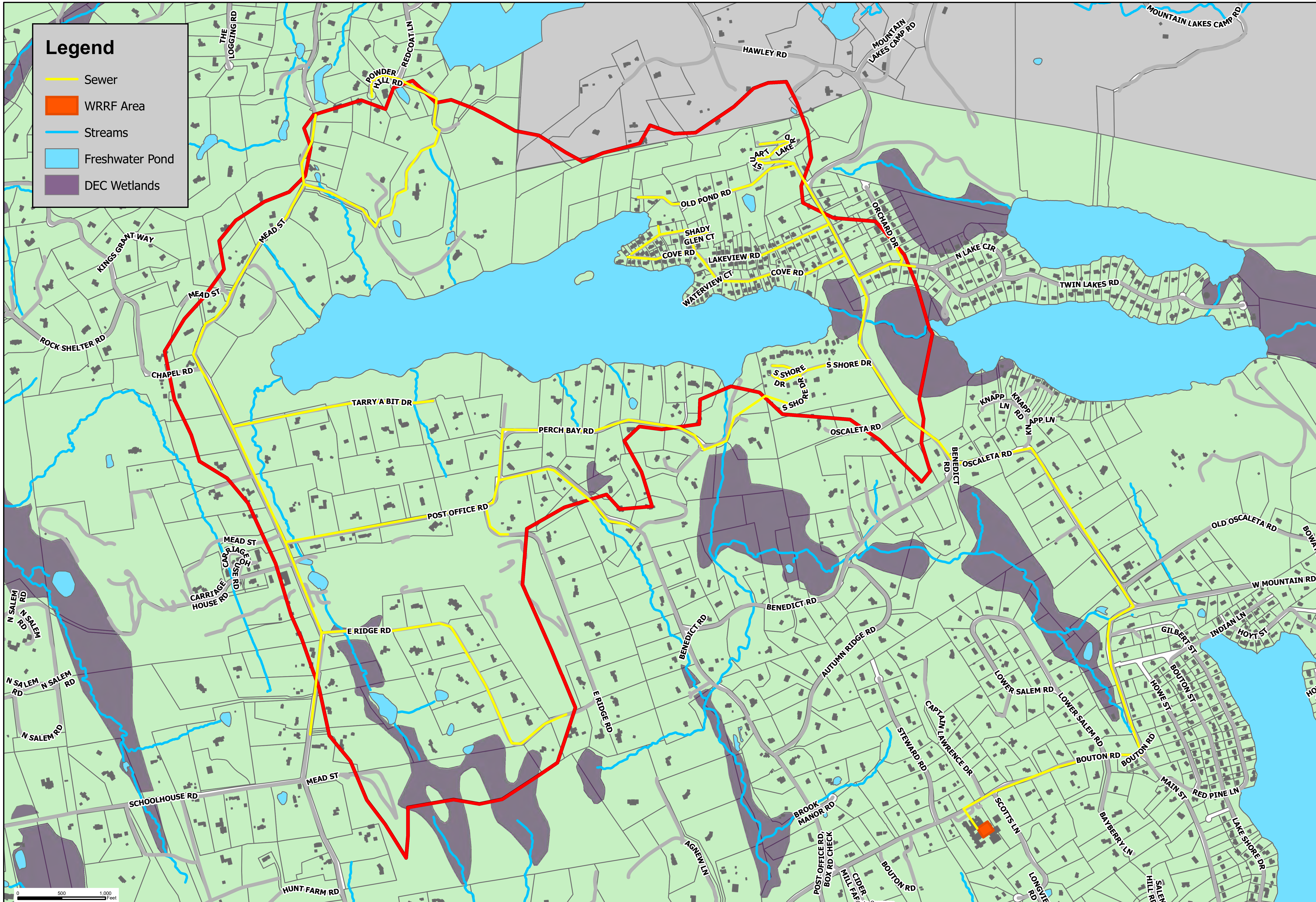
1" = 1,000'

Figure Number

7-3

Project Number

2390.001.001



Town of Lewisboro

Alternative 4B

WRRF at Lewisboro Elementary

Westchester County

New York

Barton & Loguidice

Date

November 2, 2021

Scale

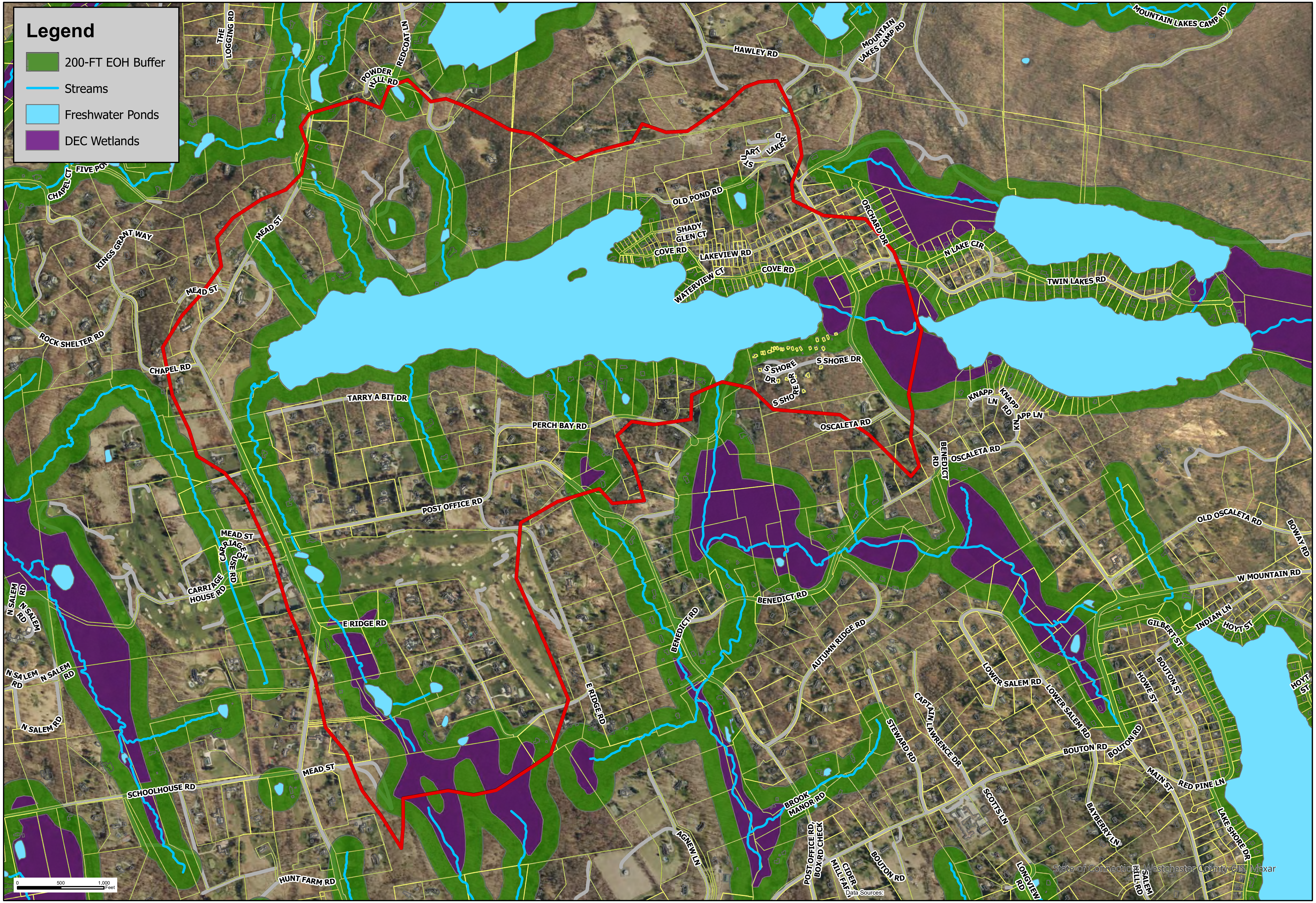
1" = 1,000'

Figure Number

7-4

Project Number

2390.001.001



Town of Lewisboro

EOH Potential Funding Zone

Westchester County

New York

Barton & Loguidice

Date

July 30, 2021

Scale

1" = 1,000'

Figure Number

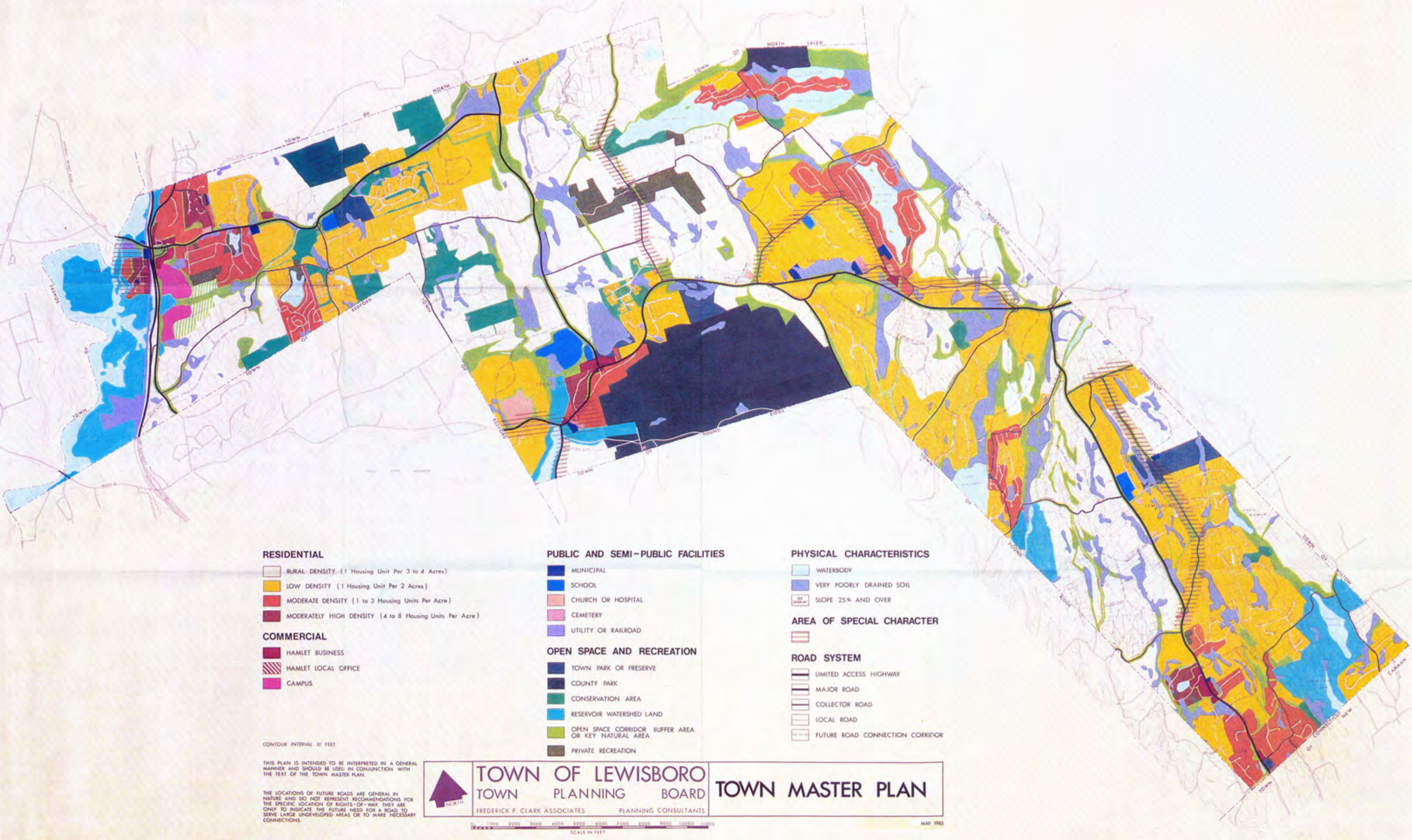
12-1

Project Number

2390.001.001

Appendices

Appendix A
1985 Town of Lewisboro Zoning Map



RESIDENTIAL
RURAL DENSITY (1 Housing Unit Per 3 to 4 Acres)
LOW DENSITY (1 Housing Unit Per 2 Acres)
MODERATE DENSITY (1 to 3 Housing Units Per Acre)
MODERATELY HIGH DENSITY (4 to 8 Housing Units Per Acre)
COMMERCIAL
HAMLET BUSINESS
HAMLET LOCAL OFFICE
CAMPUS
CONTOUR INTERVAL 10 FEET
THIS PLAN IS INTENDED TO BE INTERPRETED IN A GENERAL MANNER AND SHOULD BE USED IN CONJUNCTION WITH THE TEXT OF THE TOWN MASTER PLAN.
THE LOCATIONS OF FUTURE ROADS ARE GENERAL IN NATURE AND DO NOT REPRESENT RECOMMENDATIONS FOR THE SPECIFIC LOCATION OF RIGHTS-OF-WAY. THEY ARE ONLY TO INDICATE THE FUTURE NEED FOR A ROAD TO SERVE LARGE UNDEVELOPED AREAS OR TO MAKE NECESSARY CONNECTIONS.
PUBLIC AND SEMI-PUBLIC FACILITIES
MUNICIPAL
SCHOOL
CHURCH OR HOSPITAL
CEMETERY
UTILITY OR RAILROAD
OPEN SPACE AND RECREATION
TOWN PARK OR PRESERVE
COUNTY PARK
CONSERVATION AREA
RESERVOIR WATERSHED LAND
OPEN SPACE CORRIDOR BUFFER AREA OR KEY NATURAL AREA
PRIVATE RECREATION
PHYSICAL CHARACTERISTICS
WATERBODY
VERY POORLY DRAINED SOIL
SLOPE 25% AND OVER
AREA OF SPECIAL CHARACTER
ROAD SYSTEM
LIMITED ACCESS HIGHWAY
MAJOR ROAD
COLLECTOR ROAD
LOCAL ROAD
FUTURE ROAD CONNECTION CORRIDOR
NORTH
TOWN OF LEWISBORO
TOWN PLANNING BOARD
FREDERICK P. CLARK ASSOCIATES PLANNING CONSULTANTS
TOWN MASTER PLAN
0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000 11000
SCALE IN FEET
MAY 1985
TOWN OF NORTH SALEM
TOWN OF RIDGEFIELD
TOWN OF BEDFORD
TOWN OF POUND RIDGE
TOWN OF WILTON
TOWN OF NEW CANAAN

Appendix B
NRCS Soil Resources Report

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Westchester County, New York

March 30, 2021

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map

Map Scale: 1:14,700 if printed on B portrait (11" x 17") sheet.

Meters: 0, 200, 400, 800, 1200

Feet: 0, 500, 1000, 2000, 3000

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Westchester County, New York
Survey Area Data: Version 16, Jun 11, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 31, 2009—Oct 30, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Ce	Catden muck, 0 to 2 percent slopes	7.6	0.8%
ChB	Charlton fine sandy loam, 3 to 8 percent slopes	17.1	1.9%
ChC	Charlton fine sandy loam, 8 to 15 percent slopes	10.1	1.1%
ChD	Charlton fine sandy loam, 15 to 25 percent slopes	3.8	0.4%
CrC	Charlton-Chatfield complex, 0 to 15 percent slopes, very rocky	51.3	5.6%
CsD	Chatfield-Charlton complex, 15 to 35 percent slopes, very rocky	28.1	3.1%
CtC	Chatfield-Hollis-Rock outcrop complex, 0 to 15 percent slopes	60.1	6.6%
CuD	Chatfield-Hollis-Rock outcrop complex, 15 to 35 percent slopes	107.3	11.7%
HrF	Hollis-Rock outcrop complex, 35 to 60 percent slopes	54.1	5.9%
LcA	Leicester loam, 0 to 3 percent slopes, stony	1.7	0.2%
LeB	Leicester loam, 2 to 8 percent slopes, very stony	6.5	0.7%
NcA	Natchaug muck, 0 to 2 percent slopes	16.4	1.8%
PnB	Paxton fine sandy loam, 3 to 8 percent slopes	145.8	15.9%
PnC	Paxton fine sandy loam, 8 to 15 percent slopes	20.6	2.2%
PoB	Paxton fine sandy loam, 0 to 8 percent slopes, very stony	6.4	0.7%
PoC	Paxton fine sandy loam, 8 to 15 percent slopes, very stony	33.6	3.7%
PoD	Paxton fine sandy loam, 15 to 25 percent slopes, very stony	4.6	0.5%
RdA	Ridgebury complex, 0 to 3 percent slopes	11.0	1.2%
RdB	Ridgebury complex, 3 to 8 percent slopes	37.8	4.1%
Sh	Sun loam	15.4	1.7%
SuB	Sutton loam, 3 to 8 percent slopes	7.0	0.8%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
W	Water	139.7	15.2%
WdA	Woodbridge loam, 0 to 3 percent slopes	14.9	1.6%
WdB	Woodbridge loam, 3 to 8 percent slopes	115.0	12.6%
Totals for Area of Interest		**915.8**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Westchester County, New York

Ce—Catden muck, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2t2qk
Elevation: 0 to 1,430 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Catden and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Catden

Setting

Landform: Depressions, depressions, swamps, bogs, marshes, kettles, depressions, fens
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Highly decomposed herbaceous organic material and/or highly decomposed woody organic material

Typical profile

Oa1 - 0 to 2 inches: muck
Oa2 - 2 to 79 inches: muck

Properties and qualities

Slope: 0 to 1 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water capacity: Very high (about 26.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Ecological site: F144AY042NY - Semi-Rich Organic Wetlands
Hydric soil rating: Yes

Minor Components

Alden

Percent of map unit: 5 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Natchaug

Percent of map unit: 5 percent
Landform: Depressions, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Timakwa

Percent of map unit: 5 percent
Landform: Swamps
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Hydric soil rating: Yes

Canandaigua

Percent of map unit: 5 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

ChB—Charlton fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2wh0n
Elevation: 0 to 1,440 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Charlton and similar soils: 85 percent

Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Charlton

Setting

Landform: Hills, ground moraines, ridges
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Crest, side slope, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bw - 7 to 22 inches: gravelly fine sandy loam
C - 22 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Moderate (about 6.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Sutton

Percent of map unit: 8 percent
Landform: Ground moraines, hills
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Paxton

Percent of map unit: 5 percent
Landform: Drumlins, hills, ground moraines
Landform position (two-dimensional): Backslope, summit, shoulder
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear, convex
Across-slope shape: Convex

Hydric soil rating: No

Leicester

Percent of map unit: 1 percent
Landform: Drainageways, depressions
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

Chatfield

Percent of map unit: 1 percent
Landform: Hills, ridges
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Crest, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Linear, convex
Hydric soil rating: No

ChC—Charlton fine sandy loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2wh0q
Elevation: 0 to 1,440 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Charlton and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Charlton

Setting

Landform: Ground moraines, ridges, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bw - 7 to 22 inches: gravelly fine sandy loam
C - 22 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 8 to 15 percent

Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Moderate (about 6.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Paxton

Percent of map unit: 5 percent
Landform: Drumlins, hills, ground moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Sutton, fine sandy loam

Percent of map unit: 5 percent
Landform: Hills, ridges, ground moraines
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Chatfield

Percent of map unit: 3 percent
Landform: Hills, ridges
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Crest, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Canton

Percent of map unit: 2 percent
Landform: Hills, ground moraines, ridges
Landform position (two-dimensional): Shoulder, backslope, summit
Landform position (three-dimensional): Side slope, nose slope, crest
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

ChD—Charlton fine sandy loam, 15 to 25 percent slopes

Map Unit Setting

National map unit symbol: 2wh0t
Elevation: 0 to 1,290 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Charlton and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Charlton

Setting

Landform: Hills, ground moraines, ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss and/or schist

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bw - 7 to 22 inches: gravelly fine sandy loam
C - 22 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Moderate (about 6.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Sutton, fine sandy loam

Percent of map unit: 5 percent
Landform: Ridges, ground moraines, hills
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Paxton

Percent of map unit: 5 percent
Landform: Drumlins, hills, ground moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Chatfield

Percent of map unit: 3 percent
Landform: Hills, ridges
Landform position (two-dimensional): Summit, backslope, shoulder
Landform position (three-dimensional): Crest, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Canton

Percent of map unit: 2 percent
Landform: Ridges, hills, moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

CrC—Charlton-Chatfield complex, 0 to 15 percent slopes, very rocky

Map Unit Setting

National map unit symbol: 2w698
Elevation: 0 to 1,550 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Charlton, very stony, and similar soils: 50 percent

Chatfield, very stony, and similar soils: 30 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Charlton, Very Stony

Setting

Landform: Hills, ridges
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Crest, side slope, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 4 inches: fine sandy loam
Bw - 4 to 27 inches: gravelly fine sandy loam
C - 27 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 3 to 15 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Description of Chatfield, Very Stony

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Crest, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Linear, convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 2 inches: fine sandy loam
Bw - 2 to 30 inches: gravelly fine sandy loam

2R - 30 to 40 inches: bedrock

Properties and qualities

Slope: 3 to 15 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 20 to 41 inches to lithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Rock outcrop

Percent of map unit: 5 percent
Hydric soil rating: No

Sutton, very stony

Percent of map unit: 5 percent
Landform: Ground moraines, hills
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Hollis, very stony

Percent of map unit: 5 percent
Landform: Ridges, hills
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Crest, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Leicester, very stony

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

CsD—Chatfield-Charlton complex, 15 to 35 percent slopes, very rocky

Map Unit Setting

National map unit symbol: 2w69k
Elevation: 0 to 1,290 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Chatfield, very stony, and similar soils: 45 percent
Charlton, very stony, and similar soils: 35 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chatfield, Very Stony

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Crest, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Linear, convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 2 inches: fine sandy loam
Bw - 2 to 30 inches: gravelly fine sandy loam
2R - 30 to 40 inches: bedrock

Properties and qualities

Slope: 15 to 35 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 20 to 41 inches to lithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Description of Charlton, Very Stony

Setting

Landform: Hills, ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 4 inches: fine sandy loam
Bw - 4 to 27 inches: gravelly fine sandy loam
C - 27 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 15 to 35 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Leicester, very stony

Percent of map unit: 6 percent
Landform: Hills, ground moraines, depressions, drainageways
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave
Hydric soil rating: Yes

Hollis, very stony

Percent of map unit: 5 percent
Landform: Hills, ridges

Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Crest, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Rock outcrop

Percent of map unit: 5 percent
Landform: Ridges, hills
Hydric soil rating: No

Sutton, very stony

Percent of map unit: 4 percent
Landform: Hills, ground moraines
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

CtC—Chatfield-Hollis-Rock outcrop complex, 0 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2w69g
Elevation: 0 to 1,540 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Chatfield, extremely stony, and similar soils: 39 percent
Hollis, extremely stony, and similar soils: 26 percent
Rock outcrop: 17 percent
Minor components: 18 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chatfield, Extremely Stony

Setting

Landform: Hills, ridges
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Crest, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Linear, convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material

A - 1 to 2 inches: fine sandy loam
Bw - 2 to 30 inches: gravelly fine sandy loam
2R - 30 to 40 inches: bedrock

Properties and qualities

Slope: 0 to 15 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 20 to 41 inches to lithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Description of Hollis, Extremely Stony

Setting

Landform: Hills, ridges
Landform position (two-dimensional): Shoulder, summit, backslope
Landform position (three-dimensional): Crest, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Linear, convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 7 inches: gravelly fine sandy loam
Bw - 7 to 16 inches: gravelly fine sandy loam
2R - 16 to 26 inches: bedrock

Properties and qualities

Slope: 0 to 15 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 8 to 23 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Description of Rock Outcrop

Setting

Parent material: Igneous and metamorphic rock

Properties and qualities

Slope: 0 to 15 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Runoff class: Very high

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Charlton, extremely stony

Percent of map unit: 12 percent
Landform: Ridges, hills
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Sutton, extremely stony

Percent of map unit: 3 percent
Landform: Ground moraines, hills
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Paxton, extremely stony

Percent of map unit: 2 percent
Landform: Drumlins, hills, ground moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Hydric soil rating: No

Leicester, extremely stony

Percent of map unit: 1 percent
Landform: Depressions, drainageways, hills, ground moraines
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope

Down-slope shape: Linear, concave
Across-slope shape: Concave
Hydric soil rating: Yes

CuD—Chatfield-Hollis-Rock outcrop complex, 15 to 35 percent slopes

Map Unit Setting

National map unit symbol: 2w69h
Elevation: 0 to 1,540 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Chatfield, extremely stony, and similar soils: 35 percent
Hollis, extremely stony, and similar soils: 30 percent
Rock outcrop: 20 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chatfield, Extremely Stony

Setting

Landform: Hills, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Crest, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Convex, linear
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 2 inches: fine sandy loam
Bw - 2 to 30 inches: gravelly fine sandy loam
2R - 30 to 40 inches: bedrock

Properties and qualities

Slope: 15 to 35 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 20 to 41 inches to lithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None

Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Description of Hollis, Extremely Stony

Setting

Landform: Hills, ridges
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, nose slope, crest
Down-slope shape: Convex
Across-slope shape: Linear, convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 7 inches: gravelly fine sandy loam
Bw - 7 to 16 inches: gravelly fine sandy loam
2R - 16 to 26 inches: bedrock

Properties and qualities

Slope: 15 to 35 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 8 to 23 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Description of Rock Outcrop

Setting

Landform: Hills, ridges
Parent material: Igneous and metamorphic rock

Typical profile

R - 0 to 79 inches: bedrock

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Available water capacity: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Charlton, extremely stony

Percent of map unit: 7 percent
Landform: Hills, ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Leicester, extremely stony

Percent of map unit: 4 percent
Landform: Ground moraines, depressions, drainageways, hills
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave
Hydric soil rating: Yes

Sutton, extremely stony

Percent of map unit: 2 percent
Landform: Hills, ground moraines
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Paxton, extremely stony

Percent of map unit: 2 percent
Landform: Ground moraines, drumlins, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Hydric soil rating: No

HrF—Hollis-Rock outcrop complex, 35 to 60 percent slopes

Map Unit Setting

National map unit symbol: 2w69q
Elevation: 0 to 1,540 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Hollis, very stony, and similar soils: 60 percent
Rock outcrop: 20 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hollis, Very Stony

Setting

Landform: Hills, ridges
Landform position (two-dimensional): Shoulder, summit, backslope
Landform position (three-dimensional): Nose slope, crest, side slope
Down-slope shape: Convex
Across-slope shape: Linear, convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 7 inches: gravelly fine sandy loam
Bw - 7 to 16 inches: gravelly fine sandy loam
2R - 16 to 26 inches: bedrock

Properties and qualities

Slope: 35 to 60 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 8 to 23 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Description of Rock Outcrop

Setting

Landform: Hills, ridges
Parent material: Igneous and metamorphic rock

Typical profile

R - 0 to 79 inches: bedrock

Properties and qualities

Slope: 35 to 60 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Available water capacity: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Chatfield, very stony

Percent of map unit: 10 percent
Landform: Hills, ridges
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Crest, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Charlton, very stony

Percent of map unit: 5 percent
Landform: Ridges, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Leicester, very stony

Percent of map unit: 4 percent
Landform: Depressions, drainageways, hills, ground moraines
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Concave

Hydric soil rating: Yes

Sutton, very stony

Percent of map unit: 1 percent
Landform: Hills, ground moraines
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

LcA—Leicester loam, 0 to 3 percent slopes, stony

Map Unit Setting

National map unit symbol: bd8v
Elevation: 0 to 1,120 feet
Mean annual precipitation: 46 to 50 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 115 to 215 days
Farmland classification: Not prime farmland

Map Unit Composition

Leicester, poorly drained, and similar soils: 50 percent
Leicester, somewhat poorly drained, and similar soils: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Leicester, Poorly Drained

Setting

Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loamy acid till derived mostly from schist and gneiss

Typical profile

H1 - 0 to 8 inches: loam
H2 - 8 to 26 inches: sandy loam
C - 26 to 60 inches: sandy loam

Properties and qualities

Slope: 0 to 3 percent
Surface area covered with cobbles, stones or boulders: 0.1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: About 0 to 12 inches

Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A/D
Ecological site: F144AY009CT - Wet Till Depressions
Hydric soil rating: Yes

Description of Leicester, Somewhat Poorly Drained

Setting

Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loamy acid till derived mostly from schist and gneiss

Typical profile

H1 - 0 to 8 inches: loam
H2 - 8 to 26 inches: sandy loam
C - 26 to 60 inches: sandy loam

Properties and qualities

Slope: 0 to 3 percent
Surface area covered with cobbles, stones or boulders: 0.1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A/D
Ecological site: F144AY009CT - Wet Till Depressions
Hydric soil rating: No

Minor Components

Sun

Percent of map unit: 7 percent
Landform: Depressions
Hydric soil rating: Yes

Sutton

Percent of map unit: 5 percent
Hydric soil rating: No

Leicester, very stony

Percent of map unit: 3 percent

Landform: Depressions
Hydric soil rating: Yes

LeB—Leicester loam, 2 to 8 percent slopes, very stony

Map Unit Setting

National map unit symbol: bd8x
Elevation: 20 to 1,160 feet
Mean annual precipitation: 46 to 50 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 115 to 215 days
Farmland classification: Not prime farmland

Map Unit Composition

Leicester, somewhat poorly drained, and similar soils: 50 percent
Leicester, poorly drained, and similar soils: 25 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Leicester, Somewhat Poorly Drained

Setting

Landform: Hills, ridges, till plains
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy acid till derived mostly from schist and gneiss

Typical profile

H1 - 0 to 8 inches: loam
H2 - 8 to 26 inches: sandy loam
C - 26 to 60 inches: sandy loam

Properties and qualities

Slope: 2 to 8 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A/D

Ecological site: F144AY009CT - Wet Till Depressions
Hydric soil rating: No

Description of Leicester, Poorly Drained

Setting

Landform: Hills, till plains, ridges
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy acid till derived mostly from schist and gneiss

Typical profile

H1 - 0 to 8 inches: loam
H2 - 8 to 26 inches: sandy loam
C - 26 to 60 inches: sandy loam

Properties and qualities

Slope: 2 to 8 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A/D
Ecological site: F144AY009CT - Wet Till Depressions
Hydric soil rating: Yes

Minor Components

Sun

Percent of map unit: 10 percent
Landform: Depressions
Hydric soil rating: Yes

Sutton

Percent of map unit: 10 percent
Hydric soil rating: No

Charlton

Percent of map unit: 3 percent
Hydric soil rating: No

Leicester, extremely stony

Percent of map unit: 2 percent
Hydric soil rating: No

NcA—Natchaug muck, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2w68z
Elevation: 0 to 1,550 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Natchaug and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Natchaug

Setting

Landform: Depressions, depressions, depressions
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Highly decomposed organic material over loamy glaciofluvial deposits and/or loamy glaciolacustrine deposits and/or loamy till

Typical profile

Oa1 - 0 to 12 inches: muck
Oa2 - 12 to 31 inches: muck
2Cg1 - 31 to 39 inches: silt loam
2Cg2 - 39 to 79 inches: fine sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.01 to 14.17 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 25 percent
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Very high (about 17.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Ecological site: F144AY042NY - Semi-Rich Organic Wetlands

Hydric soil rating: Yes

Minor Components

Catden

Percent of map unit: 8 percent
Landform: Depressions, depressions, depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Limerick

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Sun

Percent of map unit: 4 percent
Landform: Depressions, hills
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Halsey

Percent of map unit: 3 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

PnB—Paxton fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2t2qp
Elevation: 0 to 1,570 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Paxton and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Paxton

Setting

Landform: Drumlins, ground moraines, hills
Landform position (two-dimensional): Backslope, summit, shoulder
Landform position (three-dimensional): Side slope, crest, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 8 inches: fine sandy loam
Bw1 - 8 to 15 inches: fine sandy loam
Bw2 - 15 to 26 inches: fine sandy loam
Cd - 26 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 18 to 39 inches to densic material
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Woodbridge

Percent of map unit: 9 percent
Landform: Hills, drumlins, ground moraines
Landform position (two-dimensional): Backslope, footslope, summit
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Ridgebury

Percent of map unit: 6 percent
Landform: Drainageways, hills, ground moraines, depressions
Landform position (two-dimensional): Backslope, footslope, toeslope
Landform position (three-dimensional): Head slope, base slope, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Charlton

Percent of map unit: 5 percent
Landform: Hills
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

PnC—Paxton fine sandy loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2w66y
Elevation: 0 to 1,320 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Paxton and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Paxton

Setting

Landform: Ground moraines, drumlins, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 8 inches: fine sandy loam
Bw1 - 8 to 15 inches: fine sandy loam
Bw2 - 15 to 26 inches: fine sandy loam
Cd - 26 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)

Available water capacity: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Charlton

Percent of map unit: 7 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Woodbridge

Percent of map unit: 6 percent
Landform: Ground moraines, drumlins, hills
Landform position (two-dimensional): Backslope, footslope, summit
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Ridgebury

Percent of map unit: 2 percent
Landform: Drumlins, hills, ground moraines, depressions, drainageways
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: Yes

PoB—Paxton fine sandy loam, 0 to 8 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2w673
Elevation: 0 to 1,340 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Paxton, very stony, and similar soils: 85 percent
Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Paxton, Very Stony

Setting

Landform: Drumlins, hills, ground moraines
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 10 inches: fine sandy loam
Bw1 - 10 to 17 inches: fine sandy loam
Bw2 - 17 to 28 inches: fine sandy loam
Cd - 28 to 67 inches: gravelly fine sandy loam

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 20 to 43 inches to densic material
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Woodbridge, very stony

Percent of map unit: 8 percent
Landform: Drumlins, hills, ground moraines
Landform position (two-dimensional): Backslope, footslope, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Ridgebury, very stony

Percent of map unit: 4 percent
Landform: Ground moraines, hills, depressions, drainageways, drumlins
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Head slope, base slope

Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Charlton, very stony

Percent of map unit: 3 percent
Landform: Hills
Landform position (two-dimensional): Shoulder, summit, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

PoC—Paxton fine sandy loam, 8 to 15 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2w677
Elevation: 0 to 1,330 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Paxton, very stony, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Paxton, Very Stony

Setting

Landform: Hills, ground moraines, drumlins
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 10 inches: fine sandy loam
Bw1 - 10 to 17 inches: fine sandy loam
Bw2 - 17 to 28 inches: fine sandy loam
Cd - 28 to 67 inches: gravelly fine sandy loam

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 20 to 43 inches to densic material
Drainage class: Well drained

Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Woodbridge, very stony

Percent of map unit: 8 percent
Landform: Ground moraines, drumlins, hills
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Charlton, very stony

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Ridgebury, very stony

Percent of map unit: 2 percent
Landform: Drainageways, hills, ground moraines, depressions, drumlins
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

PoD—Paxton fine sandy loam, 15 to 25 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2w67h
Elevation: 0 to 1,400 feet
Mean annual precipitation: 36 to 71 inches

Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Paxton, very stony, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Paxton, Very Stony

Setting

Landform: Drumlins, hills, ground moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 10 inches: fine sandy loam
Bw1 - 10 to 17 inches: fine sandy loam
Bw2 - 17 to 28 inches: fine sandy loam
Cd - 28 to 67 inches: gravelly fine sandy loam

Properties and qualities

Slope: 15 to 25 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 20 to 43 inches to densic material
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Woodbridge, very stony

Percent of map unit: 5 percent
Landform: Hills, ground moraines, drumlins
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear

Hydric soil rating: No

Charlton, very stony

Percent of map unit: 4 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Ridgebury, very stony

Percent of map unit: 1 percent
Landform: Ground moraines, depressions, drumlins, drainageways, hills
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

RdA—Ridgebury complex, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2xfg1
Elevation: 130 to 940 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Ridgebury, loam, and similar soils: 50 percent
Ridgebury, somewhat poorly drained, and similar soils: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ridgebury, Loam

Setting

Landform: Depressions, drumlins, drainageways, hills, ground moraines
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 6 inches: loam
Bw - 6 to 10 inches: gravelly fine sandy loam

Bg - 10 to 19 inches: gravelly fine sandy loam
Cd - 19 to 66 inches: gravelly loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 15 to 35 inches to densic material
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: D
Ecological site: F144AY009CT - Wet Till Depressions
Hydric soil rating: Yes

Description of Ridgebury, Somewhat Poorly Drained

Setting

Landform: Depressions, drumlins, drainageways, hills, ground moraines
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oa - 0 to 1 inches: highly decomposed plant material
A - 1 to 7 inches: loam
Bw - 7 to 13 inches: loam
Bg - 13 to 21 inches: fine sandy loam
Cd - 21 to 60 inches: gravelly fine sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 15 to 35 inches to densic material
Drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 10 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w

Hydrologic Soil Group: D
Ecological site: F144AY009CT - Wet Till Depressions
Hydric soil rating: No

Minor Components

Sun, very poorly drained

Percent of map unit: 5 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Woodbridge, loam

Percent of map unit: 5 percent
Landform: Drumlins, hills, ground moraines
Landform position (two-dimensional): Footslope, backslope, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Leicester, loam

Percent of map unit: 3 percent
Landform: Drainageways, hills, ground moraines, depressions
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Concave
Hydric soil rating: Yes

Ridgebury, loam, very stony

Percent of map unit: 2 percent
Landform: Hills, ground moraines, depressions, drumlins, drainageways
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

RdB—Ridgebury complex, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2xfg2
Elevation: 10 to 1,180 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Ridgebury, loam, and similar soils: 50 percent
Ridgebury, somewhat poorly drained, and similar soils: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ridgebury, Loam

Setting

Landform: Drainageways, hills, ground moraines, depressions, drumlins
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 6 inches: loam
Bw - 6 to 10 inches: gravelly fine sandy loam
Bg - 10 to 19 inches: gravelly fine sandy loam
Cd - 19 to 66 inches: gravelly loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 15 to 35 inches to densic material
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: D
Ecological site: F144AY009CT - Wet Till Depressions
Hydric soil rating: Yes

Description of Ridgebury, Somewhat Poorly Drained

Setting

Landform: Hills, ground moraines, depressions, drumlins, drainageways
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oa - 0 to 1 inches: highly decomposed plant material
A - 1 to 7 inches: loam
Bw - 7 to 13 inches: loam
Bg - 13 to 21 inches: fine sandy loam
Cd - 21 to 60 inches: gravelly fine sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 15 to 35 inches to densic material
Drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 10 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: D
Ecological site: F144AY009CT - Wet Till Depressions
Hydric soil rating: No

Minor Components

Woodbridge, loam

Percent of map unit: 5 percent
Landform: Ground moraines, drumlins, hills
Landform position (two-dimensional): Backslope, footslope, summit
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Sun, very poorly drained

Percent of map unit: 5 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Leicester, loam

Percent of map unit: 3 percent
Landform: Drainageways, hills, depressions, ground moraines
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Concave
Hydric soil rating: Yes

Paxton

Percent of map unit: 2 percent
Landform: Hills, ground moraines, drumlins

Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Hydric soil rating: No

Sh—Sun loam

Map Unit Setting

National map unit symbol: bd9q
Elevation: 600 to 1,800 feet
Mean annual precipitation: 46 to 50 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 115 to 215 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Sun and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sun

Setting

Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loamy till derived primarily from limestone and sandstone, with a component of schist, shale, or granitic rocks in some areas

Typical profile

H1 - 0 to 9 inches: loam
H2 - 9 to 27 inches: loam
H3 - 27 to 60 inches: gravelly fine sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 15 percent
Available water capacity: Moderate (about 6.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C/D
Ecological site: F144AY039NY - Semi-Rich Wet Till Depressions
Hydric soil rating: Yes

Minor Components

Leicester

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Ridgebury

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Palms

Percent of map unit: 3 percent
Landform: Swamps, marshes
Hydric soil rating: Yes

Sun, stony

Percent of map unit: 2 percent
Landform: Depressions
Hydric soil rating: Yes

SuB—Sutton loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2xffp
Elevation: 10 to 1,250 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 145 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Sutton, loam, and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sutton, Loam

Setting

Landform: Hills, ridges, ground moraines
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave

Across-slope shape: Linear
Parent material: Coarse-loamy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 9 inches: loam
Bw1 - 9 to 17 inches: fine sandy loam
Bw2 - 17 to 30 inches: sandy loam
C1 - 30 to 39 inches: sandy loam
C2 - 39 to 60 inches: sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: About 12 to 27 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: High (about 9.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D
Ecological site: F144AY008CT - Moist Till Uplands
Hydric soil rating: No

Minor Components

Charlton

Percent of map unit: 10 percent
Landform: Ridges, ground moraines, hills
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Leicester, loam

Percent of map unit: 5 percent
Landform: Depressions, drainageways, hills, ground moraines
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Concave
Hydric soil rating: Yes

Woodbridge, loam

Percent of map unit: 5 percent
Landform: Drumlins, hills, ground moraines
Landform position (two-dimensional): Footslope, summit, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex

Across-slope shape: Linear
Hydric soil rating: No

W—Water

Map Unit Setting

National map unit symbol: bd7z
Mean annual precipitation: 46 to 50 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 115 to 215 days
Farmland classification: Not prime farmland

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

WdA—Woodbridge loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2w68t
Elevation: 0 to 770 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 145 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Woodbridge, loam, and similar soils: 86 percent
Minor components: 14 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodbridge, Loam

Setting

Landform: Drumlins, hills, ground moraines
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 6 inches: loam
Bw1 - 6 to 18 inches: gravelly loam
Bw2 - 18 to 29 inches: gravelly loam
Cd - 29 to 65 inches: gravelly loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Ecological site: F144AY037MA - Moist Dense Till Uplands
Hydric soil rating: No

Minor Components

Ridgebury

Percent of map unit: 7 percent
Landform: Ground moraines, depressions, drumlins, drainageways, hills
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Paxton

Percent of map unit: 5 percent
Landform: Drumlins, hills, ground moraines
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Crest
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Sutton

Percent of map unit: 2 percent
Landform: Hills, ground moraines
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

WdB—Woodbridge loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2w688
Elevation: 0 to 1,280 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 145 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Woodbridge, loam, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodbridge, Loam

Setting

Landform: Drumlins, hills, ground moraines
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 6 inches: loam
Bw1 - 6 to 18 inches: gravelly loam
Bw2 - 18 to 29 inches: gravelly loam
Cd - 29 to 65 inches: gravelly loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Ecological site: F144AY037MA - Moist Dense Till Uplands

Hydric soil rating: No

Minor Components

Ridgebury

Percent of map unit: 7 percent
Landform: Drainageways, hills, ground moraines, depressions, drumlins
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Paxton

Percent of map unit: 7 percent
Landform: Ground moraines, drumlins, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Sutton

Percent of map unit: 1 percent
Landform: Hills, ground moraines
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

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Appendix C
Threatened and Endangered Species Documentation

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Long Island Ecological Services Field Office
340 Smith Road
Shirley, NY 11967-2258
Phone: (631) 286-0485 Fax: (631) 286-4003

In Reply Refer To: August 04, 2021
Consultation Code: 05E1LI00-2021-SLI-0822
Event Code: 05E1LI00-2021-E-01931
Project Name: Lake Waccabuc Engineering Study

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2) (c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Long Island Ecological Services Field Office
340 Smith Road
Shirley, NY 11967-2258
(631) 286-0485

This project's location is within the jurisdiction of multiple offices. Expect additional species list documents from the following office, and expect that the species and critical habitats in each document reflect only those that fall in the office's jurisdiction:

New York Ecological Services Field Office
3817 Luker Road
Cortland, NY 13045-9385
(607) 753-9334

Project Summary

Consultation Code: 05E1LI00-2021-SLI-0822
Event Code: 05E1LI00-2021-E-01931
Project Name: Lake Waccabuc Engineering Study
Project Type: WASTEWATER FACILITY
Project Description: Engineering study within the Lake Waccabuc watershed.
Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@41.29325765,-73.58979561072003,14z

Counties: Westchester County, New York

Endangered Species Act Species

There is a total of 2 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Indiana Bat *Myotis sodalis* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/5949	Endangered

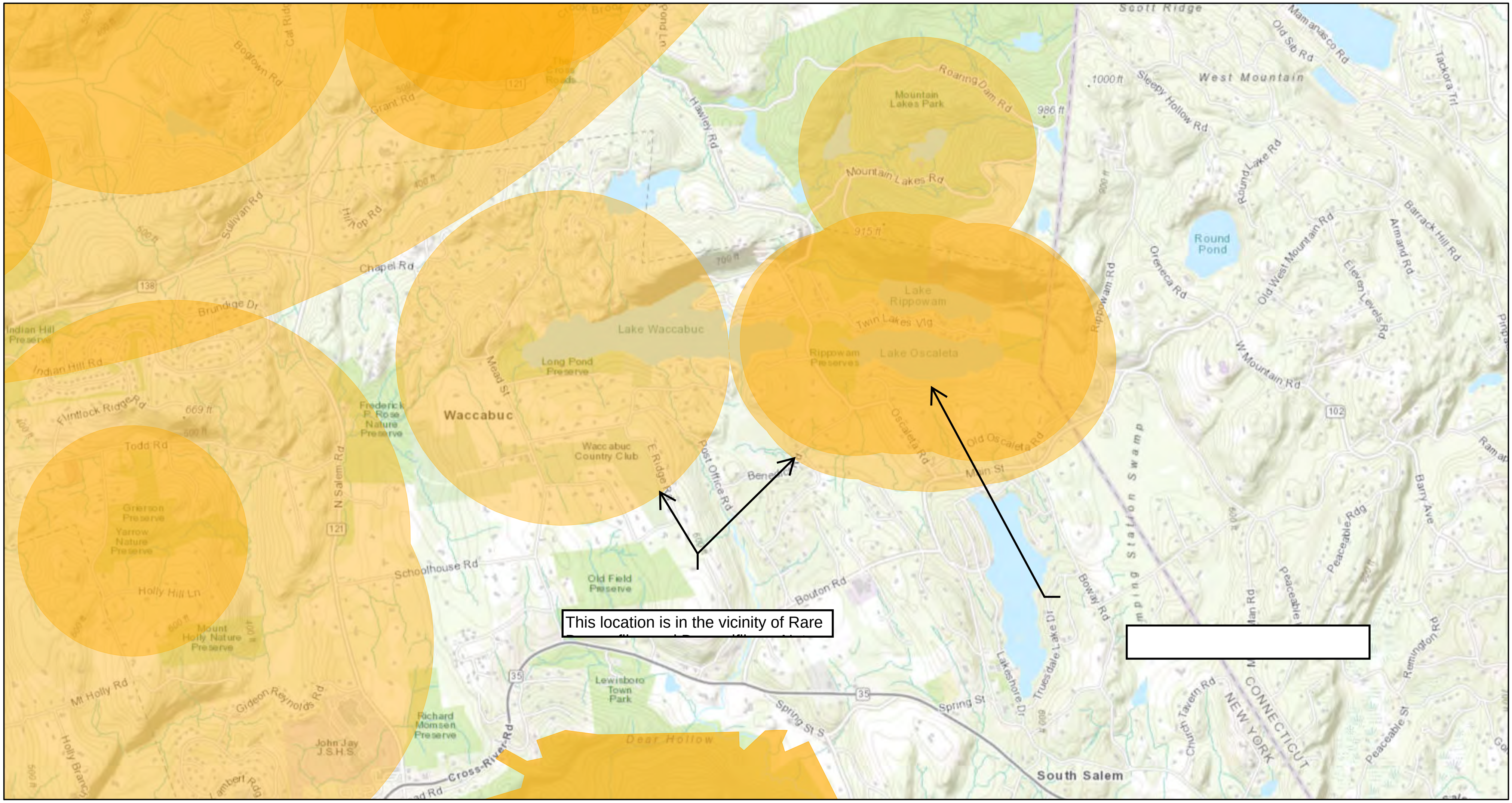
Reptiles

NAME	STATUS
Bog Turtle *Clemmys muhlenbergii* Population: Wherever found, except GA, NC, SC, TN, VA No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6962	Threatened

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

Environmental Resource Mapper - Rare or Protected Species



Legend

- Rare Plants or Animals
- Significant Natural Communities (none in extent)

1:36,112

0 0.33 0.65 1.3 mi

0 0.5 1 2 km

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

NYS Department of Environmental Conservation
Not a legal document

Appendix D
2021 April Community Survey Results

(T) Lewisboro - Lake Waccabuc Water Quality Survey

Wednesday, August 11, 2021

Powered by SurveyMonkey

84

Total Responses

Date Created: Tuesday, March 02, 2021

Complete Responses: 84

Q2: What street do you live on in the Lake Waccabuc Study Area:

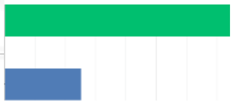
Answered: 83   Skipped: 1

ANSWER CHOICES	RESPONSES	
BENEDICT RD	0.00%	0
CARRIAGE HOUSE RD	0.00%	0
CHAPEL RD	0.00%	0
COVE RD	30.12%	25
EAST RIDGE RD	2.41%	2
HAWLEY RD	1.20%	1
LAKEVIEW RD	6.02%	5
MEAD ST	6.02%	5
OLD POND RD	6.02%	5
OSCALETA RD	4.82%	4
PATRIOTS PASS	0.00%	0
PERCH BAY RD	4.82%	4
POST OFFICE RD	2.41%	2
POWDER HILL RD	0.00%	0
REDCOAT LANE	0.00%	0
SHADY GLEN CT	0.00%	0
SOUTH SHORE DR	19.28%	16
STUART LAKE RD	0.00%	0
TARRY-A-BIT DR	0.00%	0
THE HOOK	6.02%	5
TWIN LAKES RD	2.41%	2
WATERVIEW CT	8.43%	7
Other (please specify)	1.20%	1
Total Respondents: 83		

Q3: Is your home occupied full time or just seasonally?

Answered: 83   Skipped: 1

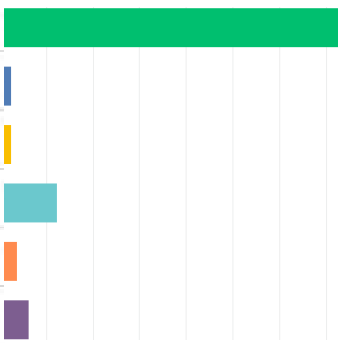
ANSWER CHOICES	RESPONSES	
Full Time	74.70%	62
Seasonally	25.30%	21
TOTAL		83



Q4: What kind of septic system do you currently have?

Answered: 81 Skipped: 3

ANSWER CHOICES	RESPONSES	
Septic tank that discharges to a septic field	72.84%	59
Septic tank that discharges to one or more seepage pits/cesspools	2.47%	2
One or more seepage pits/cesspools without a septic tank	2.47%	2
Holding tank that does not discharge, but needs to be regularly pumped out	12.35%	10
Outhouse	3.70%	3
Other (please specify)	6.17%	5
TOTAL		81



Q5: What year was your original septic system installed?

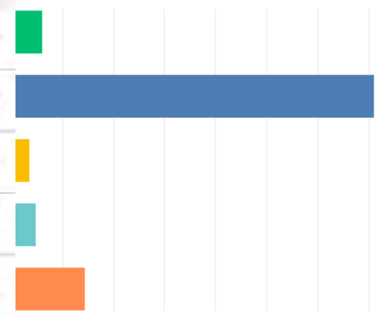
Answered: 77 Skipped: 7

- 2000
- 1977-2004
- No record; in 2018 it was inspected and we were told it was working exceptionally well...only 1 of the 3 fields were being used.
- Not sure.
- 1990
- ?
- Unsure
- N/A
- N/A
- 2010
- 1964
- 1998
- 1946
- 2017
- 1956
- 1985
- 1960
- 1994
- 1927-1950
- Maybe 1930s?
- Septic tank over 50 years old, leaching field/pit updated about 40 years ago
- Repairs done in 2014.
- 2010
- Not sure
- approx. 1960-62
- 1952
- 1960's
- 2019
- 1989
- 1977
- 2020
- N/A
- 1976
- 1957
- 1950
- 1946
- 2008
- No idea. Regularly serviced. No issues.
- 1945
- Failed septic field replaced in early 90s with tank
- 2018
- The back cottage- probably 1930, the other maybe 10-15 years ago a septic tank was installed.
- 2005
- no idea
- 1965
- 1960
- Unsure - maybe 50's or 60's?
- 1994
- 1924?
- Approximate 1980
- Unsure - before 1974
- circa 1920
- 1977
- 1900
- 1986
- 1940s
- 1955
- Before 1957
- 1970
- 2020
- 1975-85
- 1975
- 1998
- 2005
- mid 1950s
- 9/2013
- 1939
- 1973
- No idea. It was here when I bought the house in approx. 1992
- 1980
- 1960
- 2012
- Not sure at all
- 1995
- 2013
- 10/18/93
- Unknown

Q6: How often do you have your septic tank/seepage pit/cesspool/holding tank pumped?

Answered: 83 Skipped: 1

ANSWER CHOICES	RESPONSES	
Multiple times a year	6.02%	5
Once every 1 to 5 years	71.08%	59
As-needed/If issues arise	3.61%	3
Not Applicable	4.82%	4
Other (please specify)	14.46%	12
TOTAL		83



Q7: Has your septic system been repaired/replaced since it was first constructed?

Answered: 78   Skipped: 6

ANSWER CHOICES	RESPONSES	
Yes	41.03%	32
No	58.97%	46
TOTAL		78

Q8: In what year was your septic system repaired/replaced?

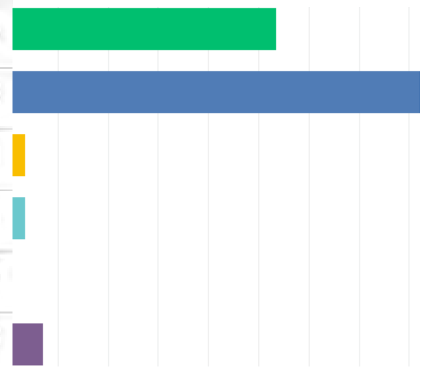
Answered: 29 Skipped: 55

- 2004-2014
- 2010
- 1998---2005
- 1998
- 1991
- 1995
- 1994
- 2011
- 2014
- 2016
- 1970's
- 2013 the leaching field
- 2020
- 2014
- early 90s
- 2018
- 2008
- 2008
- only components - overflow/pump tank, maybe 20 2000?
- 2011 - 2012
- Unsure. Believe it was sometime between 1984 and 1994.
- Summer house replaced with new construction/full-time house 2010, septic field replaced 2015+/-
- 1999
- 2000
- about 10 years ago by previous owner
- 2020
- 2004 & 2020
- 2013
- 2005

Q9: What was repaired and/or replaced? (Check all that apply.)

Answered: 28   Skipped: 56

ANSWER CHOICES	RESPONSES	
Septic tank	53.57%	15
Septic field	82.14%	23
Seepage pit/cesspool	3.57%	1
Holding tank	3.57%	1
Outhouse	0.00%	0
Other	7.14%	2
Total Respondents: 28		



Q10: How close is your septic field/seepage pit/cesspool/outhouse to Lake Waccabuc or a stream?

Answered: 78 Skipped: 6

ANSWER CHOICES	RESPONSES	
Greater than 300 feet	39.74%	31
Less than 300 feet, but greater than 100 feet	34.62%	27
Less than 100 feet	19.23%	15
Not Applicable	6.41%	5
TOTAL		78

Q11: Have you ever seen wastewater reach the ground surface of your property?

Answered: 78   Skipped: 6

ANSWER CHOICES	RESPONSES	
Yes	5.13%	4
No	94.87%	74
TOTAL		78

Q12: Is there lush green grass over the septic field/seepage pit/cesspool, even during dry weather?

Answered: 78   Skipped: 6

ANSWER CHOICES	RESPONSES	
Yes	12.82%	10
No	71.79%	56
Not Applicable	15.38%	12
TOTAL		78

Q13: Do you use fertilizers, pesticides, or herbicides on your property? (check all that apply)

Answered: 78   Skipped: 6

ANSWER CHOICES	RESPONSES	
Fertilizers	17.95%	14
Pesticides	3.85%	3
Herbicides	3.85%	3
None	79.49%	62
Total Respondents: 78		

Q14: Have there been known nutrient/bacteria contaminants in your well water?

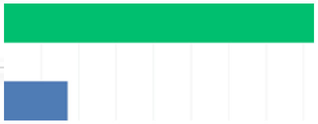
Answered: 78   Skipped: 6

ANSWER CHOICES	RESPONSES	
Yes	5.13%	4
No	71.79%	56
Not Applicable - My household water comes from the lake	17.95%	14
Not Applicable	5.13%	4
TOTAL		78

Q15: Is your household well water treated with chemicals? If so, what kind(s)?

Answered: 76 Skipped: 8

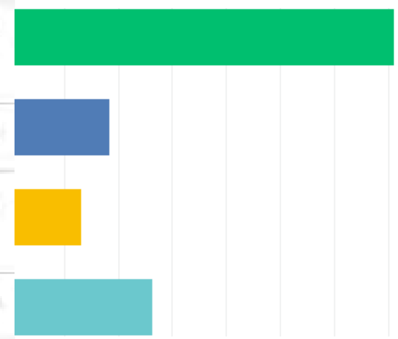
ANSWER CHOICES	RESPONSES	
No	82.89%	63
Yes (please specify)	17.11%	13
Total Respondents: 76		



Q16: Have you observed any of the following? (Check all that apply)

Answered: 76 Skipped: 8

ANSWER CHOICES	RESPONSES	
a. Excessive weed or algae growth in Lake Waccabuc or a stream in the study area	71.05%	54
b. Evidence of soil erosion into Lake Waccabuc or a stream in the study area	18.42%	14
c. One or more sources of pollution that potentially reached Lake Waccabuc or a stream in the study area	13.16%	10
d. None of the above	26.32%	20
Total Respondents: 76		



Appendix E
Wastewater Flow Calculations

LAKE WACCABUC STUDY AREA WASTEWATER FLOW ESTIMATE					
Facility	**Conversion**		**Unit**		**Flow GPD**
Residential	130	GPD/bedroom	947	bedrooms	123,110
Post Office	0.1	GPD/ft^2	1280	ft^2	128
Church	5	GPD/seat	90	seats	450
WCC Beach Club House	25	GPD/person	150	people	3,750
				Total	**127,438**

Appendix F
In Situ Field Monitoring and Laboratory Results

IN SITU FIELD MONITORING RESULTS SUMMARY

In Situ Field Monitoring Results
Lake Waccabuc Engineering Study

	Sample Date	Sample Time	pH		Temperature (^oC)		Turbidity (NTU)		Sp. Conductance (uS/cm)		Redox Potential (mV)		Dissolved Oxygen (mg/L)		Microcystins (ppb)	Anionic Surfactants (ppb)	Clarity (m)
			Surface	12' Depth	Surface	12' Depth	Surface	12' Depth	Surface	12' Depth	Surface	12' Depth	Surface	12' Depth			
LW-1	7/7/2021	8:30	6.80	6.57	25.1	23.9	2.4	2.3	207	209	182.2	33.4	3.2	1.5	5	0.00	0.6
LW-2		9:04	8.94	8.21	26.0	25.6	8.9	6.6	222	225	123.9	138.3	8.8	6.8	5	0.25	0.8
LW-3		9:24	9.03	8.55	26.5	26.0	5.9	5.6	226	227	134.3	143.4	9.3	7.8	5	0.25	1.0
LW-4		9:43	9.31	8.80	26.3	25.6	6.2	6.3	226	228	123.9	136.4	10.9	8.2	0	0.25	0.6
LW-5		10:10	9.31	7.05	26.6	18.4	5.8	0.5	228	222	125.7	168.5	11.1	1.2	5	0.25	1.0
LW-6		10:24	8.96	8.31	25.6	25.2	6.1	5.7	227	227	128.4	142.5	8.6	7.0	5	0.25	0.8
LW-7		12:30	9.30	7.40	23.3	19.7	5.6	1.6	229	227	131.7	173.0	11.1	4.3	5	0.25	1.2
LW-8		13:00	9.30	7.31	28.2	21.0	5.4	2.4	230	230	136.9	82.8	11.1	3.8	0	0.25	1.0
LW-9		13:30	9.42	8.46	27.2	22.1	5.8	2.2	230	229	105.9	136.9	11.7	6.2	5	0.25	1.1
LW-10		13:40	9.29	7.61	28.4	21.4	5.7	2.6	230	226	116.6	150.0	11.1	6.0	5	0.25	1.2
LW-11	7/8/2021	8:15	10.87	8.42	26.7	22.8	5.5	2.8	204	203	152.9	183.5	10.6	6.6	0	0.25	1.4
LW-12		8:40	10.90	8.03	26.7	21.9	5.3	2.5	204	203	162.1	189.6	10.6	5.4	0	0.50	1.2
LW-13		9:00	10.78	7.75	26.8	21.9	5.3	3.0	204	203	168.9	193.7	10.4	4.5	0	0.25	1.4
LW-14		9:15	10.80	7.91	26.8	21.6	5.2	2.6	204	202	169.6	190.8	10.5	5.4	5	0.25	1.2
LW-15		9:30	10.85	7.95	26.7	21.5	5.5	2.5	203	202	168.8	191.1	10.7	5.6	5	0.25	1.2
LW-16		9:40	10.75	7.77	26.5	20.6	5.6	2.2	204	203	172.1	194.2	10.5	4.9	5	0.25	1.4
LW-17		9:50	10.36	7.68	26.5	20.5	6.4	1.8	203	202	177.5	196.0	9.8	4.1	5	0.25	0.9
LW-18		10:00	10.85	7.67	26.9	21.6	5.5	2.3	204	202	169.7	194.3	10.8	5.1	5	-	1.2
LW-19		10:10	10.69	7.48	27.1	21.2	5.8	2.3	204	203	173.1	197.3	10.6	4.8	5	-	1.2
LW-20		10:20	9.81	7.29	26.6	20.8	6.4	1.7	200	201	181.2	180.5	8.9	3.3	5	-	1.0

LABORATORY RESULTS SUMMARY

	Sampling Tier	Sample Date	Sample Time	Color, Apparent (A.P.C.U)	Nitrogen, Ammonia (mg/L)	Nitrogen, Nitrate/Nitrite (mg/L)	Nitrogen, Dissolved Nitrate/Nitrite (mg/L)	Total Nitrogen (mg/L)	Dissolved Nitrogen (mg/L)	Nitrogen, Total Kjeldahl (mg/L)
LW-1	1	7/7/2021	8:30	23	0.114	0.42	0.32	1.20	1.10	0.81
LW-2	1		9:04	26	0.041	0.075	0.034	1.20	0.61	1.15
LW-3	1		9:24	20	0.625	0.072	0.023	0.96	0.48	0.96
LW-4	1		9:43	22	0.041	0.078	0.026	1.10	0.62	1.12
LW-5	1		10:10	17	0.045	0.084	0.026	1.00	0.50	1.04
LW-6	1		10:24	27	0.158	0.066	0.024	1.20	0.58	1.19
LW-7*	1		12:30	18	0.07	0.063	0.023	1.10	0.71	1.14
LW-8**	1		13:00	15	0.103	0.064	0.023	1.10	0.64	1.08
LW-9	1		13:30	22	0.062	0.067	0.023	1.00	0.60	1.04
LW-10	1		13:40	21	0.099	0.06	0.023	0.99	0.54	0.99
LW-11	1	7/8/2021	8:15	27	0.098	0.034	0.023	1.10	2.80	1.14
LW-12	2		8:40	26	-	0.032	0.023	1.00	1.40	1.02
LW-13	2		9:00	28	-	0.027	0.023	1.20	1.40	1.17
LW-14	2		9:15	22	-	0.023	0.023	1.30	1.10	1.26
LW-15	3		9:30	-	-	0.023	0.023	1.90	1.50	1.91
LW-16	3		9:40	-	-	0.027	0.023	3.20	1.60	3.22

*MS/MSD Location

**DUP Location

	Sampling Tier	Sample Date	Sample Time	Nitrogen, Soluble Kjeldahl (mg/L)	Nitrogen, Soluble Kjeldahl (ug/L)	Phosphorus, Total (ug/L)	Phosphorus, Soluble (ug/L)	Chlorophyll A (mg/m^3)	Boron mg/L	Total Hardness mg/L
LW-1	1	7/7/2021	8:30	0.77	770	37	12	42.3	0.03	54.3
LW-2	1		9:04	0.61	610	43	9	42.1	0.03	67.5
LW-3	1		9:24	0.45	450	28	7	34.8	0.03	61.0
LW-4	1		9:43	0.62	620	30	9	34.6	0.03	63.0
LW-5	1		10:10	0.50	500	32	9	21.3	0.03	64.8
LW-6	1		10:24	0.58	580	38	9	36.2	0.03	59.9
LW-7*	1		12:30	0.71	710	25	6	27.6	0.03	62.5
LW-8**	1		13:00	0.64	640	27	10	27.8	0.03	61.9
LW-9	1		13:30	0.60	600	33	10	29.8	0.03	66.2
LW-10	1		13:40	0.54	540	27	11	21.3	0.03	59.6
LW-11	1	7/8/2021	8:15	1.00	1000	37	14	30.9	0.03	60.1
LW-12	2		8:40	1.40	1400	29	14	28.6	-	-
LW-13	2		9:00	1.40	1400	39	11	33.7	-	-
LW-14	2		9:15	1.10	1100	32	10	27.2	-	-
LW-15	3		9:30	1.50	1500	33	24	-	-	-
LW-16	3		9:40	1.60	1600	32	19	-	-	-

*MS/MSD Location

**DUP Location

LABORATORY REPORTS

```
JOB: L2136469     REPORT STYLE: Data Usability Report
0010: Alpha Analytical Report Cover Page - OK
0015: Sample Cross Reference Summary - OK
0060: Case Narrative - OK
1180: Inorganics Cover Page - OK
1200: Wet Chemistry Sample Results - OK
1210: Wet Chemistry Method Blank Report - OK
1220: Wet Chemistry LCS Report - OK
1240: Wet Chemistry Matrix Spike Report - OK
1250: Wet Chemistry Duplicate Report - OK
5100: Sample Receipt & Container Information Report - OK
5200: Glossary - OK
5400: References - OK
----------------------------------------------------------
No results found for sample L2136469-01 for product SNITROGEN
No results found for sample L2136469-02 for product SNITROGEN
No results found for sample L2136469-03 for product SNITROGEN
No results found for sample L2136469-04 for product SNITROGEN
No results found for sample L2136469-05 for product SNITROGEN
No results found for sample L2136469-06 for product SNITROGEN
No results found for sample L2136469-07 for product SNITROGEN
No results found for sample L2136469-08 for product SNITROGEN
No results found for sample L2136469-09 for product SNITROGEN
No results found for sample L2136469-10 for product SNITROGEN
No results found for sample L2136469-11 for product SNITROGEN
```

ANALYTICAL REPORT

Lab Number:	L2136469
Client:	Barton & Loguidice 11 Centre Park Drive Rochester, NY 14614
ATTN:	Dave Hanny
Phone:	(585) 325-7190
Project Name:	LAKE WACCABUC FIELD SAMPLING
Project Number:	2390.001.001
Report Date:	07/30/21

Certifications & Approvals: MA (M-MA086), NH NELAP (2064), CT (PH-0574), IL (200077), ME (MA00086), MD (348), NJ (MA935), NY (11148), NC (25700/666), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #P330-17-00196).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: LAKE WACCABUC FIELD SAMPLING
Project Number: 2390.001.001

Lab Number: L2136469
Report Date: 07/30/21

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L2136469-01	LW-1	WASTEWATER	LEWISBORO, NY	07/07/21 08:30	07/07/21
L2136469-02	LW-2	WASTEWATER	LEWISBORO, NY	07/07/21 09:09	07/07/21
L2136469-03	LW-3	WASTEWATER	LEWISBORO, NY	07/07/21 09:24	07/07/21
L2136469-04	LW-4	WASTEWATER	LEWISBORO, NY	07/07/21 09:43	07/07/21
L2136469-05	LW-5	WASTEWATER	LEWISBORO, NY	07/07/21 10:10	07/07/21
L2136469-06	LW-6	WASTEWATER	LEWISBORO, NY	07/07/21 10:24	07/07/21
L2136469-07	LW-7	WASTEWATER	LEWISBORO, NY	07/07/21 12:30	07/07/21
L2136469-08	LW-8	WASTEWATER	LEWISBORO, NY	07/07/21 13:00	07/07/21
L2136469-09	LW-9	WASTEWATER	LEWISBORO, NY	07/07/21 13:30	07/07/21
L2136469-10	LW-10	WASTEWATER	LEWISBORO, NY	07/07/21 13:40	07/07/21
L2136469-11	DUP	WASTEWATER	LEWISBORO, NY	07/07/21 13:00	07/07/21

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively.

When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances, the specific failure is not narrated but noted in the associated QC Outlier Summary Report, located directly after the Case Narrative. QC information is also incorporated in the Data Usability Assessment table (Format 11) of our Data Merger tool, where it can be reviewed in conjunction with the sample result, associated regulatory criteria and any associated data usability implications.

Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

HOLD POLICY - For samples submitted on hold, Alpha's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Alpha Project Manager and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Project Management at 800-624-9220 with any questions.

Project Name:	LAKE WACCABUC FIELD SAMPLING	**Lab Number:**	L2136469
Project Number:	2390.001.001	**Report Date:**	07/30/21

Case Narrative (continued)

Report Submission

July 30, 2021: This is a preliminary report.

All non-detect (ND) or estimated concentrations (J-qualified) have been quantitated to the limit noted in the MDL column.

The analysis of Fecal Coliform was subcontracted. A copy of the laboratory report is included as an addendum. Please note: This data is only available in PDF format and is not available on Data Merger.

Sample Receipt

The analyses performed were specified by the client and project manager.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature: Jennifer L Clements

Title: Technical Director/Representative Date: 07/30/21

INORGANICS
&
MISCELLANEOUS

Project Name: LAKE WACCABUC FIELD SAMPLING | **Lab Number:** L2136469
Project Number: 2390.001.001 | **Report Date:** 07/30/21

SAMPLE RESULTS

Lab ID: L2136469-01 | Date Collected: 07/07/21 08:30
Client ID: LW-1 | Date Received: 07/07/21
Sample Location: LEWISBORO, NY | Field Prep: Not Specified

Sample Depth:
Matrix: Wastewater

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Color, Apparent	23		A.P.C.U.	5.0	5.0	1	-	07/08/21 17:52	121,2120B	AS
Nitrogen, Ammonia	0.114		mg/l	0.075	0.024	1	07/27/21 02:00	07/27/21 20:28	121,4500NH3-BH	AT
Nitrogen, Nitrate/Nitrite	0.42		mg/l	0.10	0.023	1	-	07/27/21 10:24	44,353.2	EL
Nitrogen, Dissolved Nitrate/Nitrite	0.32		mg/l	0.10	0.023	1	-	07/28/21 02:53	121,4500NO3-F	MR
Total Nitrogen	1.2		mg/l	0.30	0.30	1	-	07/29/21 16:28	107,-	JO
Nitrogen, Total Kjeldahl	0.814		mg/l	0.300	0.066	1	07/27/21 10:35	07/28/21 20:15	121,4500NH3-H	AT
Nitrogen, Soluble Kjeldahl	0.77		mg/l	0.50	0.066	1	07/26/21 18:30	07/28/21 19:36	121,4500NH3-H	AT
Phosphorus, Total	0.037		mg/l	0.010	0.004	1	07/26/21 08:20	07/26/21 13:19	121,4500P-E	SD
Phosphorus, Soluble	0.012		mg/l	0.010	0.004	1	07/19/21 13:55	07/20/21 11:54	121,4500P-E	SD
Chlorophyll A	42.3		mg/m3	2.00	NA	1	07/08/21 07:50	07/09/21 09:15	121,10200H	MT

Project Name: LAKE WACCABUC FIELD SAMPLING
Lab Number: L2136469
Project Number: 2390.001.001
Report Date: 07/30/21

SAMPLE RESULTS

Lab ID: L2136469-02
Date Collected: 07/07/21 09:09
Client ID: LW-2
Date Received: 07/07/21
Sample Location: LEWISBORO, NY
Field Prep: Not Specified

Sample Depth:
Matrix: Wastewater

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Color, Apparent	26		A.P.C.U.	5.0	5.0	1	-	07/08/21 17:52	121,2120B	AS
Nitrogen, Ammonia	0.041	J	mg/l	0.075	0.024	1	07/27/21 02:00	07/27/21 20:43	121,4500NH3-BH	AT
Nitrogen, Nitrate/Nitrite	0.075	J	mg/l	0.10	0.023	1	-	07/27/21 10:26	44,353.2	EL
Nitrogen, Dissolved Nitrate/Nitrite	0.034	J	mg/l	0.10	0.023	1	-	07/28/21 02:55	121,4500NO3-F	MR
Total Nitrogen	1.2		mg/l	0.30	0.30	1	-	07/29/21 16:28	107,-	JO
Nitrogen, Total Kjeldahl	1.15		mg/l	0.300	0.066	1	07/27/21 10:35	07/28/21 20:16	121,4500NH3-H	AT
Nitrogen, Soluble Kjeldahl	0.61		mg/l	0.50	0.066	1	07/26/21 18:30	07/28/21 19:37	121,4500NH3-H	AT
Phosphorus, Total	0.043		mg/l	0.010	0.004	1	07/26/21 08:20	07/26/21 13:20	121,4500P-E	SD
Phosphorus, Soluble	0.009	J	mg/l	0.010	0.004	1	07/19/21 13:55	07/20/21 11:55	121,4500P-E	SD
Chlorophyll A	41.2		mg/m3	2.00	NA	1	07/08/21 07:50	07/09/21 09:15	121,10200H	MT

Project Name: LAKE WACCABUC FIELD SAMPLING
Project Number: 2390.001.001

Lab Number: L2136469
Report Date: 07/30/21

SAMPLE RESULTS

Lab ID: L2136469-03
Client ID: LW-3
Sample Location: LEWISBORO, NY

Date Collected: 07/07/21 09:24
Date Received: 07/07/21
Field Prep: Not Specified

Sample Depth:
Matrix: Wastewater

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Color, Apparent	20		A.P.C.U.	5.0	5.0	1	-	07/08/21 17:52	121,2120B	AS
Nitrogen, Ammonia	0.625		mg/l	0.075	0.024	1	07/27/21 02:00	07/27/21 20:30	121,4500NH3-BH	AT
Nitrogen, Nitrate/Nitrite	0.072	J	mg/l	0.10	0.023	1	-	07/27/21 10:27	44,353.2	EL
Nitrogen, Dissolved Nitrate/Nitrite	ND		mg/l	0.10	0.023	1	-	07/28/21 02:56	121,4500NO3-F	MR
Total Nitrogen	0.96		mg/l	0.30	0.30	1	-	07/29/21 16:28	107,-	JO
Nitrogen, Total Kjeldahl	0.960		mg/l	0.300	0.066	1	07/27/21 10:35	07/28/21 20:17	121,4500NH3-H	AT
Nitrogen, Soluble Kjeldahl	0.45	J	mg/l	0.50	0.066	1	07/26/21 18:30	07/28/21 19:38	121,4500NH3-H	AT
Phosphorus, Total	0.028		mg/l	0.010	0.004	1	07/26/21 08:20	07/26/21 13:21	121,4500P-E	SD
Phosphorus, Soluble	0.007	J	mg/l	0.010	0.004	1	07/19/21 13:55	07/20/21 11:57	121,4500P-E	SD
Chlorophyll A	34.8		mg/m3	2.00	NA	1	07/08/21 07:50	07/09/21 09:15	121,10200H	MT

Project Name: LAKE WACCABUC FIELD SAMPLING
Lab Number: L2136469
Project Number: 2390.001.001
Report Date: 07/30/21

SAMPLE RESULTS

Lab ID: L2136469-04
Client ID: LW-4
Sample Location: LEWISBORO, NY

Date Collected: 07/07/21 09:43
Date Received: 07/07/21
Field Prep: Not Specified

Sample Depth:
Matrix: Wastewater

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Color, Apparent	22		A.P.C.U.	5.0	5.0	1	-	07/08/21 17:52	121,2120B	AS
Nitrogen, Ammonia	0.041	J	mg/l	0.075	0.024	1	07/27/21 02:00	07/27/21 20:31	121,4500NH3-BH	AT
Nitrogen, Nitrate/Nitrite	0.078	J	mg/l	0.10	0.023	1	-	07/27/21 10:32	44,353.2	EL
Nitrogen, Dissolved Nitrate/Nitrite	0.026	J	mg/l	0.10	0.023	1	-	07/28/21 02:57	121,4500NO3-F	MR
Total Nitrogen	1.1		mg/l	0.30	0.30	1	-	07/29/21 16:28	107,-	JO
Nitrogen, Total Kjeldahl	1.12		mg/l	0.300	0.066	1	07/27/21 10:35	07/28/21 20:21	121,4500NH3-H	AT
Nitrogen, Soluble Kjeldahl	0.62		mg/l	0.50	0.066	1	07/26/21 18:30	07/28/21 19:39	121,4500NH3-H	AT
Phosphorus, Total	0.030		mg/l	0.010	0.004	1	07/26/21 08:20	07/26/21 13:23	121,4500P-E	SD
Phosphorus, Soluble	0.009	J	mg/l	0.010	0.004	1	07/19/21 13:55	07/20/21 11:58	121,4500P-E	SD
Chlorophyll A	34.6		mg/m3	2.00	NA	1	07/08/21 07:50	07/09/21 09:15	121,10200H	MT

Project Name: LAKE WACCABUC FIELD SAMPLING

Project Number: 2390.001.001

Lab Number: L2136469

Report Date: 07/30/21

SAMPLE RESULTS

Lab ID: L2136469-05

Client ID: LW-5

Sample Location: LEWISBORO, NY

Date Collected: 07/07/21 10:10

Date Received: 07/07/21

Field Prep: Not Specified

Sample Depth:

Matrix: Wastewater

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Color, Apparent	17		A.P.C.U.	5.0	5.0	1	-	07/08/21 17:52	121,2120B	AS
Nitrogen, Ammonia	0.045	J	mg/l	0.075	0.024	1	07/27/21 02:00	07/27/21 20:32	121,4500NH3-BH	AT
Nitrogen, Nitrate/Nitrite	0.084	J	mg/l	0.10	0.023	1	-	07/27/21 10:34	44,353.2	EL
Nitrogen, Dissolved Nitrate/Nitrite	0.026	J	mg/l	0.10	0.023	1	-	07/28/21 02:59	121,4500NO3-F	MR
Total Nitrogen	1.0		mg/l	0.30	0.30	1	-	07/29/21 16:28	107,-	JO
Nitrogen, Total Kjeldahl	1.04		mg/l	0.300	0.066	1	07/27/21 10:35	07/28/21 20:22	121,4500NH3-H	AT
Nitrogen, Soluble Kjeldahl	0.50		mg/l	0.50	0.066	1	07/26/21 18:30	07/28/21 19:39	121,4500NH3-H	AT
Phosphorus, Total	0.032		mg/l	0.010	0.004	1	07/26/21 08:20	07/26/21 13:24	121,4500P-E	SD
Phosphorus, Soluble	0.009	J	mg/l	0.010	0.004	1	07/19/21 13:55	07/20/21 11:59	121,4500P-E	SD
Chlorophyll A	21.3		mg/m3	2.00	NA	1	07/08/21 07:50	07/09/21 09:15	121,10200H	MT

Project Name: LAKE WACCABUC FIELD SAMPLING
Lab Number: L2136469
Project Number: 2390.001.001
Report Date: 07/30/21

SAMPLE RESULTS

Lab ID: L2136469-06
Client ID: LW-6
Sample Location: LEWISBORO, NY
Date Collected: 07/07/21 10:24
Date Received: 07/07/21
Field Prep: Not Specified

Sample Depth:
Matrix: Wastewater

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Color, Apparent	27		A.P.C.U.	5.0	5.0	1	-	07/08/21 17:52	121,2120B	AS
Nitrogen, Ammonia	0.158		mg/l	0.075	0.024	1	07/27/21 02:00	07/27/21 20:33	121,4500NH3-BH	AT
Nitrogen, Nitrate/Nitrite	0.066	J	mg/l	0.10	0.023	1	-	07/27/21 10:35	44,353.2	EL
Nitrogen, Dissolved Nitrate/Nitrite	0.024	J	mg/l	0.10	0.023	1	-	07/28/21 03:00	121,4500NO3-F	MR
Total Nitrogen	1.2		mg/l	0.30	0.30	1	-	07/29/21 16:28	107,-	JO
Nitrogen, Total Kjeldahl	1.19		mg/l	0.300	0.066	1	07/27/21 10:35	07/28/21 20:23	121,4500NH3-H	AT
Nitrogen, Soluble Kjeldahl	0.58		mg/l	0.50	0.066	1	07/26/21 18:30	07/28/21 19:40	121,4500NH3-H	AT
Phosphorus, Total	0.038		mg/l	0.010	0.004	1	07/26/21 08:20	07/26/21 13:27	121,4500P-E	SD
Phosphorus, Soluble	0.009	J	mg/l	0.010	0.004	1	07/19/21 13:55	07/20/21 12:00	121,4500P-E	SD
Chlorophyll A	36.2		mg/m3	2.00	NA	1	07/08/21 07:50	07/09/21 09:15	121,10200H	MT

Project Name: LAKE WACCABUC FIELD SAMPLING
Lab Number: L2136469
Project Number: 2390.001.001
Report Date: 07/30/21

SAMPLE RESULTS

Lab ID: L2136469-07
Client ID: LW-7
Sample Location: LEWISBORO, NY
Date Collected: 07/07/21 12:30
Date Received: 07/07/21
Field Prep: Not Specified

Sample Depth:
Matrix: Wastewater

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Color, Apparent	18		A.P.C.U.	5.0	5.0	1	-	07/08/21 17:52	121,2120B	AS
Nitrogen, Ammonia	0.070	J	mg/l	0.075	0.024	1	07/27/21 02:00	07/27/21 20:34	121,4500NH3-BH	AT
Nitrogen, Nitrate/Nitrite	0.063	J	mg/l	0.10	0.023	1	-	07/27/21 10:36	44,353.2	EL
Nitrogen, Dissolved Nitrate/Nitrite	ND		mg/l	0.10	0.023	1	-	07/28/21 03:05	121,4500NO3-F	MR
Total Nitrogen	1.1		mg/l	0.30	0.30	1	-	07/29/21 16:28	107,-	JO
Nitrogen, Total Kjeldahl	1.14		mg/l	0.300	0.066	1	07/27/21 10:35	07/28/21 20:24	121,4500NH3-H	AT
Nitrogen, Soluble Kjeldahl	0.71		mg/l	0.50	0.066	1	07/26/21 18:30	07/28/21 19:41	121,4500NH3-H	AT
Phosphorus, Total	0.025		mg/l	0.010	0.004	1	07/26/21 08:20	07/26/21 13:28	121,4500P-E	SD
Phosphorus, Soluble	0.006	J	mg/l	0.010	0.004	1	07/19/21 13:55	07/20/21 12:01	121,4500P-E	SD
Chlorophyll A	27.6		mg/m3	2.00	NA	1	07/08/21 07:50	07/09/21 09:15	121,10200H	MT

Project Name: LAKE WACCABUC FIELD SAMPLING
Project Number: 2390.001.001

Lab Number: L2136469
Report Date: 07/30/21

SAMPLE RESULTS

Lab ID: L2136469-08
Client ID: LW-8
Sample Location: LEWISBORO, NY

Date Collected: 07/07/21 13:00
Date Received: 07/07/21
Field Prep: Not Specified

Sample Depth:
Matrix: Wastewater

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Color, Apparent	15		A.P.C.U.	5.0	5.0	1	-	07/08/21 17:52	121,2120B	AS
Nitrogen, Ammonia	0.103		mg/l	0.075	0.024	1	07/27/21 02:00	07/27/21 20:39	121,4500NH3-BH	AT
Nitrogen, Nitrate/Nitrite	0.064	J	mg/l	0.10	0.023	1	-	07/27/21 10:40	44,353.2	EL
Nitrogen, Dissolved Nitrate/Nitrite	ND		mg/l	0.10	0.023	1	-	07/28/21 03:09	121,4500NO3-F	MR
Total Nitrogen	1.1		mg/l	0.30	0.30	1	-	07/29/21 16:28	107,-	JO
Nitrogen, Total Kjeldahl	1.08		mg/l	0.300	0.066	1	07/27/21 10:35	07/28/21 20:27	121,4500NH3-H	AT
Nitrogen, Soluble Kjeldahl	0.64		mg/l	0.50	0.066	1	07/26/21 18:30	07/28/21 19:47	121,4500NH3-H	AT
Phosphorus, Total	0.027		mg/l	0.010	0.004	1	07/26/21 08:20	07/26/21 13:32	121,4500P-E	SD
Phosphorus, Soluble	0.010		mg/l	0.010	0.004	1	07/19/21 13:55	07/20/21 12:04	121,4500P-E	SD
Chlorophyll A	27.8		mg/m3	2.00	NA	1	07/08/21 07:50	07/09/21 09:15	121,10200H	MT

Project Name: LAKE WACCABUC FIELD SAMPLING
Lab Number: L2136469
Project Number: 2390.001.001
Report Date: 07/30/21

SAMPLE RESULTS

Lab ID: L2136469-09
Date Collected: 07/07/21 13:30
Client ID: LW-9
Date Received: 07/07/21
Sample Location: LEWISBORO, NY
Field Prep: Not Specified

Sample Depth:
Matrix: Wastewater

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Color, Apparent	22		A.P.C.U.	5.0	5.0	1	-	07/08/21 17:52	121,2120B	AS
Nitrogen, Ammonia	0.062	J	mg/l	0.075	0.024	1	07/27/21 02:00	07/27/21 20:40	121,4500NH3-BH	AT
Nitrogen, Nitrate/Nitrite	0.067	J	mg/l	0.10	0.023	1	-	07/27/21 10:41	44,353.2	EL
Nitrogen, Dissolved Nitrate/Nitrite	ND		mg/l	0.10	0.023	1	-	07/28/21 03:10	121,4500NO3-F	MR
Total Nitrogen	1.0		mg/l	0.30	0.30	1	-	07/29/21 16:28	107,-	JO
Nitrogen, Total Kjeldahl	1.04		mg/l	0.300	0.066	1	07/27/21 10:35	07/28/21 20:28	121,4500NH3-H	AT
Nitrogen, Soluble Kjeldahl	0.60		mg/l	0.50	0.066	1	07/26/21 18:30	07/28/21 19:48	121,4500NH3-H	AT
Phosphorus, Total	0.033		mg/l	0.010	0.004	1	07/26/21 08:20	07/26/21 13:33	121,4500P-E	SD
Phosphorus, Soluble	0.010		mg/l	0.010	0.004	1	07/19/21 13:55	07/20/21 12:07	121,4500P-E	SD
Chlorophyll A	29.8		mg/m3	2.00	NA	1	07/08/21 07:50	07/09/21 09:15	121,10200H	MT

Project Name: LAKE WACCABUC FIELD SAMPLING | **Lab Number:** L2136469
Project Number: 2390.001.001 | **Report Date:** 07/30/21

SAMPLE RESULTS

Lab ID: L2136469-10 | Date Collected: 07/07/21 13:40
Client ID: LW-10 | Date Received: 07/07/21
Sample Location: LEWISBORO, NY | Field Prep: Not Specified

Sample Depth:
Matrix: Wastewater

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Color, Apparent	21		A.P.C.U.	5.0	5.0	1	-	07/08/21 17:52	121,2120B	AS
Nitrogen, Ammonia	0.099		mg/l	0.075	0.024	1	07/27/21 02:00	07/27/21 20:41	121,4500NH3-BH	AT
Nitrogen, Nitrate/Nitrite	0.060	J	mg/l	0.10	0.023	1	-	07/27/21 10:43	44,353.2	EL
Nitrogen, Dissolved Nitrate/Nitrite	0.023	J	mg/l	0.10	0.023	1	-	07/28/21 03:12	121,4500NO3-F	MR
Total Nitrogen	0.99		mg/l	0.30	0.30	1	-	07/29/21 16:28	107,-	JO
Nitrogen, Total Kjeldahl	0.991		mg/l	0.300	0.066	1	07/27/21 10:35	07/28/21 20:29	121,4500NH3-H	AT
Nitrogen, Soluble Kjeldahl	0.54		mg/l	0.50	0.066	1	07/26/21 18:30	07/28/21 19:49	121,4500NH3-H	AT
Phosphorus, Total	0.027		mg/l	0.010	0.004	1	07/26/21 08:20	07/26/21 13:34	121,4500P-E	SD
Phosphorus, Soluble	0.011		mg/l	0.010	0.004	1	07/19/21 13:55	07/20/21 12:08	121,4500P-E	SD
Chlorophyll A	21.3		mg/m3	2.00	NA	1	07/08/21 07:50	07/09/21 09:15	121,10200H	MT

Project Name: LAKE WACCABUC FIELD SAMPLING
Project Number: 2390.001.001

Lab Number: L2136469
Report Date: 07/30/21

SAMPLE RESULTS

Lab ID: L2136469-11
Client ID: DUP
Sample Location: LEWISBORO, NY

Date Collected: 07/07/21 13:00
Date Received: 07/07/21
Field Prep: Not Specified

Sample Depth:
Matrix: Wastewater

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Color, Apparent	20		A.P.C.U.	5.0	5.0	1	-	07/08/21 17:52	121,2120B	AS
Nitrogen, Ammonia	0.036	J	mg/l	0.075	0.024	1	07/27/21 02:00	07/27/21 20:42	121,4500NH3-BH	AT
Nitrogen, Nitrate/Nitrite	0.076	J	mg/l	0.10	0.023	1	-	07/27/21 10:50	44,353.2	EL
Nitrogen, Dissolved Nitrate/Nitrite	0.025	J	mg/l	0.10	0.023	1	-	07/28/21 03:13	121,4500NO3-F	MR
Total Nitrogen	0.99		mg/l	0.30	0.30	1	-	07/29/21 16:28	107,-	JO
Nitrogen, Total Kjeldahl	0.992		mg/l	0.300	0.066	1	07/27/21 10:35	07/28/21 20:30	121,4500NH3-H	AT
Nitrogen, Soluble Kjeldahl	0.62		mg/l	0.50	0.066	1	07/26/21 18:30	07/28/21 19:50	121,4500NH3-H	AT
Phosphorus, Total	0.030		mg/l	0.010	0.004	1	07/26/21 09:25	07/26/21 15:53	121,4500P-E	SD
Phosphorus, Soluble	0.007	J	mg/l	0.010	0.004	1	07/19/21 13:55	07/20/21 12:09	121,4500P-E	SD
Chlorophyll A	22.1		mg/m3	2.00	NA	1	07/08/21 07:50	07/09/21 09:15	121,10200H	MT

Project Name: LAKE WACCABUC FIELD SAMPLING
Project Number: 2390.001.001
Lab Number: L2136469
Report Date: 07/30/21

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab for sample(s): 01-11 Batch: WG1521708-1										
Chlorophyll A	ND		mg/m3	2.00	NA	1	07/08/21 07:50	07/09/21 09:15	121,10200H	MT
General Chemistry - Westborough Lab for sample(s): 01-11 Batch: WG1525414-1										
Phosphorus, Soluble	ND		mg/l	0.010	0.004	1	07/19/21 13:55	07/20/21 11:49	121,4500P-E	SD
General Chemistry - Westborough Lab for sample(s): 01-10 Batch: WG1527396-1										
Nitrogen, Nitrate/Nitrite	0.049	J	mg/l	0.10	0.023	1	-	07/27/21 10:22	44,353.2	EL
General Chemistry - Westborough Lab for sample(s): 11 Batch: WG1527397-1										
Nitrogen, Nitrate/Nitrite	0.025	J	mg/l	0.10	0.023	1	-	07/27/21 10:44	44,353.2	EL
General Chemistry - Westborough Lab for sample(s): 01-10 Batch: WG1527798-1										
Phosphorus, Total	ND		mg/l	0.010	0.004	1	07/26/21 08:20	07/26/21 13:17	121,4500P-E	SD
General Chemistry - Westborough Lab for sample(s): 11 Batch: WG1527829-1										
Phosphorus, Total	ND		mg/l	0.010	0.004	1	07/26/21 09:25	07/26/21 15:51	121,4500P-E	SD
General Chemistry - Westborough Lab for sample(s): 01-11 Batch: WG1528011-1										
Nitrogen, Soluble Kjeldahl	0.084	J	mg/l	0.50	0.022	1	07/26/21 18:30	07/28/21 19:33	121,4500NH3-H	AT
General Chemistry - Westborough Lab for sample(s): 01-11 Batch: WG1528102-1										
Nitrogen, Ammonia	ND		mg/l	0.075	0.024	1	07/27/21 02:00	07/27/21 20:14	121,4500NH3-BH	AT
General Chemistry - Westborough Lab for sample(s): 01-11 Batch: WG1528348-1										
Nitrogen, Total Kjeldahl	ND		mg/l	0.300	0.022	1	07/27/21 10:35	07/28/21 20:09	121,4500NH3-H	AT
General Chemistry - Westborough Lab for sample(s): 01-11 Batch: WG1528636-1										
Nitrogen, Dissolved Nitrate/Nitrite	ND		mg/l	0.10	0.023	1	-	07/28/21 02:51	121,4500NO3-F	MR

Lab Control Sample Analysis
Batch Quality Control

Project Name: LAKE WACCABUC FIELD SAMPLING
Project Number: 2390.001.001
Lab Number: L2136469
Report Date: 07/30/21

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-11 Batch: WG1525414-2								
Phosphorus, Soluble	109		-		80-120	-		
General Chemistry - Westborough Lab Associated sample(s): 01-10 Batch: WG1527396-2								
Nitrogen, Nitrate/Nitrite	102		-		90-110	-		
General Chemistry - Westborough Lab Associated sample(s): 11 Batch: WG1527397-2								
Nitrogen, Nitrate/Nitrite	102		-		90-110	-		
General Chemistry - Westborough Lab Associated sample(s): 01-10 Batch: WG1527798-2								
Phosphorus, Total	100		-		80-120	-		
General Chemistry - Westborough Lab Associated sample(s): 11 Batch: WG1527829-2								
Phosphorus, Total	103		-		80-120	-		
General Chemistry - Westborough Lab Associated sample(s): 01-11 Batch: WG1528011-2								
Nitrogen, Soluble Kjeldahl	95		-		78-122	-		
General Chemistry - Westborough Lab Associated sample(s): 01-11 Batch: WG1528102-2								
Nitrogen, Ammonia	102		-		80-120	-		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: LAKE WACCABUC FIELD SAMPLING
Lab Number: L2136469
Project Number: 2390.001.001
Report Date: 07/30/21

Parameter	LCS %Recovery	LCSD %Recovery	%Recovery Limits	RPD	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-11 Batch: WG1528348-2					
Nitrogen, Total Kjeldahl	103	-	78-122	-	
General Chemistry - Westborough Lab Associated sample(s): 01-11 Batch: WG1528636-2					
Nitrogen, Dissolved Nitrate/Nitrite	98	-	90-110	-	20

Matrix Spike Analysis
Batch Quality Control

Project Name: LAKE WACCABUC FIELD SAMPLING
Project Number: 2390.001.001
Lab Number: L2136469
Report Date: 07/30/21

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-11 QC Batch ID: WG1525414-4 QC Sample: L2136469-07 Client ID: LW-7												
Phosphorus, Soluble	0.006J	0.5	0.563	113		-	-		75-125	-		20
General Chemistry - Westborough Lab Associated sample(s): 01-10 QC Batch ID: WG1527396-4 QC Sample: L2136469-07 Client ID: LW-7												
Nitrogen, Nitrate/Nitrite	0.063J	4	4.1	102		-	-		80-120	-		20
General Chemistry - Westborough Lab Associated sample(s): 11 QC Batch ID: WG1527397-4 QC Sample: L2139386-03 Client ID: MS Sample												
Nitrogen, Nitrate/Nitrite	3.0	4	6.8	95		-	-		80-120	-		20
General Chemistry - Westborough Lab Associated sample(s): 01-10 QC Batch ID: WG1527798-4 QC Sample: L2136469-07 Client ID: LW-7												
Phosphorus, Total	0.025	0.5	0.521	99		-	-		75-125	-		20
General Chemistry - Westborough Lab Associated sample(s): 11 QC Batch ID: WG1527829-4 QC Sample: L2136469-11 Client ID: DUP												
Phosphorus, Total	0.030	0.5	0.563	107		-	-		75-125	-		20
General Chemistry - Westborough Lab Associated sample(s): 01-11 QC Batch ID: WG1528011-4 QC Sample: L2136469-07 Client ID: LW-7												
Nitrogen, Soluble Kjeldahl	0.71	8	8.5	97		-	-		77-111	-		24
General Chemistry - Westborough Lab Associated sample(s): 01-11 QC Batch ID: WG1528102-4 QC Sample: L2136469-07 Client ID: LW-7												
Nitrogen, Ammonia	0.070J	4	3.79	95		-	-		80-120	-		20
General Chemistry - Westborough Lab Associated sample(s): 01-11 QC Batch ID: WG1528348-4 QC Sample: L2136469-07 Client ID: LW-7												
Nitrogen, Total Kjeldahl	1.14	8	9.23	101		-	-		77-111	-		24
General Chemistry - Westborough Lab Associated sample(s): 01-11 QC Batch ID: WG1528636-4 QC Sample: L2136469-07 Client ID: LW-7												
Nitrogen, Dissolved Nitrate/Nitrite	ND	4	4.0	100		-	-		80-120	-		20

Project Name: LAKE WACCABUC FIELD SAMPLING
Project Number: 2390.001.001

Lab Duplicate Analysis
Batch Quality Control

Lab Number: L2136469
Report Date: 07/30/21

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-11 QC Batch ID: WG1521708-2 QC Sample: L2136469-07 Client ID: LW-7						
Chlorophyll A	27.6	23.0	mg/m3	18		35
General Chemistry - Westborough Lab Associated sample(s): 01-10 QC Batch ID: WG1521889-1 QC Sample: L2136469-07 Client ID: LW-7						
Color, Apparent	18	18	A.P.C.U.	0		
General Chemistry - Westborough Lab Associated sample(s): 11 QC Batch ID: WG1521890-1 QC Sample: L2136469-11 Client ID: DUP						
Color, Apparent	20	22	A.P.C.U.	10		
General Chemistry - Westborough Lab Associated sample(s): 01-11 QC Batch ID: WG1525414-3 QC Sample: L2136469-07 Client ID: LW-7						
Phosphorus, Soluble	0.006J	0.015	mg/l	NC		20
General Chemistry - Westborough Lab Associated sample(s): 01-10 QC Batch ID: WG1527396-3 QC Sample: L2136469-07 Client ID: LW-7						
Nitrogen, Nitrate/Nitrite	0.063J	0.072J	mg/l	NC		20
General Chemistry - Westborough Lab Associated sample(s): 11 QC Batch ID: WG1527397-3 QC Sample: L2139386-03 Client ID: DUP Sample						
Nitrogen, Nitrate/Nitrite	3.0	3.0	mg/l	0		20
General Chemistry - Westborough Lab Associated sample(s): 01-10 QC Batch ID: WG1527798-3 QC Sample: L2136469-07 Client ID: LW-7						
Phosphorus, Total	0.025	0.026	mg/l	4		20
General Chemistry - Westborough Lab Associated sample(s): 11 QC Batch ID: WG1527829-3 QC Sample: L2136469-11 Client ID: DUP						
Phosphorus, Total	0.030	0.028	mg/l	7		20
General Chemistry - Westborough Lab Associated sample(s): 01-11 QC Batch ID: WG1528011-3 QC Sample: L2136469-07 Client ID: LW-7						
Nitrogen, Soluble Kjeldahl	0.71	0.64	mg/l	10		24

Lab Duplicate Analysis
Batch Quality Control

Project Name: LAKE WACCABUC FIELD SAMPLING
Project Number: 2390.001.001

Lab Number: L2136469
Report Date: 07/30/21

Parameter	Native Sample	Duplicate Sample	Units	RPD	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-11 QC Batch ID: WG1528102-3 QC Sample: L2136469-07 Client ID: LW-7					
Nitrogen, Ammonia	0.070J	0.061J	mg/l	NC	20
General Chemistry - Westborough Lab Associated sample(s): 01-11 QC Batch ID: WG1528348-3 QC Sample: L2136469-07 Client ID: LW-7					
Nitrogen, Total Kjeldahl	1.14	1.24	mg/l	8	24
General Chemistry - Westborough Lab Associated sample(s): 01-11 QC Batch ID: WG1528636-3 QC Sample: L2136469-07 Client ID: LW-7					
Nitrogen, Dissolved Nitrate/Nitrite	ND	ND	mg/l	NC	20

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information

Cooler	*Custody Seal*
A	Absent
B	Absent
C	Absent
D	Absent
E	Absent
F	Absent
G	Absent

Container Information

Container ID	*Container Type*	*Cooler*	*Initial pH*	*Final pH*	*Temp deg C*	*Pres*	*Seal*	*Frozen Date/Time*	*Analysis(*)*
L2136469-01A	Plastic 250ml unpreserved	D	7	7	4.9	Y	Absent		FILTER(1)
L2136469-01B	Plastic 250ml HNO3 preserved	C	<2	<2	3.1	Y	Absent		SUB-HARDNESS(180),SUB-METALS 200.7(180)
L2136469-01C	Amber 250ml unpreserved	F	7	7	2.4	Y	Absent		COLOR-A-2120(2)
L2136469-01D	Plastic 500ml unpreserved	D	7	7	4.9	Y	Absent		FILTER(1)
L2136469-01E	Plastic 500ml H2SO4 preserved	D	<2	<2	4.9	Y	Absent		TKN-4500(28),NO3/NO2-353(28),TPHOS-4500(28),TNITROGEN(28),NH3-4500(28)
L2136469-01F	Plastic 500ml H2SO4 preserved	C	<2	<2	3.1	Y	Absent		TKN-4500(28),NO3/NO2-353(28),TPHOS-4500(28),TNITROGEN(28),NH3-4500(28)
L2136469-01G	Brown Plastic 1000ml unpreserved	F	NA		2.4	Y	Absent		CHLORO-A(1)
L2136469-01H	Brown Plastic 1000ml unpreserved	F	NA		2.4	Y	Absent		CHLORO-A(1)
L2136469-01Z	Plastic 250ml H2SO4 preserved Filtrates	D	NA		4.9	Y	Absent		SNO3/NO2-4500(28),STKN-4500(28),SNITROGEN(28),SPHOS-4500(28)
L2136469-02A	Plastic 250ml unpreserved	D	7	7	4.9	Y	Absent		FILTER(1)
L2136469-02B	Plastic 250ml HNO3 preserved	C	<2	<2	3.1	Y	Absent		SUB-HARDNESS(180),SUB-METALS 200.7(180)
L2136469-02C	Amber 250ml unpreserved	F	7	7	2.4	Y	Absent		COLOR-A-2120(2)
L2136469-02D	Plastic 500ml unpreserved	D	7	7	4.9	Y	Absent		FILTER(1)
L2136469-02E	Plastic 500ml H2SO4 preserved	D	<2	<2	4.9	Y	Absent		TKN-4500(28),NO3/NO2-353(28),TPHOS-4500(28),TNITROGEN(28),NH3-4500(28)

*Values in parentheses indicate holding time in days

Project Name: LAKE WACCABUC FIELD SAMPLING
Project Number: 2390.001.001

Lab Number: L2136469
Report Date: 07/30/21

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2136469-02F	Plastic 500ml H2SO4 preserved	C	<2	<2	3.1	Y	Absent		TKN-4500(28),NO3/NO2-353(28),TPHOS-4500(28),TNITROGEN(28),NH3-4500(28)
L2136469-02G	Brown Plastic 1000ml unpreserved	F	NA		2.4	Y	Absent		CHLORO-A(1)
L2136469-02H	Brown Plastic 1000ml unpreserved	F	NA		2.4	Y	Absent		CHLORO-A(1)
L2136469-02Z	Plastic 250ml H2SO4 preserved Filtrates	D	NA		4.9	Y	Absent		SNO3/NO2-4500(28),STKN-4500(28),SNITROGEN(28),SPHOS-4500(28)
L2136469-03A	Plastic 250ml unpreserved	A	7	7	2.3	Y	Absent		FILTER(1)
L2136469-03B	Plastic 250ml HNO3 preserved	E	<2	<2	2.7	Y	Absent		SUB-HARDNESS(180),SUB-METALS 200.7(180)
L2136469-03C	Amber 250ml unpreserved	A	7	7	2.3	Y	Absent		COLOR-A-2120(2)
L2136469-03D	Plastic 500ml unpreserved	A	7	7	2.3	Y	Absent		FILTER(1)
L2136469-03E	Plastic 500ml H2SO4 preserved	E	<2	<2	2.7	Y	Absent		TKN-4500(28),NO3/NO2-353(28),TPHOS-4500(28),TNITROGEN(28),NH3-4500(28)
L2136469-03F	Plastic 500ml H2SO4 preserved	NA	NA			Y	Absent		NH3-4500(28)
L2136469-03G	Brown Plastic 1000ml unpreserved	A	NA		2.3	Y	Absent		CHLORO-A(1)
L2136469-03H	Brown Plastic 1000ml unpreserved	A	NA		2.3	Y	Absent		CHLORO-A(1)
L2136469-03Z	Plastic 250ml H2SO4 preserved Filtrates	A	NA		2.3	Y	Absent		SNO3/NO2-4500(28),STKN-4500(28),SNITROGEN(28),SPHOS-4500(28)
L2136469-04A	Plastic 250ml unpreserved	D	7	7	4.9	Y	Absent		FILTER(1)
L2136469-04B	Plastic 250ml HNO3 preserved	C	<2	<2	3.1	Y	Absent		SUB-HARDNESS(180),SUB-METALS 200.7(180)
L2136469-04C	Amber 250ml unpreserved	F	7	7	2.4	Y	Absent		COLOR-A-2120(2)
L2136469-04D	Plastic 500ml unpreserved	D	7	7	4.9	Y	Absent		FILTER(1)
L2136469-04E	Plastic 500ml H2SO4 preserved	D	<2	<2	4.9	Y	Absent		TKN-4500(28),NO3/NO2-353(28),TPHOS-4500(28),TNITROGEN(28),NH3-4500(28)
L2136469-04F	Plastic 500ml H2SO4 preserved	C	<2	<2	3.1	Y	Absent		TKN-4500(28),NO3/NO2-353(28),TPHOS-4500(28),TNITROGEN(28),NH3-4500(28)
L2136469-04G	Brown Plastic 1000ml unpreserved	F	NA		2.4	Y	Absent		CHLORO-A(1)
L2136469-04H	Brown Plastic 1000ml unpreserved	F	NA		2.4	Y	Absent		CHLORO-A(1)
L2136469-04Z	Plastic 250ml H2SO4 preserved Filtrates	D	NA		4.9	Y	Absent		SNO3/NO2-4500(28),STKN-4500(28),SNITROGEN(28),SPHOS-4500(28)
L2136469-05A	Plastic 250ml unpreserved	D	7	7	4.9	Y	Absent		FILTER(1)
L2136469-05B	Plastic 250ml HNO3 preserved	C	<2	<2	3.1	Y	Absent		SUB-HARDNESS(180),SUB-METALS 200.7(180)
L2136469-05C	Amber 250ml unpreserved	F	7	7	2.4	Y	Absent		COLOR-A-2120(2)

*Values in parentheses indicate holding time in days

Project Name: LAKE WACCABUC FIELD SAMPLING
Project Number: 2390.001.001

Lab Number: L2136469
Report Date: 07/30/21

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2136469-05D	Plastic 500ml unpreserved	D	7	7	4.9	Y	Absent		FILTER(1)
L2136469-05E	Plastic 500ml H2SO4 preserved	D	<2	<2	4.9	Y	Absent		TKN-4500(28),NO3/NO2-353(28),TPHOS-4500(28),TNITROGEN(28),NH3-4500(28)
L2136469-05F	Plastic 500ml H2SO4 preserved	C	<2	<2	3.1	Y	Absent		TKN-4500(28),NO3/NO2-353(28),TPHOS-4500(28),TNITROGEN(28),NH3-4500(28)
L2136469-05G	Brown Plastic 1000ml unpreserved	F	NA		2.4	Y	Absent		CHLORO-A(1)
L2136469-05H	Brown Plastic 1000ml unpreserved	F	NA		2.4	Y	Absent		CHLORO-A(1)
L2136469-05Z	Plastic 250ml H2SO4 preserved Filtrates	D	NA		4.9	Y	Absent		SNO3/NO2-4500(28),STKN-4500(28),SNITROGEN(28),SPHOS-4500(28)
L2136469-06A	Plastic 250ml unpreserved	D	7	7	4.9	Y	Absent		FILTER(1)
L2136469-06B	Plastic 250ml HNO3 preserved	C	<2	<2	3.1	Y	Absent		SUB-HARDNESS(180),SUB-METALS 200.7(180)
L2136469-06C	Amber 250ml unpreserved	E	7	7	2.7	Y	Absent		COLOR-A-2120(2)
L2136469-06D	Plastic 500ml unpreserved	D	7	7	4.9	Y	Absent		FILTER(1)
L2136469-06E	Plastic 500ml H2SO4 preserved	D	<2	<2	4.9	Y	Absent		TKN-4500(28),NO3/NO2-353(28),TPHOS-4500(28),TNITROGEN(28),NH3-4500(28)
L2136469-06F	Plastic 500ml H2SO4 preserved	C	<2	<2	3.1	Y	Absent		TKN-4500(28),NO3/NO2-353(28),TPHOS-4500(28),TNITROGEN(28),NH3-4500(28)
L2136469-06G	Brown Plastic 1000ml unpreserved	E	NA		2.7	Y	Absent		CHLORO-A(1)
L2136469-06H	Brown Plastic 1000ml unpreserved	E	NA		2.7	Y	Absent		CHLORO-A(1)
L2136469-06Z	Plastic 250ml H2SO4 preserved Filtrates	D	NA		4.9	Y	Absent		STKN-4500(28),SNO3/NO2-4500(28),SNITROGEN(28),SPHOS-4500(28)
L2136469-07A	Plastic 250ml unpreserved	D	7	7	4.9	Y	Absent		FILTER(1)
L2136469-07A1	Plastic 250ml unpreserved	D	7	7	4.9	Y	Absent		FILTER(1)
L2136469-07A2	Plastic 250ml unpreserved	G	7	7	3.6	Y	Absent		FILTER(1)
L2136469-07B	Plastic 250ml HNO3 preserved	C	<2	<2	3.1	Y	Absent		SUB-HARDNESS(180),SUB-METALS 200.7(180)
L2136469-07B1	Plastic 250ml HNO3 preserved	C	<2	<2	3.1	Y	Absent		-
L2136469-07B2	Plastic 250ml HNO3 preserved	C	<2	<2	3.1	Y	Absent		-
L2136469-07C	Amber 250ml unpreserved	E	7	7	2.7	Y	Absent		COLOR-A-2120(2)
L2136469-07C1	Amber 250ml unpreserved	G	7	7	3.6	Y	Absent		COLOR-A-2120(2)
L2136469-07C2	Amber 250ml unpreserved	G	7	7	3.6	Y	Absent		COLOR-A-2120(2)
L2136469-07D	Plastic 500ml unpreserved	D	7	7	4.9	Y	Absent		FILTER(1)
L2136469-07D1	Plastic 500ml unpreserved	D	7	7	4.9	Y	Absent		FILTER(1)

*Values in parentheses indicate holding time in days

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2136469-07D2	Plastic 500ml unpreserved	D	7	7	4.9	Y	Absent		FILTER(1)
L2136469-07E	Plastic 500ml H2SO4 preserved	D	<2	<2	4.9	Y	Absent		TKN-4500(28),NO3/NO2-353(28),TPHOS-4500(28),TNITROGEN(28),NH3-4500(28)
L2136469-07E1	Plastic 500ml H2SO4 preserved	D	<2	<2	4.9	Y	Absent		TKN-4500(28),NO3/NO2-353(28),TPHOS-4500(28),TNITROGEN(28)
L2136469-07E2	Plastic 500ml H2SO4 preserved	D	<2	<2	4.9	Y	Absent		TKN-4500(28),NO3/NO2-353(28),TPHOS-4500(28),TNITROGEN(28)
L2136469-07F	Plastic 500ml H2SO4 preserved	C	<2	<2	3.1	Y	Absent		TKN-4500(28),NO3/NO2-353(28),TPHOS-4500(28),TNITROGEN(28),NH3-4500(28)
L2136469-07F1	Plastic 500ml H2SO4 preserved	C	<2	<2	3.1	Y	Absent		TKN-4500(28),NO3/NO2-353(28),TPHOS-4500(28),TNITROGEN(28)
L2136469-07F2	Plastic 500ml H2SO4 preserved	C	<2	<2	3.1	Y	Absent		TKN-4500(28),NO3/NO2-353(28),TPHOS-4500(28),TNITROGEN(28)
L2136469-07G	Brown Plastic 1000ml unpreserved	E	NA		2.7	Y	Absent		CHLORO-A(1)
L2136469-07G1	Brown Plastic 1000ml unpreserved	G	NA		3.6	Y	Absent		CHLORO-A(1)
L2136469-07G2	Brown Plastic 1000ml unpreserved	G	NA		3.6	Y	Absent		CHLORO-A(1)
L2136469-07H	Brown Plastic 1000ml unpreserved	E	NA		2.7	Y	Absent		CHLORO-A(1)
L2136469-07H1	Brown Plastic 1000ml unpreserved	G	NA		3.6	Y	Absent		CHLORO-A(1)
L2136469-07H2	Brown Plastic 1000ml unpreserved	G	NA		3.6	Y	Absent		CHLORO-A(1)
L2136469-07Z	Plastic 250ml H2SO4 preserved Filtrates	D	NA		4.9	Y	Absent		STKN-4500(28),SNO3/NO2-4500(28),SNITROGEN(28),SPHOS-4500(28)
L2136469-07Z1	Plastic 250ml H2SO4 preserved Filtrates	D	NA		4.9	Y	Absent		STKN-4500(28),SNO3/NO2-4500(28),SNITROGEN(28),SPHOS-4500(28)
L2136469-07Z2	Plastic 250ml H2SO4 preserved Filtrates	D	NA		4.9	Y	Absent		STKN-4500(28),SNO3/NO2-4500(28),SNITROGEN(28),SPHOS-4500(28)
L2136469-08A	Plastic 250ml unpreserved	G	7	7	3.6	Y	Absent		FILTER(1)
L2136469-08B	Plastic 250ml HNO3 preserved	E	<2	<2	2.7	Y	Absent		SUB-HARDNESS(180),SUB-METALS 200.7(180)
L2136469-08C	Amber 250ml unpreserved	G	7	7	3.6	Y	Absent		COLOR-A-2120(2)
L2136469-08D	Plastic 500ml unpreserved	G	7	7	3.6	Y	Absent		FILTER(1)
L2136469-08E	Plastic 500ml H2SO4 preserved	G	<2	<2	3.6	Y	Absent		TKN-4500(28),NO3/NO2-353(28),TPHOS-4500(28),TNITROGEN(28),NH3-4500(28)
L2136469-08F	Plastic 500ml H2SO4 preserved	E	<2	<2	2.7	Y	Absent		TKN-4500(28),NO3/NO2-353(28),TPHOS-4500(28),TNITROGEN(28),NH3-4500(28)
L2136469-08G	Brown Plastic 1000ml unpreserved	G	NA		3.6	Y	Absent		CHLORO-A(1)
L2136469-08H	Brown Plastic 1000ml unpreserved	G	NA		3.6	Y	Absent		CHLORO-A(1)

*Values in parentheses indicate holding time in days

Project Name: LAKE WACCABUC FIELD SAMPLING
Project Number: 2390.001.001

Lab Number: L2136469
Report Date: 07/30/21

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2136469-08Z	Plastic 250ml H2SO4 preserved Filtrates	G	NA		3.6	Y	Absent		STKN-4500(28),SNO3/NO2-4500(28),SNITROGEN(28),SPHOS-4500(28)
L2136469-09A	Plastic 250ml unpreserved	A	7	7	2.3	Y	Absent		FILTER(1)
L2136469-09B	Plastic 250ml HNO3 preserved	C	<2	<2	3.1	Y	Absent		SUB-HARDNESS(180),SUB-METALS 200.7(180)
L2136469-09C	Amber 250ml unpreserved	G	7	7	3.6	Y	Absent		COLOR-A-2120(2)
L2136469-09D	Plastic 500ml unpreserved	A	7	7	2.3	Y	Absent		FILTER(1)
L2136469-09E	Plastic 500ml H2SO4 preserved	A	<2	<2	2.3	Y	Absent		TKN-4500(28),NO3/NO2-353(28),TPHOS-4500(28),TNITROGEN(28),NH3-4500(28)
L2136469-09F	Plastic 500ml H2SO4 preserved	C	<2	<2	3.1	Y	Absent		TKN-4500(28),NO3/NO2-353(28),TPHOS-4500(28),TNITROGEN(28),NH3-4500(28)
L2136469-09G	Brown Plastic 1000ml unpreserved	G	NA		3.6	Y	Absent		CHLORO-A(1)
L2136469-09H	Brown Plastic 1000ml unpreserved	G	NA		3.6	Y	Absent		CHLORO-A(1)
L2136469-09Z	Plastic 250ml H2SO4 preserved Filtrates	A	NA		2.3	Y	Absent		STKN-4500(28),SNO3/NO2-4500(28),SNITROGEN(28),SPHOS-4500(28)
L2136469-10A	Plastic 250ml unpreserved	B	7	7	4.8	Y	Absent		FILTER(1)
L2136469-10B	Plastic 250ml HNO3 preserved	A	<2	<2	2.3	Y	Absent		SUB-HARDNESS(180),SUB-METALS 200.7(180)
L2136469-10C	Amber 250ml unpreserved	B	7	7	4.8	Y	Absent		COLOR-A-2120(2)
L2136469-10D	Plastic 500ml unpreserved	B	7	7	4.8	Y	Absent		FILTER(1)
L2136469-10E	Plastic 500ml H2SO4 preserved	B	<2	<2	4.8	Y	Absent		TKN-4500(28),NO3/NO2-353(28),TPHOS-4500(28),TNITROGEN(28),NH3-4500(28)
L2136469-10F	Plastic 500ml H2SO4 preserved	A	<2	<2	2.3	Y	Absent		TKN-4500(28),NO3/NO2-353(28),TPHOS-4500(28),TNITROGEN(28),NH3-4500(28)
L2136469-10G	Brown Plastic 1000ml unpreserved	B	NA		4.8	Y	Absent		CHLORO-A(1)
L2136469-10H	Brown Plastic 1000ml unpreserved	B	NA		4.8	Y	Absent		CHLORO-A(1)
L2136469-10Z	Plastic 250ml H2SO4 preserved Filtrates	B	NA		4.8	Y	Absent		SNO3/NO2-4500(28),STKN-4500(28),SNITROGEN(28),SPHOS-4500(28)
L2136469-11A	Plastic 250ml unpreserved	A	7	7	2.3	Y	Absent		FILTER(1)
L2136469-11B	Plastic 250ml HNO3 preserved	B	<2	<2	4.8	Y	Absent		SUB-HARDNESS(180),SUB-METALS 200.7(180)
L2136469-11C	Amber 250ml unpreserved	B	7	7	4.8	Y	Absent		COLOR-A-2120(2)
L2136469-11D	Plastic 500ml unpreserved	A	7	7	2.3	Y	Absent		FILTER(1)
L2136469-11E	Plastic 500ml H2SO4 preserved	A	<2	<2	2.3	Y	Absent		TKN-4500(28),NO3/NO2-353(28),TPHOS-4500(28),TNITROGEN(28),NH3-4500(28)

*Values in parentheses indicate holding time in days

Project Name: LAKE WACCABUC FIELD SAMPLING
Project Number: 2390.001.001

Lab Number: L2136469
Report Date: 07/30/21

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2136469-11F	Plastic 500ml H2SO4 preserved	B	<2	<2	4.8	Y	Absent		TKN-4500(28),NO3/NO2-353(28),TPHOS-4500(28),TNITROGEN(28),NH3-4500(28)
L2136469-11G	Brown Plastic 1000ml unpreserved	B	NA		4.8	Y	Absent		CHLORO-A(1)
L2136469-11H	Brown Plastic 1000ml unpreserved	B	NA		4.8	Y	Absent		CHLORO-A(1)
L2136469-11Z	Plastic 250ml H2SO4 preserved Filtrates	A	NA		2.3	Y	Absent		STKN-4500(28),SNO3/NO2-4500(28),SNITROGEN(28),SPHOS-4500(28)

*Values in parentheses indicate holding time in days

GLOSSARY

Acronyms

DL	- Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the limit of quantitation (LOQ). The DL includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)
EDL	- Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).
EMPC	- Estimated Maximum Possible Concentration: The concentration that results from the signal present at the retention time of an analyte when the ions meet all of the identification criteria except the ion abundance ratio criteria. An EMPC is a worst-case estimate of the concentration.
EPA	- Environmental Protection Agency.
LCS	- Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
LCSD	- Laboratory Control Sample Duplicate: Refer to LCS.
LFB	- Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
LOD	- Limit of Detection: This value represents the level to which a target analyte can reliably be detected for a specific analyte in a specific matrix by a specific method. The LOD includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)
LOQ	- Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.) Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)
MDL	- Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
MS	- Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. For Method 332.0, the spike recovery is calculated using the native concentration, including estimated values.
MSD	- Matrix Spike Sample Duplicate: Refer to MS.
NA	- Not Applicable.
NC	- Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.
NDPA/DPA	- N-Nitrosodiphenylamine/Diphenylamine.
NI	- Not Ignitable.
NP	- Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.
NR	- No Results: Term is utilized when 'No Target Compounds Requested' is reported for the analysis of Volatile or Semivolatile Organic TIC only requests.
RL	- Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
RPD	- Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.
SRM	- Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.
STLP	- Semi-dynamic Tank Leaching Procedure per EPA Method 1315.
TEF	- Toxic Equivalency Factors: The values assigned to each dioxin and furan to evaluate their toxicity relative to 2,3,7,8-TCDD.
TEQ	- Toxic Equivalent: The measure of a sample's toxicity derived by multiplying each dioxin and furan by its corresponding TEF and then summing the resulting values.
TIC	- Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Report Format: *DU Report with 'J' Qualifiers*

Footnotes

1 - The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Difference: With respect to Total Oxidizable Precursor (TOP) Assay analysis, the difference is defined as the Post-Treatment value minus the Pre-Treatment value.

Final pH: As it pertains to Sample Receipt & Container Information section of the report, Final pH reflects pH of container determined after adjustment at the laboratory, if applicable. If no adjustment required, value reflects Initial pH.

Frozen Date/Time: With respect to Volatile Organics in soil, Frozen Date/Time reflects the date/time at which associated Reagent Water-preserved vials were initially frozen. Note: If frozen date/time is beyond 48 hours from sample collection, value will be reflected in 'bold'.

Initial pH: As it pertains to Sample Receipt & Container Information section of the report, Initial pH reflects pH of container determined upon receipt, if applicable.

PAH Total: With respect to Alkylated PAH analyses, the 'PAHs, Total' result is defined as the summation of results for all or a subset of the following compounds: Naphthalene, C1-C4 Naphthalenes, 2-Methylnaphthalene, 1-Methylnaphthalene, Biphenyl, Acenaphthylene, Acenaphthene, Fluorene, C1-C3 Fluorenes, Phenanthrene, C1-C4 Phenanthrenes/Anthracenes, Anthracene, Fluoranthene, Pyrene, C1-C4 Fluoranthenes/Pyrenes, Benz(a)anthracene, Chrysene, C1-C4 Chrysenes, Benzo(b)fluoranthene, Benzo(j)+(k)fluoranthene, Benzo(e)pyrene, Benzo(a)pyrene, Perylene, Indeno(1,2,3-cd)pyrene, Dibenz(ah)+(ac)anthracene, Benzo(g,h,i)perylene. If a 'Total' result is requested, the results of its individual components will also be reported.

PFAS Total: With respect to PFAS analyses, the 'PFAS, Total (5)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA and PFOS. In addition, the 'PFAS, Total (6)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA, PFDA and PFOS. For MassDEP DW compliance analysis only, the 'PFAS, Total (6)' result is defined as the summation of results at or above the RL. Note: If a 'Total' result is requested, the results of its individual components will also be reported.

The target compound Chlordane (CAS No. 57-74-9) is reported for GC ECD analyses. Per EPA,this compound "refers to a mixture of chlordane isomers, other chlorinated hydrocarbons and numerous other components." (Reference: USEPA Toxicological Review of Chlordane, In Support of Summary Information on the Integrated Risk Information System (IRIS), December 1997.)

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Data Qualifiers

A - Spectra identified as "Aldol Condensates" are byproducts of the extraction/concentration procedures when acetone is introduced in the process.

B - The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

C - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.

D - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

F - The ratio of quantifier ion response to qualifier ion response falls outside of the laboratory criteria. Results are considered to be an estimated maximum concentration.

G - The concentration may be biased high due to matrix interferences (i.e, co-elution) with non-target compound(s). The result should be considered estimated.

H - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.

I - The lower value for the two columns has been reported due to obvious interference.

J - Estimated value. The Target analyte concentration is below the quantitation limit (RL), but above the Method Detection Limit (MDL) or Estimated Detection Limit (EDL) for SPME-related analyses. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

M - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.

ND - Not detected at the method detection limit (MDL) for the sample, or estimated detection limit (EDL) for SPME-related analyses.

Report Format: DU Report with 'J' Qualifiers

Data Qualifiers

NJ - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.

P - The RPD between the results for the two columns exceeds the method-specified criteria.

Q - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)

R - Analytical results are from sample re-analysis.

RE - Analytical results are from sample re-extraction.

S - Analytical results are from modified screening analysis.

REFERENCES

44 Methods for the Determination of Inorganic Substances in Environmental Samples, EPA/600/R-93/100, August 1993.

107 Alpha Analytical - In-house calculation method.

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.

Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility
EPA 624/624.1: m/p-xylene, o-xylene, Naphthalene
EPA 625/625.1: alpha-Terpineol
EPA 8260C/8260D: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D/8270E: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine, alpha-Terpineol; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
SM4500: NPW: Amenable Cyanide; SCM: Total Phosphorus, TKN, NO2, NO3.

Mansfield Facility
SM 2540D: TSS
EPA 8082A: NPW: PCB: 1, 5, 31, 87,101, 110, 141, 151, 153, 180, 183, 187.
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.
Biological Tissue Matrix: EPA 3050B

The following analytes are included in our Massachusetts DEP Scope of Accreditation

Westborough Facility:

Drinking Water
EPA 300.0: Chloride, Nitrate-N, Fluoride, Sulfate; **EPA 353.2**: Nitrate-N, Nitrite-N; **SM4500NO3-F**: Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500Cl-D, SM2320B, SM2540C, SM4500H-B, SM4500NO2-B**
EPA 332: Perchlorate; **EPA 524.2:** THMs and VOCs; **EPA 504.1:** EDB, DBCP.
Microbiology: **SM9215B; SM9223-P/A, SM9223B-Colilert-QT,SM9222D**.

Non-Potable Water
SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH: Ammonia-N and Kjeldahl-N, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **EPA 351.1, SM4500NO3-F, EPA 353.2**: Nitrate-N**, SM4500P-E, SM4500P-B, E, SM4500SO4-E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D, EPA 300: Chloride, Sulfate, Nitrate.**
EPA 624.1: Volatile Halocarbons & Aromatics,
EPA 608.3: Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs
EPA 625.1: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E, EPA 1600, EPA 1603, SM9222D.**

Mansfield Facility:

Drinking Water
EPA 200.7: Al, Ba, Cd, Cr, Cu, Fe, Mn, Ni, Na, Ag, Ca, Zn. **EPA 200.8:** Al, Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn. **EPA 245.1** Hg.
EPA 522, EPA 537.1.

Non-Potable Water
EPA 200.7: Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.
EPA 200.8: Al, Sb**,** As, Be, Cd, Cr, Cu, Fe, Pb, Mn, Ni, K, Se, Ag, Na, TL, Zn.
EPA 245.1 Hg.
SM2340B

For a complete listing of analytes and methods, please contact your Alpha Project Manager.

Serial_No:07302119:08

ALPHA ANALYTICAL

NEW YORK CHAIN OF CUSTODY

Westborough, MA 01581
8 Walkup Dr.
TEL: 508-898-9220
FAX: 508-898-9193

Mansfield, MA 02048
320 Forbes Blvd
TEL: 508-822-9300
FAX: 508-822-3288

Service Centers
Mahwah, NJ 07430: 35 Whitney Rd, Suite 5
Albany, NY 12205: 14 Walker Way
Tonawanda, NY 14150: 275 Cooper Ave, Suite 105

Page of

Date Rec'd in Lab: 7/7/21

ALPHA Job #: L2136469 / 354451

Project Information

Project Name: LAKE WACCABUC FIELD SAMPLING
Project Location: LEWISBORO, NY
Project #: 2390-001.001
(Use Project name as Project #) ☐
Project Manager: DAVID HANNY
ALPHAQuote #:

Turn-Around Time

Standard ☑ Due Date:
Rush (only if pre approved) ☐ # of Days:

Client Information

Client: BARTON & LOGUIDICE
Address: 443 ELECTRONICS PKWY LIVERPOOL, NY 13088
Phone: 585-325-7190
Fax:
Email: JWILLIAMS@BARTONANDLOGUIDICE.COM

Deliverables

☐ ASP-A ☐ ASP-B
☐ EQuIS (1 File) ☐ EQuIS (4 File)
☐ Other

Billing Information

☑ Same as Client Info
PO # 2390.001.001

Regulatory Requirement

☐ NY TOGS ☐ NY Part 375
☐ AWQ Standards ☐ NY CP-51
☐ NY Restricted Use ☐ Other
☐ NY Unrestricted Use
☐ NYC Sewer Discharge

Disposal Site Information

Please identify below location of applicable disposal facilities.

Disposal Facility:
☐ NJ ☐ NY
☐ Other:

These samples have been previously analyzed by Alpha ☐

Other project specific requirements/comments:

Please specify Metals or TAL.

Sample Filtration
☐ Done
☐ Lab to do
Preservation
☐ Lab to do
(Please Specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	TOTAL N CALC NO3/NO2 TKN TPHOS	SO4 ALK CL SULF/NO3 4500-SNO5	STRU-4500	CHLORO-A	CHLORO-A	COLOR-A-2120	NH3	TOTAL METALS	Sample Specific Comments	Total Bottles
36469-01	LW-1	7/7/21	08:30	WATER	JMW										
-02	LW-2	7/7/21	09:09		JMW										
-03	LW-3	7/7/21	09:24		JMW		X	X	X	X	X	X	X	CAP BROKE FOR TOTAL N	
-04	LW-4	7/7/21	09:43		JMW	X	X	X	X	X	X	X	X		
-05	LW-5	7/7/21	10:10		JMW	X	X	X	X	X	X	X	X		
-06	LW-6	7/7/21	10:24		JMW	X	X	X	X	X	X	X	X		
-07	LW-~~3~~7	7/7/21	12:30		JMW	X	X	X	X	X	X	X	X		
-08	LW-~~3~~8	7/7/21	13:08		JMW	X	X	X	X	X	X	X	X		
-09	LW-~~10~~9	7/7/21	13:30		JMW	X	X	X	X	X	X	X	X		
-10	~~DUP~~ LW-10	7/7/21	13:40		JMW	X	X	X	X	X	X	X	X		

Container Type	P	P	P	P	P	G	P	P
Preservative	A	A	A	A	A			

Preservative Code:
A = None
B = HCl
C = HNO_3
D = H_2SO_4
E = NaOH
F = MeOH
G = $NaHSO_4$
H = $Na_2S_2O_3$
K/E = Zn Ac/NaOH
O = Other

Container Code
P = Plastic
A = Amber Glass
V = Vial
G = Glass
B = Bacteria Cup
C = Cube
O = Other
E = Encore
D = BOD Bottle

Westboro: Certification No: MA935
Mansfield: Certification No: MA015

Relinquished By:	Date/Time	Received By:	Date/Time
JACK WILLIAMS	7/7/21 1530		
		[signature] AAL	7/7/21 15:20
[signature] AAL	7/7/21 18:05	[signature] AAL	7/7/21 2000
[signature] AAL	7/7/21 0200	[signature]	7/8/21 0230

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. BY EXECUTING THIS COC, THE CLIENT HAS READ AND AGREES TO BE BOUND BY ALPHA'S TERMS & CONDITIONS. (See reverse side.)

Form No: 01-25 HC (rev. 30-Sept-2013)

NEW YORK CHAIN OF CUSTODY

ALPHA ANALYTICAL

Westborough, MA 01581
8 Walkup Dr.
TEL: 508-898-9220
FAX: 508-898-9193

Mansfield, MA 02048
320 Forbes Blvd
TEL: 508-822-9300
FAX: 508-822-3288

Service Centers
Mahwah, NJ 07430: 35 Whitney Rd, Suite 5
Albany, NY 12205: 14 Walker Way
Tonawanda, NY 14150: 275 Cooper Ave, Suite 105

Page of

Date Rec'd in Lab: 7/7/21

ALPHA Job #: L2136469 / 354451

Project Information
Project Name: LAKE WACCABUC FIELD SAMPLING
Project Location: LEWISBORO, NY
Project #: 2390.001.001
(Use Project name as Project #) ☐
Project Manager: DAVID HANNY
ALPHAQuote #:

Turn-Around Time
Standard ☑ Due Date:
Rush (only if pre approved) ☐ # of Days:

Client Information
Client: BARTON & LOGUIDICE
Address: 443 ELECTRONICS PKWY LIVERPOOL, NY 13088
Phone: 585-325-7190
Fax:
Email: JWILLIAMS@BARTONANDLOGUIDICE

Deliverables
☐ ASP-A ☐ ASP-B
☐ EQuIS (1 File) ☐ EQuIS (4 File)
☐ Other

Billing Information
☑ Same as Client Info
PO #: 2390.001.001

Regulatory Requirement
☐ NY TOGS ☐ NY Part 375
☐ AWQ Standards ☐ NY CP-51
☐ NY Restricted Use ☐ Other
☐ NY Unrestricted Use
☐ NYC Sewer Discharge

Disposal Site Information
Please identify below location of applicable disposal facilities.
Disposal Facility:
☐ NJ ☐ NY
☐ Other:

These samples have been previously analyzed by Alpha ☐

Other project specific requirements/comments:

Please specify Metals or TAL.

Sample Filtration
☐ Done
☐ Lab to do
Preservation
☐ Lab to do
(Please Specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	TOTAL N CALC NH3/NO3 TKN TPHOS-NO2	SOL UF CALC SUP3/NO3 4500-SPHOS	ST KN-4500	CHLORO-A	CHLORO-A	CLLOR-A-3130	NH3	TOTAL METALS	Sample Specific Comments	Total Bottles
36469-07	MS	7/7/21	12:30	WATER	JMW	X	X	X	X	X	X	X	X		
↓	MSD	7/7/21	12:30	WATER	JMW	X	X	X	X	X	X	X	X		
-11	DUP	7/7/21	13:00	WATER	JMW	X	X	X	X	X	X	X	X		

Container Type	P	P	P	P	P	G	P	P
Preservative	D			A	A			

Preservative Code:
A = None
B = HCl
C = HNO_3
D = H_2SO_4
E = NaOH
F = MeOH
G = $NaHSO_4$
H = $Na_2S_2O_3$
K/E = Zn Ac/NaOH
O = Other

Container Code
P = Plastic
A = Amber Glass
V = Vial
G = Glass
B = Bacteria Cup
C = Cube
O = Other
E = Encore
D = BOD Bottle

Westboro: Certification No: MA935
Mansfield: Certification No: MA015

Relinquished By:	Date/Time	Received By:	Date/Time
Jack Williams	7/7/21 15:30		
[signature]		Dell Cima-AAL	7/7/21 15:30
Dell Cima-AAL	7/7/21 18:05	[signature] AAC	7/7/21 2000
[signature] AAC	7/7/21 2345	[signature]	7/7/21 23:45

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. BY EXECUTING THIS COC, THE CLIENT HAS READ AND AGREES TO BE BOUND BY ALPHA'S TERMS & CONDITIONS. (See reverse side.)

Form No: 01-25 HC (rev. 30-Sept-2013)

ALPHA

NEW YORK CHAIN OF CUSTODY

Service Centers
Mahwah, NJ 07430: 35 Whitney Rd, Suite 5
Albany, NY 12205: 14 Walker Way
Tonawanda, NY 14150: 275 Cooper Ave, Suite 105

Page of

Date Rec'd In Lab

ALPHA Job # 354451

Westborough, MA 01581 8 Walkup Dr. TEL 508-898-9220 FAX 508-898-9193

Mansfield, MA 02048 320 Forbes Blvd TEL: 508-822-9300 FAX 508-822-3288

Project Information

Project Name: LAKE WACCABUC FIELD SAMPLING
Project Location: LEWISBORO, NY
Project # 2390 001.001
(Use Project name as Project #) ☐
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Turn-Around Time

Standard ☑ Due Date:
Rush (only if pre approved) ☐ # of Days:

Deliverables

☐ ASP-A ☐ ASP-B
☐ EQuIS (1 File) ☐ EQuIS (4 File)
☐ Other

Regulatory Requirement

☐ NY TOGS ☐ NY Part 375
☐ AWQ Standards ☐ NY CP-51
☐ NY Restricted Use ☐ Other
☐ NY Unrestricted Use
☐ NYC Sewer Discharge

Billing Information

☑ Same as Client Info
PO # 2390.001.001

Disposal Site Information

Please identify below location of applicable disposal facilities.
Disposal Facility
☐ NJ ☐ NY
☐ Other

These samples have been previously analyzed by Alpha ☐

Other project specific requirements/comments:

Please specify Metals or TAL.

ANALYSIS

Sample Filtration
☐ Done
☐ Lab to do
Preservation
☐ Lab to do
(Please Specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	F-COLI-MF	E-COLI-MF	Sample Specific Comments	Total Bottles
	LW-1	7/7/21	08:30	WATER	JMW	X	X		
	LW-2	7/7/21	09:09		JMW	X	X		
	LW-3	7/7/21	09:24		JMW	X	X		
	LW-4	7/7/21	09:43		JMW	X	X		
	LW-5	7/7/21	10:10		JMW	X	X		
	LW-6	7/7/21	10:24		JMW	X	X		
	LW-7	7/7/21	12:30		JMW	X	X		
	LW-8	7/7/21	13:00		JMW	X	X		
	LW-9	7/7/21	13:30		JMW	X	X		
	LW-10	7/7/21	13:40		JMW	X	X		
				Container Type		P	P		
				Preservative		A	A		

Preservative Code: A = None, B = HCl, C = HNO_3, D = H_2SO_4, E = NaOH, F = MeOH, G = $NaHSO_4$, H = $Na_2S_2O_3$, K/E = Zn Ac/NaOH, O = Other

Container Code: P = Plastic, A = Amber Glass, V = Vial, G = Glass, B = Bacteria Cup, C = Cube, O = Other, E = Encore, D = BOD Bottle

Westboro: Certification No: MA935
Mansfield: Certification No: MA015

Relinquished By:	Date/Time	Received By:	Date/Time
JACK WILLIAMS	7/7/21 15:30		
[signature]			
[signature]-AAL-7/7/21		[signature]-AAL	7/7/21 15:30

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. BY EXECUTING THIS COC, THE CLIENT HAS READ AND AGREES TO BE BOUND BY ALPHA'S TERMS & CONDITIONS. (See reverse side.)

Form No: 01-25 HC (rev. 30-Sept-2013)

ALPHA

NEW YORK CHAIN OF CUSTODY

Service Centers
Mahwah, NJ 07430: 35 Whitney Rd, Suite 5
Albany, NY 12205: 14 Walker Way
Tonawanda, NY 14150: 275 Cooper Ave, Suite 105

Page of

Date Rec'd In Lab

ALPHA Job # 354451

Westborough, MA 01581, 8 Walkup Dr., TEL 508-898-9220, FAX 508-898-9193
Mansfield, MA 02048, 320 Forbes Blvd, TEL 508-822-9300, FAX 508-822-3288

Project Information
Project Name: LAKE WACCABUC FIELD SAMPLING
Project Location: LEWISBORO, NY
Project # 2390.001.001
(Use Project name as Project #) ☐
Project Manager: DAVID HANNY
ALPHAQuote #:

Client Information
Client: BARTON & LOGUIDICE
Address: 443 ELECTRONICS PKWY LIVERPOOL, NY 13088
Phone: 585-325-7190
Fax:
Email: JWILLIAMS@BARTONANDLOGUIDICE

Turn-Around Time
Standard ☑ Due Date:
Rush (only if pre approved) ☐ # of Days:

Deliverables
☐ ASP-A ☐ ASP-B
☐ EQuIS (1 File) ☐ EQuIS (4 File)
☐ Other

Regulatory Requirement
☐ NY TOGS ☐ NY Part 375
☐ AWQ Standards ☐ NY CP-51
☐ NY Restricted Use ☐ Other
☐ NY Unrestricted Use
☐ NYC Sewer Discharge

Billing Information
☑ Same as Client Info
PO # 2390.001.001

Disposal Site Information
Please identify below location of applicable disposal facilities.
Disposal Facility:
☐ NJ ☐ NY
☐ Other:

These samples have been previously analyzed by Alpha ☐

Other project specific requirements/comments:

Please specify Metals or TAL.

Sample Filtration
☐ Done
☐ Lab to do
Preservation
☐ Lab to do
(Please Specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	ANALYSIS: F-COLI-MP	F-COLI-MP							Sample Specific Comments	Total Bottles
	MS	7/7/21	12:30	WATER	JMW	X	X								
	MSD	7/7/21	12:30	WATER	JMW	X	X								
	DUP	7/7/21	13:00	WATER	JMW	X	X								

Preservative Code	Container Code
A = None	P = Plastic
B = HCl	A = Amber Glass
C = HNO_3	V = Vial
D = H_2SO_4	G = Glass
E = NaOH	B = Bacteria Cup
F = MeOH	C = Cube
G = $NaHSO_4$	O = Other
H = $Na_2S_2O_3$	E = Encore
K/E = Zn Ac/NaOH	D = BOD Bottle
O = Other	

Westboro: Certification No: MA935
Mansfield: Certification No: MA015

	F-COLI-MP	F-COLI-MP
Container Type	P	P
Preservative	A	A

Relinquished By:	Date/Time	Received By:	Date/Time
JACK WILLIAMS	7/7/21 15:30		
[signature]		[signature] AAL	7/7/21 15:30
[signature] AAL 7/7/21			

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. BY EXECUTING THIS COC, THE CLIENT HAS READ AND AGREES TO BE BOUND BY ALPHA'S TERMS & CONDITIONS. (See reverse side.)

Form No: 01-25 HC (rev. 30-Sept-2013)

EnviroTest Laboratories Inc.

ANALYTICAL REPORT

Job Number: 420-201534-1

Job Description: Alpha Analytical, Inc.

For:
Alpha Analytical
8 Walkup Drive
Westborough, MA 01581

Attention: Subcontract Reports

Renee M. Cusack

Renee Cusack
Lab Director
rcusack@envirotestlaboratories.com
07/22/2021

EnviroTest Laboratories, LLC. Certifications and Approvals: NYSDOH 10142, NJDEP NY015, CTDOPH PH-0554

Envirotest Laboratories
315 Fullerton Avenue, Newburgh, NY 12550
Tel (845) 562-0890 Fax (845) 562-0841 www.envirotestlaboratories.com

ACCREDITED IN ACCORDANCE WITH nelac

METHOD SUMMARY

Client: Alpha Analytical Job Number: 420-201534-1

Description	Lab Location	Method	Preparation Method
Matrix: Water			
Membrane Filter Technique - Fecal Coliform Procedure	EnvTest	SMWW SM 9222D-97	

Lab References:

EnvTest = EnviroTest

Method References:

SMWW = "Standard Methods for the Examination of Water and Wastewater"

METHOD / ANALYST SUMMARY

Client: Alpha Analytical

Job Number: 420-201534-1

Method	Analyst	Analyst ID
SMWW SM 9222D-97	Donnarumma, Lena	LD

SAMPLE SUMMARY

Client: Alpha Analytical

Job Number: 420-201534-1

Lab Sample ID	Client Sample ID	Client Matrix	Date/Time Sampled	Date/Time Received
420-201534-1	LW-1	Water	07/07/2021 0830	07/07/2021 1636
420-201534-2	LW-2	Water	07/07/2021 0909	07/07/2021 1636
420-201534-3	LW-3	Water	07/07/2021 0924	07/07/2021 1636
420-201534-4	LW-4	Water	07/07/2021 0943	07/07/2021 1636
420-201534-5	LW-5	Water	07/07/2021 1010	07/07/2021 1636
420-201534-6	LW-6	Water	07/07/2021 1024	07/07/2021 1636
420-201534-7	LW-7	Water	07/07/2021 1230	07/07/2021 1636
420-201534-8	LW-8	Water	07/07/2021 1300	07/07/2021 1636
420-201534-9	LW-9	Water	07/07/2021 1330	07/07/2021 1636
420-201534-10	LW-10	Water	07/07/2021 1340	07/07/2021 1636
420-201534-11	MS	Water	07/07/2021 1230	07/07/2021 1636
420-201534-12	MSD	Water	07/07/2021 1236	07/07/2021 1636
420-201534-13	DUP	Water	07/07/2021 1300	07/07/2021 1636

SAMPLE RESULTS

Subcontract Reports
Alpha Analytical
8 Walkup Drive
Westborough, MA 01581

Job Number: 420-201534-1

Client Sample ID: **LW-1**
Lab Sample ID: **420-201534-1**

Date Sampled: 07/07/2021 0830
Date Received: 07/07/2021 1636
Client Matrix: Water

Analyte	Result/Qualifier		Unit	RL	RL	Dilution
Method: SM 9222D-97			Date Analyzed:		07/07/2021 1743	
Coliform, Fecal	10	U H	CFU/100mL	10	10	10

Subcontract Reports
Alpha Analytical
8 Walkup Drive
Westborough, MA 01581

Job Number: 420-201534-1

Client Sample ID: **LW-2**
Lab Sample ID: **420-201534-2**

Date Sampled: 07/07/2021 0909
Date Received: 07/07/2021 1636
Client Matrix: Water

Analyte	Result/Qualifier		Unit	RL	RL	Dilution
Method: SM 9222D-97			Date Analyzed:	07/07/2021 1743		
Coliform, Fecal	10	U H	CFU/100mL	10	10	10

Subcontract Reports
Alpha Analytical
8 Walkup Drive
Westborough, MA 01581

Job Number: 420-201534-1

Client Sample ID: **LW-3**
Lab Sample ID: **420-201534-3**

Date Sampled: 07/07/2021 0924
Date Received: 07/07/2021 1636
Client Matrix: Water

Analyte	Result/Qualifier	Unit	RL	RL	Dilution
Method: SM 9222D-97		Date Analyzed:	07/07/2021 1719		
Coliform, Fecal	20	CFU/100mL	10	10	10

Subcontract Reports
Alpha Analytical
8 Walkup Drive
Westborough, MA 01581

Job Number: 420-201534-1

Client Sample ID: **LW-4**
Lab Sample ID: **420-201534-4**

Date Sampled: 07/07/2021 0943
Date Received: 07/07/2021 1636
Client Matrix: Water

Analyte	Result/Qualifier		Unit	RL	RL	Dilution
Method: SM 9222D-97			Date Analyzed:	07/07/2021 1743		
Coliform, Fecal	10	U	CFU/100mL	10	10	10

Subcontract Reports
Alpha Analytical
8 Walkup Drive
Westborough, MA 01581

Job Number: 420-201534-1

Client Sample ID: **LW-5**
Lab Sample ID: **420-201534-5**

Date Sampled: 07/07/2021 1010
Date Received: 07/07/2021 1636
Client Matrix: Water

Analyte	Result/Qualifier		Unit	RL	RL	Dilution
Method: SM 9222D-97			Date Analyzed:	07/07/2021 1743		
Coliform, Fecal	10	U	CFU/100mL	10	10	10

Subcontract Reports
Alpha Analytical
8 Walkup Drive
Westborough, MA 01581

Job Number: 420-201534-1

Client Sample ID: **LW-6**
Lab Sample ID: **420-201534-6**

Date Sampled: 07/07/2021 1024
Date Received: 07/07/2021 1636
Client Matrix: Water

Analyte	Result/Qualifier	Unit	RL	RL	Dilution
Method: SM 9222D-97		Date Analyzed:		07/07/2021 1743	
Coliform, Fecal	90	CFU/100mL	10	10	10

Subcontract Reports
Alpha Analytical
8 Walkup Drive
Westborough, MA 01581

Job Number: 420-201534-1

Client Sample ID: **LW-7**
Lab Sample ID: **420-201534-7**

Date Sampled: 07/07/2021 1230
Date Received: 07/07/2021 1636
Client Matrix: Water

Analyte	Result/Qualifier		Unit	RL	RL	Dilution
Method: SM 9222D-97			Date Analyzed:		07/07/2021 1743	
Coliform, Fecal	10	U	CFU/100mL	10	10	10

Subcontract Reports
Alpha Analytical
8 Walkup Drive
Westborough, MA 01581

Job Number: 420-201534-1

Client Sample ID: **LW-8**
Lab Sample ID: **420-201534-8**

Date Sampled: 07/07/2021 1300
Date Received: 07/07/2021 1636
Client Matrix: Water

Analyte	Result/Qualifier		Unit	RL	RL	Dilution
Method: SM 9222D-97			Date Analyzed:	07/07/2021 1800		
Coliform, Fecal	10	U	CFU/100mL	10	10	10

Subcontract Reports
Alpha Analytical
8 Walkup Drive
Westborough, MA 01581

Job Number: 420-201534-1

Client Sample ID: **LW-9**
Lab Sample ID: **420-201534-9**

Date Sampled: 07/07/2021 1330
Date Received: 07/07/2021 1636
Client Matrix: Water

Analyte	Result/Qualifier		Unit	RL	RL	Dilution
Method: SM 9222D-97			Date Analyzed:	07/07/2021 1800		
Coliform, Fecal	10	U	CFU/100mL	10	10	10

Subcontract Reports
Alpha Analytical
8 Walkup Drive
Westborough, MA 01581

Job Number: 420-201534-1

Client Sample ID: **LW-10**
Lab Sample ID: **420-201534-10**

Date Sampled: 07/07/2021 1340
Date Received: 07/07/2021 1636
Client Matrix: Water

Analyte	Result/Qualifier		Unit	RL	RL	Dilution
Method: SM 9222D-97			Date Analyzed:	07/07/2021 1820		
Coliform, Fecal	10	U	CFU/100mL	10	10	10

Subcontract Reports
Alpha Analytical
8 Walkup Drive
Westborough, MA 01581

Job Number: 420-201534-1

Client Sample ID: **MS**
Lab Sample ID: **420-201534-11**

Date Sampled: 07/07/2021 1230
Date Received: 07/07/2021 1636
Client Matrix: Water

Analyte	Result	Qualifier	Unit	RL	RL	Dilution
Method: SM 9222D-97			Date Analyzed:	07/07/2021 1820		
Coliform, Fecal	10	U	CFU/100mL	10	10	10

Subcontract Reports
Alpha Analytical
8 Walkup Drive
Westborough, MA 01581

Job Number: 420-201534-1

Client Sample ID: **MSD**
Lab Sample ID: **420-201534-12**

Date Sampled: 07/07/2021 1236
Date Received: 07/07/2021 1636
Client Matrix: Water

Analyte	Result/Qualifier		Unit	RL	RL	Dilution
Method: SM 9222D-97			Date Analyzed:	07/07/2021 1820		
Coliform, Fecal	10	U	CFU/100mL	10	10	10

Subcontract Reports
Alpha Analytical
8 Walkup Drive
Westborough, MA 01581

Job Number: 420-201534-1

Client Sample ID: **DUP**
Lab Sample ID: **420-201534-13**

Date Sampled: 07/07/2021 1300
Date Received: 07/07/2021 1636
Client Matrix: Water

Analyte	Result/Qualifier		Unit	RL	RL	Dilution
Method: SM 9222D-97			Date Analyzed:	07/07/2021 1820		
Coliform, Fecal	10	U	CFU/100mL	10	10	10

DATA REPORTING QUALIFIERS

Client: Alpha Analytical

Job Number:

Lab Section	Qualifier	Description
Biology		
	H	Sample was prepped or analyzed beyond the specified holding time
	U	The analyte was analyzed for but not detected at or above the lowest stated limit.

Definitions and Glossary

Client: Alpha Analytical Job Number:

Abbreviation	These commonly used abbreviations may or may not be present in this report.
%R	Percent Recovery
DL, RA, RE	Indicates a Dilution, Reanalysis or Reextraction.
EPA	United States Environmental Protection Agency
MDL	Method Detection Limit - an estimate of the minimum amount of a substance that an analytical process can reliably detect. A MDL is analyte- and matrix-specific and may be laboratory-dependent.
ND	Not detected at the reporting limit (or MDL if shown).
QC	Quality Control
RL	Reporting Limit - the minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence.
RPD	Relative Percent Difference - a measure of the relative difference between two points.

QUALITY CONTROL RESULTS

Quality Control Results

Client: Alpha Analytical | Job Number: 420-201534-1

Method Blank - Batch: 420-156056

Method: SM 9222D-97
Preparation: N/A

Lab Sample ID:	MB 420-156056/11	Analysis Batch:	420-156056	Instrument ID:	No Equipment Assigned
Client Matrix:	Water	Prep Batch:	N/A	Lab File ID:	N/A
Dilution:	1.0	Units:	CFU/100mL	Initial Weight/Volume:	mL
Date Analyzed:	07/07/2021 1719			Final Weight/Volume:	mL
Date Prepared:	N/A			Injection Volume:	

Analyte	Result	Qual	RL	RL
Coliform, Fecal	1.0	U	1.0	1.0

Method Blank - Batch: 420-156056

Method: SM 9222D-97
Preparation: N/A

Lab Sample ID:	MB 420-156056/21	Analysis Batch:	420-156056	Instrument ID:	No Equipment Assigned
Client Matrix:	Water	Prep Batch:	N/A	Lab File ID:	N/A
Dilution:	1.0	Units:	CFU/100mL	Initial Weight/Volume:	mL
Date Analyzed:	07/07/2021 1719			Final Weight/Volume:	mL
Date Prepared:	N/A			Injection Volume:	

Analyte	Result	Qual	RL	RL
Coliform, Fecal	1.0	U	1.0	1.0

Calculations are performed before rounding to avoid round-off errors in calculated results.

Quality Control Results

Client: Alpha Analytical

Job Number: 420-201534-1

Duplicate - Batch: 420-156056

Method: SM 9222D-97
Preparation: N/A

Lab Sample ID:	420-201527-A-10 DU	Analysis Batch:	420-156056	Instrument ID:	No Equipment Assigned
Client Matrix:	Water	Prep Batch:	N/A	Lab File ID:	N/A
Dilution:	10	Units:	CFU/100mL	Initial Weight/Volume:	mL
Date Analyzed:	07/07/2021 1719			Final Weight/Volume:	mL
Date Prepared:	N/A			Injection Volume:	

Analyte	Sample Result/Qual		Result	RPD	Limit	Qual
Coliform, Fecal	10	U	0	NC	20	U

Duplicate - Batch: 420-156056

Method: SM 9222D-97
Preparation: N/A

Lab Sample ID:	420-201534-10	Analysis Batch:	420-156056	Instrument ID:	No Equipment Assigned
Client Matrix:	Water	Prep Batch:	N/A	Lab File ID:	N/A
Dilution:	10	Units:	CFU/100mL	Initial Weight/Volume:	mL
Date Analyzed:	07/07/2021 1820			Final Weight/Volume:	mL
Date Prepared:	N/A			Injection Volume:	

Analyte	Sample Result/Qual		Result	RPD	Limit	Qual
Coliform, Fecal	10	U	0	NC	20	U

Calculations are performed before rounding to avoid round-off errors in calculated results.

201534 Serial_No:07302119:08
1 of 2

NEW YORK CHAIN OF CUSTODY

ALPHA ANALYTICAL

Westborough, MA 01581
8 Walkup Dr.
TEL: 508-898-9220
FAX: 508-898-9193

Mansfield, MA 02048
320 Forbes Blvd
TEL: 508-822-9300
FAX: 508-822-3288

Service Centers
Mahwah, NJ 07430: 35 Whitney Rd, Suite 5
Albany, NY 12205: 14 Walker Way
Tonawanda, NY 14150: 275 Cooper Ave, Suite 105

Page of

Date Rec'd in Lab

ALPHA Job # 354451

Project Information

Project Name: LAKE WACCABUC FIELD SAMPLING
Project Location: LEWISBORO, NY
Project # 2390.001.001
(Use Project name as Project #) ☐
Project Manager: DAVID HANNY
ALPHAQuote #:

Turn-Around Time

Standard ☑ Due Date:
Rush (only if pre approved) ☐ # of Days:

Client Information

Client: BARTON & LOGUIDICE
Address: 443 ELECTRONICS PKWY
LIVERPOOL, NY 13088
Phone: 585-325-7190
Fax:
Email: JWILLIAMS@BARTONANDLOGUIDICE.COM

Deliverables

☐ ASP-A ☐ ASP-B
☐ EQuIS (1 File) ☐ EQuIS (4 File)
☐ Other

Billing Information

☑ Same as Client Info
PO # 2390.001.001

Regulatory Requirement

☐ NY TOGS ☐ NY Part 375
☐ AWQ Standards ☐ NY CP-51
☐ NY Restricted Use ☐ Other
☐ NY Unrestricted Use
☐ NYC Sewer Discharge

Disposal Site Information

Please identify below location of applicable disposal facilities.
Disposal Facility:
☐ NJ ☐ NY
☐ Other:

These samples have been previously analyzed by Alpha ☐

Other project specific requirements/comments:

Please specify Metals or TAL.

ANALYSIS

Sample Filtration
☐ Done
☐ Lab to do
Preservation
☐ Lab to do
(Please Specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	F-Coli-MF	F-Coli-MF	Sample Specific Comments	Total Bottles
	LW-1	7/7/21	08:30	WATER	JMW	X	/		
	LW-2	7/7/21	09:09		JMW	X	X		
	LW-3	7/7/21	09:24		JMW	X	X		
	LW-4	7/7/21	09:43		JMW	X	X		
	LW-5	7/7/21	10:10		JMW	X	X		
	LW-6	7/7/21	10:24		JMW	X	X		
	LW-7	7/7/21	12:30		JMW	X	X		
	LW-8	7/7/21	13:00		JMW	X	X		
	LW-9	7/7/21	13:30		JMW	X	X		
	LW-10	7/7/21	13:40		JMW	X	X		

420-201534-B-1
LW-1
Date Sampled: 7/7/2021 420-1732690

Preservative Code:	Container Code
A = None	P = Plastic
B = HCl	A = Amber Glass
C = HNO_3	V = Vial
D = H_2SO_4	G = Glass
E = NaOH	B = Bacteria Cup
F = MeOH	C = Cube
G = $NaHSO_4$	O = Other
H = $Na_2S_2O_3$	E = Encore
K/E = Zn Ac/NaOH	D = BOD Bottle
O = Other	

Westboro: Certification No: MA935
Mansfield: Certification No: MA015

	F-Coli-MF	F-Coli-MF
Container Type	P	P
Preservative	A	A

Relinquished By:	Date/Time	Received By:	Date/Time
JACK WILLIAMS	7/7/21 15:30	[signature] AAL	7/7/21 15:30
[signature] AAL	7/7/21 16:36	[signature]	7/7/21 1636

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. BY EXECUTING THIS COC, THE CLIENT HAS READ AND AGREES TO BE BOUND BY ALPHA'S TERMS & CONDITIONS. (See reverse side.)

Form No: 01-25 HC (rev. 30-Sept-2013)

8.9°C on ice

LOGIN SAMPLE RECEIPT CHECK LIST

Client: Alpha Analytical

Job Number: 420-201534-1

Login Number: 201534

Question	T/F/NA	Comment
Samples were collected by ETL employee as per SOP-SAM-1	NA	
The cooler's custody seal, if present, is intact.	NA	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is recorded.	True	8.9 C
Cooler Temp. is within method specified range.(0-6 C PW, 0-8 C NPW, or BAC <10 C	True	
If false, was sample received on ice within 6 hours of collection.	NA	
Based on above criteria cooler temperature is acceptable.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
There are no discrepancies between the sample IDs on the containers and the COC.	True	
Samples are received within Holding Time.	False	LW-1 Received out of hold time
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
VOA sample vials do not have headspace or bubble is <6mm (1/4") in diameter.	NA	
If necessary, staff have been informed of any short hold time or quick TAT needs	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	

```
JOB: L2136669     REPORT STYLE: Data Usability Report
0010: Alpha Analytical Report Cover Page - OK
0015: Sample Cross Reference Summary - OK
0060: Case Narrative - OK
1180: Inorganics Cover Page - OK
1200: Wet Chemistry Sample Results - OK
1210: Wet Chemistry Method Blank Report - OK
1220: Wet Chemistry LCS Report - OK
1240: Wet Chemistry Matrix Spike Report - OK
1250: Wet Chemistry Duplicate Report - OK
5100: Sample Receipt & Container Information Report - OK
5200: Glossary - OK
5400: References - OK
----------------------------------------------------------
No results found for sample L2136669-01 for product SNITROGEN
No results found for sample L2136669-01 for product SNO3/NO2-4500
No results found for sample L2136669-01 for product STKN-4500
No results found for sample L2136669-01 for product TNITROGEN
No results found for sample L2136669-02 for product SNITROGEN
No results found for sample L2136669-02 for product STKN-4500
No results found for sample L2136669-02 for product TNITROGEN
No results found for sample L2136669-03 for product SNITROGEN
No results found for sample L2136669-03 for product STKN-4500
No results found for sample L2136669-03 for product TNITROGEN
No results found for sample L2136669-04 for product SNITROGEN
No results found for sample L2136669-04 for product STKN-4500
No results found for sample L2136669-04 for product TNITROGEN
No results found for sample L2136669-05 for product SNITROGEN
No results found for sample L2136669-05 for product STKN-4500
No results found for sample L2136669-05 for product TNITROGEN
No results found for sample L2136669-06 for product SNITROGEN
No results found for sample L2136669-06 for product STKN-4500
No results found for sample L2136669-06 for product TNITROGEN
```

ANALYTICAL REPORT

Lab Number:	L2136669
Client:	Barton & Loguidice 11 Centre Park Drive Rochester, NY 14614
ATTN:	Dave Hanny
Phone:	(585) 325-7190
Project Name:	LAKE WACCABUC FIELD SAMPLING
Project Number:	29.30.001.001
Report Date:	07/30/21

Certifications & Approvals: MA (M-MA086), NH NELAP (2064), CT (PH-0574), IL (200077), ME (MA00086), MD (348), NJ (MA935), NY (11148), NC (25700/666), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #P330-17-00196).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: LAKE WACCABUC FIELD SAMPLING
Project Number: 29.30.001.001

Lab Number: L2136669
Report Date: 07/30/21

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L2136669-01	LW-11	WASTEWATER	LEWISBORO, NY	07/08/21 08:15	07/08/21
L2136669-02	LW-12	WASTEWATER	LEWISBORO, NY	07/08/21 08:40	07/08/21
L2136669-03	LW-13	WASTEWATER	LEWISBORO, NY	07/08/21 09:00	07/08/21
L2136669-04	LW-14	WASTEWATER	LEWISBORO, NY	07/08/21 09:15	07/08/21
L2136669-05	LW-15	WASTEWATER	LEWISBORO, NY	07/08/21 09:30	07/08/21
L2136669-06	LW-16	WASTEWATER	LEWISBORO, NY	07/08/21 09:40	07/08/21

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively.

When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances, the specific failure is not narrated but noted in the associated QC Outlier Summary Report, located directly after the Case Narrative. QC information is also incorporated in the Data Usability Assessment table (Format 11) of our Data Merger tool, where it can be reviewed in conjunction with the sample result, associated regulatory criteria and any associated data usability implications.

Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

HOLD POLICY - For samples submitted on hold, Alpha's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Alpha Project Manager and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Project Management at 800-624-9220 with any questions.

Project Name:	LAKE WACCABUC FIELD SAMPLING	**Lab Number:**	L2136669
Project Number:	29.30.001.001	**Report Date:**	07/30/21

Case Narrative (continued)

Report Submission

July 30, 2021: This is a preliminary report.

All non-detect (ND) or estimated concentrations (J-qualified) have been quantitated to the limit noted in the MDL column.

The analysis of Fecal Coliform was subcontracted. A copy of the laboratory report is included as an addendum. Please note: This data is only available in PDF format and is not available on Data Merger.

Nitrogen, Total Kjeldahl

The WG1528625-3 Laboratory Duplicate RPD for nitrogen, total kjeldahl (78%), performed on L2136669-01, is outside the acceptance criteria. The elevated RPD has been attributed to the non-homogeneous nature of the native sample.

The WG1528625-4 MS recovery, performed on L2136669-01, is outside the acceptance criteria for nitrogen, total kjeldahl (116%); however, the associated LCS recovery is within criteria. No further action was taken.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature: Jennifer L Clements

Title: Technical Director/Representative Date: 07/30/21

INORGANICS
&
MISCELLANEOUS

Project Name: LAKE WACCABUC FIELD SAMPLING
Lab Number: L2136669
Project Number: 29.30.001.001
Report Date: 07/30/21

SAMPLE RESULTS

Lab ID: L2136669-01
Date Collected: 07/08/21 08:15
Client ID: LW-11
Date Received: 07/08/21
Sample Location: LEWISBORO, NY
Field Prep: Not Specified

Sample Depth:
Matrix: Wastewater

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Color, Apparent	27		A.P.C.U.	5.0	5.0	1	-	07/09/21 04:02	121,2120B	KA
Nitrogen, Ammonia	0.098		mg/l	0.075	0.024	1	07/28/21 06:00	07/28/21 23:28	121,4500NH3-BH	AT
Nitrogen, Nitrate/Nitrite	0.034	J	mg/l	0.10	0.023	1	-	07/15/21 03:41	44,353.2	EL
Nitrogen, Total Kjeldahl	1.14		mg/l	0.300	0.066	1	07/28/21 00:08	07/29/21 11:38	121,4500NH3-H	KP
Phosphorus, Total	0.037		mg/l	0.010	0.004	1	07/21/21 09:00	07/21/21 13:22	121,4500P-E	SD
Phosphorus, Soluble	0.014		mg/l	0.010	0.004	1	07/13/21 14:55	07/14/21 11:07	121,4500P-E	SD
Chlorophyll A	30.9		mg/m3	2.00	NA	1	07/09/21 06:00	07/12/21 07:30	121,10200H	MT

Project Name: LAKE WACCABUC FIELD SAMPLING **Lab Number:** L2136669
Project Number: 29.30.001.001 **Report Date:** 07/30/21

SAMPLE RESULTS

Lab ID: L2136669-02 Date Collected: 07/08/21 08:40
Client ID: LW-12 Date Received: 07/08/21
Sample Location: LEWISBORO, NY Field Prep: Not Specified

Sample Depth:
Matrix: Wastewater

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Color, Apparent	26		A.P.C.U.	10	10.	2	-	07/09/21 04:02	121,2120B	KA
Nitrogen, Nitrate/Nitrite	0.032	J	mg/l	0.10	0.023	1	-	07/15/21 03:49	44,353.2	EL
Nitrogen, Dissolved Nitrate/Nitrite	ND		mg/l	0.10	0.023	1	-	07/28/21 05:15	121,4500NO3-F	MR
Nitrogen, Total Kjeldahl	1.02		mg/l	0.300	0.066	1	07/28/21 00:08	07/29/21 11:44	121,4500NH3-H	KP
Phosphorus, Total	0.029		mg/l	0.010	0.004	1	07/21/21 09:00	07/21/21 13:23	121,4500P-E	SD
Phosphorus, Soluble	0.014		mg/l	0.010	0.004	1	07/13/21 14:55	07/14/21 11:08	121,4500P-E	SD
Chlorophyll A	28.6		mg/m3	2.00	NA	1	07/09/21 06:00	07/12/21 07:30	121,10200H	MT

Project Name: LAKE WACCABUC FIELD SAMPLING **Lab Number:** L2136669
Project Number: 29.30.001.001 **Report Date:** 07/30/21

SAMPLE RESULTS

Lab ID: L2136669-03 Date Collected: 07/08/21 09:00
Client ID: LW-13 Date Received: 07/08/21
Sample Location: LEWISBORO, NY Field Prep: Not Specified

Sample Depth:
Matrix: Wastewater

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Color, Apparent	28		A.P.C.U.	10	10.	2	-	07/09/21 04:02	121,2120B	KA
Nitrogen, Nitrate/Nitrite	0.027	J	mg/l	0.10	0.023	1	-	07/15/21 03:50	44,353.2	EL
Nitrogen, Dissolved Nitrate/Nitrite	ND		mg/l	0.10	0.023	1	-	07/28/21 05:16	121,4500NO3-F	MR
Nitrogen, Total Kjeldahl	1.17		mg/l	0.300	0.066	1	07/28/21 00:08	07/29/21 11:45	121,4500NH3-H	KP
Phosphorus, Total	0.039		mg/l	0.010	0.004	1	07/21/21 09:00	07/21/21 13:24	121,4500P-E	SD
Phosphorus, Soluble	0.011		mg/l	0.010	0.004	1	07/13/21 14:55	07/14/21 11:10	121,4500P-E	SD
Chlorophyll A	33.7		mg/m3	2.00	NA	1	07/09/21 06:00	07/12/21 07:30	121,10200H	MT

Project Name: LAKE WACCABUC FIELD SAMPLING
Project Number: 29.30.001.001

Lab Number: L2136669
Report Date: 07/30/21

SAMPLE RESULTS

Lab ID: L2136669-04
Client ID: LW-14
Sample Location: LEWISBORO, NY

Date Collected: 07/08/21 09:15
Date Received: 07/08/21
Field Prep: Not Specified

Sample Depth:
Matrix: Wastewater

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Color, Apparent	22		A.P.C.U.	10	10.	2	-	07/09/21 04:02	121,2120B	KA
Nitrogen, Nitrate/Nitrite	0.023	J	mg/l	0.10	0.023	1	-	07/15/21 03:52	44,353.2	EL
Nitrogen, Dissolved Nitrate/Nitrite	ND		mg/l	0.10	0.023	1	-	07/28/21 05:51	121,4500NO3-F	MR
Nitrogen, Total Kjeldahl	1.26		mg/l	0.300	0.066	1	07/28/21 00:08	07/29/21 11:45	121,4500NH3-H	KP
Phosphorus, Total	0.032		mg/l	0.010	0.004	1	07/21/21 09:00	07/21/21 13:25	121,4500P-E	SD
Phosphorus, Soluble	0.010		mg/l	0.010	0.004	1	07/13/21 14:55	07/14/21 11:11	121,4500P-E	SD
Chlorophyll A	27.2		mg/m3	2.00	NA	1	07/09/21 06:00	07/12/21 07:30	121,10200H	MT

Project Name: LAKE WACCABUC FIELD SAMPLING
Lab Number: L2136669
Project Number: 29.30.001.001
Report Date: 07/30/21

SAMPLE RESULTS

Lab ID: L2136669-05
Date Collected: 07/08/21 09:30
Client ID: LW-15
Date Received: 07/08/21
Sample Location: LEWISBORO, NY
Field Prep: Not Specified

Sample Depth:
Matrix: Wastewater

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Nitrogen, Nitrate/Nitrite	ND		mg/l	0.10	0.023	1	-	07/15/21 03:53	44,353.2	EL
Nitrogen, Dissolved Nitrate/Nitrite	ND		mg/l	0.10	0.023	1	-	07/28/21 05:55	121,4500NO3-F	MR
Nitrogen, Total Kjeldahl	1.91		mg/l	0.300	0.066	1	07/28/21 00:08	07/29/21 11:46	121,4500NH3-H	KP
Phosphorus, Total	0.033		mg/l	0.010	0.004	1	07/21/21 09:00	07/21/21 13:26	121,4500P-E	SD
Phosphorus, Soluble	0.024		mg/l	0.010	0.004	1	07/13/21 14:55	07/14/21 11:12	121,4500P-E	SD

Project Name: LAKE WACCABUC FIELD SAMPLING
Project Number: 29.30.001.001

Lab Number: L2136669
Report Date: 07/30/21

SAMPLE RESULTS

Lab ID: L2136669-06
Client ID: LW-16
Sample Location: LEWISBORO, NY

Date Collected: 07/08/21 09:40
Date Received: 07/08/21
Field Prep: Not Specified

Sample Depth:
Matrix: Wastewater

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Nitrogen, Nitrate/Nitrite	0.027	J	mg/l	0.10	0.023	1	-	07/15/21 03:54	44,353.2	EL
Nitrogen, Dissolved Nitrate/Nitrite	ND		mg/l	0.10	0.023	1	-	07/28/21 05:56	121,4500NO3-F	MR
Nitrogen, Total Kjeldahl	3.22		mg/l	0.300	0.066	1	07/28/21 00:08	07/29/21 11:47	121,4500NH3-H	KP
Phosphorus, Total	0.032		mg/l	0.010	0.004	1	07/21/21 09:00	07/21/21 13:30	121,4500P-E	SD
Phosphorus, Soluble	0.019		mg/l	0.010	0.004	1	07/13/21 14:55	07/14/21 11:15	121,4500P-E	SD

Project Name: LAKE WACCABUC FIELD SAMPLING
Lab Number: L2136669
Project Number: 29.30.001.001
Report Date: 07/30/21

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab for sample(s): 01-04 Batch: WG1522203-1										
Chlorophyll A	ND		mg/m3	2.00	NA	1	07/09/21 06:00	07/12/21 07:30	121,10200H	MT
General Chemistry - Westborough Lab for sample(s): 01-06 Batch: WG1523389-1										
Phosphorus, Soluble	ND		mg/l	0.010	0.004	1	07/13/21 14:55	07/14/21 10:55	121,4500P-E	SD
General Chemistry - Westborough Lab for sample(s): 01-06 Batch: WG1523629-1										
Nitrogen, Nitrate/Nitrite	ND		mg/l	0.10	0.023	1	-	07/15/21 01:40	44,353.2	EL
General Chemistry - Westborough Lab for sample(s): 01-06 Batch: WG1526235-1										
Phosphorus, Total	0.004	J	mg/l	0.010	0.004	1	07/21/21 09:00	07/21/21 13:19	121,4500P-E	SD
General Chemistry - Westborough Lab for sample(s): 01-06 Batch: WG1528625-1										
Nitrogen, Total Kjeldahl	ND		mg/l	0.300	0.022	1	07/28/21 00:08	07/29/21 11:34	121,4500NH3-H	KP
General Chemistry - Westborough Lab for sample(s): 02-06 Batch: WG1528637-1										
Nitrogen, Dissolved Nitrate/Nitrite	ND		mg/l	0.10	0.023	1	-	07/28/21 03:15	121,4500NO3-F	MR
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG1528655-1										
Nitrogen, Ammonia	ND		mg/l	0.075	0.024	1	07/28/21 06:00	07/28/21 23:21	121,4500NH3-BH	AT

Lab Control Sample Analysis
Batch Quality Control

Project Name: LAKE WACCABUC FIELD SAMPLING
Project Number: 29.30.001.001

Lab Number: L2136669
Report Date: 07/30/21

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-06 Batch: WG1523389-2								
Phosphorus, Soluble	109		-		80-120	-		
General Chemistry - Westborough Lab Associated sample(s): 01-06 Batch: WG1523629-2								
Nitrogen, Nitrate/Nitrite	98		-		90-110	-		
General Chemistry - Westborough Lab Associated sample(s): 01-06 Batch: WG1526235-2								
Phosphorus, Total	110		-		80-120	-		
General Chemistry - Westborough Lab Associated sample(s): 01-06 Batch: WG1528625-2								
Nitrogen, Total Kjeldahl	98		-		78-122	-		
General Chemistry - Westborough Lab Associated sample(s): 02-06 Batch: WG1528637-2								
Nitrogen, Dissolved Nitrate/Nitrite	100		-		90-110	-		20
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG1528655-2								
Nitrogen, Ammonia	99		-		80-120	-		20

Matrix Spike Analysis
Batch Quality Control

Project Name: LAKE WACCABUC FIELD SAMPLING
Project Number: 29.30.001.001
Lab Number: L2136669
Report Date: 07/30/21

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-06 QC Batch ID: WG1523389-4 QC Sample: L2136434-02 Client ID: MS Sample												
Phosphorus, Soluble	0.053	1	1.11	106		-	-		75-125	-		20
General Chemistry - Westborough Lab Associated sample(s): 01-06 QC Batch ID: WG1523629-4 QC Sample: L2136669-01 Client ID: LW-11												
Nitrogen, Nitrate/Nitrite	0.034J	4	4.0	100		-	-		80-120	-		20
General Chemistry - Westborough Lab Associated sample(s): 01-06 QC Batch ID: WG1526235-4 QC Sample: L2136958-01 Client ID: MS Sample												
Phosphorus, Total	0.158	0.5	0.665	101		-	-		75-125	-		20
General Chemistry - Westborough Lab Associated sample(s): 01-06 QC Batch ID: WG1528625-4 QC Sample: L2136669-01 Client ID: LW-11												
Nitrogen, Total Kjeldahl	1.14	8	10.4	**116**	Q	-	-		77-111	-		24
General Chemistry - Westborough Lab Associated sample(s): 02-06 QC Batch ID: WG1528637-4 QC Sample: L2136669-04 Client ID: LW-14												
Nitrogen, Dissolved Nitrate/Nitrite	ND	4	3.8	95		-	-		80-120	-		20
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1528655-4 QC Sample: L2138705-05 Client ID: MS Sample												
Nitrogen, Ammonia	0.033J	4	3.77	94		-	-		80-120	-		20

Project Name: LAKE WACCABUC FIELD SAMPLING
Project Number: 29.30.001.001

Lab Duplicate Analysis
Batch Quality Control

Lab Number: L2136669
Report Date: 07/30/21

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG1522021-1 QC Sample: L2136669-01 Client ID: LW-11						
Color, Apparent	27	27	A.P.C.U.	0		
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG1522203-2 QC Sample: L2136693-03 Client ID: DUP Sample						
Chlorophyll A	7.01	6.27	mg/m3	11		35
General Chemistry - Westborough Lab Associated sample(s): 01-06 QC Batch ID: WG1523389-3 QC Sample: L2136434-01 Client ID: DUP Sample						
Phosphorus, Soluble	0.065	0.075	mg/l	14		20
General Chemistry - Westborough Lab Associated sample(s): 01-06 QC Batch ID: WG1523629-3 QC Sample: L2136669-01 Client ID: LW-11						
Nitrogen, Nitrate/Nitrite	0.034J	0.024J	mg/l	NC		20
General Chemistry - Westborough Lab Associated sample(s): 01-06 QC Batch ID: WG1526235-3 QC Sample: L2136958-01 Client ID: DUP Sample						
Phosphorus, Total	0.158	0.154	mg/l	3		20
General Chemistry - Westborough Lab Associated sample(s): 01-06 QC Batch ID: WG1528625-3 QC Sample: L2136669-01 Client ID: LW-11						
Nitrogen, Total Kjeldahl	1.14	2.61	mg/l	**78**	Q	24
General Chemistry - Westborough Lab Associated sample(s): 02-06 QC Batch ID: WG1528637-3 QC Sample: L2136669-04 Client ID: LW-14						
Nitrogen, Dissolved Nitrate/Nitrite	ND	ND	mg/l	NC		20
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG1528655-3 QC Sample: L2138705-05 Client ID: DUP Sample						
Nitrogen, Ammonia	0.033J	0.106	mg/l	NC		20

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information

Cooler	Custody Seal
A	Absent
B	Absent

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2136669-01A	Plastic 250ml unpreserved	B	7	7	5.2	Y	Absent		FILTER(1)
L2136669-01B	Amber 250ml unpreserved	B	7	7	5.2	Y	Absent		COLOR-A-2120(2)
L2136669-01C	Plastic 250ml HNO3 preserved	B	<2	<2	5.2	Y	Absent		SUB-HARDNESS(180),SUB-METALS 200.7(180)
L2136669-01D	Plastic 500ml unpreserved	B	7	7	5.2	Y	Absent		FILTER(1)
L2136669-01E	Plastic 500ml H2SO4 preserved	B	<2	<2	5.2	Y	Absent		TKN-4500(28),NO3/NO2-353(28),TPHOS-4500(28),TNITROGEN(28),NH3-4500(28)
L2136669-01F	Plastic 500ml H2SO4 preserved	B	<2	<2	5.2	Y	Absent		TKN-4500(28),NO3/NO2-353(28),TPHOS-4500(28),TNITROGEN(28),NH3-4500(28)
L2136669-01G	Brown Plastic 1000ml unpreserved	B	NA		5.2	Y	Absent		CHLORO-A(1)
L2136669-01H	Brown Plastic 1000ml unpreserved	B	NA		5.2	Y	Absent		CHLORO-A(1)
L2136669-01W	Plastic 500ml H2SO4 preserved Filtrates	B	NA		5.2	Y	Absent		SNO3/NO2-4500(28),STKN-4500(28),SNITROGEN(28),SPHOS-4500(28)
L2136669-02A	Plastic 250ml unpreserved	B	7	7	5.2	Y	Absent		FILTER(1)
L2136669-02B	Amber 250ml unpreserved	B	7	7	5.2	Y	Absent		COLOR-A-2120(2)
L2136669-02C	Plastic 500ml unpreserved	B	7	7	5.2	Y	Absent		FILTER(1)
L2136669-02D	Plastic 500ml H2SO4 preserved	B	<2	<2	5.2	Y	Absent		TKN-4500(28),NO3/NO2-353(28),TPHOS-4500(28),TNITROGEN(28)
L2136669-02E	Brown Plastic 1000ml unpreserved	B	NA		5.2	Y	Absent		CHLORO-A(1)
L2136669-02F	Brown Plastic 1000ml unpreserved	B	NA		5.2	Y	Absent		CHLORO-A(1)
L2136669-02W	Plastic 500ml H2SO4 preserved Filtrates	B	NA		5.2	Y	Absent		STKN-4500(28),SNO3/NO2-4500(28),SNITROGEN(28),SPHOS-4500(28)
L2136669-03A	Plastic 250ml unpreserved	A	7	7	3.5	Y	Absent		FILTER(1)
L2136669-03B	Amber 250ml unpreserved	A	7	7	3.5	Y	Absent		COLOR-A-2120(2)
L2136669-03C	Plastic 500ml unpreserved	A	7	7	3.5	Y	Absent		FILTER(1)
L2136669-03D	Plastic 500ml H2SO4 preserved	A	<2	<2	3.5	Y	Absent		TKN-4500(28),NO3/NO2-353(28),TPHOS-4500(28),TNITROGEN(28)

*Values in parentheses indicate holding time in days

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2136669-03E	Brown Plastic 1000ml unpreserved	A	NA		3.5	Y	Absent		CHLORO-A(1)
L2136669-03F	Brown Plastic 1000ml unpreserved	A	NA		3.5	Y	Absent		CHLORO-A(1)
L2136669-03W	Plastic 500ml H2SO4 preserved Filtrates	A	NA		3.5	Y	Absent		SNO3/NO2-4500(28),STKN-4500(28),SNITROGEN(28),SPHOS-4500(28)
L2136669-04A	Plastic 250ml unpreserved	A	NA		3.5	Y	Absent		FILTER(1)
L2136669-04B	Amber 250ml unpreserved	A	7	7	3.5	Y	Absent		COLOR-A-2120(2)
L2136669-04C	Plastic 500ml unpreserved	A	7	7	3.5	Y	Absent		FILTER(1)
L2136669-04D	Plastic 500ml H2SO4 preserved	A	<2	<2	3.5	Y	Absent		TKN-4500(28),NO3/NO2-353(28),TPHOS-4500(28),TNITROGEN(28)
L2136669-04E	Brown Plastic 1000ml unpreserved	A	NA		3.5	Y	Absent		CHLORO-A(1)
L2136669-04F	Brown Plastic 1000ml unpreserved	A	NA		3.5	Y	Absent		CHLORO-A(1)
L2136669-04W	Plastic 500ml H2SO4 preserved Filtrates	A	NA		3.5	Y	Absent		SNO3/NO2-4500(28),STKN-4500(28),SNITROGEN(28),SPHOS-4500(28)
L2136669-05A	Plastic 250ml unpreserved	A	8	8	3.5	Y	Absent		FILTER(1)
L2136669-05B	Plastic 500ml unpreserved	A	9	9	3.5	Y	Absent		FILTER(1)
L2136669-05C	Plastic 500ml H2SO4 preserved	A	<2	<2	3.5	Y	Absent		TKN-4500(28),NO3/NO2-353(28),TPHOS-4500(28),TNITROGEN(28)
L2136669-05W	Plastic 500ml H2SO4 preserved Filtrates	A	NA		3.5	Y	Absent		SNO3/NO2-4500(28),STKN-4500(28),SNITROGEN(28),SPHOS-4500(28)
L2136669-06A	Plastic 250ml unpreserved	A	8	8	3.5	Y	Absent		FILTER(1)
L2136669-06B	Plastic 500ml unpreserved	A	8	8	3.5	Y	Absent		FILTER(1)
L2136669-06C	Plastic 500ml H2SO4 preserved	A	<2	<2	3.5	Y	Absent		TKN-4500(28),NO3/NO2-353(28),TPHOS-4500(28),TNITROGEN(28)
L2136669-06W	Plastic 500ml H2SO4 preserved Filtrates	A	NA		3.5	Y	Absent		SNO3/NO2-4500(28),STKN-4500(28),SNITROGEN(28),SPHOS-4500(28)

*Values in parentheses indicate holding time in days

GLOSSARY

Acronyms

DL - Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the limit of quantitation (LOQ). The DL includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

EDL - Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).

EMPC - Estimated Maximum Possible Concentration: The concentration that results from the signal present at the retention time of an analyte when the ions meet all of the identification criteria except the ion abundance ratio criteria. An EMPC is a worst-case estimate of the concentration.

EPA - Environmental Protection Agency.

LCS - Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

LCSD - Laboratory Control Sample Duplicate: Refer to LCS.

LFB - Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

LOD - Limit of Detection: This value represents the level to which a target analyte can reliably be detected for a specific analyte in a specific matrix by a specific method. The LOD includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

LOQ - Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

MDL - Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

MS - Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. For Method 332.0, the spike recovery is calculated using the native concentration, including estimated values.

MSD - Matrix Spike Sample Duplicate: Refer to MS.

NA - Not Applicable.

NC - Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.

NDPA/DPA - N-Nitrosodiphenylamine/Diphenylamine.

NI - Not Ignitable.

NP - Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.

NR - No Results: Term is utilized when 'No Target Compounds Requested' is reported for the analysis of Volatile or Semivolatile Organic TIC only requests.

RL - Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

RPD - Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.

SRM - Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.

STLP - Semi-dynamic Tank Leaching Procedure per EPA Method 1315.

TEF - Toxic Equivalency Factors: The values assigned to each dioxin and furan to evaluate their toxicity relative to 2,3,7,8-TCDD.

TEQ - Toxic Equivalent: The measure of a sample's toxicity derived by multiplying each dioxin and furan by its corresponding TEF and then summing the resulting values.

TIC - Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Report Format: DU Report with 'J' Qualifiers

Footnotes

1 - The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Difference: With respect to Total Oxidizable Precursor (TOP) Assay analysis, the difference is defined as the Post-Treatment value minus the Pre-Treatment value.

Final pH: As it pertains to Sample Receipt & Container Information section of the report, Final pH reflects pH of container determined after adjustment at the laboratory, if applicable. If no adjustment required, value reflects Initial pH.

Frozen Date/Time: With respect to Volatile Organics in soil, Frozen Date/Time reflects the date/time at which associated Reagent Water-preserved vials were initially frozen. Note: If frozen date/time is beyond 48 hours from sample collection, value will be reflected in 'bold'.

Initial pH: As it pertains to Sample Receipt & Container Information section of the report, Initial pH reflects pH of container determined upon receipt, if applicable.

PAH Total: With respect to Alkylated PAH analyses, the 'PAHs, Total' result is defined as the summation of results for all or a subset of the following compounds: Naphthalene, C1-C4 Naphthalenes, 2-Methylnaphthalene, 1-Methylnaphthalene, Biphenyl, Acenaphthylene, Acenaphthene, Fluorene, C1-C3 Fluorenes, Phenanthrene, C1-C4 Phenanthrenes/Anthracenes, Anthracene, Fluoranthene, Pyrene, C1-C4 Fluoranthenes/Pyrenes, Benz(a)anthracene, Chrysene, C1-C4 Chrysenes, Benzo(b)fluoranthene, Benzo(j)+(k)fluoranthene, Benzo(e)pyrene, Benzo(a)pyrene, Perylene, Indeno(1,2,3-cd)pyrene, Dibenz(ah)+(ac)anthracene, Benzo(g,h,i)perylene. If a 'Total' result is requested, the results of its individual components will also be reported.

PFAS Total: With respect to PFAS analyses, the 'PFAS, Total (5)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA and PFOS. In addition, the 'PFAS, Total (6)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA, PFDA and PFOS. For MassDEP DW compliance analysis only, the 'PFAS, Total (6)' result is defined as the summation of results at or above the RL. Note: If a 'Total' result is requested, the results of its individual components will also be reported.

The target compound Chlordane (CAS No. 57-74-9) is reported for GC ECD analyses. Per EPA,this compound "refers to a mixture of chlordane isomers, other chlorinated hydrocarbons and numerous other components." (Reference: USEPA Toxicological Review of Chlordane, In Support of Summary Information on the Integrated Risk Information System (IRIS), December 1997.)

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Data Qualifiers

A - Spectra identified as "Aldol Condensates" are byproducts of the extraction/concentration procedures when acetone is introduced in the process.

B - The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

C - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.

D - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

F - The ratio of quantifier ion response to qualifier ion response falls outside of the laboratory criteria. Results are considered to be an estimated maximum concentration.

G - The concentration may be biased high due to matrix interferences (i.e, co-elution) with non-target compound(s). The result should be considered estimated.

H - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.

I - The lower value for the two columns has been reported due to obvious interference.

J - Estimated value. The Target analyte concentration is below the quantitation limit (RL), but above the Method Detection Limit (MDL) or Estimated Detection Limit (EDL) for SPME-related analyses. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

M - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.

ND - Not detected at the method detection limit (MDL) for the sample, or estimated detection limit (EDL) for SPME-related analyses.

Report Format: DU Report with 'J' Qualifiers

Data Qualifiers

NJ - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.

P - The RPD between the results for the two columns exceeds the method-specified criteria.

Q - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)

R - Analytical results are from sample re-analysis.

RE - Analytical results are from sample re-extraction.

S - Analytical results are from modified screening analysis.

REFERENCES

44 Methods for the Determination of Inorganic Substances in Environmental Samples, EPA/600/R-93/100, August 1993.

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.

Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility
EPA 624/624.1: m/p-xylene, o-xylene, Naphthalene
EPA 625/625.1: alpha-Terpineol
EPA 8260C/8260D: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D/8270E: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine, alpha-Terpineol; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
SM4500: NPW: Amenable Cyanide; SCM: Total Phosphorus, TKN, NO2, NO3.

Mansfield Facility
SM 2540D: TSS
EPA 8082A: NPW: PCB: 1, 5, 31, 87,101, 110, 141, 151, 153, 180, 183, 187.
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.
Biological Tissue Matrix: EPA 3050B

The following analytes are included in our Massachusetts DEP Scope of Accreditation

Westborough Facility:

Drinking Water
EPA 300.0: Chloride, Nitrate-N, Fluoride, Sulfate; **EPA 353.2**: Nitrate-N, Nitrite-N; **SM4500NO3-F**: Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500Cl-D, SM2320B, SM2540C, SM4500H-B, SM4500NO2-B**
EPA 332: Perchlorate; **EPA 524.2:** THMs and VOCs; **EPA 504.1:** EDB, DBCP.
Microbiology: **SM9215B; SM9223-P/A, SM9223B-Colilert-QT,SM9222D**.

Non-Potable Water
SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH: Ammonia-N and Kjeldahl-N, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **EPA 351.1, SM4500NO3-F, EPA 353.2**: Nitrate-N**, SM4500P-E, SM4500P-B, E, SM4500SO4-E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D, EPA 300: Chloride, Sulfate, Nitrate.**
EPA 624.1: Volatile Halocarbons & Aromatics,
EPA 608.3: Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs
EPA 625.1: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E, EPA 1600, EPA 1603, SM9222D.**

Mansfield Facility:

Drinking Water
EPA 200.7: Al, Ba, Cd, Cr, Cu, Fe, Mn, Ni, Na, Ag, Ca, Zn. **EPA 200.8:** Al, Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn. **EPA 245.1** Hg.
EPA 522, EPA 537.1.

Non-Potable Water
EPA 200.7: Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.
EPA 200.8: Al, Sb**,** As, Be, Cd, Cr, Cu, Fe, Pb, Mn, Ni, K, Se, Ag, Na, TL, Zn.
EPA 245.1 Hg.
SM2340B

For a complete listing of analytes and methods, please contact your Alpha Project Manager.

ALPHA

Westborough, MA 01581
8 Walkup Dr.
TEL: 508-898-9220
FAX: 508-898-9193

Mansfield, MA 02048
320 Forbes Blvd
TEL: 508-822-9300
FAX: 508-822-3288

NEW YORK CHAIN OF CUSTODY

Service Centers
Mahwah, NJ 07430: 35 Whitney Rd, Suite 5
Albany, NY 12205: 14 Walker Way
Tonawanda, NY 14150: 275 Cooper Ave, Suite 105

Page 1 of 1

Date Rec'd in Lab: 7/9/21

ALPHA Job #: L2136669 354451

Project Information

Project Name: LAKE WACCABUC FIELD SAMPLING
Project Location: LEWISBORO, NY
Project #: 2390.001.001
(Use Project name as Project #) ☐
Project Manager: DAVID HANNY
ALPHAQuote #:

Turn-Around Time

Standard ☒ Due Date:
Rush (only if pre approved) ☐ # of Days:

Client Information

Client: BARTON AND LOGUIDICE
Address: 443 ELECTRONICS PKWY
LIVERPOOL, NY 13088
Phone: 585-325-7190
Fax:
Email: JWILLIAMS@BARTONANDLOGUIDICE

Deliverables

☐ ASP-A ☐ ASP-B
☐ EQuIS (1 File) ☐ EQuIS (4 File)
☐ Other

Regulatory Requirement

☐ NY TOGS ☐ NY Part 375
☐ AWQ Standards ☐ NY CP-51
☐ NY Restricted Use ☐ Other
☐ NY Unrestricted Use
☐ NYC Sewer Discharge

Billing Information

☒ Same as Client Info
PO #: 2390.001.001

Disposal Site Information

Please identify below location of applicable disposal facilities.
Disposal Facility:
☐ NJ ☐ NY
☐ Other:

These samples have been previously analyzed by Alpha ☐

Other project specific requirements/comments:

Please specify Metals or TAL.

Sample Filtration
☐ Done
☐ Lab to do
Preservation
☐ Lab to do
(Please Specify below)

ANALYSIS

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	TOTAL N CALC NO3/NO2 TKN + PHOS-4500	SOL. N CALC SNO3/NO2-4500 SPHOS-4500	STKN-4500	COLOR-A-2120	CHLORO-A	NH3	TOTAL METALS	~~[illegible]~~	Sample Specific Comments	Total Bottles
36669-01	LW-11	7/8/21	08:15	WATER	JMW	X	X	X	X	X	X	X	~~[illegible]~~		
-02	LW-12	7/8/21	08:40	WATER	JMW	X	X	X	X	X					
-03	LW-13	7/8/21	09:00	WATER	JMW	X	X	X	X	X					
-04	LW-14	7/8/21	09:15	WATER	JMW	X	X	X	X	X					
-05	LW-15	7/8/21	09:30	WATER	JMW	X	X	X							
-06	LW-16	7/8/21	09:40	WATER	JMW	X	X	X							
~~-07~~															

Container Type	P	P	P	G	P	P	P	~~[illegible]~~
Preservative	D	A	A	A	A	D	C	~~[illegible]~~

Preservative Code:
A = None
B = HCl
C = HNO_3
D = H_2SO_4
E = NaOH
F = MeOH
G = $NaHSO_4$
H = $Na_2S_2O_3$
K/E = Zn Ac/NaOH
O = Other

Container Code
P = Plastic
A = Amber Glass
V = Vial
G = Glass
B = Bacteria Cup
C = Cube
O = Other
E = Encore
D = BOD Bottle

Westboro: Certification No: MA935
Mansfield: Certification No: MA015

Relinquished By:	Date/Time	Received By:	Date/Time
Jack Williams [signature]	7/8/21 / 11:50	[signature] - AAL	7/8/21 11:50
[signature] - AAL	7/8/21 19:05	[signature] AAL	7/8/21 2020
[signature] AAL	7/9/21 0035	[signature]	7/9/21 00:55

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. BY EXECUTING THIS COC, THE CLIENT HAS READ AND AGREES TO BE BOUND BY ALPHA'S TERMS & CONDITIONS. (See reverse side.)

Form No: 01-25 HC (rev. 30-Sept-2013)

ALPHA

NEW YORK CHAIN OF CUSTODY

Service Centers
Mahwah, NJ 07430: 35 Whitney Rd, Suite 5
Albany, NY 12205: 14 Walker Way
Tonawanda, NY 14150: 275 Cooper Ave, Suite 105

Page 1 of 1

Date Rec'd in Lab

ALPHA Job # 354451

Westborough, MA 01581
8 Walkup Dr.
TEL 508-898-9220
FAX 508-898-9193

Mansfield, MA 02048
320 Forbes Blvd
TEL 508-822-9300
FAX 508-822-3288

Project Information

Project Name: LAKE WACCABUC FIELD SAMPLING
Project Location: LEWISBORO, NY
Project # 2930.001.001
(Use Project name as Project #) ☐
Project Manager: DAVID LIANNY
ALPHAQuote #:

Client Information

Client: BARTON AND LOGUIDICE
Address: 443 ELECTRONICS PKWY
LIVERPOOL, NY 13088
Phone: 585-325-7190
Fax:
Email: jwilliams@bartonandloguidice.com

Turn-Around Time

Standard ☒ Due Date:
Rush (only if pre approved) ☐ # of Days:

Deliverables

☐ ASP-A ☐ ASP-B
☐ EQuIS (1 File) ☐ EQuIS (4 File)
☐ Other

Billing Information

☒ Same as Client Info
PO # 2390.001.001

Regulatory Requirement

☐ NY TOGS ☐ NY Part 375
☐ AWQ Standards ☐ NY CP-51
☐ NY Restricted Use ☐ Other
☐ NY Unrestricted Use
☐ NYC Sewer Discharge

Disposal Site Information

Please identify below location of applicable disposal facilities

Disposal Facility
☐ NJ ☐ NY
☐ Other

These samples have been previously analyzed by Alpha ☐

Other project specific requirements/comments:

Please specify Metals or TAL.

Sample Filtration
☐ Done
☐ Lab to do
Preservation
☐ Lab to do
(Please Specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	ANALYSIS: F-COLI-MF								Sample Specific Comments	Total Bottles
	LW-11	7/8/21	08:15	WATER	JMW	X									

Preservative Code:
A = None
B = HCl
C = HNO_3
D = H_2SO_4
E = NaOH
F = MeOH
G = $NaHSO_4$
H = $Na_2S_2O_3$
K/E = Zn Ac/NaOH
O = Other

Container Code
P = Plastic
A = Amber Glass
V = Vial
G = Glass
B = Bacteria Cup
C = Cube
O = Other
E = Encore
D = BOD Bottle

Westboro: Certification No: MA935
Mansfield: Certification No: MA015

	F-COLI-MF
Container Type	P
Preservative	G

Relinquished By:	Date/Time	Received By:	Date/Time
Jack Williams / [signature]	7/8/21 / 11:50	[signature] AAL 7/8/21	11:50
[signature] AAL 7/8/21			

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. BY EXECUTING THIS COC, THE CLIENT HAS READ AND AGREES TO BE BOUND BY ALPHA'S TERMS & CONDITIONS. (See reverse side.)

Form No: 01-25 HC (rev. 30-Sept-2013)

ANALYTICAL REPORT

Job Number: 420-201584-1

SDG Number: 354451

Job Description: Alpha Analytical, Inc.

For:
Alpha Analytical
8 Walkup Drive
Westborough, MA 01581

Attention: Subcontract Reports

Renee M. Cusack

Renee Cusack
Lab Director
rcusack@envirotestlaboratories.com
07/15/2021

EnviroTest Laboratories, LLC. Certifications and Approvals: NYSDOH 10142, NJDEP NY015, CTDOPH PH-0554

Envirotest Laboratories
315 Fullerton Avenue, Newburgh, NY 12550
Tel (845) 562-0890 Fax (845) 562-0841 www.envirotestlaboratories.com

METHOD SUMMARY

Client: Alpha Analytical

Job Number: 420-201584-1
SDG Number: 354451

Description	Lab Location	Method	Preparation Method
Matrix: Water			
Membrane Filter Technique - Fecal Coliform Procedure	EnvTest	SMWW SM 9222D-97	

Lab References:

EnvTest = EnviroTest

Method References:

SMWW = "Standard Methods for the Examination of Water and Wastewater"

METHOD / ANALYST SUMMARY

Client: Alpha Analytical

Job Number: 420-201584-1
SDG Number: 354451

Method	Analyst	Analyst ID
SMWW SM 9222D-97	Donnarumma, Lena	LD

SAMPLE SUMMARY

Client: Alpha Analytical

Job Number: 420-201584-1
SDG Number: 354451

Lab Sample ID	Client Sample ID	Client Matrix	Date/Time Sampled	Date/Time Received
420-201584-1	LW-11	Water	07/08/2021 0815	07/08/2021 1305

SAMPLE RESULTS

Subcontract Reports
Alpha Analytical
8 Walkup Drive
Westborough, MA 01581

Job Number: 420-201584-1
Sdg Number: 354451

Client Sample ID: **LW-11**
Lab Sample ID: **420-201584-1**

Date Sampled: 07/08/2021 0815
Date Received: 07/08/2021 1305
Client Matrix: Water

Analyte	Result/Qualifier		Unit	RL	RL	Dilution
Method: SM 9222D-97			Date Analyzed:	07/08/2021 1400		
Coliform, Fecal	1.0	U	CFU/100mL	1.0	1.0	1.0

DATA REPORTING QUALIFIERS

Client: Alpha Analytical

Job Number:
Sdg Number: 354451

Lab Section	Qualifier	Description
Biology		
	U	The analyte was analyzed for but not detected at or above the lowest stated limit.

Definitions and Glossary

Client: Alpha Analytical

Job Number:

Sdg Number: 354451

Abbreviation	These commonly used abbreviations may or may not be present in this report.
%R	Percent Recovery
DL, RA, RE	Indicates a Dilution, Reanalysis or Reextraction.
EPA	United States Environmental Protection Agency
MDL	Method Detection Limit - an estimate of the minimum amount of a substance that an analytical process can reliably detect. A MDL is analyte- and matrix-specific and may be laboratory-dependent.
ND	Not detected at the reporting limit (or MDL if shown).
QC	Quality Control
RL	Reporting Limit - the minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence.
RPD	Relative Percent Difference - a measure of the relative difference between two points.

QUALITY CONTROL RESULTS

Quality Control Results

Client: Alpha Analytical

Job Number: 420-201584-1
Sdg Number: 354451

Method Blank - Batch: 420-156105

Method: SM 9222D-97
Preparation: N/A

Lab Sample ID: MB 420-156105/11
Client Matrix: Water
Dilution: 1.0
Date Analyzed: 07/08/2021 1733
Date Prepared: N/A

Analysis Batch: 420-156105
Prep Batch: N/A
Units: CFU/100mL

Instrument ID: No Equipment Assigned
Lab File ID: N/A
Initial Weight/Volume: mL
Final Weight/Volume: mL
Injection Volume:

Analyte	Result	Qual	RL	RL
Coliform, Fecal	1.0	U	1.0	1.0

Duplicate - Batch: 420-156105

Method: SM 9222D-97
Preparation: N/A

Lab Sample ID: 420-201631-A-4 DU
Client Matrix: Water
Dilution: 1.0
Date Analyzed: 07/08/2021 1733
Date Prepared: N/A

Analysis Batch: 420-156105
Prep Batch: N/A
Units: CFU/100mL

Instrument ID: No Equipment Assigned
Lab File ID: N/A
Initial Weight/Volume: mL
Final Weight/Volume: mL
Injection Volume:

Analyte	Sample Result/Qual	Result	RPD	Limit	Qual
Coliform, Fecal	600	720	18	20	

Calculations are performed before rounding to avoid round-off errors in calculated results.

201584

NEW YORK CHAIN OF CUSTODY

ALPHA ANALYTICAL

Westborough, MA 01581
8 Walkup Dr.
TEL: 508-898-9220
FAX: 508-898-9193

Mansfield, MA 02048
320 Forbes Blvd
TEL: 508-822-9300
FAX: 508-822-3288

Service Centers
Mahwah, NJ 07430: 35 Whitney Rd, Suite 5
Albany, NY 12205: 14 Walker Way
Tonawanda, NY 14150: 275 Cooper Ave, Suite 105

Page 1 of 1

Date Rec'd in Lab

ALPHA Job # 354451

Project Information

Project Name: LAKE WACCABUC FIELD SAMPLING
Project Location: LEWISBORO, NY
Project # 2930.001-001
(Use Project name as Project #) ☐
Project Manager: DAVID HANNY
ALPHAQuote #:

Client Information

Client: BARTON AND LOGUIDICE
Address: 443 ELECTRONICS PKWY
LIVERPOOL, NY 13088
Phone: 585-325-7190
Fax:
Email: JWILLIAMS@BARTONANDLOGUIDICE

Turn-Around Time

Standard ☒
Rush (only if pre approved) ☐
Due Date:
# of Days:

Deliverables

☐ ASP-A ☐ ASP-B
☐ EQuIS (1 File) ☐ EQuIS (4 File)
☐ Other

Billing Information

☒ Same as Client Info
PO # 2390.001.001

Regulatory Requirement

☐ NY TOGS ☐ NY Part 375
☐ AWQ Standards ☐ NY CP-51
☐ NY Restricted Use ☐ Other
☐ NY Unrestricted Use
☐ NYC Sewer Discharge

Disposal Site Information

Please identify below location of applicable disposal facilities.

Disposal Facility:
☐ NJ ☐ NY
☐ Other:

These samples have been previously analyzed by Alpha ☐

Other project specific requirements/comments:

Please specify Metals or TAL.

ANALYSIS

Sample Filtration
☐ Done
☐ Lab to do
Preservation
☐ Lab to do

(Please Specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	F-Coli-MF	Sample Specific Comments	Total Bottle
	LW-11	7/8/21	08:15	WATER	JMW	X		

420-201584-B-1
LW-11
Date Sampled: 7/8/2021
420-1733276

	F-Coli-MF
Container Type	P
Preservative	G

Preservative Code:
A = None
B = HCl
C = HNO_3
D = H_2SO_4
E = NaOH
F = MeOH
G = $NaHSO_4$
H = $Na_2S_2O_3$
K/E = Zn Ac/NaOH
O = Other

Container Code
P = Plastic
A = Amber Glass
V = Vial
G = Glass
B = Bacteria Cup
C = Cube
O = Other
E = Encore
D = BOD Bottle

Westboro: Certification No: MA935
Mansfield: Certification No: MA015

Relinquished By:	Date/Time	Received By:	Date/Time
Jack Williams [signature]	7/8/21 / 11:50	[signature] AAL	7/8/21 11:50
[signature] AAL	7/8/21 13:05	[signature]	7/8/21 1305

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. BY EXECUTING THIS COC, THE CLIENT HAS READ AND AGREES TO BE BOUND BY ALPHA'S TERMS & CONDITIONS. (See reverse side.)

Form No: 01-25 HC (rev. 30-Sept-2013)

ON ICE TEMP 6.4 C

LOGIN SAMPLE RECEIPT CHECK LIST

Client: Alpha Analytical

Job Number: 420-201584-1
SDG Number: 354451

Login Number: **201584**

Question	T/F/NA	Comment
Samples were collected by ETL employee as per SOP-SAM-1	NA	
The cooler's custody seal, if present, is intact.	NA	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is recorded.	True	6.9 C
Cooler Temp. is within method specified range.(0-6 C PW, 0-8 C NPW, or BAC <10 C	True	
If false, was sample received on ice within 6 hours of collection.	True	
Based on above criteria cooler temperature is acceptable.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
There are no discrepancies between the sample IDs on the containers and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
VOA sample vials do not have headspace or bubble is <6mm (1/4") in diameter.	NA	
If necessary, staff have been informed of any short hold time or quick TAT needs	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	

Appendix G

Evaluation of South Shore Community Septic System

By Kellard Sessions Consulting

John Kellard, P.E.
David Sessions, RLA, AICP
Joseph M. Cermele, P.E., CFM
Jan K. Johannessen, AICP

MEMORANDUM

TO: Supervisor Peter Parsons and
Members of the Lewisboro Town Board

FROM: Joseph M. Cermele, P.E., CFM
Kellard Sessions Consulting
Consulting Town Engineers

DATE: November 1, 2019

RE: South Shore Association
Community On-Site Wastewater Treatment System

At the request of the Lewisboro Town Board, Kellard Sessions Consulting has conducted a preliminary review of the South Shore Association (SSA) property and the feasibility of a community on-site wastewater treatment system (OWTS) or septic system to serve the SSA property. It is our understanding that Supervisor Parsons, in his capacity as member of the Northern Westchester Watershed Committee (NWWC), is prepared to present this project as a potential water quality enhancement project for the Town of Lewisboro and the New York City Watershed. As you are aware, the NWWC is composed of the chief elected official (or their appointed designee) of each of the twelve municipalities that have land area located within the New York City Watershed. This project is proposed to be consistent with the criteria set forth in the Memorandum of Agreement (MOA) between Westchester County and New York City in order to protect drinking water quality for New York City's residents.

Site Background and History

The South Shore Association is a community of thirty homes located on ±24 acres along South Shore Drive. The property is bound to the north by Lake Waccabuc and to the east by Oscaleta Road. See attached Figure – South Shore Community OWTS. The land is owned communally by the members of SSA which was organized in the 1950's and is governed by an elected Board consisting of a President, Vice President, Secretary, Treasurer and two at-large members. SSA was formed to pay the communal property taxes, as well as to create and enforce the regulations that are necessary for communal living and to maintain the land, roads, lake access, etc.

This community was developed in the early twentieth century as a group of camps in the Lake Waccabuc area. At its inception, it was a seasonal community with each home having an outhouse, but no indoor plumbing. Gradually, some residents upgraded their houses and installed indoor plumbing complete with showers, kitchen sinks and some toilet facilities. In order to make these improvements, minimal sanitary

500 MAIN STREET | ARMONK, NY 10504 | T: 914.273.2323 | F: 914.273.2329
WWW.KELSES.COM

facilities were improved, including individual holding tanks for black water and septic fields or dry wells for gray water. At present, it is reported that approximately 50% of the homes have holding tanks for black water, while the remaining homes have outhouses with no indoor toilet facilities. With regard to domestic water supply, many of the seasonal homes pump their water from the lake, while the others get their water supply from hand-dug wells. Presently, about half of the residents in this community live here year-round, while the other half are seasonal visitors.

On March 29, 2016, this office along with Mr. Paul Lewis, Lewisboro Stormwater Committee Chair, met at the site with Mr. George Peterkin, Association President and Mr. Alan Mason (SSA resident) to discuss the potential for a communal OWTS. As noted above, the total site area is approximately 24 acres. At the time of the organization of SSA, the members acquired or set aside approximately 4.5 acres of land in the south east portion of the property for a communal OWTS with the intention that at some time in the future a septic system could be installed so that all houses could have indoor bathroom facilities without the need for individual septic systems or holding tanks.

Site Description

With the exception of the developed cottages and minimal roads/drives, the property is largely wooded. The terrain generally slopes south to north toward the lake. A review of soils maps from the USDA Natural Resources Conservation Service indicates that the predominant soil type in the area of the proposed OWTS is of the Paxton soil complex (PnB). Soils of this class are typically well-drained, fine sandy loams with slopes of 3% - 8% and are in the Hydrologic Soil Group C – low to moderate permeability. These soils have a rating of "somewhat limited" for use as septic absorption fields according to the survey.

The property is located within the Waccabuc River Basin, which is tributary to the Cross River Reservoir and New York City drinking water supply watershed. Lake Waccabuc is designated as a New York State Department of Environmental Conservation (NYSDEC) Class A waterbody. In addition, NYSDEC Freshwater Wetland, L-13, is located directly opposite Oscaleta Road and the property is partially located within the check-zone associated with this wetland. Upon review of available GIS maps, it appears that additional locally regulated wetlands and/or watercourses also exist on or adjacent to the property. See the attached Figure – South Shore Community OWTS for an illustration of the site and environmental features, as well as the proposed septic field location.

Permitting

There are several local and outside agency approvals that are anticipated for this project. Disturbances associated with this project are expected to exceed one (1) acre and may partially be located within regulated wetland buffers and adjacent areas. Sanitary sewerage discharges will exceed 1,000 gpd as described further below. As such, the following minimum approvals will be required and others may become necessary as the project develops:

- Town of Lewisboro Wetland Activity Permit
- Town of Lewisboro Stormwater Permit
- NYSDEC Article 24 Freshwater Wetland Permit
- Westchester County Department of Health (WCHD)/New York City Department of Environmental Protection (NYCDEP) Joint Approval of Public OWTS
- NYSDEC SPDES General Permit GP-0-15-001 for Groundwater Discharge of Treated Sanitary Sewerage
- NYSDEC SPDES General Permit GP-0-15-002 for Stormwater Discharge from Construction Activity

Preliminary Design and Budgeting

As noted above, there are 30 dwellings in SSA. For the purpose of this preliminary report, it is assumed that each dwelling includes two (2) bedrooms. The OWTS will require design in conformance with all applicable rules and regulations of the WCHD, NYCDEP and the NYSDEC. The 2014 NYSDEC Design Standards for Intermediate Sized Wastewater Treatment Systems requires a hydraulic design loading rate of 150 GPD per bedroom. Lower flow rates are permitted for newer fixtures and/or water saving fixtures, however, for the purpose of this report the higher flow rate will be used. This results in a total design load of 9,000 GPD (30 dwellings x 2 bedrooms per dwelling x 150 GPD/bedroom).

Wastewater collection is proposed to consist of individual low-pressure sewer ejector pump systems sized to accommodate each dwelling. The units would be equipped with emergency alarms and overflow protection. The individual ejector pump units would discharge to a common low-pressure force main. Wastewater flow from all proposed units would discharge at the common septic field. The system is proposed to be equipped with an aeration system to enhance B.O.D., nitrogen and phosphorous removal, while extending the life of the septic fields. The required size of the septic field is directly related to the permeability of the soils and the available separation to underlying bedrock and/or groundwater. For example, poor soil percolation rates will require larger septic field areas and shallow depth to rock and/or groundwater will require run-of-bank (ROB) fill. Soil testing, deep and percolation, will need to be performed throughout the proposed field to verify existing soil conditions. Assuming soil percolation rates on the order of 3 - 10 min/inch, an application rate of 0.9 - 1.2 GPD/SF can be used. Adsorption trench widths are 2 ft.

As a result, the total length of adsorption trench required (L) is as follows:

L = 9,000 gpd ÷ 0.9 gpd/sf ÷ 2 sf/lf = 5,000 lineal feet of primary adsorption trenches.

Therefore, a total of 10,000 lf of trench is required (5,000 lf of primary adsorption trenches and 5,000 lf of 100% expansion adsorption trenches).

The budgetary expenses for this project include preliminary design and testing, final design, surveying, permitting and agency approvals, construction and construction management / inspection oversight costs. For the purpose of this budget it is assumed that each of the 30 homes will be equipped with a low-pressure sewer ejector system connected to a common low-pressure force main that will discharge to the septic field.

Construction:

Adsorption Fields:	$ 107,000
Individual Ejector Pump System:	$ 385,000
Collection System and Force Main:	$ 135,000
Dosing Pump Station:	$ 80,000
Soil Air Aeration System	$ 70,000
ROB Fill Contingency:	$ 85,000
Subtotal Construction:	$ 862,000
Construction Contingency (15%):	$ 129,300
Total Construction:	$ 991,300
Design (±8% of Construction):	$ 79,000
Construction Management / Inspection (±5% of Construction):	$ 49,500
Surveying:	$ 22,000
Permitting:	$ 22,000
Total Estimated Project Cost:	**$1,163,800**
Say	**$1,200,000**

The time required for design and construction is estimated to be 1 year, 6 months for design, permitting and approvals and an additional 6 months for construction.

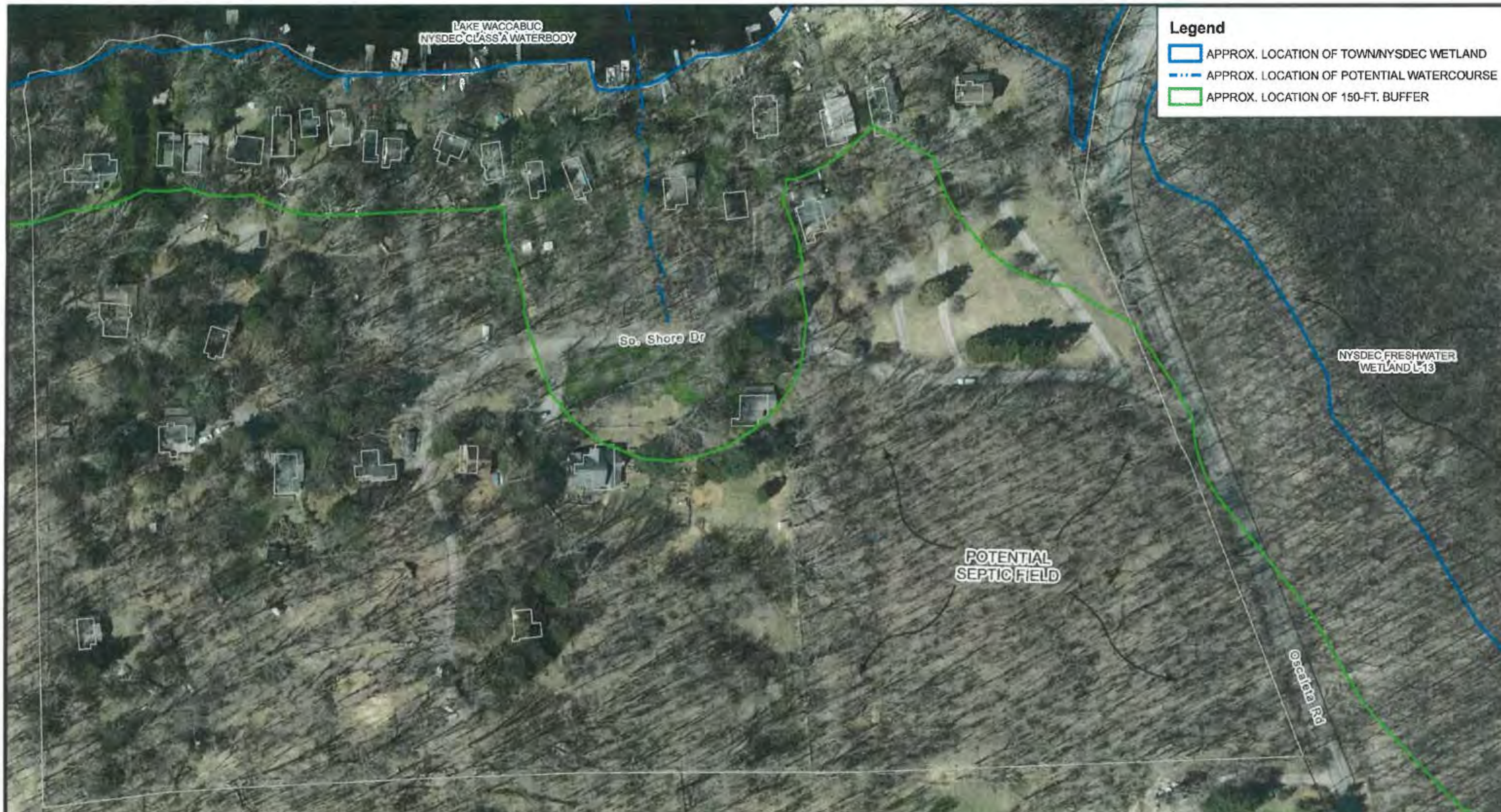
The above numbers can be refined after preliminary testing is performed and a conceptual layout developed. Alternative methods of collection can be reviewed as well, such as the use of a gravity sewer main(s) and pump station(s). The above estimate does not include any legal fees that may be required to establish ownership and long-term maintenance responsibilities.

Conclusion

In conclusion, it is believed that this project meets the criteria set forth in the New York City Watershed MOA, specifically Article V - NYC Watershed Protection and Partnership Programs, Section 140 - East of Hudson Water Quality Investment Program, Item (b) (iv) "Community septic systems and related infrastructure, in areas of existing development, to address existing or anticipated water quality problems". Although the residents of SSA represent a small part of the population of the Town of Lewisboro, the water quality benefits of this project could prove far-reaching, not only for the health of Lake Waccabuc and the Waccabuc River to which this lake is the headwater to, but for the immediately adjacent Lake Oscaleta and Lake Rippawam that share the same ±2,200 watershed, which are all tributary to the Cross River Reservoir and the New York City drinking water supply.

JMC/dc

T:\Lewisboro\Correspondence\2019-11-01-LWTB_Parsons_SouthShoreSeptic_Memo.docx



N

1 in = 100 ft

PROPERTY OWNER: SOUTH SHORE ASSOCIATION
PARCEL ID: SHEET 33D-CAMP-48
SITE AREA: +/- 24 ACRES
WATERSHED: WACCABUC RIVER BASIN

SOUTH SHORE COMMUNITY

ON-SITE WASTEWATER TREATMENT SYSTEM

TOWN OF LEWISBORO, WESTCHESTER COUNTY, NY

KELLARD SESSIONS CONSULTING, P.C.

APRIL 21, 2016

LEGEND

- EXISTING PROPERTY LINE
- APPROXIMATE LOCATION OF TOWN/NYSDEC WETLAND
- APPROXIMATE LOCATION OF 150 FT WETLAND BUFFER
- APPROXIMATE LOCATION OF POTENTIAL WATERCOURSE

SHORTEST DISTANCE TO LAKE WACCABUC	41 FT	AREA 1 - AVERAGE DISTANCE TO LAKE WACCABUC	97 FT
FURTHEST DISTANCE TO LAKE WACCABUC	619 FT	AREA 2 - AVERAGE DISTANCE TO LAKE WACCABUC	373 FT
SHORTEST DISTANCE TO STREAM	16 FT	AREA 3 - AVERAGE DISTANCE TO LAKE WACCABUC	600 FT

FIGURE 1

SOUTH SHORE COMMUNITY OWTS

JANUARY 8, 2019
TOWN OF LEWISBORO
WESTCHESTER COUNTY, NEW YORK

KELLARD SESSIONS
CONSULTING ENGINEERING & LANDSCAPE ARCHITECTURE PLANNING, D.P.C.
500 MAIN STREET
ARMONK, N.Y. 10504
P: (914) 273-2323
F: (914) 273-2329
WWW.KELSES.COM

Appendix H
July 21, 2021 Percolation Testing Field Notes

Barton & Loguidice

www.BartonandLoguidice.com

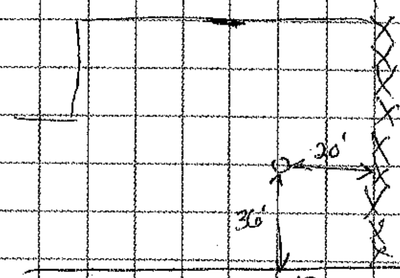
JOB 2390.001
SHEET NO. 1 OF 2
CALCULATED BY RMDS DATE 7/21/2021
CHECKED BY ______ DATE ______
DESCRIPTION Percolation Testing

124 Oscaleta Rd

Dimensions: 12" ø, 18" deep

Ties: 36' from road
20' from fence

Presoak: Filled 12"
1hr. 8 min. to empty



1" drop	7:07 min.
1" drop	9:21 min.
1" drop	12:01 min.
1" drop	11:03 min.

Design Rate: 11-15 mpi

Soil: A 0-8" Brown GLS
B 8-18"+ Red-Brown GLS

Application Rate: 0.80 gpd/ft²

39 Lakeview Rd

Dimensions: 10" ø, 20" deep

Ties: 32' from NW corner of house
9' from fence at W property line

Presoak: Filled 12"
13 min. to empty

2nd Presoak: Filled 12"
25 min. to empty

Soil: A 0-4" Brown SL
B 4-20"+ Reddish brown SL

1" drop	3:20 min.
1" drop	2:30 min.
1" drop	2:20 min.
1" drop	2:22 min.

Design Rate: 1-5 mpi Appication Rate: 1.2 gpd/ft²

Barton & Loguidice

www.BartonandLoguidice.com

JOB 2390.001

SHEET NO. 2 OF 2

CALCULATED BY RMDS DATE 7/21/2021

CHECKED BY ______ DATE ______

DESCRIPTION Percolation Testing

South Shore Drive

Dimensions: 10"ø x 19"

Location: ~100' from Oscaleta Road

~100' from back (south) property line

Presoak: Filled 12"

30 min to empty

1" drop | 2:30 min.

1" drop | 2:30 min.

1" drop | 2:30 min.

Soil: A 0-9" Brown SL 5% Gravel

B 9-19"+ Medium brown SL

5% Gravel 5% Cobble

Design Rate: 11-15 mpi

Application Rate: 0.20 gpd/ft

South Shore Drive

Dimensions: 10"ø x 18"

Location: ~200' from South Shore Drive

~100' from shed of nearest SSA home

Presoak: Filled 12"

60 min to empty

1" drop | 8:26 min.

1" drop | 10:37 min.

1" drop | 10:09 min.

Soil: A 0-4" Brown GSL

B 4-18"+ Medium Brown GSL

Design Rate: 1-5 mpi

Application Rate: 0.80 gpd/ft^2

Appendix I
Opinion of Cost

LAKE WACCABUC ALTERNATIVE 1A - REPLACEMENT OF ALL SEPTIC SYSTEMS OPINION OF PROBABLE COSTS (2021)					
Item	**Description**	**Unit**	**Qty**	**Unit Cost**	**Total Cost**
1	Furnish and Install Residential Septic System	EA	213	$ 15,000	$ 3,200,000
2	Septic System Decommissioning	EA	81	$ 3,500	$ 300,000
				Total Construction Subtotal	$ 3,500,000
				Contingency (20%)	$ 700,000
				Total Construction Costs	$ 4,200,000
				Engineering, Legal, Administration, Construction Observation, etc. (20%)	$ 900,000
				Total (2021 Dollars)	$ 5,100,000

LAKE WACCABUC
ALTERNATIVE 1B - REPLACEMENT OF SEPTIC SYSTEMS WITH ADDED PHOSPHOROUS TREATMENT
OPINION OF PROBABLE COSTS (2021)

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	Furnish and Install Residential Septic System	EA	213	$ 15,000	$ 3,200,000
2	Septic System Decommissioning	EA	81	$ 3,500	$ 300,000
3	Phosphorous Treatment System[1]	EA	173	$ 10,000	$ 1,800,000
				Total Construction Subtotal	$ 5,300,000
				Contingency (20%)	$ 1,100,000
				Total Construction Costs	$ 6,400,000
				Engineering, Legal, Administration, Construction Observation, etc. (20%)	$ 1,300,000
				Total (2021 Dollars)	$ 7,700,000

[1]Phosphorous treatment systems are assumed to be installed with new septic system. If a septic system is not needed, add $1,500 for installation costs of the phosphorous treatment system

LAKE WACCABUC
ALTERNATIVE 2A - COMMUNITY SEPTIC SYSTEM FOR SOUTH SHORE ASSOCIATION
OPINION OF PROBABLE COSTS (2021)

Item	Description	Unit	Qty	Unit Cost		Total Cost	
1	Septic System Decommissioning	EA	28	$	3,500	$	98,000
2	Simplex Grinder Pump Station	EA	30	$	8,800	$	270,000
3	Furnish and Install Open Cut 4-Inch HDPE Force Main	LF	1700	$	200	$	340,000
4	7,000 Gallon Septic Tanks	LS	1	$	15,000	$	15,000
5	7,000 Gallon Dosing Chamber	LS	1	$	15,000	$	15,000
6	Drip Dispersal Equipment	LS	1	$	80,000	$	80,000
7	Drip Dispersal Drain Field Installation Labor	LS	1	$	15,000	$	15,000
					Total Construction Subtotal	$	900,000
					Contingency (20%)	$	200,000
					Total Construction Costs	$	1,100,000
	Engineering, Legal, Administration, Construction Observation, etc. (20%)					$	220,000
					Total (2021 Dollars)	$	1,400,000

LAKE WACCABUC

ALTERNATIVE 2B - COMMUNITY SEPTIC SYSTEM FOR SOUTH SHORE WACCABUC ASSOCIATION WITH REPLACEMENT OF INDIVIDUAL SEPTIC SYSTEMS FOR REMAINING PROPERTIES

OPINION OF PROBABLE COSTS (2021)

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	Septic System Decommissioning	EA	213	$ 3,500	$ 750,000
2	Furnish and Install Residential Septic System	EA	196	$ 15,000	$ 3,000,000
3	Furnish and Install Community Septic System	LS	1	$ 125,000	$ 125,000
4	Residential Phosphorous Treatment System	EA	156	$ 10,000	$ 1,600,000
5	Simplex Grinder Pump Station	EA	30	$ 8,800	$ 270,000
6	Furnish and Install Open Cut 4-Inch HDPE Force Main	LF	1,700	$ 200	$ 400,000
				Total Construction Subtotal	$ 6,200,000
				Contingency (20%)	$ 1,300,000
				Total Construction Costs	$ 7,500,000
	Engineering, Legal, Administration, Construction Observation, etc. (20%)				$ 1,500,000
				Total (2021 Dollars)	$ 9,000,000

LAKE WACCABUC
ALTERNATIVE 3 - CONNECTION TO HERITAGE HILL WRRF
OPINION OF PROBABLE COSTS (2021)

Item	Description	Unit	Qty	Unit Cost		Total Cost	
1	Collection System	LS	1	$	9,500,000	$	9,500,000
2	Septic System Decommissioning	EA	213	$	3,500	$	800,000
3	Furnish and Install HDD 6-Inch HDPE Forcemain	LF	47,700	$	250	$	12,000,000
4	Simplex Grinder Pump Station	EA	278	$	8,800	$	2,500,000
5	Duplex Grinder Pump Station	EA	5	$	21,000	$	105,000
6	Furnish and Install Pump Station	EA	2	$	1,000,000	$	2,000,000
7	Bridge Crossing	LF	325	$	150	$	50,000
8	[1]Sewer Capacity Reservation Agreement	LS	1	$	2,979,000	$	3,000,000
					Total Construction Subtotal	$	30,000,000
					Contingency (20%)	$	6,000,000
					Total Construction Costs	$	36,000,000
					Engineering, Legal, Administration, Construction Observation, etc. (20%)	$	7,200,000
					Total (2021 Dollars)	$	43,200,000

[1]This cost is only to reserve the capacity at the Heritage Hills WRRF for 140,000 GPD. Additional costs would be required to connect the system to the facility and annual usage fees would be charged to system users.

LAKE WACCABUC
ALTERNATIVE 4A - CONSTRUCTION OF WRRF ON BENEDICT ROAD
OPINION OF PROBABLE COSTS (2021)

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	Collection System	LS	1	$ 5,840,000	$ 5,840,000
2	Property Purchase (Parcels 10804-092-0032 & 10804-093-0032)	LS	1	$ 400,000	$ 400,000
3	Water Resource Recovery Facility Construction	LS	1	$ 5,340,000	$ 5,340,000
4	Furnish and Install Open Cut 8-Inch HDPE Gravity	LF	1,500	$ 190	$ 290,000
				Total Construction Subtotal	$ 11,900,000
				Contingency (20%)	$ 2,400,000
				Total Construction Costs	$ 14,300,000
	Engineering, Legal, Administration, Construction Observation, etc. (20%)				$ 2,900,000
				Total (2021 Dollars)	$ 17,200,000

LAKE WACCABUC
ALTERNATIVE 4A - CONSTRUCTION OF WRRF ON BENEDICT ROAD
OPINION OF PROBABLE COSTS (2021)

Item	Description	Unit	Qty	Unit Cost	Total Cost
1-1	Septic System Decommissioning	EA	173	$ 3,500	$ 610,000
1-2	Simplex Grinder Pump Station	EA	173	$ 8,800	$ 1,530,000
1-3	Duplex Grinder Pump Station	EA	5	$ 21,000	$ 110,000
1-4	Furnish and Install HDD 4-Inch HDPE Material Sewer Main	LF	18,300	$ 196	$ 3,587,000
1-5	Bedrock	CY	0	$ 100	$ -
1-6	Stream Crossings	LF	1	$ 200	$ 200
2	Property Purchase (Parcels 10804-092-0032 & 10804-093-0032)	LS	1	$ 400,000	$ 400,000
3-1	Concrete channel	CY	20	$ 1,500	$ 23,000
3-2	Manually Cleaned Bar Screen	EA	1	$ 5,100	$ 5,000
3-3	Mechanical Fine Screen	EA	1	$ 131,600	$ 130,000
3-4	Influent Pumps and Meter	LS	1	$ 101,200	$ 100,000
3-5	Wet Well	LS	1	$ 24,300	$ 24,000
3-6	Preliminary Treatment Building Construction	SF	610	$ 300	$ 180,000
3-7	Odor Control System	LS	1	$ 60,700	$ 60,000
3-8	SBR aeration, controls, blowers, accessories, aerobic digester aration, blowers, controls, and VFDs	LS	1	$ 536,200	$ 530,000
3-9	SBR/Aerobic Digester/EQ Concrete Tanks	CY	410	$ 1,500	$ 600,000
3-10	EQ Tank Pumps	LS	1	$ 75,900	$ 75,000
3-11	Treatment Building Construction	SF	2,300	$ 300	$ 660,000
3-12	Odor Control System	EA	1	$ 232,700	$ 230,000
3-13	Rip Rap	CY	20	$ 100	$ 1,000
3-14	Manhole	EA	1	$ 7,600	$ 7,500
3-15	Effluent Disc Filter	LS	1	$ 536,200	$ 530,000
3-16	UV Disinfection System	LS	1	$ 151,800	$ 150,000
3-17	Generator	EA	1	$ 44,600	$ 44,000
3-18	Control Building Construction	SF	3,200	$ 300	$ 930,000
3-19	Chemical Feed Equipment (aluminum sulfate)	LS	1	$ 20,300	$ 20,000
3-20	Chemical Feed Equipment (sodium hydroxide)	LS	1	$ 20,300	$ 20,000
3-21	Yard Piping	LS	1	$ 75,900	$ 75,000
3-22	Restoration	LS	1	$ 10,200	$ 10,000
3-23	Clearing/Grubbing	LS	1	$ 5,100	$ 5,000
3-24	E&SC	LS	1	$ 5,100	$ 5,000
3-25	Piping Allowance	LS	1	$ 75,900	$ 75,000
3-26	Meter and Valve Allowance	LS	1	$ 75,900	$ 75,000
3-27	Electrical and I&C	LS	1	$ 455,200	$ 450,000
3-28	Plumbing	LS	1	$ 202,400	$ 200,000
3-29	HVAC Allowance	LS	1	$ 126,500	$ 125,000
4	Furnish and Install 8-Inch HDPE Gravity	LF	1,500	$ 190	$ 285,000
				Total Construction Subtotal	$ 11,900,000
				Contingency (20%)	$ 2,400,000
				Total Construction Costs	$ 14,300,000
				Engineering, Legal, Administration, Construction Observation, etc. (20%)	$ 2,900,000
				Total (2021 Dollars)	$ 17,200,000

LAKE WACCABUC
ALTERNATIVE 4B - CONSTRUCTION OF WRRF AT LEWISBORO ELEMENTARY
OPINION OF PROBABLE COSTS (2021)

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	Collection System	LS	1	$ 14,830,000	$ 14,830,000
2	Property Purchase (Parcel 43.1-4-14)	LS	1	$ 100,000	$ 100,000
3	School Building Demolition	LS	1	$ 2,280,000	$ 2,280,000
4	Water Resource Recovery Facility Construction	LS	1	$ 5,560,000	$ 5,560,000
5	Furnish and Install HDD 4-Inch HDPE Forcemain	LF	3,000	$ 190	$ 570,000
				Total Construction Subtotal	$ 23,400,000
				Contingency (20%)	$ 4,700,000
				Total Construction Costs	$ 28,100,000
	Engineering, Legal, Administration, Construction Observation, etc. (20%)				$ 5,700,000
				Total (2021 Dollars)	$ 33,800,000

LAKE WACCABUC
ALTERNATIVE 4B - CONSTRUCTION OF WRRF AT LEWISBORO ELEMENTARY
OPINION OF PROBABLE COSTS (2021)

Item	Description	Unit	Qty	Unit Cost	Total Cost
1-1	Septic System Decommissioning	EA	213	$ 3,500	$ 750,000
1-2	Simplex Grinder Pump Station	EA	278	$ 8,800	$ 2,500,000
1-3	Duplex Grinder Pump Station	EA	5	$ 21,000	$ 110,000
1-4	Furnish and Install HDD 4-Inch HDPE Force Main	LF	56,400	$ 196	$ 11,100,000
1-5	Bedrock	CY	3,600	$ 100	$ 360,000
1-6	Stream Crossings	LF	20	$ 200	$ 4,000
2	Property Purchase Parcel 43.1-4-14	LS	1	$ 100,000	$ 100,000
3	School Building Demolition (See Separate Breakdown)	LS	1	$ 2,280,000	$ 2,280,000
4-1	Concrete channel	CY	20	$ 1,500	$ 30,000
4-2	Manually Cleaned Bar Screen	EA	1	$ 5,300	$ 5,300
4-3	Mechanical Fine Screen	EA	1	$ 137,600	$ 137,600
4-4	Influent Pumps and Meter	LS	1	$ 105,800	$ 105,800
4-5	Wet Well	LS	1	$ 25,400	$ 25,400
4-6	Preliminary Treatment Building Construction	SF	640	$ 300	$ 192,000
4-7	Odor Control System	LS	1	$ 60,000	$ 60,000
4-8	SBR aeration, controls, blowers, accessories, aerobic digester aration, blowers, controls, and VFDs	LS	1	$ 530,000	$ 530,000
4-9	SBR/Aerobic Digester/EQ Concrete Tanks	CY	430	$ 1,500	$ 645,000
4-10	EQ Tank Pumps	LS	1	$ 79,400	$ 79,400
4-11	Treatment Building Construction	SF	2,400	$ 300	$ 720,000
4-12	Odor Control System	EA	1	$ 243,300	$ 243,300
4-13	Rip Rap	CY	10	$ 100	$ 1,000
4-14	Manhole	EA	1	$ 8,000	$ 8,000
4-15	Effluent Disc Filter	LS	1	$ 530,000	$ 530,000
4-16	UV Disinfection System	LS	1	$ 150,000	$ 150,000
4-17	Generator	EA	1	$ 46,600	$ 46,600
4-18	Control Building Construction	SF	3,300	$ 300	$ 930,000
4-19	Chemical Feed Equipment (aluminum sulfate)	LS	1	$ 21,200	$ 21,200
4-20	Chemical Feed Equipment (sodium hydroxide)	LS	1	$ 21,200	$ 21,200
4-21	Yard Piping	LS	1	$ 79,400	$ 79,400
4-22	Restoration	LS	1	$ 10,600	$ 10,600
4-23	Clearing/Grubbing	LS	1	$ 5,300	$ 5,300
4-24	E&SC	LS	1	$ 5,300	$ 5,300
4-25	Piping Allowance	LS	1	$ 79,400	$ 79,400
4-26	Meter and Valve Allowance	LS	1	$ 79,400	$ 79,400
4-27	Electrical and I&C	LS	1	$ 476,000	$ 476,000
4-28	Plumbing	LS	1	$ 211,600	$ 211,600
4-29	HVAC Allowance	LS	1	$ 132,300	$ 132,300
5	Furnish and Install HDD 4-Inch HDPE Forcemain	LF	3,000	$ 190	$ 570,000
				Total Construction Subtotal	$ 23,400,000
				Contingency (20%)	$ 4,700,000
				Total Construction Costs	$ 28,100,000
				Engineering, Legal, Administration, Construction Observation, etc. (20%)	$ 5,700,000
				Total (2021 Dollars)	$ 33,800,000

LAKE WACCABUC
FORMER LEWISBORO ELEMENTARY SCHOOL DEMOLITION
OPINION OF PROBABLE COSTS (2021)

Item	Description	Unit	Qty	Unit Cost	Total Cost
1	Asbestos Survey/LBP Survey/PCB Survey				
1-1	*ASB & PCB Pre-Demolition Surveys*	*LS*	*1*	*$ 45,000*	*$ 45,000*
1-2	*Laboratory Unit Cost Estimate*	*LS*	*1*	*$ 20,000*	*$ 20,000*
1-3	*Lead Based Paint Survey*	*LS*	*1*	*$ 10,000*	*$ 10,000*
1-4	*Engineering, Design Documents and Bidding*	*LS*	*1*	*$ 50,000*	*$ 50,000*
1-5	*Asbestos Project Monitoring*	*Shifts*	*50*	*$ 800*	*$ 40,000*
1-6	*Laboratory Unit Cost Estimate*	*LS*	*1*	*$ 15,000*	*$ 15,000*
		Engineering Estimated Total:			$ 180,000
2	Asbestos, Lead, PCB Remediation	SF	67,000	$ 10	$ 670,000
3	Building Demolition and Removal	1M	FT^3	$ 2	$ 1,407,000
4	Sidewalk/Road/Utility Disconnection and Protection	1	LS	$ 20,000	$ 20,000
		School Building Demolition Subtotal:			**$ 2,280,000**

Appendix J
2021 July Community Survey Results

Lake Waccabuc Survey

Tuesday, August 10, 2021

Total Responses **86**

Date Created: Wednesday, July 28, 2021

Complete Responses: 86

Q1: Do you live in the study area?

Answered: 86   Skipped: 0

ANSWER CHOICES	RESPONSES	
Yes	93.02%	80
No	6.98%	6
TOTAL		86

Q2: Which street do you live on/nearest to? (This is to give us an idea of the regions from which responses are coming.)

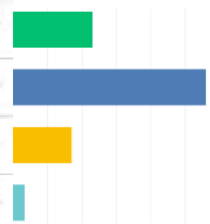
Answered: 86   Skipped: 0

ANSWER CHOICES	RESPONSES	
Cove Road	31.40%	27
East Ridge Drive	0.00%	0
Lakeview Road	5.81%	5
Mead Street	6.98%	6
Old Pond Road	3.49%	3
Oscaleta Road	6.98%	6
Perch Bay Road	16.28%	14
Post Office Road	1.16%	1
Rampart Pass	0.00%	0
South Shore Drive	12.79%	11
Tarry-A-Bit Drive	6.98%	6
Twin Lakes Road	8.14%	7
TOTAL		86

Q3: How well informed do you feel about the Lake Waccabuc Study?

Answered: 82 Skipped: 1

ANSWER CHOICES	RESPONSES	
Very	23.17%	19
Moderately	56.10%	46
Somewhat	17.07%	14
Not at all	3.66%	3
TOTAL		82



Q4: Are you in favor of establishing a sewer district in your community?

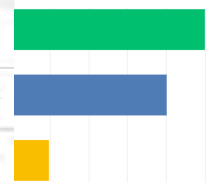
Answered: 82   Skipped: 1

ANSWER CHOICES	RESPONSES	
Yes	73.17%	60
No	10.98%	9
Indifferent	15.85%	13
TOTAL		82

Q5: Are you in favor of having a septic maintenance district in your community? Such a district would require homeowners to pay taxes that would be put towards replacing and repairing septic systems within the district as the need arises.

Answered: 82   Skipped: 1

ANSWER CHOICES	RESPONSES	
Yes	50.00%	41
No	40.24%	33
Indifferent	9.76%	8
TOTAL		82



Cove Road Responses

Answered: 27 Skipped: 0

Q3: How well informed do you feel about the Lake Waccabuc Study?

ANSWER CHOICES	RESPONSES	
Very	14.81%	4
Moderately	70.37%	19
Somewhat	11.11%	3
Not at all	3.70%	1
TOTAL		27

Q4: Are you in favor of establishing a sewer district in your community?

ANSWER CHOICES	RESPONSES	
Yes	74.07%	20
No	3.70%	1
Indifferent	22.22%	6
TOTAL		27

Q5: Are you in favor of having a septic maintenance district in your community?

ANSWER CHOICES	RESPONSES	
Yes	48.15%	13
No	37.04%	10
Indifferent	14.81%	4
TOTAL		27

Lakeview Road Responses

Q3: How well informed do you feel about the Lake Waccabuc Study?

Answered: 5 Skipped: 0

ANSWER CHOICES	RESPONSES	
Very	20.00%	1
Moderately	20.00%	1
Somewhat	60.00%	3
Not at all	0.00%	0
TOTAL		5

Q4: Are you in favor of establishing a sewer district in your community?

Answered: 4 Skipped: 1

ANSWER CHOICES	RESPONSES	
Yes	50.00%	2
No	0.00%	0
Indifferent	50.00%	2
TOTAL		4

Q5: Are you in favor of having a septic maintenance district in your community?

Answered: 4 Skipped: 1

ANSWER CHOICES	RESPONSES	
Yes	25.00%	1
No	75.00%	3
Indifferent	0.00%	0
TOTAL		4

Mead Street Responses

Answered: 6 Skipped: 0

Q3: How well informed do you feel about the Lake Waccabuc Study?

ANSWER CHOICES	RESPONSES	
Very	16.67%	1
Moderately	66.67%	4
Somewhat	16.67%	1
Not at all	0.00%	0
TOTAL		6

Q4: Are you in favor of establishing a sewer district in your community?

ANSWER CHOICES	RESPONSES	
Yes	50.00%	3
No	33.33%	2
Indifferent	16.67%	1
TOTAL		6

Q5: Are you in favor of having a septic maintenance district in your community?

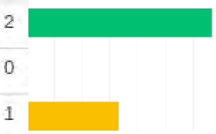
ANSWER CHOICES	RESPONSES	
Yes	66.67%	4
No	33.33%	2
Indifferent	0.00%	0
TOTAL		6

Old Pond Road Responses

Answered: 3 Skipped: 0

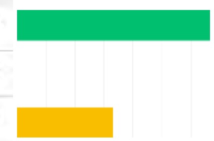
Q3: How well informed do you feel about the Lake Waccabuc Study?

ANSWER CHOICES	RESPONSES	
Very	66.67%	2
Moderately	0.00%	0
Somewhat	33.33%	1
Not at all	0.00%	0
TOTAL		3



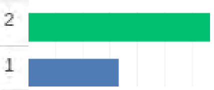
Q4: Are you in favor of establishing a sewer district in your community?

ANSWER CHOICES	RESPONSES	
Yes	66.67%	2
No	0.00%	0
Indifferent	33.33%	1
TOTAL		3



Q5: Are you in favor of having a septic maintenance district in your community?

ANSWER CHOICES	RESPONSES	
Yes	66.67%	2
No	33.33%	1
Indifferent	0.00%	0
TOTAL		3



Oscaleta Road Responses

Answered: 6

Q3: How well informed do you feel about the Lake Waccabuc Study?

ANSWER CHOICES	RESPONSES	
Very	33.33%	2
Moderately	66.67%	4
Somewhat	0.00%	0
Not at all	0.00%	0
TOTAL		6

Q4: Are you in favor of establishing a sewer district in your community?

ANSWER CHOICES	RESPONSES	
Yes	83.33%	5
No	0.00%	0
Indifferent	16.67%	1
TOTAL		6

Q5: Are you in favor of having a septic maintenance district in your community?

ANSWER CHOICES	RESPONSES	
Yes	66.67%	4
No	33.33%	2
Indifferent	0.00%	0
TOTAL		6

Perch Bay Road Responses

Q3: How well informed do you feel about the Lake Waccabuc Study?

Answered: 13 Skipped: 1

ANSWER CHOICES	RESPONSES	
Very	15.38%	2
Moderately	46.15%	6
Somewhat	30.77%	4
Not at all	7.69%	1
TOTAL		13

Q4: Are you in favor of establishing a sewer district in your community?

Answered: 14 Skipped: 0

ANSWER CHOICES	RESPONSES	
Yes	78.57%	11
No	14.29%	2
Indifferent	7.14%	1
TOTAL		14

Q5: Are you in favor of having a septic maintenance district in your community?

Answered: 14 Skipped: 0

ANSWER CHOICES	RESPONSES	
Yes	57.14%	8
No	35.71%	5
Indifferent	7.14%	1
TOTAL		14

Post Office Road Responses

Answered: 1

Q3: How well informed do you feel about the Lake Waccabuc Study?

ANSWER CHOICES	RESPONSES	
Very	0.00%	0
Moderately	0.00%	0
Somewhat	100.00%	1
Not at all	0.00%	0
TOTAL		1

Q4: Are you in favor of establishing a sewer district in your community?

ANSWER CHOICES	RESPONSES	
Yes	100.00%	1
No	0.00%	0
Indifferent	0.00%	0
TOTAL		1

Q5: Are you in favor of having a septic maintenance district in your community?

ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	0.00%	0
Indifferent	100.00%	1
TOTAL		1

South Shore Drive Responses

Answered: 11

Q3: How well informed do you feel about the Lake Waccabuc Study?

ANSWER CHOICES	RESPONSES	
Very	45.45%	5
Moderately	54.55%	6
Somewhat	0.00%	0
Not at all	0.00%	0
TOTAL		11

Q4: Are you in favor of establishing a sewer district in your community?

ANSWER CHOICES	RESPONSES	
Yes	90.91%	10
No	9.09%	1
Indifferent	0.00%	0
TOTAL		11

Q5: Are you in favor of having a septic maintenance district in your community?

ANSWER CHOICES	RESPONSES	
Yes	36.36%	4
No	45.45%	5
Indifferent	18.18%	2
TOTAL		11

Tarry-A-Bit Drive Responses

Answered: 6

Q3: How well informed do you feel about the Lake Waccabuc Study?

ANSWER CHOICES	RESPONSES	
Very	33.33%	2
Moderately	33.33%	2
Somewhat	16.67%	1
Not at all	16.67%	1
TOTAL		6

Q4: Are you in favor of establishing a sewer district in your community?

ANSWER CHOICES	RESPONSES	
Yes	50.00%	3
No	33.33%	2
Indifferent	16.67%	1
TOTAL		6

Q5: Are you in favor of having a septic maintenance district in your community?

ANSWER CHOICES	RESPONSES	
Yes	33.33%	2
No	66.67%	4
Indifferent	0.00%	0
TOTAL		6

Twin Lakes Road Responses

Answered: 7

Q3: How well informed do you feel about the Lake Waccabuc Study?

ANSWER CHOICES	RESPONSES	
Very	0.00%	0
Moderately	71.43%	5
Somewhat	28.57%	2
Not at all	0.00%	0
TOTAL		7

Q4: Are you in favor of establishing a sewer district in your community?

ANSWER CHOICES	RESPONSES	
Yes	71.43%	5
No	28.57%	2
Indifferent	0.00%	0
TOTAL		7

Q5: Are you in favor of having a septic maintenance district in your community?

ANSWER CHOICES	RESPONSES	
Yes	57.14%	4
No	42.86%	3
Indifferent	0.00%	0
TOTAL		7

Appendix K
EOH Septic Reimbursement Financial Eligibility Criteria

NYC DEP EOH SEPTIC REIMBURSEMENT PROGRAM

2021 Financial Hardship Criteria for the Cross River, Croton Falls, and Upstream Hydrologically Connected Reservoir Basins

Income Levels

Family Size	US HHS Poverty Guideline*	200% HHS	400% HHS
1	$12,880	$25,760	$51,520
2	$17,420	$34,840	$69,680
3	$21,960	$43,920	$87,840
4	$26,500	$53,000	$106,000
5	$31,040	$62,080	$124,160
6	$35,580	$71,160	$142,320
7	$40,120	$80,240	$160,480
8	$44,660	$89,320	$178,640

*US Dept of Health and Human Services 2021 Poverty Guidelines as of 1/13/2021

For families/households with more than 8 persons add $4,540 for each additional person

Incomes ≤ 200% HHS eligible for 75% reimbursement

Incomes >200% to 400% HHS eligible for 50% reimbursement

Incomes > 400% HHS not eligible

Housing Values

Town	Basin	US Census Median Value
Bedford	Cross River	$737,500
Beekman	Middle Branch	$299,400
Carmel	Multiple	$379,300
East Fishkill	Middle Branch	$358,700
Kent	Multiple	$289,900
Lewisboro	Cross River	$620,500
Patterson	Multiple	$332,100
Pawling (T)	Multiple	$301,400
Pawling (V)	Bog Brook	$284,500
Pound Ridge	Cross River	$911,200
Somers	Croton Falls	$501,000
Southeast	Multiple	$351,200

U.S. Census Bureau, American Community Survey 5-Year Estimate 2015-2019

Full Market Value as noted on Town tax bill must be at or below Median Value

Updated 01/25/2021

Appendix L

NYS EFC Smart Growth Assessment

NEW YORK STATE OF OPPORTUNITY. | Department of Health | Environmental Facilities Corporation

Smart Growth Assessment Form

This form should be completed by an authorized representative of the applicant, preferably the project engineer or other design professional.[1]

Section 1 – General Applicant and Project Information

Applicant: Town of Lewisboro Project No.:

Project Name: Lake Waccabuc Wastewater Management

Is project construction complete? ☐ Yes, date: ☑ No

Please provide a brief project summary in plain language including the location of the area the project serves:

Section 2 – Screening Questions

A. Prior Approvals

1. Has the project been previously approved for Environmental Facilities Corporation (EFC) financial assistance? ☐ Yes ☑ No
2. If yes to A(1), what is the project number(s) for the prior approval(s)? Project No.:
3. If yes to A(1), is the scope of the previously-approved project substantially the same as the current project? ☐ Yes ☐ No

If your responses to A(1) and A(3) are both yes, please proceed to Section 5, Signature.

B. New or Expanded Infrastructure

1. Does the project involve the construction or reconstruction of new or expanded infrastructure? ☑ Yes ☐ No

Examples of new or expanded infrastructure include, but are not limited to:

(i) The addition of new wastewater collection/new water mains or a new wastewater treatment system/water treatment plant where none existed previously;

(ii) An increase of the State Pollutant Discharge Elimination System (SPDES) permitted flow capacity for an existing wastewater treatment system; and OR

[1] If project construction is complete and the project was not previously financed through EFC, an authorized municipal representative may complete and sign this assessment.

(iii) An increase of the permitted water withdrawal or the permitted flow capacity for the water treatment system such that a Department of Environmental Conservation (DEC) water withdrawal permit will need to be obtained or modified, or result in the Department of Health (DOH) approving an increase in the capacity of the water treatment plant.

If your response to B(1) is no, please proceed to Section 5, Signature.

Section 3 –Smart Growth Criteria

Your project must be consistent will all relevant Smart Growth criteria. For each question below please provide a response and explanation.

1. Does the project use, maintain, or improve existing infrastructure?
   ☐ Yes ☑ No

   Explain your response: This project is for a new collection system and WWTP to consolidate and improve wastewater treatment to protect a NYC drinking water source.

2. Is the project located in a (1) municipal center, (2) area adjacent to a municipal center, or (3) area designated as a future municipal center, as such terms are defined herein (please select one response)?

   ☐ Yes, my project is located in a municipal center, which is an area of concentrated and mixed land uses that serves as a center for various activities, including but not limited to: central business districts, main streets, downtown areas, brownfield opportunity areas (see www.dos.ny.gov for more information), downtown areas of local waterfront revitalization program areas (see www.dos.ny.gov for more information), areas of transit-oriented development, environmental justice areas (see *www.dec.ny.gov/public/899.html* for more information), and hardship areas (projects that primarily serve census tracts or block numbering areas with a poverty rate of at least twenty percent according to the latest census data).

   ☐ Yes, my project is located in an area adjacent to a municipal center which has clearly defined borders, is designated for concentrated development in the future in a municipal or regional comprehensive plan, and exhibits strong land use, transportation, infrastructure, and economic connections to an existing municipal center.

   ☐ Yes, my project is located in an area designated as a future municipal center in a municipal or comprehensive plan and is appropriately zoned in a municipal zoning ordinance

   ☑ No, my project is not located in a (1) municipal center, (2) area adjacent to a municipal center, or (3) area designated as a future municipal center.

   Explain your response and reference any applicable plans:

   The project is located in an area of mixed land use within the Town of Lewisboro, outside of the municipal center.

3. Is the project located in a developed area or an area designated for concentrated infill development in a municipally-approved comprehensive land use plan, local waterfront revitalization plan, and/or brownfield opportunity area plan?

☑Yes ☐No

Explain your response and reference any applicable plans:

The study area is already developed to capacity with few vacant properties viable for further development. The area is in need of a comprehensive wastewater management solution.

4. Does the project protect, preserve, and enhance the State's resources, including surface and groundwater, agricultural land, forests, air quality, recreation and open space, scenic areas, and significant historic and archaeological resources?

☑Yes ☐No

Explain your response:

This project will directly and significantly reduce phosphorus loading entering Lake Waccabuc, protecting the Cross River Reservoir, a NYC drinking water source. Reducing nutrient concentration entering the Lake will also enhance the beauty and recreational opportunities for residents and reverse the decades long trend towards a eutrophic lake while mitigating harmful algal blooms.

5. Does the project foster mixed land uses and compact development, downtown revitalization, brownfield redevelopment, the enhancement of beauty in public spaces, the diversity and affordability of housing in proximity to places of employment, recreation and commercial development, and the integration of all income and age groups?

☑Yes ☐No

Explain your response:

The project allows for the existing mixed land uses and compact development to adequately and properly treat their wastewater. The project will significantly improve water quality in Lake Waccabuc and contribute to enhanced water quality in the Cross River Basin.

6. Does the project provide mobility through transportation choices including improved public transportation and reduced automobile dependency?

☐Yes ☐No ☑N/A

Explain your response:

Not relevant, the project is focused on improving water quality by consolidating wastewater treatment.

7. Does the project involve coordination between State and local government, intermunicipal planning, or regional planning?

☑Yes ☐No ☐

Explain your response and reference any applicable plans:

This project has and will continue to involve significant and intricate coordination with numerous agencies. The Town of Lewisboro, Westchester County DOH, NYSDEC, NYSEFC, NYCDEP, NEIWPCC, and several local Lake committees are all crucial to progressing this project and ensuring its completion.

8. Does the project involve community-based planning and collaboration?

☑Yes ☐No

Explain your response and reference any applicable plans:

Community involvement has been significant with respect to this project. The project has been presented at multiple public information meetings, public surveys and crowdsourcing have been conducted, and regular progress meetings with the Town of Lewisboro, Three Lakes Council, South Shore Waccabuc Association, Lake Waccabuc Association, and Lakeside Association of Lake Waccabuc have contributed to strong community-based planning and collaboration.

9. Does the project support predictability in building and land use codes?

☑Yes ☐No ☐N/A

Explain your response:

The only anticipated change to land use codes will occur with the construction of the new wastewater treatment plant, which will likely change the land use code for the parcel from residential to industrial.

10. Does the project promote sustainability by adopting measures such as green infrastructure techniques, decentralized infrastructure techniques, or energy efficiency measures?

☑Yes ☐No

Explain your response and reference any applicable plans:

The proposed wastewater treatment plant will include energy efficiency measures by utilizing premium-efficiency blowers with variable frequency drives (VFDs), VFDs on all pumps, fine bubble diffusers, and low-pressure, high output UV lamps for disinfection.

11. Does the project mitigate future physical climate risk due to sea-level rise, storm surges, and/or flooding, based on available data predicting the likelihood of future extreme weather events, including hazard risk analysis data, if applicable?

☑Yes ☐No

Explain your response and reference any applicable plans:

The proposed project will mitigate flood risks by relocating wastewater treatment for several properties with septic systems inside the 100-year floodplain. Instead of onsite treatment systems, wastewater will be collected and conveyed to a new wastewater treatment plant that will be built outside of the 100-year floodplain.

Section 4 – Miscellaneous

1. Is the project expressly required by a court or administrative consent order? ☐ Yes ☑ No

If yes, and you have not previously provided the applicable order to EFC/DOH, please submit it with this form.

Section 5 – Signature

By signing below, you agree that you are authorized to act on behalf of the applicant and that the information contained in this Smart Growth Assessment is true, correct and complete to the best of your knowledge and belief.

Applicant: Town of Lewisboro	Phone Number: 518-218-1801
Name and Title of Signatory: Donald H. Fletcher, P.E., Senior Vice President	
Signature: Donald H Fletcher	Date: 11/29/21

Appendix M
Engineering Report Certification

Engineering Report Certification

During the preparation of this Engineering Report, I have studied and evaluated the cost and effectiveness of the processes, materials, techniques, and technologies for carrying out the proposed project or activity for which assistance is being sought from the New York State Clean Water State Revolving Fund. In my professional opinion, I have recommended for selection, to the maximum extent practicable, a project or activity that maximizes the potential for efficient water use, reuse, recapture, and conservation, and energy conservation, taking into account the cost of constructing the project or activity, the cost of operating and maintaining the project or activity over the life of the project or activity, and the cost of replacing the project and activity.

Title of Engineering Report: Lake Waccabuc Engineering Study
Wastewater Issues and Solutions
Preliminary Engineering Report

Date of Report: December 2021

Professional Engineer's Name: Donald H. Fletcher, P.E.

Signature:

Date: 11/29/21

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