

APPENDICES

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APPENDIX A: THEMATIC WATERSHED MAPS

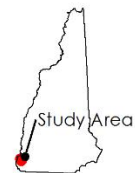
Spofford Lake Watershed

Cheshire County
Chesterfield, New Hampshire

BASE MAP

-  Spofford Lake Watershed
 -  Wetland
 -  Lake/Pond
 -  Stream
 -  Conserved Land
 -  Private Road
 -  Public Road
 -  State Road
 -  Beach
 -  Boat Landing
 -  Public Camp
 -  Golf course
 -  Horsemanship Camp
 -  Yacht Club
- 1 North Shore Town Beach
 - 2 Ware's Grove Public Beach
 - 3 Boat Landing
 - 4 Camp Spofford
 - 5 Pine Grove Springs Golf Course
 - 6 Road's End Farm Horsemanship Camp
 - 7 Spofford Yacht Club

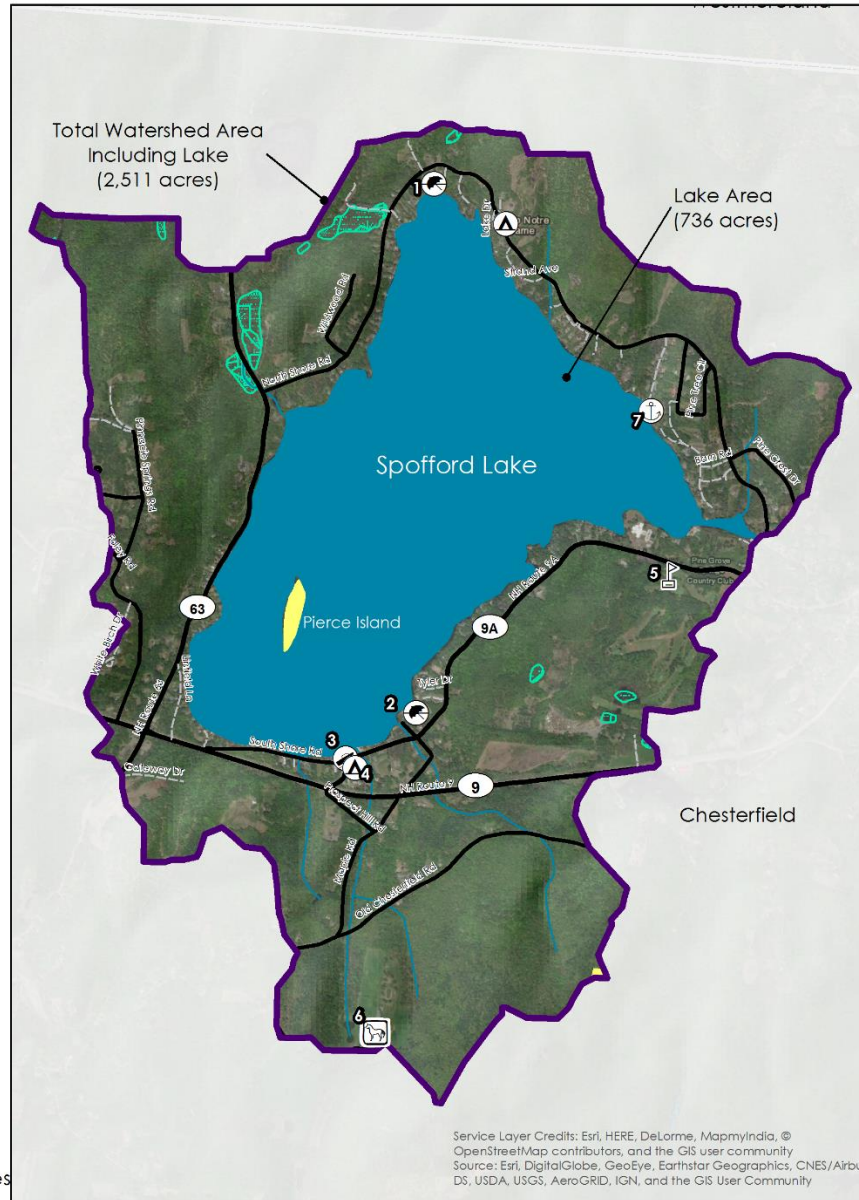
The only conserved lands within the Spofford Lake watershed are represented by two locations: Pierce Island, and a small part of Pisgah State Park in the southwestern corner of the watershed. Together, these areas make up 0.25% of the watershed. Pierce Island is the largest island on Spofford Lake and stands as a beautiful backdrop for the lake's seasonal residents, as well as a destination for boaters and swimmers. The watershed also consists of two beaches (one public and one private), a public boat launch, a family camp, a yacht club, a golf course, and a horsemanship farm.



Source: New Hampshire GRANIT, National Wetland Inventory, FB Environmental, ESRI, Lake Area from National Hydrography Dataset, Watershed Area from NHDES/ SWRPC
Projection: NAD 1983 New Hampshire State Plane FIPS 2800
Created by FB Environmental (C. Bunyan), May 2018



0 0.5 1 Miles



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Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

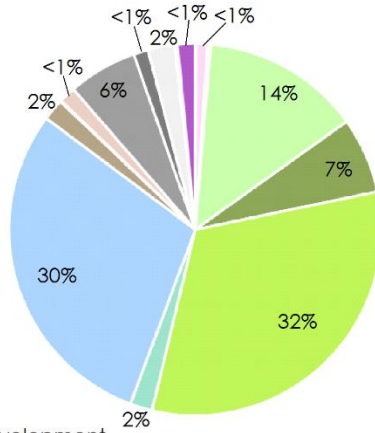
MAP 1

Spofford Lake Watershed

Cheshire County
Chesterfield, New Hampshire

Land Cover

-  Town Boundary
-  Spofford Lake Watershed
-  Lake/River
-  Wetland
-  Deciduous Forest
-  Non-Deciduous Forest
-  Mixed Forest
-  Meadow
-  Hayfield
-  Grazing
-  Row Crop
-  Unpaved Road
-  Paved Road
-  Low Density Residential Development
-  Mid Density Residential/Commercial Development
-  Industrial Development
-  Mowed Field
-  Beach



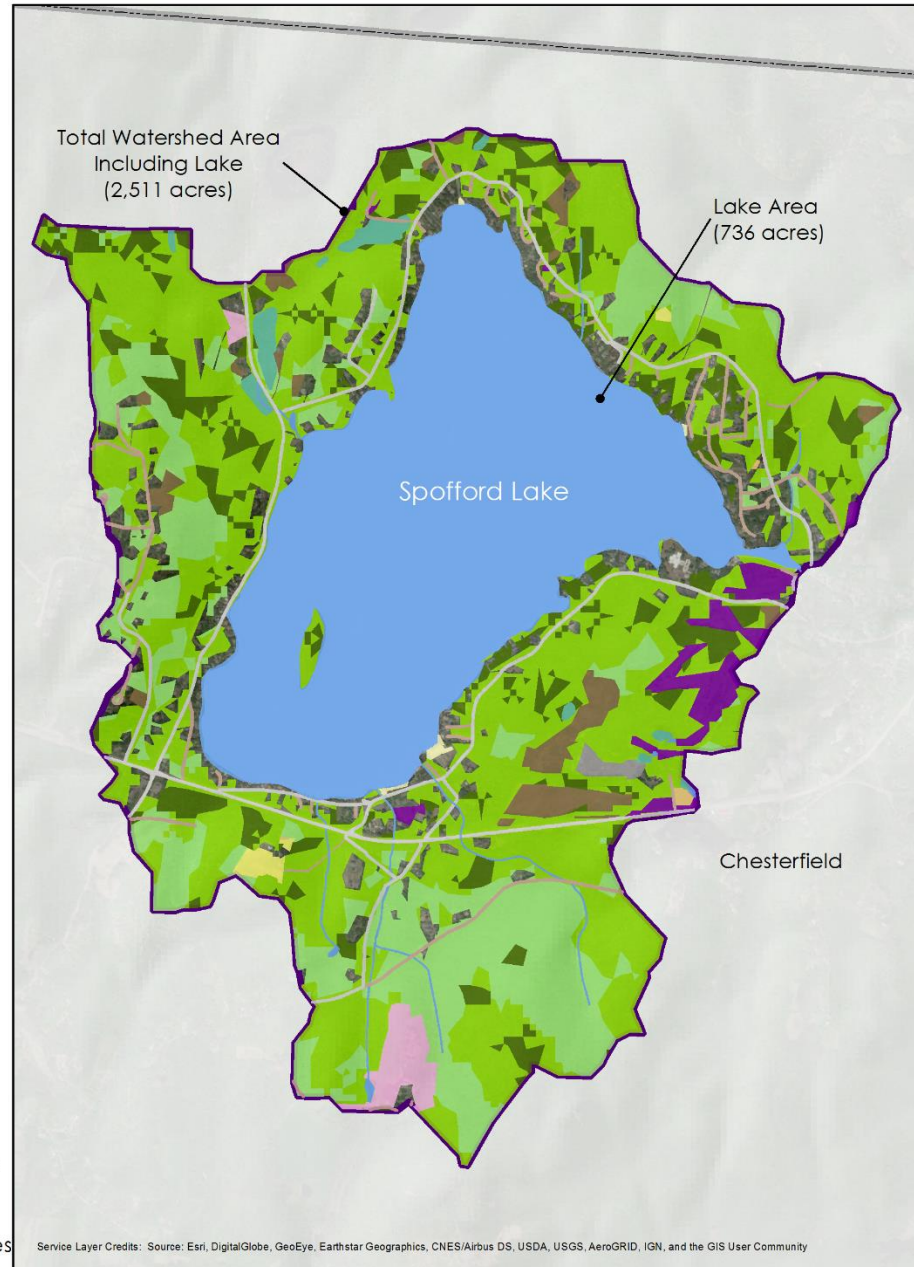
One of the first and most important steps in modeling pollutant loading in the watershed is updating the land cover to better reflect the most recent aeriels. The land cover of the Spofford Lake watershed was updated from the NH Land Cover Assessment 2001 using Google Earth Imagery available for 9/18/2014 aeriels. Overlaid GRANIT NH Public Roads layer and GRANIT NWI layer. Land cover was carefully reviewed and edited to account for new development and for changes in land use (post 2001).



Source: New Hampshire GRANIT, National Wetland Inventory, FB Environmental, ESRI, Lake Area from National Hydrography Dataset, Watershed Area from NHDES/ SWRPC
Projection: NAD 1983 New Hampshire State Plane FIPS 2800
Created by FB Environmental (C. Bunyan), July 2018



0 0.5 1 Miles



MAP 2

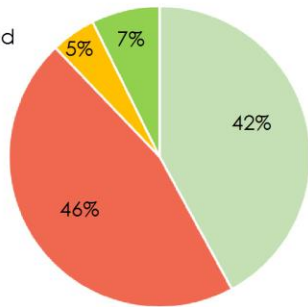
Spofford Lake Watershed

Cheshire County
Chesterfield, New Hampshire

High Value Habitat

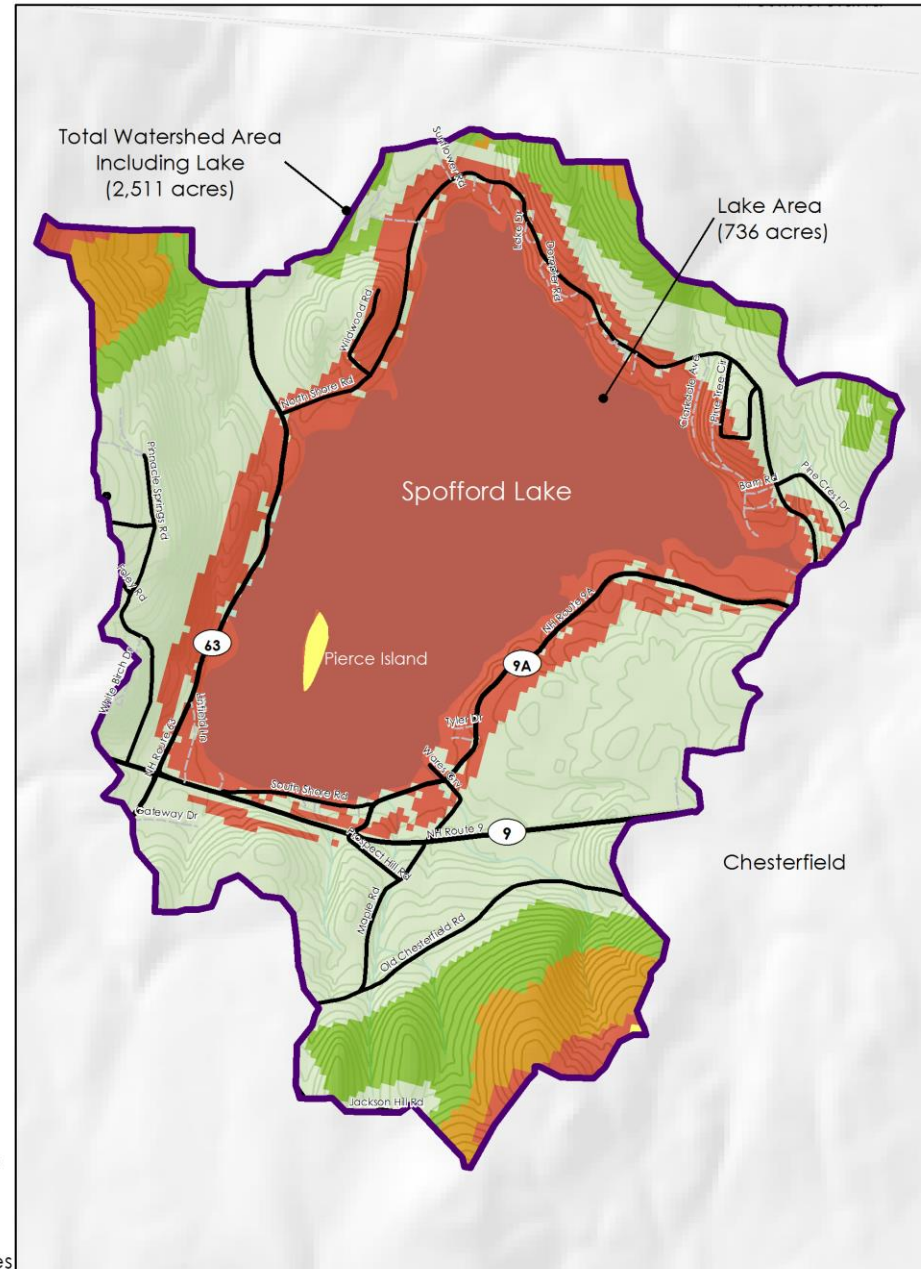
Legend

- Spofford Lake Watershed
- Wetland
- Lake/Pond
- Stream
- Conserved Land
- Private Road
- Public Road
- State Road



- Not Classified
- Highest Ranked Habitat in New Hampshire
- Highest Ranked Habitat in Biological Region
- Supporting Landscapes

New Hampshire Fish and Game Department (NHFGD) ranks habitat based on value to the State, biological region (areas with similar climate, geology, and other factors that influence biology), and supporting landscape. These habitat rankings are published in the State's 2015 Wildlife Action Plan, which serves as a blueprint for prioritizing conservation actions to protect Species of Greatest Conservation Need in New Hampshire. 46% of the Spofford Lake watershed (including the lake) have been classified as Highest Ranked Habitat in New Hampshire.



Source: New Hampshire GRANIT, National Wetland Inventory, FB Environmental, ESRI, Lake Area from National Hydrography Dataset, Watershed Area from NHDES/ SWRPC
Projection: NAD 1983 New Hampshire State Plane FIPS 2800
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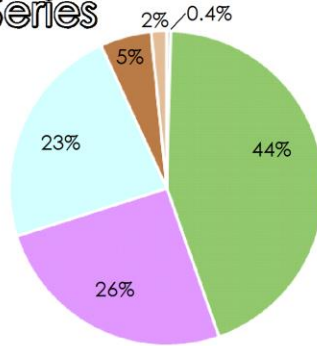
0 0.5 1 Miles

MAP 3

Spofford Lake Watershed

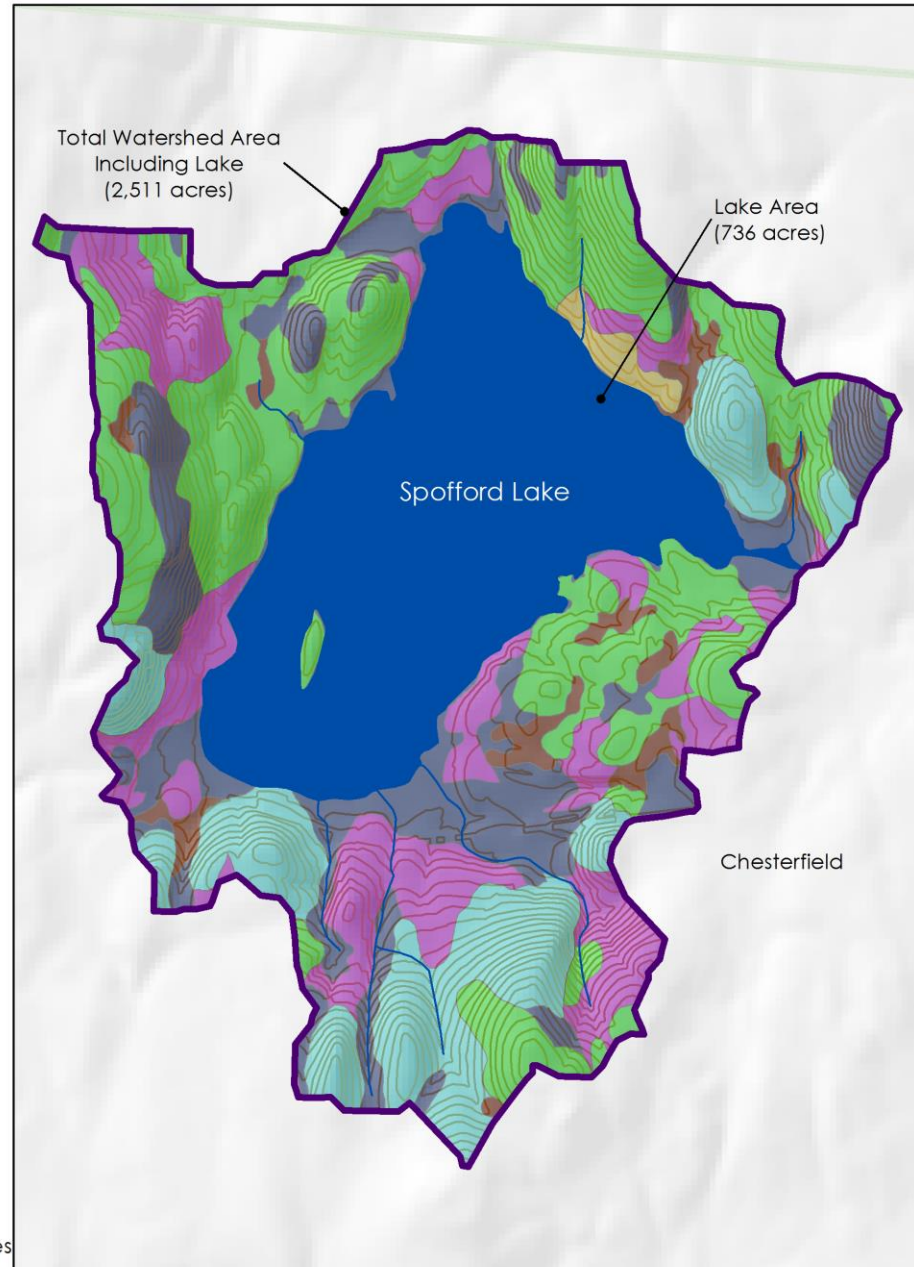
Cheshire County
Chesterfield, New Hampshire

Soil Series

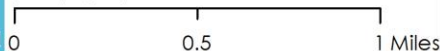


- Spofford Lake Watershed
- Lake/Pond
- Stream
- Cardigan-Kearsarge-Rock outcrop complex
- Dutchess silt loam, very stony
- Bernardston silt loam, very stony
- Stissing silt loam, very stony
- Monadnock fine sandy loam, very stony
- Other (17 soil series)

The soils in the Spofford Lake watershed are a direct result of geologic processes in the region. The most prevalent soil group in the watershed is Cardigan-Kearsarge-Rock outcrop complex (522.9 acres, 44%), closely followed by Dutchess silt loam, very stony (360.6 acres, 26%), Bernardston silt loam, very stony (326.1 acres, 23%), Stissing silt loam, very stony (74.5 acres, 5%), and Monadnock fine sandy loam, very stony (22.6 acres, 2%). These soils are all classified with having moderately low to moderately high runoff potential, and are comprised of a silty loam, well-drained soil.



Source: New Hampshire GRANIT, National Wetland Inventory, FB Environmental, ESRI, Lake Area from National Hydrography Dataset, Watershed Area from NHDES/ SWRPC
Projection: NAD 1983 New Hampshire State Plane FIPS 2800
Created by FB Environmental (C. Bunyon), May 2018











MAP 4

Spofford Lake Watershed

Cheshire County
Chesterfield, New Hampshire

Soil Erosion Potential

Legend

-  Spofford Lake Watershed
-  Lake/Pond
-  Stream
-  Not Classified
-  Low Runoff Potential
-  Moderately Low Runoff Potential
-  Moderately High Runoff Potential
-  High Runoff Potential

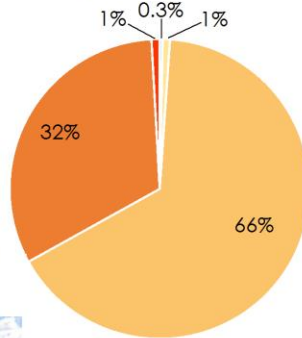
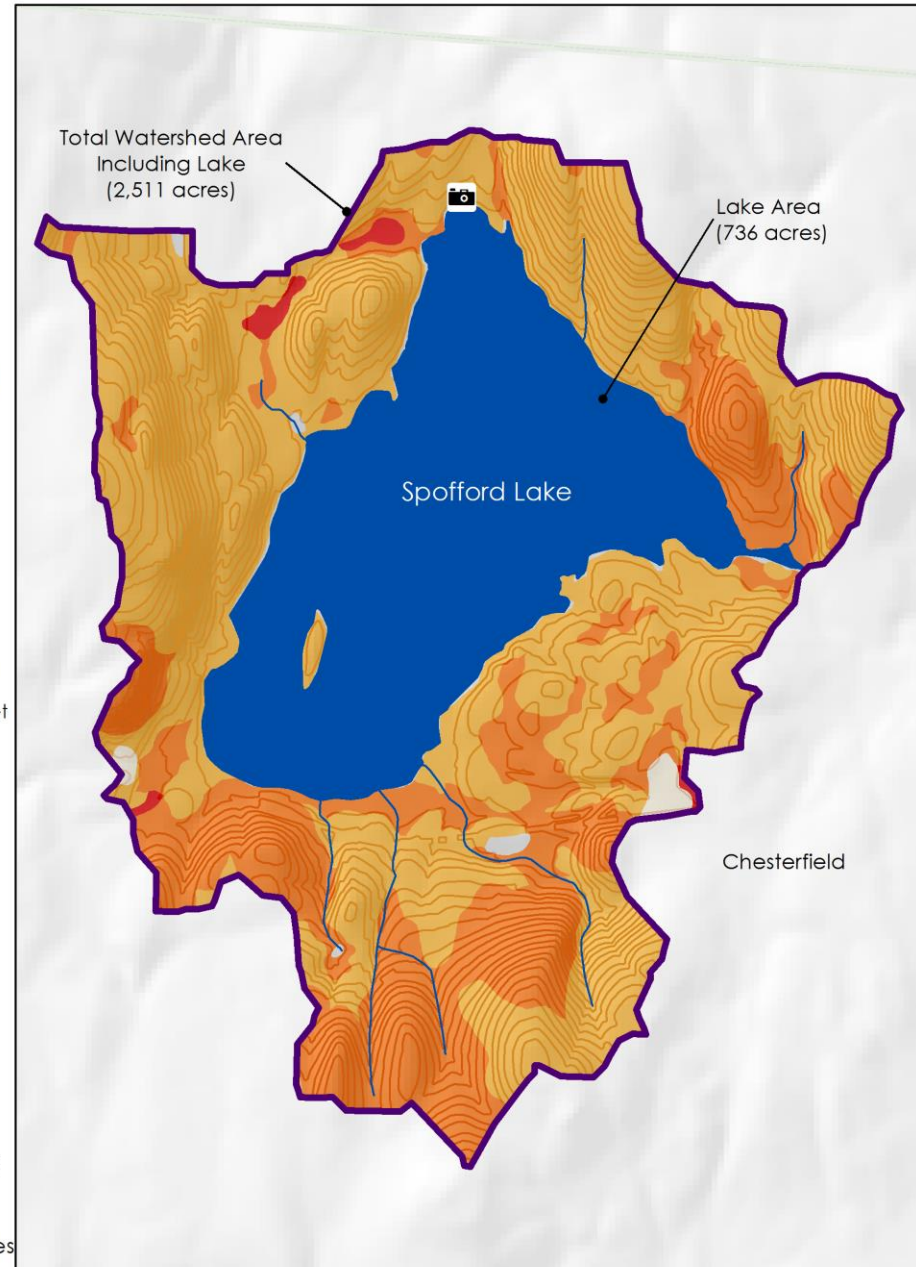
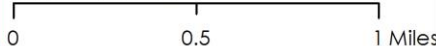


Photo taken from the 2017 Watershed BMP Assessment of Spofford Lake. This shows an area of exposed shoreline where sediments are observed as a pollutant of concern as storm water flows from the street and over the soil at the North Shore Town Beach.

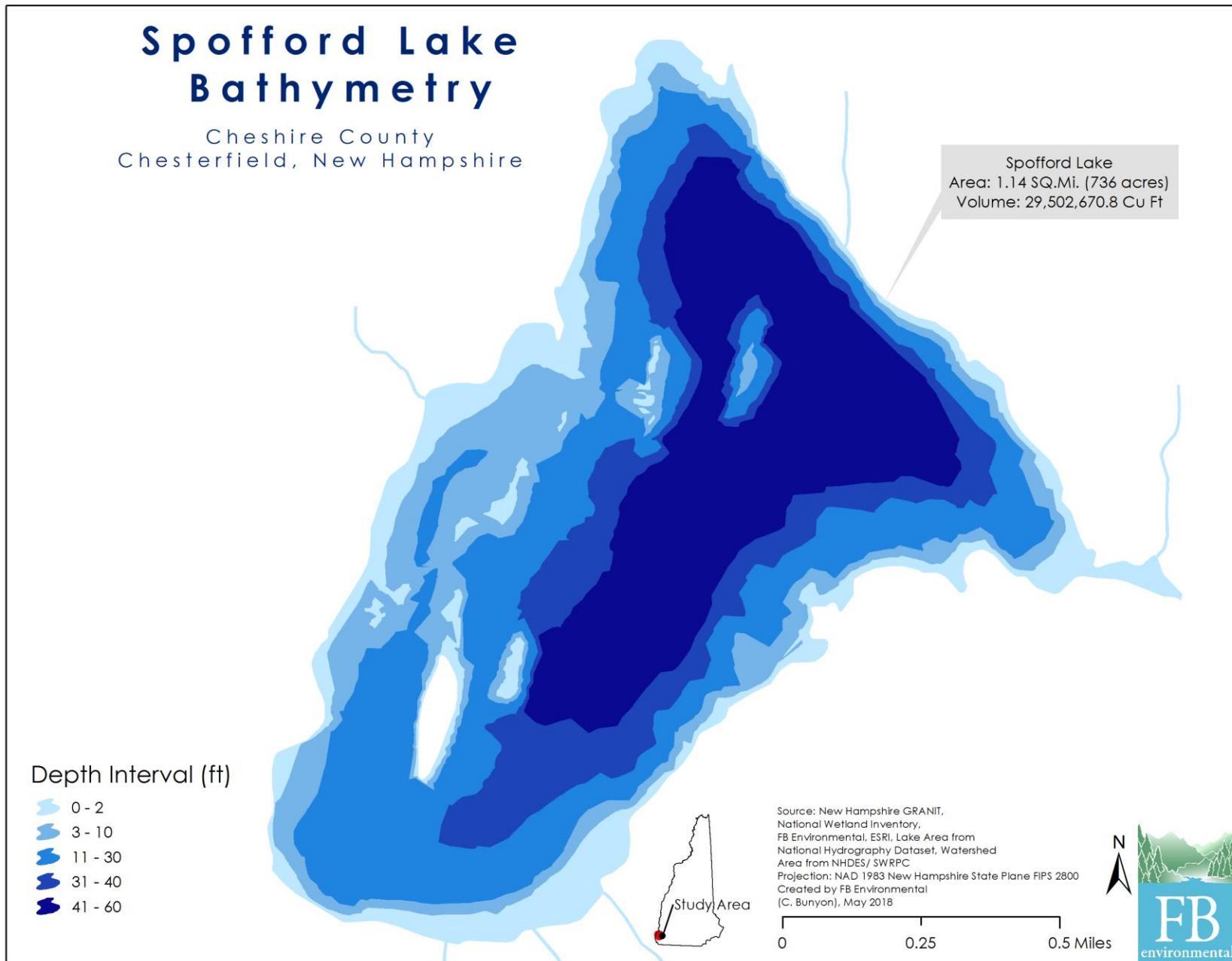
Soil erosion potential is dependent on a combination of factors, including land contours, climate conditions, soil texture, soil composition, permeability, and soil structure (O'Geen et al., 2006). Soil erosion potential should be a primary factor in determining the rate and placement of development within a watershed. Excluding the lake area, only 1% of the Spofford Lake watershed is classified as having a high runoff potential, while the majority of the watershed has a moderately low runoff potential (66%).



Source: New Hampshire GRANIT, National Wetland Inventory, FB Environmental, ESRI, Lake Area from National Hydrography Dataset, Watershed Area from NHDES/ SWRPC
Projection: NAD 1983 New Hampshire State Plane FIPS 2800
Created by FB Environmental (C. Bunyan), May 2018



MAP 5



MAP 6

Spofford Lake Watershed

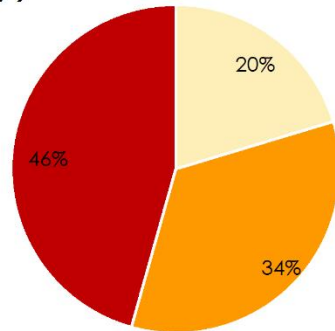
Cheshire County
Chesterfield, New Hampshire

Total Phosphorus Load

Total Phosphorus Load (kg/ha/yr)

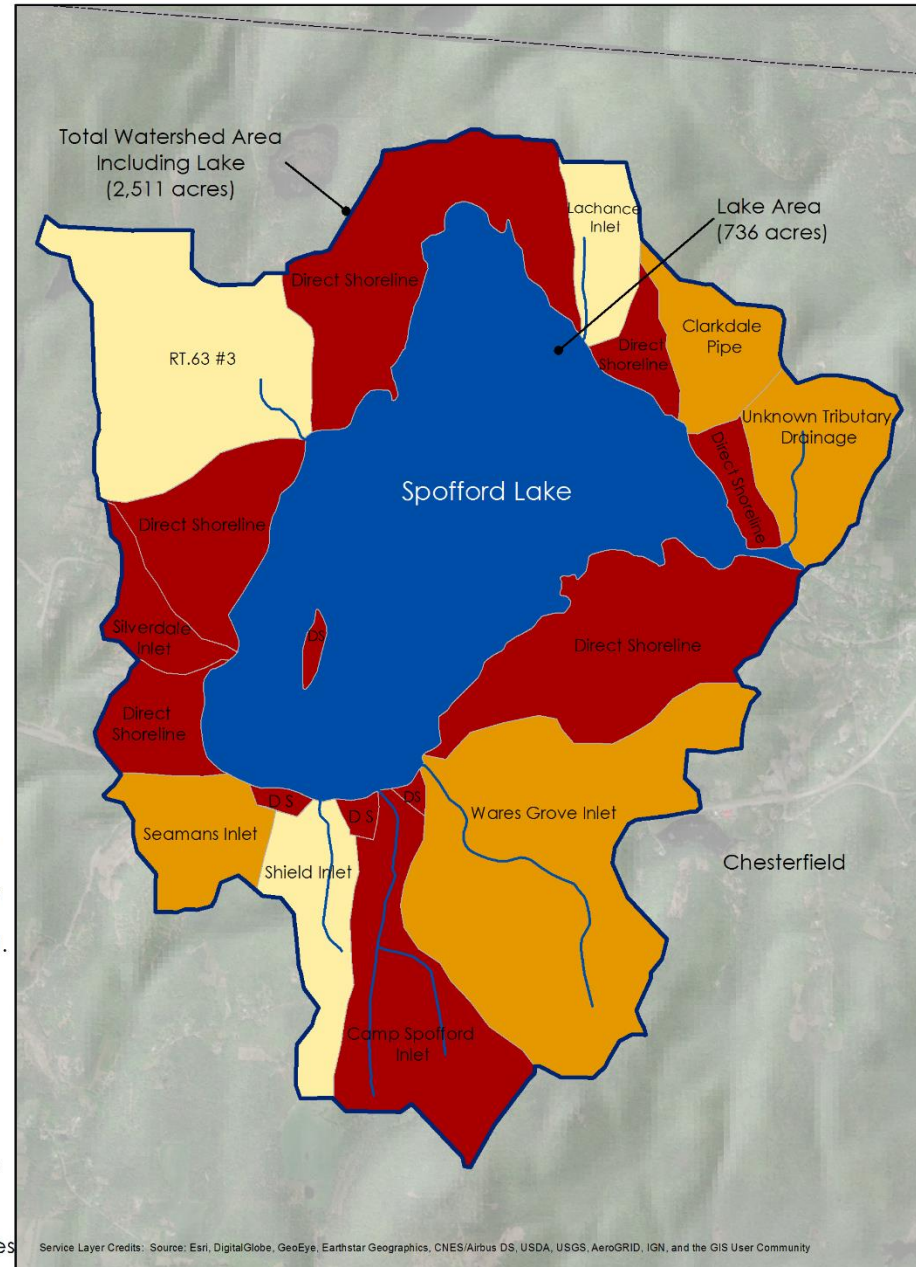
- 0-0.10 (Low)
- 0.11-0.19 (Moderate)
- 0.20-0.29 (High)

- Lake
- Stream
- Spofford Lake Watershed
- Town Boundary



DS: Direct Shoreline

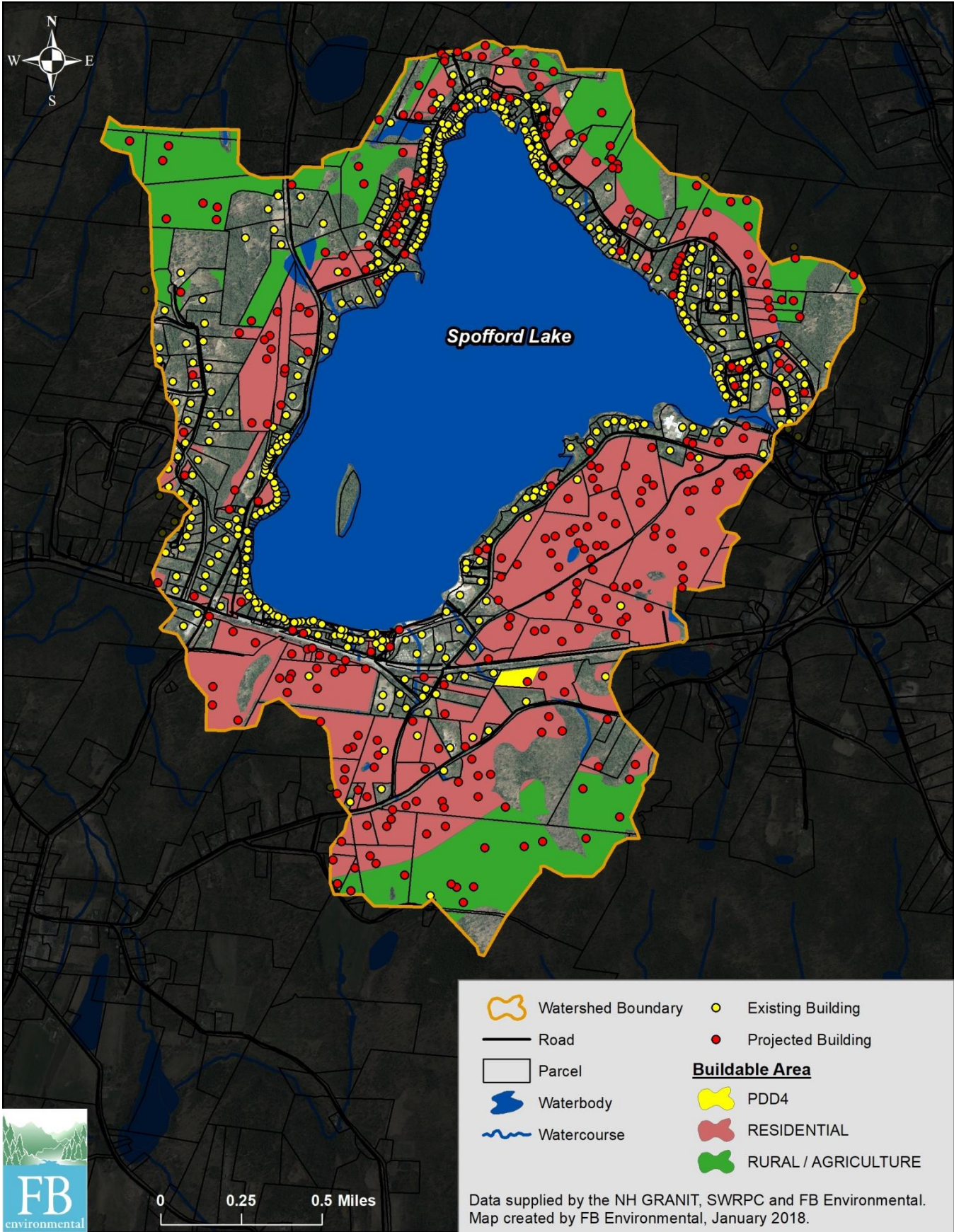
Normalizing for the size of a tributary (i.e., accounting for its annual discharge and contributing drainage area) better highlights sub-basins with elevated pollutant exports per unit of area. Sub-basins with moderate-to-high phosphorus mass exported by area (> 0.1 kg/ha/yr) generally had more development or agriculture (i.e., all sub-basins except Lachance Inlet, Rt. 63 #3, and Shield Inlet). Camp Spofford Inlet had the highest phosphorus mass exported by area. A few sub-basins did not have predicted phosphorus concentrations that matched well with measured phosphorus concentrations (e.g., Lachance Inlet and Silverdale Inlet), likely due to limited data (n=1-3). More data are needed to better adjust the coefficients and attenuation factors used for those sub-basins.



Source: New Hampshire GRANIT, National Wetland Inventory, FB Environmental, ESRI, Lake Area from National Hydrography Dataset, Watershed Area from NHDES/ SWRPC
Projection: NAD 1983 New Hampshire State Plane FIPS 2800
Created by FB Environmental (C. Bunyon), July 2018

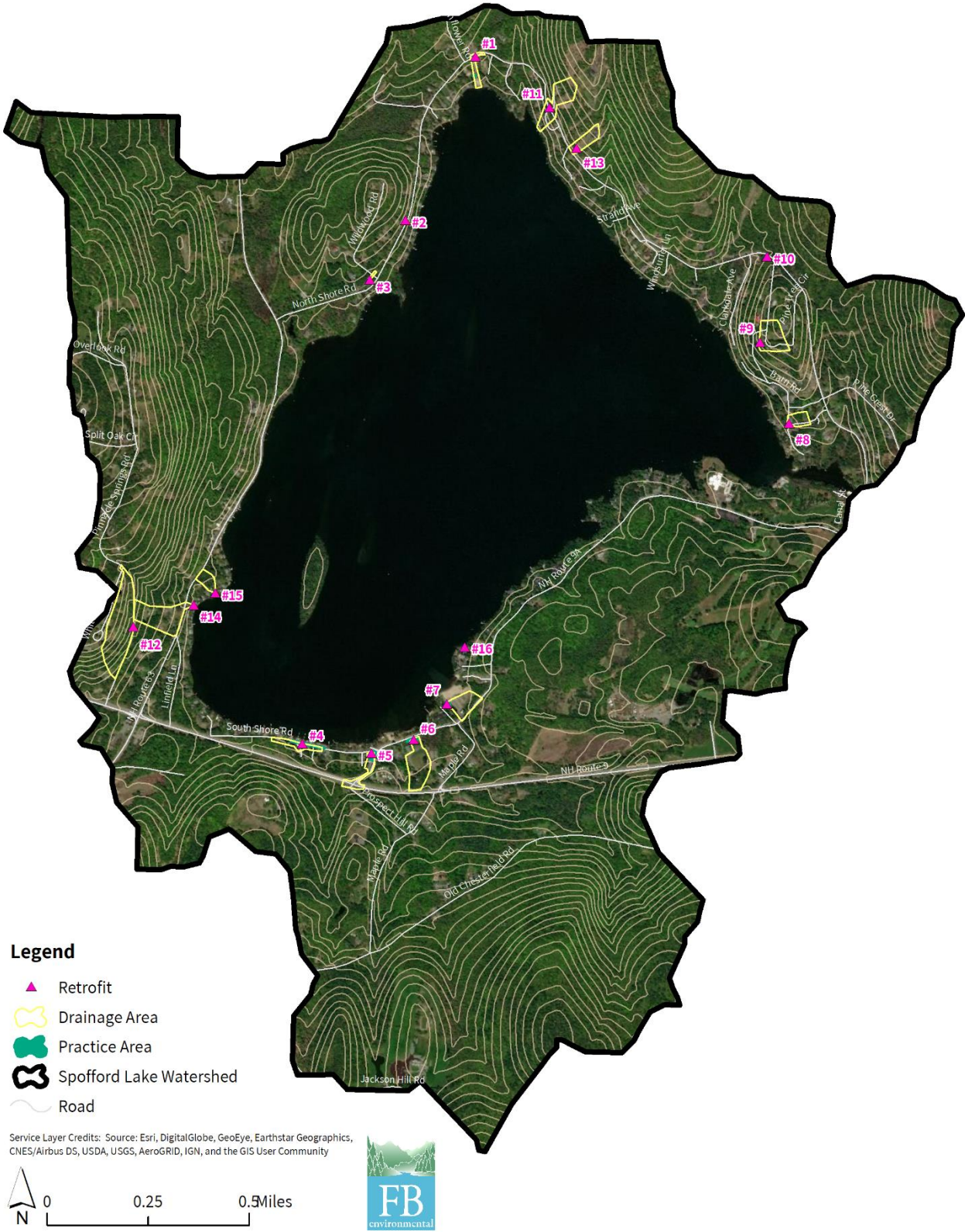
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

MAP 7

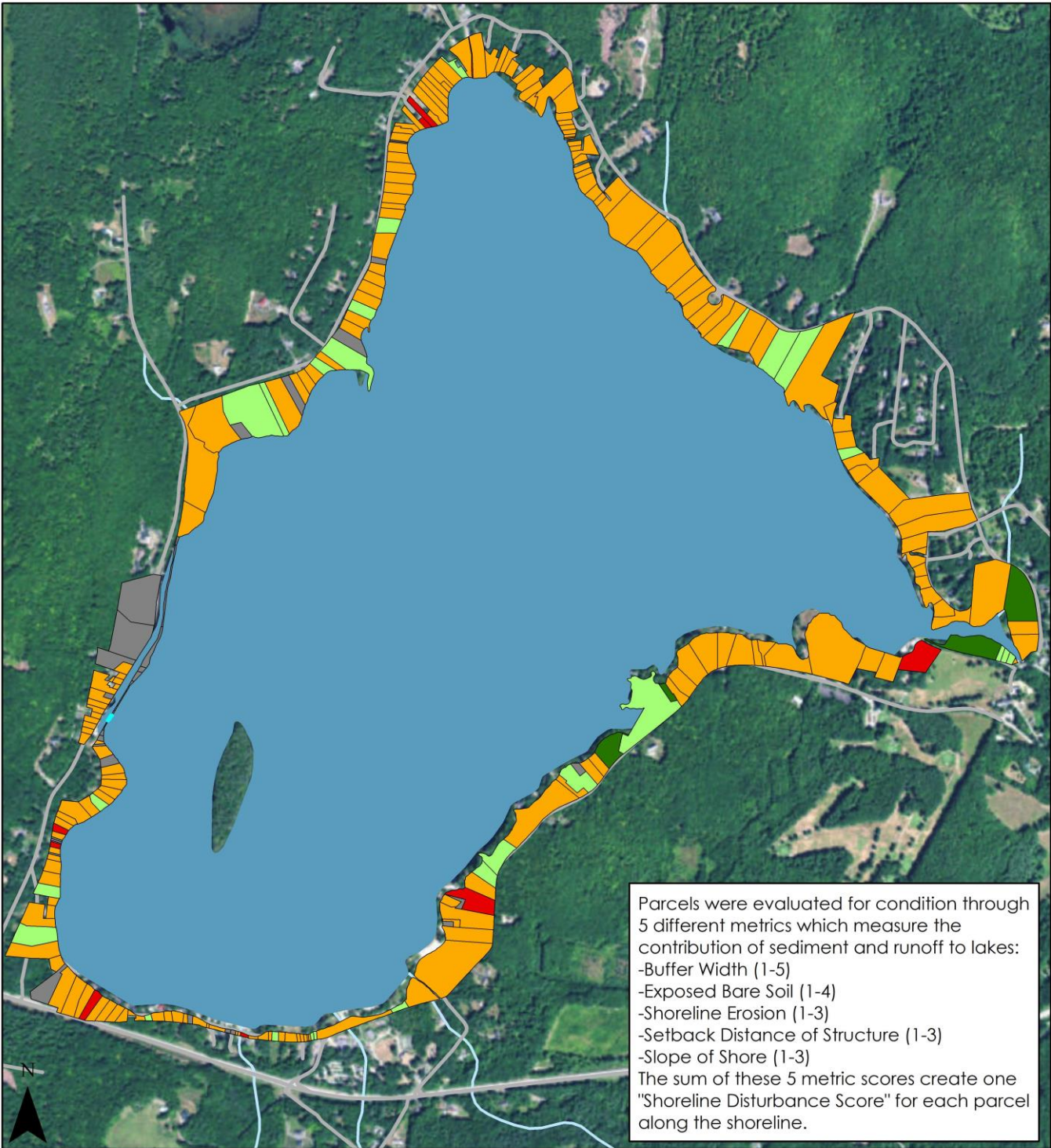


MAP 8

Spofford Lake - BMP Sites

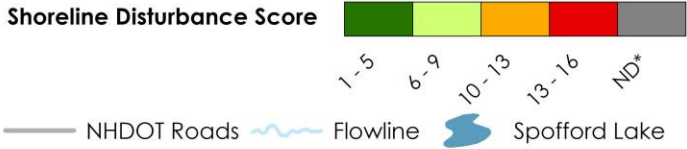


MAP 9



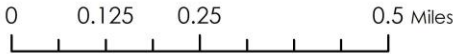
Parcels were evaluated for condition through 5 different metrics which measure the contribution of sediment and runoff to lakes:
 -Buffer Width (1-5)
 -Exposed Bare Soil (1-4)
 -Shoreline Erosion (1-3)
 -Setback Distance of Structure (1-3)
 -Slope of Shore (1-3)
 The sum of these 5 metric scores create one "Shoreline Disturbance Score" for each parcel along the shoreline.

SPOFFORD LAKE: Shoreline Survey



*ND = No Data

MAP 10



Data Sources: NH Granit, Southwest Region Planning Commission, and ESRI DigitalGlobe
 Projection: NAD 1983 State Plane New Hampshire FIPS 2800 ft
 Created By: FB Environmental, Sept 2017



APPENDIX B: BMP MATRIX

Rank	Site	NPS Issue	Impact Rating (1=High, 2=Med, 3=Low)	Recommended BMP	TSS Load Reduction (lbs/yr)	TP Load Reduction (lbs/yr)	TN Load Reduction (lbs/yr)	Est. Cost (Low)	Est. Cost (High)
1	7	Runoff from unpaved parking lot of Ware's Grove Beach conveyed to catchbasin to drainage swale to Spofford Lake	1	Bioretention	828.7	4.0	39.7	\$150,000	\$150,000
2	1	Erosion at parking area entrance and along North Shore Town Beach caused by street runoff	1	Bioretention	205.5	1.0	9.9	\$150,000	\$150,000
3	6	Untreated runoff from unpaved areas at Spofford Camp	2	Constructed wetland (shallow wetland) or rain garden	669.6	2.6	31.8	\$30,000	\$60,000
4	16	Untreated runoff from unpaved parking area and grassy slope causing significant gully erosion at beach owned by the Lake Spofford Family Recreation	1	Vegetated swales, bioretention	2.4	2.0	4.1	\$20,000	\$30,000
5	8	Erosion of gravel road at intersection of Echo Cove Way and Barn Road	1	Bioretention, vegetated swales with check dams	151.9	0.7	6.7	\$7,500	\$15,000
6	2	Erosion of gravel fill for residential parking	2	Retaining wall and stabilization	250.0	0.4	0.8	\$5,000	\$10,000
7	5	Sediment deposition in boat landing parking lot from stormwater system bypass	1	Infiltration trench and/or catchbasin with infiltration field	567.2	2.8	25.3	\$75,000	\$200,000
8	15	Private lake access erosion with deep gully formations	1	Vegetated buffer and stabilization (rip rap)	93.0	0.2	1.2	\$10,000	\$20,000
9	13	Steep driveway along North Shore Rd causing erosion across road to properties near the lake	1	Driveway waterbars/turnouts, ditch stabilization (riprap, check dams), plant shrubs to minimize lawn sheet flow	122.6	0.2	0.8	\$10,000	\$20,000
10	3	Erosion along road edge to residential driveway	3	Grading and stabilization (vegetated buffer)	9.4	0.1	0.4	\$2,000	\$4,000
11	10	Erosion of roadside ditch along North Shore Road	2	Stabilization	174.3	0.3	2.8	\$10,000	\$20,000
12	14	Significant runoff from Rt 63 from Bennett Rd north to 1A Silverdale Rd property	2	Infiltration trench and/or catchbasin(s) with infiltration field(s)	532.7	1.0	7.4	\$25,000	\$75,000
13	12	Severe ditch and roadside bank erosion along steep grade of Pinnacle Springs Rd	1	Regrade/shape/stabilize roadside bank and ditches; enlarge culverts	294.3	0.4	2.2	\$30,000	\$50,000

Rank	Site	NPS Issue	Impact Rating (1=High, 2=Med, 3=Low)	Recommended BMP	TSS Load Reduction (lbs/yr)	TP Load Reduction (lbs/yr)	TN Load Reduction (lbs/yr)	Est. Cost (Low)	Est. Cost (High)
14	11	Sediment deposition and erosion along Lake Drive from new development	1	Drainage easement and new outfall	533.4	1.1	8.9	\$150,000	\$300,000
15	4	Erosion along road edge to small inlet adjacent to recent tree plantings (with exposed soil)	3	Swale and stabilization (vegetated swale)	245.1	0.7	5.4	\$20,000	\$50,000
16	9	Erosion of culvert outlet under Pine Tree Circle	3	Outlet protection	50.0	0.1	0.2	\$5,000	\$10,000
TOTAL					4730.1	17.5	147.6	\$699,500	\$1,164,000