State of Vermont
Agency of Natural Resources
Department of Forests, Parks and Recreation
Fish & Wildlife Department

Turner Hill Wildlife Management Area

Long Range Management Plan

Grafton & Athens, Vermont

1,052 acres

Prepared by: Springfield Stewardship Team

Draft: March 19, 2019

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Mission Statements

Vermont Agency of Natural Resources

The mission of the Agency of Natural Resources (ANR) is "to protect, sustain, and enhance Vermont's natural resources, for the benefit of this and future generations."

Four agency goals address the following:

- To promote the sustainable use of Vermont's natural resources;
- To protect and improve the health of Vermont's people and ecosystems;
- To promote sustainable outdoor recreation; and
- To operate efficiently and effectively to fulfill our mission.

Departments

Vermont Department of Environmental Conservation
Mission Statement

The mission of the Department of Environmental Conservation (DEC) is to preserve, enhance, restore, and conserve Vermont's natural resources, and protect human health, for the benefit of this and future generations.

Vermont Fish & Wildlife Department
Mission Statement

The mission of the Vermont Fish & Wildlife Department (VFWD) is the conservation of all species of fish, wildlife, and plants and their habitats for the people of Vermont. To accomplish this mission, the integrity, diversity, and vitality of their natural systems must be protected.

Vermont Department of Forests, Parks and Recreation
Mission Statement

The mission of the Department of Forests, Parks and Recreation (FPR) is to practice and encourage high quality stewardship of Vermont's environment by monitoring and maintaining the health, integrity, and diversity of important species, natural communities, and ecological processes; managing forests for sustainable use; providing and promoting opportunities for compatible outdoor recreation; and furnishing related information, education, and services.

EXECUTIVE SUMMARY

The 1,052.02-acre (1,052 acre) Turner Hill Wildlife Management Area (THWMA) is located in Grafton and Athens, Vermont in the Southern Vermont Piedmont biophysical region, in southeastern Vermont. It is located in a rural area which features a primarily forested, undeveloped landscape.

Natural Communities

There are 69 different occurrences of 15 natural communities on the wildlife management area (WMA). Four natural communities are occurrences of State Significance. Two are designated Rare, and all normally occur in this region, except for Lowland Spruce-Fir Forest which is more common at higher elevations. The property sits on what is referred to as the "Athens Dome" which is an elevated high plateau comprised of acidic granite and gneiss.

Natural Communities of Turner Hill WMA

Natural Community		Acres	Vermont Distribution	Example of Statewide Significance?
Wetlands	Beaver Wetland	52.1	n/a*	n/a*
	Basin Shrub Swamp	.5	rare	yes
	Hemlock-Balsam Fir-Black Ash Seepage Swamp	3.2	common	
	Hemlock-Sphagnum Basin Swamp	.3	rare	
	Red Spruce-Cinnamon Fern Swamp	3.2	uncommon	
	Seep	4	common	
	Vernal Pool	2.2	uncommon	yes
Uplands	Hemlock-Northern Hardwood Forest	517	very common	
	Hemlock Forest	29.5	common	yes
	Red Oak-Northern Hardwood Forest	21	common	
	Northern Hardwood Talus Woodland	2.7	uncommon	yes
	Northern Hardwood Forest	372	very common	
	Lowland Spruce-Fir Forest	41	uncommon	
	Red Spruce-Heath Rocky Ridge Forest	2.7	uncommon	
	Temperate Acidic Cliff	0.6	common	

*Because of their dynamic nature, beaver wetlands cannot be assessed for distribution or significance using comparable methods to other natural community types.

For more information on these and other natural communities, see Wetland, Woodland, Wildland: a Guide to the Natural Communities of Vermont, by Elizabeth Thompson and Eric Sorenson. Information may also be found online at: https://vtfishandwildlife.com/conserve/conservation-planning/natural-community-inventory

Wildlife and Habitat

Deer wintering area is a widespread habitat feature on the WMA, occupying approximately 274 acres of Hemlock and Hemlock-Northern Hardwood natural community. There are multiple wetland occurrences, approximately 65.5 acres, on the WMA which provide habitats beneficial to a variety of mammals, birds, amphibians, and insects. Some riparian areas around these wetlands are comprised of alder scrub/shrub habitats. These wetlands are also important to bear

for spring feeding and moose for summer forage. One of the key features on the WMA is a beaver wetland complex in the south-center of the parcel. This area hosts a great blue heron rookery.

Three plant species of conservation concern have been located within the WMA including;

1. Northeastern Bulrush (*Scirpus ancistrochaetus*) – Rare (S2S3), Endangered
2. Spotted Wintergreen (*Chimaphila maculata*) – Rare (S2S3)

Northeastern bulrush is listed as "endangered" by the Federal Endangered Species Act and the Vermont state endangered species statute (10 V.S.A. § 123). Spotted wintergreen is listed as rare to uncommon. The third is not described to provide enhanced protection.

Timber Resource

Most stands are fully stocked with pole to small sawtimber size trees. Stem quality (for sawtimber) ranges from poor to moderate in pockets of better soils. The lack of high quality sawtimber and sawtimber potential is attributed more to past management than site. Regeneration is unacceptable in many areas with moderate to high densities of American beech and striped maple. Beech and striped maple will create low productivity monocultures over the long term. Several areas with dense red spruce regeneration are present. Pockets of dense northern hardwood regeneration (sugar maple, white ash, yellow birch) exist in some previously harvested areas. Of the 1,052 acres, roughly 800 acres are suitable for timber management due to excessively steep terrain and the prevalence of wetlands and associated riparian areas. Evidence of past timber harvest operations previous to State ownership are common, including wetland sites that will now be protected. Most of the larger sawlog trees were harvested before State acquisition. The best regeneration and pole stems are found in previous patch cuts and clear cuts.

Fisheries and Water

THWMA is located entirely within the Saxtons River watershed which drains to the Connecticut River. Most of the land drains west from four small tributaries to the South Branch Saxtons River while about 250 acres on the eastern side drain to Athens Pond, Bull Creek, and eventually into the mainstem of the Saxtons River. The largest western tributary drains less than one square mile.

Wetlands: There are seven wetland communities mapped on THWMA that comprise approximately 65.5 acres. These range in size from the smallest, a vernal pool less than 1/10th of an acre, to the largest an 18-acre beaver pond toward the southern boundary. THWMA was acquired for the purpose of protecting wetland habitats for northeastern bulrush (*Scirpus ancistrochaetus*), a federally and state listed endangered species known to exist at this site.

Riparian Zones: There are approximately 2 miles of linear streams within THWMA and 161 acres of wetland shoreline. This results in approximately 185 acres of riparian forests that will be managed according to state law, easement restrictions, and district guidelines for riparian function, including protection of rare, threatened, and endangered species and enhancement of flood resiliency.

Invasive Exotic Plant Species

There are several non-native plant species at THWMA. Most are not a threat to native vegetation, habitats, or wildlife; however, there are some notable exceptions. Small populations

of invasive Eurasian honeysuckle (*Lonicera* spp.), Japanese barberry (*Berberis thunbergii*), multiflora rose (*Rosa multiflora*), common buckthorn (*Rhamnus cathartica*), and Japanese knotweed (*Fallopia japonica*) occur on the WMA. While their risk to native plants and habitats is currently low, they represent a long-term potential threat to the ecological integrity of the WMA. These are most commonly found around the edges of wetlands where light can penetrate to the forest floor.

Historic Resources

THWMA is located on a plateau overlooking the Saxtons River. This aspect and the wetland features common throughout the property elevate some areas to moderate archeological sensitivity using a GIS-based predictive model. However, no prehistoric resource sites have been found within THWMA.

There are several cultural historic sites on the WMA – many associated with Alexander Turner, a freed slave who moved to Grafton in 1872. The Turner portion of the property was deemed historically significant at the local, state, and national levels in a report by the Preservation Trust of Vermont in 2011. Therefore, in 2018, the homestead site and 5 acres were deeded to the Windham Foundation to be redeveloped as a historic educational site highlighting Vermont's African-American heritage. This site contains several dilapidated buildings, including the "Birchdale Camp," and one rock foundation of 19th and 20th century residential and agricultural remnants. The Preservation Trust and Windham Foundation are currently restoring the Birchdale Camp and developing access and educational materials for this site. In addition, there are two other cellar holes and stone walls and fencing are common.

Recreational Users

Recreational experience in this WMA is characterized by a natural-appearing setting with obvious modifications including constructed roads and trails, and evidence of timber cutting. It is presumed that most recreational use occurs during the fall hunting seasons. There are no established trails on the property, but hiking/walking is another popular activity. The WMA is located adjacent to the Townshend/Grafton Road, a paved scenic and popular foliage viewing road on the west. All the WMA is located within one mile of this busy paved road though due to the steep hills, most of the WMA is not visible from this road. On the east, the WMA borders Walker Road. This road is frequently used by adjacent landowners and recreational users and is a snowmobile trail in the winter.

Infrastructure and Access

Access into the WMA is generally undeveloped. The class 3 Turner Hill Road terminates at an extensive wetland on the northern portion of the WMA. Historically, this is the primary access for both public recreation and management activities. The parking area is partly flooded by beaver wetland. The road is not plowed in winter. Additional parking is anticipated as a component to the Turner Site project which should be completed in 2019. A property identification sign was installed at this location in the summer of 2014. A management right-of-way (ROW) on the east side of the property through the adjacent Bemis lands is not currently usable due to extensive erosion that occurred before State ownership. The class 2 paved Townshend/Grafton Road passes through the northwest corner of the property but due to the South Branch Saxtons River and an extremely steep rocky slope, this access is suitable for non-trail pedestrian recreational use only. There is a rough and steep road ROW extending from the Townshend/Grafton Road to the southernmost unit that would require a bridge access across the

river. It has been used as a management access, but its use by the public needs to be clarified. The best access to the property came with the acquisition of a parcel off Walker Road. The Vermont Fish & Wildlife Department now has approximately 1500' of frontage on Walker Road on the Athens side, and some work initiated in the fall of 2018 to facilitate management and public access. With that acquisition also came a ROW which accesses southern sections of that unit.

Management Classification

After completion of inventories and assessments, the lands, resources, and facilities held by the Vermont Agency of Natural Resources (ANR) are evaluated and assigned to appropriate Agency Land Management Classification categories based upon knowledge and understanding of resources and appropriate levels of management. The four categories as applied to THWMA are Highly Sensitive Management (10%), Special Management (40%), General Management (50%), and Intensive Management (0%). This enables land managers to allocate use and management by area minimizing conflicts between competing objectives and facilitating a common understanding of the overall use or type of management to occur specific areas of THWMA.

Property stewardship goals for THWMA include strategies to:

- Protect and improve the condition and resiliency of important biological resources.
- Enhance wildlife habitat for a variety of game and non-game species through management and development of all seral stages; creation of early successional growth; improvement of deer wintering areas and mast production; and protection of unique habitats.
- Improve timber resource through sustainable management practices.
- Develop and improve appropriate non-motorized recreation opportunities for wildlife-based activities including hunting, fishing, trapping, and wildlife viewing.
- Maintain and improve management and recreational access and infrastructure.
- Protect and document cultural and historic sites.

TABLE OF CONTENTS

I. PARCEL DESCRIPTION 1
- A. Location and Parcel Information 1
- B. Purpose of Ownership 1
- C. History of Acquisition 1
  - Table 1: Acquisition history of the Turner Hill WMA 2
- D. Land Use History 2
- E. Resource Highlights 2
- F. Relationship to Town, Regional, and Other Pertinent Planning Efforts 3
  - Figure 1: Locator and Biophysical Region Map 5
  - Figure 2: Parcel Base Map 6

II. PUBLIC INPUT 7

III. RESOURCE ANALYSIS 8
- A. Legal Constraints Assessment 8
  - Figure 3: Legal Constraints Map 11
- B. Natural Community Assessment 12
  - Table 2: Natural Communities of Turner Hill Wildlife Management Area 14
  - Figure 4: Natural Community Map 15
  - Table 3: Rare, Threatened, and Endangered Plants of Turner Hill WMA 17
- C. Forest Health Assessment 18
  - Table 4: Invasive Exotic Plants of Turner Hill WMA 19
  - Table 5: Invasive Exotic Insect Species that will be monitored over time at Turner Hill WMA 19
- D. Wildlife and Habitat Assessment 21
  - Table 6: Habitat Diversity in Turner Hill WMA 26
  - Figure 5: Wildlife Habitat Map 27
- E. Timber Resource Assessment 28
  - Table 7: Site Class Management Potential 28
  - Table 8: Dominant Forest Types 29
  - Figure 6: Soils and Site Class Map 31
- F. Water Resource Assessment 32
  - Figure 7: Water Resources Map 35
- G. Fisheries Resource Assessment 36
- H. Historic Resource Assessment 37
  - Figure 8: Historic Resource Map 39

I. Recreation Resource Assessment 40
J. Infrastructure and Public Access Assessment 41
Figure 9: Recreation and Infrastructure Map 43
IV. MANAGEMENT STRATEGIES AND ACTIONS 44
Land Management Classification 44
1.0 HIGHLY SENSITIVE MANAGEMENT 47
2.0 SPECIAL MANAGEMENT 47
3.0 GENERAL MANAGEMENT 51
Figure 10: Land Use Classification Map 52
Table 9: Implementation Schedule 53
Figure 11: Implementation Map 54
V. VEGETATIVE MANAGEMENT 55
VI. CLIMATE CHANGE ADAPTATION 57
Table 10: Expected Climate Change Effects and Timeframes 58
VII. MONITORING AND EVALUATION 61
Ecological/Wildlife 61
Timber and Wildlife Habitat 61
Recreation 62
Historic 62
Invasive Exotic Species 63
Climate Change 63
VIII. NEW USES AND PLAN AMENDMENT PROCESS 64
IX. FUTURE ACQUISITION/DISPOSITION 65
APPENDICES 66
APPENDIX 1: Forest Inventory Data 67
APPENDIX 2: Forest Stands Map 68
APPENDIX 3: Notice of Grant Agreements 69
APPENDIX 4: Declaration of Restrictive Covenants 78
APPENDIX 5: Natural Community Assessment 82
APPENDIX 6: Public Comment Summary 91
APPENDIX 7: Works Cited 92
APPENDIX 8: 10 V.S.A. App. § 15 Rule Governing Public Use of Vermont Fish and Wildlife Department Lands 94
APPENDIX 9: Glossary 100

I. PARCEL DESCRIPTION

A. Location and Parcel Information

Turner Hill Wildlife Management Area is in Grafton and Athens, Vermont, in the Southern Vermont Piedmont biophysical region (Figure 1). It is comprised of one contiguous parcel between Route 35 on the east and the Townshend/Grafton Road on the west. The 1,052.02-acre (1,052 acre) WMA (Figure 2) is similar in topography and forest composition to nearby landscapes. Parcel elevations range from 960' to 1450'. The terrain is relatively flat with excessively steep slopes on the western and southeastern sides. Substantial wetland complexes are found throughout the WMA. The town of Grafton is two miles to the north and Townshend is six miles to the south along the Townshend/Grafton Road.

B. Purpose of Ownership

Wildlife Management Areas are managed by the Vermont Fish & Wildlife Department to meet a variety of goals. Wildlife management objectives favor game species such as white-tailed deer, turkey, grouse, and beaver as well as nongame species such as songbirds, small mammals, amphibians, and birds of prey. Multiple objectives are accomplished through a combination of commercial and non-commercial vegetative management practices applied over time in a manner that protects unique habitats.

THWMA will be primarily managed to provide important wildlife habitat such as early successional forest and shrubland, wetland and riparian habitat, deer and moose wintering cover, black bear mast and spring food production, and potential bobcat denning sites.

Property stewardship goals for THWMA include strategies to:

- Protect and improve the condition and resiliency of important biological resources.
- Enhance wildlife habitat for a variety of game and non-game species through management and development of all seral stages; creation of early successional growth; improvement of deer wintering areas and mast production; and protection of unique habitats.
- Improve timber resource through sustainable management practices.
- Develop and improve appropriate non-motorized recreation opportunities for wildlife-based activities including hunting, fishing, trapping, and wildlife viewing.
- Maintain and improve management and recreational access and infrastructure.
- Protect and document cultural and historic sites.

C. History of Acquisition

THWMA is comprised of five individual land parcels that were acquired by the State of Vermont from 2011 to 2015 (Table 1). The first acquisition in 2011 was from The Nature Conservancy (TNC) and comprised 78.77 acres abutting the Townshend/Grafton Road. This was formerly called the Wright Estate. The second acquisition was the David Bemis lands on the south and southeast containing 209.1 acres. These were acquired in two separate transactions because a small portion of the Bemis lands (29.2 acres) did not have clear title and, therefore, was quitclaimed to the State in a separate transaction. The third tract came from Vermont Transco

LLC as mitigation for the "Southern Loop" power grid expansion project. This parcel contains 311.7 acres and was the homestead of the Daisy Turner family (also known as the Knight Estate). This parcel was also acquired in two separate transactions in 2013 due to title concerns on a 25-acre tract in the south of the property, which was also quitclaimed in a separate transaction. In 2015 two additional parcels became available for purchase adjacent to the recently conserved lands. These were the Sheehan Parcels, 213.65 acres on the east side of the Daisy Turner lands, and the Dewitt parcel, 243.8 acres to the south of the Bemis lands. In 2018 the Turner homestead and 5 acres were subdivided from the main parcel and deeded to the Windham Foundation who are, with Preservation Trust of Vermont, in the process of restoring the Birchdale camp and using the site for educational purposes featuring Vermont African American history.

Table 1: Acquisition history of the Turner Hill WMA

Year	# of Acres	Seller
2011	78.77	The Nature Conservancy
2012	209.1	David Bemis
2013	311.7	Vermont Transco LLC
2015	213.65	Peter & Susan Sheehan
2015	243.8	Vance Dewitt
2019	(5)	ANR Deeded to Windham Foundation

D. Land Use History

Prior to European settlement in the 1700s, THWMA likely consisted of forestland interspersed with multiple beaver impoundments. Human activities before this time probably did not significantly alter these lands but may have been utilized by native peoples seasonally. Then, like much of the land in Vermont, early European settlements expanded, and new areas were colonized. The early settlement period in the mid to late 1700s focused on clearing forests for agricultural land. In time, industry developed including sawmills, grist mills, maple sugar production, and wool. Adjacent lands were also quarried for soapstone. According to archived stories told by Daisy Turner and additional historical research, land comprising THWMA was primarily farm pasture (cattle, sheep, turkeys) and forestland at the end of the 19th and early 20th centuries.

E. Resource Highlights

THWMA provides some regionally significant wildlife habitat. The prevalence of beech and oak mast stands, wetland and riparian areas, rocky denning habitat, and softwood cover are all highly beneficial to a suite of wildlife. While vegetative diversity is high, age class diversity is limited with the majority of the parcel in one age class and fewer younger and older stands. Beaver wetland complexes totaling approximately 52 acres enhance biodiversity by supporting plant and animal species and plant communities not found in the drier uplands. These wetlands provide habitat for the northeastern bulrush (*Scirpus ancistrochaetus*), a federally and state listed endangered species, and a great blue heron rookery.

F. Relationship to Town, Regional, and Other Pertinent Planning Efforts

This LRMP reflects the values and goals recommended in the town and regional plans for the geographic area of Grafton and Athens.

Regional Plan
The Windham Regional Planning Commission adopted an updated Windham Regional Plan (WRP) on September 30, 2014.

This plan outlines broad goals for many areas ranging from residential and business development to energy and land use. The WRP plan outlines natural resource and recreational values in Windham County and provides goals and guidelines for maintaining and enhancing these resources that apply to THWMA.

The lands of THWMA are classified as "Resource" land in the WRP, lands that require special protection or consideration based on the existing natural resources. A sub category, "Critical Resource Areas", includes many of the wetland communities on the WMA. In these areas conservation and protection are the suggested practices.

Complimentary to goals in the WRP plan, management at THWMA will:

- Promote productive, healthy forests and manage forestland for long-term sustained yield.
- Discourage forest fragmentation.
- Protect important natural resources and encourage land conservation.
- Preserve and protect wildlife habitats, corridors and ecological diversity.
- Provide protection of water quality and remediation of impaired waters.
- Provide variable and accessible opportunities for public recreation.
- Encourage public land ownership and acquisition.

Town Plan
The Grafton Town Plan was adopted in 2008. Goals are similar to the WRP plan with more specific delineation of geographic areas within the Town.

The Grafton Town Plan land use section zones the lands encompassing THWMA as "Conservation Areas." Conservation areas are large, essentially undeveloped areas without access to an improved public road. They are predominantly forested, are important aquifer recharge areas and contain significant wildlife habitat. A major goal of the town plan is to protect and preserve the natural and historic features of Grafton and maintain and improve the quality of the air, waters, wildlife, and land resources.

The Town of Athens does not currently have a town plan on file at the Windham Regional Commission.

Windmill Hill Pinnacle Association

The Windmill Hill Pinnacle Association (WHPA) is a group of residents of southeastern VT that was started in 1992 to develop a strategy to preserve "The Pinnacle" and develop public access to it. In 1993 they became a Vermont Non-Profit Corporation. Today they manage approximately 1,820 acres of forestland stretching from Putney to Grafton for recreation. In conjunction with this effort, they have actively been engaged with private landowners and many organizations to promote the conservation of additional lands in this region. They were instrumental in the conservation of THWMA. As a result of these efforts, the WHPA offers over 20 miles of recreation trails with 10 trailheads. The lands of THWMA fit well with other conserved lands in the area and add to the growing land base that connects WHPA lands.

Figure 1: Locator and Biophysical Region Map

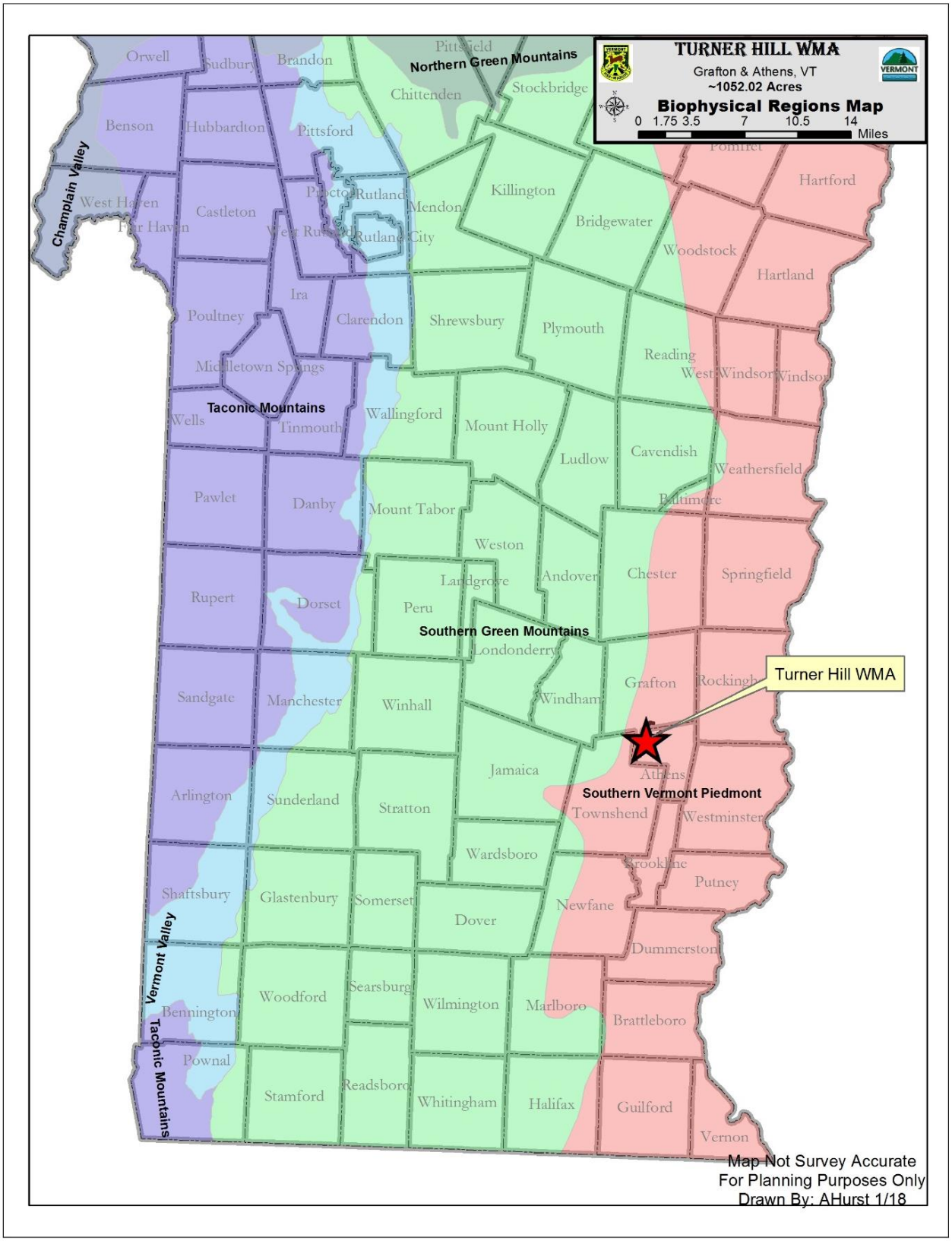
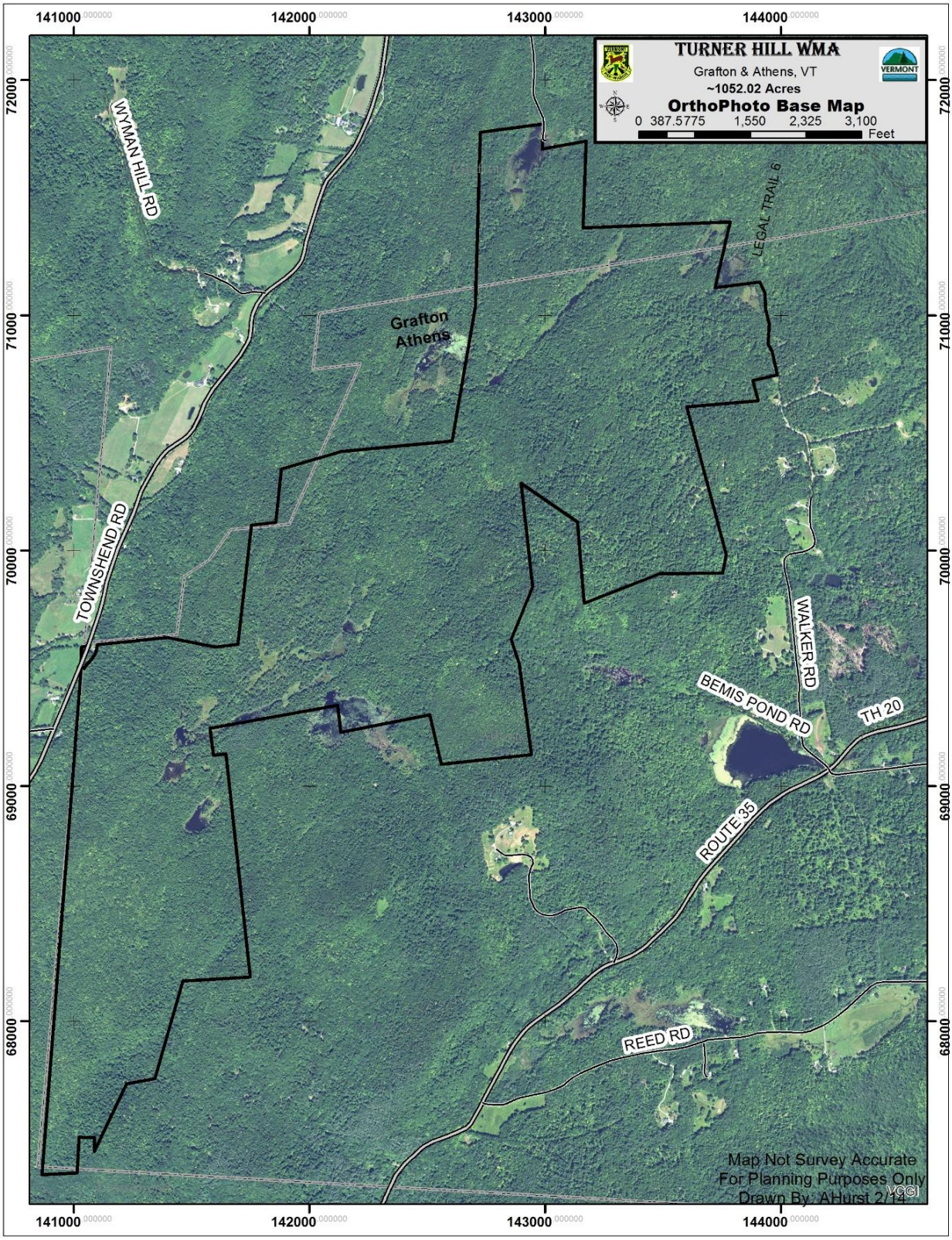


Figure 2: Parcel Base Map



II. PUBLIC INPUT

The citizen participation process for THWMA Long Range Management Plan (LRMP) was conducted in accordance with Agency of Natural Resources policies, procedures, and guidelines. Public involvement or citizen participation is a broad term for a variety of methods through which the general public has input into public land management decisions. The Agency of Natural Resources, including the Departments of Forests, Parks and Recreation and Fish & Wildlife, is committed to a planning process which offers the opportunity for all citizens and stakeholders to participate. These include letters, surveys, personal comments, telephone calls, e-mails, and more formal methods such as public meetings and workshops. All public input received concerning the future stewardship of THWMA has been considered in the preparation of this plan.

An open-house style informational public meeting was held on at the in , Vermont to present inventory and assessment information and to receive comments. After a 30-day public comment period ending , the comments were reviewed and analyzed by the District Stewardship Team and a draft long-range management plan was written.

A summary of the comments received during the public involvement process, a summary of the Department's response to comments, and additional information about the public involvement process are in Appendix 6.

III. RESOURCE ANALYSIS

A. Legal Constraints Assessment

Legal constraints that affect the stewardship of THWMA including deed restrictions, funding conditions, and rights-of-way (ROW). To assess the effects legal constraints have on implementation of a LRMP, it is important to understand the specific details of the legal constraints that apply to THWMA.

All the parcels that make up THWMA are encumbered by multiple restrictions. As described above in section I.C., *History of Acquisition*, THWMA is comprised of five individual land parcels that were acquired by the State of Vermont from 2011 to 2015. In addition to each of the parcel's pre-existing legal constraints such as ROWs and deed restrictions, several unique legal constraints also resulted from the acquisition of each of these properties. One key factor in acquisition of these lands, for example, was habitat protection for the northeastern bulrush (*Scirpus ancistrochaetus*), a federally and state listed endangered species known to exist at this site. A Notice of Grant Agreement, which established THWMA for the protection of the Athens Dome wetland complex through money allocated under the United State Fish and Wildlife Service (USFWS) Land Recovery Grant Program to protect endanger species, was therefore incorporated into the purchase of those parcels where clear title could be found. Similarly, one tract was purchased for use as wetland mitigation and certain restrictive covenants were incorporated upon acquisition to reflect this purpose.

The following is a summary of the major legal constrains that impact management and public use of THWMA. Figure 3 provides an overview of where the following constraints apply with respect to the five main parcels of the property. More detailed information for the properties regarding the specific conditions is available in the ANR regional office.

Summary of Major Legal Constraints

The TNC Wright Estate

1) New England Power Company
    - Property is subject to a ROW easement for a powerline corridor.

2) Declaration of Title
    - The parcel is comprised of three separate parcels. The middle or "Mabel B. Wright" parcel containing 45.24 acres survey bears the notation "This area claimed by the estate of Mabel B. Wright, title not found." Title research conducted at the time of acquisition indicated a clerical mistake rather than an ownership discrepancy. Further information that documents State of Vermont ownership is available at the district office.
    - A survey conducted by I. J. Steele Surveyors LLC in 2010 concluded this parcel contains 78.77 acres. This matches the Grafton tax map but differs from the Town of Grafton Grand list which has the property listed as 93.7 acres.

3) United States Fish and Wildlife Service (USFWS) Grant Agreement Number E-4-RL-1 Dated 8/23/11

- Because federal funds were used in acquisition, the property is subject to the terms and conditions set forth in the *Notice of Grant Agreement* which is provided in Appendix 3. The *Notice of Grant Agreement* states that the property will remain in a "natural and open state" and outlines 13 restricted activities.

David Bemis Lands

1) State holds a ROW from TH#5, Bemis Pond Road, over an old woods road, not a town highway.

2) Declaration of Title
   - This property comes with a Declaration of Title which outlines 12 special exceptions not fully resolved in the deed transfer. These exceptions were researched for this legal assessment by district staff. None of the exceptions were found to affect the management or ownership of the Bemis Lands now in State ownership.

3) USFWS Grant Agreement Number E-4-RL-1 Dated 8/23/11
   - Because federal funds were used in the acquisition of these lands, 179.9 acres of the property is subject to the terms and conditions set forth in the *Notice of Grant Agreement* found in Appendix 3.
   - The 29.2-acre Bemis quitclaim lands are not included in the Grant Agreement.

4) Duck Stamp Funds
   - State Duck Stamp Funds were used in the acquisition of this parcel. These funds are used for wetland conservation.

VT Transco LLC Lands

1) Declaration of Restrictive Covenants dated 6/4/09
   - These lands were purchased as mitigation lands for the "Southern Loop Project" and are subject to restrictions as outlined by the U. S. Army Corps of Engineers declaration found in Appendix 4.

2) USFWS Grant Agreement Number E-4-RL-1 Dated 8/23/11
   - Because federal funds were used in the acquisition of these lands, the property is subject to the terms and conditions set forth in the *Notice of Grant Agreement* found in Appendix 3.
   - The 25-acre Transco quitclaim lands are not included in the Grant Agreement.
   - The 5 acres around the Turner Homestead **are** included in the Grant Agreement and were transferred to the Windham Foundation.

4) Property was granted water rights by John B. Lawrence to Daisy Turner dated 2/27/32. The spring has not been located, but it is believed to be to the north of the Turner Homestead and WMA parcel boundary.

Dewitt Lands

1) USFWS Grant Agreement Number F16AP00052 Dated 12/17/15
    - Because federal funds were used in the acquisition of these lands, the property is subject to the terms and conditions set forth in the *Notice of Grant Agreement,* found in Appendix 3.

2) Property includes a deeded 45' ROW from the Townshend/Grafton Road to the Athens Town Line for "ingress, egress and regress and utility rights."

Sheehan Lands

1) USFWS Grant Agreement Number F16AP00052 Dated 12/17/15
    - Because federal funds were used in the acquisition of these lands, the property is subject to the terms and conditions set forth in the *Notice of Grant Agreement,* found in Appendix 3.

2) Property **may have** a ROW retained by Daisy Turner dated 2/20/74 over TH#6 and located on the east side of the parcel.

3) Property has a deeded 50' ROW for the property owners of the Sheehan subdivision, of which two parcels were sold into private ownership, for access from/to Walker Road (TH#6).

4) Property subject to subdivision permit by State of Vermont Environmental Protection Rules for disposal of waste and sewage.

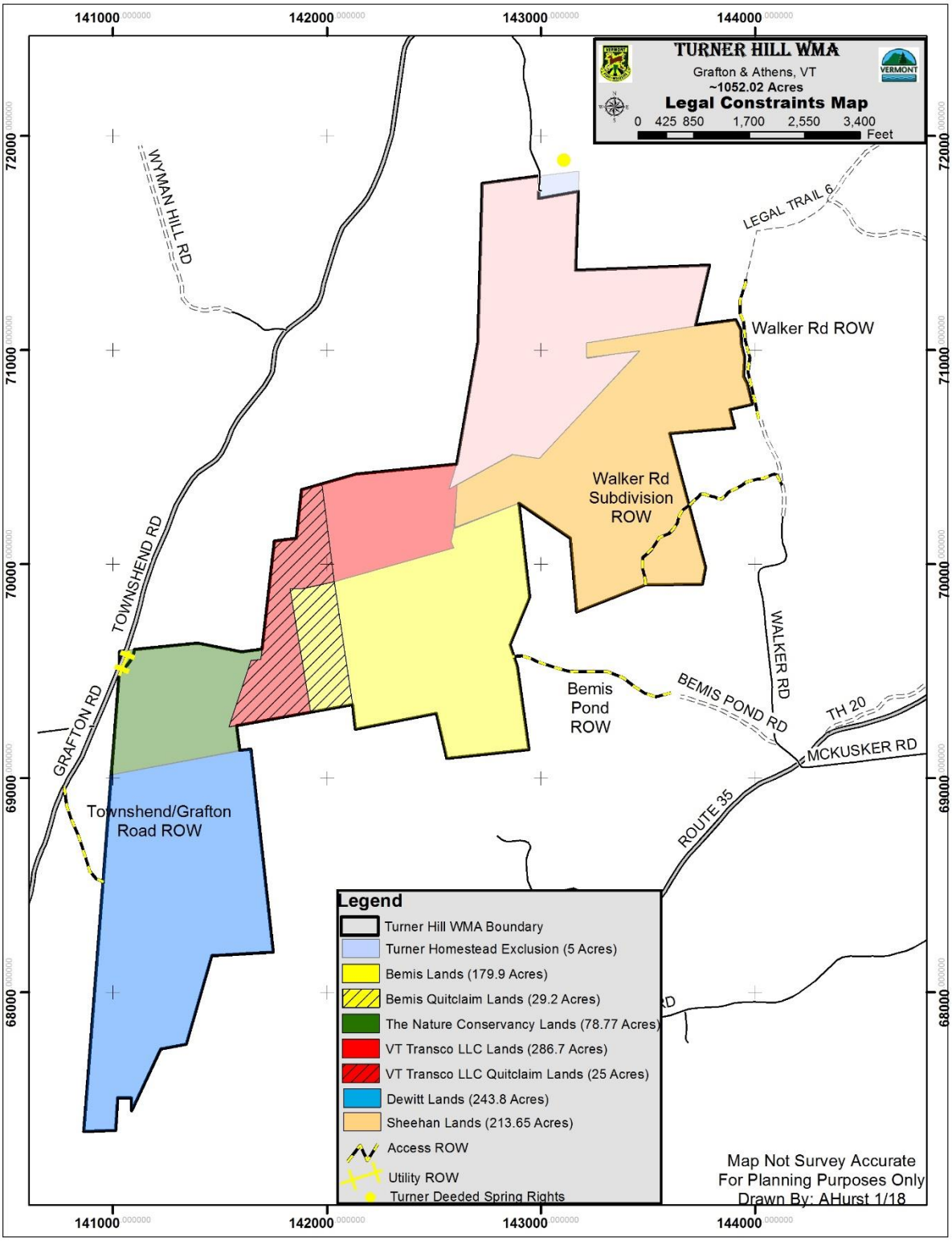
<u>Pertinent Issues</u>:

- The quitclaim parcels are not encumbered by the USFWS Grant Agreement.
- The location of the deeded spring water rights to Daisy Turner has not been found.
- Some of the legal paperwork for title to part of the Wright Estate has not been located.
- The Town of Athens does not list the section of road located between the end of Class 3 Walker Road and Legal Trail #6 in Grafton as town public highway.

<u>Assessment of Need</u>:

- Correct the Athens Land Records to reflect actual survey acreage.
- Continue to research town records for the Mabel Wright Estate.
- Obtain a legal opinion on the validity of the ROW or use of the old roadway along the Walker Road to Legal Trail 6 in Grafton.
- Research all management ROWs for public access potential.

Figure 3: Legal Constraints Map



B. Natural Community Assessment

Coarse Filter Assessment

Biophysical Region and Climate

THWMA is located near the western edge of the Southern Vermont Piedmont biophysical region (Figure 1). This region extends from the relatively warm and dry Connecticut River Valley, to the foothills of the Green Mountains. Because THWMA is located at a relatively high-elevation (approximately 1,000 to 1,600 feet) in the foothills, its climate likely is intermediate in temperature and precipitation between the Connecticut River Valley and the cold and wet higher elevations of the Southern Green Mountains biophysical region. Field inventory of natural communities suggests that some portions of THWMA have a notably cool climate and short growing season that is out of character with much of the Southern Vermont Piedmont.

Bedrock, Surficial Geology and Soils

The bedrock underlying THWMA is some of the oldest in Vermont with rocks formed during Precambrian times some 500 million to one billion years ago. The majority of the WMA is underlain by Mount Holly Complex gneiss. The western portion of THWMA is underlain by granite and gneiss of the Cardinal Brook Intrusive Suite (Athens Dome). All these rocks are acidic and do not contribute substantially to soil enrichment. Glacial till is the predominant surficial geology feature found at THWMA. Where the WMA reaches the valley along the Townshend/Grafton Road, there are areas mapped as kame terrace and as glacial outwash. All these features would have been formed as the glacier ice melted at the end of the last continental glaciation, some 15,000-12,000 years ago. In addition, many of the wetlands have post-glacial accumulations of muck and peat. These are organic materials deposited in very acidic and anaerobic environments which consequently decay more slowly than they are produced. The soils of THWMA are primarily the result of these surficial deposits. The Natural Resource Conservation Service (NRCS) soil mapping indicates that Tunbridge-Lyman fine sandy loams are the most widespread soils, covering approximately 687 acres (Figure 6). Fine sandy loams of the Berkshire, Marlow, Monadnock, Tunbridge, and Westbury series cover much of the remainder of the parcel, with some areas of Lyman-rock outcrop complex. Lupton and Markey series muck and peat is mapped in the wetlands.

Hydrology/Streams/Rivers/Ponds

THWMA receives around 47 inches of precipitation annually. The WMA is located entirely within the Saxtons River watershed. The many wetlands on the WMA form the headwaters for small streams that drain into Athens Pond and Athens Brook to the east, and into the South Branch Saxtons River. The extensive wetlands of THWMA may play an important role in moderating downstream flow volumes and water temperature.

Natural and Human Disturbance

The process of natural disturbance such as wind, fire, and flooding, continually shapes the landscape and influences the expression of natural communities. THWMA shows evidence of typical natural disturbance processes including small scale disturbances such as individual tree death and more moderate scale events such as ice damage. Large scale disturbances (events affecting many hundreds of acres or more) are expected to occur only rarely, but when an event does occur it would have the potential to create dramatic changes in natural communities. The many wetlands in the WMA are highly influenced by periodic disturbance from beaver activity.

The natural cycle of disturbance and recovery resulting from beaver activity creates a diverse set of wetland habitats for many plant and animal species found on the WMA.

Land use history also influences the present-day distribution and condition of natural communities. There is extensive evidence of past timber harvesting and agricultural on THWMA. Much of the northern portion of the WMA near Turner Hill Road was cleared for agricultural. The remainder of the WMA has a history of timber harvesting.

Natural Community Summary and Table

A natural community is an assemblage of biological organisms, their physical environment (e.g., geology, hydrology, climate, natural disturbance regime, etc.), and the interactions between them. The 89 natural community types described in Vermont repeat across the landscape in patches of various sizes. These patches (or groups of patches near each other) are referred to as natural community occurrences and are to be distinguished from broad descriptions of community types.

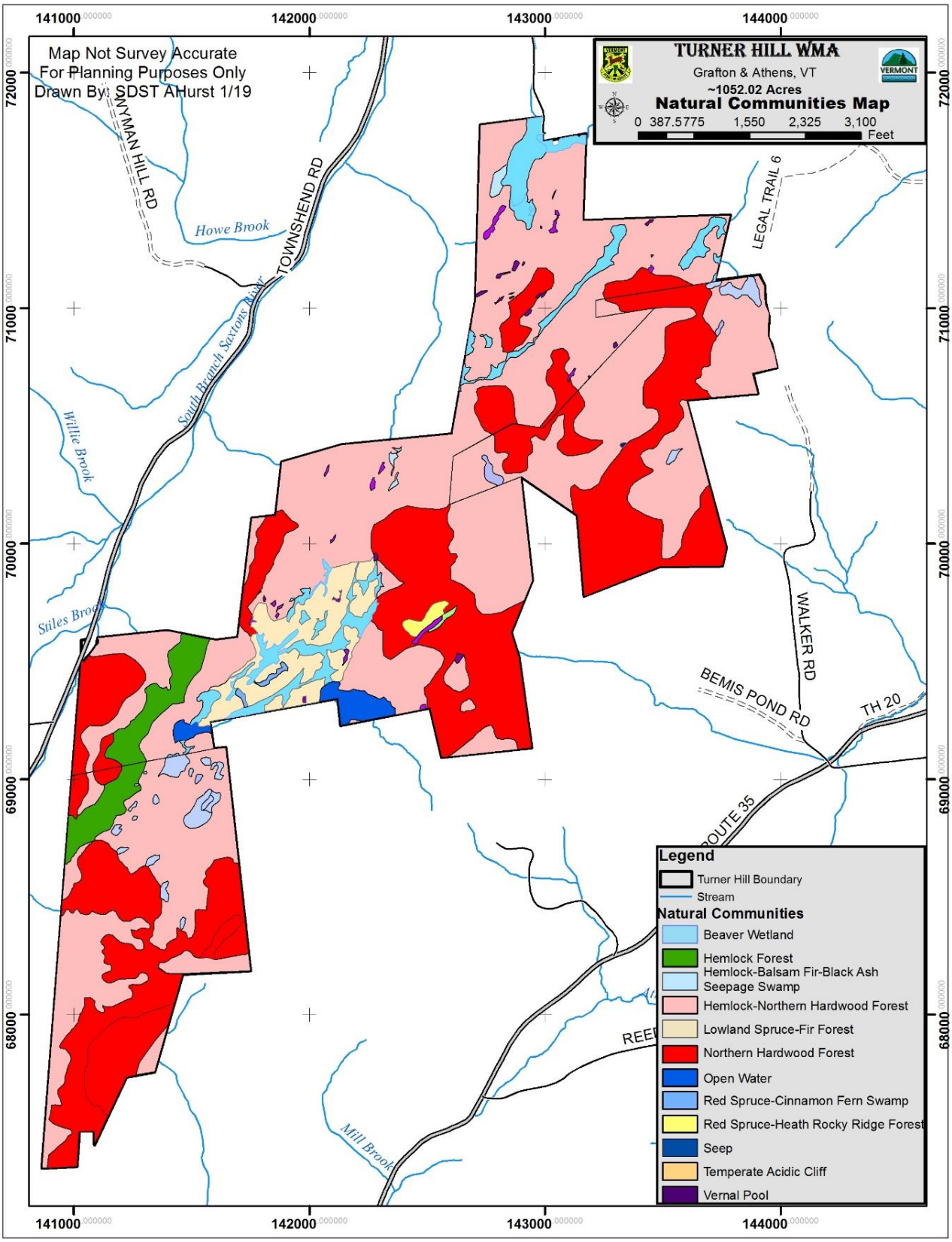
Natural communities at THWMA were identified through aerial photograph interpretation and field surveys (Figure 4 and Table 2). Because some natural communities occur at very small scales (e.g., less than ¼ acre), this mapping effort is probably incomplete. Natural community mapping is an iterative process, and our knowledge improves with each mapping effort. Thus, the map presented here should not be viewed as a final statement on community distribution at THWMA; instead, it should be treated as a first attempt at describing natural communities in this area. Land managers and members of the public should be aware that additional examples of small patch natural communities (e.g., vernal pools and seeps) probably occur on the management unit. As subsequent inventories and site visits are conducted, this map will be improved.

Sixty-nine occurrences of 15 natural community types were identified on THWMA. A total of 160 natural community polygons were mapped. Some broad patterns emerged from this mapping effort. As is typical of the Vermont landscape, most of the parcel is upland forest characterized by a mix of northern hardwood species and eastern hemlock. The high plateau on the southern portion of the parcel, however, contains a notable occurrence of Lowland Spruce-Fir Forest, which is typically found only in the coldest regions of the state. Wetlands comprise about 6.2% of the land area at THWMA yet are responsible for most of the species and habitat diversity on the parcel. Aside from vernal pools and seeps, almost all of the wetlands are influenced by beaver activity. The dynamic nature of these wetlands makes them especially valuable to the plant and animal species on the WMA.

Table 2: Natural Communities of Turner Hill Wildlife Management Area

Natural Communities of Turner Hill WMA				
Natural Community		**Acres**	**Vermont Distribution**	**Example of Statewide Significance?**
Wetlands	Beaver Wetland	52.1	n/a*	n/a*
	Basin Shrub Swamp	.5	rare	yes
	Hemlock-Balsam Fir-Black Ash Seepage Swamp	3.2	common	
	Hemlock-Sphagnum Basin Swamp	.3	rare	
	Red Spruce-Cinnamon Fern Swamp	3.2	uncommon	
	Seep	4	common	
	Vernal Pool	2.2	uncommon	yes
Uplands	Hemlock-Northern Hardwood Forest	517	very common	
	Hemlock Forest	29.5	common	yes
	Red Oak-Northern Hardwood Forest	21	common	
	Northern Hardwood Talus Woodland	2.7	uncommon	yes
	Northern Hardwood Forest	372	very common	
	Lowland Spruce-Fir Forest	41	uncommon	
	Red Spruce-Heath Rocky Ridge Forest	2.7	uncommon	
	Temperate Acidic Cliff	0.6	common	
*Because of their dynamic nature, beaver wetlands cannot be assessed for distribution or significance using comparable methods to other natural community types.				
For more information on these and other natural communities, see Wetland, Woodland, Wildland: a Guide to the Natural Communities of Vermont, by Elizabeth Thompson and Eric Sorenson. Information may also be found online at: https://vtfishandwildlife.com/conserve/conservation-planning/natural-community-inventory				

Figure 4: Natural Community Map



Fine Filter Assessment

Rare, Threatened, and Endangered Plant Species

Two species of rare to uncommon plants have been located within THWMA (Table 3). In addition, a third plant species of conservation concern occurs on THWMA but is not listed in this report because of data sensitivity concerns. One of the rare species, northeastern bulrush (*Scirpus ancistrochaetus*) is listed as "endangered" by both the Federal Endangered Species Act and the Vermont state endangered species statute (10 V.S.A. 123). Its occurrence at THWMA is thus very important on a statewide and nationwide basis.

1. Northeastern Bulrush (*Scirpus ancistrochaetus*) – Rare (S2S3) to Uncommon

Northeastern bulrush is legally protected as "endangered" under both the Vermont state endangered species statute and the Federal Endangered Species Act. The species is typically found in wetlands prone to fluctuating water levels and is commonly found in association with beaver flowages as is the case within THWMA. Since beaver activity fosters such water level fluctuations, allowing for the natural cycle of beaver activity within THWMA is an important strategy for protecting the long-term viability of this rare plant population. Furthermore, because the seeds of this bulrush can remain viable and go undetected in wetland substrate for long periods of time, management activities that alter the natural fluctuation of water levels may have negative impacts on the persistence of this species even if the plants have not been documented within a particular wetland.

2. Spotted Wintergreen (*Chimaphila maculata*) – Rare (S2S3) to Uncommon

This species is typically found in dry-mesic forests and almost all occurrences in Vermont are in the southeastern part of the state. Its presence at THWMA is somewhat unusual since the site appears to be more mesic and cooler in climate than most other known Vermont sites for this species. Only a few stems of this species were found on the WMA. Management activities that directly damage individual plants are probably the greatest threat to the long-term persistence of this occurrence.

Table 3: Rare, Threatened, and Endangered Plants of Turner Hill WMA

Rare, Threatened and Endangered Plants of Turner Hill WMA				
Species Name	**Common Name**	**State Rarity Rank***	**Rarity***	**Legal Status**
Scirpus ancistrochaetus	Northeastern Bulrush	S2	Rare	Endangered
Habitat: Beaver Pond/Wetland Complex Threats: Water Level Management Opportunities: Continued monitoring and maintaining beaver wetlands.				
Chimaphila maculata	Spotted Wintergreen	S2	Rare	Uncommon
Habitat: Dry Mesic Forests Threats: Damage to individual plants Management Opportunities: Manage activities to avoid plants.				
*For a full explanation of these rarity ranks, visit the Vermont Natural Heritage Information Project website: https://vtfishandwildlife.com/node/179				

Definitions for Rare Plant Table

Rare	S2	At high risk of extinction or extirpation in Vermont due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.
Uncommon	S3	At moderate risk of extinction or extirpation in Vermont due to restricted range relatively few populations or occurrences (often 80 or fewer), recent and widespread declines, or other factors.

Pertinent Issues:

- Beaver impoundments are critical to the habitat for northeastern bulrush.
- Maintain ecological integrity of wetlands.

Assessment of Need:

- Further delineation and mapping of natural communities.
- Continued surveys for rare, threatened, and endangered species.
- Monitor existing rare, threatened, and endangered populations.
- Further identification and ground truthing of Natural Community types on southern and eastern parcels.

C. Forest Health Assessment

General Forest Health:
Forest health with regard to productivity and management at THWMA is a result of insect and disease damage, environmental and site conditions, and human factors.

Human Factors
The initial clearing and agricultural uses of this land by European settlers and their successors compacted soils, caused erosion, and depleted soil nutrients. Once reforested, selective harvesting of the largest and most vigorous trees resulted in the further decline of overall tree vigor and soil rutting and erosion on the wetter or steeper sites. Such timber harvesting activities have occurred on the property on a periodic basis since the late 1800s and evidence of damage to trees and soils from these poor harvesting practices is still evident.

Insect and Disease
The maple leaf cutter insect was first documented on the property in 1980; however, the severity of this outbreak and the resulting damage is unknown. In 1988, pear thrips defoliated hardwood foliage in the region though in most cases trees made a full recovery. Pear thrips were again documented in 1998 in another region-wide outbreak. Birch leaf miner defoliated paper birch trees on the property in 1992. From 2004 through 2006, forest tent caterpillars defoliated hardwood stands throughout Vermont and may have affected this property as well although it was not specifically identified as having been damaged by this outbreak during annual forest health aerial surveys. Beech bark disease, a fungal pathogen, is common on the WMA as well as white ash decline of an undetermined cause.

Environmental and Site Conditions
Although ice damage was documented on the property in 2009, low to moderate elevation minimized vulnerability to damage from heavy snowfalls and ice accumulations. Soils are composed of acidic glacial till and productivity on these sites is typically moderate to poor. Deer and moose populations on THWMA are a moderate concern to forest regeneration (seedlings and saplings). Previous harvests have stimulated dense northern hardwood seedling growth and browse pressures do not seem to be limiting stem growth in many areas. However, heavy browsing by deer/moose in a few areas have left hardwood seedlings stunted and damaged. Intense browsing on red maple, yellow birch, and white ash is most notable.

Invasive Exotic Species:
Similar to the patterns experienced throughout the region, human activities on and in the vicinity of this WMA over past centuries has led to the introduction of many exotic plant and insect species. In many cases, the occurrence of these species has significant management implications warranting special consideration. The risk of new invasive exotic species becoming established is an ongoing concern.

Plants
There are many non-native plant species at THWMA. Although most are not a threat to native vegetation, habitats, or wildlife, there are some of notable exceptions (Table 4). Invasive Eurasian honeysuckle (*Lonicera* spp.) has been found near the Turner Homestead. Japanese barberry (*Berberis thunbergii*), glossy buckthorn *(Rhamnus frangula)*, and common buckthorn (*Rhamnus cathartica*) are scattered, often on wetland edges. There is one patch of Japanese

knotweed (*fallopian japonica*) near the parking area along Turner Hill Road. While at present these species are sparse and/or widely scattered on the parcel and are having minimal impacts, they have the potential to rapidly spread, resulting in the displacement of native plant species and a reduction in wildlife habitat value. Since these are relatively small populations of invasive plants, it is likely that effective control of these species on the parcel is possible.

Table 4: Invasive Exotic Plants of Turner Hill WMA

Invasive Exotic Plants of Turner Hill WMA					
Species Name	**Common Name**	**Distribution**	**Estimated % Cover**	**Sites Where Found**	**Present Threat to Native Plant Communities**
Phragmities australis	Japanese Knotweed	Low	N/A	Parking Area	Local threat to native species
Berberis thunbergii	Japanese Barberry	Low	N/A	Throughout	Local threat to native species
Lonicera spp.	Eurasian Honeysuckle	Low	N/A	Homestead Area	Local threat to native species
Rhamnus cathartica	Common Buckthorn	Low	N/A	Throughout	Local threat to native species
Rhamnus Frangula	Glossy Buckthorn	Low	N/A	Throughout	Local threat to native species

Insects
There have not been any sightings of invasive insects on THWMA. There are, however, three potential damaging exotic insects currently of regional concern (Table 5).

Table 5: Invasive Exotic Insect Species that will be monitored over time at Turner Hill WMA

Invasive Exotic Insect Species that will be Monitored over Time at Turner Hill WMA			
Name	**Description**	**Species**	**Nearest Location**
Asian Longhorned Beetle	White and black 1-1 ½” long	maple and other hardwoods	Worchester, MA ~ 80 miles
Emerald Ash Borer	Metallic green ½” long D-shaped exit holes	all species of ash	Concord, NH ~ 50 miles
Hemlock Woolly Adelgid	White woolly mass underneath hemlock needles	hemlock	Grafton, VT

<u>Pertinent Issues</u>:
- Potential threat from invasive exotic plant and insect species.
- Decline of hemlock in deer wintering areas due to hemlock woolly adelgid.

Assessment of Need:

- Monitor for invasive exotic insects.
- Monitor for insect and disease outbreaks.
- Manage invasive exotic plants pre-emptively.
- Maintain closed-canopy cover in deer wintering areas and perhaps transition from hemlock to other softwood species.

D. Wildlife and Habitat Assessment

The diverse habitats found on THWMA fulfill part or all of the life cycle requirements for many common wildlife species (Figure 5). Although specific surveys to document the presence of wildlife on the WMA have been limited, such surveys conducted on other properties containing similar natural communities are relied upon to provide baseline information as to what species would be expected to exist within THWMA. No population data has been collected.

Expected and Observed Species

Mammals: Although the Southern Vermont Piedmont biophysical region offers a diversity of natural communities upon which many common species of wildlife depend, the species most likely to be found within the WMA is influenced by the specific habitat conditions that occur. Most of the WMA is comprised of two upland natural community types: Hemlock-Northern Hardwood Forest and Northern Hardwood Forest. Common mammals occurring in association with these natural communities include masked shrew, red squirrel, northern flying squirrel, southern flying squirrel, white-footed mouse, woodland jumping mouse, deer mouse, chipmunk, porcupine, black bear, and white-tailed deer.

Hard and soft mast food sources interspersed throughout these natural communities further enhances foraging opportunities for black bear, white-tailed deer, fox, coyote, and fisher. A small area of the WMA, the three acres of Red Spruce-Heath Rocky Ridge Forest and Temperate Acidic Cliff communities located in the Southeast area, offer denning habitat for porcupine and bobcat as well as foraging habitat for fisher. The Hemlock and Hemlock-Northern Hardwood Forest serve as critical wintering habitat for deer. The beaver wetland and other wetland community types found on the WMA provide essential habitat for numerous species. These wetland communities are vital to the life cycle of furbearer species such as beaver, muskrat, mink, and otter, and they provide important habitat during certain times of the year for bear, white-tailed deer, and moose. During routine field work on the WMA, common species observed include black bear, white-tailed deer, moose, bobcat, mink, beaver, muskrat, and various small mammals.

Birds: Similar to mammals, the diversity and abundance of birds expected to exist within the WMA is indicated by the natural community types present. Characteristic birds of the northern hardwood forest communities include the hermit thrush, rose-breasted grosbeak, ovenbird, red-eyed vireo, eastern wood pewee, black and white warbler, black-throated blue warbler, veery, and scarlet tanager. The ruffed grouse and eastern turkey undoubtedly make use of the hard and soft mast sources found in this forest type. The northern saw-whet owl, red-breasted nuthatch, blackburnian warbler, and solitary vireo are known to nest within the Hemlock Forest natural community, and brown creepers and winter wrens are likely inhabitants of the Lowland Spruce-Fir Forest. The beaver wetlands found within the WMA provide essential foraging and nesting habitat for a variety of wetland dependent birds such as the Canada goose, wood duck, and great blue heron. Game species such as ruffed grouse, eastern turkey, American woodcock, and a variety of waterfowl have been observed on the WMA during routine field work. Similarly, a host of neo-tropical migrants and residential species are also routinely observed on the WMA. Additional common species are expected.

Bats: Though bat populations are dramatically reduced due to several factors, the wetlands, seeps, pools, and swamps present on Turner Hill WMA could provide ideal foraging habitat for a variety of Vermont's bat species, including the little brown bat, which is known to forage on aquatic insects. Apart from the small-footed bat, which has been observed within a few miles of the WMA, all of Vermont's bat species roost in trees and utilize a variety of both live, and dead and dying trees that contain suitable roosting features such as cracks, crevices, cavities, and loose bark. The three migratory tree-bat species (i.e., the hoary, silver-haired, and eastern red bats) roost solitarily on tree branches or leaf petioles in a variety of both hardwood and softwood species.

Most bat species forage within 3 miles of their roost and often used this habitat in the spring and fall as migratory stopovers. The closest hibernaculum is 7 miles to the northwest of this WMA and both northern long-eared and little brown bats have been observed there during the 2014/15 winter. Below is a list of bat species illustrating their conservation status and proximity to the WMA. Of the nine species of bat found in Vermont all but the Indiana Bat, *Myotis sodalis* (FE, SE)*, could utilize this WMA.

Species & Status	**Town Confirmed**
Big brown bat, *Eptesicus fuscus*	Athens, Grafton, Jamaica & Townshend
Eastern red bat, *Lasiurus borealis*	Widespread
Hoary bat, *Lasiurus cinereus*	Widespread
Silver-haired bat, *Lasionycterus noctivigans*	Widespread
Tri-colored bat, *Pipistrellus subflavus* (SE)	Jamaica
Little brown bats, *Myotis lucifugus* (SE)	Jamaica, Townshend & Windham
Northern long-eared bats, *Myotis septentrionalis* (FT, SE)	Jamaica, Townshend & Windham
Eastern small-footed bat, *Myotis leibii* (ST)	Jamaica & Townshend

* Species presence records with notation on federally endangered or threatened (FE, FT) or state endangered or threatened (SE, ST)
* Data and supporting information obtained from Alyssa Bennett, Small Mammals Biologist, VT Fish & Wildlife Department

Reptiles and Amphibians: There is an abundance of reptile and amphibian habitat found on the WMA. Extensive surveys conducted on the 312-acre VT Transco LLC mitigation lands identified the occurrence of at least 11 vernal pools functioning as amphibian breeding areas. Although no similar surveys have yet been conducted on the remaining acreage, additional reptile and amphibian habitats are expected to occur. Common species found on the WMA include eastern newt, northern two-lined salamanders, red-backed salamanders, spotted salamanders, wood frogs, snapping turtles, and garter snakes. Egg masses of the less common Jefferson and blue-spotted salamanders have also observed on the WMA. It is expected that spring salamanders and dusky salamanders make use of the numerous seeps and headwater streams. One red bellied snake was observed on a beaver dam near the Turner Homestead. Additional common species are expected.

Fish: The beaver wetlands and headwater streams found on THWMA host a variety of fish species including brook trout, brown bullhead, pumpkinseed, blacknosed dace, creek chub, and slimy sculpin. A full aquatic assessment, including fish community survey, has yet to be completed for surface waters on THWMA.

Critical Habitats

Wetlands, Streams, Ponds, and Riparian Habitat: Water features on the WMA are numerous and varied. There is 65.5 acres of water associated habitat mapped on the property in wetland categories such as vernal pools, seeps, swamps, and beaver ponds. Additionally, there is 2 miles of riparian habitat associated with wetlands and streams. Smaller, ephemeral streams have also been identified on the WMA. Water features such as those found on THWMA provide a variety of critical habitats for a host of wildlife species.

Heron Rookery: A great blue heron nesting site is present in a large beaver wetland on the south-central portion of the WMA. Two active nests were identified in June of 2013. Great blue herons typically nest in the crowns of dead trees located in or very near water. Wetlands and surrounding uplands provide important feeding and nesting habitats.

Amphibian Breeding Sites: Eleven vernal pools are functioning as amphibian breeding sites. Additional breeding areas are expected to be identified upon further evaluation of such habitats on the WMA. There was a total of 19 vernal pools found on the WMA during forest inventory.

Deer Wintering Areas: Hemlock-Northern Hardwood Forest is a predominate forest type on the WMA. Hemlock Forest a smaller proportion. Approximately 274 acres of deer wintering area have been identified within these forest types. These sites are characterized by concentrations of softwoods having high canopy closure and providing numerous thermal and microclimatic advantages to deer such as reduced snow depths, less wind, increased daily mean temperatures, and increased relative humidity. South and southwest facing slopes are often preferred wintering areas because of the increased solar heat they receive. The proximity of hardwood browse to the core wintering areas is also an important consideration for delineating and managing deer wintering areas.

Black Bear Feeding Areas (wetlands and/or bear-scarred beech): Several habitats supporting important spring time foraging for black bear were observed during the forest inventory. These are characterized by an abundance of herbaceous vegetation early in the spring and are typically associated with wetlands. A variety of mast producing trees such as red oak and black cherry occur on the property and provide important foraging opportunities for bears in both the fall and spring. Scattered bear-scarred beech trees can be found throughout the WMA indicating a history of bear use of this important mast crop. Previous timber harvests have regenerated raspberry and blackberry providing soft mast for bear and other wildlife. An apple orchard by the Turner Homestead provides soft mast during the late summer and early fall.

Bobcat Den Habitat: Although no actual den sites have been found on the WMA, a rocky area has been identified as having reasonable potential for bobcat denning sites. This area is comprised of various sized boulders on steep slopes in the eastern region of the WMA. There is also a steep rocky bank on western portions of the WMA above the Townshend/Grafton Road which may serve as additional bobcat denning and foraging habitat.

Important Habitat Features

Core Forest and Habitat Blocks: "Core Forest" is a biological term used to refer to any forested areas that are greater than 100 meters from human-created, non-forested opening. While edges and transition zones are excellent habitat for some native plant and animal species, edges also negatively impact many forest resources. Increases in invasive species and in predation on many native songbirds, and a decrease in wildlife that prefer to use large blocks of intact forest, are all associated with an increase in forest edge. Additionally, unbroken forest allows for easy dispersal of plants and animals, without large barriers to this movement.

THWMA is located within a 7,400-acre habitat block. At least 5,500 acres of that block is considered core forest. Most of THWMA meets this definition except for areas within 100 meters of Turner Hill Road, the historic Turner Homestead and the Townshend/ Grafton Road. The WMA is also near an 18,000-acre habitat block just to the west of the Townshend/Grafton Road and other large habitat blocks that connect to the Green Mountains.

Species Movement Corridors: Connections between wild lands serve an important role in maintaining the long-term health and viability of wildlife populations. Wildlife corridors allow individual animals such as dispersing young to move throughout the landscape and also facilitate the transfer of genetic information across the region. Even the occasional travel of a few individual animals between otherwise isolated populations can increase overall genetic diversity and enhance a species long-term viability.

In a 2012 landscape-level analysis, the area around THWMA was identified as suitable for concentrated species movements suggesting its high value as a species movement corridor. Suitable conditions for concentrated movements extend west into the Southern Green Mountains and the large habitat blocks of the Green Mountain National Forest. The same analysis found that most of the landscape around THWMA is suitable for diffuse species movements, indicating that overall the landscape is "permeable" and functions to provide plant and animal species opportunities to shift their distributions across the landscape.

Hard Mast Stands: American beech is a common species throughout the WMA. Red oak was also identified as important hard mast species. Distribution of these species is variable throughout the parcel with red oak being more common on the higher dry ridges. A 20-acre concentration of beech and red oak on the south-central portion is an important mast feeding area.

Soft Mast Trees and Shrubs: An abundance of soft mast species is present. One small apple orchard has been maintained near the Turner Homestead. Black cherry is a common forest species found throughout the WMA while blueberry and hobblebush are present in several natural community types. Raspberry and blackberry are commonly found in previously harvested areas.

Cliff or Talus Slopes: A single, small occurrence of cliff is found on the eastern side of the property, characterized by a 5- to 10-foot-high broken ledge system. On the western portions of the property is a steep rocky slope which resembles a Talus Slope and shares some habitat values with those habitat types. Though small in area, the jumbled rocks in these landforms can provide habitat for many wildlife species including porcupine, bobcat, and other small mammals.

Snags, Den Trees, and Downed, Dead Wood: These features provide nesting habitat, roosting habitat, and cover for a wide variety of bird, mammal, and amphibian species. The state-endangered northern long-eared bat (*Myotis septentrionalis*) and tricolored bat (*Perimyotis subflavus*) are known to roost in snags and cavity trees. Past insect defoliations, storm damage events, and forest management practices have all increased the amount and type of this material occurring on the WMA. Forest inventory data indicates an abundance of these features on the property and that ample opportunity exists to perpetuate these important habitat features via the implementation of forest management practices. Current data shows that there is on average ~16 snags/acre (5 trees/acre >20" DBH) with a mean diameter of 9.7", indicating many large dead trees serving this critical habitat component.

Habitat Diversity: The most common forest type on the WMA is even-aged hemlock-northern hardwood forest (Table 6). There are stands of hardwood and hemlock scattered throughout the property. Most of the WMA is even-aged and of small to medium sawtimber size. Stand age is between 60 and 80 years with larger and older individual trees scattered throughout.
A spruce/fir forest in the southern section of the property is interspersed with wetlands. Additional wetland habitats such as ponds, streams, and swamps provide important habitat features and are more common and disbursed here then on the typical upland forest of this region. One old apple orchard is located around the Turner Homestead. Riparian stands of alder are common as well as grassland habitats associated with abandoned beaver ponds. Prominent rock ridges, locally known as the Athens Dome, are exposed where soils are shallow and provide additional habitat types.

Open Lands: The only "permanent" opening is around the Turner Homestead, although this has not been maintained in recent years. Most of the open land that surrounded the homestead was abandoned to revegetate to alder and northern hardwood, and portions of this area have subsequently been inhabited by beavers. This area is now the responsibility of the Windham Foundation. Beaver flowages provide additional open lands throughout the WMA. When beaver abandon an area, the unmaintained dams eventually breach allowing the pond to drain and become re-vegetated by first grasses and sedges and ultimately by a new forest. These "openings" are cyclical in nature and provide a variety of habitats for many species of wildlife.

Aquatic Habitat Diversity: Fish use large woody debris (LWD) for refuge during high flows, cover from predation, and feeding locations where macroinvertebrates are typically abundant. LWD serves as substrate for an array of invertebrates that feed directly on the woody debris or that use the wood structure to build retreats for filtering the water column. Some research has shown a link between increased fish diversity and LWD abundance. LWD also serves as important winter rearing grounds for fish and contributes to bed roughness in streams. Several studies on riparian areas have suggested that LWD is a good indicator of lateral connectivity, helps retain organic material in a stream and serves as retentive substrate for riparian vegetation. No assessment has been done to survey the quantity of LWD in the brooks or ponds.

Age Class Diversity:

Table 6: Habitat Diversity in Turner Hill WMA

Habitat Diversity in Turner Hill WMA			
Habitat Condition	**Description**	**Acres**	**Percent of Parcel**
Wetlands (23.8% of the 1,052 Acres)	Open Water and Wetlands	65.5	6.2%
	Riparian Areas	185	17.6%
Permanent Openings	Fields, landings, orchards, powerline corridor	0	
Lowland Spruce-Fir Forest: Even-aged Sawtimber (St)	Red Spruce and Balsam Fir Habitat	41	3.9%
Upland Forest: Even-aged	Northern Hardwood, Hemlock Northern Hardwood & Hemlock Forest	760.5	72.3%
• Regeneration through seedlings (S)		0	>1%
• Sapling through poletimber (Sp)		0	>1%
• Sawtimber (St)		760.5	72.3%
Upland Forest Uneven Aged		0	0%

S *Regeneration through seedlings:* Live trees and associated vegetation less than 1.0 inch DBH and at least 1 foot in height.

Sp *Sapling through poletimber*: Saplings are live trees 1.0 to 4.9 inches DBH; poles are live trees 5.0 to 8.9 inches DBH for softwoods and 5.0 to 10.9 inches DBH for hardwoods. The matrix assumes that stands are fully stocked, that is, contain approximately 75 square feet of basal area per acre.

St *Sawtimber:* A stand with at least half of the stocking in sawtimber-size trees – at least 9.0 inches DBH for softwoods or 11.0 inches for hardwoods.

L *Large sawtimber*: A stand with at least half of the stocking in large sawtimber trees – at least 20 inches DBH for softwoods and 24 inches DBH for hardwoods.

U *Uneven-aged:* Stands of northern hardwood cover types that contain trees of all size classes.

Source: DeGraaf, R., et al. 2006. Technical Guide to Forest Wildlife Habitat Management in New England. University of Vermont Press, Burlington, Vermont.

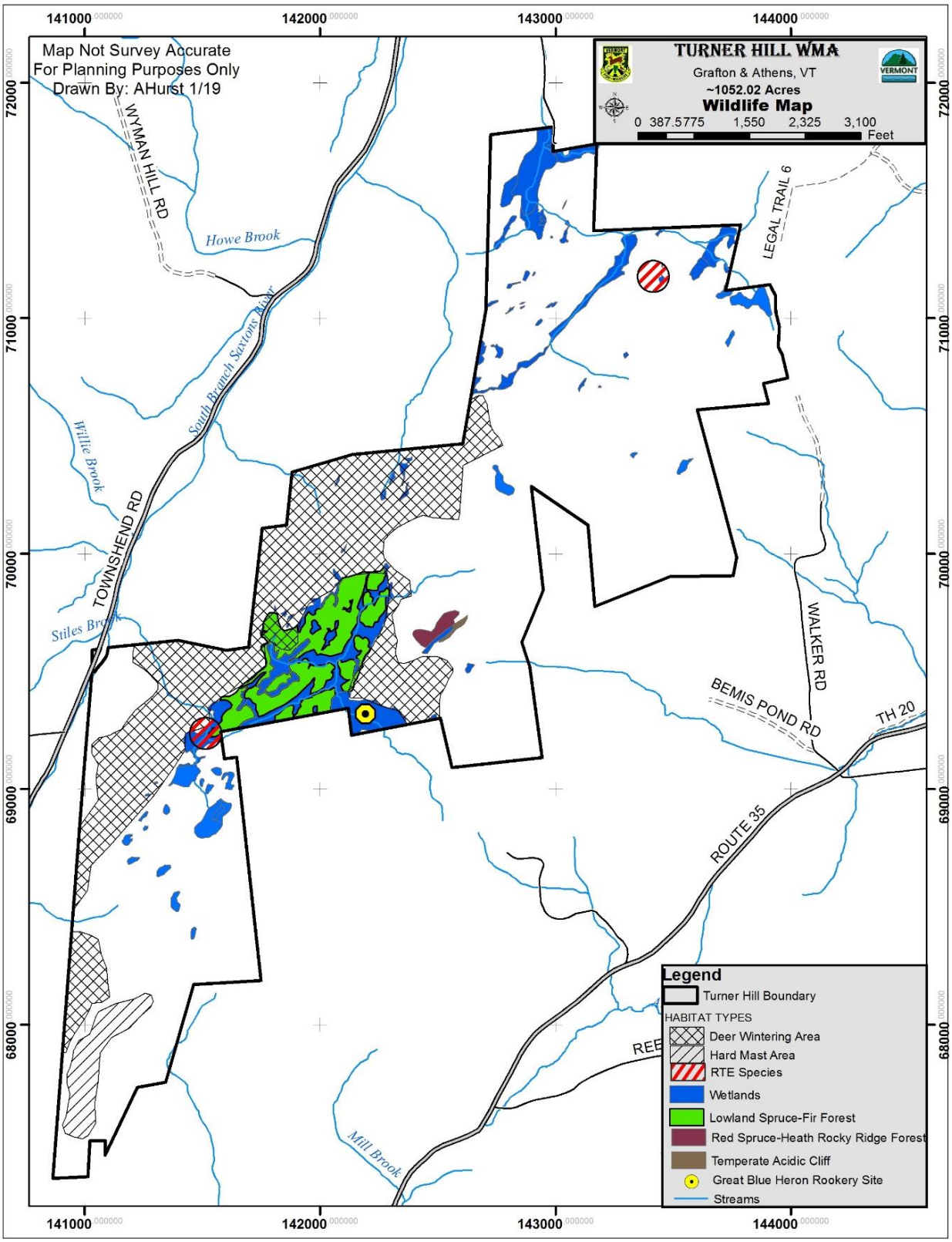
Pertinent Issues:

- Lack of diversity in size and age class of trees/stands.
- Invasive plant and animal species impacting wildlife habitats and complicating management activities and options, i.e. honeysuckle and hemlock woolly adelgid.
- Lack of markets for low quality wood products limiting habitat management options.
- Limited access to lands suitable for forest/habitat management.

Assessment of Need:

- Development of multiple age and size classes thru management.
- Comprehensive wildlife species assessments.
- In-stream and water body LWD assessments.
- Fish community assessment.
- Additional inventory of amphibian breeding sites.
- Continued survey work throughout the property to determine additional amphibian breeding sites.
- Surveys for bat species presence and abundance.

Figure 5: Wildlife Habitat Map



E. Timber Resource Assessment

History of Forest Management: There were numerous timber harvests throughout the WMA before State ownership. Most of the valuable trees were harvested before State acquisition. Access from Turner Hill Road in Grafton served as the main access for northern sections of the WMA. Beaver dams have flooded this access which is currently not usable for management activities. Southern portions were accessed via a ROW from Bemis Pond Road. Previous sale activities did not include stabilizing road networks, and the ROW is no longer usable. The ROW to the southern lands is in similar condition and complicated by a stream crossing. Eastern portions of the property were accessed via Walker Road.

Existing Conditions:

a) Regeneration/Age Class Distribution/Tree Quality – Most stands are stocked with pole to small sawtimber size trees. Stem quality ranges from poor to moderate in pockets of better soils. Tree stocking is moderate to high over much of the WMA. Regeneration is unacceptable in many areas with moderate to high stocking of American beech and striped maple. Beech and striped maple will create low productivity monocultures over the long term. Several areas with dense red spruce regeneration are present. Pockets of desirable northern hardwood regeneration exist in some previously harvested areas.

   Tree species composition is well suited to the goals of wildlife habitat management. Low quality stands lend themselves to early successional habitat. Stands have a significant amount of old logging damage to dominant and co-dominant stems. Most forest stands are even-aged or two-aged where regeneration from the last harvest was established. Invasive plant species do not pose a concern for this parcel currently. Future management activities may need to address this issue if conditions change.

b) Soil and Site Conditions – Timber management potential is poor over much of the WMA due to a prevalence of low productivity soils (837 acres) and good to excellent on 215 acres (Table 7, Figure 6).

Table 7: Site Class Management Potential

Site Class	**Potential Productivity** (cubic feet of wood/acre/year)	**Site Index** (height at age 50)		**Acres**
Site Class I	>85 cubic feet	White Pine Northern Hardwoods	70’ 60’	164
Site Class II	50 to 84 cubic feet	White Pine Northern Hardwoods	60-69’ 53-59’	51
Site Class III	20 to 49 cubic feet	White Pine Northern Hardwoods	50-59’ 45-52’	687
Site Class IV	<20 cubic feet	White Pine Northern Hardwoods	50’ 45’	150

Primary soils include:

Tunbridge-Lyman Fine Sandy Loam: Poorly productive soils for deciduous trees such as sugar maple. Parent Material: Extremely to strongly acidic glacial till, 10 to 40 inches to bedrock.

Marlow Fine Sandy Loam: Very productive soils for northern hardwood. Parent Material is dense basil till: Very strongly to moderately acidic glacial till, > 60 inches to bedrock.

c) Dominant Forest Types – The most common forest types are Hemlock Northern Hardwood Forest and Northern Hardwood Forest (Table 8). Aspen-Paper Birch forest type, a variant of northern hardwood type, is present but in low abundance. Patches of alder are common in wet depressions and wetland edges.

Table 8: Dominant Forest Types

Type	Major Species	Condition	Quality	Regeneration
Hemlock-Northern Hardwood *567 acres**	Hemlock Red Maple	Small sawtimber. Moderate to low stocking.	Variable to Poor	Mixed, often poor as above. Occasional dense pockets of Red Spruce and Northern Hardwood regeneration.
Northern Hardwood *329 acres**	Red Maple American Beech Paper Birch	Small sawtimber. Moderate stocking.	Variable to Poor	Often poor – American Beech and Striped Maple. Some pockets of Northern Hardwood and Hemlock regeneration.

**total acres*

d) Health/Vigor of Timber Resource – Soils are moderate to poorly productive for growing trees on most of the WMA. Tree health is best in pockets where soils are deeper and fertile. Most of the stands were harvested before state ownership and have a history of insect and disease damage.

e) Access/Operability – THWMA has limited access for management. There are potentially four access points but multiple water features that limit equipment use. Of the 1,052 acres, roughly 800 acres are suitable for timber management. The main access for the property is from the class 3 Turner Hill Road in Grafton. The town road ends on the property. Beavers have flooded this access which is currently not usable for management. Southern portions were accessed via a ROW from Bemis Pond Road. Previous sale activities did not include stabilizing road networks, and the ROW is no longer usable. On the southwest, there is a ROW for access from the Townshend/Grafton road to the Dewitt lands, but this access is steep and requires crossing the Saxtons River. On the east, the property borders the Walker Road, but it's unclear if this section of road is a public highway. However, it is used frequently by the public and adjacent landowners for recreation and commercial activities. There is also a ROW to eastern portions through private land, but it is unclear if this can be used for public access. Access from Walker Road is the best access option.

Terrain at THWMA is mostly flat with occasional rolling hills. Due to this, water features are common; and the size, abundance, and placement within the WMA make some management operations challenging. A few ledges are present oriented in a north/south direction. Western portions of the WMA are extremely steep and are considered to be non-commercial. Southeastern portions are sloped to the east and some are considered to be non-commercial.

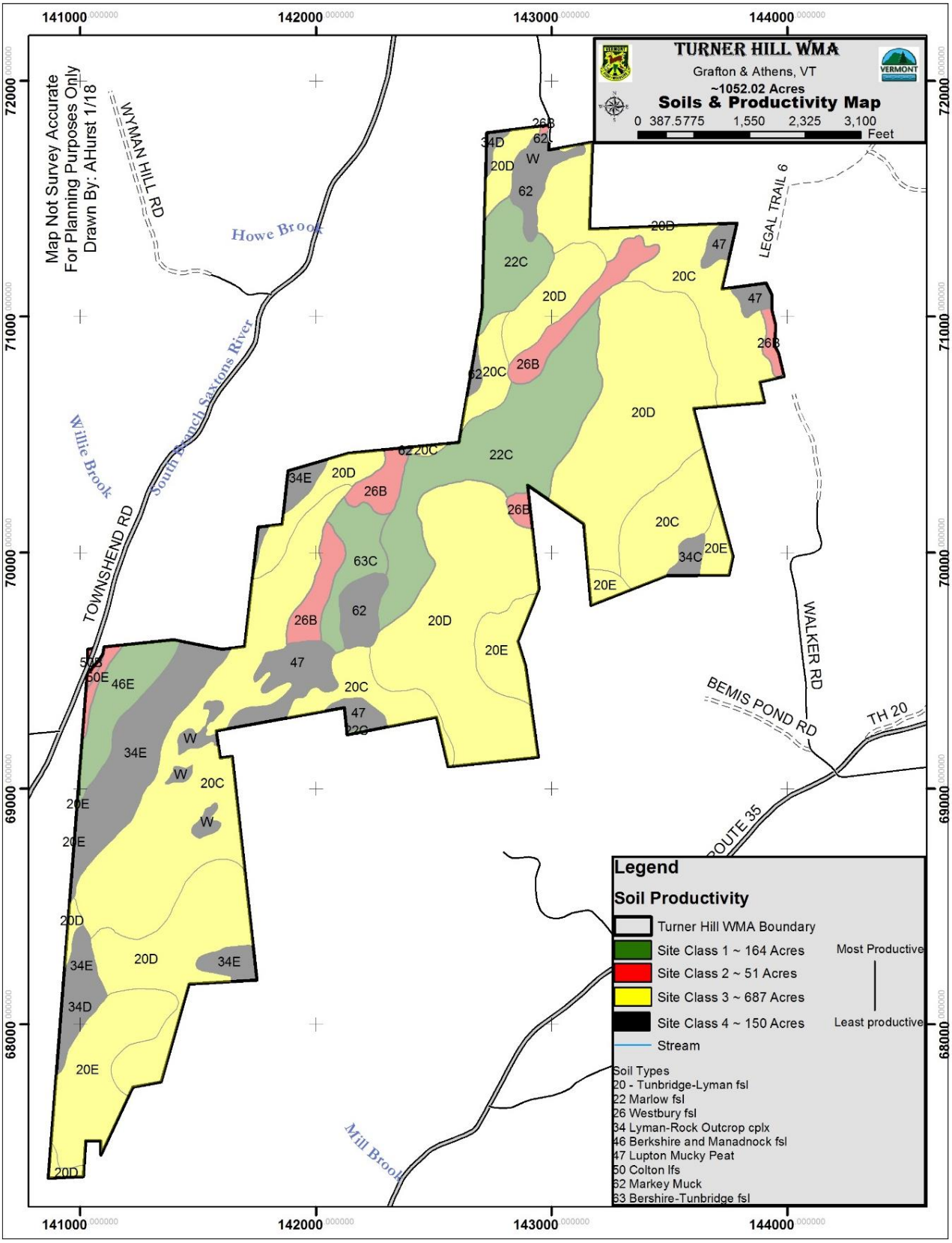
Pertinent Issues for Forest Management:

- Maintaining access from Turner Hill Road through or around the beaver pond.
- Maintaining access from Turner Hill Road through or around the Turner Homestead.
- Building new or rebuilding the ROW from Bemis Pond Road on the east.
- Condition and utility of the southwestern ROW.
- Damage to road networks by unauthorized off-roading and previous timber harvest operations.
- Existing timber stands of poor to moderate quality may not support commercial operations.
- History of insect, moose, and logging damage resulting in stem decay and decline.
- Locating proposed trail network to minimize conflict with management activities.
- Access and operability on portions of the WMA due to aquatic habitats and wet soils.
- Legal status of the Walker Road and periodic maintenance for management access.

Assessment of Need: Major factors affecting management of THWMA are:

- Better access to the entire property is needed.
- Segments of interior roads need re-location out of wet soils.
- Low quality stands and poor regeneration need replacement.
- Construction of a landing off Walker Road to facilitate management activities and public access.

Figure 6: Soils and Site Class Map



F. Water Resource Assessment

Watershed Description: THWMA is entirely within the Saxtons River watershed which drains to the Connecticut River. Most of the land drains west from four small tributaries to the South Branch Saxtons River while about 250 acres on the eastern side drain to Athens Pond, Bull Creek, and then to the main stem of the Saxtons River. The largest western tributary drains less than one square mile.

There are numerous Class 2 wetlands on or contiguous to the property (Figure 7), the largest being approximately 18 acres. The WMA was acquired for protection of the wetland habitat of northeastern bulrush (*Scirpus ancistrochaetus*) a federally and state listed endangered species.

Significant Feature(s): Aquatic habitats include three unnamed first order streams and two second order streams draining to the South Branch Saxtons River and Athens Pond.

Wetland Description and Function: Wetlands provide many functions which were historically ignored in Vermont. Commonly they were drained or filled, as was some on THWMA. These complex systems are now a focus of natural resource planning efforts and management of state lands. Some of the important functions wetlands provide are water purification, flood protection, riparian stabilization, groundwater recharge, streamflow maintenance, and fish and wildlife habitats. There are recreational and economic benefits as well.

One of the primary purposes for acquiring the Turner Hill lands was for wetlands protection. The conservation of THWMA was greatly assisted by VT Transco LLC through the Public Service Board conditions for wetlands mitigation for the Southern Loop power line expansion project, and The Nature Conservancy with their objective of northern bulrush habitat protection.

Approximately 90 acres of wetlands are either contained in or are contiguous to THWMA, ranging from less than an acre to over 19 acres in size. These encompass open water, forested, shrub, and emergent wetlands. In addition, there are approximately 65.5 acres of wetland features mapped on the WMA: 19 vernal pools, 18 seeps, 2 miles of streams, 4 swamps of four different types and an extended beaver wetland complex.

Tropical Storm Irene (2011) and Hurricane Sandy (2012) had limited impact on these wetlands and drainages within the WMA, though Turner Hill Road sustained heavy damage. Because of the minimal damage sustained by 100-year flood events within the parcel, wetland and riparian function seem to be in working condition. However, the South Branch Saxton River and its floodplain sustained damage.

Relationship to Basin Plan and Basin Plan Recommendations: All waters within THWMA are classified as Class B which will be managed to achieve and maintain a level of quality that fully supports aquatic biota and habitat, swimming, fishing, boating, irrigation of crops, and public water supply with treatment.

Being near the highest elevation of the watershed, there are no Vermont Department of Environmental (VTDEC) biological monitoring sites at or above THWMA. The nearest site downstream is at Cambridgeport on the main stem, at site Saxtons_9.4. The assessment rating at this location is rated as *Excellent*, meaning that at this site the stream is considered to fully support aquatic life.

Downstream from the WMA beginning where the South Branch Saxtons River joins the main stem of the Saxtons River, below Grafton village, is on the Vermont List of Priority Rivers and Streams as being stressed for sediment and temperature which is negatively impacting aesthetics and aquatic life. More monitoring is needed but this is suspected to be due to poor riparian condition and channel modifications as a result of both human and natural causes.

Athens Pond, also downstream of the WMA is a warm water fishery with an average spring phosphorus concentration of 10.27 ug/l, based on 9 years of data. While this is in line with other ponds in the region, concentrations are slowly rising over time. If this trend continues, it may lead to aquatic impacts such as algae blooms and degraded habitat. Low alkalinity reveals a lack of buffering capacity, or the ability for a waterbody to counter the effects of acid rain, and signs of acidification are also reflected in low water hardness.

Stream geomorphic assessment (SGA) of the South Branch Saxtons River reveals extensive straightening and encroachment by the Townshend/Grafton Road which has caused a departure from reference channel morphology (natural condition of the stream). The channel is incised (cut down to the riverbed) and fill associated with Townshend/Grafton Road has led to an elevated floodplain with decreased floodplain accessibility.

A mass failure on the left bank along the South Branch Saxtons River in the junction area with Turner Hill Road still contributes to downstream sediment. The channelized nature of this segment has limited the available habitat leaving the habitat condition ranked as *Fair*. This ranking indicates that biological diversity and productivity have been negatively affected. The altered channel morphology also lowers the channel's ability to trap large woody debris and pools are mostly small with poor cover.

The South Branch Saxtons River in the vicinity of the WMA should, under natural conditions, have a more meandering channel through the broad valley along the Townshend/Grafton Road. The loss of floodplain connectivity through historic degradation and straightening has trapped this reach in its current configuration and as a result the geomorphic condition is rated as *Fair*. However, on the WMA side, the riparian zone has good vegetation and no human impacts. In this area the river is very sensitive to change from natural causes and human activity. Stream Geomorphic Assessment recommendations for the river are for long-term stream corridor protection to avoid conflict with river migration and human development and for avoidance of encroachment on and development within the river corridor which is the area most susceptible to erosion and flooding.

<u>Pertinent Issues</u>:

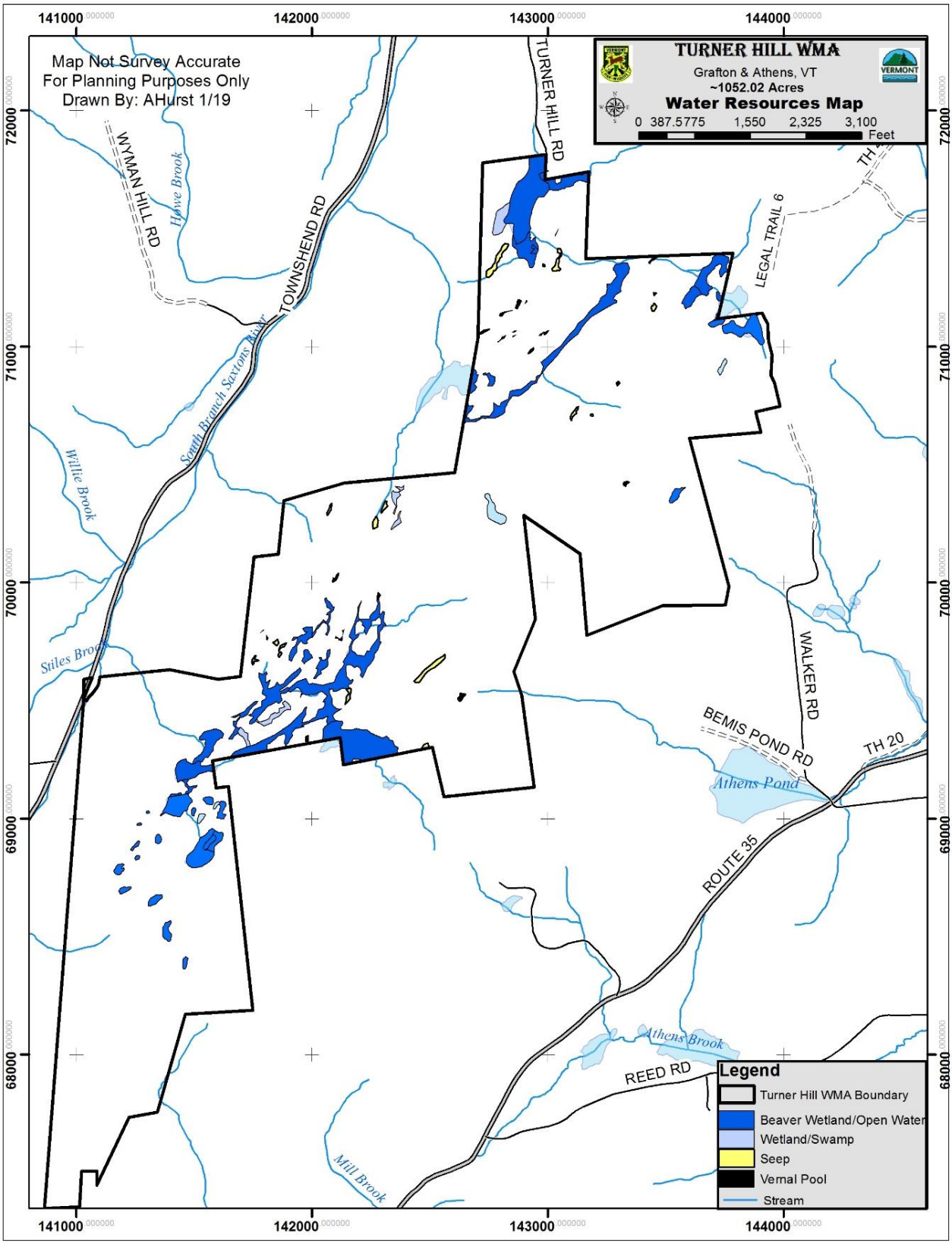
- Maintain wetland habitats and enhance where feasible.
    - Northeast bulrush thrives under the varying water level conditions produced by the natural cycles of beaver activity which causes periods of flooding and drying. Management should allow these natural cycles to perpetuate.

- Maintain and improve functional riparian zones along all waters.
- On the WMA lands directly adjacent to the South Branch Saxtons River:
    - Allow the river to meander and re-establish natural channel where infrastructure allows.
    - Maintain a densely vegetated riparian zone. This is the area where there is the greatest likelihood of erosion in high flow events.
    - Do not encroach on the limited floodplain available in this area.
- Allow for the natural expansion of wetlands to:
    - Enhance habitat for the northeast bulrush; and
    - Provide for greater flood storage in the headwaters of the South Branch Saxtons River.

Assessment of Need:

- Invasive species monitoring.
- Additional wetlands assessments as needed.
- Additional monitoring of the South Branch Saxtons River.

Figure 7: Water Resources Map



G. Fisheries Resource Assessment

An aquatic assessment, including fish community survey, has yet to be completed for surface waters on THWMA. Assessments should be conducted within the next five years and included as an addendum to the LRMP.

Approximately 490 feet of the South Branch Saxtons River west bank is located on the property. Over the term of 20 years (1992-2011), the South Branch Saxtons River was stocked annually in the spring of the year with Atlantic salmon *Salmo salar* fry as part of the multi-state program to restore anadromous salmon to the Connecticut River basin. State and federal fisheries agencies terminated the program in 2012.

The fish community in vicinity of THWMA is comprised of the following species: brown trout *(Salmo trutta)*, brook trout *(Salvelinus fontinalis)*, common shiner *(Luxilus cornutus)*, blacknose dace *(Rhinichthys atratulus)*, longnose dace *(R. cataractae)*, creek chub *(Semotilus atramaculatus)*, white sucker *(Catostomus commersomi)*, and slimy sculpin *(Cottus cognatus)*. Brown and brook trout populations are self-supporting and are not supplemented with hatchery-reared fish.

Pertinent Issues:

- Surface waters have not yet been surveyed.
- Fluctuating water levels due to beaver influence.

Assessment of Need:

- Fish community and aquatic habitat surveys will be conducted in the next five years and included as an addendum to this assessment with management recommendations (if any) added to the implementation schedule.

H. Historic Resource Assessment

A contracted Cultural Resource Assessment of THWMA was prepared in 2011. This assessment was the product of extensive research and a GIS-based predictive model based on environmental factors known to be important to Native Americans to determine the likelihood of use or settlement.

Native American and Pre-historic Sensitivity Analysis

The assessment concludes that while there are no known prehistoric sites on the property, THWMA is considered sensitive for prehistoric archaeological sites. This is due to the property's position on an elevated landform near a brook and large wetlands which suggests that the setting would be adequate for supplying resources for hunting and gathering groups to maintain prehistoric populations. Beyond these areas, there are no archeologically sensitive areas detected by the predictive model within THWMA. One shortcoming of this ecologically-based predictive model is its inability to incorporate human behavior. Inevitably potential sites will be missed, and other areas misidentified. For this reason, projects on ANR lands that involve ground disturbance are reviewed in more detailed fashion during scoping.

Within THWMA, sensitive areas border brooks and wetlands and may contain small residential camps and kill sites. Large base camps may have been located on the floodplain of the Connecticut River to the east of the WMA, especially at the confluence of the West River. Large base camps are not expected within THWMA. It is also unlikely that burial sites will be recovered within THWMA. The GIS model does not factor in areas with outcrops of high-quality quartzite, which may have been visited by pre-contact era Native Americans for tool stone. Bedrock quarried and the quarry workshops associated with them would be likely if there are sources of high-quality quartzite or cherts within THWMA. As a result, small level landforms adjacent to drainages, wetlands, and water bodies, as well as areas near quartzite outcrops that do not appear as sensitive on the GIS predictive model could be considered as potential locations of archeological sensitivity by land managers.

Early Settlement and Industrial History

The earliest European settlement in Vermont is believed to have occurred in this southeastern corner of the state in 1724 as settlers traveled north from Massachusetts along the Connecticut River and its tributaries. Grafton and Athens were remote, and human population didn't expand there at the same rate as along the Connecticut River. Grafton was chartered in 1754, but the first permanent settlers didn't arrive until 1780. At the time, the town was known as Thomlinson and was renamed Grafton in 1791. Athens was chartered in 1780 when settlers were expanding into the general area. By 1850 both towns were thriving and had populations larger than today. There are many accounts at that time of doctor's offices, taverns, mills, quarries, lawyer offices, stores, and schools. Populations in both towns decreased during and after the Civil War.

Turner Family Homestead

The northern portion of THWMA contains the site of the former Turner Family Homestead (Figure 8). The following information on this homestead portion of the WMA was obtained from a 2013 thesis entitled "Journey's End: An Analysis of the Turner Family Homestead in Grafton, Vermont" and from a history of the Turner family based on interviews with Daisy Turner.

The Turner Homestead is a significant historic resource related to the heritage of African Americans in Vermont and as the birthplace of Daisy Turner who chronicled her father's history and the history of the homestead through story telling. The collection of Daisy Turner interviews, stories and photos can be found at www.vermontfolklifecenter.org. Additional information is also available in the District Office.

Existing Conditions: No historic properties are listed on either the National or State Registers of Historic Places, nor are there any known prehistoric Native American or EuroAmerican historic sites within THWMA. The closest state registered historic resource is Grafton Village which is also on the national register. The Birchdale Camp is the only standing structure still intact within the Turner Homestead. However, there is a stone foundation, multiple collapsed structures, an apple orchard, and several garbage caches. This area has qualified for eligibility on the State Register. Outside of the Homestead area there are remnants of two structures and farm equipment scattered throughout. Many miles of stone walls and wire fence are also present.

The Birchdale Camp and approximately five acres surrounding the building were transferred to the Windham Foundation for preservation and interpretation through the Preservation Trust of Vermont.

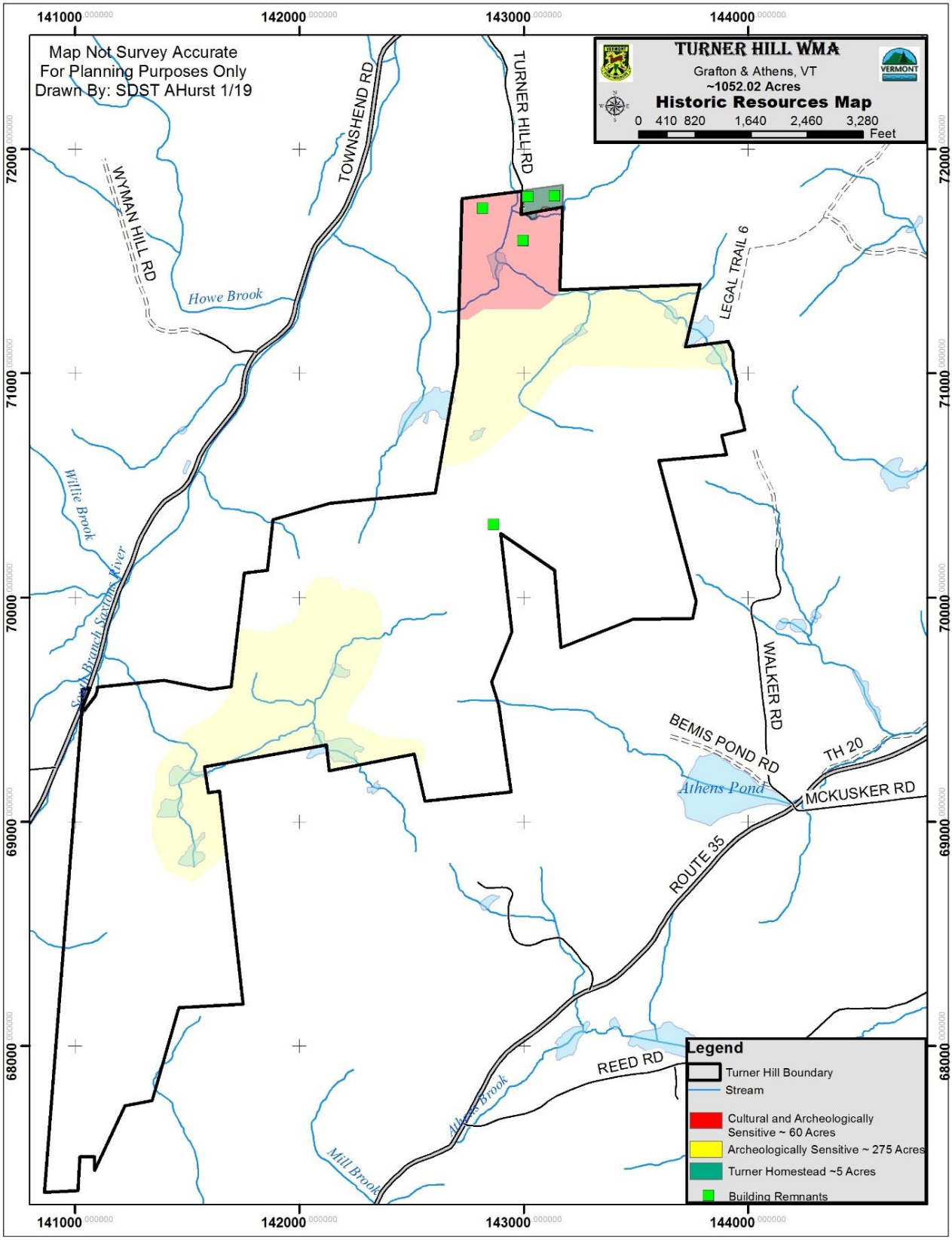
Pertinent Issues:

- Sensitivity to known historic structures during management activities.
- Additional historic sites may be found within THWMA and will need to be protected during management operations.
- The 5-acre Turner Homestead was deeded to the Windham Foundation for possible revitalization as an educational resource regarding African American history.

Assessment of Need:

- Additional field research into the exact location of structures associated with the Turner Homestead.
- Stone walls were not mapped during inventory process and should be documented as management activities occur.

Figure 8: Historic Resource Map



I. Recreation Resource Assessment

The bulk of the WMA offers a remote recreational experience in a natural-appearing setting. The chance of contact with other recreational users is low. An extensive network of woods roads are found in this area. Evidence of past timber harvesting is common. Most of the property is located more than 0.5 miles from town-maintained roads.

Existing Conditions:

The following activities have been identified as recreational uses of the land within the scope of the THWMA LRMP planning process.

a) Hunting and Fishing – Hunting is a popular activity that occurs on this WMA. Evidenced by parked vehicles, most of the activity centers around deer season (mainly the rifle season in November) and turkey seasons. Bear, moose, turkeys, partridge, woodcock, and waterfowl are also hunted on this WMA. The South Branch Saxtons River is located along a short section of the western boundary of this WMA and offers trout fishing opportunities. Other small streams and beaver ponds on the WMA offer native brook trout fishing.

b) Hiking and Wildlife viewing – Although there are no official hiking trails on this property, there is an extensive network of woods roads and paths that are used for hiking, walking, and wildlife viewing. The wetland areas are especially popular destinations for wildlife viewing. A local trail group, Windmill Hill Pinnacle Association, has an extensive network of popular hiking trails located on adjoining properties and has proposed a connector trail through THWMA.

c) Trapping – The large wetland areas on the property provide opportunities for trapping furbearers such as beavers, muskrat, and otters. Coyote, fox, and fisher are common in hemlock and hardwood stands.

d) Scenic resources are very limited within the property. Being a high plateau, there are no viewsheds on or from the WMA. Views of the nearby landscape from the edges of the larger wetlands are attractive though seen by few.

Pertinent Issues:

- Windmill Hill Pinnacle Association (WHPA) owns and manages approximately 1,820 acres in the general area of the WMA.
- WHPA operates and maintains approximately 20 mile of pedestrian trails in the general area of the WMA.

Assessment of Need:

- Continue partnership with WHPA
- Better parking and access for recreational users.
- Additional signage and kiosk with information and maps of the WMA.

J. Infrastructure and Public Access Assessment

Description:

Public access to THWMA is provided by Turner Hill Road (Figure 9) – a very steep, gravel class 3 town road located on the northern end of the property. The last 0.5 mile of Turner Hill Road is not plowed during the winter. A small gravel surface parking area is located at the terminus of Turner Hill Road. Access beyond this point requires finding a route around wetlands located at this end of the property.

The western portion of this WMA has road frontage on the Townshend/Grafton Road, a paved class 2 town road; but there are no parking areas, and public access on this side of the property is difficult. Approximately 100' of WMA road frontage is located on the east side of this Townshend/Grafton Road, but the South Branch Saxtons River is also located along this section of road making it unlikely that a parking lot could be constructed here. A 0.1-acre triangle shaped parcel of WMA land that may provide future parking opportunities is located on the west side of the Townshend/Grafton Road. There is a ROW from the Townshend/Grafton Road to the southern unit that is steep and requires crossing the Saxtons River. It is unexamined whether public access is possible over the ROW.

There is a management ROW to the east which starts at the end of Bemis Pond Road. The ROW then follows a woods road to the property through private land.

Bordering the eastern lands is a dirt roadway connecting the Class 3 Walker Road in Athens to Legal Trail #6 in Grafton. The WMA has approximately 1500' of frontage on this road and is a popular recreation corridor and provides good access to the WMA lands.

The eastern lands also have a legal ROW established and constructed for the buyers of subdivided house lots. The State acquired five of these lots and with them permanent access to Walker Road. However, two additional private lots that the ROW accesses do have buildings and residents that use the ROW road to access. It is unexamined whether public access is possible over the ROW.

Existing Conditions:

There is a two-car parking lot at the end of Turner Hill Road. This area is under threat of flooding and beaver population will need to be monitored over time. No public parking area or formal access is available along the Townshend/Grafton Road. There may be public access from this ROW to the southern unit but no public parking. No public access or parking area is available from the Bemis Pond Road on the east. This ROW is in poor condition and suitable only for foot traffic. This access is limited to management activities only but has been severely eroded and currently is not considered a viable access. Walker Road is used extensively for year-round recreational opportunities and serves as access to the WMA. It is unknown if this roadway is a public highway. The ROW from Walker Road to eastern sections of the WMA through the former subdivision is in good condition and provides management access but public access rights have not been determined.

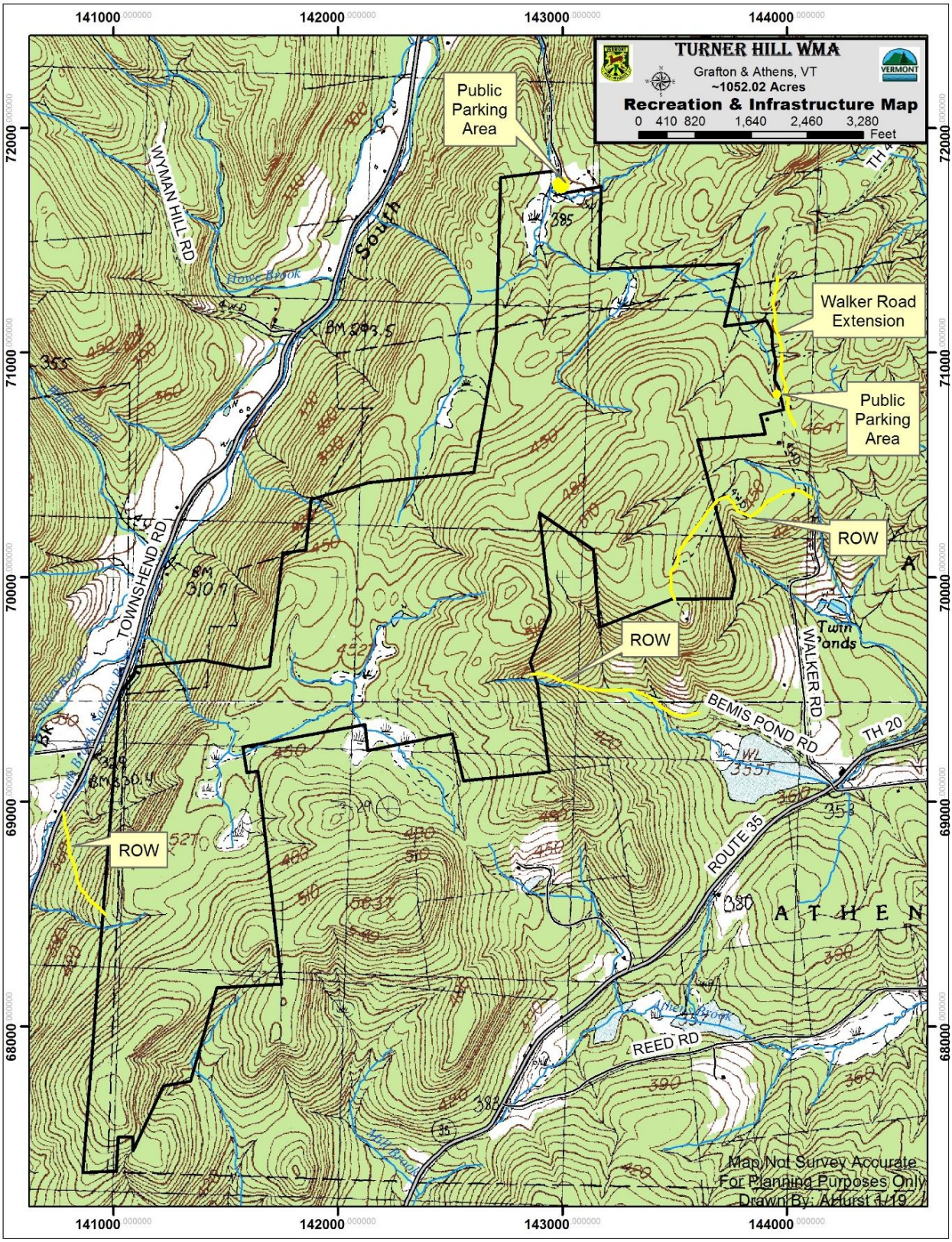
Pertinent Issues:

- Flooding of the Turner Hill Road public access area and parking lot.
- The Town of Grafton has expressed concern about potential damage to Turner Hill Road by impounded water should beaver dams fail.
- Severe erosion on the Bemis Pond ROW to Bemis Pond Road.
- Minor unauthorized use and damage by ATVs and trucks.
- Limited public access and parking in the Turner Homestead area.
- Minor erosion and unsafe skidder bridge on the Townshend/Grafton Road ROW.
- Legal Status at end of Walker Road.
- Public Access on Walker Road, subdivision road, and Townshend/Grafton Road ROW.

Assessment of Need:

- Monitor/manage beaver population at the end of Turner Hill Road.
- Rebuild and stabilize Bemis Pond Road ROW.
- Public parking lot on the Townshend/Grafton Road.
- Install gate, sign, and kiosk at the end of Turner Hill Road.
- Continue to work with partners to facilitate public access in Turner Homestead area.
- Rebuild and stabilize the Townshend/Grafton Road ROW and remove old skidder bridge.
- Legal opinion on the access status of Walker Road.
- Determine which ROWs can be used for public access vs. management access.

Figure 9: Recreation and Infrastructure Map



IV. MANAGEMENT STRATEGIES AND ACTIONS

Land Management Classification

Vermont ANR lands are managed using four categories of use or types of management to be emphasized on the land. In this section of the plan, the recommended levels of use or types of management (Table 9) will be shown for all the land area in this parcel. This section also describes generally how the land will be managed so that the activities occurring on the land are compatible with the category assigned. The four categories are: (1) *Highly Sensitive Management*; (2) *Special Management*; (3) *General Management*; and (4) *Intensive Management*.

As part of the planning process, the lands, resources, and facilities held by the ANR are evaluated and assigned to the appropriate land management category. Assignment of management categories for THWMA (Figure 10) is based on a thorough understanding of the resources identified and the application of over-arching lands management standards. The resources include natural communities, plants, and wildlife as well as recreation, historic, timber, and water resources.

1.0) **Highly Sensitive Management**– Areas designated as Highly Sensitive Management are described as ***"areas with uncommon or outstanding biological, ecological, geological, scenic, cultural, or historical significance…"*** Acres managed under this category will have no timber management, salvage harvest, or active wildlife habitat management. However, trees and other vegetation may be cut to restore natural community species composition and structure in limited locations; manage specific habitat conditions for rare, threatened, and endangered species; and to maintain safe and enjoyable recreational conditions.

2.0) **Special Management** – Areas designated as Special Management include areas ***"…where protection and/or enhancement of those resources is an important consideration for management."*** Timber harvesting and wildlife habitat management as well as recreation are considered to be complementary uses within this classification to the extent that they do not impact special features.

3.0) **General Management** – The General Management category includes areas where ***"dominant uses include vegetation management for timber and wildlife habitat, concentrated trail networks, and dispersed recreation…"*** A primary consideration for management is minimizing conflict between activities. Sensitive resources that occur within these areas may require special attention.

4.0) **Intensive Management** – The Intensive Management category is characterized by a ***"high level of human activity and high intensity development on/or adjacent to State land."*** Aesthetics and safety are the primary management considerations in these areas. However, more sensitive resources that occur within these areas may require special attention.

Management Goals and Objectives for: Turner Hill Wildlife Management Area

I. Protect and improve the condition and resiliency of important biological resources.

A. Protect and enhance species of greatest conservation need (SGCN) and rare, threatened, and endangered (RTE) species and their habitats.

B. Maintain existing Core Forest and increase its size and resiliency through acquisition and conservation agreements.

C. Monitor for hemlock woolly adelgid, emerald ash borer, and Asian longhorned beetle. Follow ANR Guidelines for response if presence detected.

D. Maintain or enhance the quality of State Significant natural communities and wetlands.

E. Protect and enhance wetland habitat and water feature function in accordance with Vermont's Riparian Zone Management Guidelines.

(1) Riparian Zone guidelines followed during management activities will be designed to protect water quality and to protect and enhance habitat for wetland dependent amphibians, reptiles, birds, and mammals.

(2) Manage travel corridors between seeps and wetlands to maintain or improve conditions for amphibians.

(3) Minimize the spread of exotic shrub species through monitoring and management.

II. Enhance wildlife habitat for a variety of game and non-game species through management and development of all seral stages.

A. Develop and implement vegetative management prescriptions that enhance habitats that support specific species and species groups such as beaver, heron, raptors, bats, black bear, and songbirds; e.g., may include patch cuts to create beaver food sources, pre-commercial crop tree release, development of snags for bat brooding and roosting and perches for raptors, development of den trees for small mammal habitat, alder management for American woodcock, and recruitment of large woody material on the forest floor.

B. Using all-aged management techniques in Special Management Zones improve health and vigor of conifer stands to provide winter deer cover and forest type diversity.

C. In anticipation of the possible loss of eastern hemlock to the hemlock woolly adelgid, promote long term recruitment of other conifer species.

D. Practice even aged management to develop early successional habitat, hard and soft mast, and woody browse in general management areas.

III. Improve timber resource through sustainable management practices.

A. Regenerate low-quality stands where UGS proportion is greater than AGS through even-aged techniques.

B. Crop Tree Release and Timber Stand Improvement, either commercial or non-commercial, to favor high quality stems and mast trees.

C. Release existing regeneration in group and small patches that were established in previous harvests.

IV. Develop and improve appropriate non-motorized recreation opportunities for wildlife-based activities including hunting, fishing, trapping, and wildlife viewing.

A. Facilitate uses by the public that are compatible with wildlife habitat and conservation goals by maintaining access roads and parking areas, providing foot access for users. Minimize impacts to sensitive sites, such as cultural and historic districts, and wetlands. Limit road construction into critical habitats or rare natural communities and prevent damaging uses such as off-roading and discourage the spread of exotic plants and animals.
B. Maintain and improve public access and parking facilities.
C. Install and maintain additional signage and information kiosks in key areas.
D. Restore heavily-eroded roads and trails and prevent continued damage by off-roading with trucks, ATVs, and motorcycles.

IV. Maintain and improve management access and infrastructure.

A. Stabilize all internal roads and trails and relocate from lowlands to uplands where feasible.
B. Work with adjacent landowners and public/private partners to secure improved access.
C. Consider purchasing additional lands or easements to facilitate access.
D. Stabilize existing stream crossings.

V. Protect and document cultural and historic sites.

A. Locate and map additional historic sites such as foundations, cellar holes, stone walls and orchards.
B. Implement ANR Timber Harvest Archeological Protection Protocol (October 2004).

1.0 HIGHLY SENSITIVE MANAGEMENT — 100 Acres

Highly Sensitive Management areas represent approximately 100 acres or 10% of the WMA. This unit is one contiguous area located in the south-central part of the WMA. It features spruce-fir forests with many scattered and diverse wetlands. Historically it has been utilized for wood production as evidenced by historical damage to soils and wet terrain. Because of the sensitive and unique nature of the area the primary objective will be restoration, wildlife habitat and natural community development.

1.1 Wetland & Rookery Complex This complex is characterized by a lowland spruce–fir forest with multiple wetland features scattered throughout. It is more representative of the Nulhegan Basin in the Northeast Kingdom than Windham County. Primary use of this area will be protection of wildlife habitat, wetland features and scientific research. The eastern half of this unit is subject to a USFWS Grant Agreement (see Appendix 3). There is an active heron rookery in the southwest portion of the unit. A federally and state endangered plant species has been found in the wetlands. This area was found to be archeologically sensitive due to the wetlands and high plateau.

Management Goals and Objectives:

- Protect and improve the condition and resiliency of important biological resources.
- Protect and enhance species of greatest conservation need (SGCN) and rare, threatened, and endangered (RTE) species and their habitats.
- Maintain existing Core Forest and increase its size and resiliency through acquisition and conservation agreements.
- Maintain or enhance the quality of State Significant natural communities and wetlands.
- Protect and enhance wetland and water feature function in accordance with Vermont's Riparian Zone Management Guidelines.

Management Strategies and Actions:

- Smooth ruts and clear old crossing materials from previous logging.
- Monitor and inventory RTE species as needed.
- Design management and recreational access to minimize human disturbance.

2.0 SPECIAL MANAGEMENT — 417 Acres

Special Management areas represent approximately 417 acres or 40% of the WMA. Three units are categorized in this designation. These areas have management concerns related to a variety of factors ranging from cultural and archeological resources to habitat and wetland protection and enhancement. Historically the primary uses were agricultural and wood production.

2.1 Turner Family District 44 Acres

This is an area featuring many historic sites associated with the Turner Family. There is a large beaver wetland complex, with associated riparian areas, all of which were previously drained for agricultural and logging activities. Primary use of this area will be protection and enhancement of historic resources, wildlife habitat, and dispersed recreation. This area is subject to the USFWS Grant Agreement (see Appendix 3) and ACE Declaration of Restrictive Covenants (Appendix 4). The Turner Hill Road ends at a beaver pond which has encroached upon the public parking area in recent years complicating access to the property. There is no alternative access from Turner Hill Road currently.

Management Goals and Objectives:

- Protect and improve the condition and resiliency of important biological resources.
- Enhance wildlife habitat for a variety of game and non-game species through management and development of all seral stages; creation of early successional growth; improvement of deer wintering areas and mast production; and protection of unique habitats.
- Develop and improve appropriate non-motorized recreation opportunities for wildlife-based activities including hunting, fishing, trapping, and wildlife viewing.
- Maintain and improve management access and infrastructure.
- Protect and document cultural and historic sites.

Management Strategies and Actions:

- Develop and implement vegetative management prescriptions that enhance habitats that support specific species and species groups such as beaver, heron, raptors, bats, black bear, and songbirds; e.g., may include patch cuts to create beaver food sources, pre-commercial crop tree release, development of snags for bat brooding and roosting and perches for raptors, development of den trees for small mammal habitat, alder management for American woodcock, and recruitment of large woody material on the forest floor.
- Facilitate uses by the public that are compatible with wildlife habitat and conservation goals by maintaining access roads and parking areas, providing foot access for users. Minimize impacts to sensitive cultural and historic sites and wetlands. Limit road construction into critical habitats or rare natural communities and prevent damaging uses such as off-roading and discourage the spread of exotic plants and animals.
- Riparian Zone guidelines followed during management activities will be designed to protect water quality and to protect and enhance habitat for wetland dependent species including plants.
- Manage travel corridors between seeps and wetlands to maintain or improve conditions for amphibians.
- Minimize the spread of exotic shrub species through monitoring and management.
- Work with adjacent landowners and public/private partners to secure improved access.
- Stabilize existing stream crossings.
- Locate and map additional historic sites such as foundations, cellar holes, stone walls, and orchards.

2.2A Deer Wintering Area 274 Acres

Deer wintering areas consist of Hemlock and Hemlock Northern Hardwood stands on south and southwest facing slopes. Primary use will be habitat management and dispersed recreation. This area is subject to the USFWS Grant Agreement (see Appendix 3) and ACE Declaration of Restrictive Covenants (Appendix 4) on the north half and just the USFWS Grant to the south. The western most portions of the deer wintering area are located above the Townshend/Grafton Road on a site considered to be non-commercial due to steep slopes and lack of access. Management access to this portion remains to be determined. There are multiple wetland features in and adjacent to this area to be considered during management activities. Hemlock woolly adelgid has been found within 10 miles of THWMA. Spread of hemlock woolly adelgid into and/or the severity may be minimized by the cooler temperatures associated with this upper elevation plateau.

Management Goals and Objectives:

- Enhance wildlife habitat for a variety of game and non-game species through management and development of all seral stages; creation of early successional growth; improvement of deer wintering areas and mast production; and protection of unique habitats.
- Develop and improve appropriate non-motorized recreation opportunities for wildlife-based activities including hunting, fishing, trapping, and wildlife viewing.
- Maintain and improve management access and infrastructure.

Management Strategies and Actions:

- Using all-aged management techniques in Special Management Zones, improve health and vigor of conifer stands to provide winter deer cover and forest type diversity. Utilize current research on methods to limit adelgid success.
- In anticipation of the possible loss of eastern hemlock to the hemlock woolly adelgid, promote long-term recruitment of other conifer species in the regeneration component.
- Facilitate uses by the public that are compatible with wildlife habitat and conservation goals by maintaining access roads and parking areas and providing foot access for users. Minimize impacts to sensitive sites, such as cultural and historic sites, and wetlands. Limit roads and trails in critical habitats or rare natural communities and prevent damaging uses such as off-roading. Prevent the spread of exotic plants and animals.
- Stabilize all internal roads and trails and relocate from lowlands to uplands where feasible.
- Stabilize existing stream crossings.
- Work with adjacent landowners and public/private partners to secure improved access.

2.2B Wetland Protection Area 99 Acres

This area is characterized by an abundance of wetlands dispersed throughout the stands, some of which are considered state significant communities. There are several rare, threatened and endangered (RTE) and uncommon species identified within this area. In addition, wetlands serve as spring bear feeding areas. This area was also found to be archeologically sensitive due to the wetlands and being located on a high plateau. These lands were part of the VELCO lands where wetland monitoring by VELCO that was done annually as part of the mitigation requirements for the Southern Loop Expansion from 2009 to 2014. This area is subject to the USFWS Grant Agreement (see Appendix 3) and ACE Declaration of Restrictive Covenants (Appendix 4). The primary use of this area will be protection of wildlife habitat, wetland communities and dispersed non-motorized recreation.

Management Goals and Objectives:

- Protect and improve the condition and resiliency of important biological resources.
- Enhance wildlife habitat for a variety of game and non-game species through management and development of all seral stages; creation of early successional growth; improvement of deer wintering areas and mast production; and protection of unique habitats.
- Develop and improve appropriate non-motorized recreation opportunities for wildlife-based activities including hunting, fishing, trapping, and wildlife viewing.
- Maintain and improve management access and infrastructure.

Management Strategies and Actions:

- Protect and enhance wetland and water feature function in accordance with Vermont's Riparian Zone Management Guidelines.
- Maintain existing Core Forest and increase its size and resiliency through acquisition and conservation agreements.
- Develop and implement vegetative management prescriptions that enhance habitats that support specific species and species groups such as beaver, heron, raptors, bats, black bear, and songbirds; e.g., may include patch cuts to create beaver food sources, mast tree release, development of snags for bat brooding and roosting and perches for raptors, development of den trees for small mammal habitat, alder management for American woodcock, and recruitment of large woody material on the forest floor.
- Restore heavily-eroded roads and trails and prevent continued damage by off-roading with trucks, ATVs, and motorcycles.
- Work with adjacent landowners and public/private partners to secure improved access.
- Stabilize existing stream crossings.

3.0 GENERAL MANAGEMENT — 535 Acres

General Management areas represent approximately 535 acres or 50% of the WMA.

There are three separate areas classified as General Management. These are primarily Northern Hardwood Forest types that have historically been used for forest management purposes. They are typical of the region and are not considered to be exemplary. Forest management will continue to be a primary use along with wildlife habitat management and dispersed non-motorized recreation. Currently, forest management opportunities for early successional wildlife habitat are abundant. Dispersed non-motorized recreation would also be an appropriate use. The western most area adjacent to the Townshend/Grafton Road is considered non-commercial due to steep slopes. Within the easterly area are embedded smaller water features such as seeps, streams, and vernal pools. Cultural/historical sites have also been documented. Access needs development either through the Bemis Pond ROW, Walker Road, or the Townshend/Grafton Rd ROW on the west. This area is subject to the USFWS Grant Agreement (see Appendix 3).

Management Goals and Objectives:

- Enhance wildlife habitat for a variety of game and non-game species through management and development of all seral stages; creation of early successional growth; improvement of deer wintering areas and mast production; and protection of unique habitats.
- Develop and improve appropriate non-motorized recreation opportunities for wildlife-based activities including hunting, fishing, trapping, and wildlife viewing.
- Maintain and improve management access and infrastructure.
- Protect and document cultural and historic sites.

Management Strategies and Actions:

- Produce a sustainable supply of timber products to improve habitat and opportunities for habitat improvement.
- Practice even aged management to develop early successional habitat, hard and soft mast, and woody browse.
- Facilitate uses by the public that are compatible with wildlife habitat and conservation goals by maintaining access roads and parking areas, providing foot access for users. Minimize impacts to sensitive sites, such as cultural and historic sites, and wetlands. Limit road construction into critical habitats or rare natural communities and prevent damaging uses such as off-roading and discourage the spread of exotic plants and animals.
- Restore heavily-eroded roads and trails and prevent continued damage by off-roading.
- If offered, consider adjacent lands and conservation easements that enhance protection of wetland habitats and facilitate WMA access.
- Locate and map additional historic sites such as foundations, cellar holes, and stone walls.
- Implement ANR Timber Harvest Archeology Protocol.

Figure 10: Land Use Classification Map

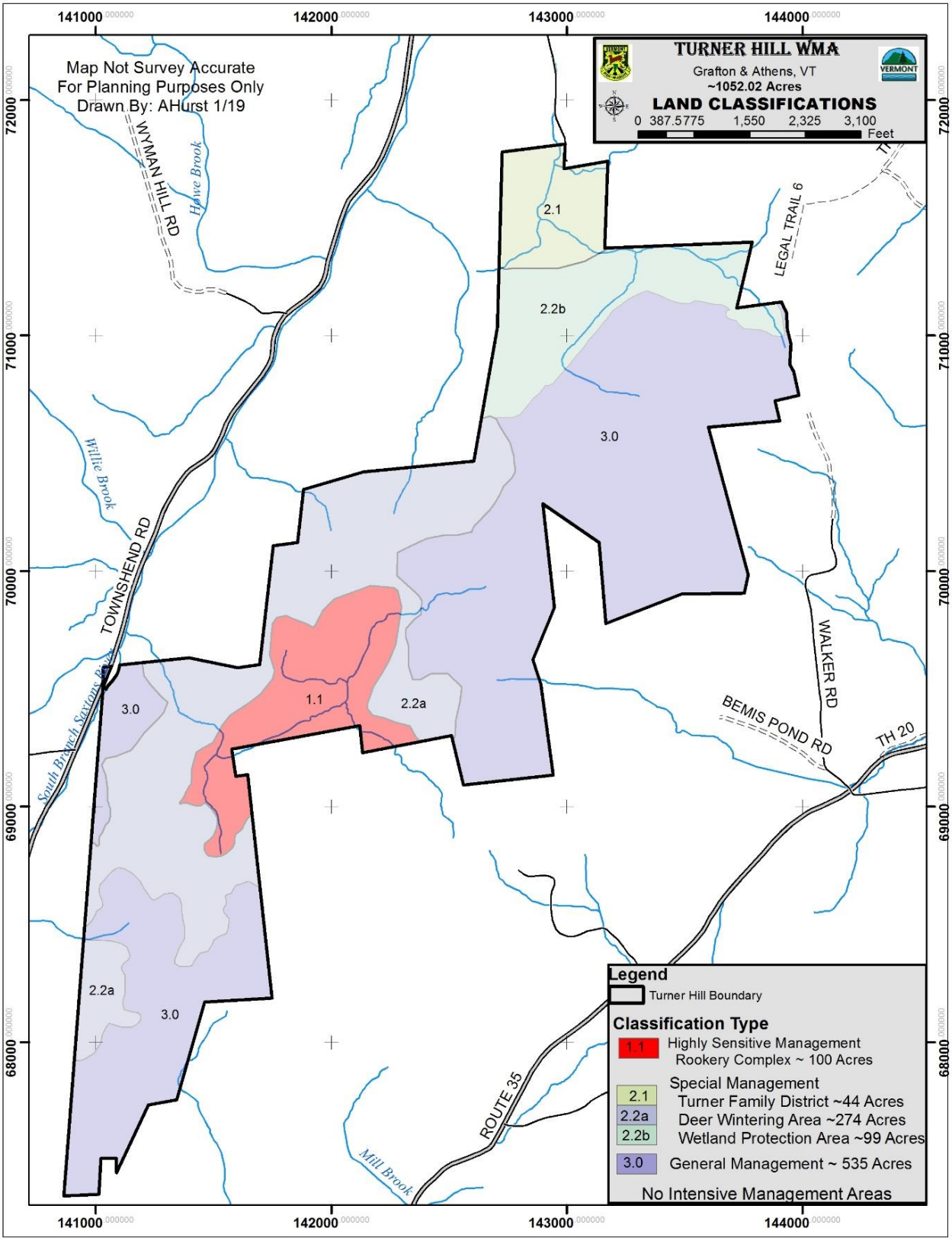
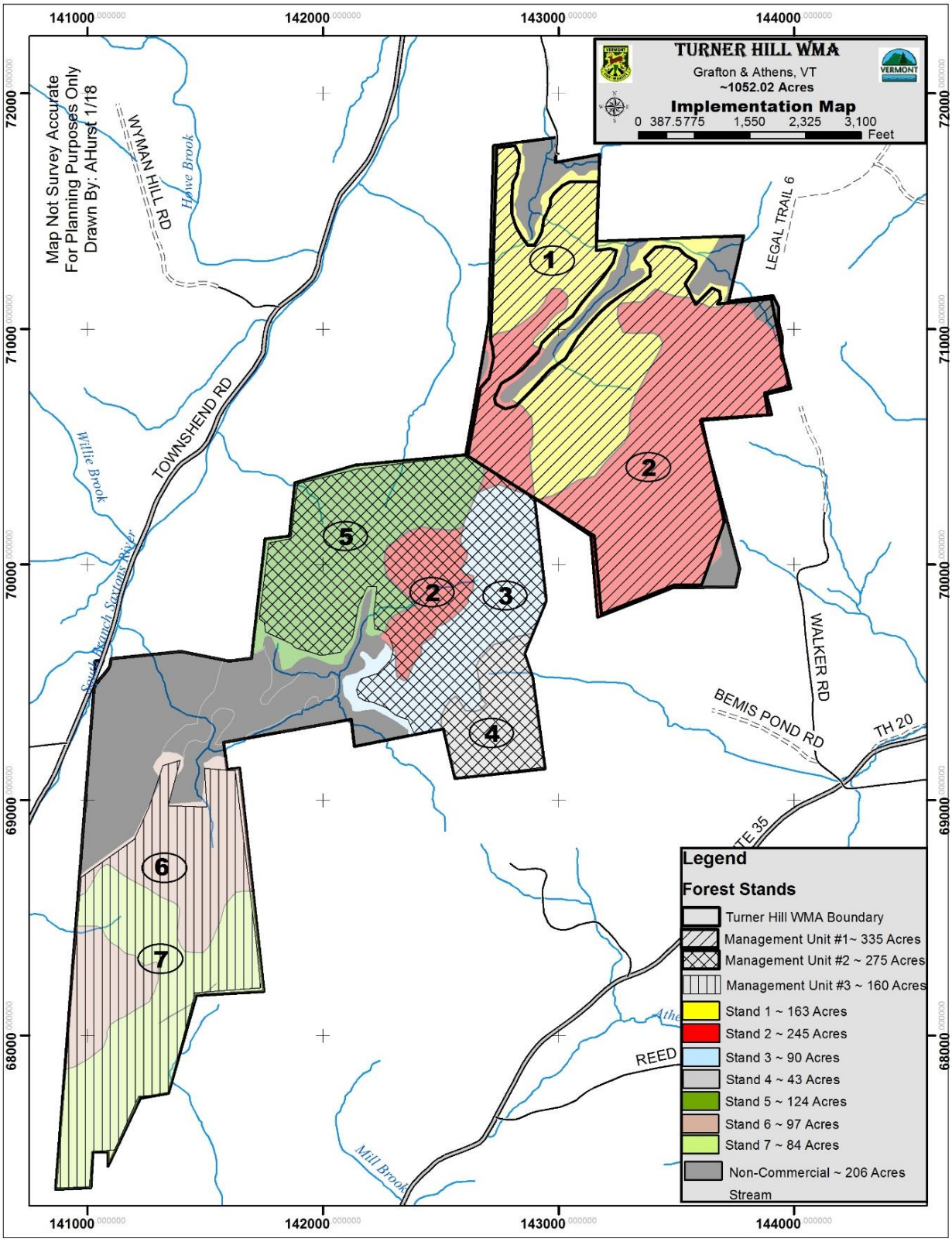


Table 9: Implementation Schedule

Activity	Location	Potential Acres	Goal	Calendar Year	Outcome
Infrastructure Monitoring and Maintenance	Public parking areas and gates 2.1/3.0	n/a	Monitor water, parking area and signage	Periodically	Infrastructure secure
Management Unit #1 (Figure 11)	2.1, 2.2B	335	Mast tree release, early successional habitat	2020 2035	Improved wildlife habitat
	Northern Lands				Stabilize road system and water quality protection and improvement
Management Unit #2 (Figure 11)	2.2A, 3.0	275	Mast tree release, early successional habitat	2022 2037	Improved wildlife habitat and road stabilization
	Central Lands		DWA improvement		
Management Unit #3 (Figure 11)	2.2A, 3.0 Southern Lands	160	Mast tree release, early successional habitat DWA Improvement	2024 2030	Improved wildlife habitat
Hemlock Woolly Adelgid Monitoring	DWA 2.2A	274	Detect early occurrence	Annually	Early response
Invasive Plant Monitoring	All, Focus on wetland/forest edges	n/a	Detect early occurrence	Annually	Early response
Invasive Insect Monitoring	Northern hardwood and hemlock stands	n/a	Detect early occurrence	Periodically	Early response
Rare Plant Monitoring				Periodically	
Trail Construction	2.1, 2.2A, 2.2B, 3.0		Hiking trail	2019	Enhanced Public Recreation

Figure 11: Implementation Map



V. VEGETATIVE MANAGEMENT

A. Treatment Goals

Protection of historic sites and wetlands, improvement of wildlife habitat conditions, growth and harvest of wood products and high quality sawtimber, and establishment and release of seedling/sapling class.

B. General Treatment Prescription

- *Management Unit #1* – Hemlock Northern Hardwood and Northern Hardwood ~ 335 acres. The predominant tree species in this Management Unit (MU) are red maple and hemlock. Forest Stand #1 and #2 comprise this unit. Approximately 40% of the stocking is Acceptable Growing Stock (AGS), trees determined to have a sound bole with a vigorous crown. Goals include establishing early successional wildlife habitat and production of sawtimber.

  Management Recommendations: Harvest Unacceptable Growing Stock (UGS), trees with defective boles and/or declining vigor, to favor growth of Acceptable Growing Stock (AGS). Crop trees will include AGS sugar maple, yellow birch, and hemlock. Mast trees both AGS and UGS of beech and oak will be retained as wildlife food sources. Pockets of hemlock/softwood regeneration will be released. Residual Basal Area (BA) 90-120 sq. ft. Utilize uneven-aged single tree and group selection (1/4 to 1-acre gaps) harvest techniques and larger even-aged patch cuts designed to release and promote established regeneration. Strip cuts up to five acres may be utilized in areas where overstory quality is poor and regeneration consists of undesirable species. Focus of management activities will be on regenerating forest stands and promoting mast species. Harvest intervals of 15 years with regeneration of approximately 20 acres in each entry will provide long-term early successional habitats while creating and promoting the next generation of desirable and high-quality forest products. Multiple wetland features within the unit will require extra attention during sale layout.

  Diameter Goals: Hemlock 24”, red maple 16”. For wildlife consideration, three trees >12” DBH will be girdled and retained per treated acre. Retain >26” DBH UGS trees for cavity trees.

- *Management Unit #2* – Hemlock Northern Hardwood and Northern Harwood ~275 acres. This MU is stocked primarily with red maple, paper birch, and hemlock. Forest stands #2, 3, 4 and 5 comprise this unit. Approximately 52% of the stocking is AGS. Goals include establishing early successional wildlife habitat, production of high quality sawtimber and wildlife mast, and maintaining and improving deer wintering areas.

  Management Recommendations: UGS hemlock and UGS hardwood removal to favor growth of AGS hemlock and to release softwood and hardwood regeneration. Residual BA 80 (hardwood)-120 (softwood) sq. ft. Utilize uneven-aged single tree and group selection (1/4 to 1-acre gaps) harvest techniques and larger even-aged patch cuts designed to release and promote established regeneration. Utilize crop tree release for AGS yellow birch, sugar maple, and mast-producing trees. Some beech trees within the unit appear resistant to beech bark disease (BBD). Follow beech recommendations outlined in VT ANR BBD Management

Guidelines. Stand 3 contains some pockets were the percentage of red oak stems is higher. These areas will be maintained for wildlife. Stand 4 has a higher percentage of paper birch and aspen which may be managed (harvested) for early successional habitat. Parts of stand 5 have been mapped as deer wintering area so hemlock stands will be kept in a high-density condition unless determined to be adversely affected by hemlock woolly adelgid and at high risk. The wetlands to the south of the management unit consist of habitat for the northern bulrush and home to a heron rookery. Management activities will need to be modified to protect these resources. Harvest intervals of 15 years with regeneration of approximately 30 acres in each entry will provide long term early successional habitats while creating and promoting the next generation of desirable and high-quality forest products.

Diameter Goals: Hemlock 24", paper birch and red maple 16". For wildlife consideration, three trees > 12" DBH will be girdled and retained per treated acre.

- *Management Unit #3* – Hemlock Northern Hardwood and Northern Harwood ~160 acres. This MU is stocked primarily with red maple, red oak, beech, and hemlock. Forest stands #6 and 7 comprise this unit. Approximately 48% of the stocking is AGS. Goals include establishing early successional wildlife habitat, production of high quality sawtimber, high quality hard mast production area, and maintaining deer wintering areas.

  Management Recommendations: UGS hardwood removal to favor growth of AGS hardwood and to release softwood and hardwood regeneration. Residual BA 80-100 sq. ft. Utilize uneven-aged single tree and group selection (1/4 to 1-acre gaps) harvest techniques and larger even-aged patch cuts designed to release and promote established regeneration. Utilize crop tree release for AGS black birch, sugar maple, and mast-producing trees. Some beech trees within the unit appear resistant to beech bark disease (BBD). Follow beech recommendations outlined in VT ANR BBD Management Guidelines. Stand 7 contains some pockets where the proportion of red oak stems is higher. Parts of stand 6 have been mapped as deer wintering area so hemlock stands will be kept in a high-density condition unless determined to be adversely affected by hemlock woolly adelgid, and at high risk. The wetlands to the northeast of the management unit consist of habitat for the northern bulrush and home to a heron rookery. Management activities will need to be modified to protect these resources. Harvest intervals of 15 years with regeneration of approximately 30 acres in each entry will provide long term early successional habitats while creating and promoting the next generation of desirable and high-quality forest products.

  Diameter Goals: Black birch and red maple 16". Sugar maple 24".

VI. CLIMATE CHANGE ADAPTATION

The effects of climate change are an evolving management issue at THWMA.
Historical data have shown changes across Vermont over the past 50 years, including:

- Summer temperatures increased 0.4°F per decade
- Winter temperature increased 0.9°F per decade
- Spring thaw arrives 2.3 days earlier per decade
- Precipitation increased 15-20%, with 67% from "heavy precipitation" events

1. Anticipated Climate Change Effects

Scientific studies estimate a variety of potential changes in the future, including:

- Increased temperatures, especially in winter
- Increased precipitation, especially rain in winter
- Increased extreme weather events, including floods, wind storms, and fires
- Longer growing seasons, shorter winters
- Changing biological interactions

These potential changes are expected to have a range of effects on the forested ecosystems of the WMA, as with forests across the state. Table 10 lists examples of anticipated effects and time frames of many key climate factors on upland forests of Vermont.

Table 10: Expected Climate Change Effects and Timeframes[1]

Key Climate Change Factors	Expected Effects	Timeframe
Warming temperatures	Compositional changes associated with changes in thermally suitable habitat (loss of cold-adapted species and increase in warm-adapted species)	Long-term, but localized effects could occur on a shorter timescale
	Increase in overwinter survival of pests, such as balsam and hemlock woolly adelgid	Immediate
	Increased physiological stress, resulting in increased susceptibility to pests and disease, decreased productivity and increased tree mortality	Immediate
	Increased evapotranspiration, resulting in a decrease in soil moisture; moisture limitation/stress negatively impacts productivity and survival in many species	Immediate
	Increased decomposition rate of organic material may enrich soils and make them more suitable for competitors	Long-term, but localized effects could occur on a shorter timescale
	Decrease in winter snow pack, leading to change in deer browsing patterns, which affects regeneration	Immediate
	Lengthening of growing season resulting in changes in species competitiveness, especially favoring non-native invasive plants	Immediate
Increase in extreme storm events	Increased physical damage and disturbance, leading to gap formation, which could facilitate the spread of invasive plants	Immediate
Phenology (timing)	Longer growing season	Immediate
	Early spring thaws/late frosts can damage buds, blossoms and roots, which affects regeneration	Immediate
	Change in freeze/thaw cycles could disrupt regular periodicity of cone cycles	Immediate
	Asynchronous changes in phenology may negatively impact some migratory species and pollinators	Immediate

[1] Source: TetraTech. 2013. Climate change adaptation framework. Prepared for Vermont Agency of Natural Resources.

Key Climate Change Factors	Expected Effects	Timeframe
Increase in fire risk	Loss of fire intolerant species and increase in fire tolerant species, such as red and pitch pines	Long-term, but localized effects could occur on a shorter timescale
	Earlier and warmer springs and smaller snow packs, and hotter drier summers conducive to increased fire risk	Immediate
Increase in number of short-term droughts	Declines in forest productivity and tree survival associated with water limitation	Long-term

2. Land Management Adaptation Strategies[2]

Adaptation to these effects will take a variety of forms, many of which have long been a part of the land management ANR practices. Some of these primary goals and strategies are listed below. Note that some, but not all, strategies are applicable in all parts of THWMA.

A) *Sustain fundamental ecological functions: protect soil quality, nutrient cycling, and hydrology.*

- Enhancing nutrient cycling and soil protection by retaining woody material on the forest floor.
- Matching harvesting equipment to the site for soil protection.
- Minimizing the number of skid roads and trails.
- Maintaining roads in good condition and following all Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont (AMPs) and Vermont Voluntary Harvesting guidelines.
- Replacing and enlarging inadequate culverts and stream crossing structures.

B) *Reduce impact of existing biological stressors: increase pest and pathogen resistance, limit herbivory, and manage invasive species.*

- Control and limit spread of non-native invasive plants.
- Control of white-tailed deer numbers through maintaining hunting access.
- Management of beech mast production areas to promote resistant trees.

C) *Moderate impacts of severe disturbances, such as fire and wind disturbance.*

- Managing for a multi-age, structurally diverse forest.

D) *Maintain or create refugia and increase ecosystem redundancy.*

- Maintaining rare and sensitive natural communities as potential refugia.
- Maintaining and developing biological "legacies," such as very old trees.

E) *Maintain, enhance species and structural diversity and facilitate community adjustments through species transition.*

[2] Source: Creating and Maintaining Resilient Forests in Vermont. October 2014 Draft. Vermont Department of Forests, Parks and Recreation.

- Maintaining and developing a forest with a diversity of species and age classes.
- Retention of biological legacies from a variety of tree species.

F) *Promote landscape connectivity.*

- Maintain a landscape-scale focus, in cooperation with the other nearby landowners, and being mindful of management in the surrounding region.

Taken together, these strategies will help the full range of native fish, wildlife, and plant species; natural communities; and ecological processes face a changing climate.

3. Infrastructure and Public Use Adaptation Strategies

In addition to the far-reaching effects on ecological systems described above, climate change may also affect the infrastructure and public uses on THWMA.

Potential effects could include:

- Floods damaging roads and trails.
- Fires endangering users, campground properties, and neighboring properties.
- Increased precipitation leading to more temporary/seasonal road closures and increased road maintenance.
- Windstorms increasing maintenance needs to keep roads clear of trees.

Such effects will be dealt with on a case-by-case basis. It is anticipated that the systems in place to manage many of these uses will readily handle these issues. Others will require more comprehensive considerations, for example, increased precipitation and flooding – maintaining the WMA as extensively forested, with significant riparian zones and intact wetlands is a key strategy to reduce and mitigate flooding in the WMA and downstream to the Connecticut River. In addition, however, ANR has and will continue to replace undersized culverts (which can fail in flood events) with larger and better positioned structures, and – long term – may need to consider strategically relocating some roads away from streams.

Future assessments of landscape and species vulnerability to climate change effects may be conducted to help management decision-making by identifying locations vulnerable to weather extremes and species vulnerability based on factors such as temperature extremes and habitat conditions.

VII. MONITORING AND EVALUATION

During the life of the LRMP for THWMA, periodic monitoring and evaluation will be conducted to ensure that the resources are protected from fire, insect and disease, encroachments, or unforeseen problems that may occur within the WMA. Management activities will be evaluated to determine how closely the results matched those projected within the plan. Minor adjustments in management may be made to reflect changed conditions or unanticipated results.

As long-term management for THWMA continues, inventory, monitoring, assessment, and research are necessary to: evaluate the status of the resource; assess progress toward achieving stated goals; and determine the effectiveness of management actions and activities.

- Were proposed strategies and actions carried out?
- Did the strategies and actions have the intended effect?
- Were the results consistent with expectations and predictive models?
- Do we have the necessary information to understand and evaluate actions taken on THWMA?

Obtaining quality information is critical to making informed decisions and conducting sound, thoughtful management actions. Research projects on THWMA are directed by the District Stewardship Team to ensure that they do not conflict with the goals and objectives for THWMA as set forth in the LRMP. It is important that individual research projects be assessed for their effects on the resource, potential conflicts with other uses or users, and consist of quality proposals from credible institutions and individuals. All data from private research will be shared with the Agency of Natural Resources.

Ecological/Wildlife

Maintaining the biological diversity of THWMA requires long-term research and monitoring projects in a number of areas. Some of the efforts at meeting these goals include:

Strategies and Actions:

- Continue ongoing inventory and assessment projects promoting the collection and documentation of quality long-term information critical to the assessment and evaluation of management on THWMA (including forest inventory, aerial insect and disease surveys, amphibian, and reptile surveys).
- Monitor rare, threatened, and endangered species and natural communities.
- Consider and support appropriate, credible research project proposals which further understanding of ecological elements and wildlife habitat on THWMA and the impacts of management activities.

Timber and Wildlife Habitat

Timber management and harvest is an important tool used to achieve wildlife habitat and forest management objectives. An effective monitoring and assessment program is essential for ensuring the long-term sustainability of a quality timber management program. Careful analysis of the forest, its resource capabilities, potential impacts on other important management goals, protection of RTE species, water quality, management or protection of rare and/or state significant natural communities, and the documentation of the occurrence of natural processes

(i.e., insect and disease outbreaks, blowdown events) is important in the execution and understanding of the effects of timber management actions.

Timber harvests and wildlife management activities completion within the WMA will be periodically reviewed by the stewardship forester and the District Stewardship Team to determine how well management objectives are being met. If monitoring results indicate that there is a significant difference between the outcomes predicted by the plan and actual conditions, changes to the plan may be recommended.

Strategies and Actions:

- Continue to support ongoing assessment and mapping efforts (e.g., forest inventory, aerial insect and disease surveys).
- Conduct periodic, standardized post-practice assessments to evaluate effectiveness of management activities.
- Support proposals for appropriate research addressing long-term evaluation of forest management activities. Gather baseline data as necessary and practical to support assessment of management effectiveness and impacts.

Recreation

Public recreation will be periodically monitored by the District Stewardship Team to identify where recreational uses conflict with or may be damaging natural resources. Changes in recreational uses may be implemented including new management strategies designed to minimize or eliminate conflicts. State game wardens will be utilized to assist with maintaining compliance with state laws where specific and/or ongoing problems are occurring.

Strategies and Actions:

- Document illegal use and damage of resources.
- Support appropriate research projects including the collection of baseline data to expand knowledge of recreational carrying capacity, resource impacts, and user conflicts.

Historic

There are both historic and suspected pre-contact resources within the WMA. Current understanding and documentation of these resources varies by site. Detailed documentation and study of field evidence is an important component to the understanding, protection, and interpretation of the individual sites and the greater historic context of THWMA and surrounding areas.

Strategies and Actions:

- Continue to inventory, map, and document historic features.
- Monitor and document condition of known historic features using standardized forms and photo documentation.
- Support continued efforts in historic research of THWMA.
- Support educational outreach programs.

Invasive Exotic Species

Invasive exotic species are known to be a problem in many areas of the state negatively impacting wildlife habitat, timber management, natural community composition, recreation, and economics. The District Stewardship Team will monitor the WMA for the presence of invasive exotic species and work with cooperating partner organizations to develop a monitoring protocol. The District Stewardship Team will work to identify populations of invasive exotic species and implement control measures where feasible.

Strategies and Actions:

- Identify invasive species when populations are small. Develop control goals and implement.
- Assess and document levels of introduction of invasive exotic plants by species and location.
- Monitor timber harvest areas before and after timber sale activities. Control invasive species as necessary and practical.
- Evaluate invasive species control projects for effectiveness.

Climate Change

If the most conservative current models of climate change are accurate (Iverson, Prasad, Hale, and Sutherland), THWMA, like the rest of the region, will experience strong impacts over the next 50-100 years. These changes may have important consequences for forest nutrient cycling, timber productivity, forest pest ecology, wildlife habitat, and recreation.

Strategies and Actions:

- Monitor ground conditions, results of management, research, and adaptations of silvicultural guides to inform management decisions and adapt treatment prescriptions as appropriate.
- Support appropriate research project proposals which further understanding of climate change on THWMA.

VIII. NEW USES AND PLAN AMENDMENT PROCESS

The long-range management plan provides guidance for the long-term management and development of a parcel of state land. However, the future cannot be fully determined at the time of plan development. The departments of Fish & Wildlife and Forests, Parks and Recreation undertake an amendment or plan update process when significant changes to the current long-range management plan are proposed. These may include:

1) Substantial changes to any goals, management objectives, and implementation actions contained in the current plan;

2) Major change in land use, land classification, or species management direction;

3) Designation of non-developed camping sites (via statute regarding camping on state lands);

4) Permanent closure of existing trails and/or permanent creation of new recreation corridors not identified in the current plan;

5) Major rerouting, reclassification, permanent closing or creation of new roads (not including forest management access roads not meant for normal vehicle traffic) within state land boundaries not identified in current plan;

6) Major land acquisitions added to the existing parcel;

7) Major capital expenditures for new projects;

8) Facility closures;

9) Transfers in fee ownership;

10) Leasing of new acreage (e.g., ski resort); and

11) Renaming of natural features (prior to recommendation to Department of Libraries) or lands.

When the amendment process is triggered, a public involvement process begins. The type of process is determined at the time and is dependent upon the extent and type of amendment. If applicable, the easement holders are notified to discuss the proposed amendment.

There may be times when the public input and comments are sought regarding plan changes that are less significant than those triggering the plan amendment process. This is left to the discretion of the District Stewardship Team.

IX. FUTURE ACQUISITION/DISPOSITION

Through its October 1999 *Vermont Agency of Natural Resources Lands Conservation Plan,* the Agency outlined priorities for acquiring new lands as well as for acquiring additions to existing ANR lands. It is the State's policy to acquire additions to ANR state lands parcels that are:

1) necessary for maintaining or enhancing the integrity of existing state holdings;

2) lands, such as inholdings and other parcels that serve to consolidate or connect existing state holdings and contain important public values and/or facilitate more efficient ANR land management;

3) parcels that enhance or facilitate public access to ANR lands; and

4) parcels that serve an identified facility, infrastructure, or program need.

All new acquisitions of land to THWMA will be guided by this plan and must have a willing seller, as the Agency does not have the authority to exercise eminent domain. They will also be done in consultation with the regional planning commissions and the town(s) in which the parcel is located.

Any future disposition of land from THWMA will be approved by the ANR Land Acquisition Committee (ALAC) and the Secretary of the ANR after consultation with the regional planning commission and the town(s) in which the parcel is located.

APPENDICES

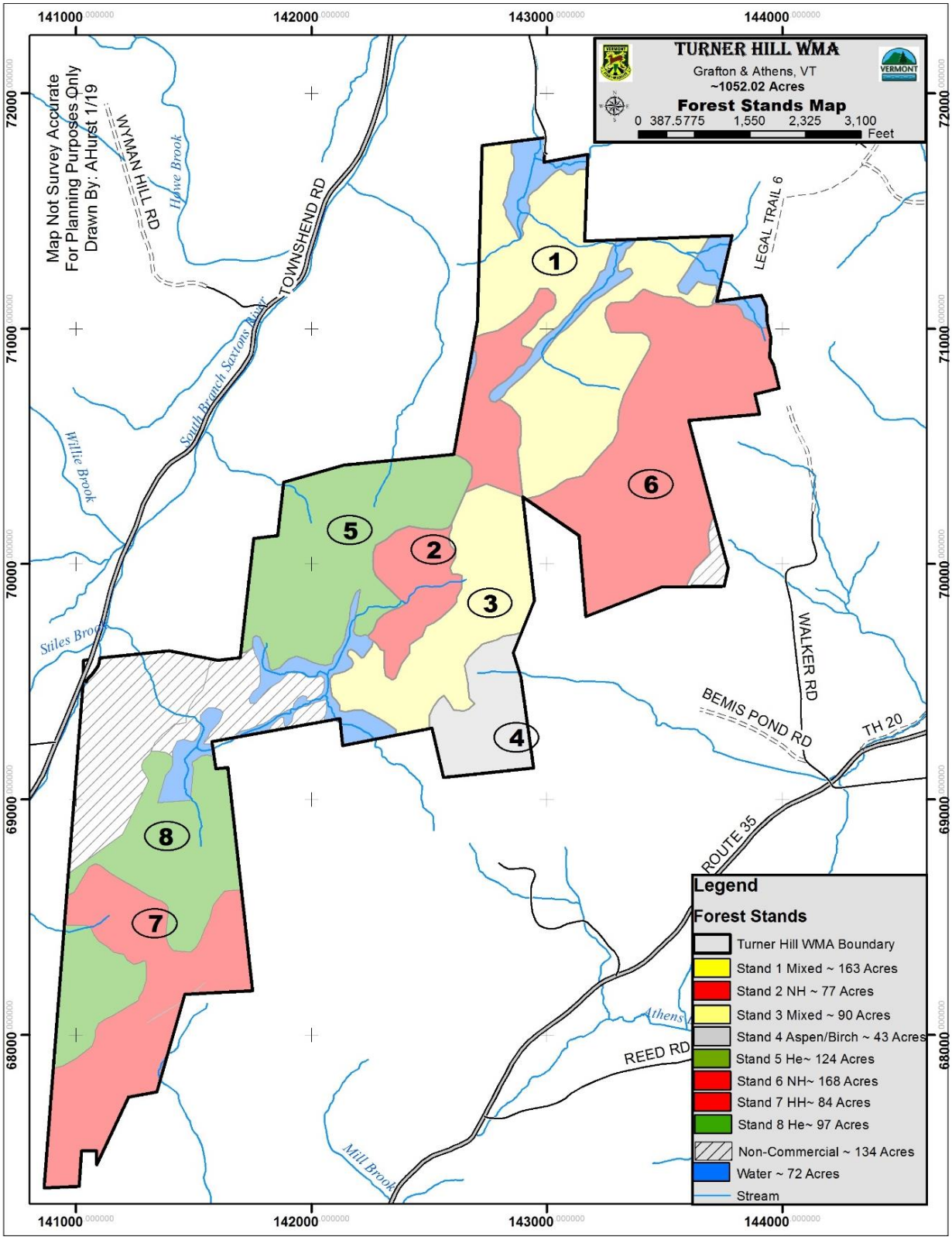
- APPENDIX 1: Forest Inventory Data
- APPENDIX 2: Forest Stands Map
- APPENDIX 3: Notice of Grant Agreements
- APPENDIX 4: Declaration of Restrictive Covenants
- APPENDIX 5: Natural Community Assessment
- APPENDIX 6: Public Comment Summary
- APPENDIX 7: Works Cited
- APPENDIX 6: 10 V.S.A. App. § 15 Rule Governing Public Use of Vermont Fish and Wildlife Department Lands
- APPENDIX 7: Glossary

APPENDIX 1: Forest Inventory Data

Comp./ Stand	Acres	MSD	BA A Total/ Dom-codom	Acc. BA/A	Unacc.BA/A	Cull BA/A	Site	Timber Type	Species % BA	Regeneration – Understory Condition	Volume/ Acre
1/1	141	12.9	123	49	74	0	1 & 3	Mixed	HE 33 MR 18 BE 12	Poor understory regeneration throughout WMA with beech predominate. Some pockets of MS and WA regeneration. Often with browse damage.	3 MBF 11.5 Cords
1/2	245	9.9	124	55	69	0	1 & 3	25 Beech-Birch-Maple	MR 20 MS 19.6 BE 20.3 HE18.6		3.2 MBF 12.8 Cords
1/3	85	9.5	127	83	46	0	3	Mixed	HE 18.4 MR 18.4 BP 14.9 MS 13.2		6.3 MBF 8.4 Cords
1/4	43	9.6	104	49	55	0	3	Aspen-Paper Birch	BP 26.3 MR 24.6 PW 21.1		2.3 MBF 6.6 Cords
1/5	122	13.8	109	63	46	0	1 & 2 & 3	Mixed	HE 34.3 MR 32.8		4.9 MBF 10.1 Cords
1/6*	168	9.9	124	55	69		3	25	BE 16.4 MR 16.2 MS 15.9		3.2 MBF 12.8 Cords
1/7*	84	10.2	128	46	86	0	3	25	BE 30.6 MR 20.6 OR 11.3		3.5 MBF 4 Cords
1/8*	97	9.5	151	90	61		3	Mixed	HE 85.4 MR 24.2 BE 13.3		8.5 MBF 4.5 Cords

*Inventory Date 2013

APPENDIX 2: Forest Stands Map



APPENDIX 3: Notice of Grant Agreements

2009 Cooperative Endangered Species Conservation Fund Grant Program
Recovery Land Acquisition Grant for the
Establishment of the Turner Hill Wildlife Management Area to
Protect the Athens Domes Wetland Complex
Athens and Grafton, Vermont

State: **Vermont**
Grant No: **E-4-RL-2**
Project/Job No. & Name: **Recovery Land Acquisition Grant for the Establishment of a new Wildlife Management Area Protecting the Athens Dome Wetland Complex**

Grant Narrative: The Vermont Department of Fish and Wildlife (Department) and The Nature Conservancy (TNC) applied for this grant to realize an exciting opportunity to protect +/-545.47 acres as a new Wildlife Management Area where numerous beaver-influenced wetlands provide ideal habitat for the federally-endangered Northeastern bulrush (*Scirpus ancistrochaetus*). The Athens Dome Wetland Complex Project located in the towns of Athens and Grafton, VT is comprised of undeveloped and intact forest land that supports vital wildlife habitat, state-significant wetlands, stream frontage, traditional recreational opportunities, and scenic viewpoints. The 545 acres, now owned by the Department, has been named the Turner Hill Wildlife Management Area (WMA). The WMA consists of a wetland complex which includes two documented occurrences of Northeastern bulrush, and supports numerous wetlands that contain ideal habitat for the Northeastern bulrush. This project was a unique opportunity to protect the Northeastern bulrush in a relatively undisturbed setting as there are no roads or other infrastructure that would be potentially impacted by natural beaver population dynamics.

The creation of the new Turner Hill WMA for the protection of the federally-endangered Northeastern bulrush is directly related to the Department's mission, which is "the conservation of fish, wildlife and plants and their habitats for the people of Vermont." The WMA also directly supports and advances the Agency Northeastern Bulrush Recovery Plan, established by the USFWS in 1993. While working on the conservation of the properties, the Department identified the Turner Farmstead property and the Birchdale Camp structures on the property which are highly significant historic resources related to the heritage of African Americans in Vermont.

Because this project was funded with a grant from the USFWS, the Department must comply with Section 106 of the National Historic Preservation Act of 1966. In consultation with the USFWS and the Vermont Division for Historic Preservation (DHP), it was been determined that this project is a federal undertaking with the potential to effect historic properties. The area of potential effect (APE) for the project is the ±545 acres of land located within the boundaries of the Turner Hill WMA. Within the APE, we have identified significant cultural resources related to the Turner Farmstead. Alexander and Sally Turner were former slaves who escaped captivity in Virginia, moved to Vermont and established the Turner Farmstead following the end of the Civil War. One of their daughters, Daisy Turner (1883-1988), was a well-known orator and folk teller whose stories and songs of African American heritage were extensively documented by the Vermont Folklife Center. These cultural resources include one standing building, known as Birchdale Camp; historical archeological remains of the original Turner house; outbuildings; wells, dumps, privies and other cultural features and the surrounding landscape related to the Turner family's use of the property.

2009 Cooperative Endangered Species Conservation Fund Grant Program
Recovery Land Acquisition Grant for the
Establishment of the Turner Hill Wildlife Management Area to
Protect the Athens Domes Wetland Complex
Athens and Grafton, Vermont

We understand that the USFWS and the Department must consider the Turner Farmstead property, even though our missions are focused on natural resource conservation and not historic preservation. As such, we are committed to working collaboratively to identify a means of preserving the Turner Farmstead and the Birchdale Camp structure while managing the WMA into the future. Until a final decision has been made on the treatment of the Birchdale Camp structure, its windows and doors have been secured with plywood panels and "No Trespassing" signs posted. A lead paint and asbestos survey has also been completed, which will help inform the possible rehabilitation of the building in the future.

The Department now owns the parcel with the building on it (former VELCO property), as well as the additional historic remains. In order to allow for more flexibility to determine what to do with the building and foundations over time, we excluded the 5 acres around the building, which includes the foundations, from the federal grant. This way the Department will be able to pursue subdividing the 5-acres off or leasing it to an appropriate steward in the future. A map of this refined APE is included with this report. This will enable the Turner Farmstead parcel to be transferred to another party in the future for long-term preservation, if that is the agreed upon course of action, recognizing the deteriorated condition of the building and the difficult and limited access. Because the Department did not apply federal funding to these 5 acres, such a transfer will not impact the terms of the Recovery Land Acquisition Grant if it ever goes forward.

It should be noted that additional historic cultural resources and cultural landscape features related to the Turner family may be located elsewhere on the property and beyond the ±5 acre boundary of the homestead. These resources, which may include culverts, fences, the remains of outbuildings, and archeological sites will not be disturbed by the creation of the WMA as no construction is planned at this time. The Management Plan for the WMA will take into account the existence of these resources and establish a consultation process with DHP for future projects on the site.

To guide the decision making process for the treatment of the Turner Farmstead property and its cultural resources, the Department entered into a Memorandum of Understanding (MOU) with the DHP, USFWS and the Preservation Trust of Vermont ("PTV") that established a process for exploring the economic and technical feasibility of rehabilitating the Birchdale Camp structure. Recognizing the lack of both technical and economic resources at the Department to undertake a project of this magnitude, PTV agreed to facilitate the effort to consult with organizations and individuals who may have an interest in the project. The PTV is a nationally recognized, statewide non-profit preservation organization with three decades of experience preserving historic properties and buildings throughout the state.

The MOU details the scope of the project, the partners involved, the expected level of effort to document the feasibility of a rehabilitation project, and a timeline by which to accomplish these tasks. At the time we signed the MOU, we were comfortable with a period of three years, at which point the MOU would expire. However because it took the Department longer than

expected to close on the property, we are currently in the process of extending the MOU for another 18 months. If at the end of the new period all the terms of the proposed MOU have been met and no feasible plan has been identified to preserve the Birchdale Camp structure, the signatories to the MOU have agreed that the only reasonable conclusion of the consultation efforts will be the demolition of the Birchdale Camp.

Revised Approach:

We worked very closely with the staff of the Vermont Chapter of TNC and the Vermont Electric Power Company (VELCO) to conserve the new Turner Hill WMA.

Purchase of the 78.77 acre TNC property (former Wright Estate). The property was purchased by TNC for the fair market value as determined by a Restricted Use appraisal of $67,000. The appraisal, completed by Robert Lamprey, was updated for the Department's use to Yellow Book standards and was valued at $88,000. The Department bought the property from TNC for $88,000. The property closed on December 22, 2011. Other costs associated with this parcel were for our attorney fees.

Acceptance of the 286.7 acre VELCO property (formerly the Knight Estate). The property was donated to the Department and used a match to leverage the federal funds. The property was appraised at $93,343.20. Five acres were excluded from the appraised value so that the federal grant conditions would not apply there. This was designed to give the Department the flexibility over time to transfer out the APE area to a more appropriate steward of the cultural resources. We reimbursed VELCO for a portion of their associated costs at $71,108.26 which went towards the survey costs. The survey was done under a fast timeline and during the winter months making the cost very high. An additional 25 acres was quitclaimed as clear title could not be secured. The Department closed on this property on March 15, 2013. Other costs associated with this parcel were for our attorney fees.

Purchase of the 180 acre Bemis parcel. After completing the survey on David Bemis' property, we realized that the landowner could not secure clear title on a portion of the property he wished to sell us. Therefore the Department revised our P&S Agreement to reflect the new acreage of 180 acres. The appraisal gave us a per acre value based on a range of acres which 180 acres still fell within. Therefore the purchase price was adjusted as well to $157,792. The Department was also donated the 29-acre parcel which the landowner could not secure clear title to since we could not use federal funds to buy it. The Department closed on the property on May 31, 2012. Other costs associated with this parcel include the survey and the Department's attorney fees.

Management, research, & monitoring. The Vermont Fish and Wildlife Department will be responsible for managing the Turner Hill WMA. Periodic monitoring of the Northeastern bulrush and its habitat will be conducted through monitoring of population size and habitat suitability over time. The Department will include more specifics in the long range management plan we develop for the property.

2009 Cooperative Endangered Species Conservation Fund Grant Program
Recovery Land Acquisition Grant for the
Establishment of the Turner Hill Wildlife Management Area to
Protect the Athens Domes Wetland Complex
Athens and Grafton, Vermont

Final Summary of Land Costs:

Parcel Name:	**VELCO (Knight Estate)**
Type of Interest Acquired:	Fee Acquisition
Seller's (Grantor) Name:	Vermont Electric Power Company
Owner's (Grantee) Name:	Vermont Fish and Wildlife Department
Parcel Name:	**TNC (Wright Estate)**
Type of Interest Acquired:	Fee Acquisition
Seller's (Grantor) Name:	The Nature Conservancy
Owner's (Grantee) Name:	Vermont Fish and Wildlife Department
Parcel Name:	**Bemis**
Type of Interest Acquired:	Fee Acquisition
Seller's (Grantor) Name:	David Bemis
Owner's (Grantee) Name:	Vermont Fish and Wildlife Department
Total Acreage Acquired:	545.47 acres
Cost Summary Acquisition Cost	$245,792.00
Associated Costs	$86,609.34
Land Donation	$93,343.20
Total	$425,744.54
Federal: RLAG Share	$282,401.34
Duck Stamp Funds	$50,000
Land Donation	$93,343.20
Total	$425,744.54

2009 Cooperative Endangered Species Conservation Fund Grant Program
Recovery Land Acquisition Grant for the
Establishment of the Turner Hill Wildlife Management Area to
Protect the Athens Domes Wetland Complex
Athens and Grafton, Vermont

Attached are the following Documents:

- Title Insurance Policies for the Bemis, VELCO and TNC properties (Properties);
- Copy of recorded deeds and Notice of Grant Agreements with legible Book & Page Numbers for the Properties;
- Copy of the Survey Maps for the Properties;
- Revised Purchase and Sales Agreement for the Bemis property;
- Maps of the final WMA and the APE on the former VELCO property; and
- the MOU for the former VELCO lands and the Turner Farmstead located on the property.

Fiscal Year 2015 Cooperative Endangered Species Conservation Fund Grant Program Recovery Land Acquisition Grant Proposal for the addition of 456.65 acres to the Turner Hill Wildlife Management Area Protecting the Athens Dome Wetland Complex in Grafton and Athens, Vermont

Project: Athens Dome Wetland Complex Phase Two
Applicant: Vermont Department of Fish & Wildlife
Contact: Jane Lazorchak, Land Acquisition Coordinator, Vermont Department of Fish & Wildlife, 802-505-0561

Grant Narrative: The Vermont Department of Fish and Wildlife applied for this grant to realize an exciting opportunity to protect +/-458.65 acres and add it to our Turner Hill Wildlife Management Area (WMA) which we purchased with the support of a Recovery Land Acquisition Grant originally awarded in 2008. The Athens Dome Wetland Complex, located on the WMA and neighboring private lands, contains numerous beaver-influenced wetlands providing ideal habitat for the federally-endangered Northeastern bulrush (*Scirpus ancistrochaetus)*. The Turner Hill WMA, located in the towns of Athens and Grafton, VT, is comprised of undeveloped and intact forest land that supports vital wildlife habitat, state-significant wetlands, stream frontage, traditional and recreational opportunities, and scenic viewpoints. This wetland complex includes two documented occurrences of Northeastern bulrush, one on the WMA and one just south of the WMA. It also supports numerous wetlands that contain ideal habitat for the Northeastern bulrush. The WMA provided a unique opportunity to protect the Northeastern bulrush in a relatively undisturbed setting as there are no roads or other infrastructure that would be potentially impacted by natural beaver population dynamics. Acquisition of the properties proposed here as additions to the WMA will contribute to the recovery of the federally-endangered Northeastern bulrush by protecting some of the best habitat for this plant in Vermont and throughout its entire range. Northeastern Bulrush was listed as Endangered on June 6, 1991 and has a recovery priority of 2C.

The need to undertake the proposed project was derived primarily from the following factors, discussed in further detail below:

- The parcels targeted for acquisition are not currently on the market as the landowners approached the Department first but if we are not successful, they will be listed with a realtor. Their conservation is therefore time sensitive;
- The protection of the Property directly supports and advances the final Recovery Plan[1] for Northeastern bulrush; and

[1] U.S. Fish and Wildlife Service. 1993. Agency Northeastern Bulrush (*Scirpus ancistrochaetus*) Recovery Plan. Hadley, Massachusetts. 70 pp

- The quality of the habitat, the location near the northern extreme of the bulrush's range (allowing for adaptation to climate change), and the current small number of protected populations in New England indicate a strong need to conserve these occurrences of Northeastern Bulrush.

The grant envisioned the acquisition of two parcels: Dewitt and Sheehan (See Exhibit 1). As mentioned above, the wetland complex here includes two documented occurrences of Northeastern bulrush and supports numerous wetlands that contain ideal habitat for the Northeastern bulrush. The second documented occurrence was not on the existing WMA. The population occurs just to the south of the original lands conserved as part of the WMA on Vance Dewitt's property. He contacted us in the fall of 2014 to give us the first opportunity to purchase his 243-acre property. The parcel is accessed from the Grafton-Townsend Road and has a legal Right-of-Way which will be conveyed to the Department as well. If the Department was not successful in raising the money to purchase it, he planned to list it with a realtor. This was an ideal addition to the WMA and we saw this as a high-priority to acquire because of the wetland habitat.

As we began to plan to apply for a Recovery Land Acquisition Grant to support the acquisition of the Dewitt parcel, the Department realized we had an opportunity to leverage the conservation of other parcels in the area. Specifically, we were most interested in acquiring property on the eastern side of our WMA in order to secure both management and public access. The access to the WMA was very limited prior to this project. All of the legal Right-of-Ways we initially had to the WMA were up very steep roads or woods roads making access in the winter with a vehicle impossible and management access at any time of the year impossible as it was too wet in the summer and not safe in the winter. In addition, the road that is passable with a vehicle in the summer has now been over taken by the beavers where the public walks onto the property. The access point is under no less than five to ten feet of water due to the new impoundments the beavers have created. This is ideal for the Northeastern bulrush as it has created new habitat but creates challenges for us as managers.

Peter Sheehan owned 215.65 acres that parallels the eastern boundary of our WMA. The property itself contains excellent wildlife habitat as red oak and other mast-producing trees occur throughout the property. The parcel also contains small wetlands throughout and ideal conditions for beavers to expand their home range. The wetlands on the northern part of the parcel (shown in Exhibit 1) seem ideal to support the Northeastern bulrush but have not been surveyed. The State Botanist plans to survey them this coming summer. The parcel is accessed from Walker Road which is maintained by the town and would therefore provide excellent access for both the public and management. We envision developing a parking lot on the property, as well as a kiosk.

While Department staff approached Peter and Susan Sheehan proactively to conserve their property, the timing was optimal. The Sheehan's, who own this property and other parcels around southern Vermont, were interested in selling some of their properties now because Peter's health no longer allows him to work as a logger. If we had not approached him, he was considering listing this property in the near future. These 215.65 acres are subdivided into seven lots and he planned to list them separately. If these lots were built on, they would have significantly compromised the long-term management of the WMA as well as the inherent wildness of the area. We plan to acquire 213.65 acres of this property. Peter and Susan will retain the camp on the property and two acres around it.

The additional conservation of land on the Athens Dome further protects the Northeastern Bulrush and numerous other conservation values. Forgoing conservation activity at this time would have resulted in the sale to private, potentially non-conservation minded buyers, who could have developed the properties.

REVISED APPROACH:

The objective of protecting existing and potential Northeastern bulrush habitat was accomplished through two distinct transactions:

Purchase of the 243 acre Vance Dewitt property. An appraisal of the Dewitt property was completed valuing the property at $140,000. The landowner, Vance Dewitt, agreed to a bargain sale of $100,000. The landowner has acknowledged a $40,000 bargain sale and donated that as match to the project. The Department closed on the property on 12/29/2015.

Purchase of the 213.65 acre Sheehan property. An appraisal was completed on the landowner's entire 215.65-acre property and camp valuing it at $290,000. An offer was made to the landowner to purchase the entire property but they declined and determined that they wanted to hold onto the camp and two acres around it. As such, we requested that the appraiser complete a supplemental letter utilizing the market data in the original report to revise his opinion of market value of the property to exclude this camp and lot. The supplemental report was provided with the original application. We arrived at a revised offer of $278,000 which the Sheehan's accepted. The Department closed on the 213.65-acre property (the total property minus the two acres around the camp) on 12/29/2015.

Final Summary of Land Costs:

Parcel Name:	**Dewitt**
Type of Interest Acquired:	Fee Acquisition
Seller's (Grantor) Name:	Vance Dewitt
Owner's (Grantee) Name:	VT Fish and Wildlife Department
Parcel Name:	**Sheehan**
Type of Interest Acquired:	Fee Acquisition
Seller's (Grantor) Name:	Peter and Susan Sheehan
Owner's (Grantee) Name:	VT Fish and Wildlife Department
Total Acreage Acquired:	456.65 acres
Cost Summary Acquisition Cost	$378,000.00
Associated Costs	$15,000.00
Land Donation	$40,000.00
Total	$433,000.00
Federal: RLAG Share	$324,750.00
Duck Stamp Funds	$60,000.00
Timber Sales	$8,250.00
Land Donation	$40,000.00
Total	$433,000.00

Attached are the following Documents:

- Title Insurance Policies for the Sheehan and Dewitt properties (Properties);
- Copy of recorded deeds and Notice of Grant Agreements with legible Book & Page Numbers for the Properties;
- Copy of the Survey Map for the camp exclusion on the Sheehan property; and
- Map of the final WMA.

APPENDIX 4: Declaration of Restrictive Covenants

DECLARATION OF RESTRICTIVE COVENANTS

RECITALS

BY THIS INDENTURE, made this 4th, day of June 2009, by **VERMONT TRANSCO, LLC** (hereinafter referred to as the "Declarant" which word, where the context requires, includes the plural and shall, unless the context clearly indicates otherwise, include the Declarant's executors, administrators, legal representatives, devisees, heirs, successors, assigns, lessees, tenants and other occupiers and users) with address of 366 Pinnacle Ridge Road, Rutland, Vermont, is the owner in fee simple of certain real property located off Turner Hill in the municipalities of Grafton and Athens, County of Windham, State of Vermont, (hereinafter "Property") more particularly bounded and described on Exhibit "A" attached hereto (hereinafter "Restriction Area") and further shown on a map attached as Exhibit "B" and incorporated herein by this reference; and

WHEREAS, Declarant is in the process of constructing new transmission lines and substations in connection with a project known as the Southern Loop Project, the "SLP" or "Project"), and in connection with the Project, the U.S. Army Corps of Engineers has requested mitigation for impacts from the Project to jurisdictional wetlands. In connection with said mitigation, the U.S. Army Corps of Engineers requests that Declarant retain, maintain, and preserve the Property designated as the Restriction Area as open space, in its natural state; and

WHEREAS, Declarant is willing, in order to mitigate the impacts of the Project, to preserve the natural, scenic, aesthetic and special character of the Property, and desires to conserve and protect the Property as a natural habitat for birds, wildlife, plants and similar ecosystems by encumbering the Property with the restrictive covenants (hereinafter, "Covenants") hereinafter set forth in this Declaration;

NOW THEREFORE, be it known that Declarant does hereby restrict and encumber the Property with the Covenants (described in this Declaration) in perpetuity over the Restriction Area.

1. PURPOSE

The Covenants are hereby established exclusively for the following conservation purposes:

(a) To have the Property remain in a natural and open condition in order for it to fulfill its present historic, scenic, vegetative, wildlife and/or hydrological functions.

(b) To offset wetland impacts due to the Project.

2. USE LIMITATIONS

Declarant intends that these Covenants will confine the use of the Restriction Area in perpetuity to such activities as are consistent with the purposes of this Declaration. Any activity on or use of the Restriction Area inconsistent with the purposes of this Declaration is prohibited. The following limitations shall apply:

(a) The Restriction Area shall not be subdivided and none of the individual tracts, which together comprise the Restriction Area, shall be conveyed separately from one another.

(b) The Restriction Area shall be maintained in perpetuity as open space without there being conducted thereon any industrial, commercial, agricultural or forestry activities. Agricultural and forestry shall include animal husbandry, floricultural, horticultural

activities, the production of plant and animal products for domestic or commercial purposes, the growing, stocking, cutting and sale of forest trees of any size capable of producing timber or other forest products and the processing and sale of products produced on the Property (e.g., maple syrup).

(c) No structures, improvements or alterations, including but not limited to, a dwelling, any portion of a subsurface wastewater treatment and disposal system, mobile home, utility tower, or wireless communication facility shall be constructed, placed or introduced onto the Restriction Area.

(d) No removal, filling, or other disturbances of soil nor any changes in the topography, surface or subsurface water systems, wetlands or natural habitats shall be allowed.

(e) No mining, quarrying, excavation or removal of rocks, minerals, gravel, sand, topsoil or other similar materials shall be allowed on the Restriction Area.

(f) The placement of signs, billboards or other advertising materials or structures of any kind is prohibited.

(g) There shall be no use of pesticides, poisons, biocides or fertilizers, draining of wetlands, burning of marshland or disturbances or changes in the natural habitat of the premises.

(h) There shall be no manipulation or alteration of the natural watercourses, lakeshores, marshes or other water bodies, nor shall any uses of or activities upon the property be permitted which could be detrimental to water purity or to any vegetative, wildlife or hydrological function.

(i) There shall be no operation of vehicles, snowmobiles, dune buggies, motorcycles, mini-bikes, go-cars, all-terrain vehicles, or any other type of motorized vehicle upon the Property, other than all-terrain or other vehicles necessary for the sole purpose of monitoring or inspecting the Property periodically by Declarant.

(j) There shall be no storage or placement of equipment, natural or man-made materials or substances upon the Property.

(k) There shall be no dumping, burning, release, burial, injection, or disposal of any type of material on the Restriction Area.

. EXCEPTIONS

This Declaration does not restrict the following activities by Declarant provided Declarant obtains written approval from any local or state agencies for which approval is required:

(a) Limited forestry operations shall be permitted on the Restriction Area that either enhance wildlife or plant habitat for the purpose of scientific studies. All such operations shall be based on a forest management plan prepared by the Vermont Department of Fish and Wildlife and/or Declarant. Any profits generated from the harvest of timber on the property as a result of this plan shall be used by the Vermont Department of Fish and Wildlife to protect and manage wildlife habitat in Vermont.

(b) Pruning and thinning live trees and brush and the removal of debris, dead trees or brush for the purpose of promoting forest health and wildlife habitat, safety and aesthetic quality.

(c) Planting of trees, shrubs, or other vegetation for the purpose of promoting wildlife or aesthetic quality.

(d) Pesticides and herbicides may be used by the Vermont Department of Fish and Wildlife as identified in their forest management plan for the treatment of non-native invasive species on the Property.

(e) Grading and landscaping at the direction and approval of the Town Engineer and/or any other local or state boards/agencies.

(g) Maintenance, repair and replacement of utilities.

(h) The use of machinery or vehicles (including motorized vehicles) for the sole purpose of accomplishing the activities set forth in Section 3(a)-(g).

(i) The removal and proper disposal of any existing structures on the property.

4. RESERVED RIGHTS

It is expressly understood and agreed that this Declaration does not grant or convey to members of the general public any rights of ownership, entry or use of the Property. This Declaration is created solely for the protection of the Property and Declarant reserves the ownership of the fee simple estate and all rights appertaining thereto, including without limitation the right to exclude others and to use the Property for all purposes consistent with this Declaration.

5. MARKING OF PROPERTY

The perimeter of the Property shall at all times be plainly marked by permanent signs or by an equivalent, permanent marking system designating the area as a protected area.

6. PROPERTY TRANSFERS

Declarant shall include the following notice on all deeds, mortgages, plats, or any other legal instrument used to convey any interest in the Property. Failure to comply with this paragraph does not impair the validity or enforceability of these Covenants:

> NOTICE: This Property is Subject To a Declaration of Restrictive Covenants recorded at *[insert book and page references, county(ies) and date of recording.]*

7. BENEFITS AND BURDENS

This Declaration shall run with the Property and shall be enforceable against all future owners and tenants in perpetuity.

8. SEVERABILITY

If any provision of this Declaration, or the application thereof to any person or circumstances, is found to be invalid by a court of competent jurisdiction, by confirmation of an arbitration award or otherwise, the remainder of the provisions of this Declaration or the application of such provisions to persons of circumstances other than those to which it is found to be invalid, as the case may be, shall not be affected thereby.

9. MERGER

The provisions of this Declaration set forth herein are to last in perpetuity, and that to that end no purchase or transfer of the underlying fee interest in the Property shall be deemed to eliminate the Covenants, or any portion thereof, granted under the doctrine of "merger" or any other legal doctrine.

Declarant hereby affirms that it is the sole owner of the Property in fee simple and has the right to grant this Declaration and to encumber the Property by the Covenants. The Property is free and clear of all liens and encumbrances other than those of record, including but not limited to any mortgage not subordinated to this Declaration. Declarant agrees to be bound by and to observe and enforce the provisions hereof and assumes the rights and responsibilities set forth herein, all in the furtherance of the conservation purposes for which this Declaration is established.

IN WITNESS WHEREOF, the Declarant duly executed this Declaration of Restrictive Covenants under seal this 4th day of June 2009.

IN THE PRESENCE OF:

Christine E. Carr

DECLARANT:

VERMONT TRANSCO LLC

By: John J. Donleavy

Its: President and Chief Executive Officer

STATE OF VERMONT
COUNTY OF RUTLAND, SS.

On this 4th day of June 2009, personally appeared John J. Donleavy, Duly Authorized Agent of **VERMONT TRANSCO LLC**, to me known to be the person who executed the foregoing instrument, and he acknowledged this instrument, by him signed, to be his free act and deed and the free act and deed of **VERMONT TRANSCO LLC.**

Before me, Judy Frazier
Notary Public
Notary commission issued in Rutland County
My commission expires: 2/10/2011

APPENDIX 5: Natural Community Assessment

The Agency of Natural Resources uses a "coarse filter/ fine filter" approach to the ecological inventory and assessment of state lands (Jenkins 1985; Noss 1987; Hunter et al. 1988; Hunter 1991; Noss and Cooperrider 1994; Haufler et al. 1996; Jenkins 1996; Poiani et al. 2000). Widely employed as a management tool on state, federal, and private lands (see for example: Leslie et al. 1996; Committee of Scientists 1999; Stein et al. 2000; USFS 2000, 2004), it is an aid to land managers who seek to protect most or all of the species that naturally occur on their lands, but who lack the resources to make exhaustive inventories of all taxonomic groups. Because many groups of organisms are cryptic or poorly understood (for example, fungi and soil invertebrates), it is not practical to make lists of all of them (Anderson et al. 1999; Willis and Whittaker 2002). Even if we could assemble such lists of species, it would be impossible to manage the land with all of them in mind. Instead, natural communities are treated as a proxy for the biological organisms of which they are composed. It is thought that if examples of all of Vermont's natural communities are conserved at the scale at which they naturally occur, most of the species they contain, from the largest trees and mammals to the smallest insects, will also be conserved (NCASI 2004). Natural communities are thus a coarse filter for "catching" the majority of an area's native organisms. Because conservation of habitats (in the form of natural communities) will not protect all species, we also employ a "fine filter" to catch the remaining species that are known to require very specific conditions for their growth, reproduction, wintering, etc. Examples of organisms benefiting from the fine filter inventories described below include breeding birds, deer and their wintering areas, and rare plants.

The coarse filter assessment begins by describing landscape and climatic factors that characterize THWMA, such as bedrock geology and water resources. It then details the 11 distinct natural community types documented and mapped during inventories of the WMA. This is followed by a fine filter assessment describing rare species, invasive plants, and wildlife habitats found here.

Coarse Filter Assessment

Biophysical Region and Climate

THWMA is located near the western of the Southern Vermont Piedmont biophysical region. This region extends from the relatively warm and dry Connecticut River Valley, to the foothills of the Green Mountains. Because THWMA is located at a relatively high-elevation (approximately 1,000 to 1,600 feet) in the foothills, its climate likely is intermediate in temperature and precipitation between the Connecticut River Valley and the cold and wet higher elevations of the Southern Green Mountains. Field inventory of natural communities suggested that some portions of THWMA have a notably cool climate and short growing season that is out of character with much of the Southern Vermont Piedmont.

Bedrock, Surficial Geology and Soils

The bedrock underlying THWMA is some of the oldest in Vermont with rocks formed 500 million to one billion years ago, during Precambrian times. The majority of the WMA is underlain by Mount Holly Complex gneiss. The western portion of THWMA is underlain by granite and gneiss of the Cardinal Brook Intrusive Suite. All of these rocks are acidic and do not contribute substantially to soil enrichment. Glacial till is the predominant surficial geology feature found at THWMA (Doll et al. 1970). Where the WMA reaches the valley along the

Townshend/Grafton Road, there are areas mapped as kame terrace and as glacial outwash. All of these features were formed as the glacier ice melted at the end of the last continental glaciation, some 15,000-12,000 years ago. In addition, many of the wetlands have post-glacial accumulations of muck and peat. These are organic materials deposited in very acidic and anaerobic environments, which consequently decay more slowly than they are produced. The soils of THWMA are primarily the results of these surficial deposits. NRCS soil mapping indicates that Tunbridge-Lyman fine sandy loams are the most widespread soils, covering approximately 333 acres. Fine sandy loams of the Berkshire, Marlow, Monadnock, Tunbridge, and Westbury series cover much of the remainder of the parcel, with some areas of Lyman-rock outcrop complex. Lupton and Markey series muck and peat is mapped in the wetlands.

Hydrology/Streams/Rivers/Ponds

THWMA receives around 47 inches of precipitation annually. The WMA is located entirely within the Saxton's River watershed. The many wetlands on the WMA form the headwaters for small streams that drain into Athens Pond and Athens Brook to the east, and into the South Branch Saxtons River. The extensive wetlands of THWMA play a role in moderating downstream flow volumes and water temperatures.

Natural and Human Disturbance

Natural disturbance process, such as wind, fire, and flooding, continually shape landscapes and define their natural communities. THWMA shows evidence of typical natural disturbance processes, including small scale disturbances such as individual tree death, and more moderate scale events such as ice damage. Very large scale disturbances (events affecting many hundreds of acres or more) are expected to occur only rarely, but when an event does occur it would have the potential to create dramatic changes in natural communities. The many wetlands in the WMA are highly influenced by periodic disturbance from beaver activity. This process is described in more detail in the natural community section below; this natural cycle of disturbance and recovery creates a diverse set of wetland habitats for many plant and animal species found on the WMA.

Land use history can also influence the present-day distribution and condition of natural communities. THWMA has extensive evidence of past timber harvesting and agriculture. Much of the northern portion of the WMA near Turner Hill Road was cleared for agriculture. The rest of the WMA has a history of timber harvesting, with some areas showing evidence of intensive harvesting.

Natural Communities

A natural community is an assemblage of biological organisms, their physical environment (e.g., geology, hydrology, climate, natural disturbance regime, etc.), and the interactions between them (Thompson and Sorenson 2000). The 89 natural community types described in Vermont repeat across the landscape in patches (or "polygons") of various sizes. These patches (or groups of patches in close proximity to each other) are referred to as natural community occurrences, and are to be distinguished from broad descriptions of community types.

Natural communities at THWMA were identified through aerial photograph interpretation and field surveys. Because some natural communities occur at very small scales (e.g., less than ¼ acre), this mapping effort is probably incomplete. Natural community mapping is an iterative

process, and our knowledge improves with each mapping effort. Thus, the map presented here should not be viewed as a final statement on community distribution at THWMA; instead, it should be treated as a first attempt at describing natural communities in this area. Land managers and members of the public should be aware that additional examples of small patch natural communities (e.g., vernal pools and seeps) probably occur on the management unit. As subsequent inventories and site visits are conducted, this map will be improved.

Sixty-nine occurrences of 15 natural community types were identified and mapped on THWMA. A total of 160 natural community polygons were mapped.

Some broad patterns emerged from this mapping effort. As is typical of the Vermont landscape, the majority of the parcel is upland forest characterized by a mix of northern hardwood species and Eastern Hemlock. The high plateau on the southern portion of the parcel, however, contains a notable occurrence of Lowland Spruce-Fir Forest, which is typically found only in the coldest regions of the state. Wetlands comprise about 6.2% of the land area at THWMA yet are disproportionately responsible for species and habitat diversity on the parcel. Aside from vernal pools and seeps, almost all of the wetlands are influenced by beaver activity – the dynamic nature of these wetlands makes them especially valuable to the plant and animal species of the WMA.

Natural Communities of Turner Hill WMA

Natural Community		Acres	Vermont Distribution	Example of Statewide Significance?
Wetlands	Beaver Wetland	52.1	n/a*	n/a*
	Basin Shrub Swamp	.5	rare	yes
	Hemlock-Balsam Fir-Black Ash Seepage Swamp	3.2	common	
	Hemlock-Sphagnum Basin Swamp	.3	rare	
	Red Spruce-Cinnamon Fern Swamp	3.2	uncommon	
	Seep	4	common	
	Vernal Pool	2.2	uncommon	yes
Uplands	Hemlock-Northern Hardwood Forest	517	very common	
	Hemlock Forest	29.5	common	yes
	Red Oak-Northern Hardwood Forest	21	common	
	Northern Hardwood Talus Woodland	2.7	uncommon	yes
	Northern Hardwood Forest	372	very common	
	Lowland Spruce-Fir Forest	41	uncommon	
	Red Spruce-Heath Rocky Ridge Forest	2.7	uncommon	
	Temperate Acidic Cliff	0.6	common	

*Because of their dynamic nature, beaver wetlands cannot be assessed for distribution or significance using comparable methods to other natural community types.

For more information on these and other natural communities, see Wetland, Woodland, Wildland: a Guide to the Natural Communities of Vermont, by Elizabeth Thompson and Eric Sorenson. Information may also be found online at: https://vtfishandwildlife.com/node/200

Basin Shrub Swamp
These small swamps are found in small, topographic depressions with very small surface watersheds. The water table is high in the spring, often flooding these swamps, but drops over the growing season. As a result, trees are sparse but shrubs such as winterberry (*Ilex verticillata*) and highbush blueberry (*Vaccinium corymbosum*) are abundant. This is a rare natural community and both examples found on the WMA are state-significant.

Beaver Wetland
These wetlands are a prominent feature on the landscape of THWMA and have been mapped on 52 acres of the WMA. Unlike other natural communities, beaver wetlands are constantly changing in response to the presence or absence of beavers. As a result, they are not mapped as a natural community type; instead they are separately identified to indicate their dynamic nature. During inventory of THWMA, beaver wetlands were found in all different stages, from active use by beaver to apparently long-abandoned. For these reasons, the beaver wetlands mapped in this report are not assessed for statewide significance in the same way that specific natural community types are. Nevertheless, these wetlands are highly important for their ecological functions and habitat values, and likely represent one of the most valuable ecological attributes of THWMA.

Vegetation in these wetlands at THWMA can be quite diverse, and the processes of flooding and draining that characterize beaver wetlands influences vegetative composition. Soils vary dramatically and some beaver wetlands at THWMA appear bog-like, with deep organic soils and the presence of bog species such as Leatherleaf (*Chamaedaphne calyculata*) and *Sphagnum* mosses. Others are marshy and dominated by Northern Manna Grass (*Glyceria borealis*); or saturated and dominated by Speckled Alder (*Alnus incana*); or relatively dry and characterized by sedges (*Carex spp*).

The beaver wetlands at THWMA provide habitat for the federally-endangered northeastern bulrush (*Scirpus ancistrochaetus*). This species grows in open wetlands that have seasonal or annual fluctuations in water level between inundated and saturated (US Fish and Wildlife, 1993). The dispersal of this species is not well-understood, but its absence from apparently suitable wetland habitat near existing populations suggests that it does not readily spread. Thus, protecting the existing populations is of high conservation importance. It is likely that the species has evolved to tolerate regular cycles of beaver activity; maintaining beaver populations on the WMA is important to the long-term persistence of this species in the wetlands.

Beaver wetlands provide habitat for many wildlife species. Open water is used by many species of waterfowl. Amphibians including wood frog, spring peeper, and eastern newt likely use the ponded water in the wetlands. The early herbaceous growth in these wetlands can be an important food source for black bear, and evidence of bear use was noted in many beaver wetlands. Mink, otter, and other mammal species use wetlands for foraging and for travel corridors.

Hemlock-Sphagnum Basin Swamp
This small swamp is found a basin with a small surface watershed. It is characterized by peat accumulation and a hemlock canopy. This small occurrence is not state-significant, but it is ecologically important as a part of the overall complex of wetlands found in the WMA.

Hemlock-Balsam Fir-Black Ash Seepage Swamp

Three small patches of this natural community type, totaling just two acres and forming two distinct ecological occurrences, are found in THWMA. At least one of these patches has evidence of timber harvesting which has lowered the ecological condition. Due to small size and moderate current condition, neither occurrence is state-significant. These three swamp patches are characterized by groundwater seepage and shallow, mucky soils. Species noted in this community include Eastern Hemlock (*Tsuga canadensis*), Red Maple (*Acer rubrum*), Red Spruce (*Picea rubens*), Speckled Alder (*Alnus incana*), Black Ash (*Fraxinus nigra*), Fowl Manna Grass (*Glyceria striata*), Sensitive Fern (*Onoclea sensibilis*), Cinnamon Fern (*Osmundastrum cinnamomeum*), and Fringed Yellow-Loosestrife (*Lysimachia ciliata*). The wet ground may provide habitat for dusky salamander, northern two-lined salamander, and spring salamander, and tip up mounds in these swamps can be nesting habitat for winter wren.

Hemlock-Northern Hardwood Forest

Hemlock-Northern Hardwood Forest is the matrix forest of THWMA and is found on over 517 acres of the parcel. As the name implies, this community is characterized by a mix of Eastern Hemlock (*Tsuga canadensis*) and other northern hardwood species. It is found on shallow, sandy loam soils, and the majority of this community type at THWMA is found on Tunbridge-Lyman soils. Interestingly, not all soil samples have an eluviated layer. In addition to hemlock, other abundant canopy species include Red Maple (*Acer rubrum*), Paper Birch (*Betula papyrifera*), American Beech (*Fagus grandifolia*), Sugar Maple (*Acer saccharum*), and Red Spruce (*Picea rubens*). Some areas have dense regeneration of American Beech (*Fagus grandifolia*); Hobblebush (*Viburnum lantanoides*) is also present in the shrub layer. Herbs noted during field surveys include Hairy Solomon's-Seal (*Polygonatum pubescens*), Marginal Wood Fern (*Dryopteris marginalis*), Eastern Hay-Scented Fern (*Dennstaedtia punctilobula*), New York Fern (*Parathelypteris noveboracensis*), and Sessile-Leaved Bellwort (*Uvularia sessilifolia*). Portions of this community with dense hemlock cover may function as deer wintering habitat.

Almost all of this forest has had relatively recent timber harvesting, which has lowered the ecological condition of this community occurrence. While some harvesting impacts—such as ground disturbance—may have long-lasting impacts, it is expected that over time the forest composition and structure will improve. Because this is a relatively small, disturbed example of a very common Vermont natural community type, it is not an example of statewide significance.

Northern Hardwood Talus Woodland

A relatively small but high-quality example of this community is found at the southern end of the Dewitt parcel. A steep southeast facing slope is characterized by broken cliffs and large (refrigerator-sized) talus blocks. Sugar maple (*Acer saccharum*), American beech (*Fagus grandifolia*), yellow birch (*Betula alleghaniensis*), and red oak (*Quercus rubra*) are common canopy trees. There is no evidence of past harvesting, and there are large trees, and dead and downed wood in multiple decay stages. These all indicate that this is likely a patch of old forest, which provides ecological functions that are otherwise very rare on the landscape. This occurrence is state-significant.

Red Oak-Northern Hardwood Forest

This forest is found on the south-facing aspects of the ridge at the south end of the Dewitt parcel. Red oak (*Quercus rubra*) is relatively abundant compared to other places on the WMA. This occurrence is not state-significant, but it may have local significance as a mast-producing stand.

Hemlock Forest

Thirty acres of Hemlock Forest are found on the steep, west-facing hillside above the Townshend/Grafton Road. The soil is extremely shallow, with just a few inches or less of duff and eluviated sandy loam over boulders or bedrock. In fact, some areas have enough exposed and fractured rock that they have affinities to a Boreal Talus Woodland natural community. This patch is characterized by a dense canopy of Eastern Hemlock (*Tsuga canadensis*), with occasional Sugar Maple (*Acer saccharum*), Yellow Birch (*Betula alleghaniensis*), and Red Spruce (*Picea rubens*) present as well. In some areas, past logging has resulted in canopy cover of 60-70% and patches of dense hemlock and yellow birch regeneration. Shrub and herb species (<25% cover combined) in this community include Common Lowbush Blueberry (*Vaccinium angustifolium*), Appalachian Polypody (*Polypodium appalachianum*), and Marginal Wood Fern (*Dryopteris marginalis*). The softwood cover, along with the habitat diversity created by talus and exposed bedrock, likely makes this community excellent wildlife habitat for a number of species, including fisher, porcupine, and bobcat. This example of Hemlock Forest is state-significant.

Lowland Spruce-Fir Forest

The occurrence of Lowland Spruce-Fir Forest at THWMA is notable, as this community type is not typically associated with the Southern Vermont Piedmont biophysical region. Its presence is likely the result of cold-air drainage into the relatively high-elevation basin located on the southern portion of the WMA. Despite the many wetlands found in this basin, soils and vegetation indicate that the upland forest areas are dry and well-drained, with sandy loams soils that vary from 6-16 inches in depth. All soil samples showed a distinct eluviated layer. The tree canopy includes 10% cover of tall, emergent Eastern White Pine (*Pinus strobus*), over a secondary canopy (50-60% cover, 40-50' tall) with Red Spruce (*Picea rubens*), Eastern Hemlock (*Tsuga canadensis*), Red Maple (*Acer rubrum*), and Paper Birch (*Betula papyrifera*). A fairly dense understory (60-70% cover) includes Red Spruce (*Picea rubens*), Eastern Hemlock (*Tsuga canadensis*), Red Maple (*Acer rubrum*), and Eastern White Pine (*Pinus strobus*). Shrub cover is also high (60-70%) and species include Mountain Holly (*Ilex mucronata*), Common Lowbush Blueberry (*Vaccinium angustifolium*), Withe-Rod (*Viburnum nudum*), Sheep American-Laurel (*Kalmia angustifolia*), Rhodora (*Rhododendron canadense*), Trailing-Arbutus (*Epigaea repens*), and Eastern Spicy-Wintergreen (*Gaultheria procumbens*). Herbs observed include Bracken Fern (*Pteridium aquilinum*), Yellow Blue-Bead Lily (*Clintonia borealis*), Three-Leaved Goldthread (*Coptis trifolia*), Canada Dwarf-Dogwood (*Cornus canadensis*), Indian Cucumber Root (*Medeola virginiana*), Partridge-Berry (*Mitchella repens*), and Dewdrop (*Rubus dalibarda*). Bryophyte species observed include Knight's Plume Moss (*Ptilium crista-castrensis*), a windswept moss (*Dicranum* sp.), a lichen (*Cladonia cristatella*) and a liverwort (*Bazzania trilobata*).

Past timber harvest in this community has resulted in an even-aged stand, but the dense understory and shrub layers likely provide good habitat for a number of wildlife species, including snowshoe hare, fisher, moose, and birds such as yellow-rumped warbler, red-breasted nuthatch, and ruby-crowned kinglet.

Due to its small size relative to other examples in Vermont, this occurrence is not ranked as state-significant. It is, however, highly significant to the local landscape because it is an unusual community in southeastern Vermont and provides important landscape diversity relative to its size.

Northern Hardwood Forest
Northern Hardwood Forest is found in several patches around THWMA, totaling 372 acres. Together these patches form one ecological occurrence, which is not state-significant. Because these patches share the same aspects and soils as the Hemlock-Northern Hardwood Forest community on the parcel, it is unclear if timber harvesting or other disturbances have changed the forest composition. It is possible that these patches eventually could develop a more mixed composition that includes substantial softwood cover.

At present these are even-aged forest patches with recent timber harvesting, resulting in stands characterized by Red Maple (*Acer rubrum*), Paper Birch (*Betula papyrifera*), Eastern White Pine (*Pinus strobus*), and American Beech (*Fagus grandifolia*). Sugar Maple (*Acer saccharum*), Yellow Birch (*Betula alleghaniensis*), Northern Red Oak (*Quercus rubra*), and White Ash (*Fraxinus americana*) are all present but in relatively low abundance. No thorough inventory of shrubs or herbs was conducted in this natural community type; these species should be assessed before any management activities take place in these areas. While this community can provide habitat for a wide variety of wildlife, this occurrence generally lacks the complex vertical and horizontal structure used by many animal species.

Red Spruce-Cinnamon Fern Swamp
Red Spruce-Cinnamon Fern Swamps comprise approximately 3.2 acres. Five occurrences were found within the complex of Lowland Spruce-Fir Forest and Beaver Wetlands in the southern portion of the WMA. Because of their small size, they are not state-significant; however, forested wetlands not altered by beaver on the property are locally important to habitat diversity. These swamps are characterized by deep, poorly-decomposed peat (over 3 feet deep in some spots), and a dense canopy of Red Spruce (*Picea rubens*) and Eastern White Pine (*Pinus strobus*), above sapling Eastern Hemlock (*Tsuga canadensis*) and Red Maple (*Acer rubrum*). Other species noted include: Withe-Rod (*Viburnum nudum*), Leatherleaf (*Chamaedaphne calyculata*), blueberries (*Vaccinum* spp.), Cinnamon Fern (*Osmundastrum cinnamomeum*) and Three-Seeded Sedge (*Carex trisperma*).

Red Spruce-Heath Rocky Ridge Forest
Slightly less than three acres of this natural community type are found on a low knob in the southern part of the WMA. As a small, poorly-developed example of Red Spruce-Heath Rocky Ridge Forest, this patch is not considered to be state-significant. It is characterized by Red Spruce (*Picea rubens*), Eastern White Pine (*Pinus strobus*), Northern Red Oak (*Quercus rubra*), and blueberries (*Vaccinium* spp.). Soils were not sampled but would be expected to be very shallow to bedrock. The oaks in this community are a source of hard mast for black bear, white-tailed deer, wild turkey, and other species.

Seep
Eighteen seeps have been identified at THWMA. Many of these were identified during wetlands mapping conducted for VELCO prior to state ownership. Seeps form when groundwater seepage results in a small wetland. These are often, but not always, the headwaters of small streams. Some characteristic species found in seeps at THWMA include: Golden-Saxifrage (*Chrysosplenium americanum*), Fowl Manna Grass (*Glyceria striata*), Cinnamon Fern (*Osmundastrum cinnamomeum*), Fringed Sedge (*Carex crinita*), and Marsh Fern (*Thelypteris palustris*). Sphagnum moss is present in some seeps. Soils vary from greyed mineral soils to mucks but are typically shallow to bedrock. Early spring vegetation in seeps can be an important

food source black bear and white-tailed deer. The wet ground also provides suitable habitat for dusky salamander, northern two-lined salamander, and spring salamander.

Temperate Acidic Cliff
A five-to-ten-foot-high, broken ledge system is found in the southern part of the WMA. It is not state-significant. Although it is a poor example of a true vertical cliff, this occurrence may provide important habitat that is otherwise limited in the WMA. Bobcat, porcupine, and other small mammals may use these ledges for shelter or denning. Detailed vegetation inventory was not conducted at this community, but expected species would include Appalachian Polypody (*Polypodium appalachianum*) and rock tripe lichens (*Umbilicaria* spp.).

Vernal Pool
Vernal pools form in small basins that are often dry but fill with water in the spring (and occasionally in other seasons) due to heavy rain and snowmelt. Because they lack fish, these pools are excellent amphibian breeding habitat. Unlike other natural communities, which are typically defined and assessed based on vegetation, vernal pools are better characterized and assessed by the amphibian and species present, such as wood frog, spotted salamander, and Jefferson salamander.

Nineteen Vernal Pools have been mapped at THWMA. All pools were mapped, and some were assessed, by VELCO prior to state ownership. Based on these assessments and subsequent inventories, 11 pools are state-significant and provide high-quality amphibian breeding habitat. Several of these pools have been observed to have egg masses characteristic of the rare Jefferson salamander. Of the remaining pools, two pools were determined after repeated visits not to provide suitable amphibian habitat, while five pools have not been fully assessed to determine amphibian use and significance. All pools may still provide habitat for invertebrates such as fairy shrimp and may have other important ecological functions such as nutrient cycling.

Fine Filter Assessment

Rare, Threatened, and Endangered Plant Species
Two species of rare plants have been located within THWMA. (In addition, a third plant species of conservation concern occurs on THWMA but is not listed in this report because of data sensitivity concerns.) One of the rare species, Northeast Bulrush (*Scirpus ancistrochaetus*) is listed as “endangered” by both the Federal Endangered Species Act and the Vermont state endangered species statute (10 V.S.A. 123). Its occurrence at THWMA is thus very important on a statewide and nationwide basis.

1. Northeast Bulrush (*Scirpus ancistrochaetus*) – Rare to uncommon (S2S3), Endangered
Northeast Bulrush is legally protected as “endangered” under both the Vermont state endangered species statute and the Federal Endangered Species Act. Although not exceedingly rare in Vermont, this species is globally uncommon (G3). The species is typically found in wetlands with fluctuating water levels, and at THWMA it is found in beaver wetlands. Since beaver wetlands change over time, allowing for natural cycles of beaver activity and a variety of stages of beaver-influenced habitat at THWMA is an important strategy for protecting the long-term viability of this population. Management activities that alter water levels or otherwise disturb beaver wetlands may have negatives impacts on the persistence of this species, even if the plants have not been documented at a particular wetland.

2. Spotted Wintergreen (*Chimaphila maculata*) – Rare to uncommon (S2S3)
This species is typically found in dry-mesic forests, and almost all occurrences in Vermont are in the southeastern part of the state. Its presence at THWMA is somewhat unusual since the site appears to be more mesic and cooler in climate than most other known Vermont sites for this species. Only a few stems of this species were found on the WMA. Management activities that directly damage individual plants are probably the greatest threat to the long-term persistence of this occurrence.

Habitat Blocks and Core Forest
THWMA is located within a 7,400-acre habitat block. At least 5,500 acres of that block is considered "core forest," a biological term used to refer to any forested areas greater than 100 meters from human-created, non-forested opening. Almost all of THWMA is meets this definition, with the exception of areas within 100 meters of Turner Hill Road and historic house site. The WMA is also in close proximity to an 18,000-acre habitat block just to the west of the Townshend/Grafton Road, as well as a number of other large habitat blocks that eventually connect to the Green Mountains.

Species Movement Corridors
In a landscape-level analysis, Anderson et al. (2012) identified the area around THWMA as suitable for concentrated species movements, suggesting high-value as a species movement corridor. Suitable conditions for concentrated movements extend west into the Southern Green Mountains and the large habitat blocks of the Green Mountain National Forest. The same analysis found that almost all of the landscape around THWMA is suitable for diffuse species movements, indicating that overall the landscape is "permeable" and functions to provide plant and animal species opportunities to shift their distributions across the landscape.

Literature Cited

Anderson, M.G., M. Clark, and A. Olivero Sheldon. 2012. Resilient Sites for Terrestrial Conservation in the Northeast and Mid-Atlantic Region. The Nature Conservancy, Eastern Conservation Science. 168 pp. Accessed February 7, 2013 at: http://conserveonline.org/workspaces/ecs/documents/resilient-sites-for-terrestrial-conservation

Doll, C.G., D.P. Stewart, and P. MacClintock. 1970. Surficial geologic map of Vermont. Miscellaneous Map MISCMAP-02. Vermont Geological Survey. Waterbury, VT.

Ratcliffe, N.M., Stanley, R.S, Gale, M.H., Thompson, P.J., and Walsh, G.J. 2011. Bedrock Geologic Map of Vermont: U.S. Geological Survey Scientific Investigations Map 3184, 3 sheets, scale 1:100,000.

Thompson, E.H., and E.R. Sorenson. 2000. Wetland, woodland, wildland. A guide to the natural communities of Vermont. University Press of New England. Hanover, NH.

U.S. Fish and Wildlife Service. 1993. Northeastern Bulrush (*Scirpus ancistrochaetus*) Recovery Plan. Hadley, Massachusetts. 68 pp.

APPENDIX 6: Public Comment Summary

APPENDIX 7: Works Cited

CAP. Jan 2009, *Archeological Precontact Site Sensitivity Analysis and GIS Mapping for Atherton Meadows WMA*. University of Vermont, Consulting Archeological Program, Burlington, VT.

Iverson, L., A. Prasad, B. Hale & E. Sutherland. *Atlas of Current and Potential Future Distributions of Common Trees of the Eastern United States.* General Technical Report NE-265. Northeastern Research Station, USDA, Forest Service, Radnor, PA.

Jackson, D.A., P.R. Peres-Neto, and J.D. Olden. 2001. What controls who is where in freshwater fish communities – the roles of biotic, abiotic, and spatial factors. Canadian Journal of Fisheries and Aquatic Sciences 58: 157-170.

Kart, J., R. Regan, S.R. Darling, C. Alexander, K. Cox, M. Ferguson, S. Parren, K. Royar, and B. Popp, editors. 2005. Vermont's wildlife action plan. Vermont Fish and Wildlife Department, Waterbury. Available: http://www.vtfishandwildlife.com/SWG_home.cfm. 12/08

Langdon, R., J. Andrews, K. Cox, S. Fiske, N. Kamman, and S. Warren. 1998. A classification of the aquatic communities of Vermont. The Aquatic Classification Workgroup for The Nature Conservancy and the Vermont Biodiversity Project, Waterbury.

Lobb, M.D., and D.J. Orth. 1991. Habitat use by an assemblage of fish in a large warmwater stream. Transactions of the American Fisheries Society 120:65-78.

Lorimer, C. & A. White. *A Scale and Frequency of Natural Disturbance in Northeastern United States: Implications for Early Successional Forest Habitat and Regional Age Distribution.* Forest Ecology Management (185), 41-64.

MacMartin, J. (1962) *Statewide Stream Survey by Watersheds.* Vermont Fish and Game, Montpelier, VT.

More, T, S. Bulmer, L. Henzel & A. Mates. (2003) *Extending the Recreational Opportunity Spectrum to Nonfederal Lands in the Northeast: An Implementation Guide.* USDA Forest Service. Newtown Square, PA.

Reash, R.J., and J. Pigg. 1990. Physiochemical factors affecting the abundance and species richness of fishes in the Cimarron River. Proceedings of the Oklahoma Academy of Sciences 70:23-28.

Rolando, V. (1992) *200 Years of Soot and Sweat.* Vermont Archeological Society.

Thompson, E., & E. Sorenson. (2000) *Wetland, Woodland, Wildland. A Guide to the Natural Communities of Vermont.* Hanover, New Hampshire: University Press of New England.

Vermont Fish and Wildlife Department. (2009). *Regulation: Public Activities at Wildlife Management Areas, Riparian Lands, Conservation Camps, and Fish Culture Stations of the Vermont Fish and Wildlife Department.*

Wright, K.K., and J.L. Li. 2002. From continua to patches: examining stream community structure of large environmental gradients. Canadian Journal of Fisheries and Aquatic Sciences 59:1404-1417.

APPENDIX 8: 10 V.S.A. App. § 15 Rule Governing Public Use of Vermont Fish and Wildlife Department Lands

1.0 Authority

1.1 This rule is adopted pursuant to 10 V.S.A. §4145(a) which authorizes the Board to adopt rules to "regulate the use by the public of access areas, landing areas, parking areas or other lands or waters acquired or maintained pursuant to 10 V.S.A. § 4144."

2.0 Purpose

2.1 The purposes of this rule is to regulate public activities and use at Wildlife Management Areas, Riparian Lands, Conservation Camps, and Fish Culture Stations in order to protect, manage, and conserve the fish, wildlife, vegetation, and other natural and cultural resources of the state, to provide for the safe and efficient operation of the developed facilities of the Department and to protect the health, safety, and welfare of the public.

2.2 To foster quality hunting, fishing, trapping, and other fish-based and wildlife-based activities at these lands and facilities.

2.3 This rule does not apply to Fishing Access Areas governed by 10 V.S.A. § 4145.

2.4 This rule is not intended to interfere with deed restrictions, easements, rights-of-way or other applicable legal agreements.

3.0 Definitions

3.1 "Board" means the Vermont Fish and Wildlife Board as defined in 10 V.S.A. § 4041.

3.2 "Department" means Vermont Fish and Wildlife Department.

3.3 "Commissioner" means Commissioner of the Vermont Fish and Wildlife Department.

3.4 "Wildlife Management Area" or "WMA" means any lands or portions of lands of the Department so designated by the Department.

3.5 "Riparian Land" means any lands or portions of lands of the Department other than WMAs, Fish Culture Stations, Fishing Access Areas, and Conservation Camps so designated by the Department, such as but not limited to stream bank parcels, dams, and pond sites.

3.6 "Conservation Camp" means any facilities, lands or portions of lands of the Department so designated by the Department.

3.7 "Fish Culture Station" means any facilities, lands or portions of lands of the Department so designated by the Department.

3.8 “Designated Site” means a delineated area at a WMA, Riparian Land, Conservation Camp or Fish Culture Station that the Department has designated for a particular activity or prohibition on an activity, and so identified and demarcated with signage or identified on a Department-issued map.

3.9 “Designated Corridor” means a road, trail, path or other linear travel route at a WMA, Riparian Land, Conservation Camp or Fish Culture Station that the Department has designated for travel by a particular means or vehicle, and so identified with signage or identified on a Department-issued map.

3.10 “Authorized Activity” means an activity for which a person does not need prior permission to engage in, and can engage in at a WMA, Riparian Land, Conservation Camp or Fish Culture Station, or at a Designated Site or on a Designated Corridor within a WMA, Riparian Land, Conservation Camp or Fish Culture Station.

3.11 “Prohibited Activity” means an activity that no person, group, business or entity shall be allowed to engage in under any circumstances, and for which no Permit, License or Lease shall be authorized, except as provided for in Sections 6.0 of this regulation.

3.12 “Commercial Activity” means any activity or service that produces income for any person, group, business or entity, including any activity or service by any non-profit entity where a fee is required or requested.

3.13 “Special Use Permit” means a written authorization issued by the Department or its designee issued to a person, group, business or entity to undertake an activity.

3.14 “Group” means ten (10) or more persons.

3.15 “Primitive Camping” means temporary overnight occupancy in a natural environment with no developed facilities leaving the site in its original condition so there is no or minimal evidence of human visitation.

3.16 “Self-contained Camping” means camping with a portable shelter equipped with a self-contained, portable, sanitary toilet.

3.17 “Artifact” means an object produced or shaped by human craft, especially a tool, weapon, or ornament or archaeological or historical interest.

3.18 “Emergency situation” means an unintended or unforeseen situation that poses a risk to health or life of a person or animal.

3.19 “Field processing” means the gutting or dressing or other removal of non-consumptive parts of an animal for the preservation of the carcass to include the boning and quartering.

3.20 “Tree stand” means a platform or structure (placed for any period of time) which is fastened to a tree by nails, bolts, wire, or other fasteners that intrude through the bark into the wood of the tree, or around the tree.

3.21 “Ground blind” means a structure or manufactured enclosure made of natural or man-made materials placed on the ground to assist in concealing or disguising the user or occupant. This does not apply to blinds constructed for purposes of hunting waterfowl which are governed by 10 V.S.A. App. § 23.

3.22 “Bait” means any animal, vegetable, fruit or mineral matter placed with the intention of attracting wildlife.

3.23 “All-terrain vehicle” or “ATV” means any non-highway recreational vehicle, except snowmobiles, having no less than two low pressure tires (10 pounds per square inch, or less) or tracks, not wider than 60 inches with two-wheel ATVs having permanent, full-time power to both wheels, and having a dry weight of less than 1,700 pounds, when used for cross-country travel on trails or on any one of the following or a combination thereof: land, water, snow, ice, marsh, swampland, and natural terrain.

3.24 “Utility task vehicle” means a side-by-side four-wheel drive off-road vehicle that has four wheels, or tracks, and is propelled by an internal combustion engine with a piston displacement capacity of 1,200 cubic centimeters or less and has a total dry weight of 1,200 to 2,600 pounds.

3.25 “Waterbody” means any lake, pond, river, or stream.

4.0 Authorized Activities

4.1 The following activities are authorized on all lands under this rule:

a) Hunting, fishing, trapping, and target shooting at designated shooting ranges, as well as all other activities authorized under 10 V.S.A. Part 4;

b) Fish and wildlife viewing and photography;

c) Boating, including launching and landing, for fish-based and wildlife-based activities where not otherwise prohibited by any other relevant regulations or statutes;

d) Dispersed, wildlife-based pedestrian activities including walking, snowshoeing, swimming, cross-country skiing, and collection of shed antlers;

e) Non-commercial picking of berries, nuts, fungi, and other wild edibles except ginseng;

f) Camping for purposes of hunting, fishing or trapping:

i. Primitive camping on WMAs designated by the Department for no more than 3 consecutive nights. Camp sites must be at least 200 feet from any waterbody, property line, or road;

ii. Self-contained camping on sites designated by the Department for this purpose, for no more than 16 days during the periods of May 1-31, September 1 through December 15. No individual parcel will have more than three designated sites for self-contained camping unless that site's use has been demonstrated to have preceded January 1, 2007.

g) Fish-based and wildlife-based commercial activities limited to those specified in 4.a-4.c of this subsection when conducted by a person. This shall include guiding for purposes of fishing, hunting, and trapping.

5.0 Prohibited Activities

5.1 The following activities are strictly prohibited, unless otherwise authorized in accordance with Section 6:

a) The operation of any ATV, UTV, or any wheeled or tracked motorized vehicle not registered for public highway use, except as noted as provided for under this subsection and section 6.0 of this regulation:

i. Pursuant to 23 V.S.A. § 3506 (b) (4), ATV use is prohibited on, "any public land, body of public water…unless the secretary has designated the area for use by all-terrain vehicles pursuant to rules promulgated under provisions of 3 V.S.A., chapter 25."

ii. If the Secretary has previously designated an area of state land for use by ATVs pursuant to 23 V.S.A. § 3506 (b) (4), the Commissioner shall authorize a designated corridor on Department lands for under section 6.0 of this rule subject to the terms and conditions the Commissioner deems appropriate.

b) Use of motorized vehicles except on roads specifically designated for such use;

c) Snowmobiling except as approved by the Department and on designated corridors;

d) Horseback riding, dog sledding, non-motorized cycle riding, or use of motorized vehicles except on designated corridors;

e) Draft and pack animals except for retrieval of legally harvested moose, deer, and black bear during the respective hunting season(s);

f) Commercial Activities except those allowed under 4.1(a-c);

g) Artifact or fossil collection;

h) Fires except in emergency situations, or for non-primitive and primitive camping in accordance with 4.1(f);

i) Abandoning, or disposing of any animal carcass, or their parts, except that portions of fish or game legally harvested on the property may be deposited on site during routine field processing for preservation and transport, or parts used in conjunction with legal trapping;

j) Construction or placement of temporary or permanent structures, except as provided under Section 7 of this rule or for primitive and non-primitive camping in accordance with Section 4.1(f);

k) Collection of plants, trees, evergreen brush or limbs, except wild edibles as allowed under Section 4.1(e) of this rule;

l) Use of any fireworks or pyrotechnic devices except signal flares in an emergency situation;

m) Feeding or baiting of wildlife except if otherwise authorized by law;

n) Taking of fish from a fish culture station except during special events established by the Department, including but not limited to fishing derbies, clinics, and educational events;

o) Entering within 500 feet of any building or other associated infrastructure that is associated with a Department Fish Culture Station or Conservation Camp during times of the day other than those times posted for public use;

p) Parking of vehicles except while engaged in an Authorized Activity;

q) All other activities not specifically authorized by this rule, or authorized in writing by the Commissioner including, but not limited to: para-sailing, hang-gliding, recreational rock climbing, and geocaching.

6.0 Special Use Activities and Designated Sites on Vermont Fish and Wildlife Department Lands

6.1 The Commissioner may grant a Special Use Permit, Lease or License for any activity under this rule, subject to Section 5.1(a), so long as the Commissioner has determined that there will be no adverse impact on Authorized Activities or other adverse impacts on Authorized Activities or other adverse impacts on the primary purposes of ownership.

6.2 The Commissioner may designate a site, by means of signage, or being identified on a Department-issued map, for any activity under this rule, subject to Section 5.1(a), so long as the Commissioner has determined that there will be no adverse impact on Authorized Activities or other adverse impacts on the primary purposes of ownership.

6.3 The Commissioner may permit accommodations to persons with a qualified disability pursuant to the Americans with Disabilities Act.

7.0 Use of Tree Stands and Ground Blinds on WMAs

7.1 Permanent tree stands and ground blinds are prohibited on state-owned WMAs.

7.2 Temporary tree stands and ground blinds are permitted on state-owned WMAs under the following conditions:

a) Tree stands and ground blinds may be erected and used without written permission from the Department during the time period from the third Sunday in August through the third Saturday in December annually, May 1 through May 31, all dates inclusive, or during any Youth Hunting Day or Weekend. This does not include blinds constructed for purposes of hunting waterfowl pursuant to 10 V.S.A. App. § 23.

b) Tree stands and ground blinds may be erected and used at other times of the year with advance notice to, and written permission from, the Department's District office staff responsible for managing and administering state land in the District in which the land is located.

c) Tree stands and ground blinds used on WMAs must be constructed and erected in such a way that:

i. No damage is done to any living tree in erecting, maintaining, using, or accessing the stand or blind except that:

a) Dead limbs, trees or shrubs may be removed as needed to erect and use the stand or blind, and;

b) No live limbs, trees or shrubs may be cut for any purpose except those one inch or less in diameter at either ground level or from the main stem or branch of the tree where the stand or blind is located as appropriate (for guidance, a United States quarter is .9 inch in diameter), and;

c) No nails, bolts, screws (including access steps), wire, chain or other material that penetrates through the bark and into the wood of live trees shall be used in erecting any stand or blind, and;

d) All tree stands or ground blinds used on WMAs must be clearly and legibly marked with the owner's name and address. Marking shall be legible and placed in a manner that enables a person to conveniently and easily read it.

7.3 Tree stands and ground blinds that do not conform to this regulation are prohibited and may be confiscated and/or destroyed by the Department. Building, erecting, maintaining, using or occupying a non-conforming tree stand or ground blind is prohibited. Construction of any tree stand or ground blind does not confer exclusive use of its location to the person who built it. Any person may use that location for purposes consistent with this rule.

APPENDIX 9: Glossary

The following is a series of key words and their definitions used in the development of Long-Range Management Plans for Vermont Agency of Natural Resource lands.

Acceptable Management Practices (AMPs). In this plan, a series of erosion control measures for timber harvesting operations, as identified in state statutes. The AMPs are the proper method for the control and dispersal of water collecting on logging roads, skid trails, and log landings to minimize erosion and reduce sediment and temperature changes in streams.

Acceptable Growing Stock (AGS). AGS trees exhibit form and appearance that suggests they will maintain and/or improve in quality and can be expected to contribute significantly to future timber crops in the form of vigorous high-quality stems. They contain or may potentially produce high or medium quality sawlogs.

Age Class. One of the intervals, commonly 10 to 20 years, into which the age range of forest trees are divided for classification or use. Also pertains to the trees included in such an interval. For example, trees ranging in age from 21 to 40 years fall into a 30-year age class; 30 designates the midpoint of the 20-year interval from 21 to 40 years.

All-aged (Uneven-aged) system. Timber management which produces a stand or forest composed of a variety of ages and sizes. Regeneration cutting methods in this system include single tree selection and group selection.

Basal area. A measure of the density of trees on an area. It is determined by estimating the total cross-sectional area of all trees measured at breast height (4.5 feet) expressed in square feet per acre.

Best management practices. A practice or combination of practices determined to be the most effective and practicable means of preventing negative impacts of silvicultural activities.

Biodiversity. The variety of plants and animals, their genetic variability, their interrelationships, and the biological and physical systems, communities, and landscapes in which they exist.

Biophysical region. A region with shared characteristics of climate, geology, soils, and natural vegetation. There are currently eight biophysical regions recognized in Vermont.

Block. A land management planning unit.

Browse. The part of leaf and twig growth of shrubs, vines, and trees available for animal consumption.

Canopy. The more or less continuous cover of branches and foliage formed collectively by the crowns of adjacent trees and other woody growth.

Capability. The potential of an area to produce resources, supply goods and services, and allow resource uses under an assumed set of management practices and at a given level of management intensity. Capability depends on current conditions and site conditions such as climate, slope,

landform, soils, and geology as well as the application of management practices such as silvicultural protection from fire, insects, and disease.

Cleaning (Weeding). Regulating the composition of a young stand by eliminating some trees and encouraging others, and also freeing seedlings or saplings from competition with ground vegetation, vines, and shrubs.

Clearcutting. A cut which removes all trees from a designated area at one time, for the purpose of creating a new, even-aged stand.

Commercial forest land. Land declared suitable for producing timber crops and not withdrawn from timber production by statute or administrative regulation.

Conservation. The careful protection, planned management, and use of natural resources to prevent their depletion, destruction, or waste.

Conservation easement. Acquisition of some rights on a parcel of land designed to keep the property undeveloped in perpetuity.

Cover. Vegetation which provides concealment and protection to wild animals.

Cull Tree. Tree that does not meet regional merchantability standards because of excessive unsound cull. May include noncommercial tree species.

Cultural operation. The manipulation of vegetation to control stand composition or structure, such as site improvement, forest tree improvement, increased regeneration, increased growth, or measures to control insects or disease. Examples of methods used are timber stand improvement, cleaning or weeding, release, and site preparation.

DBH (diameter at breast height). The diameter of the stem of the tree measured at breast height (4.5 feet or 1.37 meters) from the ground.

Deer wintering area. Forest area with at least 70 percent conifer that provides suitable, stable habitat to meet deer needs during the winter.

Den tree. A live tree at least 15 inches DBH (diameter at breast height) containing a natural cavity used by wildlife for nesting, brood rearing, hibernating, daily or seasonal shelter, and escape from predators.

Developed (or intensive) recreation. Activities associated with man-made structures and facilities that result in concentrated use of an area. Examples are campgrounds and ski areas.

Diameter at breast height (DBH). The diameter of the stem of the tree measured at breast height (4.5 feet or 1.37 meters) from the ground.

Dispersed recreation. Outdoor recreation activities requiring few, if any, support facilities.

Down woody material (DWM). DWM is also referred to as coarse woody debris, woody material, and down woody debris. DWM is comprised of woody material left in the woods from harvested trees as well as portions or whole trees that die and fall naturally.

Ecological processes. The relationships between living organisms and their environment. Among these processes are natural disturbances such as periodic fire, flooding, or beaver activity; natural stresses such as disease or insects; catastrophic weather-related events such as severe storms or lightning strikes; or more subtle ongoing processes such as succession, hydrology, and nutrient cycling.

Ecological reserve. An area of land managed primarily for long-term conservation of biodiversity.

Ecosystem. A complex array of organisms, their natural environment, the interactions between them, the home of all living things, including humans, and the ecological processes that sustain the system.

Ecosystem management. The careful and skillful use of ecological, economic, social, and managerial principles in managing ecosystems to produce, restore, or sustain ecosystem integrity, uses, products, and services over the long-term.

Endangered species. A species listed on the current state or Federal endangered species list (V.S.A. Title 10, chapter 123). Endangered species are those which are in danger of becoming extinct within the foreseeable future throughout all or a significant portion of their range.

Even-aged system. Timber management that produces a forest or stand composed of trees having relatively small differences in age. Regeneration cutting methods in this system include clearcutting, seed tree (seed cut) method, and shelterwood method.

Forest health. Condition in which forest ecosystems sustain their complexity, diversity, resiliency, and productivity.

Forest type. A natural group or association of different species of trees which commonly occur together over a large area. Forest types are defined and named after the one or more dominant species of trees, such as the spruce-fir and the birch-beech-maple types.

Forestry. The art and science of growing and managing forests and forest lands for the continuing use of their resources.

Fragmentation. Division of a large forested area into smaller patches separated by areas converted to a different land use.

Game species. Animals habitually hunted for food, particular products, sport, or trophies.

Gap. An opening in the forest canopy caused by the death or harvest of one or several overstory trees.

Geographic Information Systems. A computer-based means of mapping lands and resources and communicating values associated with them (GIS).

Green certification. A process, sponsored by several international organizations, that promotes sustainable forest management practices, providing a marketplace identify for forest products certified to have been grown and manufactured in a sustainable manner.

Group Selection. The removal of small groups of trees to meet a predetermined goal of size, distribution, and species.

Habitat. A place that provides seasonal or year-round food, water, shelter, or other environmental conditions for an organism, community, or population of plants or animals.

Hardwood. A broad leaved, flowering tree as distinguished from a conifer. Trees belonging to the botanical group of angiospermae.

Healthy ecosystem. An ecosystem in which structure and functions allow the maintenance of the desired conditions of biological diversity, biotic integrity, and ecological processes over time.

Heritage Sites. Sites identified by the Vermont Nongame and Natural Heritage Program of the Department of Fish and Wildlife, which have rare, threatened, or endangered species of plants or animals. Heritage sites are identified using a common standards-based methodology, which provides a scientific and universally applicable set of procedures for identifying, inventorying, and mapping these species.

Intensive (or developed) recreation. Outdoor recreation activities requiring major structures and facilities.

Interior dependent species. Those wildlife species that depend on large unbroken tracts of forest land for breeding and long-term survival. The term is also often used in conjunction with neotropical migratory bird species requiring large patches of fairly homogeneous habitat for population viability**.**

Intermediate treatment. Any treatment or tending designed to enhance growth, quality vigor, and composition of the stand after its establishment or regeneration and prior to the final harvest.

Invasive Exotic (Non-native). A species that is 1) non-native (or alien) to the ecoregion or watershed under consideration and 2) whose introduction does or is likely to cause economic or environmental harm or harm to human health.

Land conservation. The acquisition or protection through easements of land for wildlife habitat, developed state parks, and working forests.

Landscape. A heterogeneous area of land containing groups of natural communities and clusters of interacting ecosystems. These can be of widely varying scales but normally include a range of elevations, bedrock, and soils.

Mast. The fruit (including nuts) of such plants as oaks, beech, hickories, dogwood, blueberry, and grape, used for food by certain wildlife species.

Motorized use. Land uses requiring or largely dependent on motor vehicles and roads.

Multiple-use forestry. Any practice of forestry fulfilling two or more objectives of management, more particularly in forest utilization (e.g. production of both wood products and deer browse).

Multiple-use management. An onsite management strategy that encourages a complementary mix of several uses on a parcel of land or water within a larger geographic area.

Native (species). A plant or animal indigenous to a particular locality.

Natural Area. Limited areas of land, designated by Vermont statute, which have retained their wilderness character, although not necessarily completely natural and undisturbed, or have rare or vanishing species of plant or animal life or similar features of interest which are worthy of preservation for the use of present and future residents of the state. They may include unique ecological, geological, scenic, and contemplative recreational areas on state lands.

Natural community. An assemblage of plants and animals that is found recurring across the landscape under similar environmental conditions, where natural processes, rather than human disturbances, prevail.

Nongame species. Animal species that are not hunted, fished, or trapped in this state. This classification is determined by the state legislature.

Northern hardwood. Primarily sugar maple, yellow birch, and beech. May include red maple, white ash, white birch, black cherry, red spruce, and hemlock.

Old growth forest. A forest stand in which natural processes and succession have occurred over a long period of time relatively undisturbed by human intervention.

Outdoor recreation. Leisure time activities that occur outdoors or utilize an outdoor area or facility.

Overstory. That portion of the trees, in a forest of more than one story, forming the upper or upper-most canopy layer.

Patch Clearcut (Patch-cut). Under an even-aged method, a modification of the clearcutting method where patches (groups) are clearcut in an individual stand boundary in two or more entries. Under a two-aged method, varying numbers of reserve trees are not harvested in the patches (groups), to attain goals other than regeneration.

Pole. A tree of a size between a sapling and a mature tree.

Pole timber. As used in timber survey, a size class definition; trees 5.0 to 8.9 inches (varies by species) at DBH. As used in logging operations, trees from which pole products are produced, such as telephone poles, pilings, etc.

Regeneration. Seedlings or saplings existing in a stand. Regeneration may be artificial (direct seeding or planting) or natural (natural seeding, coppice, or root suckers).

Regeneration treatment (harvest cut). Trees are removed from the stand to create conditions that will allow the forest to renew or reproduce itself. This is accomplished under either an even-aged management system or an uneven-aged management system.

The four basic methods used to regenerate a forest are clearcutting, seed-tree, shelterwood, and selection (group selection or single tree selection).

Regeneration methods. Timber management practices employed to either regenerate a new stand (regeneration cutting) or to improve the composition and increase the growth of the existing forest (intermediate treatment).

Regulated Hunting/Fishing/Trapping. The harvest of wildlife under regulations stipulating setting of seasons, time frame of lawful harvest, open and closed zones, methods of take, bag limits, possession limits, and reporting or tagging of species.

Release (release operation). The freeing of well-established cover trees, usually large seedlings or saplings, from closely surrounding growth.

Removal cut. The final cut of the shelterwood system that removes the remaining mature trees, completely releasing the young stand. An even-aged stand results.

Riparian Area. "*The word "riparian" means of or pertaining to the bank of a river or lake. Riparian areas are ecosystems comprised of streams, rivers, lakes, wetlands, and floodplains that form a complex and interrelated hydrologic system. They extend up and down streams and along lakeshores from the bottom of the water table to the top of the vegetation canopy and include all land that is directly affected by surface water. Riparian areas are unique in their high biological diversity. They are "characterized by frequent disturbances related to inundation, transport of sediments, and the abrasive and erosive forces of water and ice movement that, in turn, create habitat complexity and variability…resulting in ecologically diverse communities" (*Verry, E.S., J.W. Hornbeck, and C.A. Dolloff (eds). 2000. Riparian management in forests of the continental Eastern United States. Lewis Publishers, Boca Raton, FL. 402p.)

Riparian Management Zone (RMZ). The width of land adjacent to streams or lakes between the top of the bank or top of slope or mean water level and the edge of other land uses. Riparian management zones are typically areas of minimal disturbance, consisting of trees, shrubs, groundcover plants, duff layer, and a naturally vegetated uneven ground surface, that protect the water body and the adjacent riparian area from the impact of these land uses.

Salvage Cutting. The removal of dead, dying, and damaged trees after a natural disaster such as fire, insect or disease attack, or wind or ice storm to utilize the wood before it rots.

Sanitation cutting. The removal of dead, damaged, or susceptible trees to improve stand health by stopping or reducing the spread of insects or disease.

Sapling. As used in timber surveys, a size class definition. A usually young tree larger than seedling but smaller than pole, often 1.0 to 4.9 inches at DBH.

Sawlog or Sawtimber. A log or tree that is large enough (usually > than 10 or12 inches DBH) to be sawn into lumber. Minimum log length is typically 8 feet.

Seedling. A very young plant that grew from a seed.

Seed-Tree (Seed Cut) method. The removal of most of the trees in one cut, leaving a few scattered trees of desired species to serve as a seed source to reforest the area.

Shelterwood method. A series of two or three cuttings which open the stand and stimulate natural reproduction. A two cutting series has a seed cut and a removal cut, while a three cutting series has a preparatory cut, a seed cut, and a removal cut.

Silvicultural systems. A management process whereby forests are tended, harvested, and replaced, resulting in a forest of distinctive form. Systems are classified according to the method of carrying out the fellings that remove the mature crop and provide for regeneration and according to the type of forest thereby produced.

Single tree selection method. Individual trees of all size classes are removed more or less uniformly throughout the stand to promote growth of remaining trees and to provide space for regeneration.

Site Preparation. Hand or mechanical manipulation of a site designed to enhance the success of regeneration.

Site Quality. A broad reference of the potential of forest lands to grow wood. Site class identifies the potential growth more specifically in merchantable cubic feet/acre/year.

Snag. Includes standing dead or partially dead trees that are at least 6 inches in diameter at breast height (DBH) and 20 feet tall.

Softwood. A coniferous tree. Softwood trees belong to the botanical group gymnospermae, including balsam fir, red spruce, and hemlock.

Stand improvement. An intermediate treatment made to improve the composition, structure, condition, health, and growth of even or uneven-aged stands.

Stewardship. Caring for land and associated resources with consideration to future generations.

Stocking. A description of the number of trees, basal area, or volume per acre in the forest stand compared with a desired level for balanced health and growth. Most often used in comparative expressions, such as well-stocked, poorly stocked, or overstocked.

Sustainability. The production and use of resources to meet the needs of present generations without compromising the ability of future generations to meet their needs.

Sustained yield. The yield that a forest can produce continuously at a given intensity of management.

Thinning. Removing some of the trees in a dense immature stand primarily to improve the growth rate and form of the remaining trees and enhance forest health.

Threatened species. A species listed on the state or Federal threatened species list. Threatened species are those likely to become endangered within the foreseeable future throughout all or a significant portion of their range.

Timber lands. Properties that are managed primarily for the maximum production of forest products.

Timber Stand Improvement. Activities conducted in young stands of timber to improve growth rate and form of the remaining trees.

Traditional uses. Those uses of the forest that have characterized the general area in the recent past and present, including an integrated mix of timber and forest products harvesting, outdoor recreation, and recreation camps or residences.

Unacceptable Growing Stock (UGS). UGS trees are high risk and are expected to decline before harvest. UGS trees are of poor form and/or low quality and cannot reasonably be expected to improve. They have the potential to produce only low-quality logs or pulp-type products.

Uneven-aged (All-aged) system. Timber management which produces a stand or forest composed of a variety of ages and sizes. Regeneration cutting methods in this system include single tree selection and group selection.

Watershed. The geographic area within which water drains into a particular river, stream, or body of water. A watershed includes both the land and the body of water into which the land drains.

Weeding (cleaning). Regulating the composition of a young stand by eliminating some trees and encouraging others, and also freeing seedlings or saplings from competition with ground vegetation, vines, and shrubs.

Wilderness. Areas having pristine and natural characteristics, typically roadless and often with some limits on uses. (This is not the federal definition of wilderness.)

Wildlife habitat. Lands supplying a critical habitat need for any species of wildlife, especially that which requires specific treatment and is of limited acreage.

Working forest. Land primarily used for forestry purposes but also available for recreation, usually where both managed land and land not presently being managed is present.

Working landscape. A landscape dominated by land used for agricultural and/or forestry purposes.