State of New Hampshire

Inter-Department Communication

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At (Office): Environmental Services
Watershed Management

Subject: New Level 1- Landscape Level Wetlands Assessment Scores on the Wetland Complexes for the 2012 305(b)

To: Gregg Comstock, Supervisor, Water Quality Planning Section

INTRODUCTION

In an earlier effort for the 2008 305(b) Report, the DES Watershed Management Bureau created wetland complexes from the National Wetlands Inventory (NWI) to serve as assessment units (AUs). The method for complex creation of AUs was based on methods used by the New Hampshire Fish and Game Department in the Wildlife Action Plan (2005) wherein wetlands within 250m of one another that were not separated by a roadway were treated as one large wetland complex.

In the summer/fall of 2008 the DES Watershed Management Bureau completed a Level 1 Landscape Assessment of the state's wetland resources. The Level 1 assessment was conducted on the 2008 AUs using a GIS model to make preliminary determinations as to what wetlands were likely to potentially support and not support aquatic life. The assessments were based on the runoff Event Mean Concentration Values by land cover type in the 2006 National Land Cover Dataset (NLCD) for the 500 foot buffer around each wetland complex. (http://des.nh.gov/organization/divisions/water/wmb/swqa/2008/documents/appendix_36_l1_wet.pdf)

In support of DES's Aquatic Resource Mitigation Fund, Vanasse Hangen Brustlin (VHB) produced a GIS-based model to identify potential restoration sites using some of the questions from the "New Hampshire Method", as part of the 2009 "Merrimack River Watershed Wetland Restoration Strategy" (http://restorenhwetlands.com/documents.asp) . The VHB models were built, "In order to identify and prioritize potential wetland restoration sites in the Merrimack River Watershed…"

In 2010 the DES Watershed Management Bureau and Wetlands Bureau worked with University of New Hampshire (UNH) Cooperative Extension to construct wetland complexes from the individual NWI wetland polygons in accordance with the 2011 "The Method for Inventorying and Evaluating Freshwater Wetlands in New Hampshire" (i.e., the NH Method, see http://nhmethod.org/index.htm). These new complexes were given assessment unit IDs to replace those built in 2008. The new base layer was built to be the foundation of a comprehensive wetlands catalog for the state and to act as a starting point for anyone applying the NH Method. While the NH Method applies to freshwater wetlands, the wetland complex creation methodology was applied to both fresh and marine wetlands independent of one another. (http://www.granit.unh.edu/data/datacat/pages/nhwetlandsbase.pdf and ftp://ftp.granit.sr.unh.edu/pub/GRANIT_Data/Vector_Data/Inland_Water_Resources/d-wetland/d-nhwetlandsbase)

This memorandum documents a more thorough second version of the Landscape Level Wetlands Assessment (i.e., Level 1) that integrates some of the strategies developed by VHB in 2009 and the new assessment unit complexes built from the NWI based on the 2011 NH Method. By applying GIS modeling to 12 of the questions within the NH Method that best relate to the aquatic life designated use,

this multi-metric approach provides a more robust Level 1 assessment of the aquatic life designated use. As DES gains experience with this Level 1 assessment it's possible that further adjustments will be made to the scoring system.

Descriptions of the methods used to develop this Level 1 assessment, including pre-processing steps and the GIS process and scoring method for each of the NH Method questions selected for evaluation, are first presented. This is followed by results and discussion for each of the 12 evaluated questions including general observations, examples (presented in figures showing satellite imagery) covering a range of scores for each question, and tables, graphs and maps showing the distribution of scores for each question as well as the average score of all questions for each assessment unit.

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METHODS

Pre-Processing

The Assessment Unit complexes built from the NWI in accordance with the 2011 "The Method for Inventorying and Evaluating Freshwater Wetlands in New Hampshire" (i.e., the NH Method http://nhmethod.org/index.htm) were the base of all further processing. It was discovered during the pre-processing steps (described below) that there were 28 complexes with error. Before moving forward, those 28 errors were corrected.

The following pre-processing steps created preliminary products for use in evaluating one or more of the selected NH Method questions.

- Dissolve wetland elements on the Assessment Unit ID (AUID) (i.e. Complexes).
- For each Complex calculate the Minimum Bounding Rectangle (MBR) and related statistics.
- For each complex generate buffer donuts (or rings) with widths of 500 feet.
- For each complex generate full polygon buffers with widths of 500 feet.
- Generate Watersheds to a distance of 500 feet from each complex (a.k.a. 500ft Watersheds) from flow direction grids created on the 10 M DEMs that were walled and breached with the 1:24,000 New Hampshire Hydrography Dataset (NHHD) flowlines and catchments.
    - Secondarily delete the respective complex for each 500 foot watershed to generate 500 foot watershed "donuts" around each complex.
- Use Oracle queries to produce a list of all open water AUIDs that are dam controlled. Produce a layer of surface water AUIDs that are dam controlled.
    - Generate a 75 foot buffer on dam controlled AUIDs.
    - Intersect the 75 foot buffer with the NHHD to generate a layer of NHHD ComIDs related to the Dam Controlled AUIDs (intentionally picks up ComIDs immediate downstream of a dam).
- Remap the 2010 census data to the 1:24,000 catchments built on the NHHD by the NH Geological Survey.
- Hydrography Crossing types.
    - The NHHD with Strahler stream order was intersected with the DOT roads layer.
    - The NHHD with Strahler stream order was intersected with the railroad layer.
    - The DOT bridge layer was intersected with the NHHD. The resulting layer was used to predict the crossing type (bridge or culvert) for all of the railroad crossing locations based on stream order.

- Generate a table of all of the NWI codes for New Hampshire with related internal Cowardin 'Water Modifier' code as a secondary attribute for simpler queries.

NH Method Questions Selected for Evaluation

With regards to the aquatic life designated use, New Hampshire surface water quality regulations (Env-Wq 1703.19) require all surface waters (including wetlands) to support and maintain the integrity of the biological and aquatic community:

> *Env-Wq 1703.19 Biological and Aquatic Community Integrity.*
>
> *(a) The surface waters shall support and maintain a balanced, integrated, and adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of similar natural habitats of a region.*
>
> *(b) Differences from naturally occurring conditions shall be limited to non-detrimental differences in community structure and function.*

With this in mind, 12 questions were selected from the NH Method that were considered best suited for Level 1 assessments of the aquatic life designated use (Table 1). To be selected, the answer to the question had to be; a) associated with the aquatic life designated use assessment (i.e., could it affect the biological and aquatic community integrity of the wetlands), b) unlikely to score one wetland higher then another based on the type of wetlands rather than considering whether an individual complex is providing the healthiest condition possible for that type of complex, c) calculable from readily available existing or generated GIS data layers, and d) readily generated in a reasonable timeframe for the 52,426 wetland complexes. The final score for each question was set in the range of zero to one where zero (0) represents the most impacted condition and one (1) represents the least impacted condition. The number of each question shown in Table 1 coincides with question number presented in the NH Method.

Table 1: Questions Selected from the NH Method for Use in the Level 1 Assessment of Aquatic Life Use Support

NH Method Category	Selected Questions
ECOLOGICAL INTEGRITY	1. Has water quality in the wetland been degraded by land use in the wetland's watershed?
	2. Is there evidence of fill in the wetland?
	3. What percentage of the wetland has been altered by agricultural activities?
	4. What percentage of the wetland has been adversely impacted by logging activity within the last 10 years?
	7. How many times does a road, driveway, and/or railroad cross or border the wetland?
	8. How much human activity is taking place in the upland within 500 feet of the wetland edge?
	9. How many buildings are there within 500 feet of the wetland edge? Acres of Wetland / # of buildings?
	10. Is there a human-made structure that regulates the flow of water in

NH Method Category	Selected Questions
	the wetland?
WETLAND-DEPENDENT WILDLIFE HABITAT	8. Are there wildlife travel corridors allowing access to other wetlands?
	9. What percentage of the wetland edge is bordered by undisturbed woodland or idle land (e.g. shrub land or abandoned fields) at least 500 feet in width?
FISH AND AQUATIC HABITAT	1. What is the dominant land use in the watershed above wetland?
	10. Are there barriers to the passage of aquatic life? (e.g. dams, elevated culverts, bridge with a width less than the natural stream channel, road crossings, etc. along the stream reach associated with the wetland).

For each question, information regarding the NH Method scoring system, the GIS process and GIS scoring system used to evaluate each question for the Level 1 Assessment are provided in Table 2 through Table 4 below. ArcGIS 10 was used for all GIS analyses.

Table 2 – ECOLOGICAL INTEGRITY

NH Method Question	***NH Method Question Scoring***		***GIS Process***	***GIS Scoring***
(1) 1. Has water quality in the wetland been degraded by land use in the wetland's watershed?	a. No unnatural sediment or nutrient sources in the subwatershed	10	The Level 1 scoring methodology developed in 2008 (http://des.nh.gov/organization/divisions/water/wmb/swqa/2008/documents/appendix_36_11_wet.pdf) was applied to the 500 foot watershed for each wetland. Land use areas were calculated using the Geospatial Modeling Environment (GME) "isectpolyrst" tool to calculate the area of each 2006 NLCD land use within the 500 foot watershed of each wetland. Weighted scores were then calculated where: ▪ Class 24 - High intensity dev = 100 ▪ Class 23 - Medium intensity dev = 100 ▪ Class 22 - Low intensity dev = 100 ▪ Class 21 - Developed Open Space = 100 ▪ Class 71 - Grassland = 15.62 ▪ Class 81 - Hay = 15.62 ▪ Class 82 - Cultivated = 15.62 ▪ and all other land uses are scored as zero Two classes of wetland watersheds did not receive any scores. These included wetlands with watersheds that include portions of Canada and small wetlands which delineated entirely as internal drainages.	Final score was set as WQ Index Score: a. WQ Score < 0.01 → 1.0 b. WQ Score >= 0.01 → 0.5 c. WQ Score >= 0.10 → 0.1 Where no WQ Score was generated for a given wetland complex the Index was set to -9999 and was not used in the final averaging for that wetland.
	b. Some (1-2 sources) unnatural sediment or nutrient sources in the subwatershed	5		
	c. Many (more than 3 sources) unnatural nutrient sources in the subwatershed	1		
(1) 2. Is there evidence of fill in the wetland?	a. Less than 1 %	10	Percent of a wetland complex filled was estimated assuming that all permitted dredge and fill activities took place and involved fill. In reality, not all permitted fill	Final score was set as Fill Index Score: a. Percent Fill < 1% → 1.0
	b. From 1-3 %	5		

NH Method Question	***NH Method Question Scoring***		***GIS Process***	***GIS Scoring***
	c. More than 3 %	1	activities are implemented, some activities only involve dredging, some activities exceed the area permitted, and some areas are filled without permits. 1) Generate a near table to relate all wetland complexes with all wetland permits that permitted a quantity of fill in or within 25 feet of a wetland complex. 2) Query the permitted fill data from the wetland database by permit number. 3) Summarize the area permitted to be filled in/within 25' of a given wetland complex 4) Calculate percent of a complex permitted to be filled *Similar to the VHB method however VHB did not factor in the amount of permitted fill which means 25 sq ft of fill has the same score impact on a 0.5 acre as a 100 acre wetland.*	b. Percent Fill = 1% to 3% → 0.5 c. Percent Fill > 3% → 0.1
(1) 3. What percentage of the wetland has been altered by agricultural activities?	a. Less than 5 %	10	Two methodologies were modeled and averaged for each wetland complex recognizing that each method has its own limitations.	The final agriculture activities score was set as the average of Scores 1 & 2.
	b. From 5 to 25 %	5		

NH Method Question	***NH Method Question Scoring***		***GIS Process***	***GIS Scoring***
	c. More than 25 %	1	Score 1 – The first component of the scoring made use of the 2006 NLCD datasets 'Hay' and 'Cultivated' classes. This approach should capture areas that were wetland as of the imagery date of the NWI (~1980) but have since been put into agricultural use. 1) Tabulated the NLCD 2006 area within each complex 2) Calculated the percent agriculture from Class 81 (Hay) and Class 82 (Cultivated) 3) Percent Agricultural Area = (!VALUE_81!+ !VALUE_82!)/Total NLCD2006 Area Score 2 – The second component of the scoring made use of the NWI datasets 'special modifier' codes 'partially drained/ditched (d), 'farmed' (f), and 'excavated' (x). 1) From the NH wetland base map select "NWICODE" Like '%d' or "NWICODE" Like '%x' or "NWICODE" Like '%f' 2) Dissolve on AUID to identify all complexes with one or more modifier. 3) Calculate the sum of the d, f, x areas for each complex. 4) Calculate the percent of d, f, x areas in each complex.	Score 1 The final NLCD based score for Agriculture was set as: a. Percent Ag < 10% → 1.0 b. Percent Ag = 10% to 50% → 0.5 c. Percent Ag > 50% → 0.1 Score 2 The final NWI Special Modifier based score for Agriculture was set as: a. Percent dfx < 10% → 1.0 b. Percent dfx = 10% to 50% → 0.5 c. Percent dfx > 50% → 0.1
(1) 4. What percentage of the wetland has been adversely impacted by logging activity within the last 10 years?	a. Less than 1%	10	The best available source of spatial information of logging activities is the NHDES wetland permit database. This layer provides a point location somewhere within the area intended for logging. The analysis here assumes that logging activities equate to wetland impacts, which may not always be the case. 1) Query the wetlands permit layers for all logging activities for 2002-2012 as [("IMPACT_CAT" = '7' or "IMPACT_CAT" = '32') AND "YEAR" > 2001] 2) Intersect wetland permit layer with the wetland complexes (with a 500' buffer) to associate wetland permits within the last 10 years. 3) Count the number of forestry permits in/within 500' of a given wetland complex.	The final Logging based score was set as: a. Count Logging = 0 → 1.0 b. Count Logging = 1 → 0.5 c. Count Logging > 1 → 0.1
	b. From 1 to 10 %	5		
	c. More than 10 %	1		

NH Method Question	***NH Method Question Scoring***		***GIS Process***	***GIS Scoring***
(1) 7. How many times does a road, driveway, and/or railroad cross or border the wetland?	a. None	10	To estimate the number of road and/or railroad crossings the NHDOT roads and the railroad layers were used. No mechanism was developed to estimate the number of driveway crossings. Three separate scores were developed and then a weighted average calculated for each wetland complex. The three parts of the final score were to address, 1) the frequency of crossings, 2) the relationship between the crossing length and the maximum length of the wetland, and 3) the relationship between the crossing length and the wetland area. While the last two components are redundant for "round" wetlands, they consider those cases where a wetland is long and narrow. The frequency with which transportation routes 'bordered' a wetland complex was not addressed in the GIS modeling. As the overall goal here was to generate a set of questions to broadly represent the aquatic life designated use and there are other questions (principally E-01, E-08, & E-09) that addressed abutting land use, this question was constrained to direct impact of wetland crossings. 1) Roads and railroads were merged into a single layer. 2) The combined 'transportation' layer was intersected with the wetland complex layer. 3) The length of each transportation crossing within each complex was calculated. 4) The frequency of transportation crossings within each complex was calculated. 5) The complex minimum bounding rectangle length information was joined to the complex layer with lengths and frequencies. *VHB – calculated the number of crossings per 500' where the length is from the longest axis of the wetland. VHB C.1.9 Parameter 11 [EI-Q11]*	The final transportation score was set as the average of Scores 1(2x), 2, & 3. <u>Score 1</u> (Freq) The final frequency based score for transportation crossings was set as: a. Crossing Frequency < 1 → 1.0 b. Crossing Frequency = 1 → 0.5 c. Crossing Frequency >= 2 → 0.1 <u>Score 2</u> (CLen) The final crossing length to wetland length based score for transportation crossings was set as: a. Crossing length to wetland length < 0.1 → 1.0 b. Crossing length to wetland length 0.1 to < 0.5 → 0.5 a. Crossing length to wetland length >= 0.5 → 0.1 <u>Score 3</u> (CArea) The final crossing length to wetland area based score for transportation crossings was set as: a. Crossing length to wetland area < 0.1 → 1.0 b. Crossing length to wetland area 0.1 to < 0.25 → 0.5 a. Crossing length to wetland area >= 0.25 → 0.1 <u>Final Transportation Score</u> [(Freq*2) + CLen + CArea]/4
	b. One	5		
	c. Two or more	1		

NH Method Question	***NH Method Question Scoring***		***GIS Process***	***GIS Scoring***
(1) 8. How much human activity is taking place in the upland within 500 feet of the wetland edge?	a. Low: Little or no activity	10	The amount of human activity within 500 feet of the wetland edge was approximated using the 2006 LandSat NLCD classes within the buffer ring of each wetland complex. 1) Land use areas were calculated using the Geospatial Modeling Environment (GME) "isectpolyrst" tool to calculate the area of each 2006 NLCD land use within 500 feet of each wetland complex. 2) Calculate the 'Non-Human Area' (!NLCDV11!+ !NLCDV31!+ !NLCDV41!+ !NLCDV42!+ !NLCDV43!+ !NLCDV52!+ !NLCDV71!+ !NLCDV90!+ !NLCDV95!) where; 11=Open Water, 31=Barren Land, 41=Deciduous Forest, 42=Evergreen Forest, 43=Mixed Forest, 52=Shrub/Scrub, 71=Grassland/Herbaceous, 90=Woody Wetlands, and 95=Emergent Wetlands. 3) Calculate the 'Disturbed Area' (!NLCDV21!+ !NLCDV81!+ !NLCDV82!) where; 21=Developed, Open Space, 81=Pasture Land, and 82=Cultivated Crops. 4) Calculate the 'Developed Area' (!NLCDV22!+ !NLCDV23!+ !NLCDV24!) where; 22=Developed, Low Intensity, 23=Developed, Medium Intensity, and 24= Developed, High Intensity. *Parallels the VHB methodology for this question while applying the newer NLCD dataset. (C.1.2 Parameter 2 [EI-Q2]* *VHB – 500' buffer donuts and 2001 LCLU*	The final abutting human activity score was set as: a. Non-Human > [Disturbed + Developed] → 1.0 b. Disturbed > Developed→ 0.5 c. Else → 0.0
	b. Moderate: some activity evident	5		
	c. High: Much activity evident.	1		
(1) 9. How many buildings are there within 500 feet of the wetland edge? Acres of Wetland / # of buildings	a. More than 50 wetland acres per building	10	Two separate scores were developed and then averaged for each wetland complex. The first approach was to estimate the building density from the 2010 census data. While reasonable for the more urban areas, this method gave a false impression of the presence of people in proximity to wetlands in the large rural census blocks and	The final building score was set as the average of Scores 1 & 2. <u>Score 1</u> (PPSM) The final population density component for the scoring of buildings within 500
	b. 11-50 wetland acres per building	5		

NH Method Question	***NH Method Question Scoring***		***GIS Process***	***GIS Scoring***
	c. Less than 10 wetland acres per bldg	1	failed to illustrate non-residential buildings in industrial and retail complexes. The second approach was to calculate an effective percent imperviousness from the 2006 NLCD data assuming that where there is high imperviousness within 500 feet of a wetland, there is likely to be buildings. This approach did a better job of capturing patches of development in the rural areas and buildings in industrial and retail complexes but gave some false positives along major transportation corridors. An average of the two approaches was seen as the best approximation of the density of buildings within 500 feet of a particular wetland complex. <u>Score 1</u> 1) Calculate the population density from the 2010 Census Tab Blocks data as remapped onto the 1:24,000 catchments. 2) Calculate a Person Per Square Mile (PPSM) score. <u>Score 2</u> 1) Calculate the % developed impervious in the surrounding 500 foot area from NLCD2006, where the percent imperviousness of a landuse cals is set as the middle of the published range for the NLCD class %DEV_IMPERV = (VALUE22*0.35 + VALUE23*0.65 + VALUE24*0.9)/(VALUE11+ VALUE21+ VALUE22+ VALUE23+ VALUE24+ VALUE31+ VALUE41+ VALUE42+ VALUE43+ VALUE52+ VALUE71+ VALUE81+ VALUE82+ VALUE90+ VALUE95)	feet was set as: a. PPSM <=50 → 1 b. PPSM <=100 and > 50 → 0.5 c. PPSM > 100 → 0.1 <u>Score 2</u> (%DEV_IMPERV) The final percent developed imperviousness component for the scoring on buildings within 500 feet was set as: a. %DEV_IMPERV <= 0.025 → 1 b. %DEV_IMPERV <= 0.1 and > 0.025 → 0.5 c. %DEV_IMPERV > 0.1→ 0.1 <u>Final Building Score</u> BLDG_Score=AVERAGE (!PPSM_SCORE!, !IMPERV_Score!)
(1) 10. Is there a human-made structure that regulates the flow of water	a. No human made structures present in the wetland	10	The detailed description of this question in the NH Method indicates that the focus is on dams, bridges, and culverts and how they regulate flow. Question #7 above	The final human-made structure score was set as:

NH Method Question	***NH Method Question Scoring***		***GIS Process***	***GIS Scoring***
through the wetland?	b. One or more human made structures present in the wetland but hydrologic modification is slight	5	provides scoring on the impact of transportation crossings. In Section 3 (Fish and Aquatic Habitat) question #10 will also address barriers to aquatic passage from dams and transportation crossings. The focus of this model was constrained to those human-made structures that were built with the expressed intent to regulate the flow regime of an area thereby intentionally altering the aquatic life designated use. Two methods were used in conjunction to model whether a human-made structure intentionally regulates flow through the wetland complex. The first portion of the methodology looks at the relationship between a complex and dams. The second of the method looks at the NWI Cowardin codes for 'Water Regime' "K" (Artificially Flooded) and 'Special' the modifiers, "d" (Partially Drained/Ditched) and "h" (Diked/Impounded). <u>Part 1</u> Where a wetland complex was in or within 75 feet of a dam controlled surface water AUIDs a "Dam" flag was set to yes. <u>Part 2</u> Where the NWI Cowardin code modifier was "K - Artificially Flooded", "d - Partly Drained/Ditched" or "h - Diked/Impounded" a NWI flag was set to yes. ["NWICODE" LIKE '%K' or "NWICODE" LIKE '%K%' or "NWICODE" LIKE '%d' or "NWICODE" LIKE '%d%' or "NWICODE" LIKE '%h' or "NWICODE" LIKE '%h%] *VHB –* *1-Used the Cowardin code modifiers 'h', 'x', & 'b' (note that VHB was aiming to get at "long-term stability of the site")* *2-Applied a 100' buffer to all 'Active' dams*	a. if Neither Dam or NWI(K, d, or h) → 1.0 b. if Dam OR NWI(K, d, or h) → 0.5 c. if Dam & NWI(K, d, or h) → 0.1:

Table 3 – WETLAND-DEPENDENT WILDLIFE HABITAT

NH Method Question	***NH Method Question Scoring***		***GIS Process***	***GIS Scoring***
(2) 8. Are there wildlife travel corridors allowing access to other wetlands?	a. Free access along well vegetated stream corridor, woodland, or lakeshore	10	To address whether a wetland complex provides access to other wetlands two questions were addressed. Both components of the model used the NH F&G unfragmented forest block developed for the Wildlife Action Plan. First, what is the relationship of the complex to the unfragmented blocks? That is, is there a possible travel route or are organisms 'trapped'entirely within, straddling, or outside of the complex. Second, how many other wetland complexes are accessible through the unfragmented block?. That is, if an organism can safely travel beyond the wetland complex, is there somewhere to go? Score 1 (Unfragmented Block Association) 1) By a series of spatial selections and attribute selections determine if a wetland complex, a. Is entirely within an unfragmented block b. Touches an unfragmented block c. Is entirely outside an unfragmented block Score 2 (Wetland Complexes per Unfragmented Block) 1) Count of complexes touching an unfragmented block. Assign count to blocks. 2) By an identity apply to wetland complex/block count to the related complexes.	The final wildlife corridors score was set as the average of Scores 1 & 2. Score 1 (In Unfragmented Block) The final Unfragmented Block Association component for the scoring of corridor and access was set as: a. entirely within a block → 1.0 b. only intersects a block → 0.5 c. entirely outside a block → 0.1 Score 2 (Connected to other Unfragmented Block) The final connection component for the scoring of corridor and access was set as: a. >2 Complex/Block → 1 b. 1 Complex/ Block → 0.5 c. Complex does not intersect a Block → 0.1 Final Corridor Score Average of 1) & 2). [Mathematically and programmatically the only possibilities are 1, 0.75, 0.5, and 0.1]
	b. Access partially blocked by roads, urban areas, or other obstructions	5		
	c. Access blocked by roads, urban areas, or other obstructions	1		
(2) 9. What percentage of the wetland edge is bordered by undisturbed woodland or idle land (e.g.	a. More than 95% of the wetland	10	To model the percent of the wetland edge bordered by undisturbed lands the 2006 NLCD was clipped by the wetland complex 500 foot ring. Analysis of the land use in the ring focused on the LULC classes that are, undisturbed	The final percent of undisturbed land score was set as: a. if '%Wilds' > 0.95 → 1.0
	b. More than 75-95% of the wetland	5		

NH Method Question	***NH Method Question Scoring***		***GIS Process***	***GIS Scoring***
shrub land or abandoned fields) at least 500 feet in width?	c. Less than 75% of the wetland	1	woodland or idle land (e.g. shrub land or abandoned fields) to calculate the percent of area that is 'wild'. 1) Land use areas were calculated using the Geospatial Modeling Environment (GME) "isectpolyrst" tool to calculate the area of each 2006 NLCD landuse within the 500 feet ring around each wetland complex. 2) Percent Wild was then calculated as = (NLCDV11+ NLCDV31+ NLCDV41+ NLCDV42+ NLCDV43+ NLCDV52+ NLCDV71+ NLCDV90+ NLCDV95)/(SUM(NLCDV) *VHB – Did basically the same process as above including farm land but divided the undisturbed acres by 500 ft.*	b. if '%Wilds' <= 0.95 and >= 0.75 → 0.5 c. if '%Wilds' < 0.75 → 0.1:

Table 4 – FISH AND AQUATIC HABITAT

For both of the "Fish and Aquatic Habitat" questions addressed below, all wetland complexes with all parts identified as 'Water Modifier' = J, B, A, or P were omitted and assigned a final score of -99. This is because fish and other obligate aquatic life will not be present since these wetland types never have seasonal or permanent open water within their bounds.

NH Method Question	***NH Method Question Scoring***		***GIS Process***	***GIS Scoring***
(3) 1. What is the dominant land use in the watershed above wetland?	a. Woodland, wetland, or abandoned farmland	10	The dominant land use was calculated for the first upstream 500 feet of the watershed from the 2006 NLCD. 1) Land use areas were calculated using the Geospatial Modeling Environment (GME) "isectpolyrst" tool to calculate the area of each 2006 NLCD land use within the 500 foot ring around each wetland complex. 2) Summarize the 'Natural' area. (NLCDV11+	The final dominant land use type score was set as: a. If maximum area = Natural → 1 b. If maximum area = Agriculture plus Open Space to Low intensity developed → 0.5 c. If maximum area = Medium to
	b. Active farmland or rural residential	5		

NH Method Question	***NH Method Question Scoring***		***GIS Process***	***GIS Scoring***
	c. Urban and heavily developed suburban areas	1	NLCDV31+ NLCDV41+ NLCDV42+ NLCDV43+ NLCDV52+ NLCDV71+ NLCDV90+ NLCDV95) 3) Summarize the 'Agricultural/Rural Residential' area. (NLCDV21+ NLCDV22+ NLCDV81+ NLCDV82) 4) Summarize the 'Developed' area. (NLCDV23+ NLCDV24) 5) Determine which land use type is the majority to set the final scores with ties going to the more natural class). 6) Assign '-99' where a score was omitted for the complex due to the 'Water Modifier' 7) Assign '-999' where a score was omitted due the 10 m DEM derived watershed being insufficient to calculate LULC for the buffer ring.	Heavy developed → 0.1 -999 not enough 10m DEM derived watershed to calculate dominant landuse -99 Complexes omitted due to 'Water Modifier' (i.e. 'Water Modifier' = J, B, A, or P)
(3) 10. Are there barriers to the passage of aquatic life? (e.g. dams, elevated culverts, bridge with a width less than the natural stream channel, road crossings, etc. along the stream reach associated with the wetland).	a. No barrier(s) present.	10	Several distinct components were modeled in GIS to determine the degree of impacts to aquatic life passage on and directly abutting the 1:24,000 NHHD network. Impacts were considered to be from dams and transportation infrastructure be it a bridge or culvert. 1) Wetland complexes were spatially joined to the hydrography crossing type dataset developed in the pre-processing steps. 2) Calculate summary statistics for each wetland complex for; a. Number of railroad crossings b. Type of railroad crossings c. Number of roadway bridges d. Number of roadway culverts e. Type of road crossing f. Minimum stream order 3) Wetland complexes were spatially joined to the dammed surface water AUID dataset developed in the pre-processing steps. 4) Calculate the number of dams that influence the water elevation in a wetland complex. 5) Join the Wetland 'Water Modifier' decode table for NWI Codes to a table for final complex scoring.	The final artificial barrier score was set from the following logic: a. No Barriers → 1 b. Dam → 0.5 c. Road Bridge → 0.5 d. RR & > 2nd Order → 0.5 e. RR & <3rd order → 0.1 f. Road Culvert → 0.1 g. Not applicable due to 'Water Modifier' → -99
	b. An artificial barrier is present and equipped with a fish ladder or other provisions for fish passage, or artificial barrier is only present during extreme low water	5		
	c. Dam, elevated culverts or other artificial barrier(s) is present without provisions for fish passage	1		
	d. Stream not present	0		

RESULTS/DISCUSSION

Results and discussion for each question are provided below. This includes general observations from the GIS analyses and examples (presented in figures showing satellite imagery) covering a range of scores for each question. Tables and graphs showing the distribution of scores and a state map showing the location of assessment units within each scoring category for each of the 12 questions are provided in Plates 1 through 12 at the end of this memorandum. Finally, on the last page, the distribution of scores based on the average score of all questions for each assessment unit, are provided in Plate 13.

Ecological Integrity – Water Quality Degradation in Watershed [01-01]

The distribution of scores and a State level map of the scores for Ecological Integrity – Water Quality Degradation in Watershed are provided on PLATE 1 (near the end of this memorandum). Nearly half of the wetland complexes in the state are predicted to receive some level of polluted runoff. Some of the impacted wetlands show the predictable signature of the high population areas in the state. However, there are several areas where agricultural activities within the 500 foot watershed are the likely source of the low score. Figure 1, Figure 2, and Figure 3 provide examples of sites that score 1.0, 0.5, and 0.1 respectively.

Figure 1. Examples of sites with a score = 1.

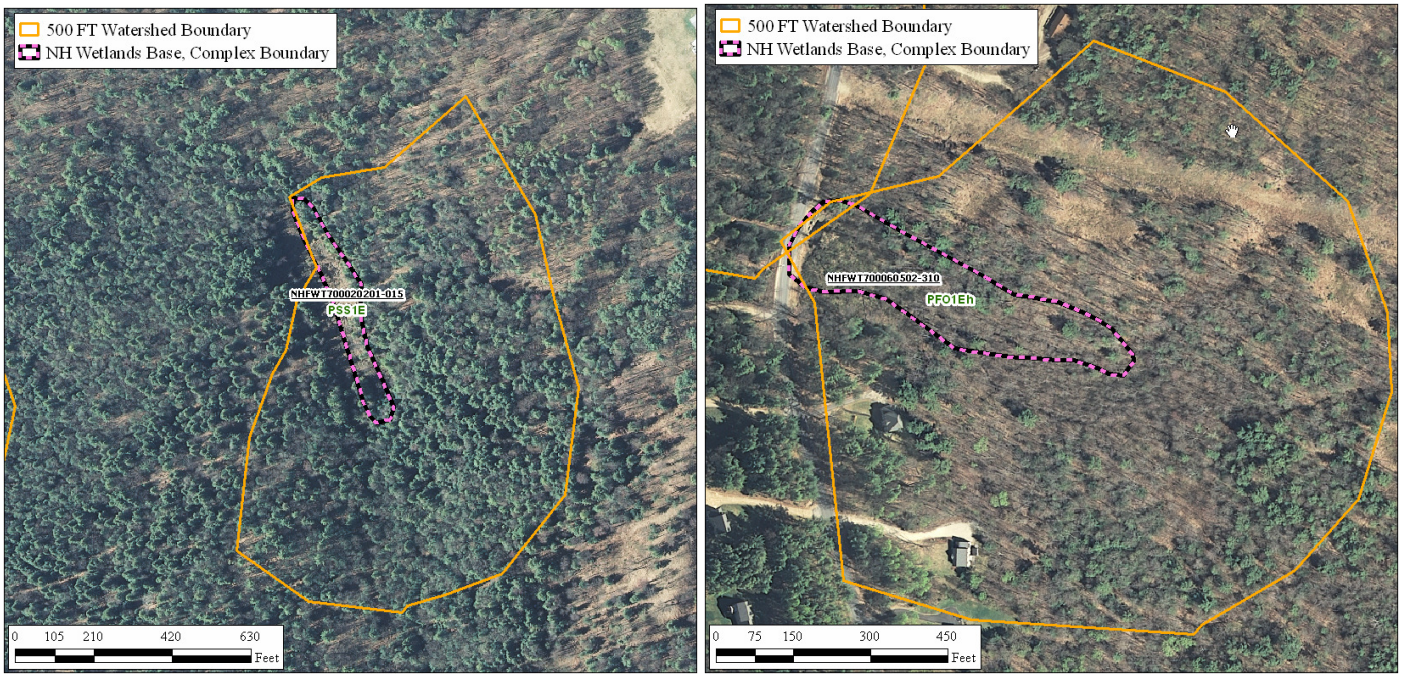


Figure 2. Examples of sites with a score = 0.5

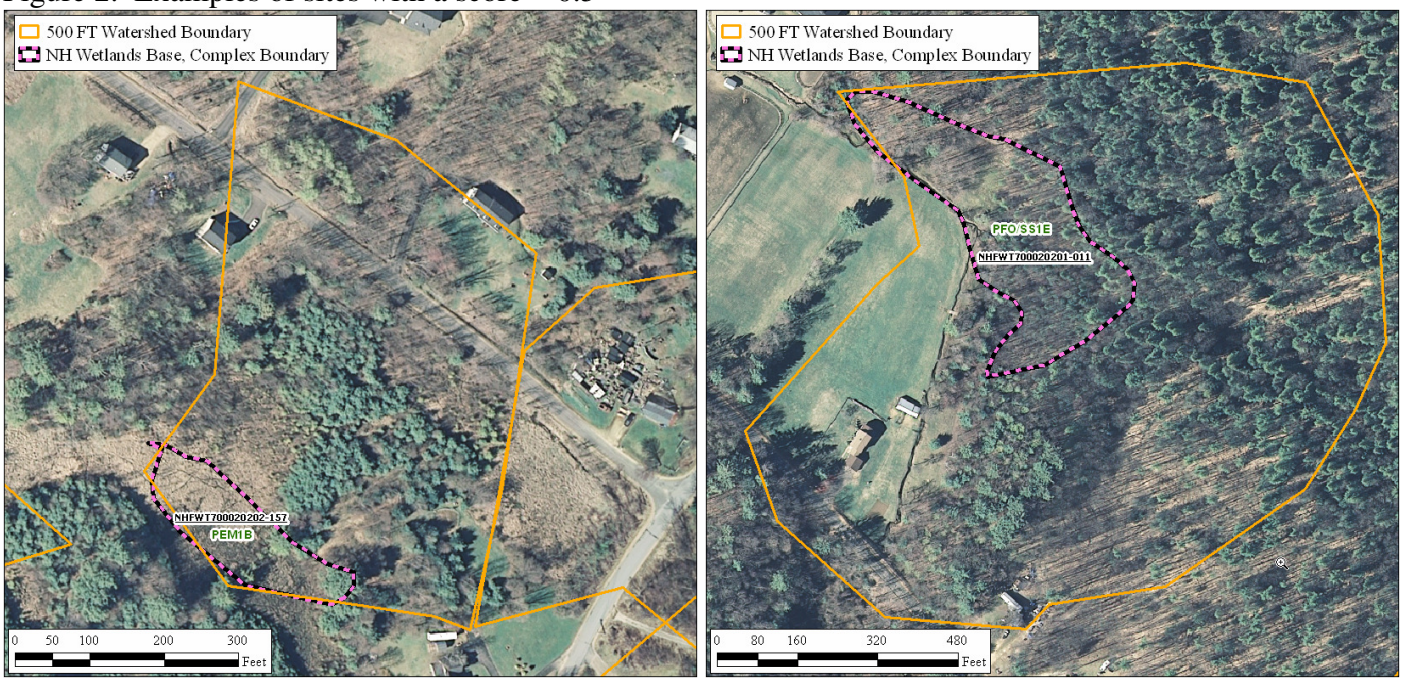
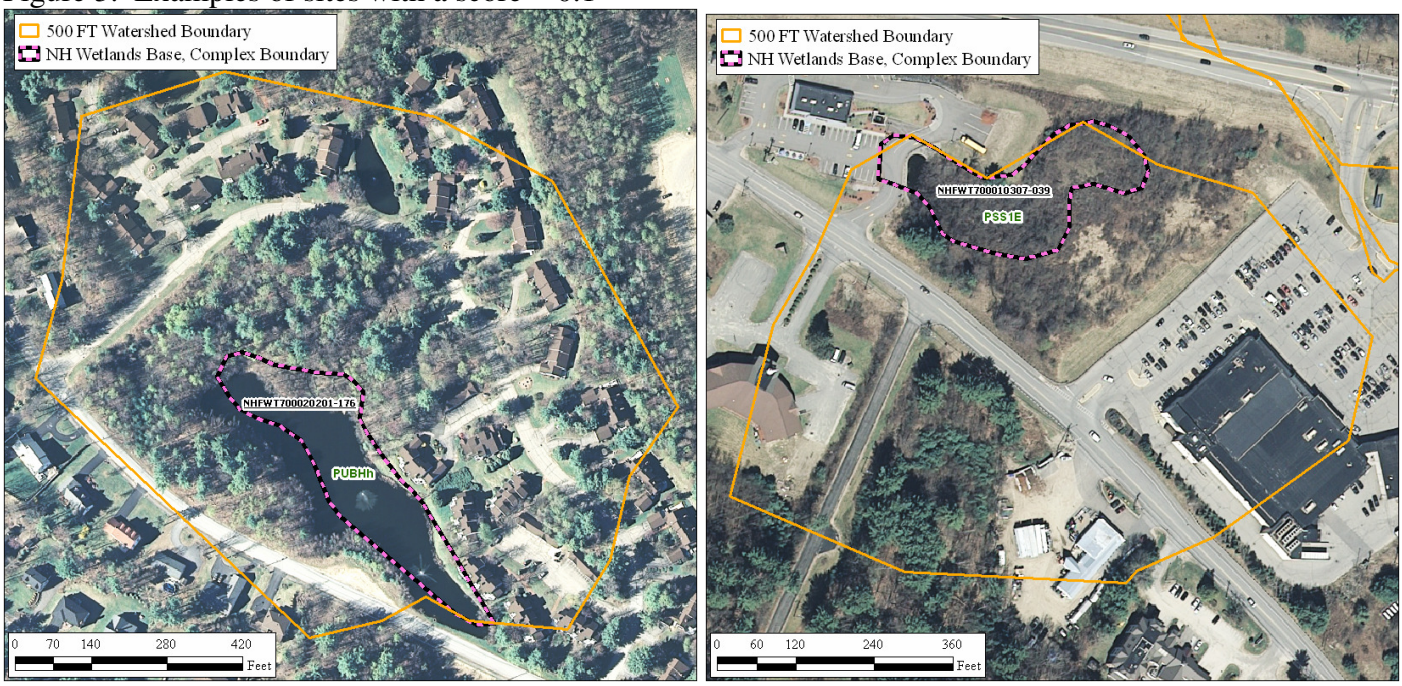


Figure 3. Examples of sites with a score = 0.1



Ecological Integrity – Evidence of Fill [01-02]

The distribution of scores and a State level map of the scores for Ecological Integrity – Evidence of Fill are provided on PLATE 2 (near the end of this memorandum). This metric did not directly translate well to GIS with only 230 of the 52,426 complexes indicating that more than 1 percent of the wetland area had been permitted to be filled. Since the metric was based on the 'permitted' fill and not the actual fill placed, the few cases with over 1 percent predicted could be an overestimate since not all permitted projects are built and not all permitted fill is placed. Conversely, since the metric only addresses permitted fill, the whole population of unauthorized fill is not addressed. Figure 4, Figure 5, and Figure 6 provide examples of sites that score 1.0,

0.5, and 0.1 respectively. The right side panel of Figure 4 illustrates a site that was clearly missed and may have been due to an error in the location of the permitting point on this large project.

Figure 4. Examples of sites with a score = 1.0

Figure 5. Examples of sites with a score = 0.5

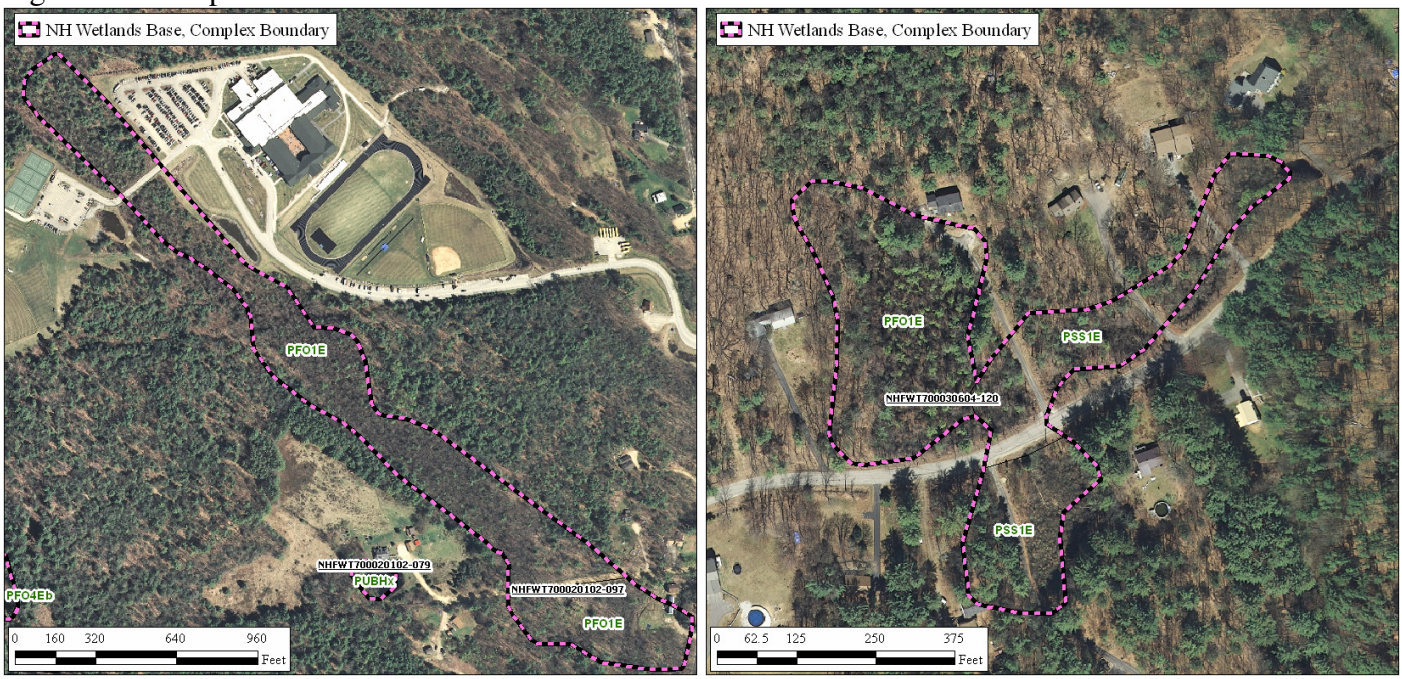
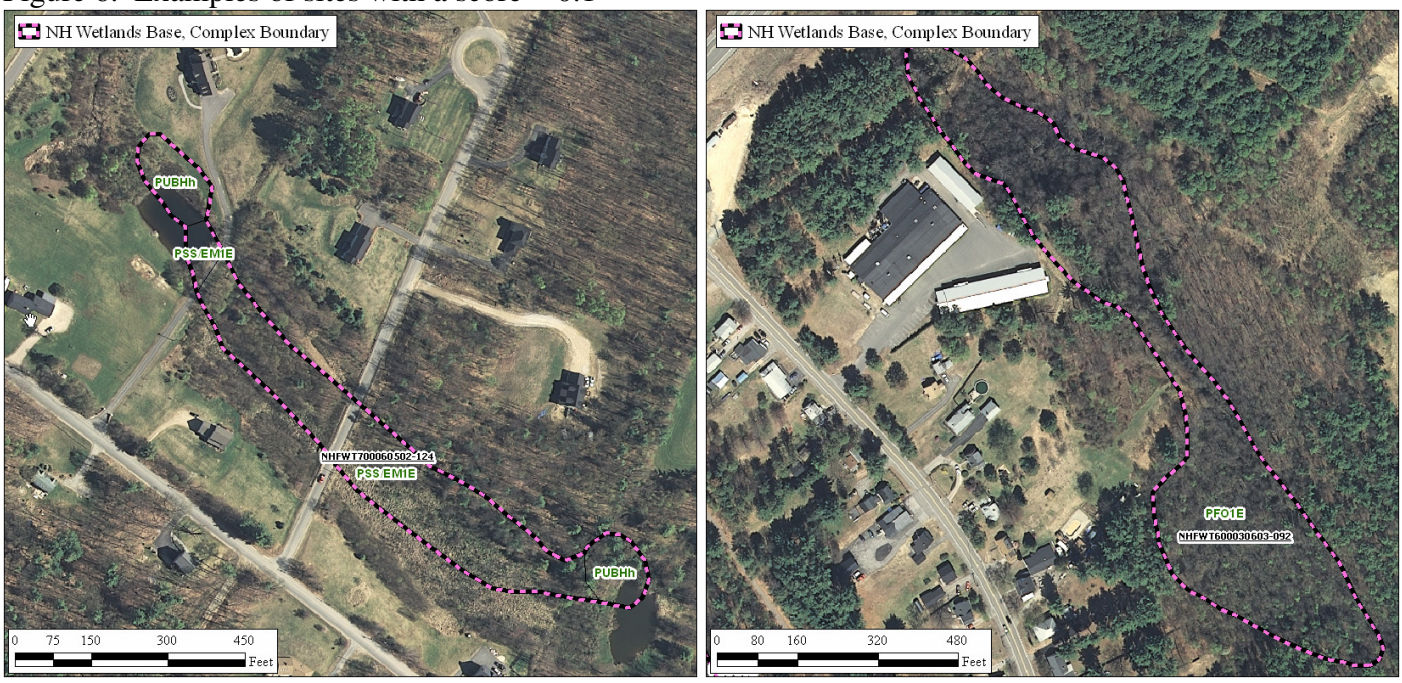


Figure 6. Examples of sites with a score = 0.1



Ecological Integrity – Agricultural Activity [01-03]

The distribution of scores and a State level map of the scores for Ecological Integrity – Agricultural Activity are provided on PLATE 3 (near the end of this memorandum). Many of the wetland areas that score as altered by agricultural activities appear to have been flagged as such by the NWI Special Modifiers. Further, quite a few of these areas appear to no longer be in use as agricultural fields but still show the markings on the landscape from historic ditching work. Additionally, the inclusion of the NWI Special Modifier 'x' pulled in scores of little dug farm ponds. Where those ponds are surrounded by agricultural lands the score is often driven lower by the NLCD classification. Some of these ponds may very well have been dug out of wetlands in years gone by but some may have been dug from uplands or simply modified open water ponds. In most cases, it is very difficult to determine from the readily available imagery.

Scores averaging 0.5 and less appear to be the most reliably correct assessment of the current agriculture activities. With all of the apparent inaccuracies in the data, the end score for agricultural activity tends to work out to a reasonable reflection of agricultural activities past and present. Figure 7 through Figure 11 provide examples of sites that score 0.1, 0.3, 0.5, 0.55, 0.75, and 1.0.

Figure 7. Score = 0.1

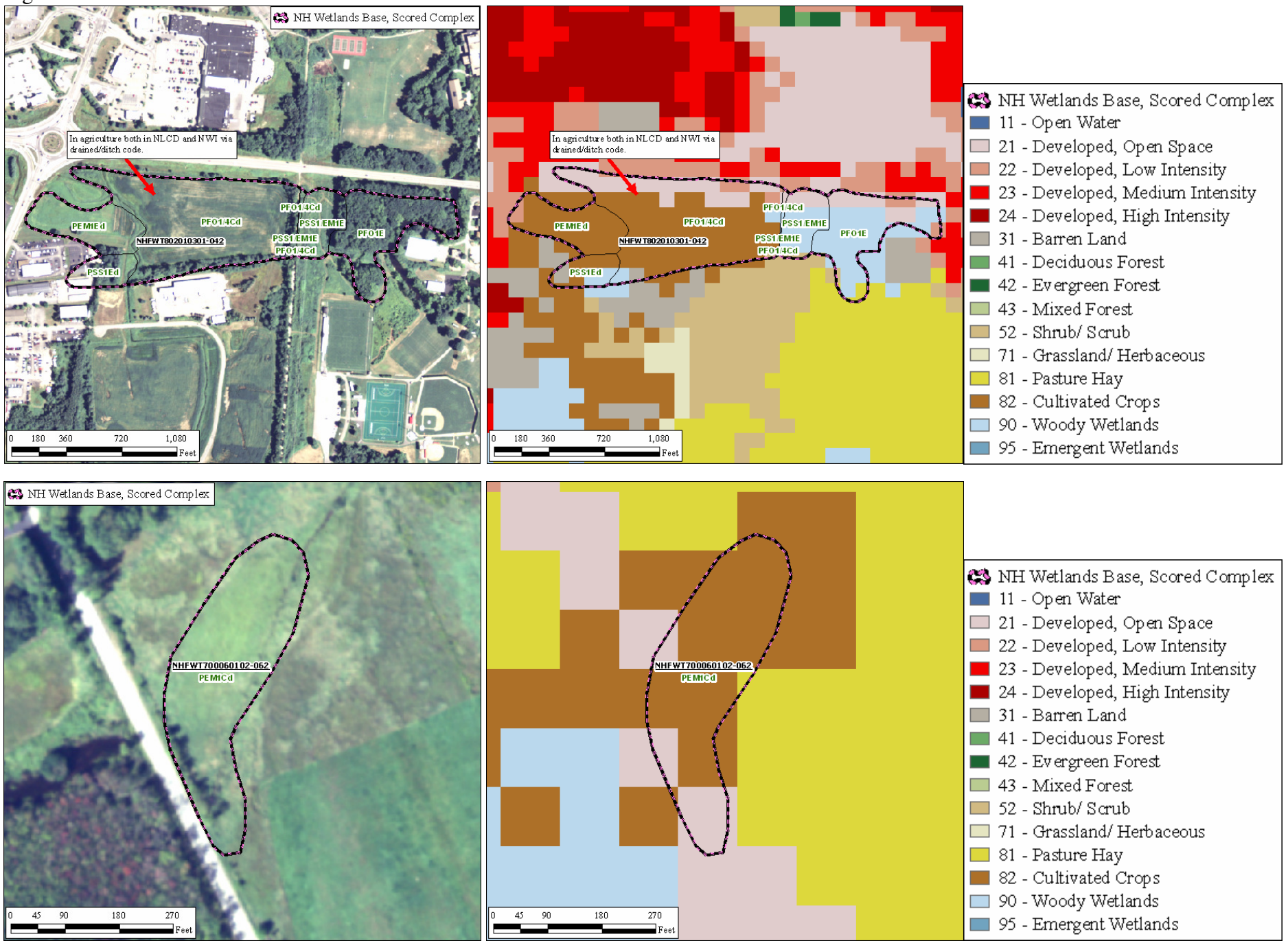


Figure 8. Score = 0.3

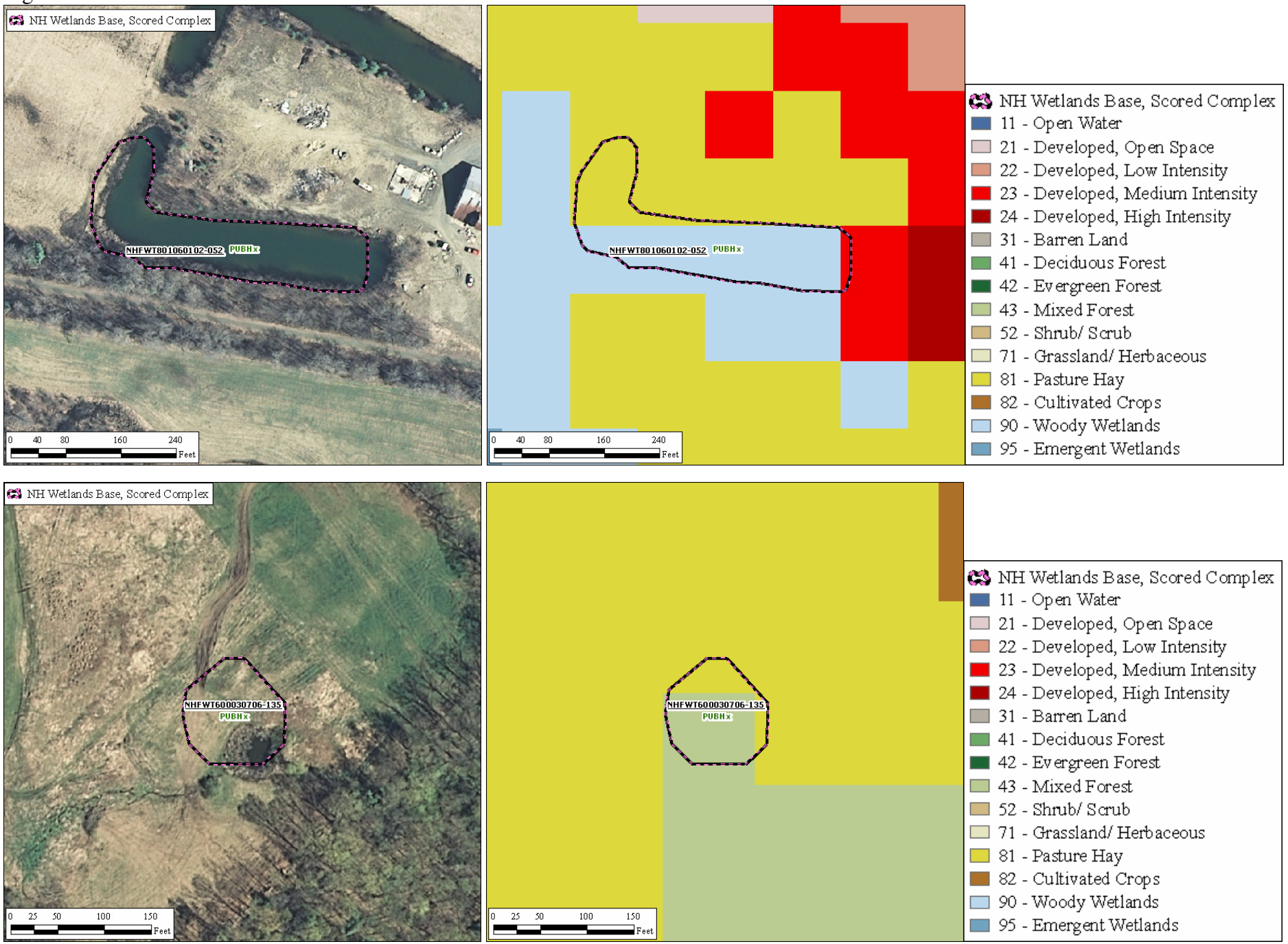


Figure 9. Score = 0.5 Ditching evident and some 2006 NLCD misclassified as 'Pasture/Hay'

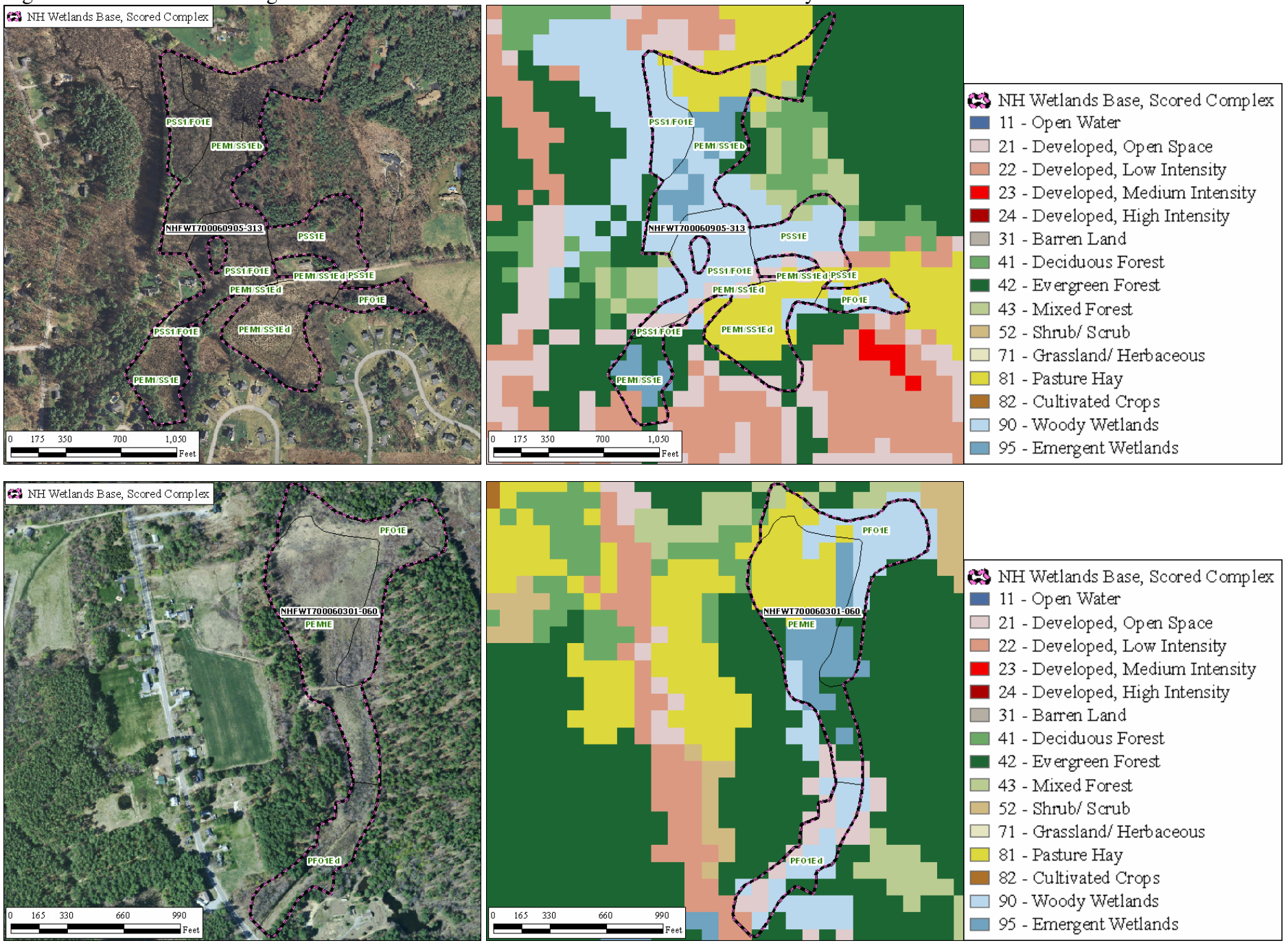


Figure 10. Score = 0.55. Example (upper) of residual ditching with NWI coding and NLCD derived current agricultural activities (lower).

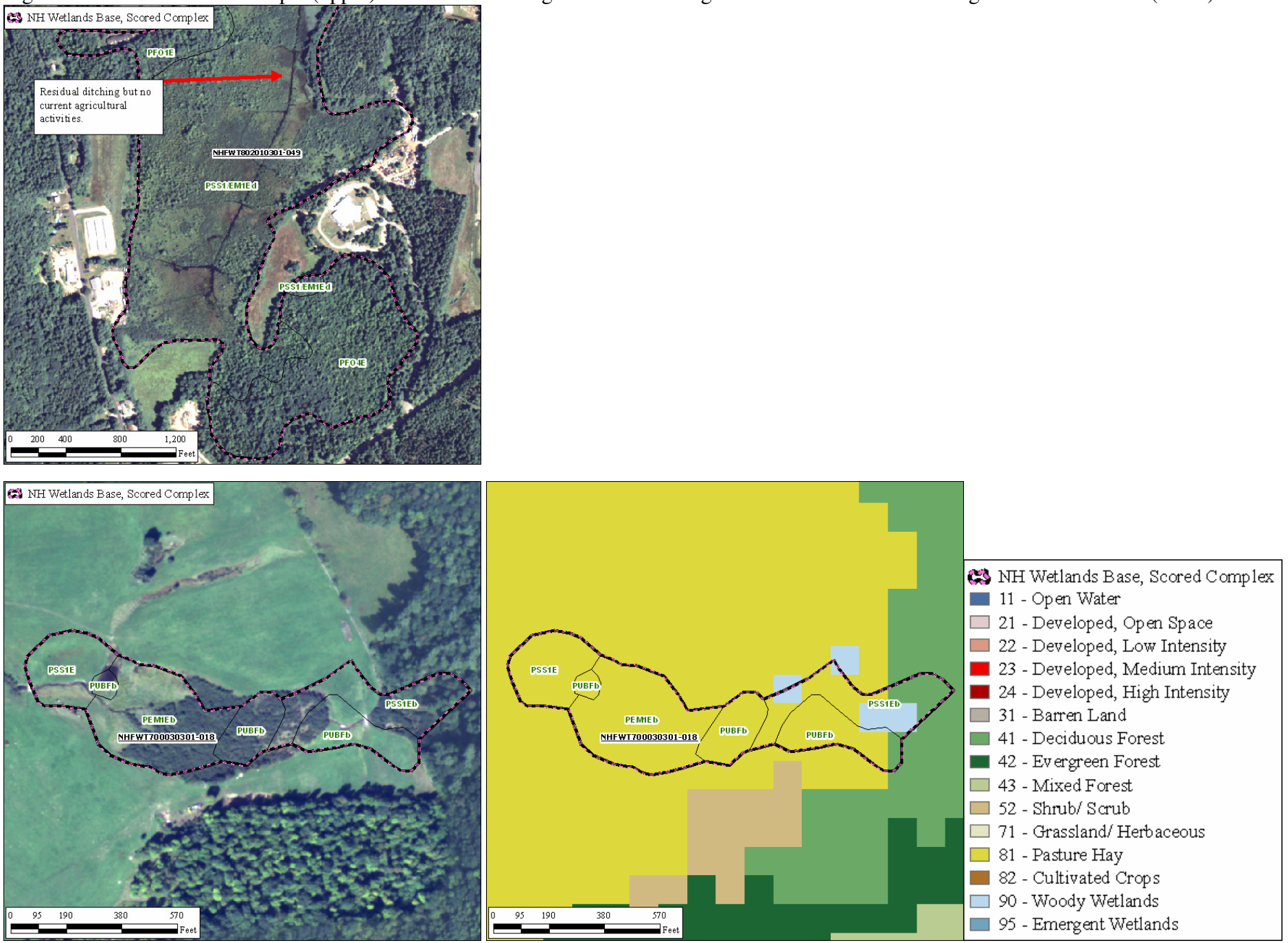


Figure 11. Score = 0.75 Example (upper) of a complex with misclassification in 2006 NLCD and but apparent residual ditching in imagery which would have reduced the score if it was coded as such in the NWI. Apparent correct classification in 2006 NLCD (lower).

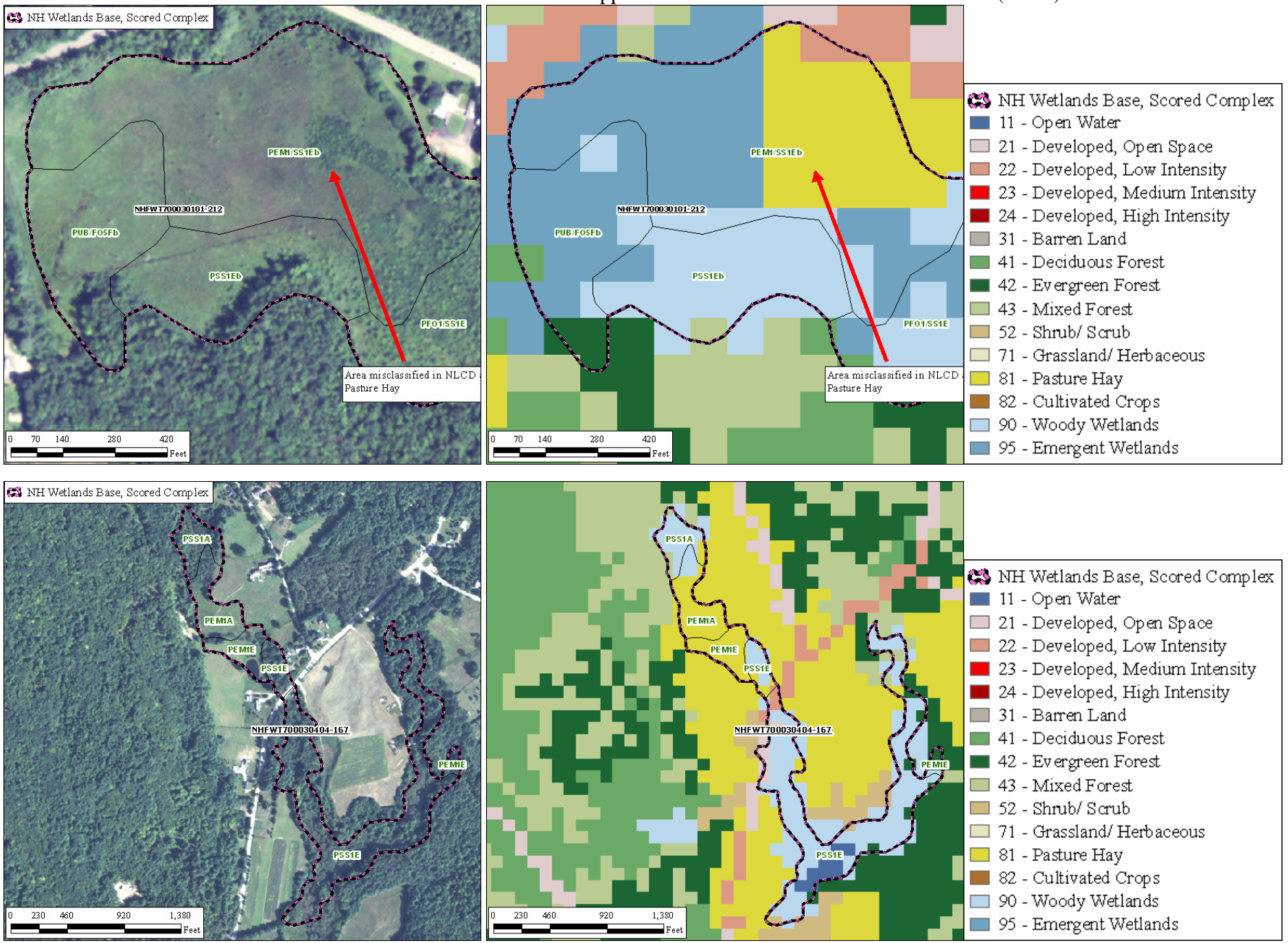
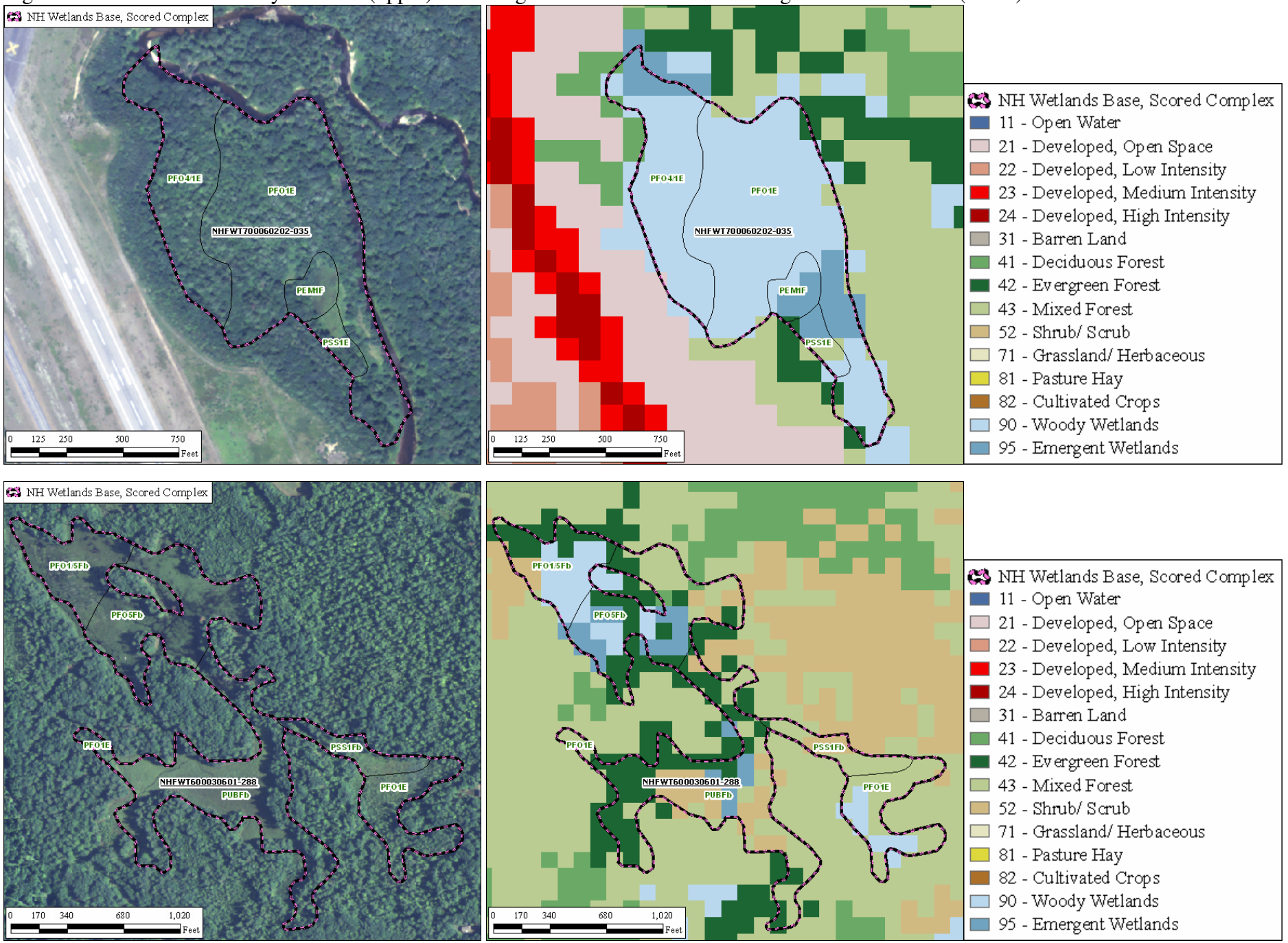


Figure 12. Score = 1.0. Nearby stressors (upper) but not agriculture and not direct. No agricultural stressors (lower).



Ecological Integrity – Logging within 10 Years [01-04]

The distribution of scores and a State level map of the scores for Ecological Integrity – Logging within 10 Years are provided on PLATE 4 (near the end of this memorandum). Figure 13 provides a pair of poorly represented logging operations as related to a final logging score. Figure 14 and Figure 15 provide examples of sites that score 0.5, and 0.1 respectively. Given that there were 2.973 logging operations identified through the wetlands permits and only 1,339 of those that were within 500 feet of a wetland complex, this score likely under represents the frequency of intersections of logging operations and wetland complexes.

Figure 13. Examples of misses

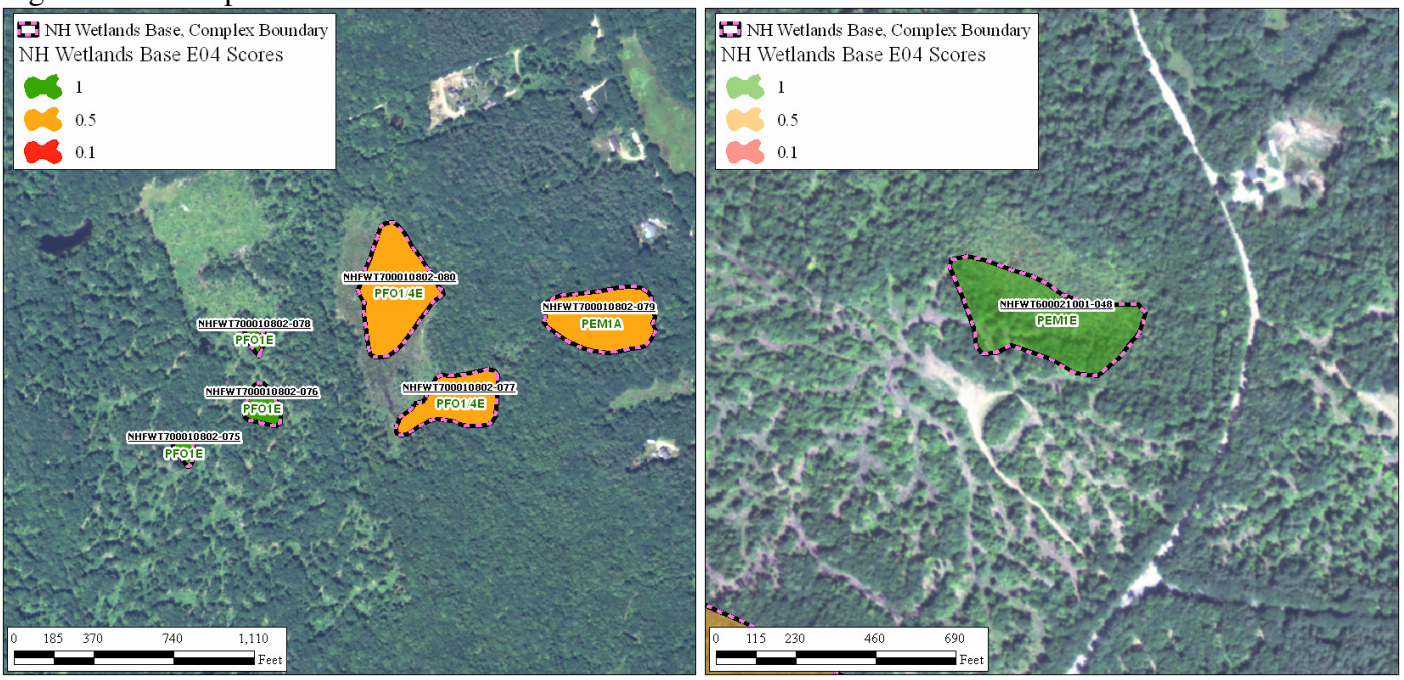


Figure 14. 0.5 score examples.

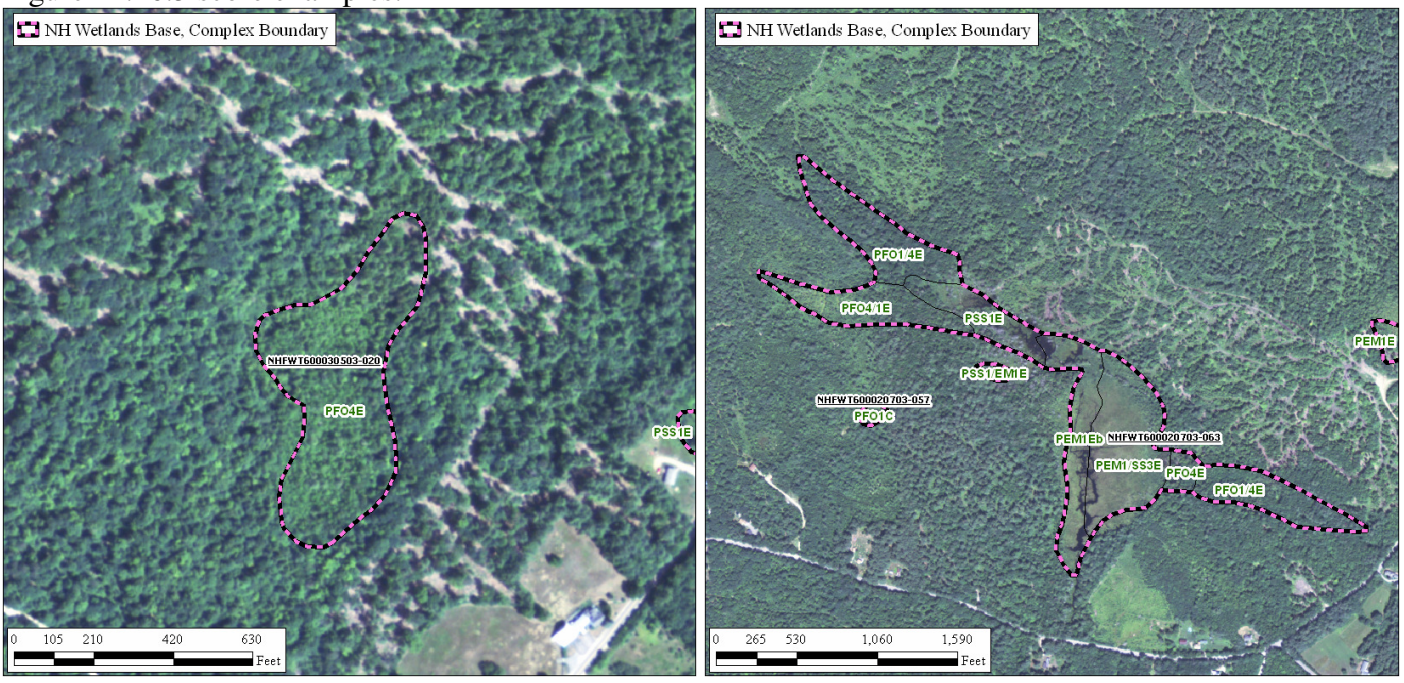
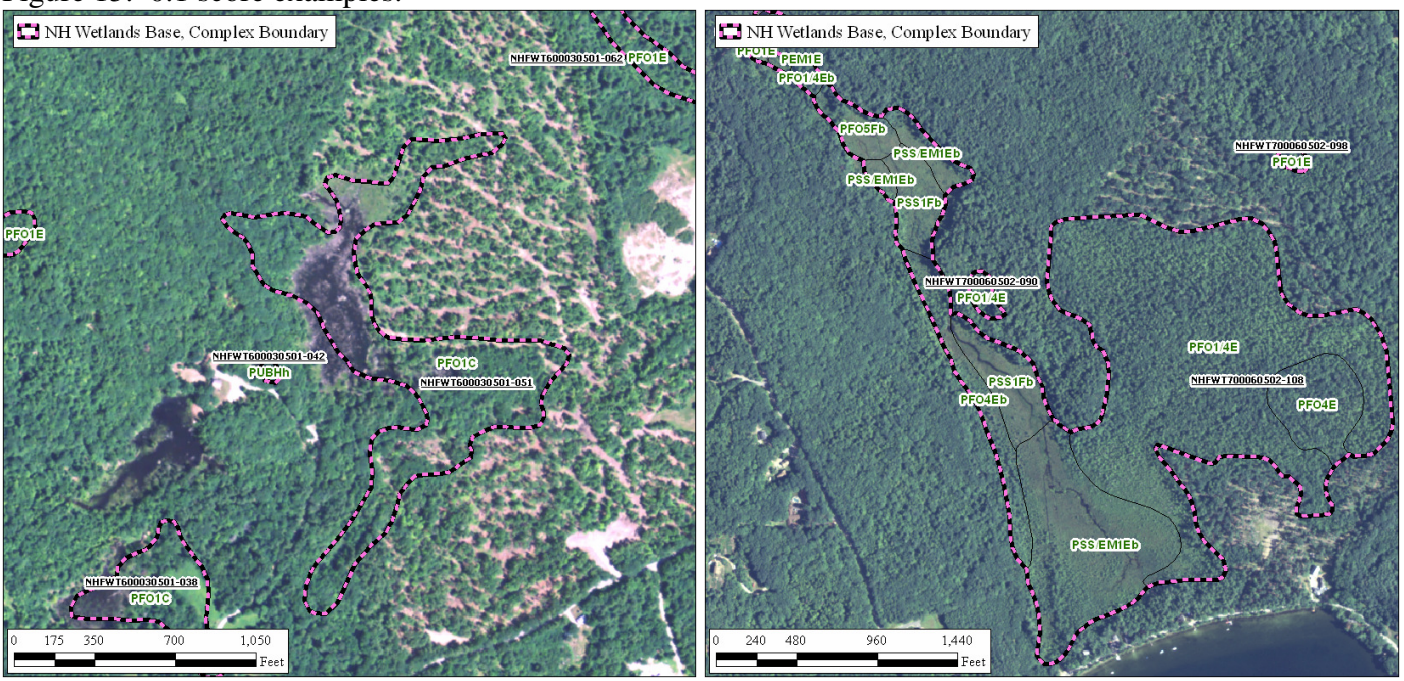


Figure 15. 0.1 score examples.



Ecological Integrity – Transportation Crossings [01-07]

The distribution of scores and a State level map of the scores for Ecological Integrity – Transportation Crossings are provided on PLATE 5 (near the end of this memorandum). Figure 16 through Figure 22 provide examples of sites that score from 0.1 to 0.75. While driveway crossings are absent from the model the transportation crossing score model provided a good range of scores in a consistent manner. Most driveways are likely too small for proper detection against the NWI based wetland complexes. A possible weakness in the model comes from the private backwoods roads and some crossings in large private industrial complexes not mapped as part of the state road network.

Figure 16. A single long crossing (left) and multiple short crossings (right) that results in score of 0.1

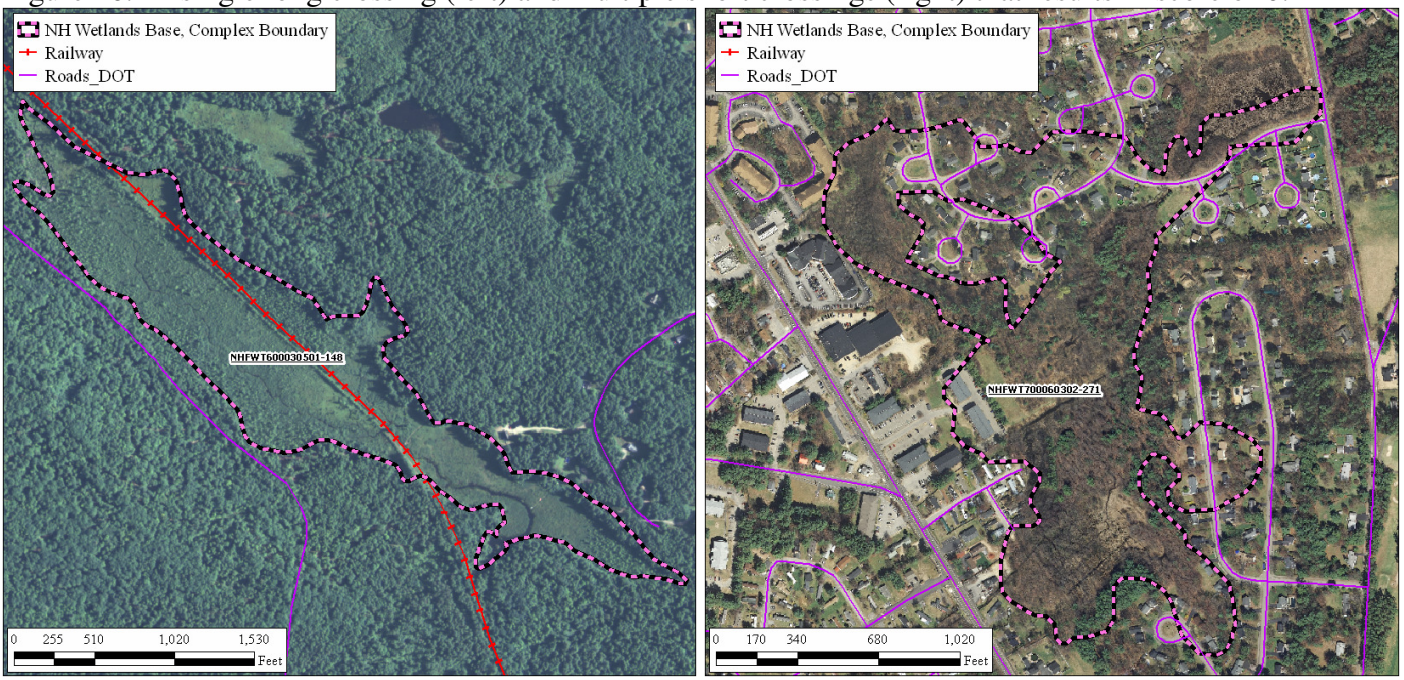


Figure 17. Similar crossing length to Figure 16 (left) on a larger complex results in a score of 0.2

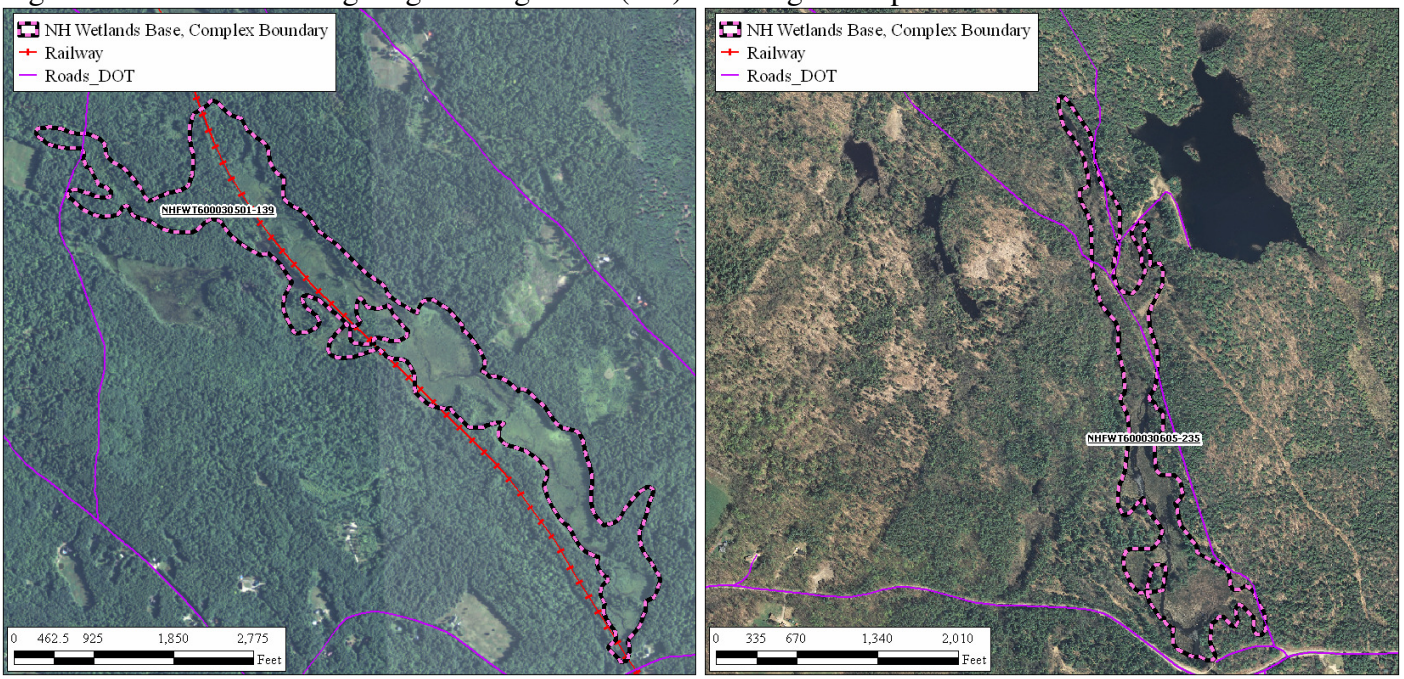


Figure 18. Multiple shorter crossings result in a score of 0.3

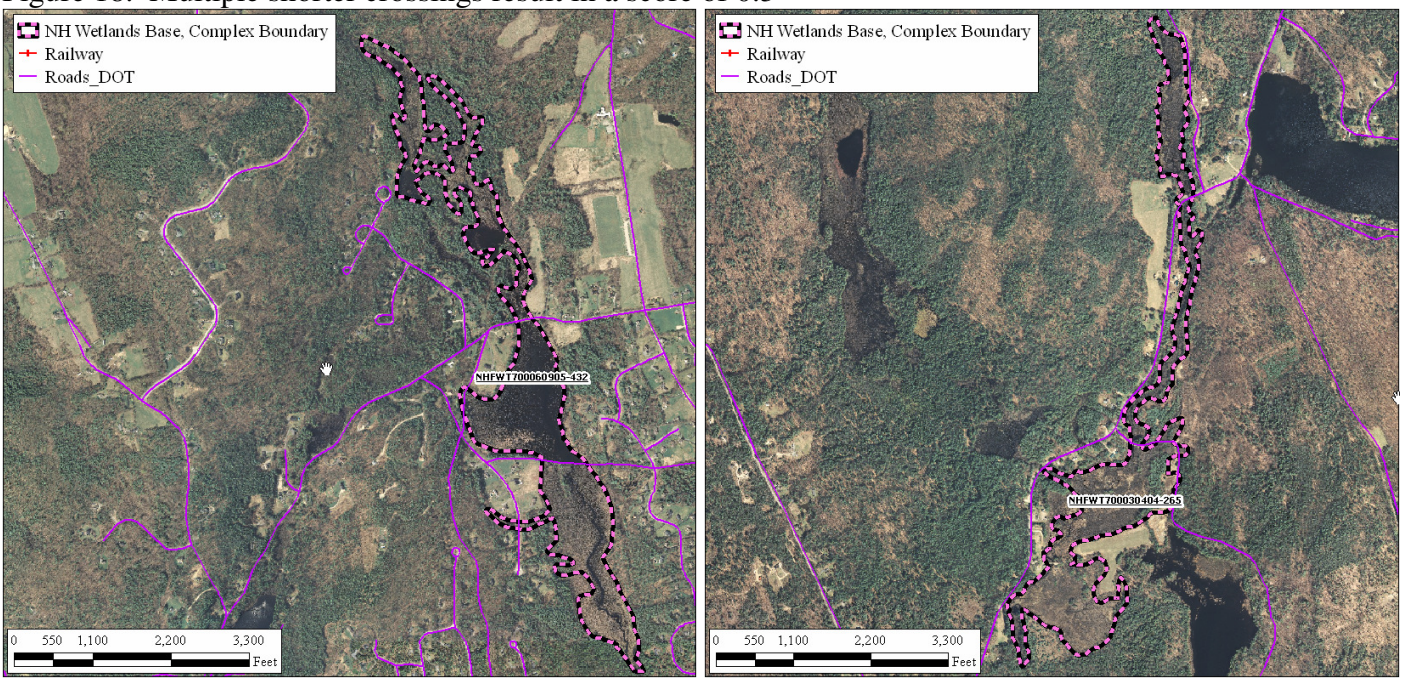


Figure 19. Single crossings that result in a score of 0.4

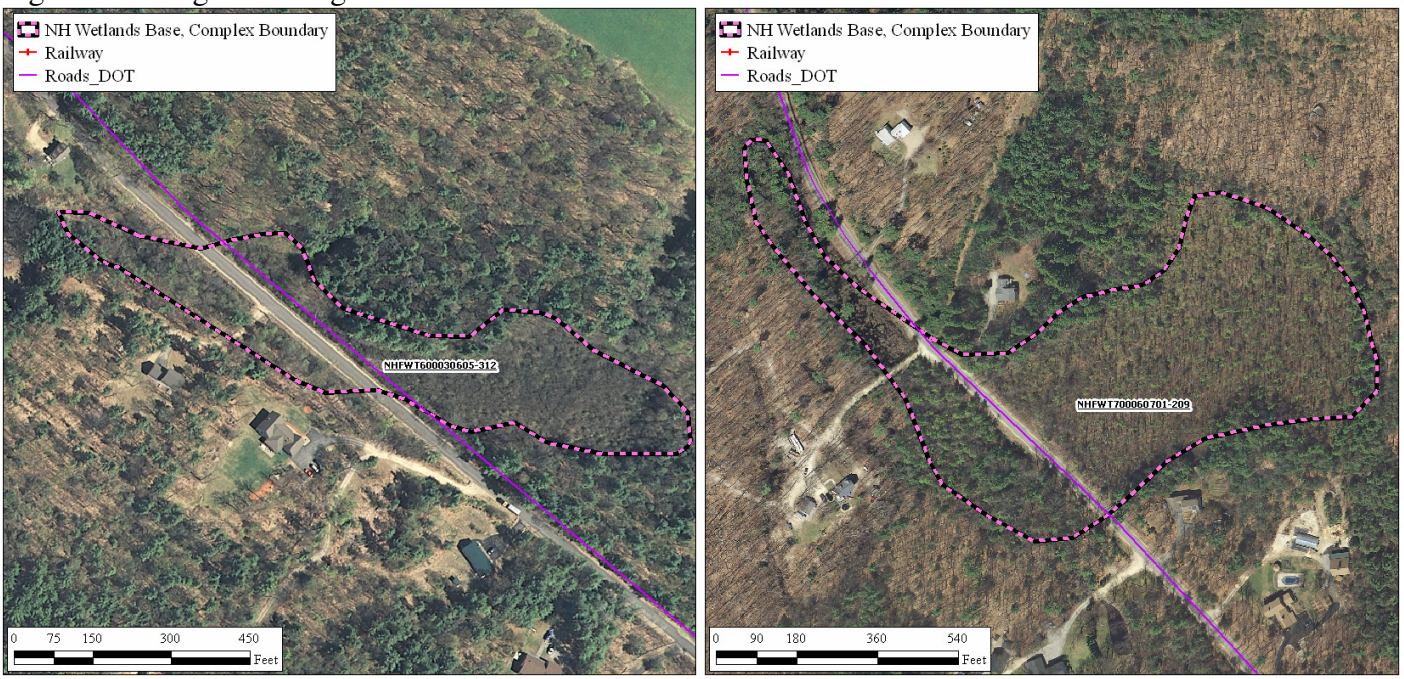


Figure 20. Single short crossing that result in a score of 0.50

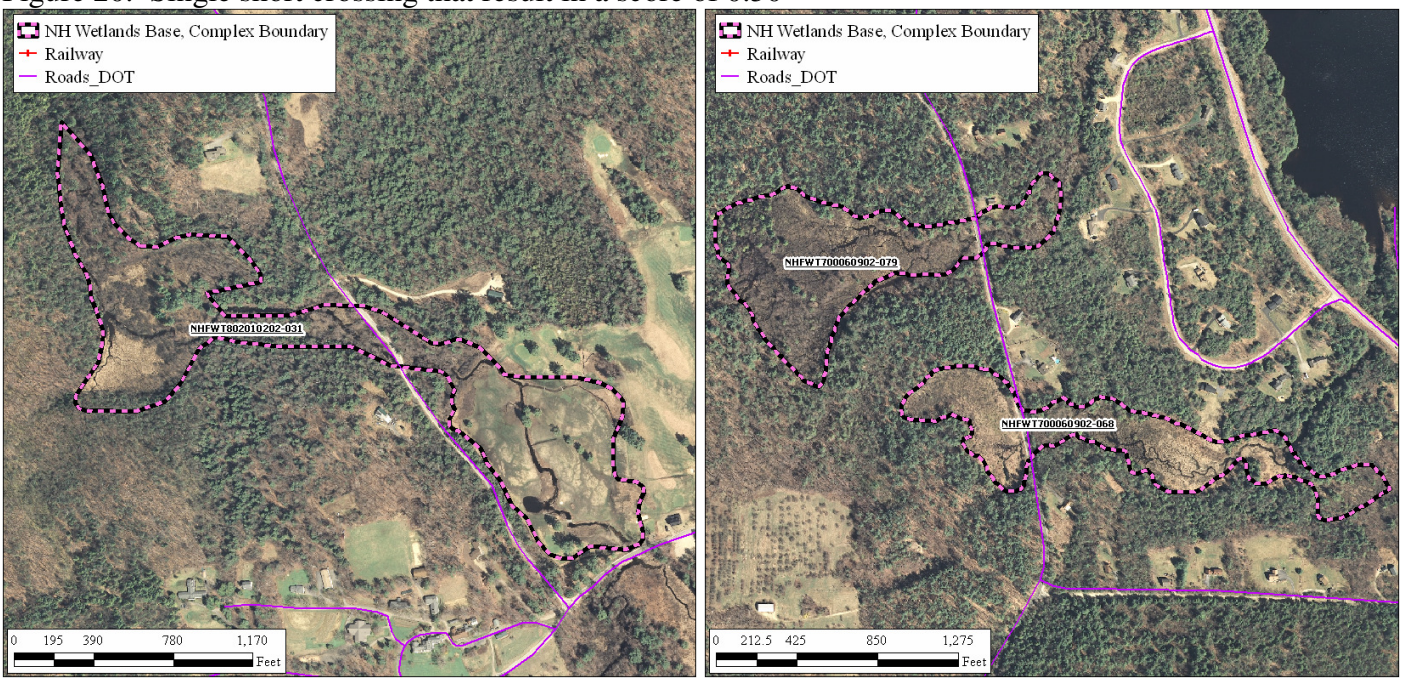


Figure 21. Single short crossing on a large wetland complex that result in a score of 0.55

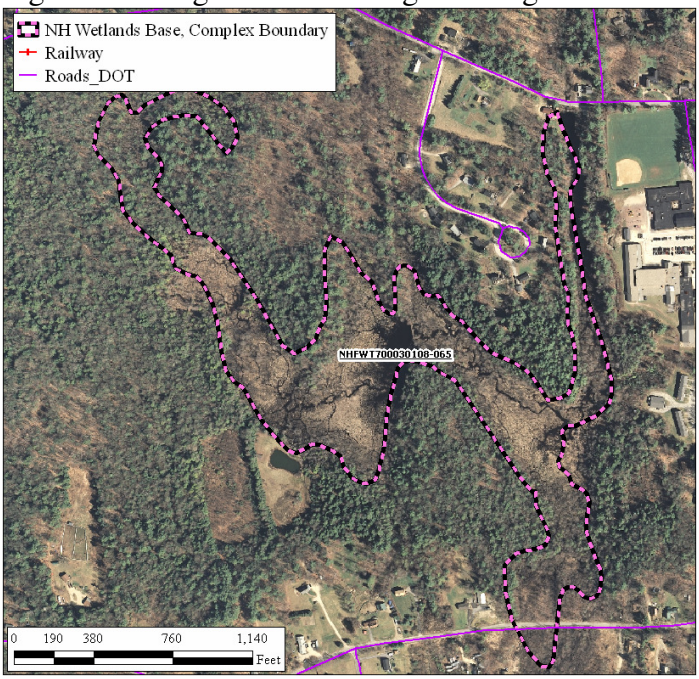
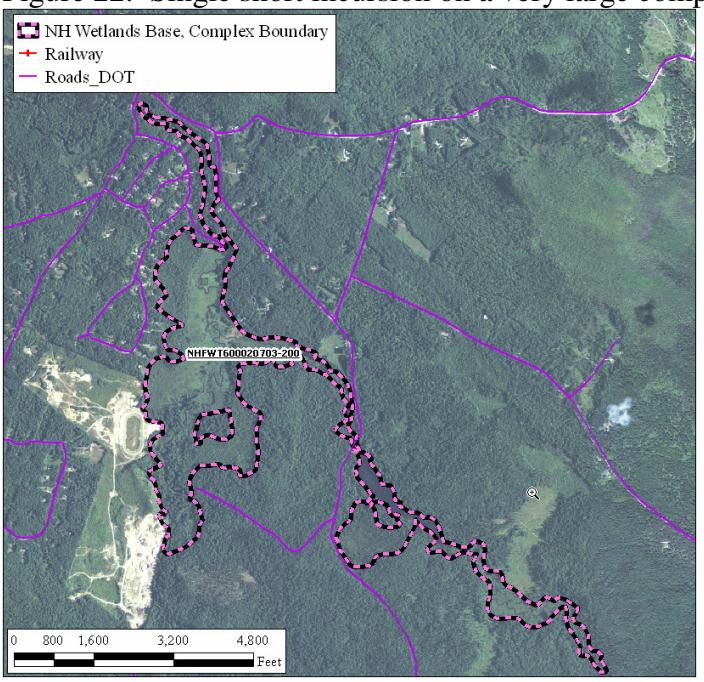


Figure 22. Single short incursion on a very large complex results in a score of 0.75



Ecological Integrity – Human Activity within 500 Feet [01-08]

The distribution of scores and a State level map of the scores for Ecological Integrity – Human Activity within 500 Feet are provided on PLATE 6 (near the end of this memorandum). Figure 23 through Figure 26 provide examples of sites that score 1.0, 0.5, and 0.1.

Figure 23. Example of a 1.0 Score – Some activity but it does not appear in the 2006 NLCD. Non-Human activity dominates.

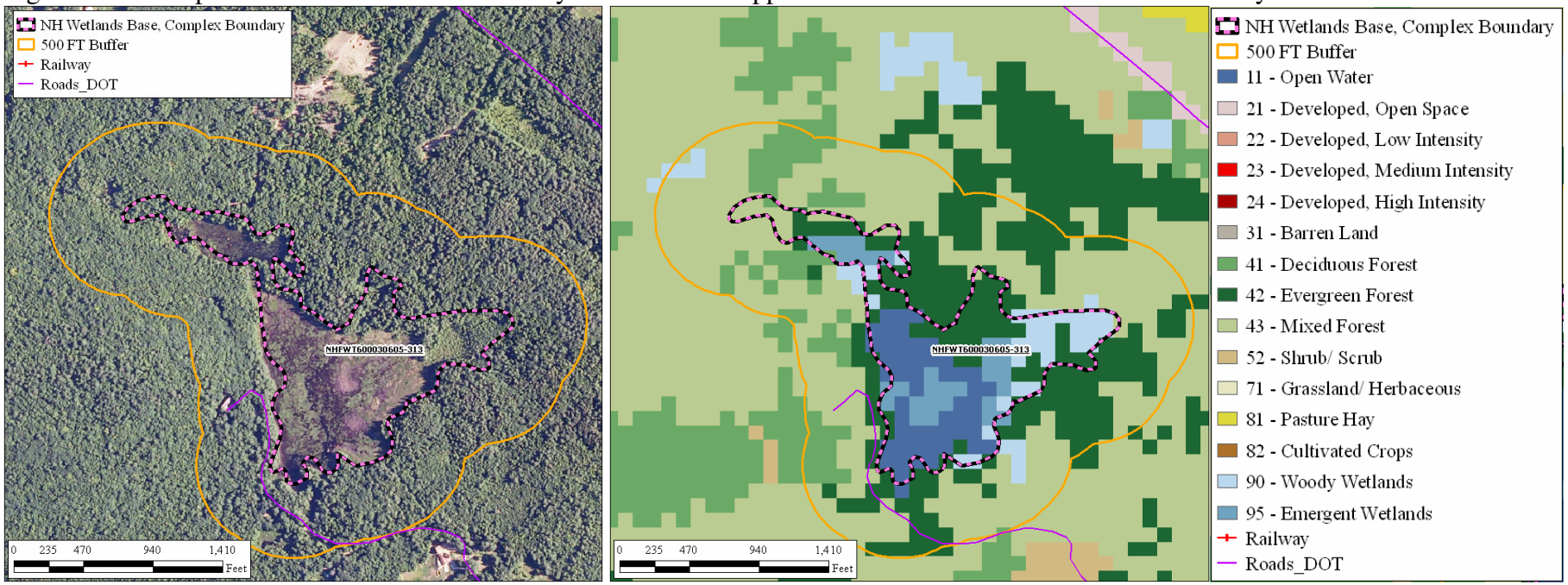


Figure 24. Example of score 0.5.

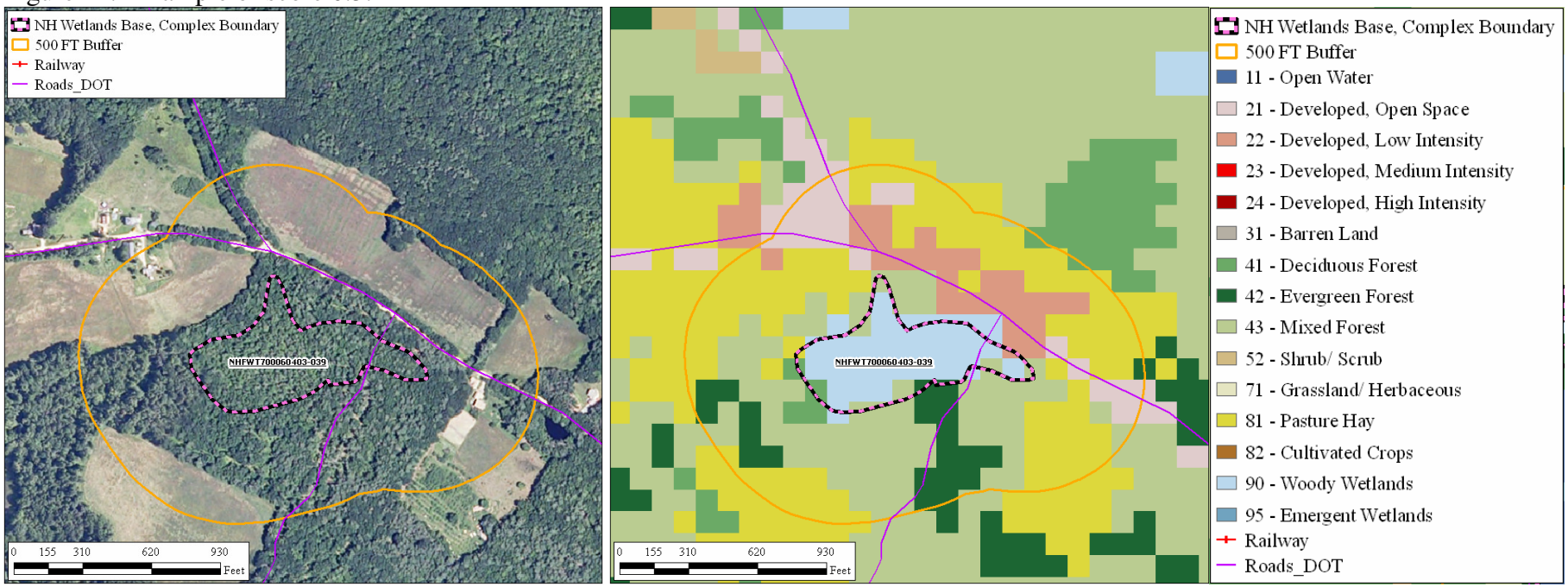


Figure 25. Example of score 0.1

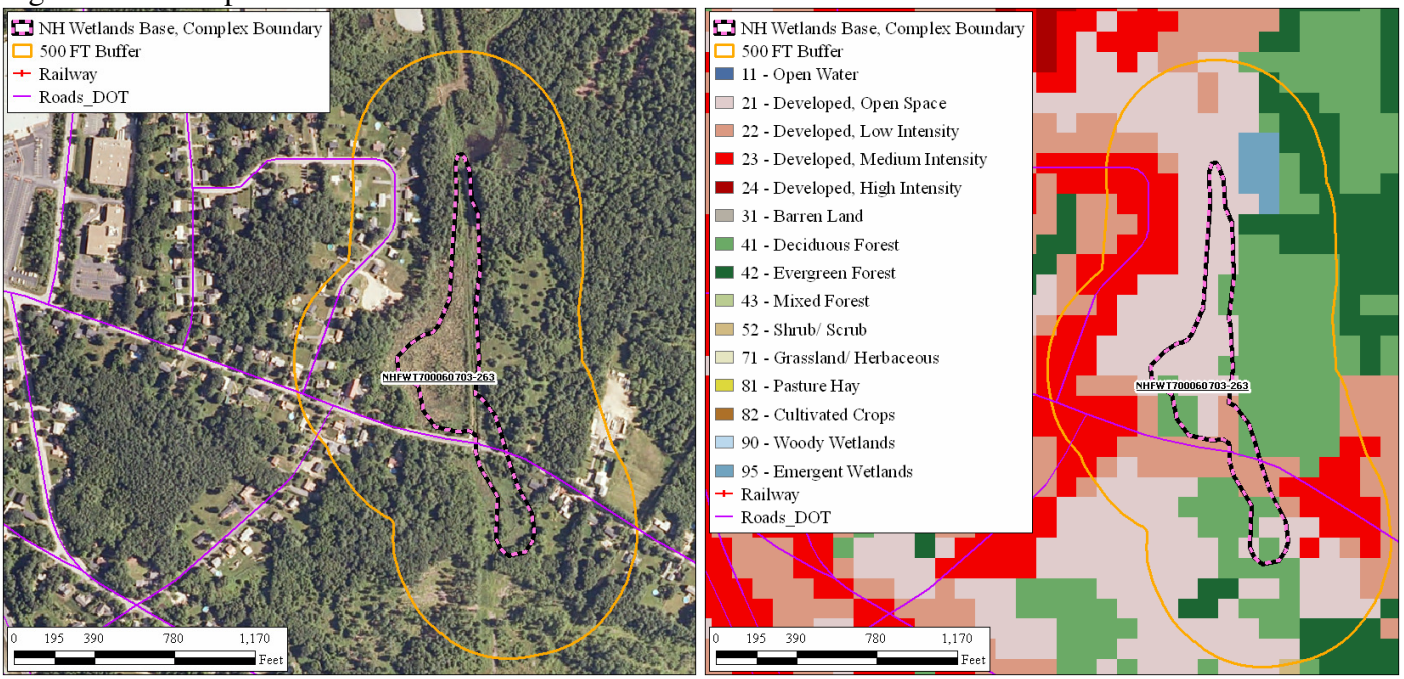
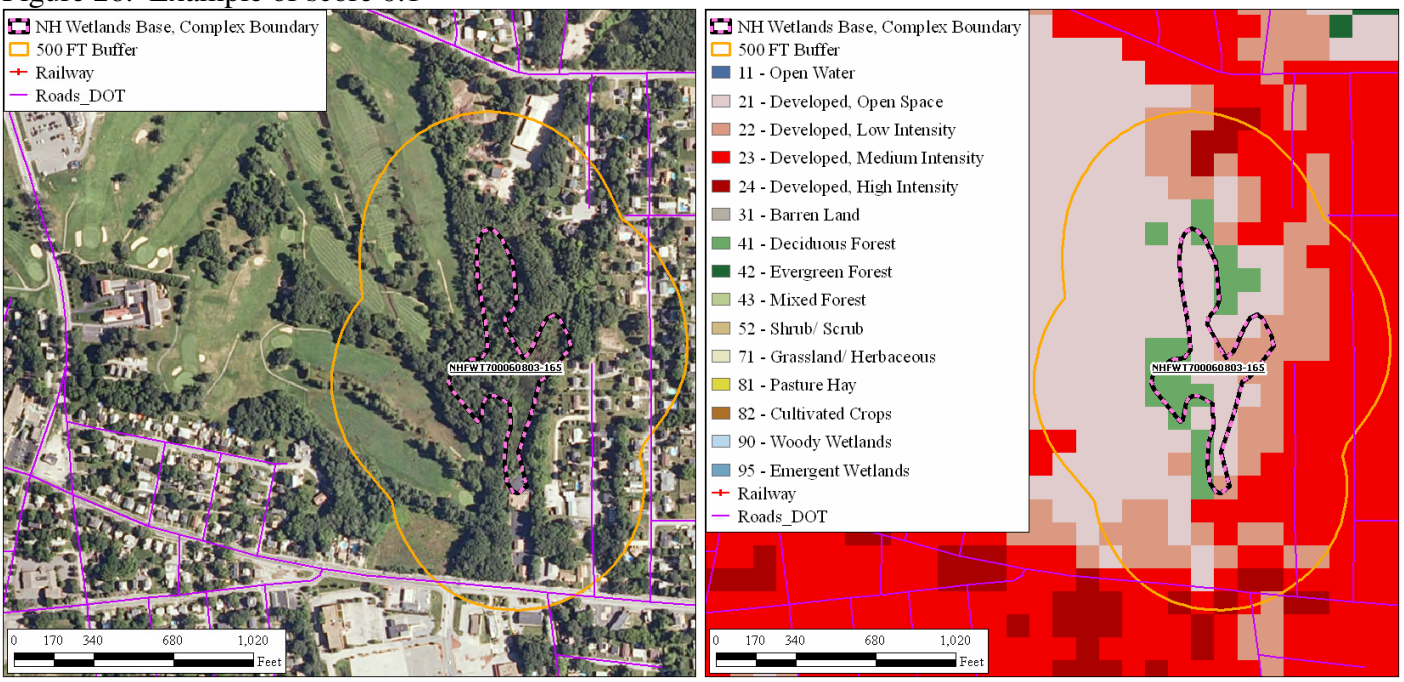


Figure 26. Example of score 0.1



Ecological Integrity – Buildings within 500 Feet [01-09]

The distribution of scores and a State level map of the scores for Ecological Integrity – Buildings within 500 Feet are provided on PLATE 7 (near the end of this memorandum). Figure 27 through Figure 32 provide examples of sites that score 0.1, 0.3, 0.5, 0.55, 0.75, and 1.0. The hybrid Census/NLCD approach did a reasonably good job of predicting the number and intensity of structures within 500 feet of a given wetland complex. In areas with low population density and no heavily developed area in the NLCD the large census blocks did cause some wetland complexes to be scored lower (0.75) where a visual interpretation would have maintained a higher score (1.0).

Figure 27. Examples of Score 0.1

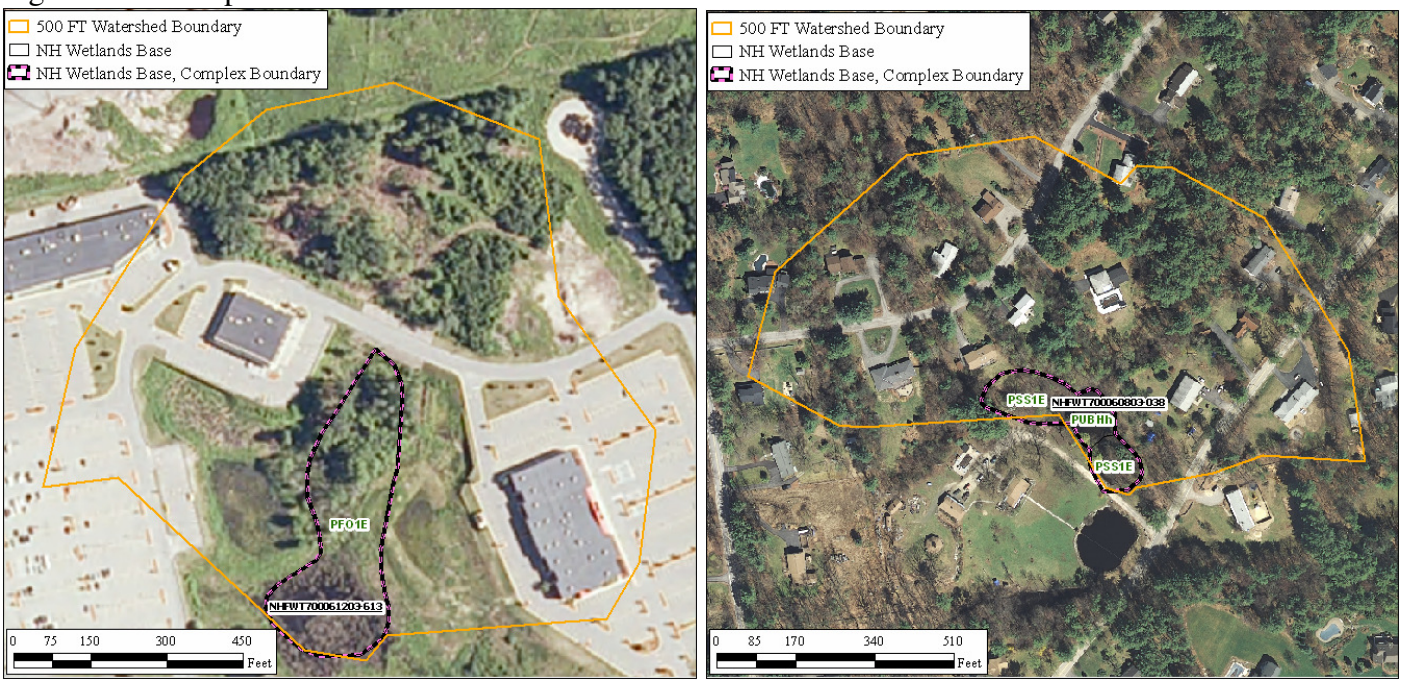


Figure 28. Example of Score 0.3

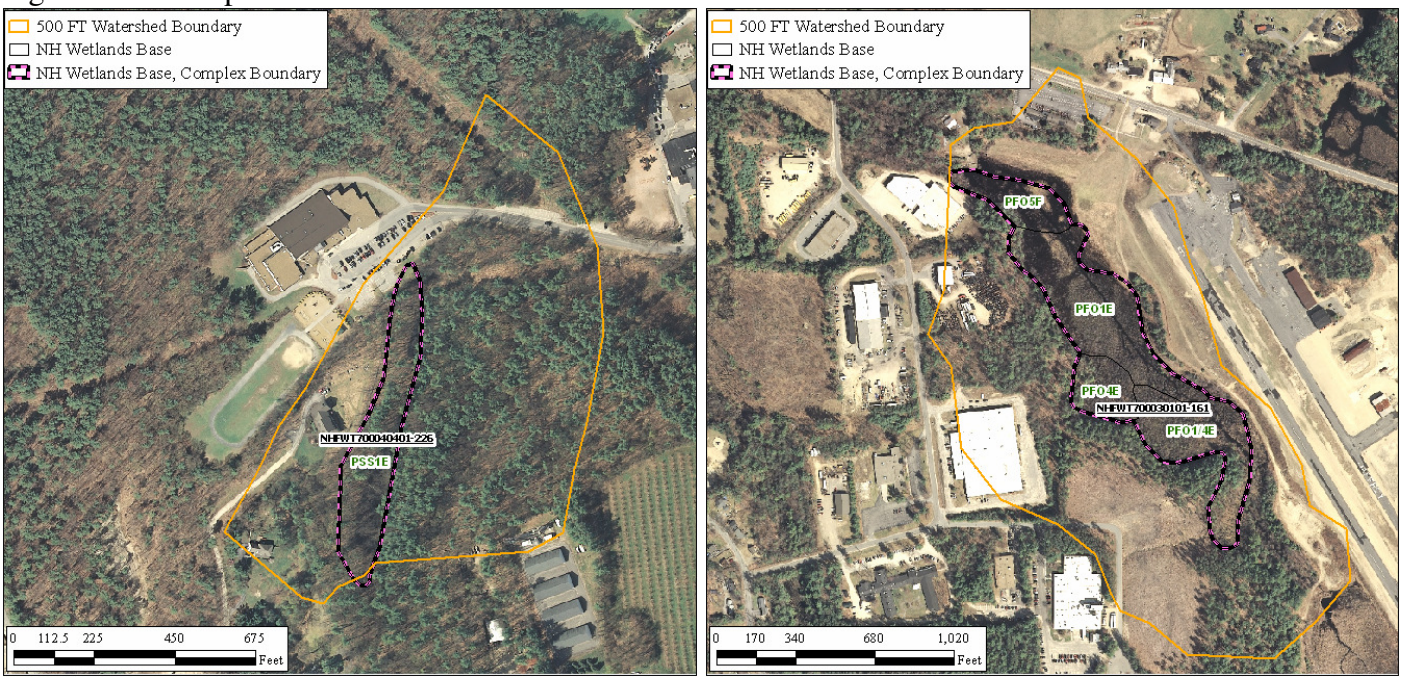


Figure 29. Example of Score 0.5

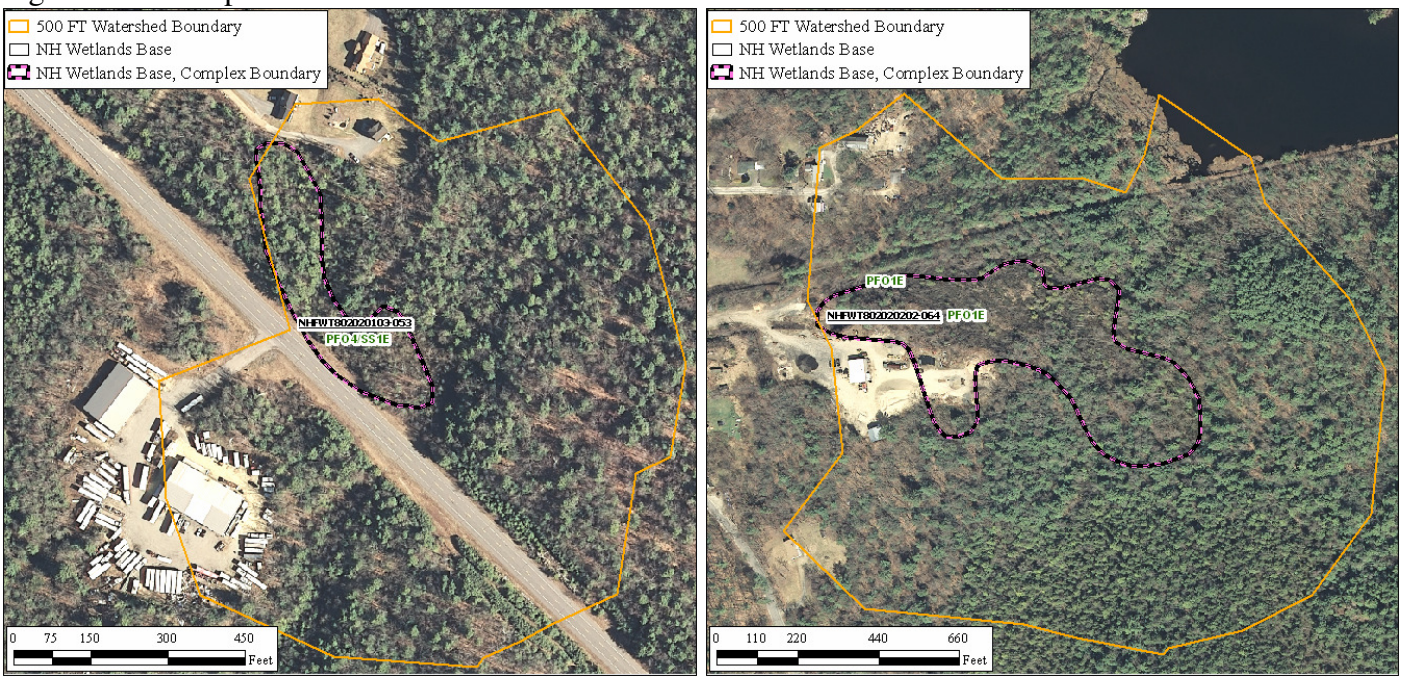


Figure 30. Example of Score 055.

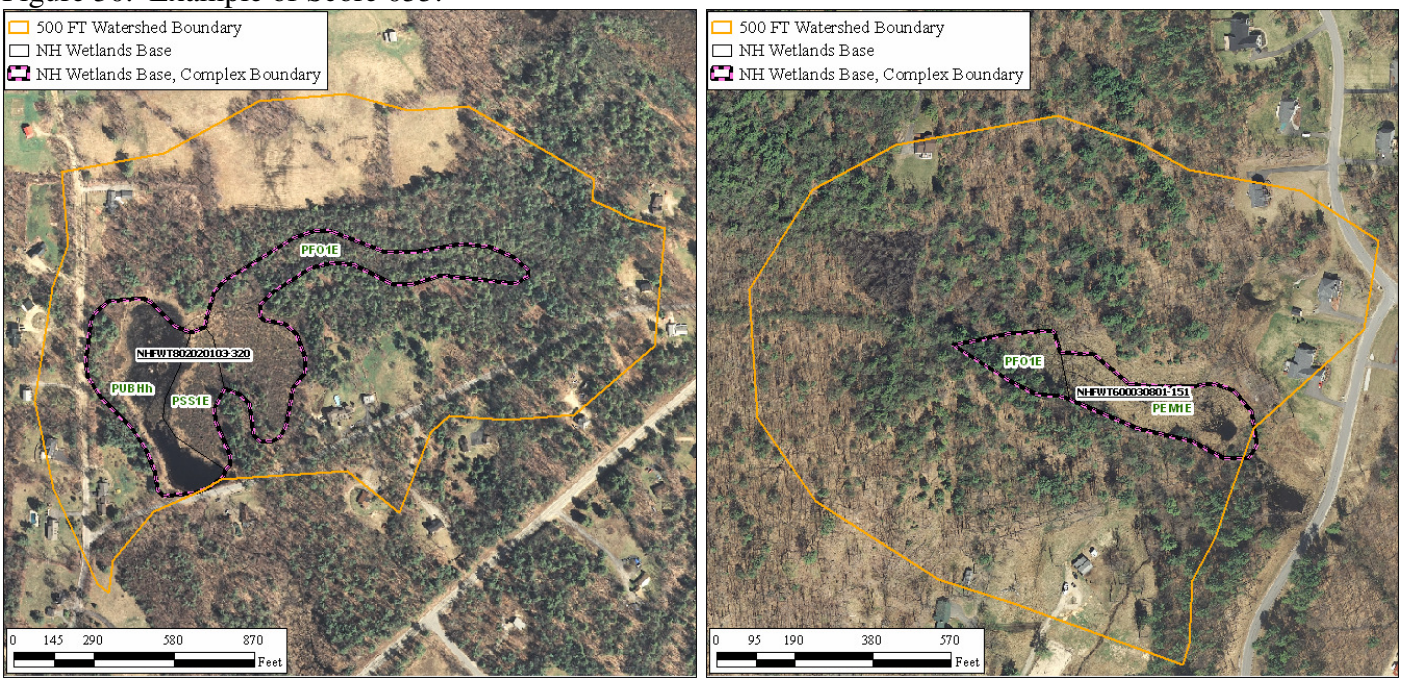


Figure 31. Example of Score 0.75.

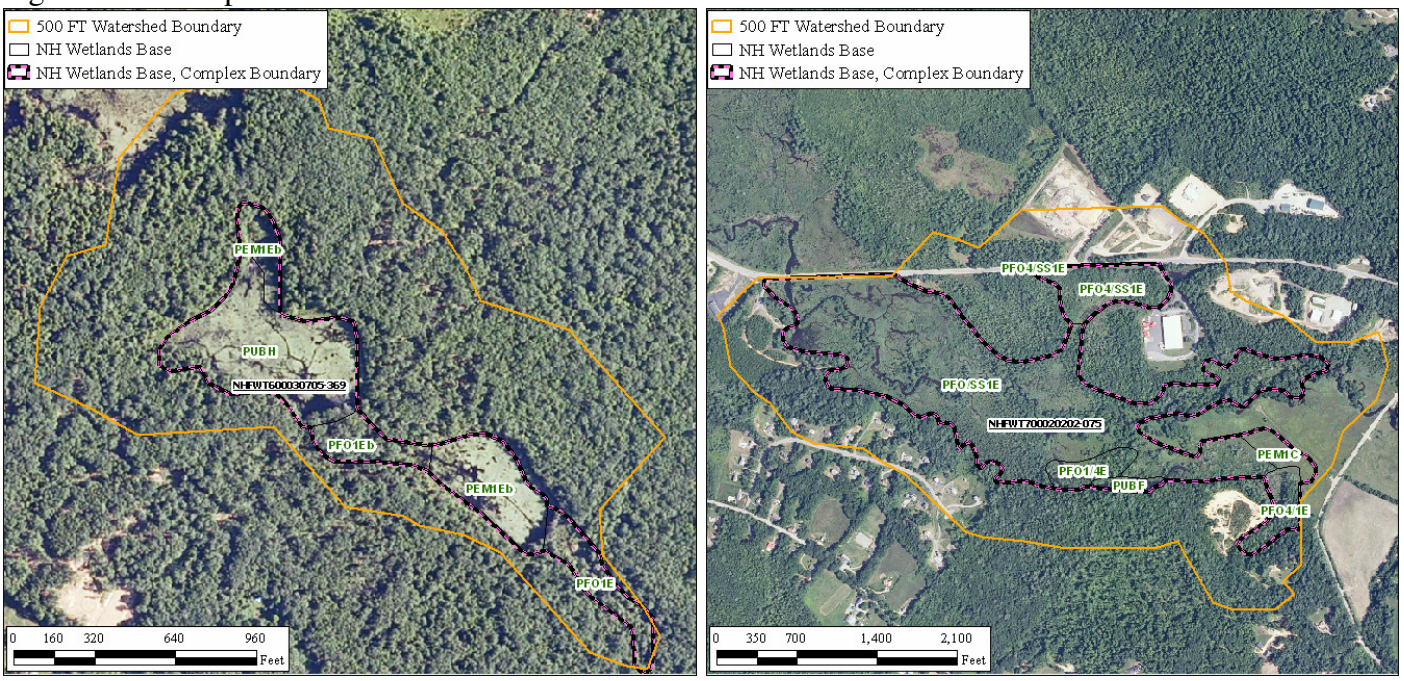
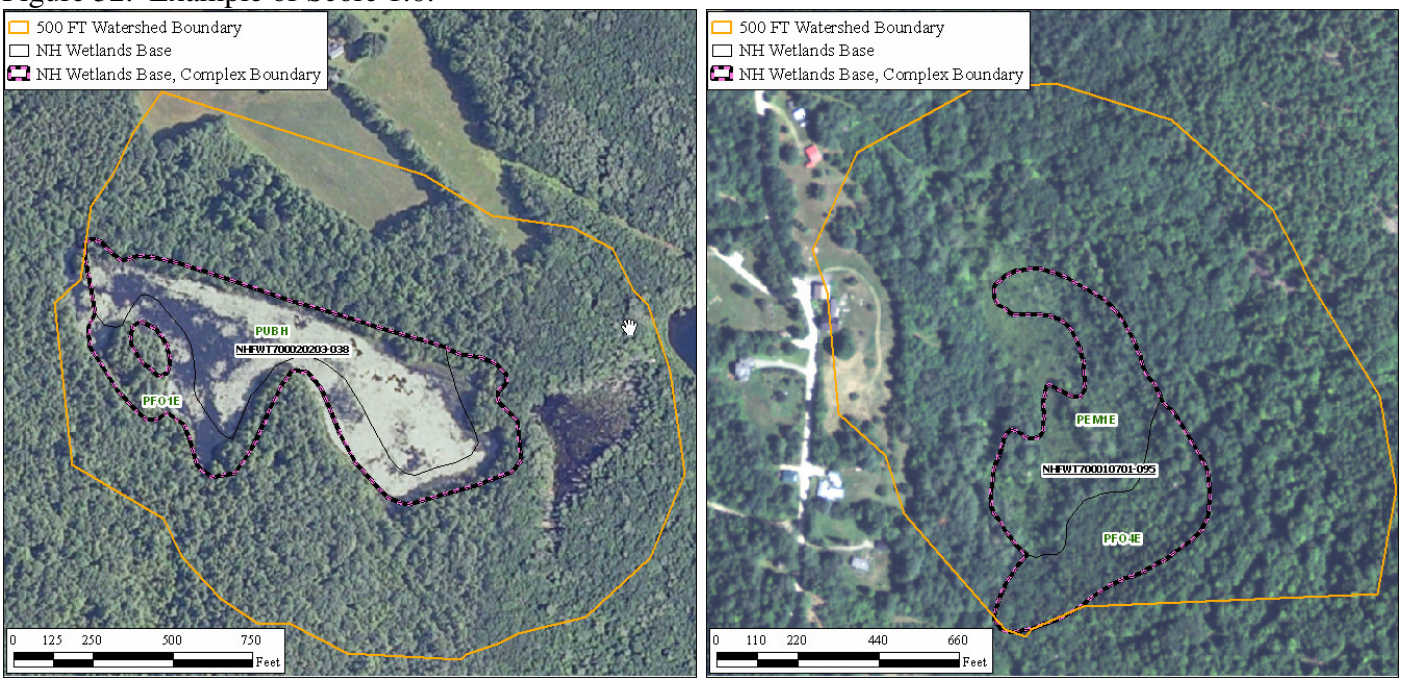


Figure 32. Example of Score 1.0.



Ecological Integrity – Human Made Regulation [01-10]

The distribution of scores and a State level map of the scores for Ecological Integrity – Human Made Regulation are provided on PLATE 8 (near the end of this memorandum). Figure 33, Figure 34 and Figure 35 provide examples of sites that score 0.1, 0.5, and 1.0 respectively.

Figure 33. Examples of Score 0.1

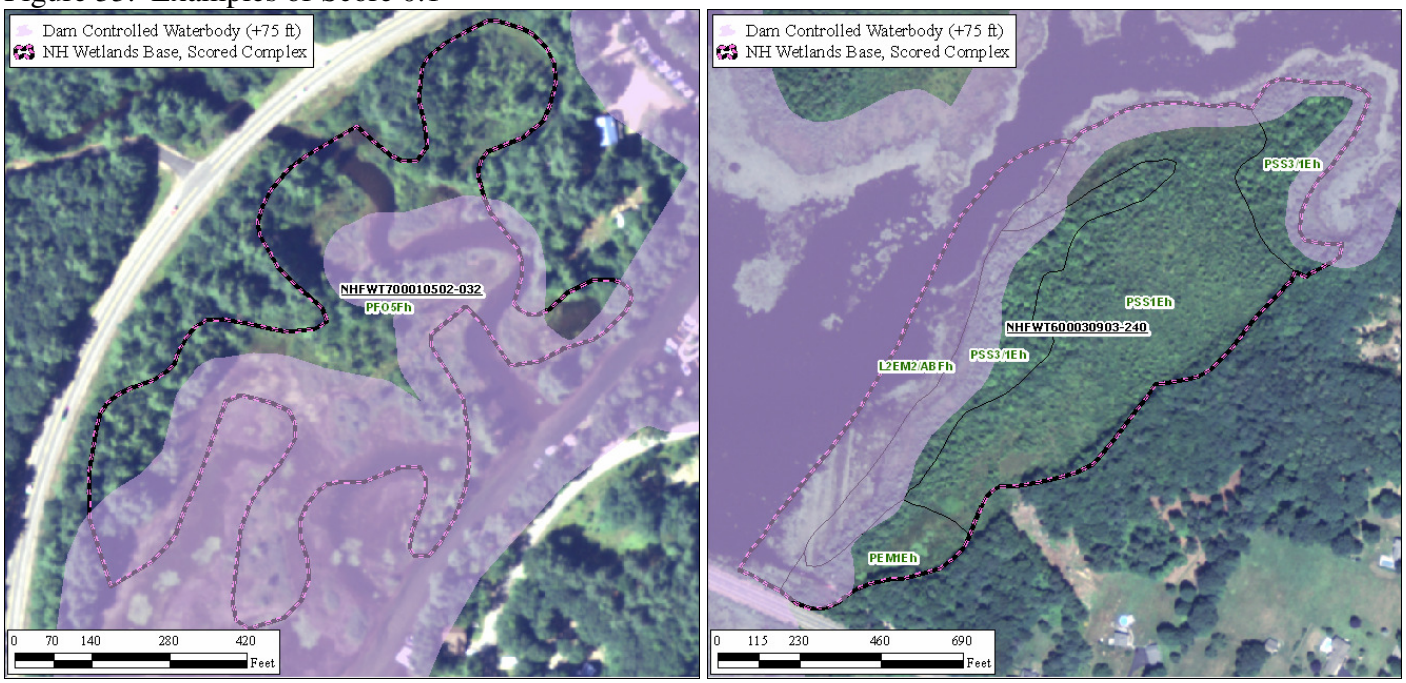


Figure 34. Examples of Score 0.5

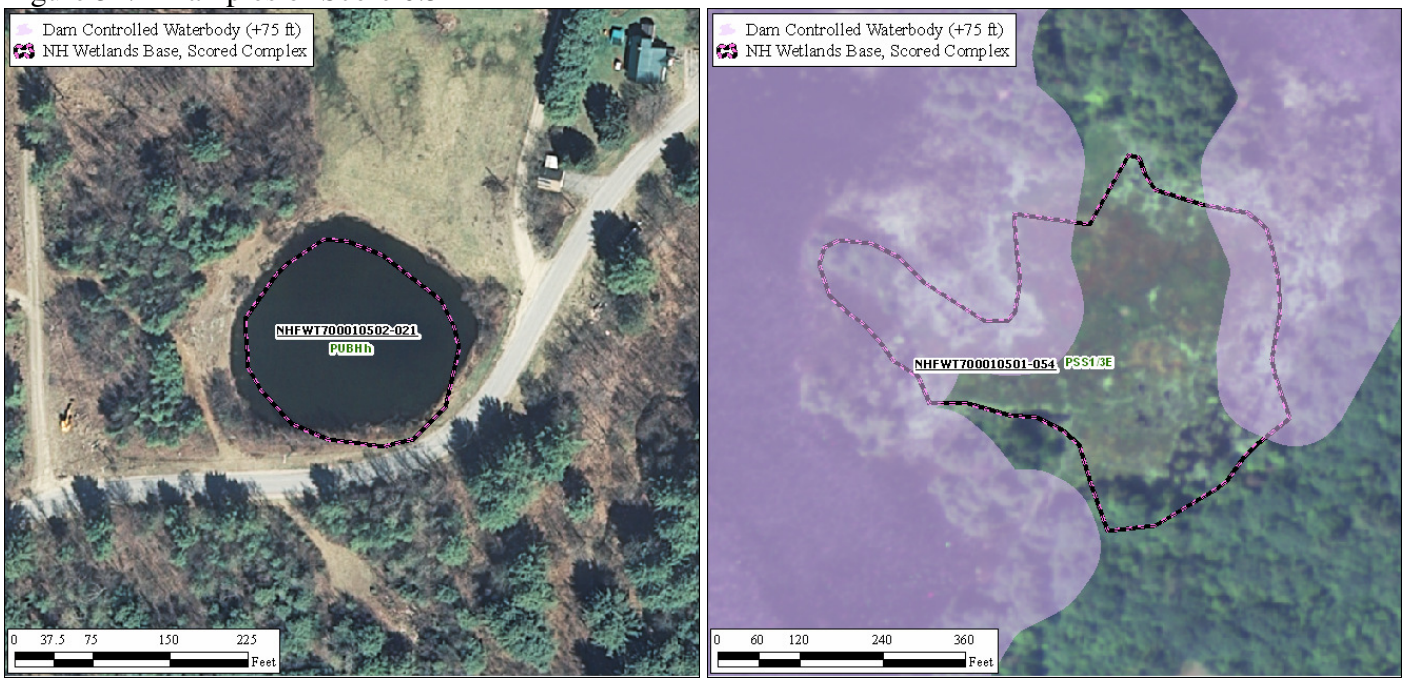
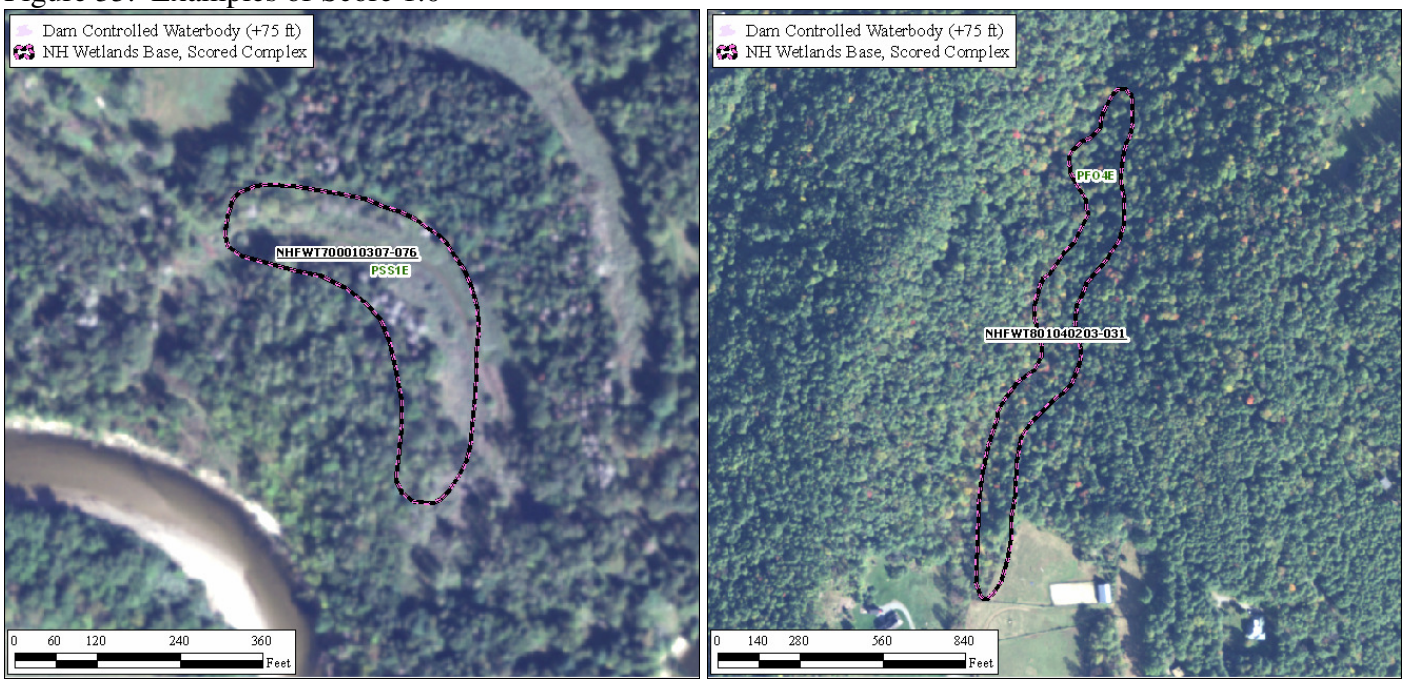


Figure 35. Examples of Score 1.0



Wildlife Habitat – Travel Corridors [02-08]

The distribution of scores and a State level map of the scores for Wildlife Habitat – Travel Corridors are provided on PLATE 9 (near the end of this memorandum). Figure 36 through Figure 39 provide examples of sites that score 0.1, 0.5, 0.75, and 1.0 respectively. No particular errors or bias was noted in the output from this model.

Figure 36. Examples of Score 0.1

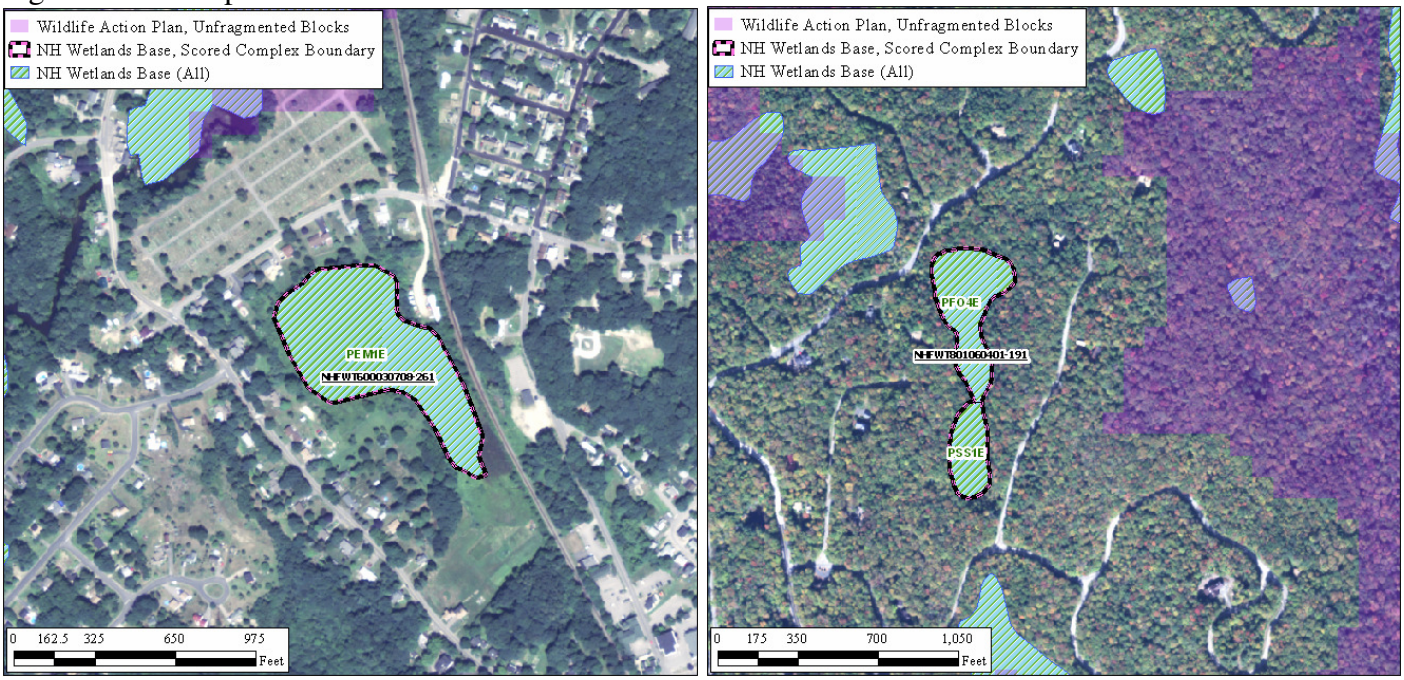


Figure 37. Examples of Score 0.5

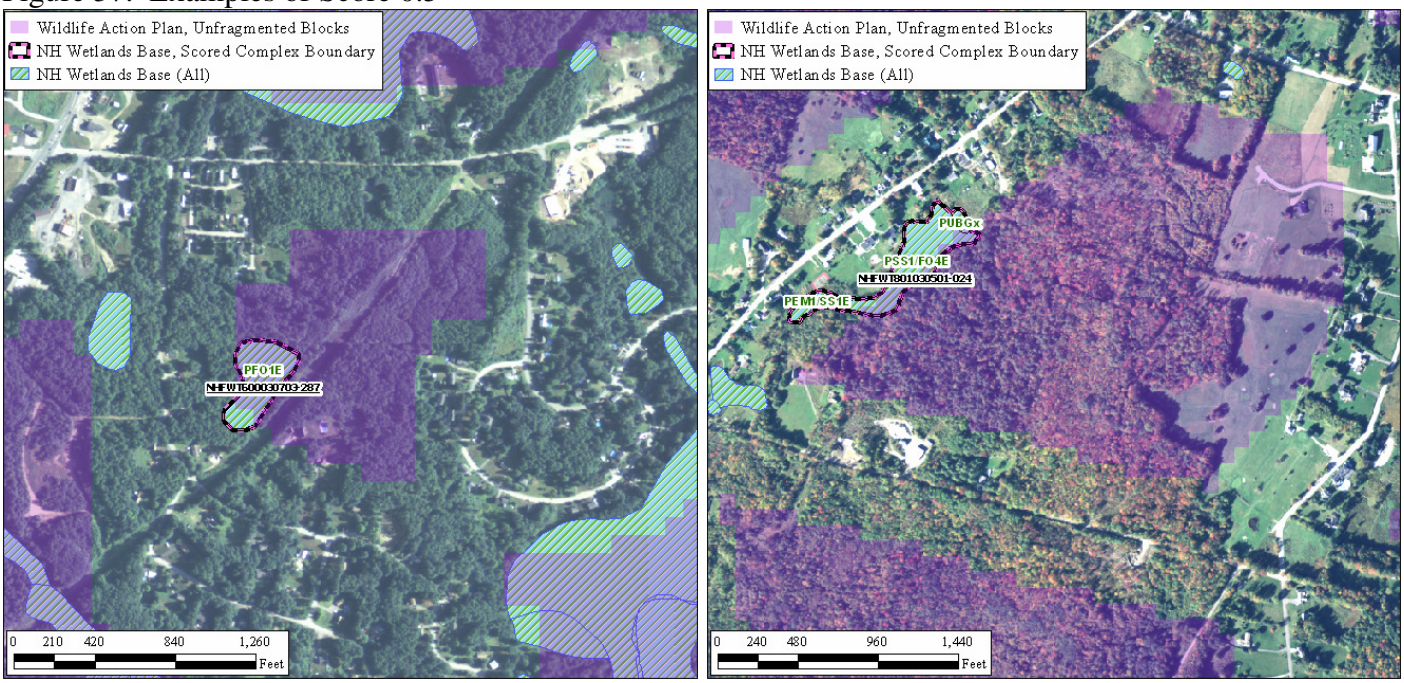


Figure 38. Examples of Score 0.75

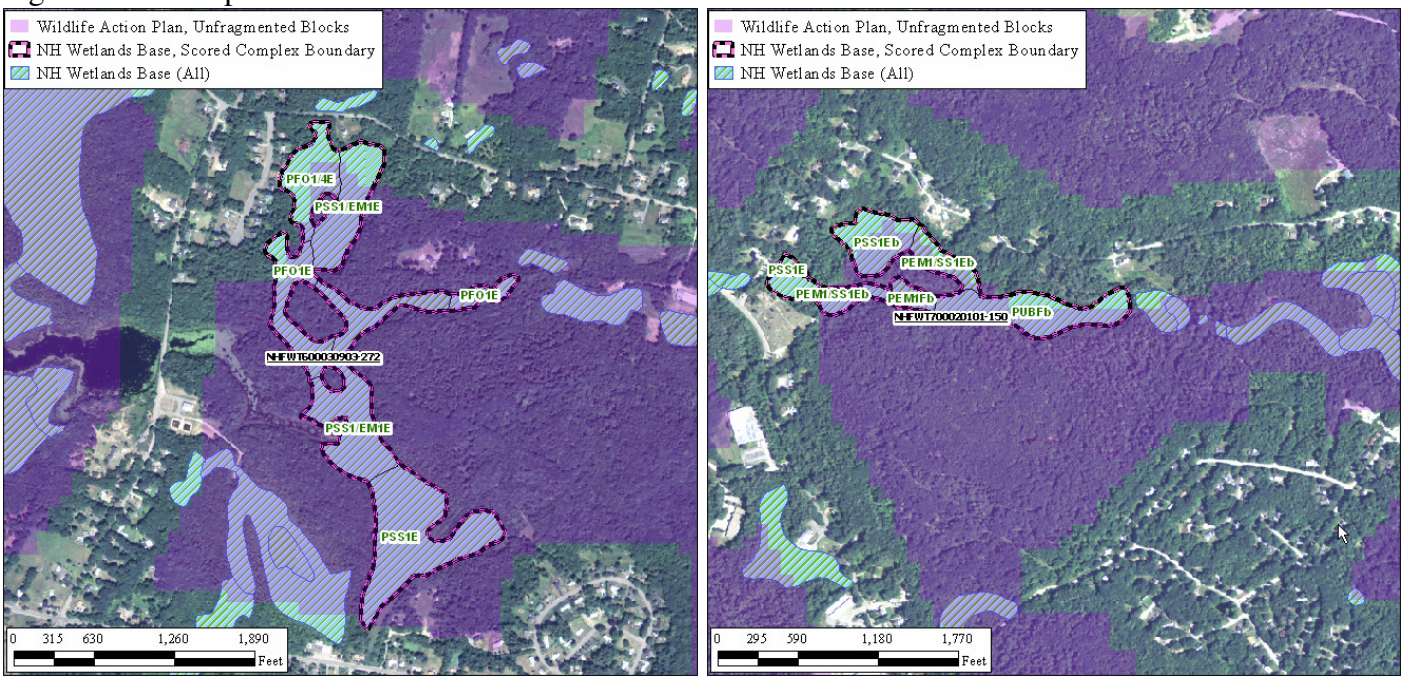
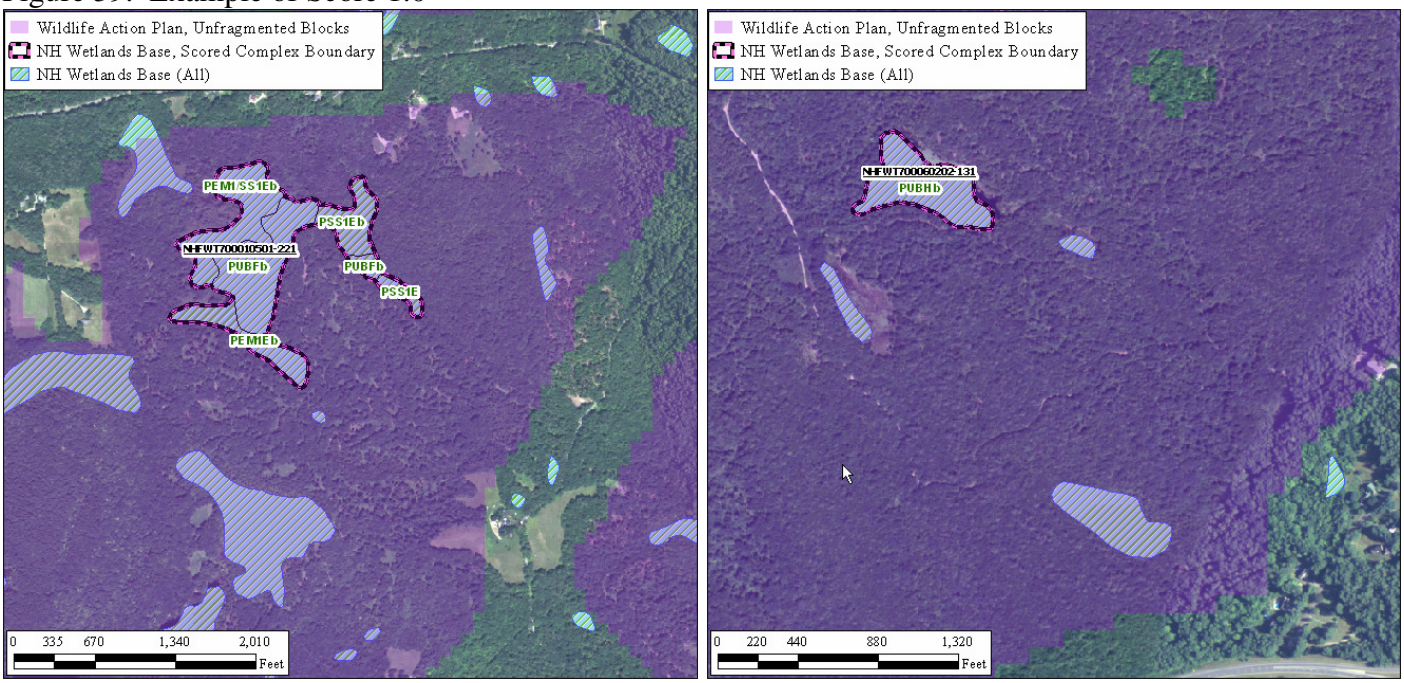


Figure 39. Example of Score 1.0



Wildlife Habitat – Undisturbed Border [02-09]

The distribution of scores and a State level map of the scores for Wildlife Habitat – Undisturbed Border are provided on PLATE 10 (near the end of this memorandum). Figure 40 through Figure 42 provide examples of sites that score 0.1, 0.5, and 1.0. No particular errors or bias was noted in the output from this model.

Figure 40. Example of Score 0.1

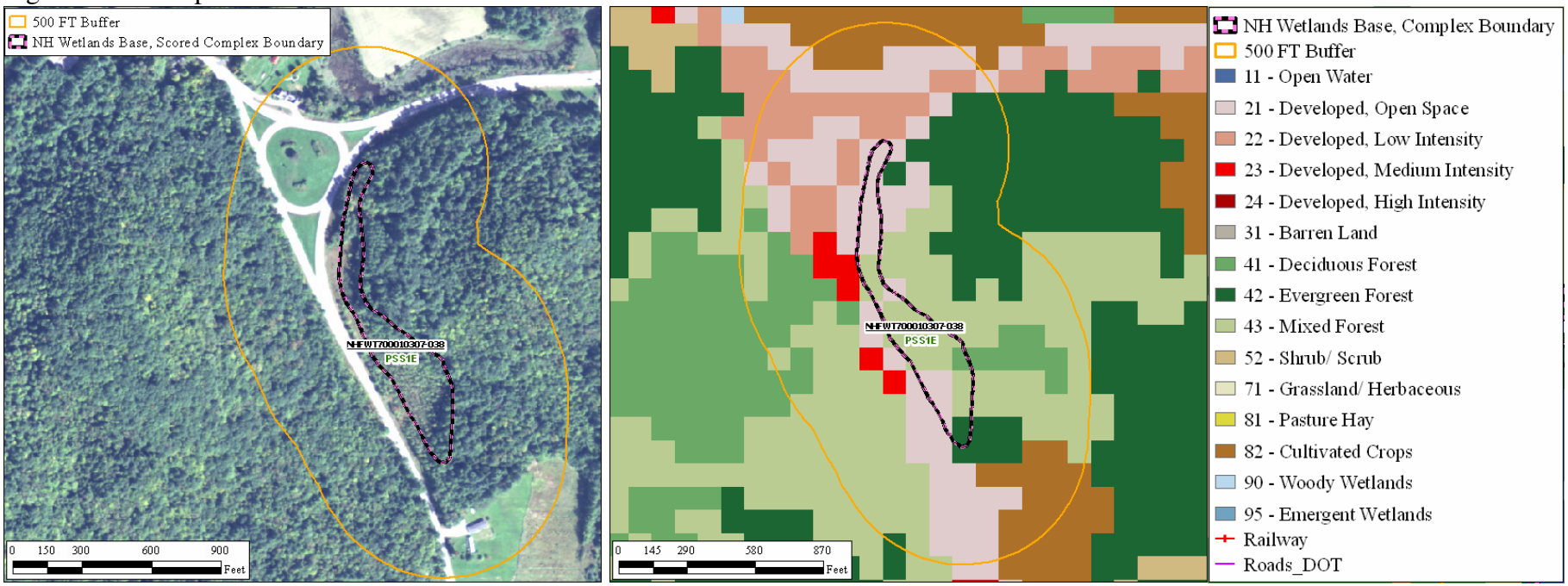


Figure 41. Example of Score 0.5

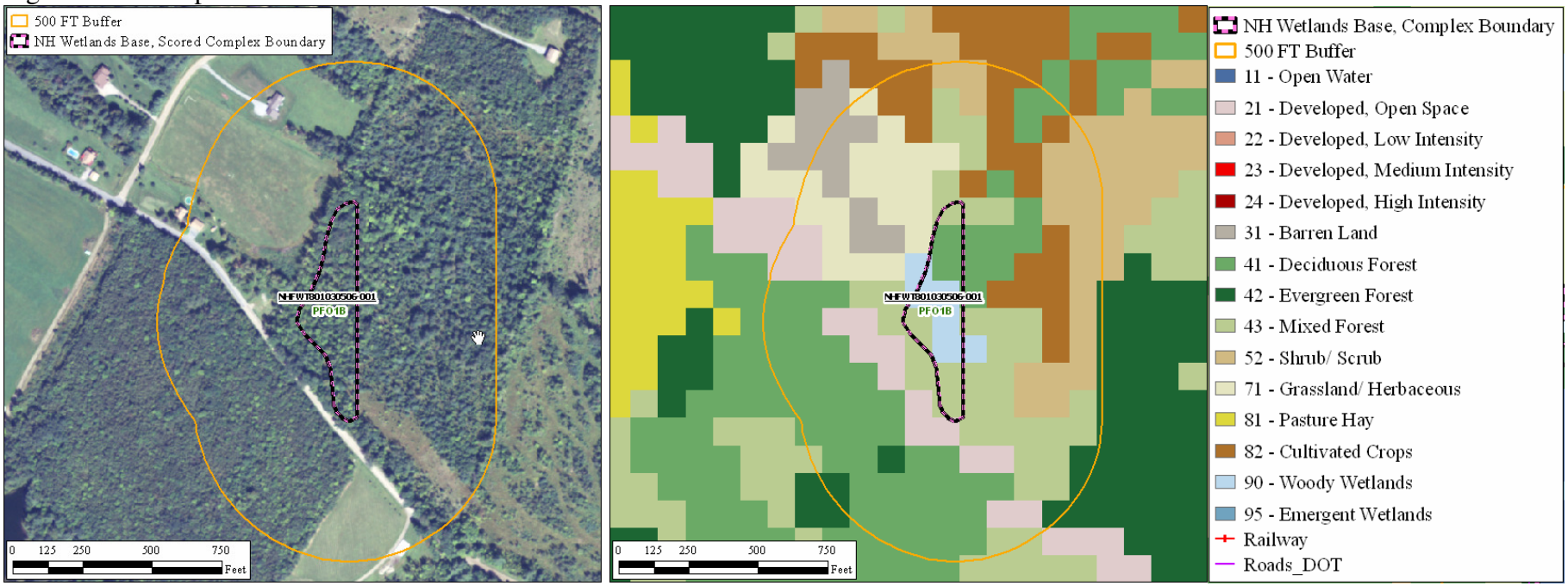
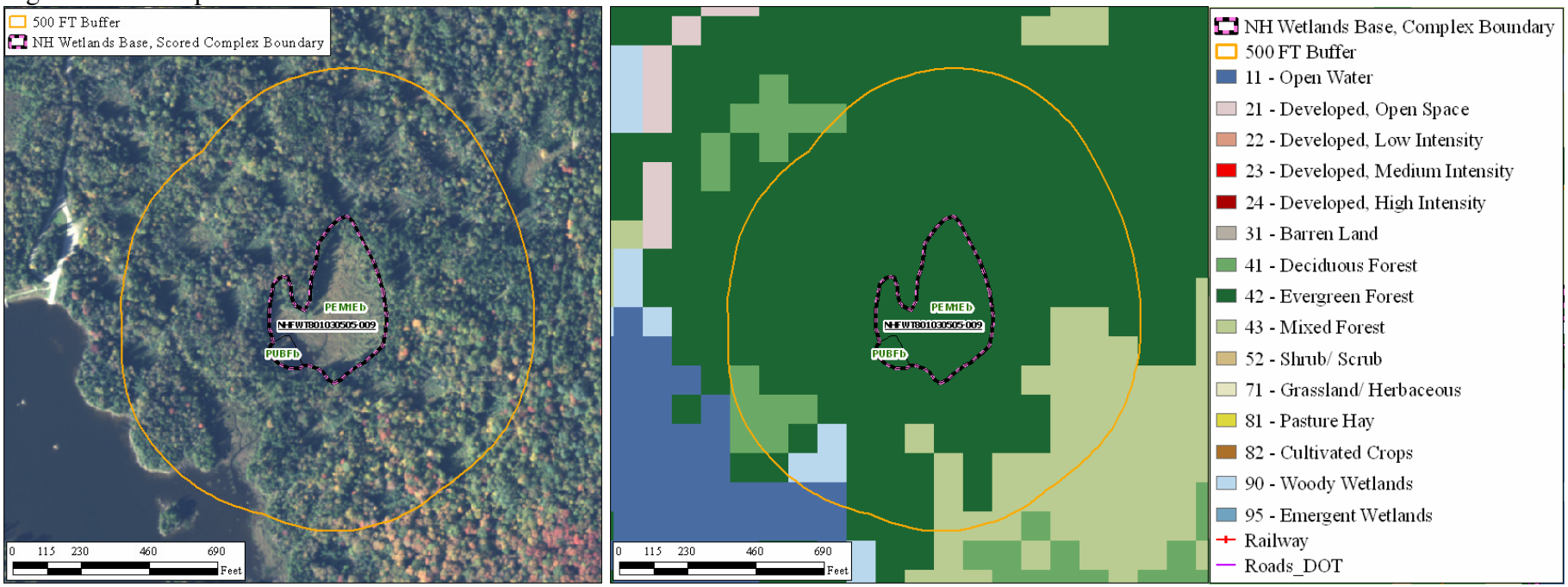


Figure 42. Example of Score 1.0



Fish and Aquatic Habitat – Watershed Dominant Landuse [03-01]

The distribution of scores and a State level map of the scores for Fish and Aquatic Habitat – Watershed Dominant Land Use are provided on PLATE 11 (near the end of this memorandum). Figure 43 through Figure 45 provide examples of sites that score 0.1, 0.5, and 1.0. No particular errors or bias was noted in the output from this model.

Figure 43. Example of Score 0.1

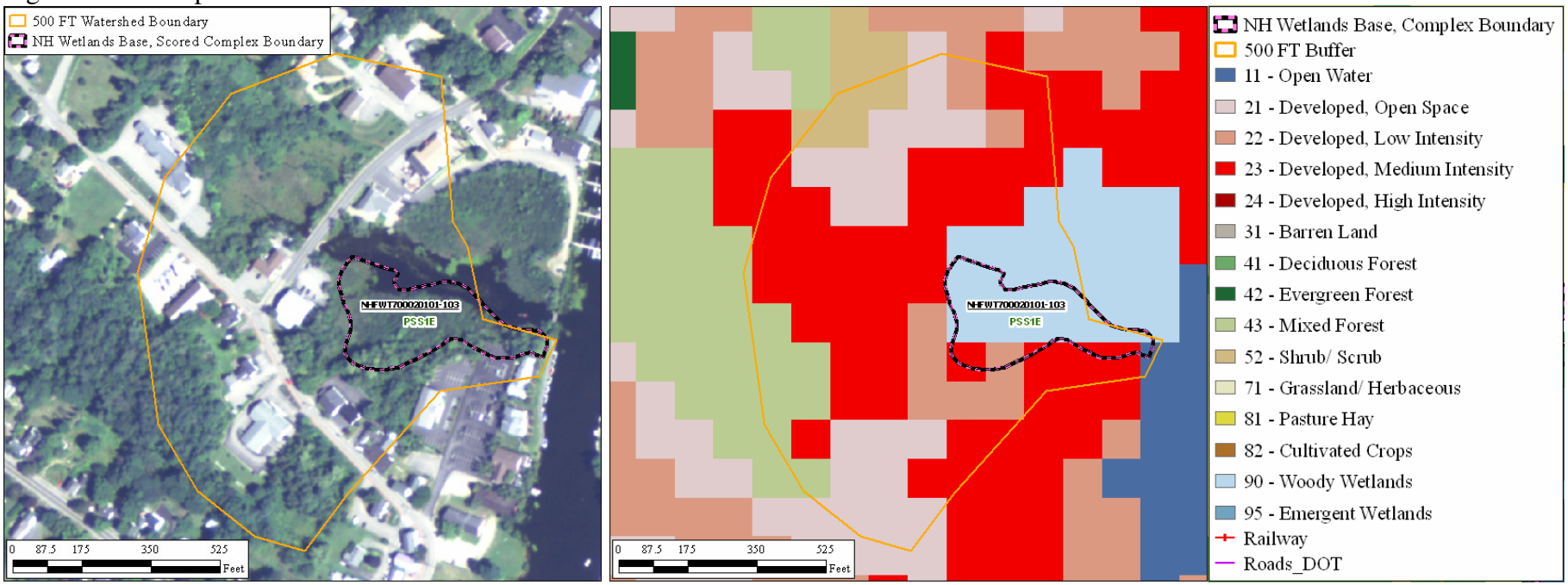


Figure 44. Example of Score 0.5

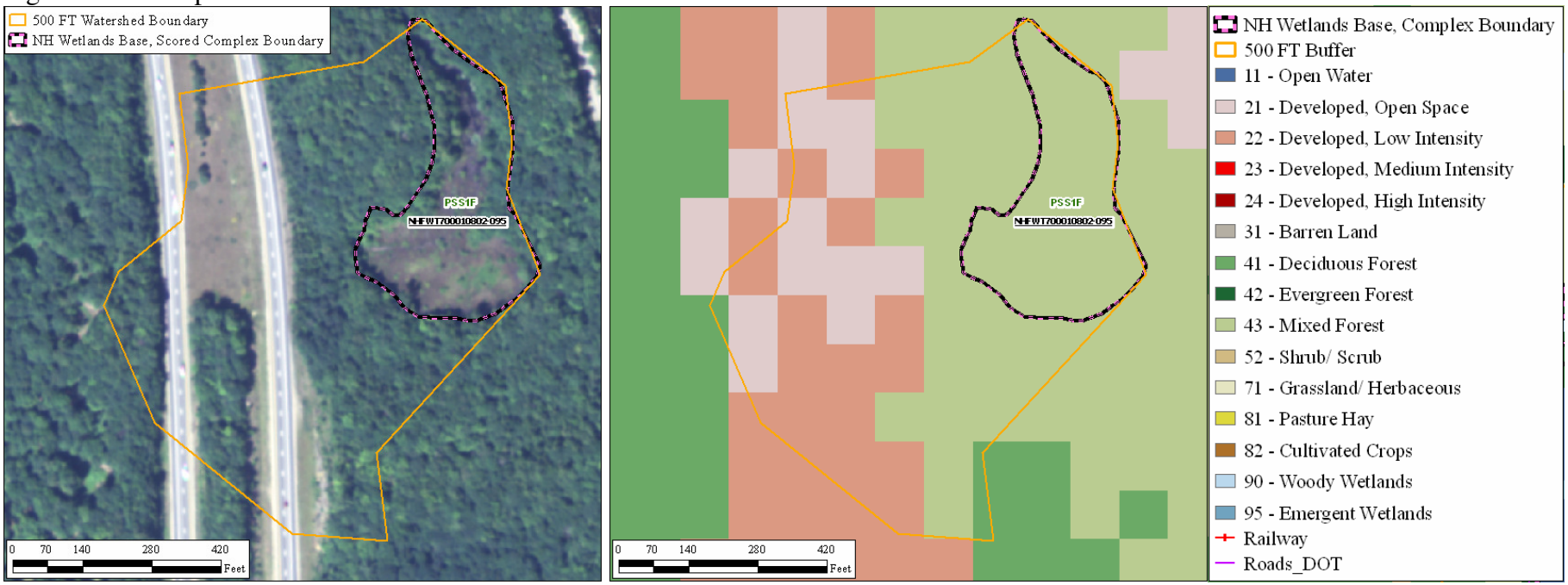
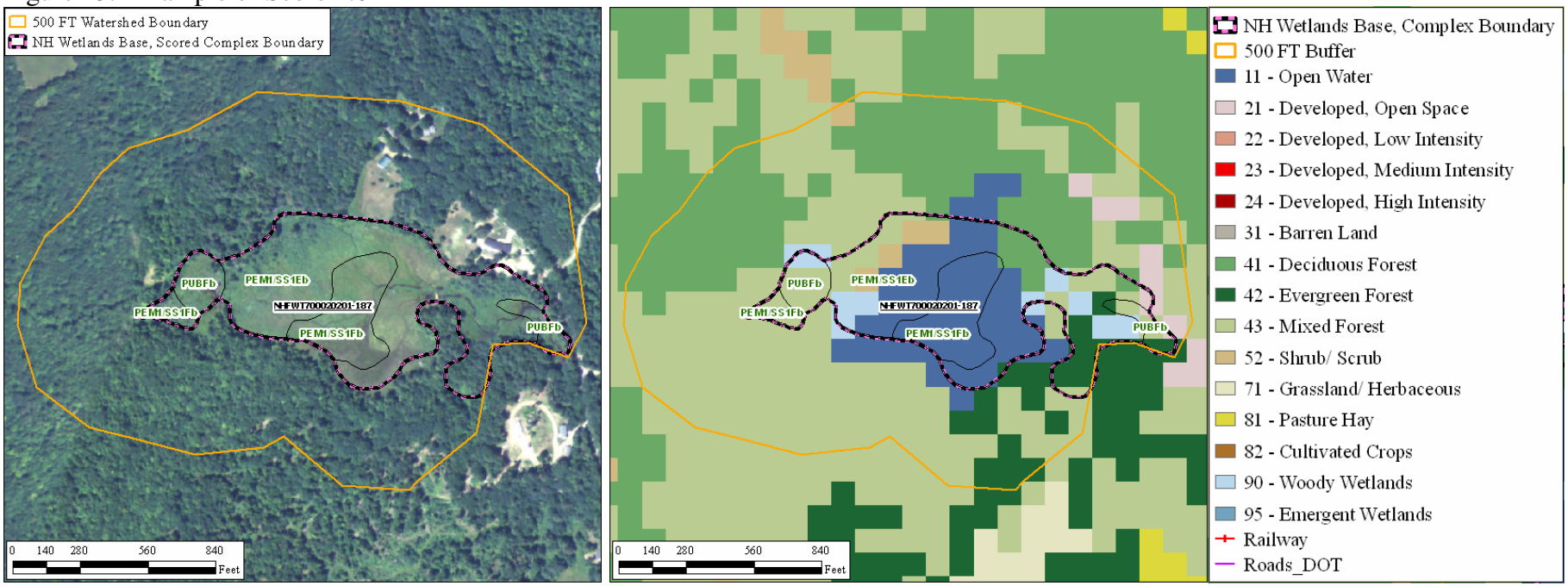


Figure 45. Example of Score 1.0



Fish and Aquatic Habitat – Barriers [03-10]

The distribution of scores and a State level map of the scores for Fish and Aquatic Habitat - Barriers are provided on PLATE 12 (near the end of this memorandum). Figure 46 through Figure 48 provide examples of sites that score 0.1, 0.5, and 1.0. No particular errors or bias was noted in the output from this model.

Figure 46. Examples of Score 0.1

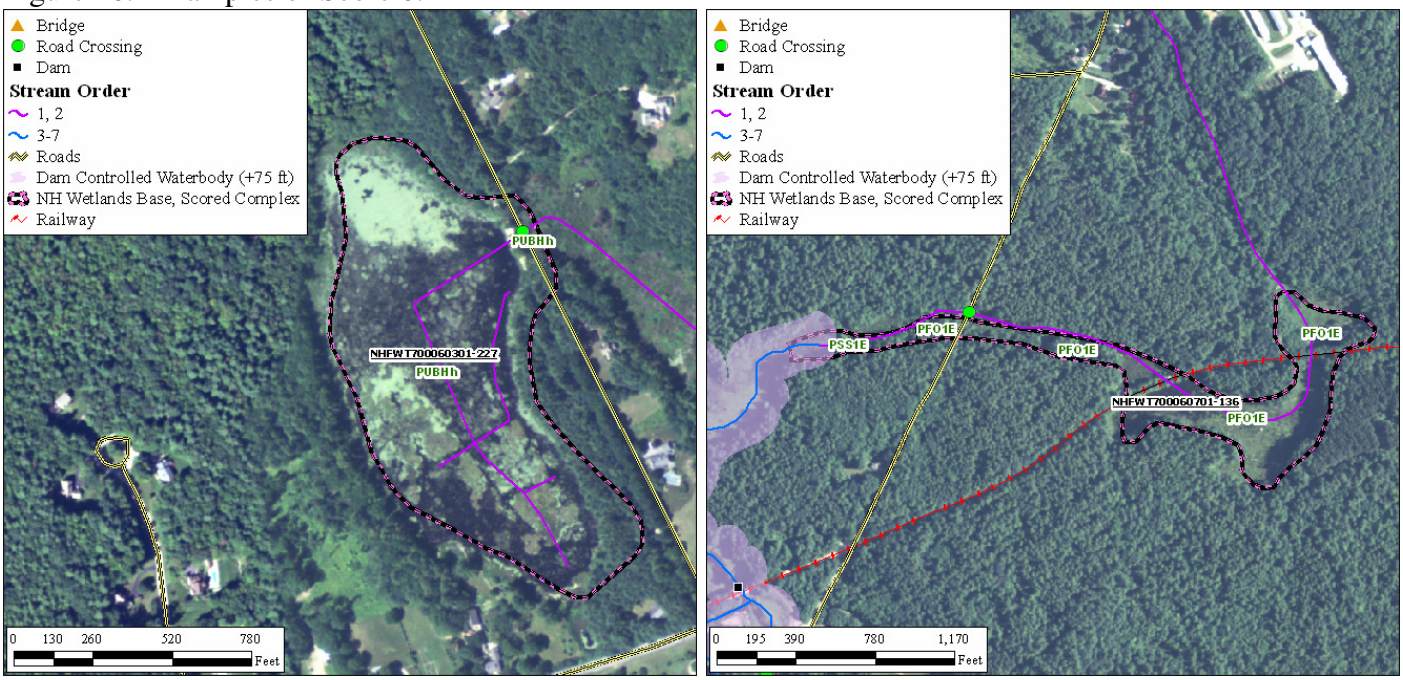


Figure 47. Examples of Score 0.5

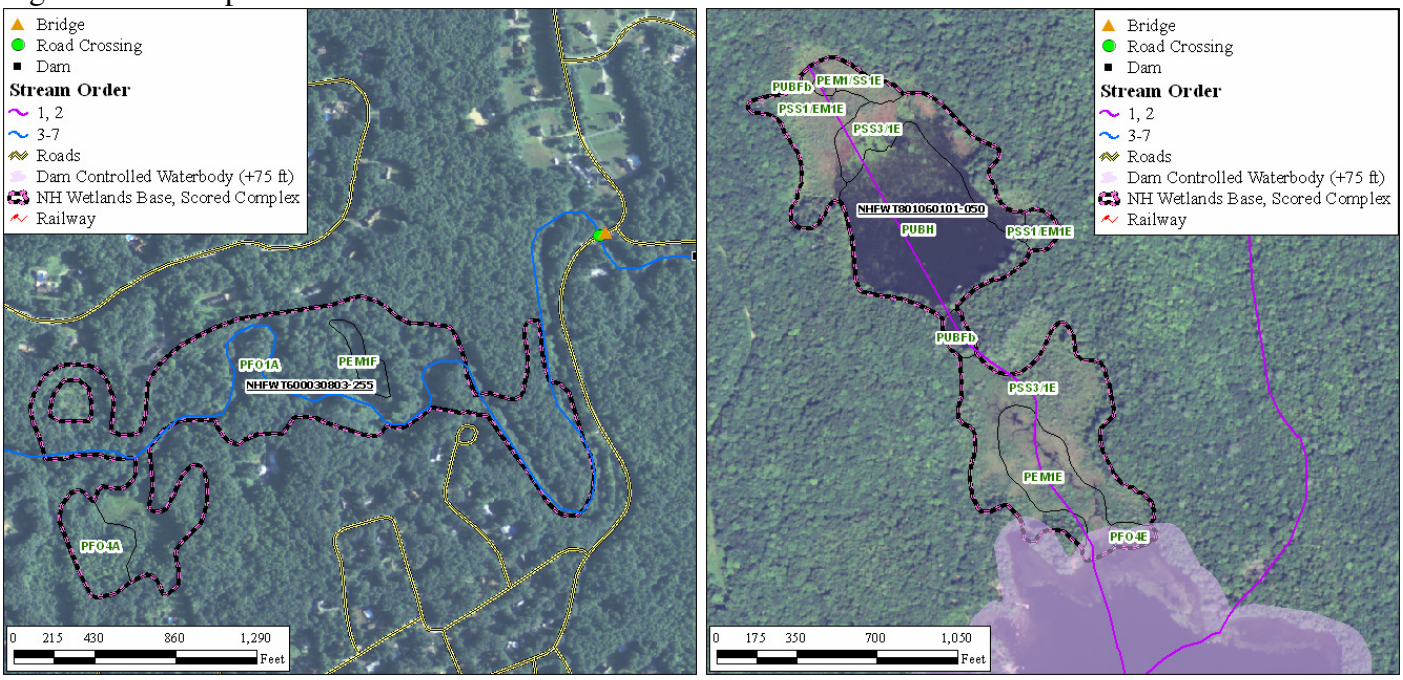
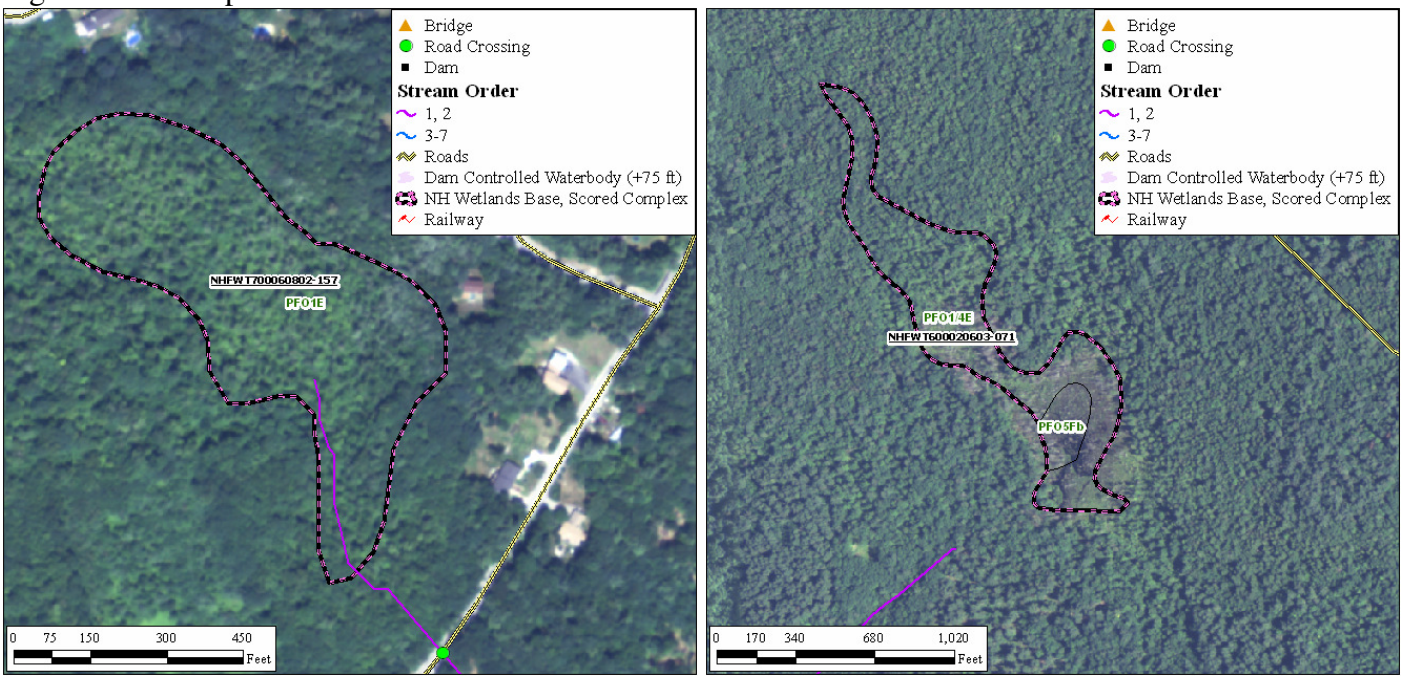


Figure 48. Examples of Score 1.0



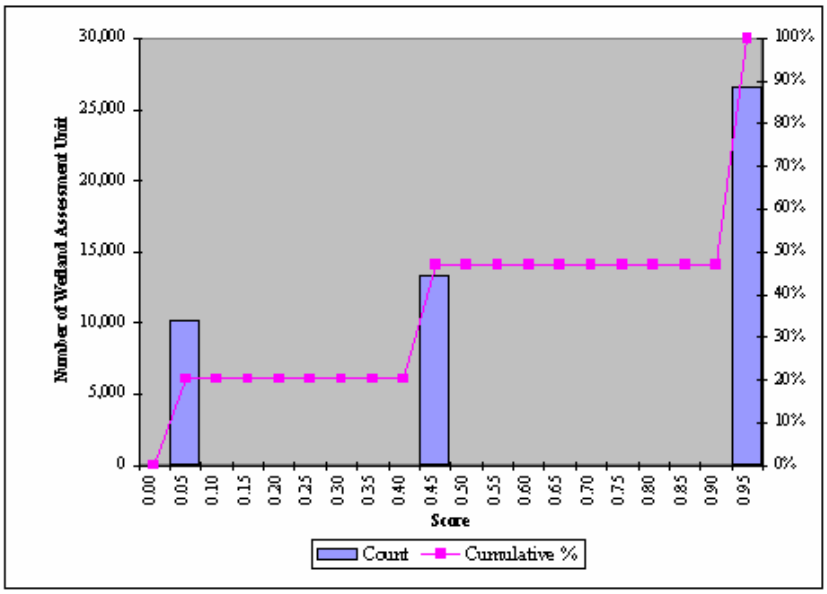
Average for All Questions

The distribution of scores and a State level map of the scores for Average for All Questions are provided on PLATE 13 (at the end of this memorandum). None of the complexes had an average score lower than 0.35. Over 99 percent of the wetland complexes had a score of 0.5 or better, approximately 50% of the complexes scored higher than 0.85 and approximately 31 percent scored higher than 0.95.

PLATE 1. ECOLOGICAL INTEGRITY – WATER QUALITY DEGRADATION IN WATERSHED.

1 – ECOLOGICAL INTEGRITY 1. Has water quality in the wetland been degraded by land use in the wetland's watershed?

Score	*Count*	*Cumulative %*
Not Scored	2,362	NA
0.05	0	0.00%
0.10	10,124	20.22%
0.15	0	20.22%
0.20	0	20.22%
0.25	0	20.22%
0.30	0	20.22%
0.35	0	20.22%
0.40	0	20.22%
0.45	0	20.22%
0.50	13,320	46.83%
0.55	0	46.83%
0.60	0	46.83%
0.65	0	46.83%
0.70	0	46.83%
0.75	0	46.83%
0.80	0	46.83%
0.85	0	46.83%
0.90	0	46.83%
0.95	0	46.83%
1.00	26,620	100.00%



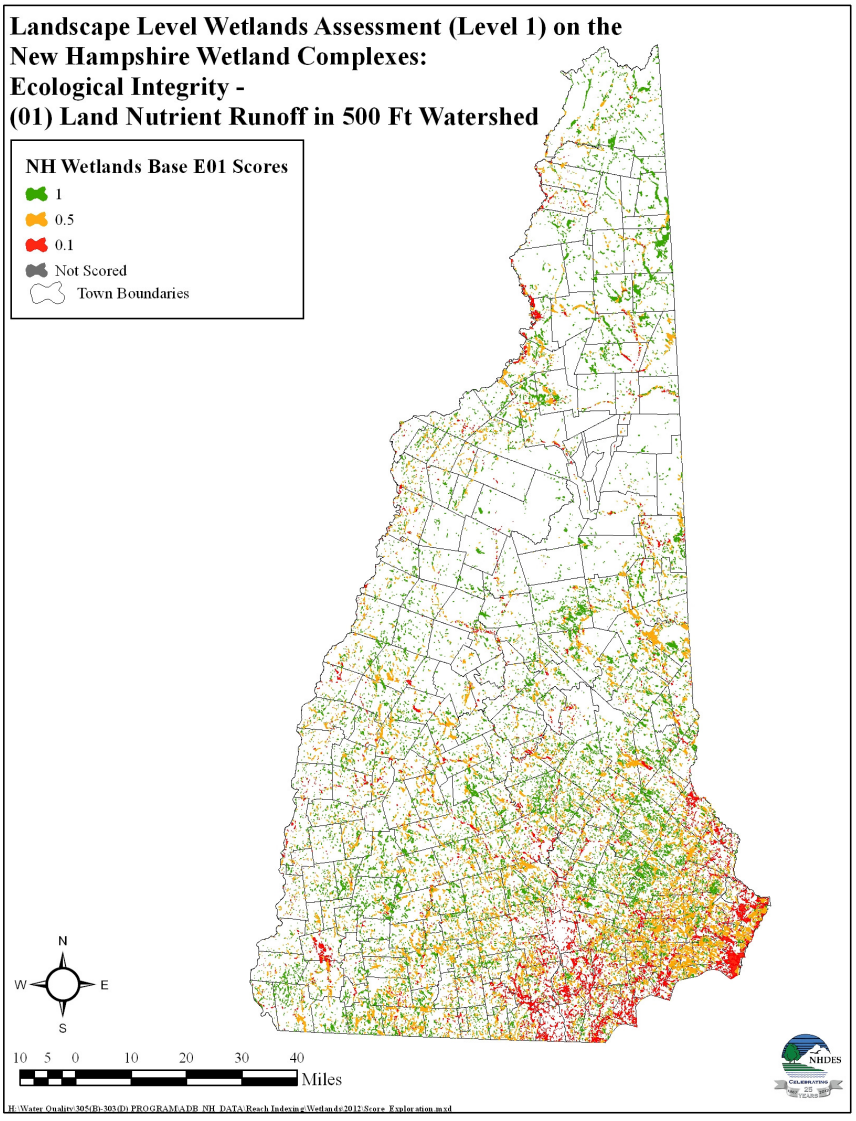
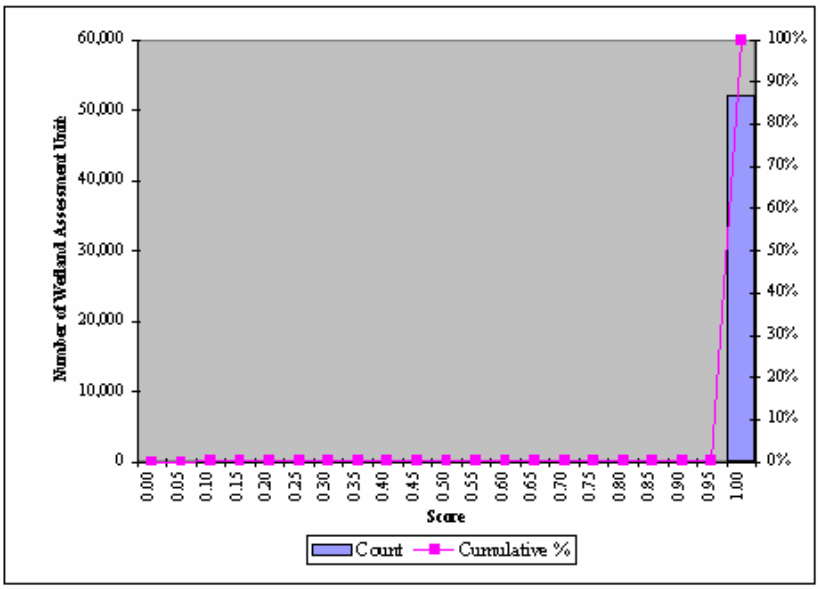


PLATE 2. ECOLOGICAL INTEGRITY – EVIDENCE OF FILL.

1 – ECOLOGICAL INTEGRITY 2. Is there evidence of fill in the wetland?

Score	*Count*	*Cumulative %*
0.00	0	0.00%
0.05	0	0.00%
0.10	125	0.24%
0.15	0	0.24%
0.20	0	0.24%
0.25	0	0.24%
0.30	0	0.24%
0.35	0	0.24%
0.40	0	0.24%
0.45	0	0.24%
0.50	105	0.44%
0.55	0	0.44%
0.60	0	0.44%
0.65	0	0.44%
0.70	0	0.44%
0.75	0	0.44%
0.80	0	0.44%
0.85	0	0.44%
0.90	0	0.44%
0.95	0	0.44%
1.00	52,196	100.00%



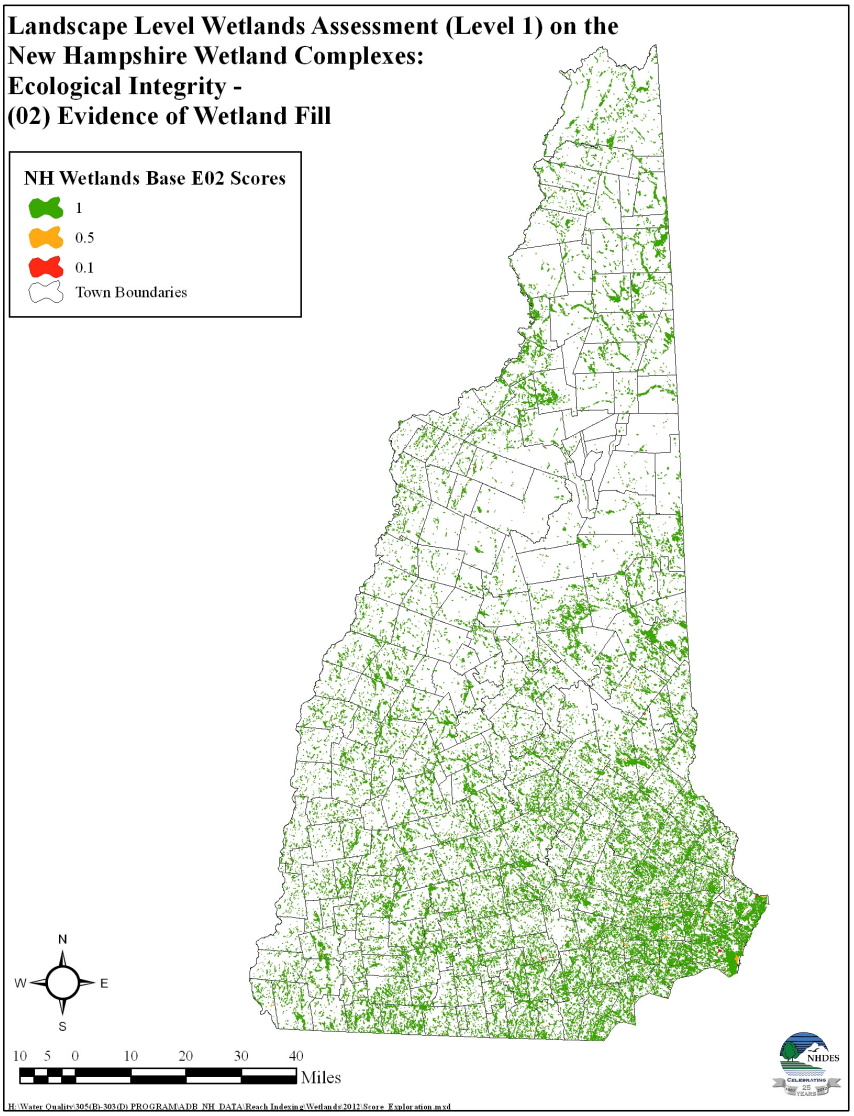
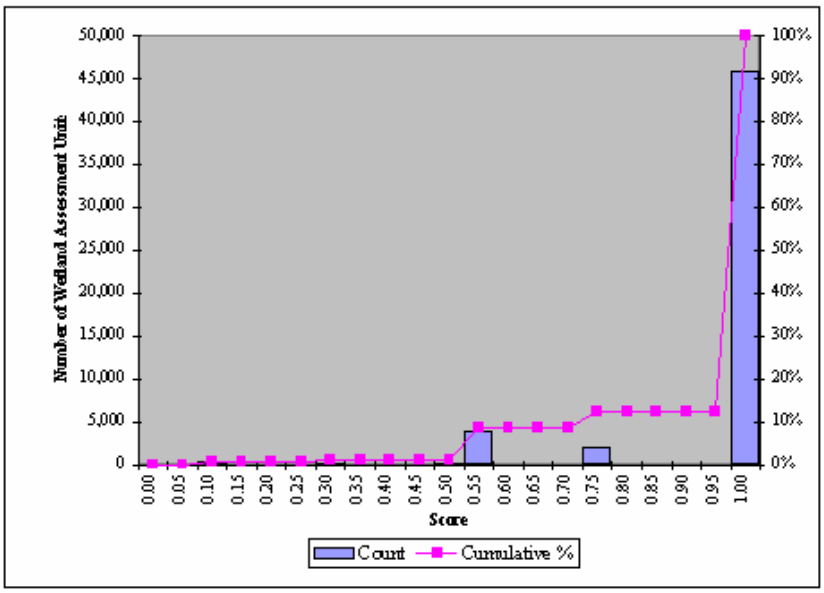


PLATE 3. ECOLOGICAL INTEGRITY – AGRICULTURAL ACTIVITY.

1 – ECOLOGICAL INTEGRITY 3. What percentage of the wetland has been altered by agricultural activities?

Score	*Count*	*Cumulative %*
0.00	0	0.00%
0.05	0	0.00%
0.10	327	0.62%
0.15	0	0.62%
0.20	0	0.62%
0.25	0	0.62%
0.30	150	0.91%
0.35	0	0.91%
0.40	0	0.91%
0.45	0	0.91%
0.50	28	0.96%
0.55	3,947	8.49%
0.60	0	8.49%
0.65	0	8.49%
0.70	0	8.49%
0.75	2,093	12.48%
0.80	0	12.48%
0.85	0	12.48%
0.90	0	12.48%
0.95	0	12.48%
1.00	45,881	100.00%



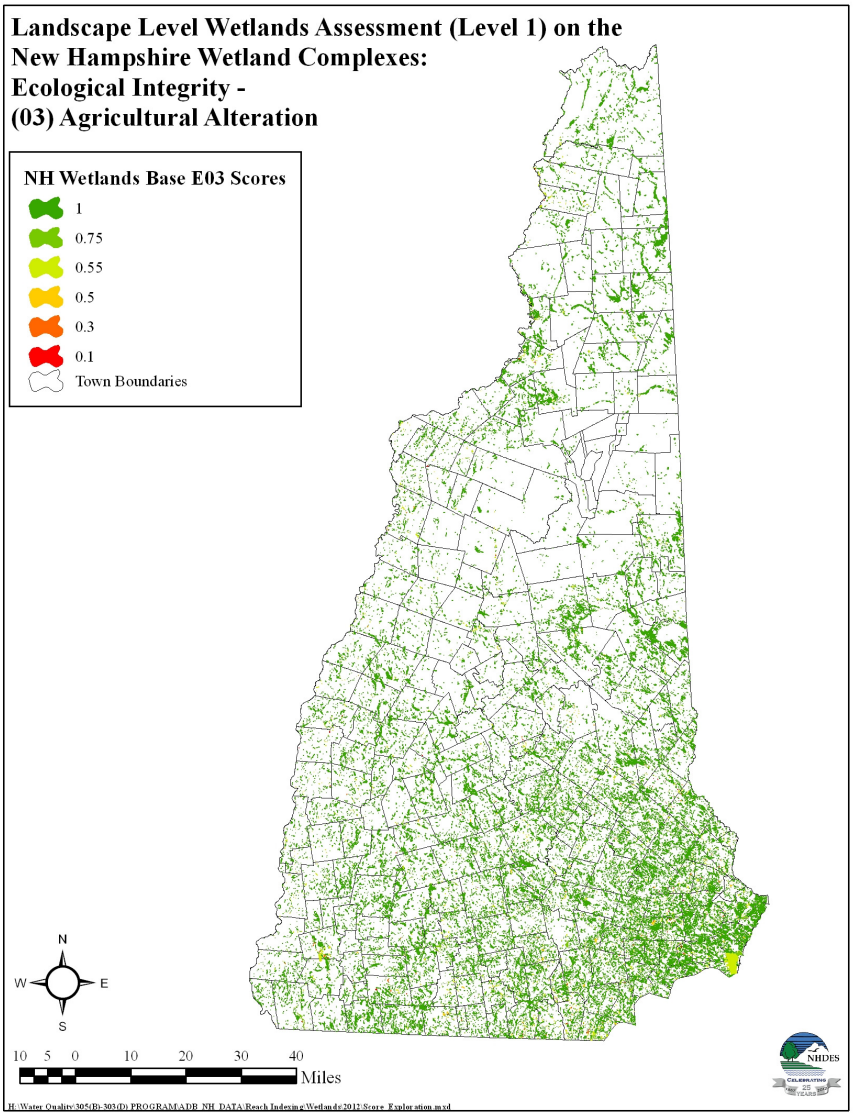
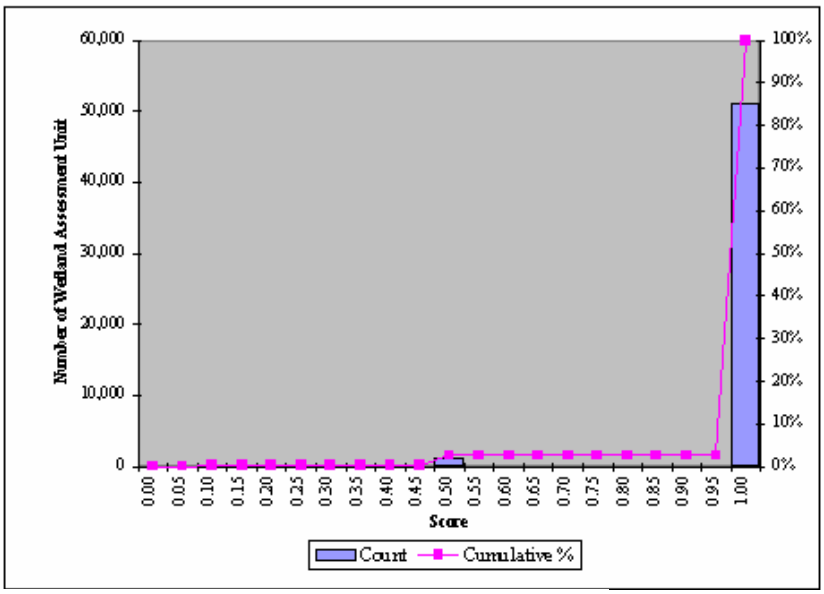


PLATE 4. ECOLOGICAL INTEGRITY – LOGGING WITHIN 10 YEARS.

1 – ECOLOGICAL INTEGRITY 4. What percentage of the wetland has been adversely impacted by logging activity within the last 10 years?

Score	*Count*	*Cumulative %*
0.00	0	0.00%
0.05	0	0.00%
0.10	91	0.17%
0.15	0	0.17%
0.20	0	0.17%
0.25	0	0.17%
0.30	0	0.17%
0.35	0	0.17%
0.40	0	0.17%
0.45	0	0.17%
0.50	1,248	2.55%
0.55	0	2.55%
0.60	0	2.55%
0.65	0	2.55%
0.70	0	2.55%
0.75	0	2.55%
0.80	0	2.55%
0.85	0	2.55%
0.90	0	2.55%
0.95	0	2.55%
1.00	51,087	100.00%



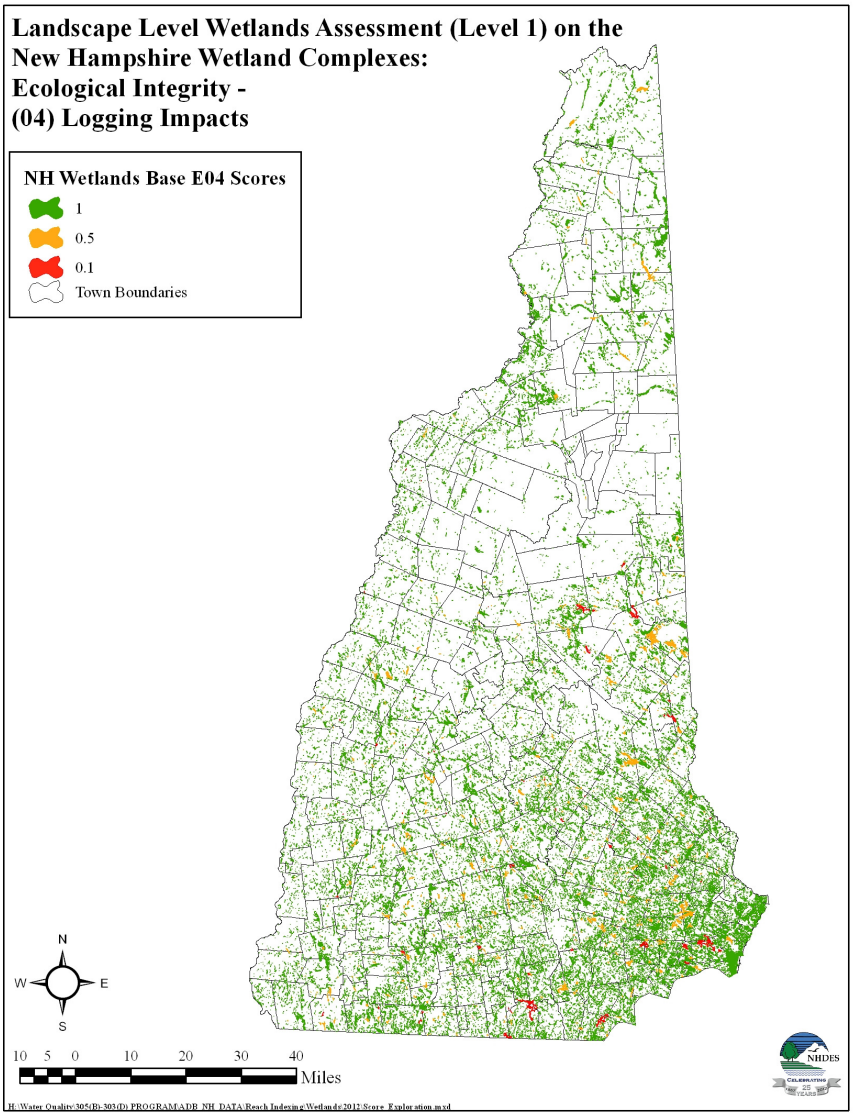
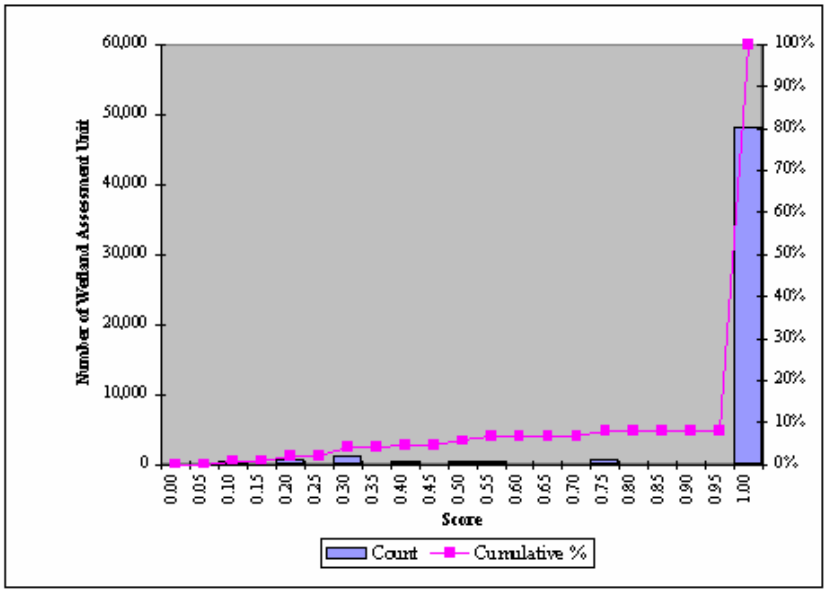


PLATE 5. ECOLOGICAL INTEGRITY – TRANSPORTATION CROSSINGS.

1 – ECOLOGICAL INTEGRITY 7. How many times does a road, ~~driveway~~, and/or railroad cross or border the wetland?

Score	*Count*	*Cumulative %*
0.00	0	0.00%
0.05	0	0.00%
0.10	483	0.92%
0.15	0	0.92%
0.20	588	2.04%
0.25	0	2.04%
0.30	1,049	4.04%
0.35	0	4.04%
0.40	325	4.66%
0.45	0	4.66%
0.50	508	5.63%
0.55	532	6.65%
0.60	0	6.65%
0.65	0	6.65%
0.70	0	6.65%
0.75	688	7.96%
0.80	0	7.96%
0.85	0	7.96%
0.90	0	7.96%
0.95	0	7.96%
1.00	48,253	100.00%



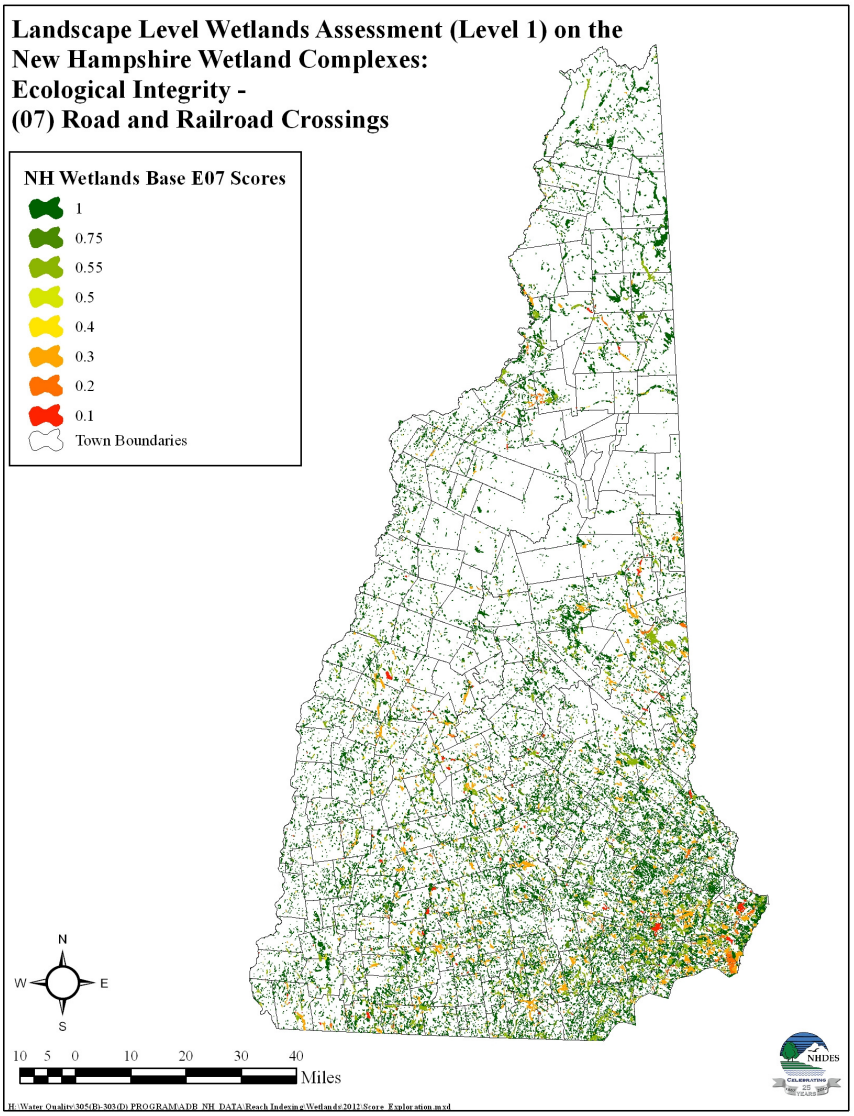
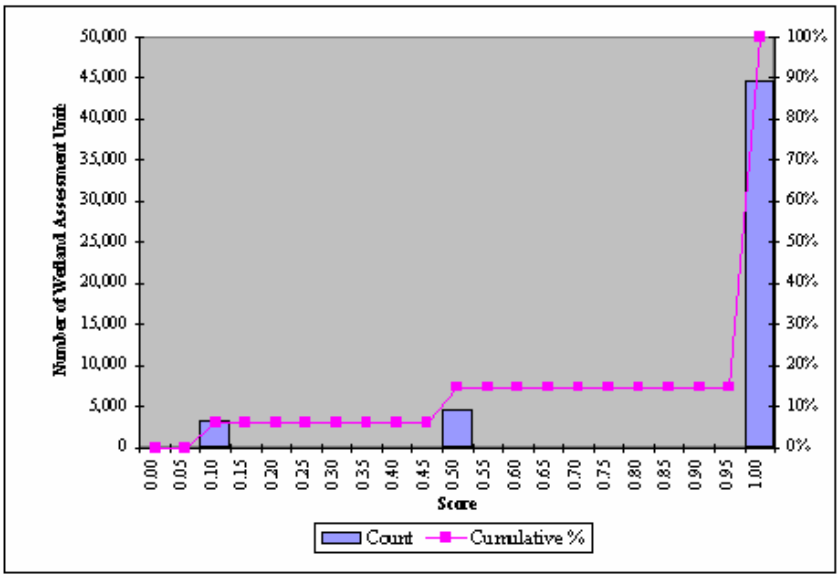


PLATE 6. ECOLOGICAL INTEGRITY – HUMAN ACTIVITY WITHIN 500 FEET.

1 – ECOLOGICAL INTEGRITY 8. How much human activity is taking place in the upland within 500 feet of the wetland edge?

Score	*Count*	*Cumulative %*
0.00	0	0.00%
0.05	0	0.00%
0.10	3,160	6.03%
0.15	0	6.03%
0.20	0	6.03%
0.25	0	6.03%
0.30	0	6.03%
0.35	0	6.03%
0.40	0	6.03%
0.45	0	6.03%
0.50	4,572	14.75%
0.55	0	14.75%
0.60	0	14.75%
0.65	0	14.75%
0.70	0	14.75%
0.75	0	14.75%
0.80	0	14.75%
0.85	0	14.75%
0.90	0	14.75%
0.95	0	14.75%
1.00	44,694	100.00%



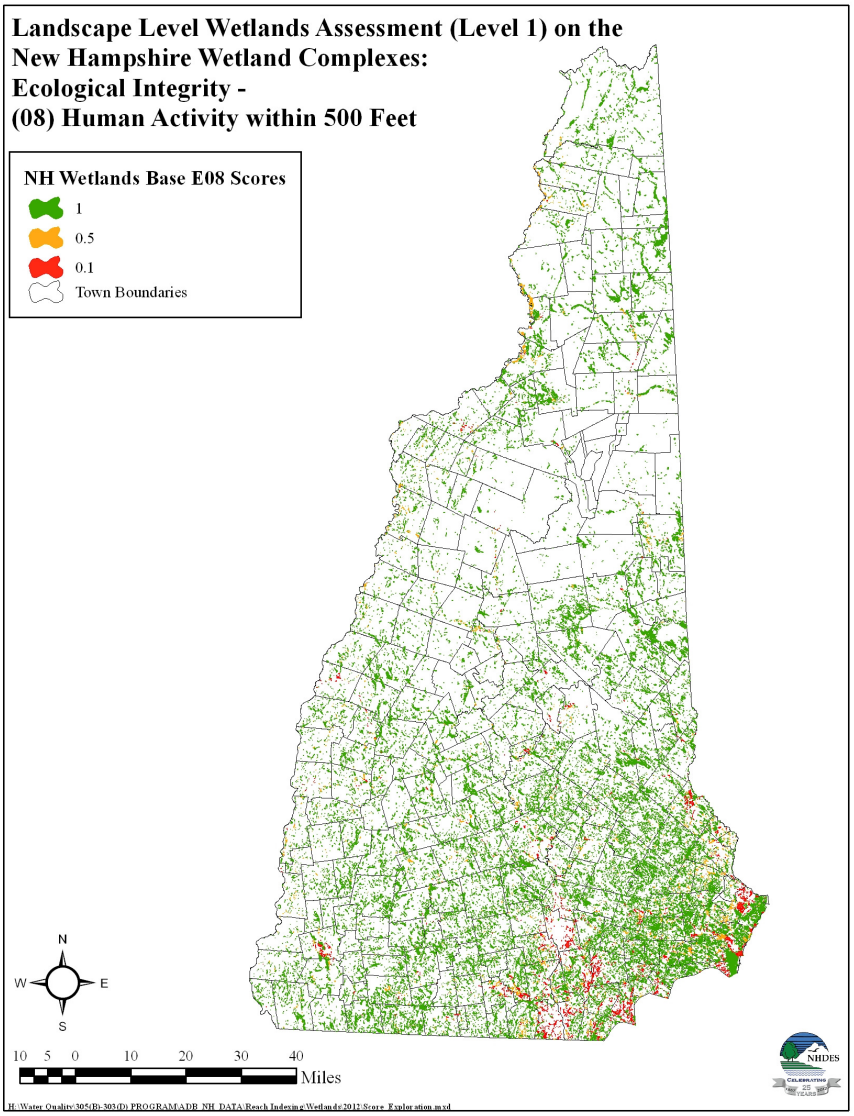
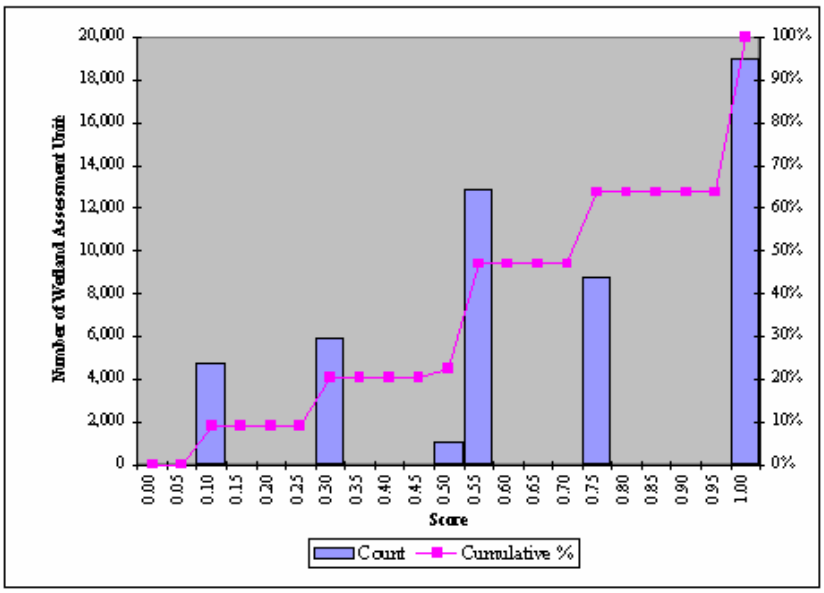


PLATE 7. ECOLOGICAL INTEGRITY – BUILDINGS WITHIN 500 FEET.

1 – ECOLOGICAL INTEGRITY 9. How many buildings are there within 500 feet of the wetland edge? Acres of Wetland / # of buildings

Score	Count	Cumulative %
0.00	0	0.00%
0.05	0	0.00%
0.10	4,748	9.06%
0.15	0	9.06%
0.20	0	9.06%
0.25	0	9.06%
0.30	5,935	20.38%
0.35	0	20.38%
0.40	0	20.38%
0.45	0	20.38%
0.50	1,038	22.36%
0.55	12,899	46.96%
0.60	0	46.96%
0.65	0	46.96%
0.70	0	46.96%
0.75	8,799	63.75%
0.80	0	63.75%
0.85	0	63.75%
0.90	0	63.75%
0.95	0	63.75%
1.00	19,007	100.00%



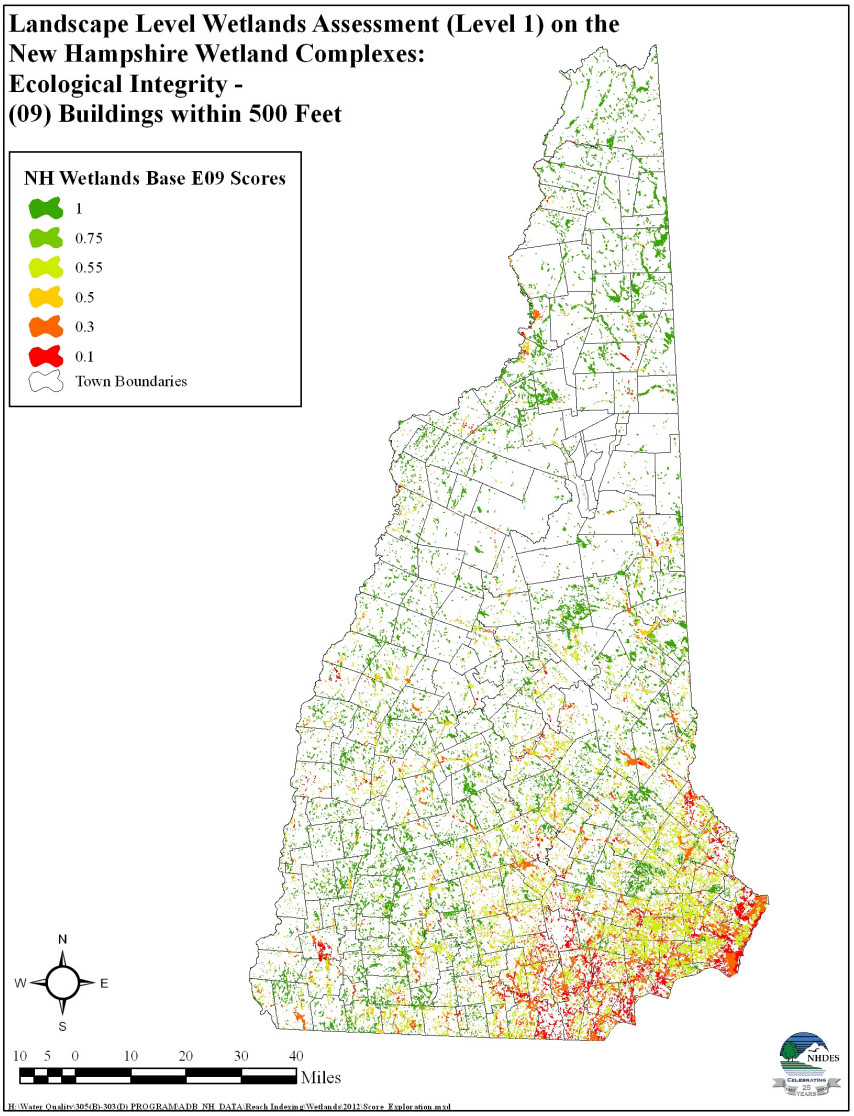
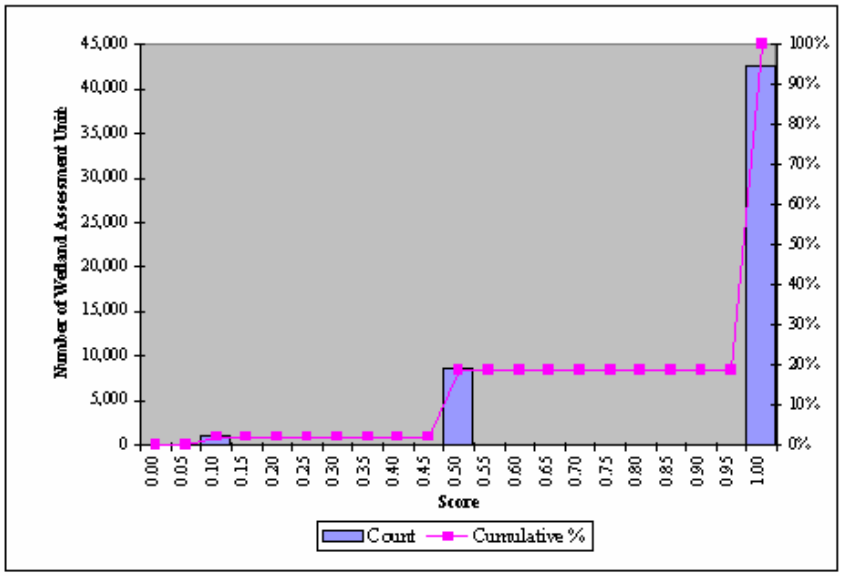


PLATE 8. ECOLOGICAL INTEGRITY – HUMAN MADE REGULATION.

1 – ECOLOGICAL INTEGRITY 10. Is there a human-made structure that regulates the flow of water through the wetland?

Score	*Count*	*Cumulative %*
0.00	0	0.00%
0.05	0	0.00%
0.10	1,156	2.21%
0.15	0	2.21%
0.20	0	2.21%
0.25	0	2.21%
0.30	0	2.21%
0.35	0	2.21%
0.40	0	2.21%
0.45	0	2.21%
0.50	8,680	18.76%
0.55	0	18.76%
0.60	0	18.76%
0.65	0	18.76%
0.70	0	18.76%
0.75	0	18.76%
0.80	0	18.76%
0.85	0	18.76%
0.90	0	18.76%
0.95	0	18.76%
1.00	42,590	100.00%



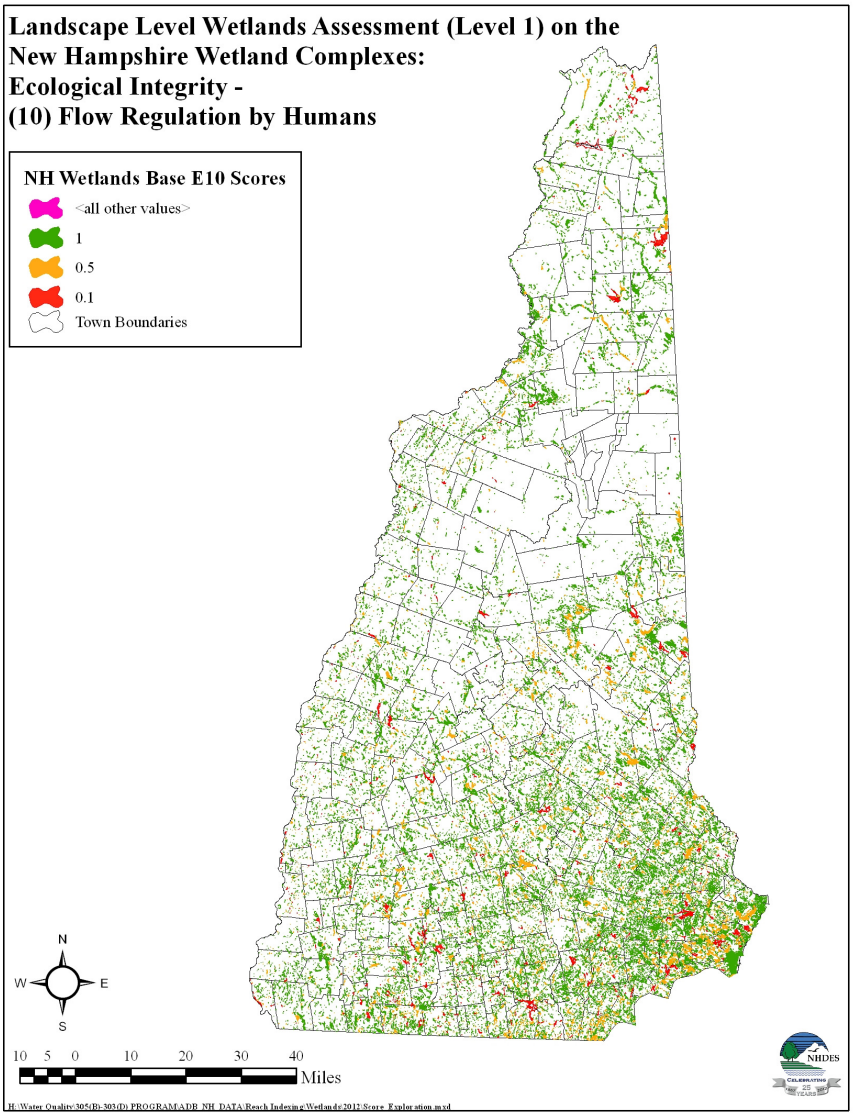
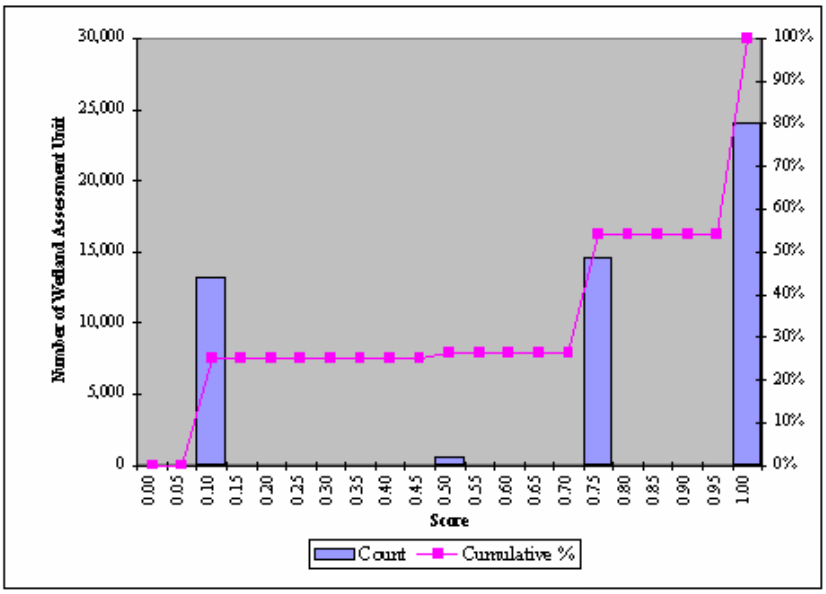


PLATE 9. WILDLIFE HABITAT – TRAVEL CORRIDORS.

2 – WETLAND-DEPENDENT WILDLIFE HABITAT 8. Are there wildlife travel corridors allowing access to other wetlands?

Score	*Count*	*Cumulative %*
0.00	0	0.00%
0.05	0	0.00%
0.10	13,211	25.20%
0.15	0	25.20%
0.20	0	25.20%
0.25	0	25.20%
0.30	0	25.20%
0.35	0	25.20%
0.40	0	25.20%
0.45	0	25.20%
0.50	524	26.20%
0.55	0	26.20%
0.60	0	26.20%
0.65	0	26.20%
0.70	0	26.20%
0.75	14,626	54.10%
0.80	0	54.10%
0.85	0	54.10%
0.90	0	54.10%
0.95	0	54.10%
1.00	24,065	100.00%



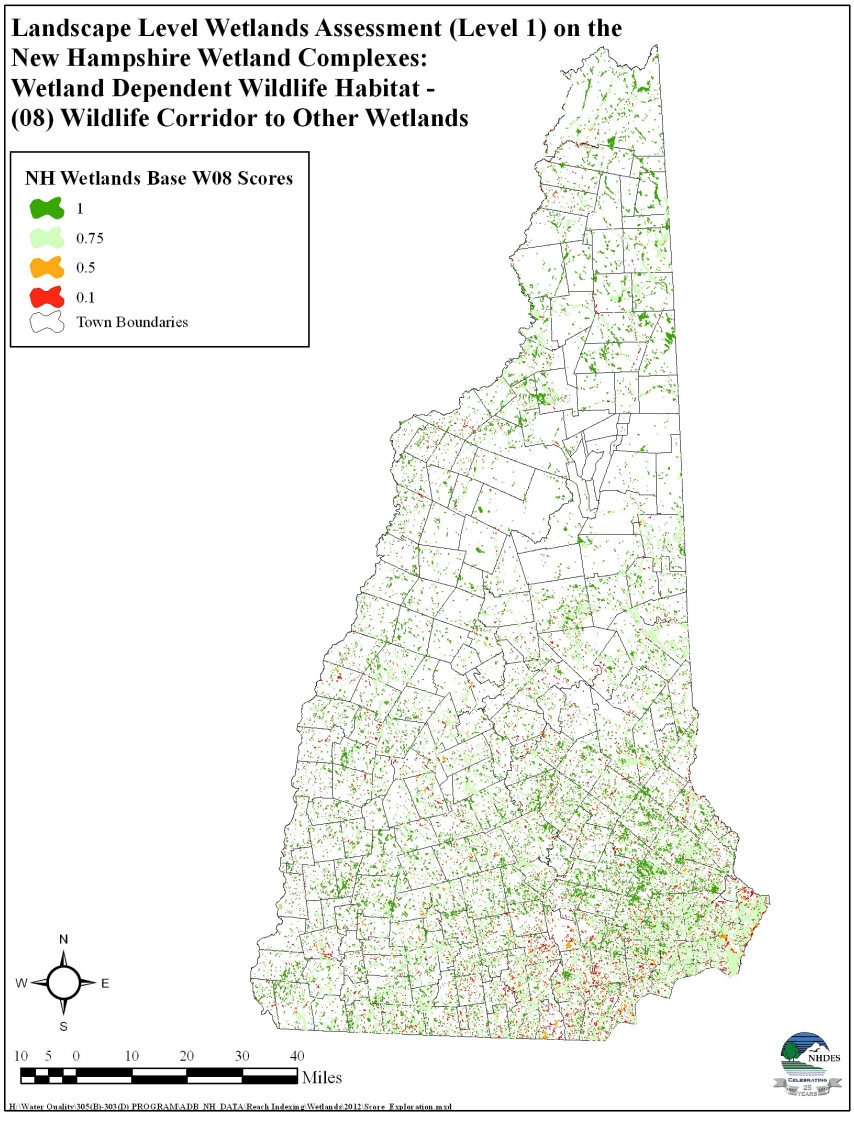
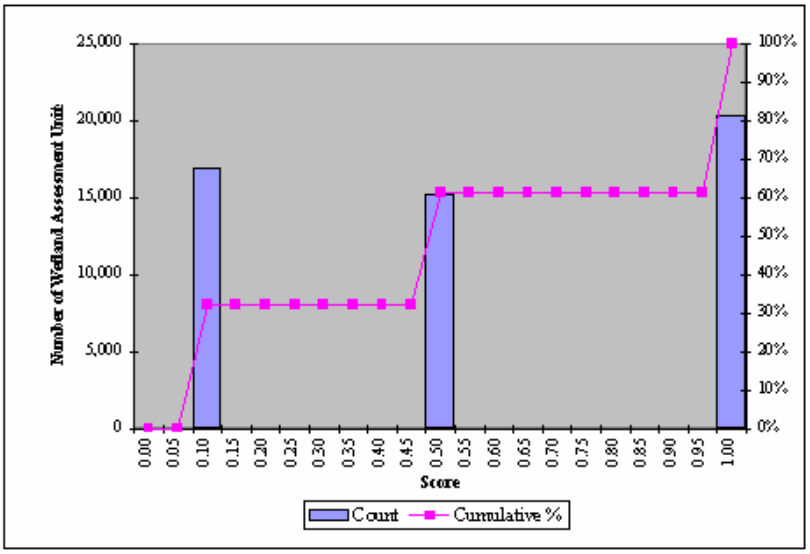


PLATE 10. WILDLIFE HABITAT – UNDISTURBED BORDER.

2 – WETLAND-DEPENDENT WILDLIFE HABITAT

9. What percentage of the wetland edge is bordered by undisturbed woodland or idle land (e.g. shrub land or abandoned fields) at least 500 feet in width?

Score	*Count*	*Cumulative %*
0.00	0	0.00%
0.05	0	0.00%
0.10	16,911	32.26%
0.15	0	32.26%
0.20	0	32.26%
0.25	0	32.26%
0.30	0	32.26%
0.35	0	32.26%
0.40	0	32.26%
0.45	0	32.26%
0.50	15,158	61.17%
0.55	0	61.17%
0.60	0	61.17%
0.65	0	61.17%
0.70	0	61.17%
0.75	0	61.17%
0.80	0	61.17%
0.85	0	61.17%
0.90	0	61.17%
0.95	0	61.17%
1.00	20,357	100.00%



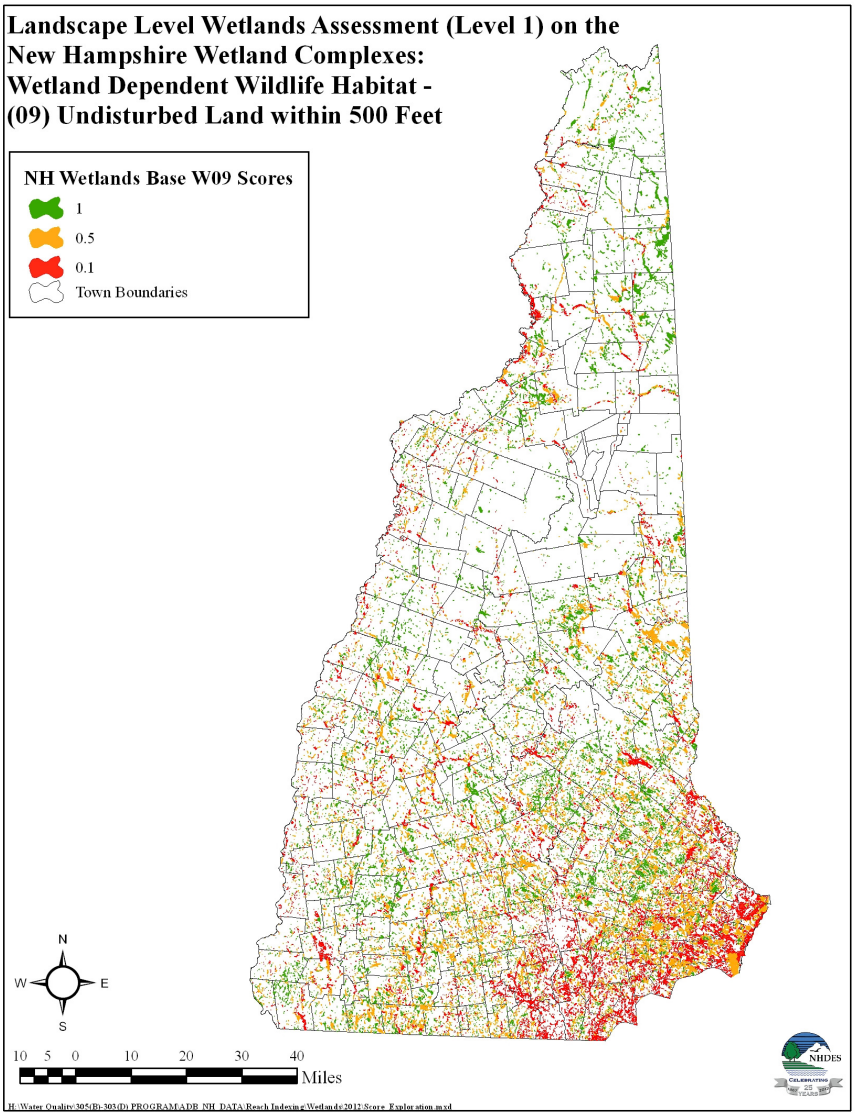
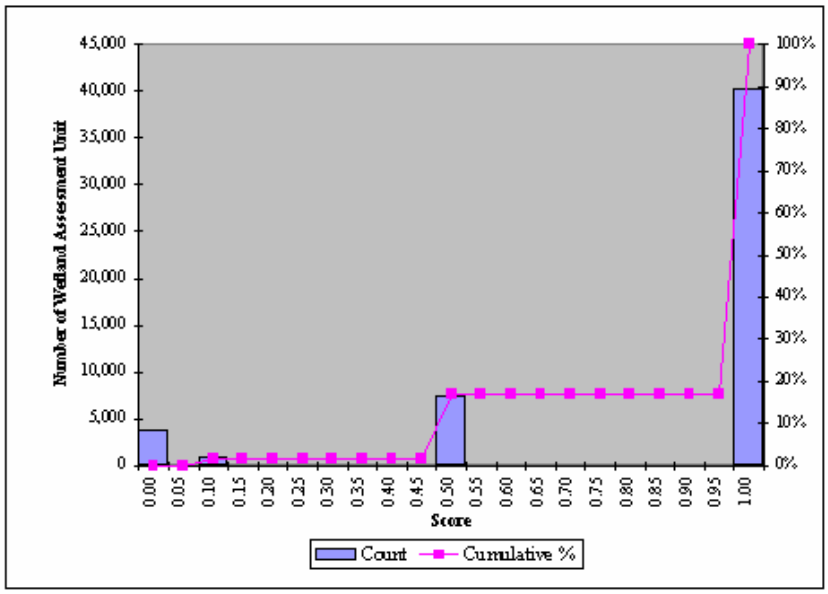


PLATE 11. FISH AND AQUATIC HABITAT – WATERSHED DOMINANT LANDUSE.

3 – FISH AND AQUATIC HABITAT

1. What is the dominant land use in the watershed above wetland?

Score	*Count*	*Cumulative %*
Not Scored	3,843	NA
0.05	0	0.00%
0.10	844	1.74%
0.15	0	1.74%
0.20	0	1.74%
0.25	0	1.74%
0.30	0	1.74%
0.35	0	1.74%
0.40	0	1.74%
0.45	0	1.74%
0.50	7,393	16.95%
0.55	0	16.95%
0.60	0	16.95%
0.65	0	16.95%
0.70	0	16.95%
0.75	0	16.95%
0.80	0	16.95%
0.85	0	16.95%
0.90	0	16.95%
0.95	0	16.95%
1.00	40,346	100.00%



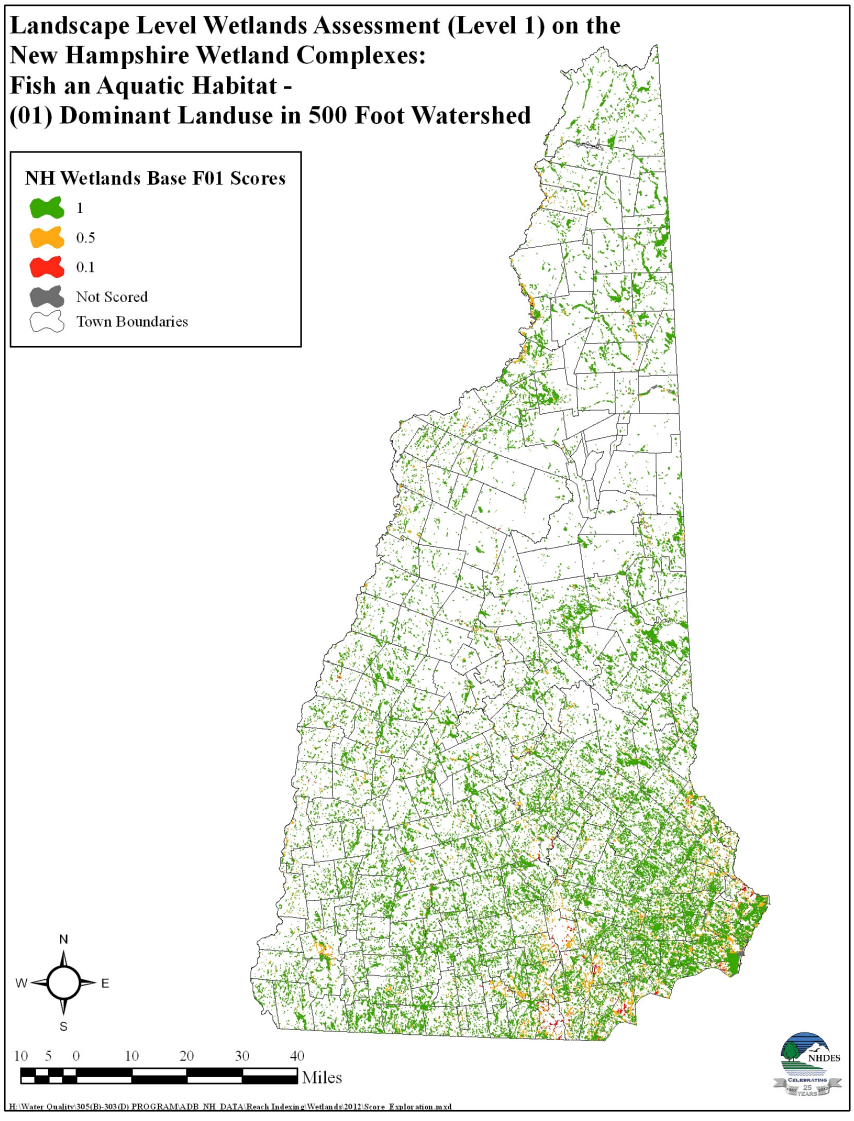
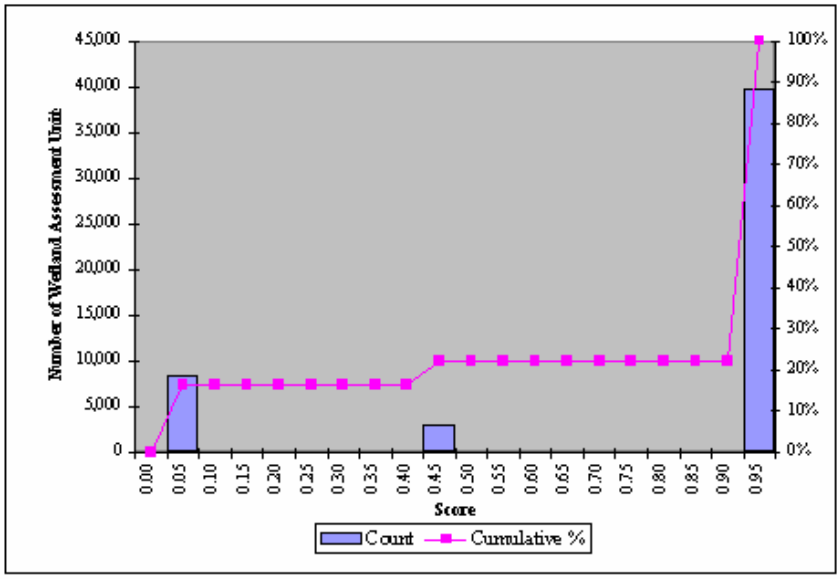


PLATE 12. FISH AND AQUATIC HABITAT - BARRIERS

3 – FISH AND AQUATIC HABITAT

10. Are there barriers to the passage of aquatic life? (e.g. dams, elevated culverts, bridge with a width less than the natural stream channel, road crossings, etc. along the stream reach associated with the wetland).

Score	Count	Cumulative %
Not Scored	1,538	NA
0.05	0	0.00%
0.10	8349	16.41%
0.15	0	16.41%
0.20	0	16.41%
0.25	0	16.41%
0.30	0	16.41%
0.35	0	16.41%
0.40	0	16.41%
0.45	0	16.41%
0.50	2913	22.13%
0.55	0	22.13%
0.60	0	22.13%
0.65	0	22.13%
0.70	0	22.13%
0.75	0	22.13%
0.80	0	22.13%
0.85	0	22.13%
0.90	0	22.13%
0.95	0	22.13%
1.00	39626	100.00%



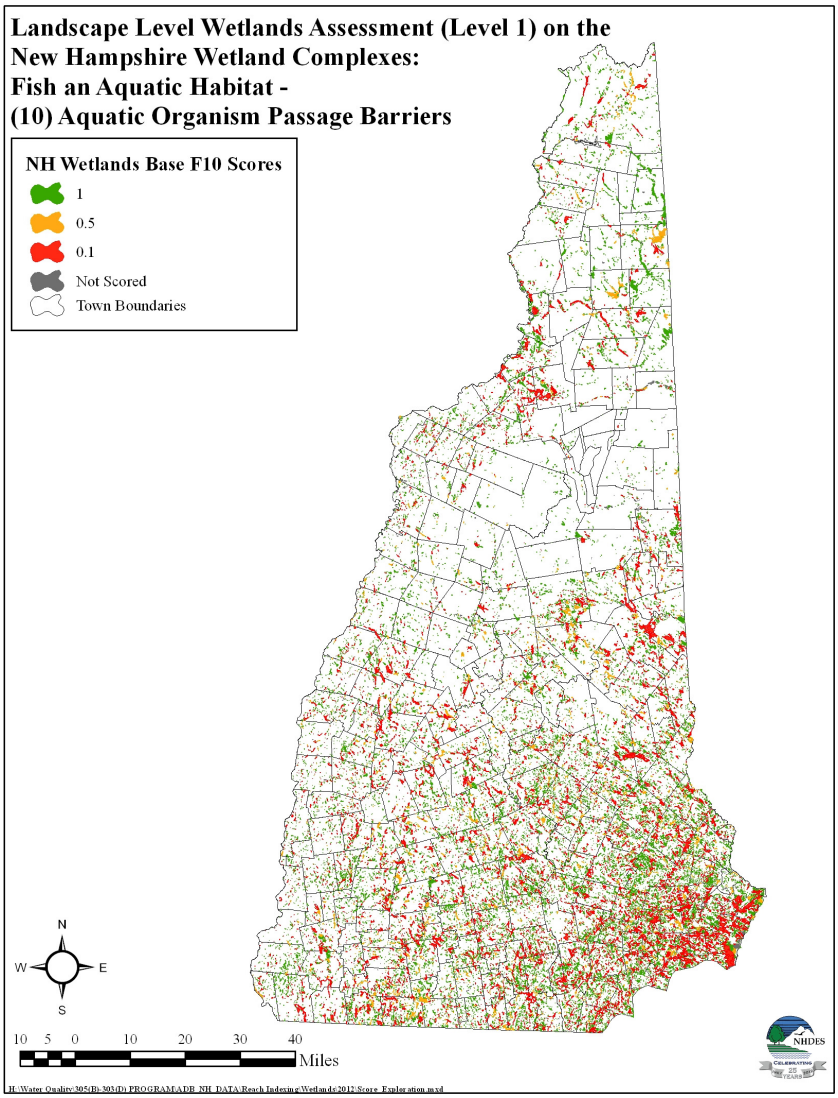
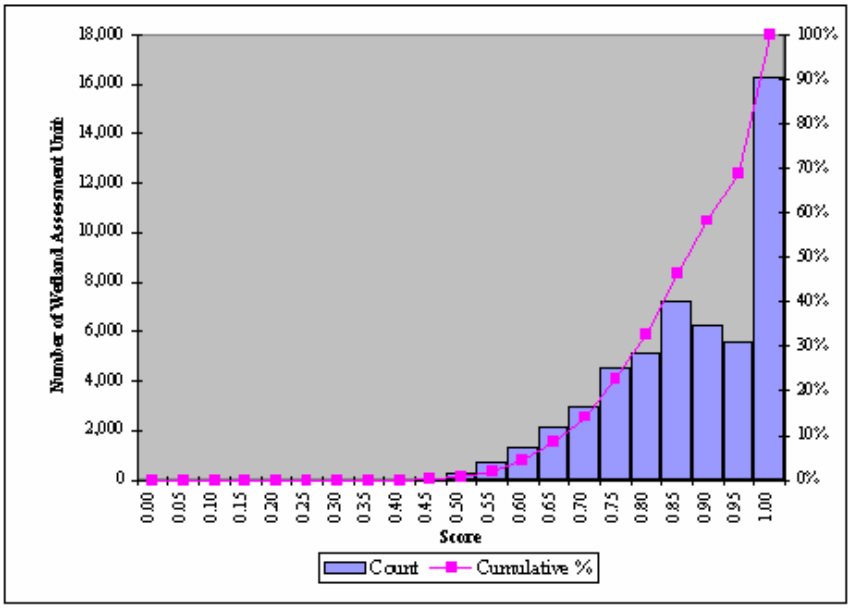
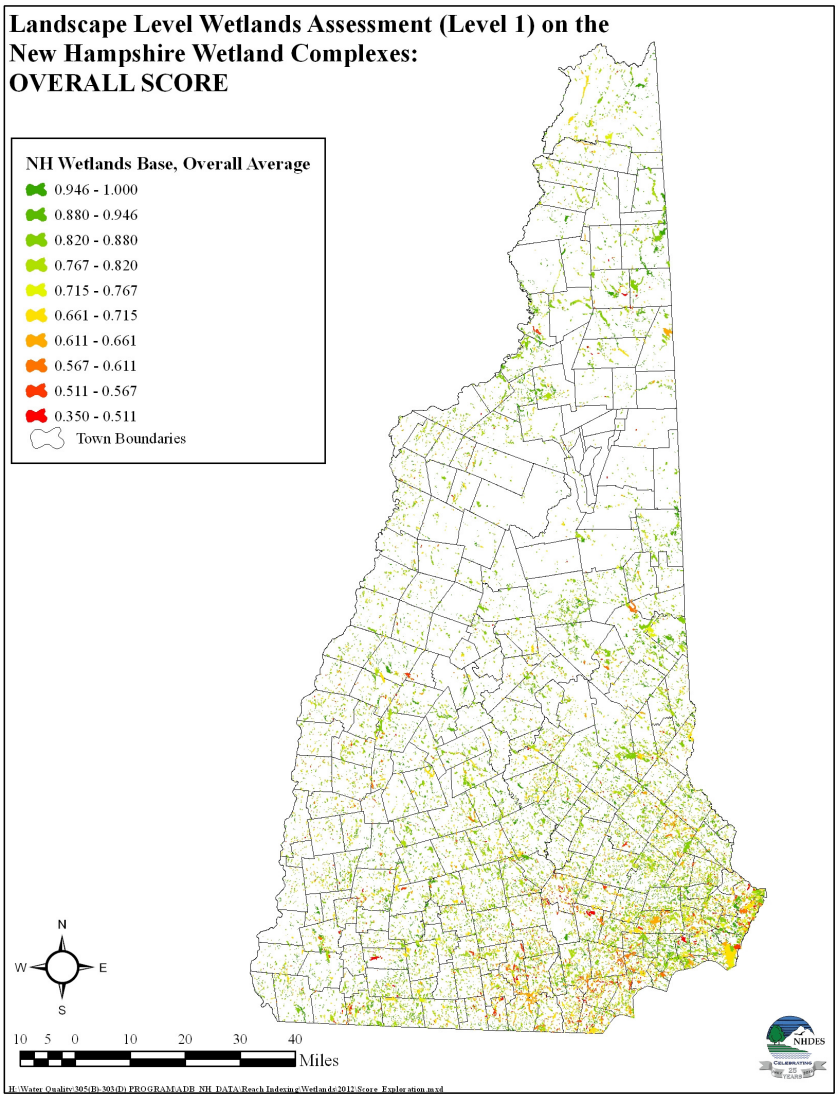


PLATE 13. AVERAGE FOR ALL QUESTIONS.

ALL QUESTIONS AVERAGED

Score	*Count*	*Cumulative %*
0.00	0	0.00%
0.05	0	0.00%
0.10	0	0.00%
0.15	0	0.00%
0.20	0	0.00%
0.25	0	0.00%
0.30	0	0.00%
0.35	0	0.00%
0.40	12	0.02%
0.45	47	0.11%
0.50	260	0.61%
0.55	699	1.94%
0.60	1,334	4.49%
0.65	2,140	8.57%
0.70	2,929	14.16%
0.75	4,568	22.87%
0.80	5,110	32.62%
0.85	7,199	46.35%
0.90	6,224	58.22%
0.95	5,599	68.90%
1.00	16,305	100.00%