DRAFT

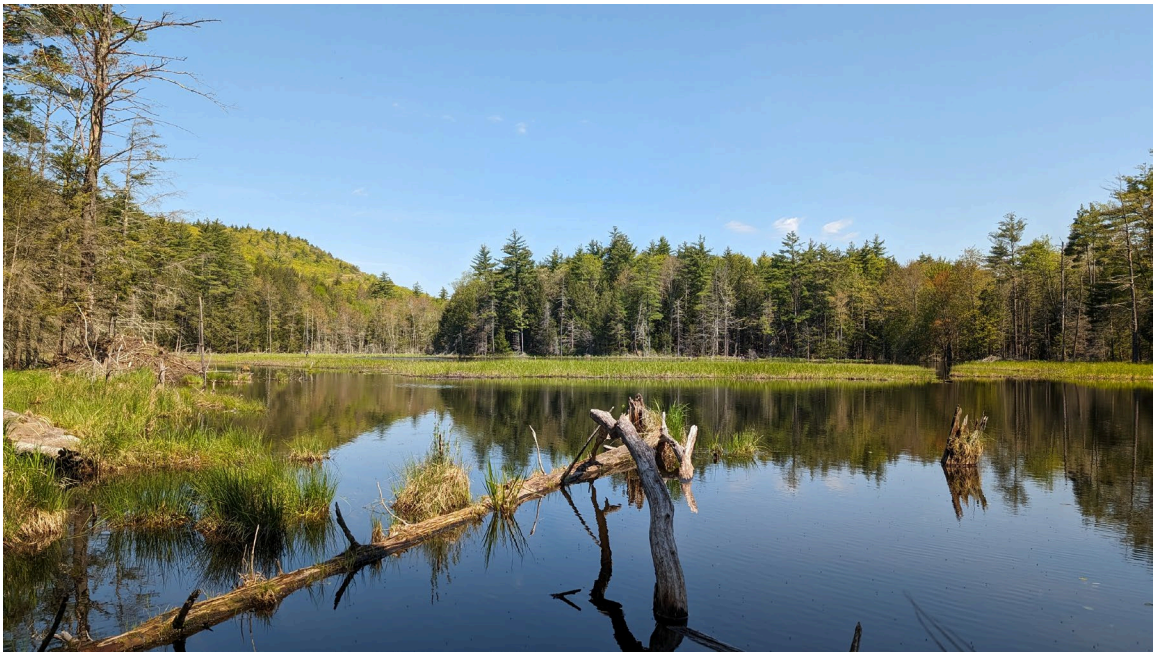
COMPARATIVE WETLANDS EVALUATION

SWANZEY, NH

SUMMARY REPORT

Prepared for:

Swanzey Conservation Commission



Prepared by:

Moosewood Ecological

Innovative Conservation Solutions for New England

November 12, 2024

Introduction

Wetland resources represent some of our most fragile ecosystems and are particularly sensitive to certain types of adjacent land uses. Wetland resources provide a variety of ecological functions and societal values, including:

- Water quality maintenance
- Flood control
- Wildlife and fisheries habitat
- Drinking water sources
- Recreation
- Visual quality and aesthetics
- Rare and endangered species habitat and natural communities
- Groundwater recharge and discharge
- Shoreline stabilization
- Educational and scientific value
- Overall biological diversity of Swanzey

Wetlands generally include familiar places such as marshes, wet meadows, beaver impoundments, swamps, fens, bogs, streams, ponds, and lakes. As noted above, they perform a variety of ecological functions and values that benefit humans. They also serve as significant habitats for wildlife and plants. In New Hampshire, wetlands are defined by RSA 482-A:2 as "an area that is inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and under normal conditions does support, a prevalence of vegetation typically adapted for life in saturated soils conditions." They are further defined by three particular elements, including hydrophytic vegetation, hydric soils, and wetlands hydrology. As such, wetlands are regulated by the NH Dept. of Environmental Services Wetlands Bureau as defined in RSA 482-A:2. They are also regulated at the federal level by the US Army Corps of Engineers.

To better understand the distribution of wetlands and the functional roles that they perform in Swanzey a town-wide wetlands comparative evaluation was conducted using the Method for Inventorying and Evaluating Freshwater Wetlands in New Hampshire (Stone and Mitchell 2015), also referred to as the "NH Method." The general approach of this method is to evaluate wetlands on the basis of their *functional value*, that is, the

ecological function and societal value that they hold for human society in improving and maintaining quality of life. The complete document can be found at nhmethod.org

The overall purpose of this evaluation is to provide a better sense of both the location and the characteristics of the wetlands within Swanzey. The fact that a *comparative* method was employed suggests that the reader has great latitude in placing a higher or lower value on a particular wetland under scrutiny. As is described below, the intention is to allow for a comparison of wetland *functions*, and not an overall value that a wetland received as a whole. This report serves to engender an understanding of the reasons *why* a particular wetland can serve a particular function better than others, as well as what it uniquely contributes to a given area of the town.

The NH Method arose out of an increasing need to adequately understand and evaluate wetland resources in the state of New Hampshire. Adopted from the Method for Evaluation of Inland Wetlands in Connecticut developed by Al Levere and Alan Ammann, it was initiated and supported by the Wetlands Studies Project of the Audubon Society of New Hampshire under the guidance of Amanda Lindley Stone. A tremendous amount of research and field testing went into both the parent edition in Connecticut, as well as the current methodology used in the 2015 NH Method.

The fundamental tenet of this methodology is that it identifies various functions of wetlands and assigns a value to those functions. For the purpose of this work, a "function" is defined as what the wetland does (e.g., provides floodwater storage, improves water quality) and a "value" is the evaluation of how important a particular function is.

The NH Method is a rapid assessment that asks a set of questions that are answered using field assessments and remote spatial data (e.g., aerial photography) in a geographic information system (GIS). The accuracy of the assessment is dependent on the theoretical knowledge of the observer regarding the abiotic and biotic factors that influence the "field indicators" observed.

A major effort put forth as part of the wetland evaluation project was to revise the wetlands data layer to better reflect the true extent of Swanzey's wetlands. This revised data was achieved using 2021 aerial photography interpretation (API) in combination with the National Wetlands Inventory (NWI) Plus, USDA hydric soils datasets, and LiDAR imagery. Discernible wetlands were mapped as entire systems. No attempt was made to adjust boundaries between the existing Cowardin (1979) system of wetland classification used by the NWI.

As part of this mapping process wetlands were field-checked to the extent possible using a combination of roadside surveys and limited on-site assessments of selected properties with landowner permission. Mapping data is used for planning purposes only, and wetlands do not reflect jurisdictional wetland boundaries. Users agree with Moosewood Ecological LLC's GIS data disclaimer (Appendix A).

In 2023, the Swanzey Conservation Commission initiated the wetland evaluation project with the assistance of Moosewood Ecological LLC. This project represents one of several measures the Conservation Commission has solicitated expertise to better understand Swanzey's natural resources and how it relates to land use planning, including the protection of Swanzey's natural resources.

The following information provides a summary of the wetland comparative evaluations in respect to the highest ranked wetlands within each of the eight ecological functions in the NH Method. These functions represent the significant ecological services wetlands perform that maintain healthy ecosystems, wildlife habitats, water quality, and drinking water sources, as well as storing floodwaters and reducing downstream flooding. These ecological functions include:

- Ecological Integrity
- Wetland-dependent Wildlife Habitat
- Fish and Aquatic Life Habitat
- Flood Storage
- Groundwater Recharge
- Sediment Trapping
- Nutrient Trapping/Retention/Transformation
- Shoreline Anchoring

The results of these highest ranked wetlands are then cross-referenced with four additional wetland functions in the NH Method. Scenic Quality, Educational Potential, and Wetlands-based Recreation represent societal values, while Noteworthiness examines other important wetland factors such as critical habitats, rare biological/geological features, and landscape-level conservation planning efforts.

RESULTS AND DISCUSSION

Wetlands Overview

A total of 374 wetlands representing palustrine and lacustrine ecosystems were mapped throughout Swanzey (Figure 1) They cover approximately 2,824 acres, average 7.6 acres, and range in size from <0.01 acre to 371 acres. Palustrine wetlands are characterized by the presence of trees, shrubs, and emergent vegetation such as grasses, sedges, rushes, and wildflowers. They range from permanently saturated to flooded areas such as marshes, swamps, peatlands, beaver ponds and lakes shores to areas that's are

only seasonally ponded such as vernal pools. Lacustrine wetlands include deepwater habitats such as Swanzey Lake and Wilson Pond.

All wetlands two acres and larger were chosen for the comparative evaluation, resulting in a total of 117 wetlands covering 2,564 acres for the comprehensive comparative evaluation in Swanzey (Figure 2). The average size of these wetlands was 21.9 acres. Below is a summary of the wetlands that scored in the top 10% for wetland functional values. Appendix B provides a table that cross references these highest ranked wetlands with the 12 functional values used for this comparative evaluation.

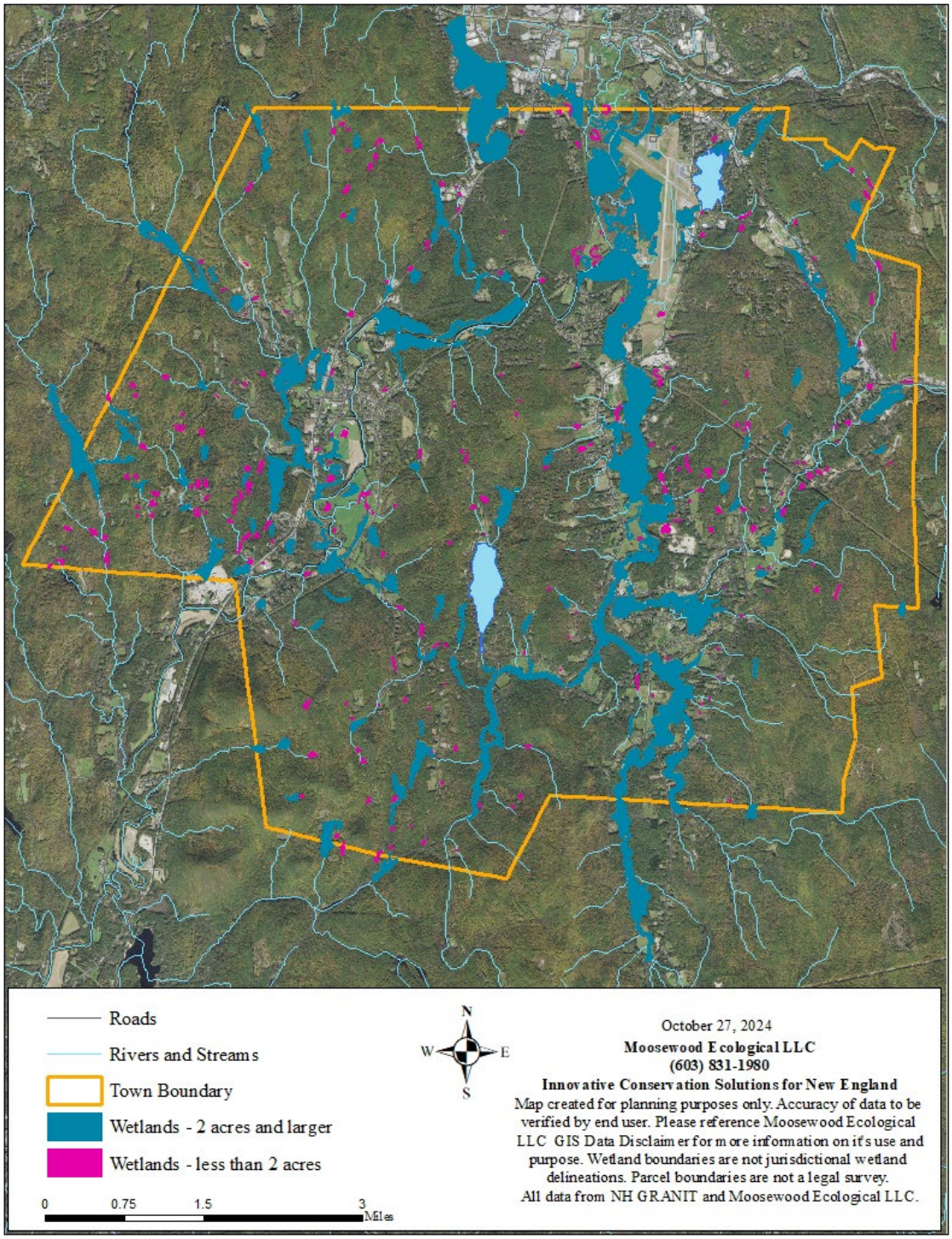


Figure 1. Distribution of wetlands in Swanzey, NH. This map provides an overview of wetlands in two size classes (greater than two acres and less than two acres). In addition, rivers and streams provide a sense of how these wetlands can provide aquatic connectivity.

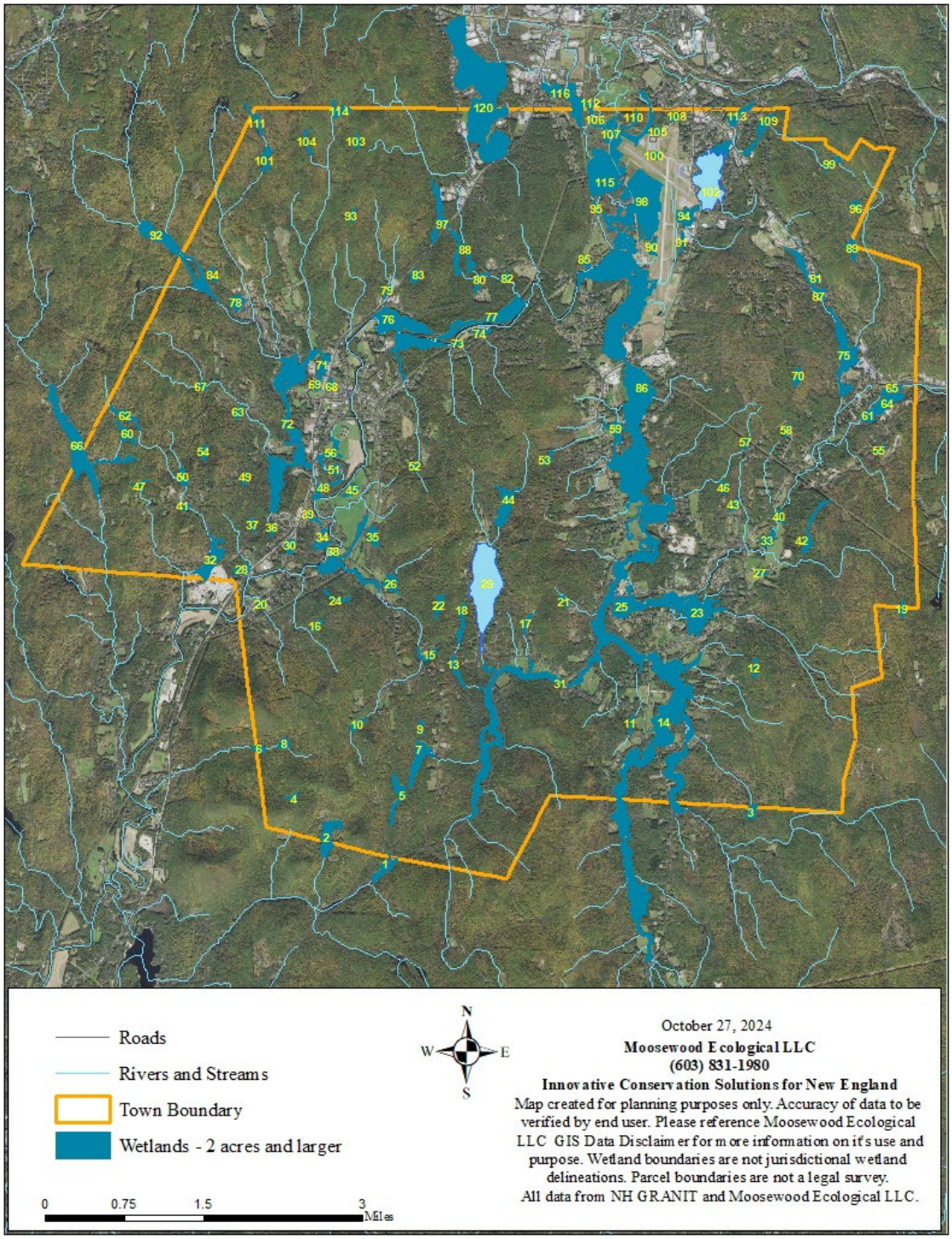


Figure 2. Distribution of wetlands two acres and larger in Swanzey, NH. This map provides an overview of the 117 wetlands that were evaluated for this project and their corresponding identification code.

Wildlife Habitats and Ecological Integrity

There are three functional values that help us better understand which wetlands scored highest for providing the best ecological integrity and wildlife habitats. These functional values include Ecological Integrity, Wetland-dependent Wildlife Habitat, and Fish and Aquatic Life Habitat.

Ecological Integrity is an overall view of the health or condition of a wetland. It seeks to better understand which wetlands demonstrate healthy signs of an unstressed ecosystem as it relates to unimpaired structure and function of wetlands by human activities; native plant diversity and presence on invasive, non-native plants; and properly functioning ecological processes. More specifically, this function addresses the following aspects:

- Land use within the wetland's watershed
- Evidence of the wetland being filled by humans
- Impacts of agriculture and logging, as well as other human activities such as trails, roads, and garbage within wetlands
- Presence of invasive plants
- Level of roadways within and adjacent to wetlands
- Level of human activity within 500 feet of wetlands
- Percent of impervious surfaces within 500 feet of wetlands
- Presence of human-made structures (such as dams and culverts) that regulate flow of water within wetlands

Wetlands provide habitat for a variety of terrestrial, aquatic, and semi-aquatic wildlife. An evaluation of the Wetland-dependent Wildlife Habitat and Fish and Aquatic Life Habitat helps us to understand which wetlands in Swanzey perform the best for these functional values. Wetland-dependent species are wildlife that typically use both upland and wetland habitats for their life cycles. These include a diverse assemblage of species such as moose, otter, mink, snakes, turtles, frogs, salamanders, waterfowl, eagle, osprey, and herons. Typical aquatic wildlife includes fish, mussels, clams, crayfish, and aquatic macroinvertebrates.

Numerous topics are addressed that account for the wildlife habitat functionality of wetlands as, including:

- Size of wetland and overall ecological integrity
- Water quality degradation due to land use within the wetland's watershed

- Type and size of open water habitats
- Number of different vegetated wetland habitats
- Proximity to other wetlands
- Access of travel corridors for wildlife
- Presence of invasive plants
- Level of disturbance within 500 feet of the wetland
- Stream width within a wetland
- Level of alteration of the stream channel within a wetland
- Diversity of substrates within the stream channel
- Presence of large trees and boulders
- Presence of floating and submerged vegetation
- Presence of human-made structures that restrict movement of aquatic organisms
- Presence of species of conservation concern

Summary

The following wetlands scored high for their respective ecological function due to their proximity to various types of developments whereby having relatively low human-related stressors.

- The top **10% for Ecological Integrity** includes 20 wetlands that scored an average of 9.0-10 out of a possible score of 10 (Figure 3).
- The top **10% for Wetland-dependent Wildlife Habitat** includes 12 wetlands that scored an average of 6.3-7.7 out of a possible score of 10 (Figure 4).
- The top **10% for Fish and Aquatic Life Habitat** includes 14 wetlands that scored an average of 5.4-8.6 out of a possible score of 10 (Figure 5).

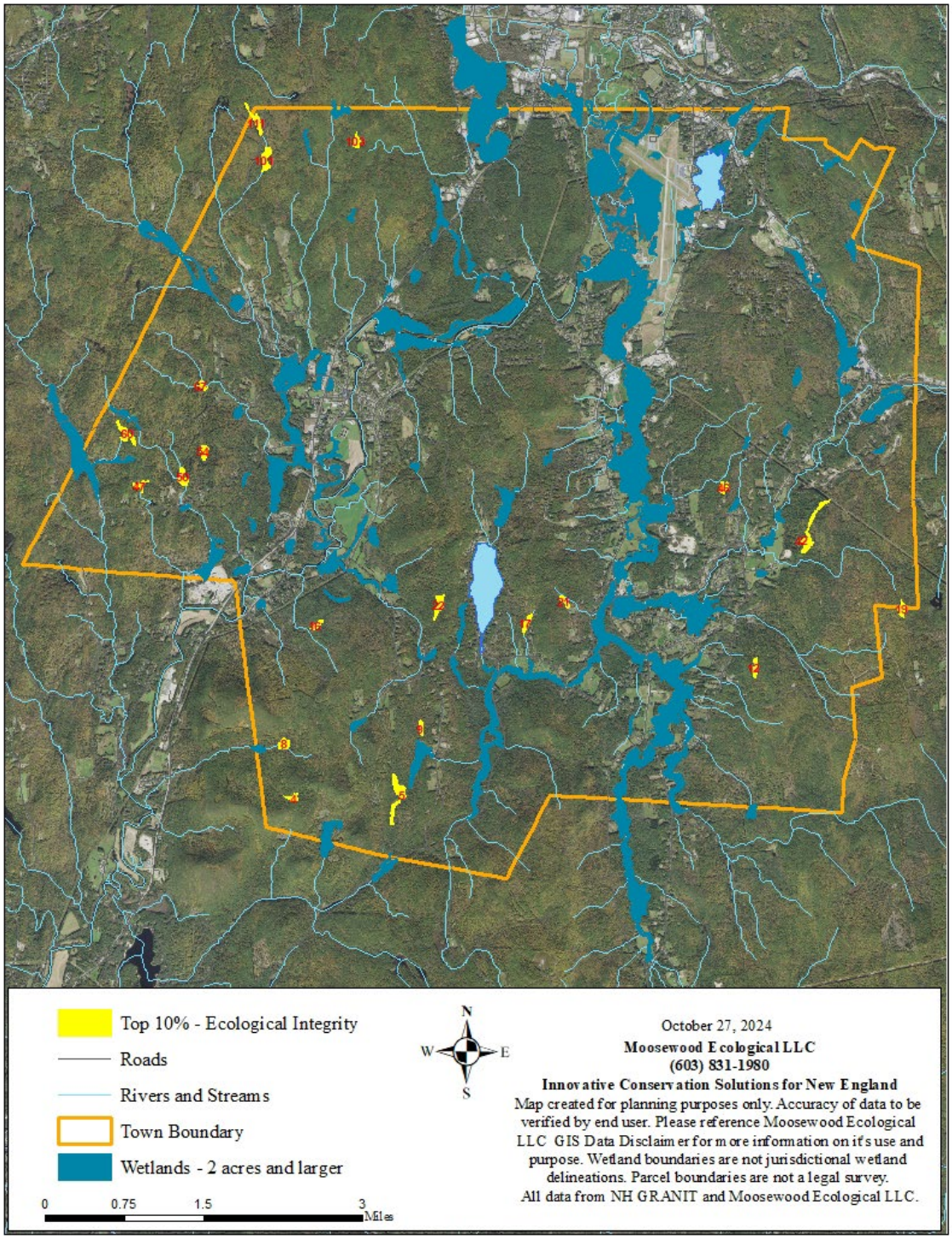


Figure 3. Location and distribution of the top 10% ranking wetlands for Ecological Integrity.

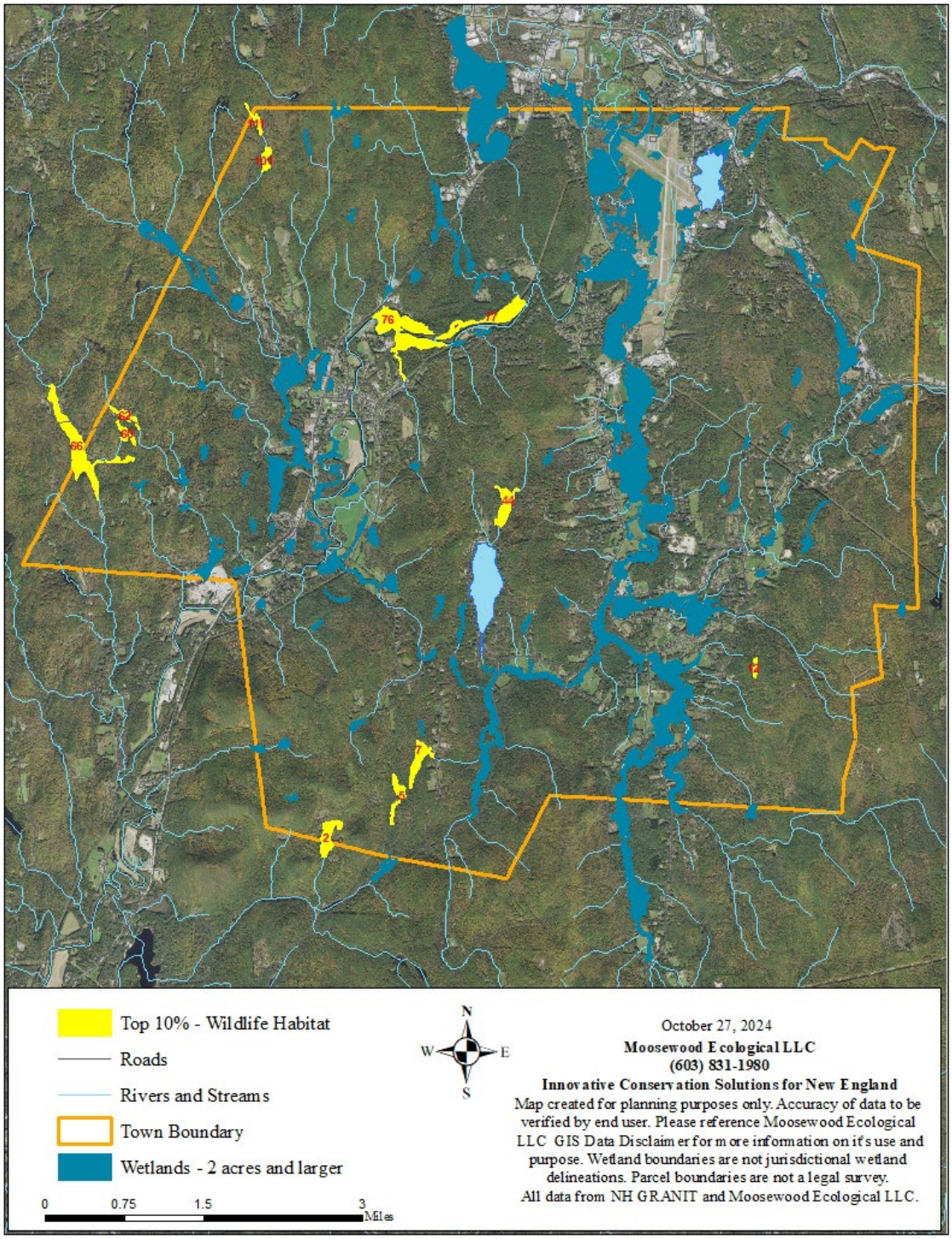


Figure 4. Location and distribution of the top 10% ranking wetlands for Wetland-dependent Wildlife Habitat.

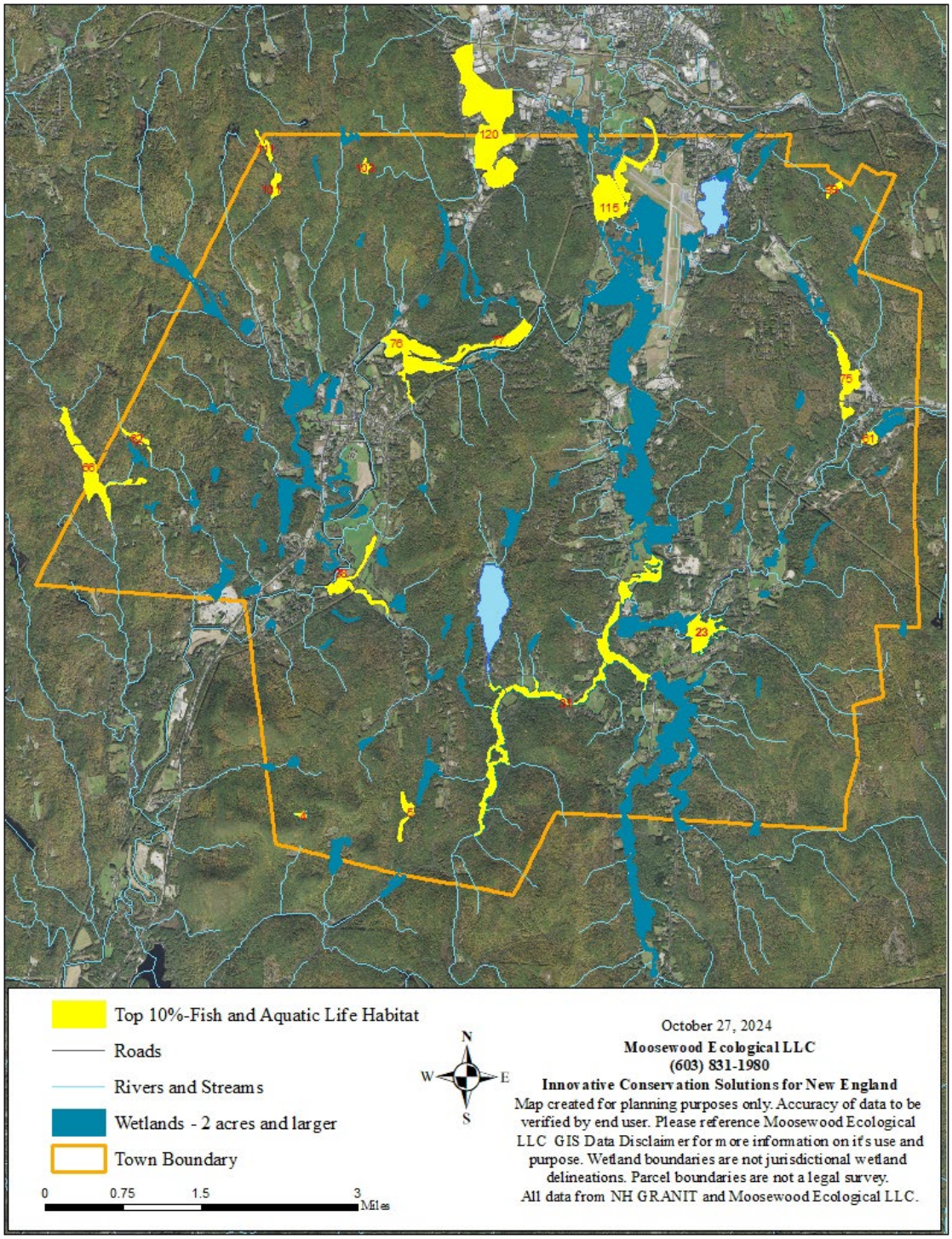


Figure 5. Location and distribution of the top 10% ranking wetlands for Fish and Aquatic Life Habitat.

Flood Storage

Wetlands naturally help with storing floodwaters during heavy rainfall and melting snow during late winter and spring. During these events wetlands temporarily retain water in depressions. In addition, various types of vegetation (i.e., shrubs, trees, grasses, and wildflowers) within and adjacent to wetlands help slowly release floodwaters, regulating flooding downstream. Various land uses can affect the ability of wetlands to store floodwaters. These include the increase of impervious surfaces such as roads, parking lots, and buildings that prevent the natural infiltration of rain and snow into the ground and potential aquifers. Loss of forested habitat and floodplain wetlands can also negatively impact the flood storage capabilities of wetlands. These elements are critical as our rain events have changed over the past several decades, resulting in more intense storms and rainfall. Therefore, our wetlands and intact uplands forests are vital to help retain floodwaters during such heavy rain events.

The intent of evaluating this function was to better understand wetlands that have relatively high value to attenuate floodwaters. A variety of features were used for this evaluation, including wetland size, watershed size, location of the wetland within a watershed, and estimating the flood storage volume. Since all wetlands were not visited, we assigned a standard water storage depth of 1 foot, as recommended by the NH Method.

The resulting potential flood storage index provides an approximate value on a wetland's ability to store floodwaters. There are 15 wetlands that ranked in the top 10% in Swanzey (Figure 6), receiving an average of 5.0-9.0 out of a possible 10 points. These 15 wetlands have moderate to high floodwater storage value.

- Moderate to high floodwater storage value
    - Wetlands: 2, 14, 30, 34, 64, 70, 77, 86, 97, 102, 107, 113, and 120
- High floodwater storage value
    - Wetlands: 29 and 98

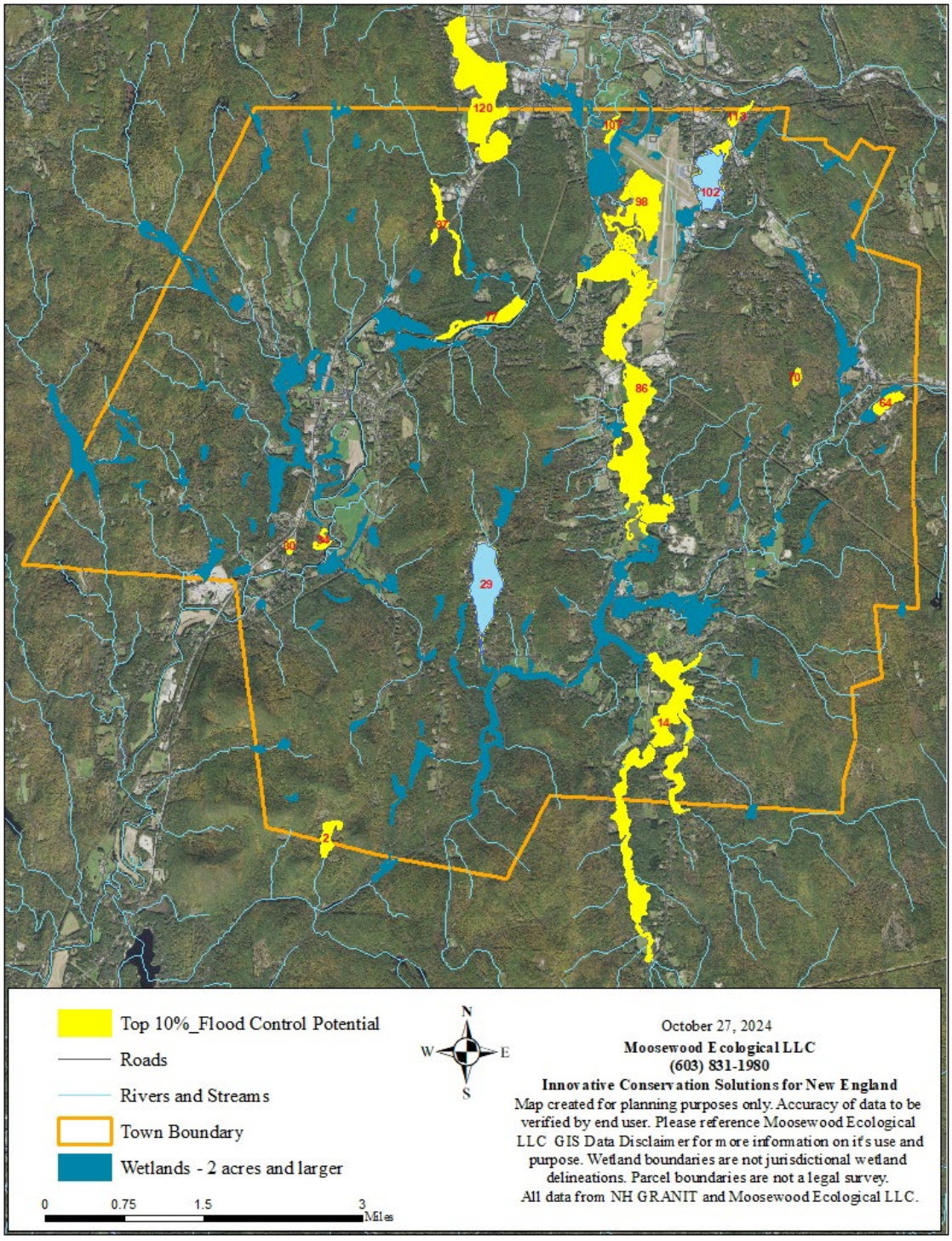


Figure 6. Location and distribution of the top 10% ranking wetlands for Floodwater Storage Potential.

Water Quality

Wetlands have a tremendous ability of helping to maintain good water quality by controlling sediments, nutrients, and other toxic materials in surface waterbodies and other wetlands. These elements can be very harmful or fatal for a variety aquatic wildlife. It also has negative effects on aquatic-dependent species such as beaver, otter, mink, waterfowl, frogs, and salamanders, as well as humans.

Three critical ecological functions were included in this study to serve as a surrogate to better understand which wetlands in Swanzey help to maintain overall good water quality. These included Sediment Trapping; Nutrient Trapping, Retention, and Transformation; and Shoreline Anchoring.

Sediment Trapping is the process by which plants within wetlands and the adjacent upland forest prevent sediments from entering surface waters. This is important since toxicants, such as pesticides and petroleum products, adhere to sediments and enter our wetlands, lakes, and rivers. Wetland plants play a vital role in preventing these toxicants from entering into aquatic systems that we enjoy for swimming, boating, and fishing. This functional value addresses topics such as flood storage value, constriction of wetland outlet, percent of vegetation present, size ratio of the wetland to its watershed, character of the flow through the wetland, wetland gradient, and the average depth of water during the growing season.

Nutrient Trapping, Retention, and Transformation involves the retention, removal, and uptake of nutrients as they enter wetlands. This function is achieved by plants and soils that capture or transform excess nutrients such as phosphorus and nitrogen into less harmful agents that typically impact water quality and aquatic organisms, such as fish. Elements this functional value evaluates includes flood storage and sediment trapping values, percent of vegetation cover, soils types within the wetland, and the length of time of standing water or saturated soils.

Lastly, Shoreline Anchoring involves the stabilization of edges of ponds, lakes, and streams to prevent sediments from entering their associated wetlands and aquatic systems. Trees, shrubs, and herbaceous plants help to hold soil in place during heavy water flows associated with rainfall and snow melting events. This helps to stabilize banks, trap sediments, and attenuate nutrients.

Summary

The following wetlands scored high for their respective ecological function due to their proximity to various types of developments whereby having relatively low human-related stressors.

- The top **10% for Sediment Trapping** includes 13 wetlands that scored an average of 7.6-7.9 out of a possible score of 10 (Figure 7).
- The top **10% for Nutrient Attenuation** includes 12 wetlands that scored an average of 7.9-8.7 out of a possible score of 10 (Figure 8).
- The top **10% for Shoreline Anchoring** includes 12 wetlands that scored an average of 8.8-10.0 out of a possible score of 10 (Figure 9).

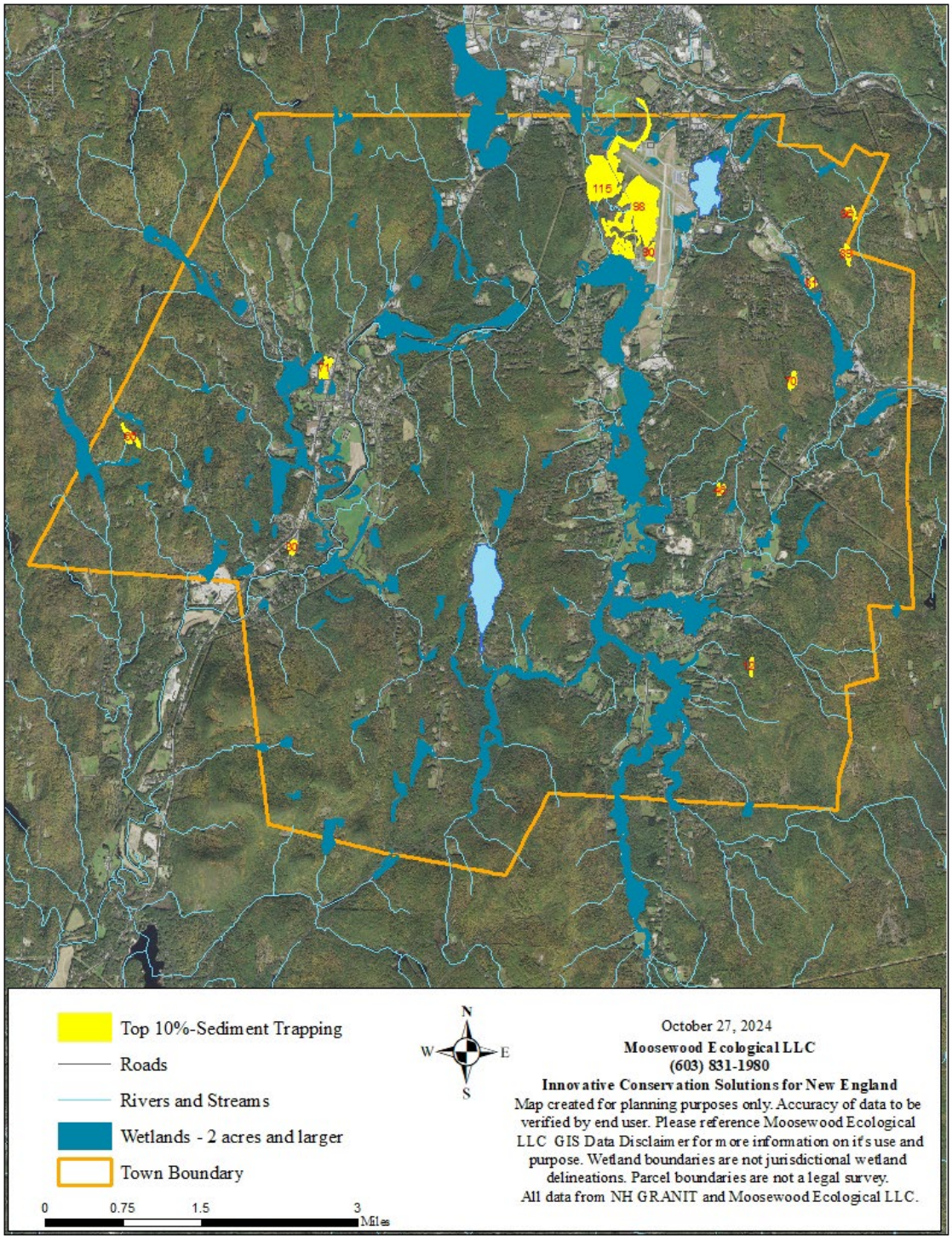


Figure 7. Location and distribution of the top 10% ranking wetlands for Sediment Trapping.

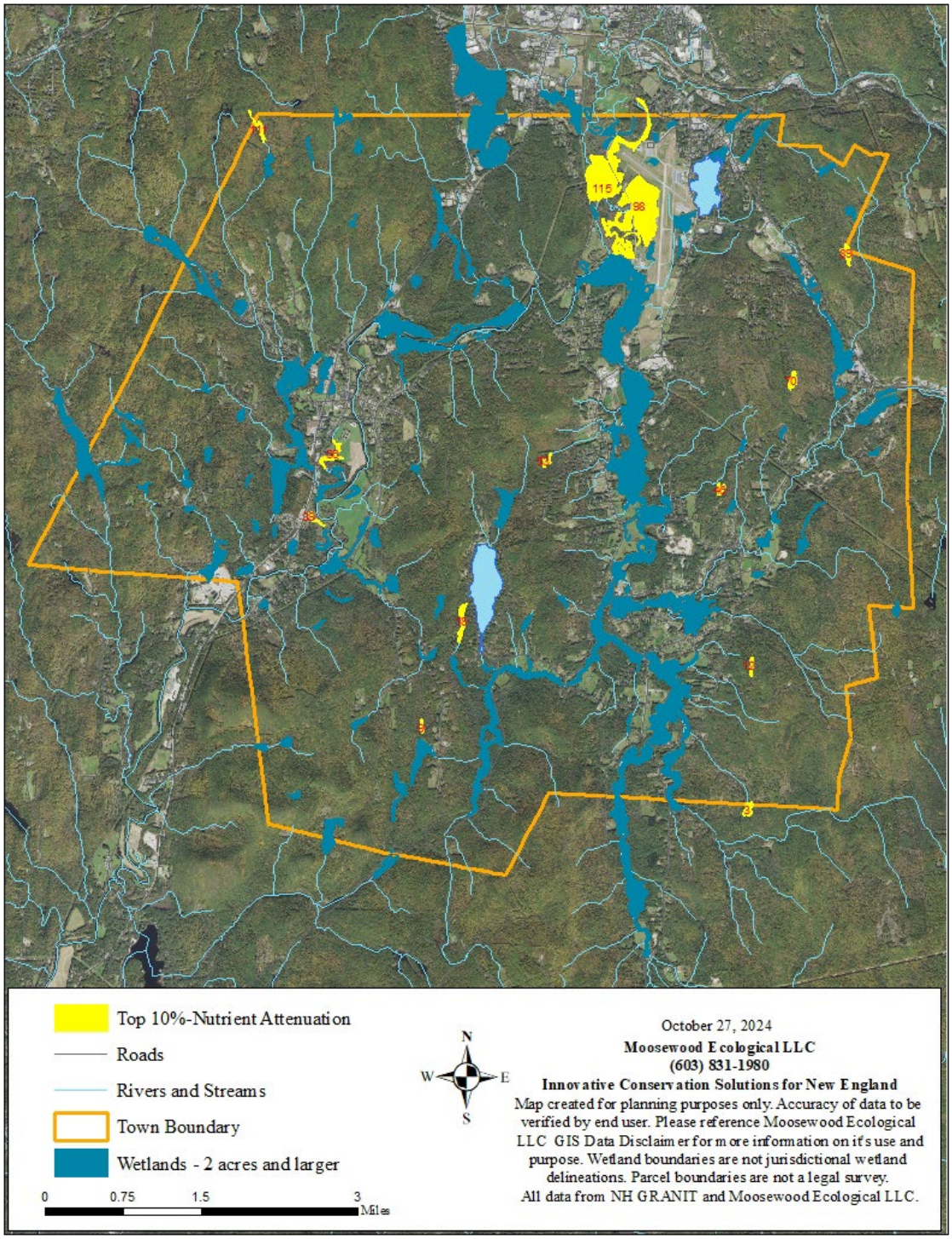


Figure 8. Location and distribution of the top 10% ranking wetlands for Nutrient Trapping, Retention, and Transformation.

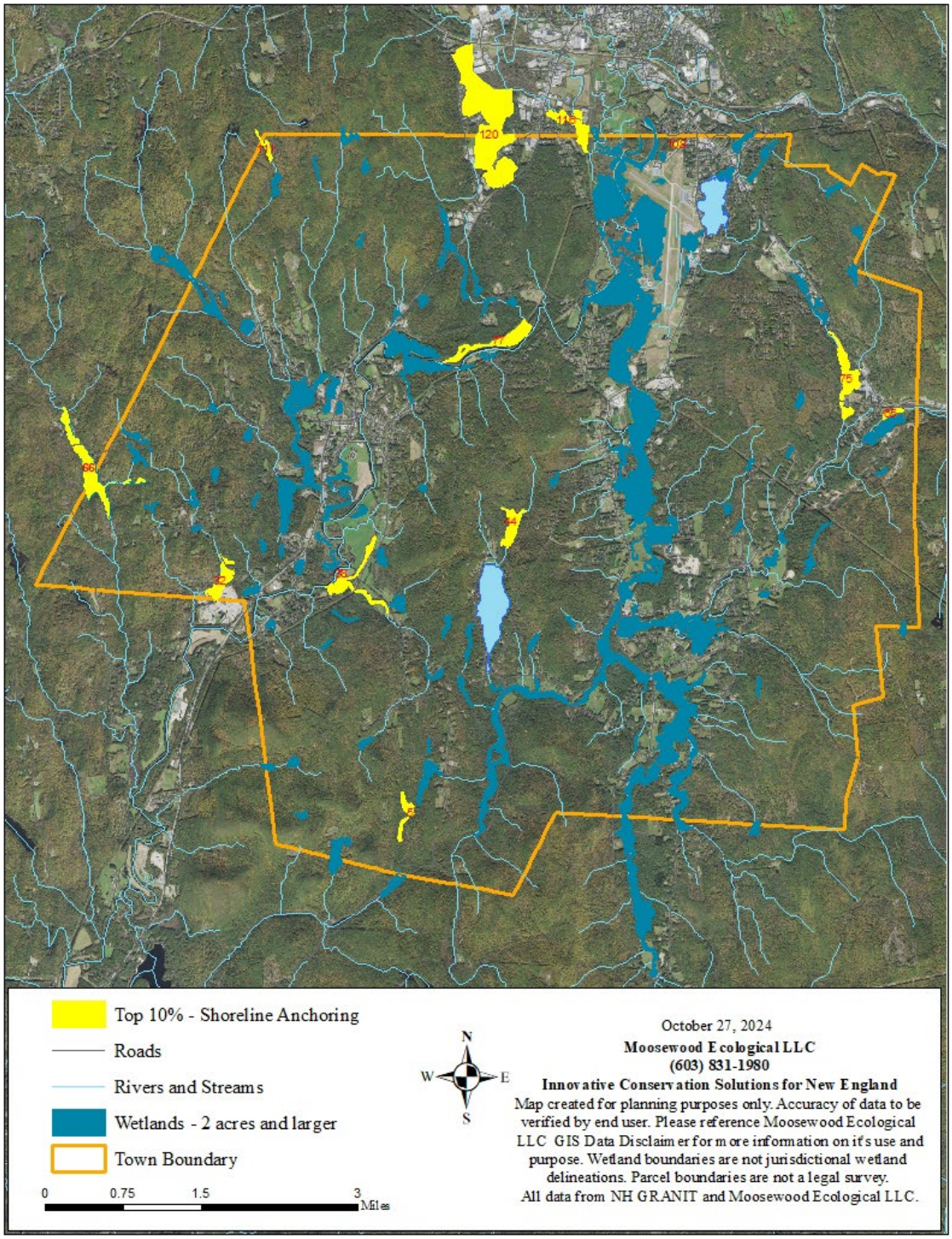


Figure 9. Location and distribution of the top 10% ranking wetlands for Shoreline Anchoring.

Groundwater Use Potential

Wetlands have an important ability to recharge groundwater resources. In certain circumstances they can provide a source to recharge drinking water supplies located within aquifers.

Groundwater resources are stored in two main types of aquifers and can serve as sources for drinking water. Aquifers can be located within saturated areas of sand and gravel deposits or in fractured bedrock. In the past as glaciers melted, they left behind layers of coarse sediments including sand and gravel. The space between these sediments provides opportunity for groundwater storage and flow. Groundwater stored in *stratified drift aquifers* of this kind can serve as an excellent source for drinking water. Locating and protecting these geologic features can help to ensure a supply of clean drinking water for the community as these areas are vulnerable to contamination.

Questions associated with the Groundwater Recharge function are related to how well a particular wetland can recharge groundwater resources since clean drinking water is vital to all wildlife and humans alike. Therefore, this function mainly relates to the wetlands in relation to Swanzey's stratified drift aquifers. These are located along the Ashuelot River and South Branch Ashuelot River in the northeastern part of town. Other attributes this function takes into account are the types of soils that are conducive to recharging these aquifers.

Figure 10 provides a summary of the groundwater recharge indices of wetlands throughout Swanzey. There are 12 wetlands that ranked in the top 10%, receiving an average of 5.4-8.2 out of a possible 10 points.

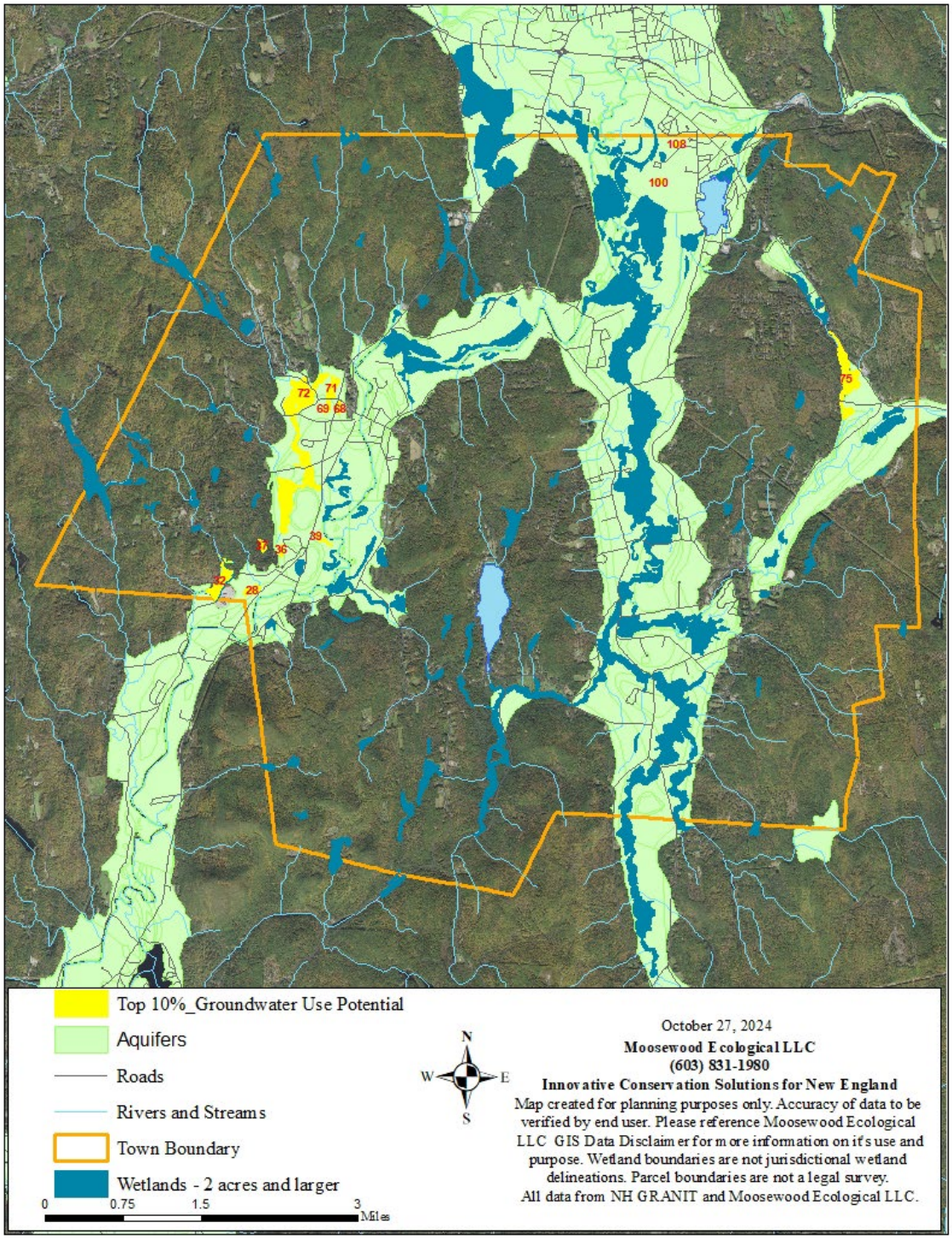


Figure 10. Location and distribution of the top 10% ranking wetlands for Groundwater Recharge.

Significant Wetlands

Figure 11 provides a composite map noting the location of the highest ranked wetlands in Swanzey. Collectively, these 68 wetlands include the top 10% ranked wetlands in each of the ecological functions outlined above. Appendix B provides a cross-walk between these wetlands and which ecological functions each scored within the top 10% throughout Swanzey. This affords the opportunity to better understand the number and types of ecological functions a wetland has significance.

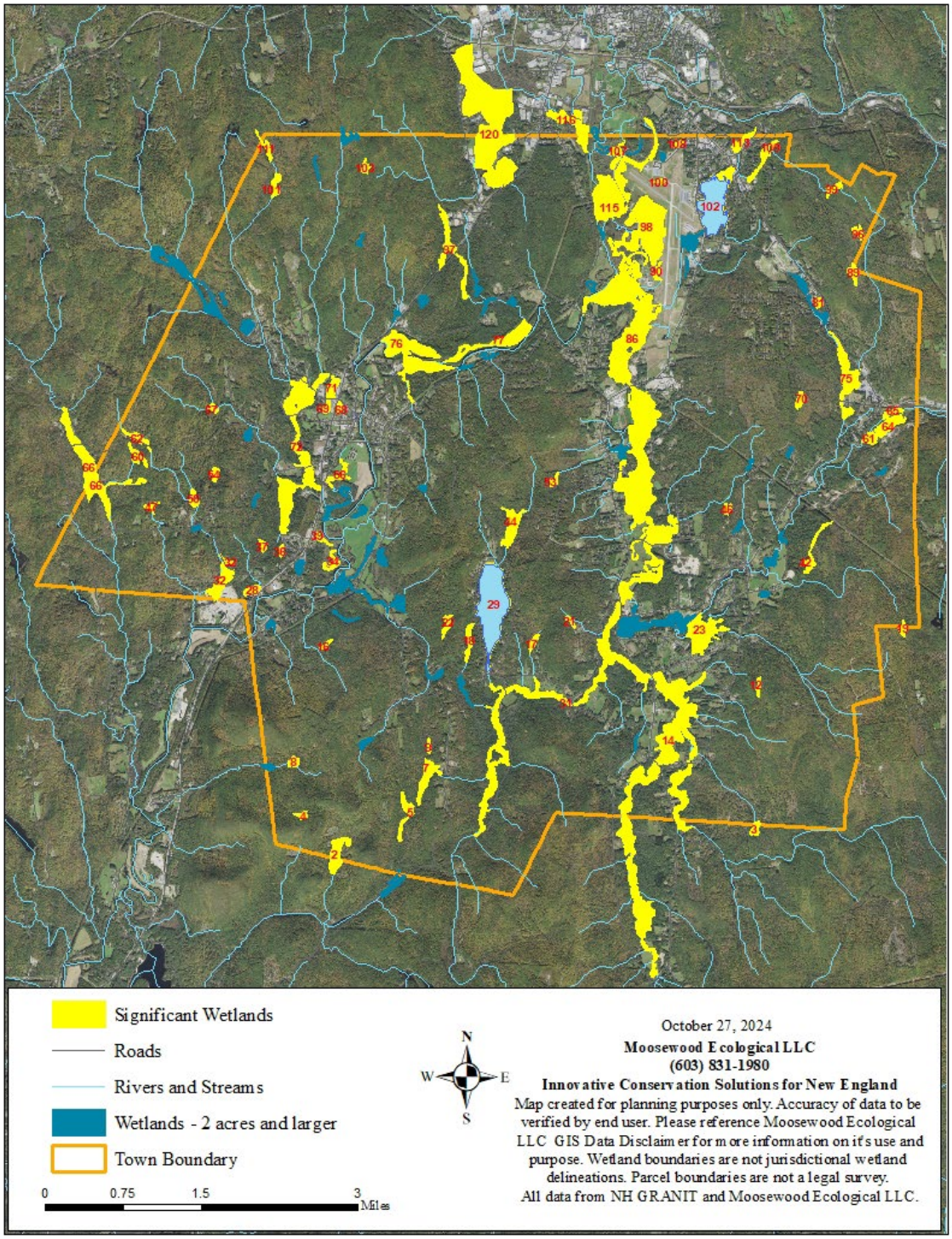


Figure 11. Location and distribution of Swanzey's significant wetlands ranking within the top 10% of the eight ecological functions described in this summary.

Scenic Quality, Educational Potential, and Water-based Recreation

The comparative evaluation also includes three wetland functions that relate to societal values. Scenic Quality refers to the visual quality and aesthetics of a wetland, while Educational Potential evaluates the suitability of a wetland for education and research. Water-based Recreation evaluates the suitability of a wetland to provide non-powered boating, fishing, hunting, and related recreational activities.

These societal values can be viewed alone, noting the top 10% throughout the Town, or they can be cross-referenced with the top 10% ranked for ecological functions. For example, Appendix B demonstrates the top 10% in each of these three values and their relation to the top 10% overall ranked for the eight ecological functions noted above.

Noteworthiness

This part of the wetland comparative evaluation affords the opportunity to examine a variety of other attributes that are important beyond the ecological functions and societal values outlined above. Noteworthiness informs us about how a particular wetland fits into the larger landscape of conservation planning and local/regional significance. Topics addressed include local significance due to high scores for each functional value, proximity of wetlands within conservation plans such as the NH Wildlife Action Plan and the Ashuelot Watershed Conservation Plan, as well as biological/geological significance, connection to state-designated rivers, and wetlands located within an urban setting. These attributes are not addressed elsewhere in the evaluation method and further highlights the significance of certain wetlands, particularly those ranked with the top 10% in Swanzey (Table 1).

Table 1. Noteworthiness categories for the top 10% ranked wetlands in Swanzey.

Wetland Name	Within 500' of Highest Ranked Habitat in NH	Local Significance for High Scores or Large Size	Identified in Local, Regional or Statewide Conservation Plan	Rare/Unique Biological or Geological Features	Connected to a State Designated River	Wetland in an Urban Setting
2	X	X				
3		X				
4	X	X				
5	X	X				
7	X	X				
8	X	X				
9		X				
12		X				
14	X	X		X	X	
16		X				
17		X				
18		X				
19	X	X				
21		X				
22	X	X				
23	X	X	X	X	X	
28	X	X	X		X	
29		X	X	X		
30		X				X
31	X	X	X	X		
32	X	X				
34	X	X	X		X	
36		X				
37		X				
38	X	X	X		X	
39	X	X	X			
42		X				
44		X				
46		X				
47	X	X				
50	X	X				
53		X				
54	X	X				
56	X	X	X		X	
60	X	X				
61	X	X	X		X	
62	X	X				
64	X	X	X			
65	X	X	X			
66	X	X				
67	X	X				
68		X			X	
69		X				
70		X				
71	X	X			X	
72	X	X			X	
75	X	X				

Wetland Name	Within 500' of Highest Ranked Habitat in NH	Local Significance for High Scores or Large Size	Identified in Local, Regional or Statewide Conservation Plan	Rare/Unique Biological or Geological Features	Connected to a State Designated River	Wetland in an Urban Setting
76	X	X	X	X	X	
77	X	X	X		X	
81		X				
86	X	X	X	X	X	
89	X	X			X	
90	X	X	X			
96	X	X		X		
97	X	X	X			
98	X	X	X	X	X	X
100	X	X		X		X
101	X	X	X			
102	X	X				X
103	X	X	X			
107	X	X	X	X	X	
108	X	X				X
111	X	X	X	X		
113		X				
115	X	X	X	X	X	
116	X	X	X		X	
118		X				X
120	X	X	X	X		

Conclusions

This report provides a brief summary of the comparative wetland evaluations conducted in Swanzey, illustrating the top 10% ranked wetlands for each of the eight ecological functions and cross-referenced with the three societal values and noteworthy function. This approach provides one lens to identify the community's most significant wetlands across all wetland functional values. Another approach would be to review these high-scoring wetlands in light of the number of categories in which they scored the top 10% using the table in Appendix B.

APPENDIX A

GIS DATA DISCLAIMER

Moosewood Ecological LLC GIS Data Disclaimer

A variety of existing and newly created data layers were used to prepare the wetland maps. These existing data have been developed by numerous government agencies and other sources. They have been produced specifically for the town, the state of New Hampshire, or the entire United States using *remote data*. These sources of remote data were developed from the interpretation of satellite imagery and aerial photography. The data were produced at various scales and therefore, represent different degrees of errors, omissions, and inaccuracies. Moosewood Ecological LLC developed the wetlands data from aerial photography interpretation.

The maps are for education and planning purposes only. They are suitable for general land use planning. However, they are not suitable for detailed site planning and design, including wetlands delineations and other jurisdictional determinations. As such, boundaries of wetlands are approximate locations and should be field verified. The accuracy of the data is the end user's responsibility, and Moosewood Ecological LLC cannot be responsible for the accuracy and completeness of the data. Moosewood Ecological LLC makes no warranty, expressed or implied, as to the accuracy or completeness of the data. Furthermore, Moosewood Ecological LLC shall assume no responsibility for any errors, omissions, or inaccuracies in the information provided.

APPENDIX B

TOP 10% WETLANDS

AND

THEIR ASSOCIATED WETLAND FUNCTIONAL VALUES

Wetland Code	Ecological Integrity	Wildlife Habitat	Fish/Aquatic Habitat	Scenic Quality	Educational Potential	Wetland-based Recreation	Floodwater Storage	Groundwater	Sediment Trapping	Nutrient Transformation	Shoreline Anchoring	Noteworthiness
2		X					X					X
3										X		X
4	X											X
5	X	X	X	X							X	X
7		X										X
8	X											X
9	X									X		X
12	X	X							X	X		X
14			X	X			X					X
16	X											X
17	X											X
18										X		X
19	X											X
21	X											X
22	X											X
23			X									X
28								X				X
29					X	X	X					X
30							X		X			X
31			X									X
32								X			X	X
34							X					X
36								X				X
37								X				X
38			X	X							X	X
39								X				X
42	X											X
44		X		X		X					X	X
46	X								X	X		X
47	X											X
50	X											X
53										X		X
54	X											X
56										X		X
60	X	X							X			X
61			X									X
62		X	X	X	X							X
64				X			X					X

Wetland Code	Ecological Integrity	Wildlife Habitat	Fish/Aquatic Habitat	Scenic Quality	Educational Potential	Wetland-based Recreation	Floodwater Storage	Groundwater	Sediment Trapping	Nutrient Transformation	Shoreline Anchoring	Noteworthiness
65											X	X
66		X	X	X	X	X					X	X
67	X											X
68								X				X
69								X				X
70							X		X	X		X
71								X	X			X
72								X				X
75			X					X			X	X
76		X	X	X	X	X						X
77		X	X		X	X					X	X
81									X			X
86							X					X
89									X	X		X
90									X			X
96									X			X
97							X					X
98				X	X	X	X		X	X		X
100								X				X
101	X	X		X	X	X						X
102				X	X	X	X					X
103	X											X
107						X	X					X
108					X			X			X	X
111	X	X	X	X	X	X				X	X	X
113							X					X
115			X	X	X	X			X	X		X
116											X	X
118									X			X
120			X				X				X	X