A Natural and Cultural Resource Inventory for the Town of Washington, NH

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Cover photo: Winter view of Lovell Mountain from East Washington, with frozen Mill Pond in the foreground (photo Jed Schwartz)

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Background

In 2005 the Town of Washington Planning Board in consultation and cooperation with the Town of Washington Conservation Commission identified the need for a Natural and Cultural Resource Inventory and Conservation Plan for the town. Concerns about growth and the informed use of natural and cultural resources, both from the boards and from the public in general underscored the need for such a document. The concept for the project that emerged envisioned several components.

First, a series of GIS maps would be produced that would incorporate both stock and new data in quantifying and documenting the natural and cultural resources in town. A series of overlays for planning purposes would compliment these maps. A so-called co-occurrence analysis map would identify areas with multiple resource values. Another map would identify areas that are suitable or un-suitable for future development. Finally, a series of maps would help identify areas as targets for conservation. A build-out analysis would provide a perspective on potential future growth, and a written report would describe the findings, analyze the results and propose recommendations.

Funding was approved by the Washington Planning Board and the Washington Conservation Commission in February of 2006. The team of Chris Kane and Pete Ingraham was selected to carry out the project with assistance from the Conservation Commission. The Planning Board and other interested citizens also participated at various stages of the project.

The project resulted in a series of 13 maps, and two separate reports, the first of which is this *Natural and Cultural Resource Inventory*, and the other a *Conservation Plan* informed by the current report. Section A of this report is the *Natural and Cultural Resource Inventory*. This is supplemented by Section B: *Developed Lands and Considerations for Further Development* that analyses the context of current development and predicted trends of future development. Section C, *Analysis of Natural Resource Areas for Conservation Planning Purposes* carries the findings of the previous sections forward to lay the groundwork for the separate *Conservation Plan* to follow.

Washington's Planning Board is presently revising the town's Master Plan and will incorporate a conservation priorities plan for the first time. The recent town meeting votes for initiatives put forward by the Planning Board show that most people in town are concerned about the future of Washington and are looking to find ways to better protect their resources and quality of life. Many people express the wish to maintain

Washington as a rural community and to protect the many outdoor recreation choices that people value. The following statement from the Master Plan update articulates the vision the citizens of Washington have for the town going into the future.

Vision Statement from 2008 Draft Master Plan

A primary emphasis must be placed on preserving and protecting the quality of life and rural character of the town. This quality is sustained by unique village centers, rich in a visual historical heritage, surrounded by a natural area of lakes, farmland, forest and mountain topography. Our view of the future envisions a town where:

- growth is managed to ensure that development enhances the quality of life with minimal visual and environmental impact on the rural surrounding.
- the density of development, lot sizes, and growth are consistent with the capacities of roads, the Capital Improvement Plan, and the constraints of existing natural resources.
- a high priority is given to the protection and preservation of its inherited historic cultural and scenic resources.
- environmentally friendly cottage and small home businesses are encouraged.
- commercial development is encouraged for businesses that are compatible in visual esthetic and complementary to a bedroom recreational community's needs.
- commercial businesses that minimally impact and fully support the protection and preservation of the existing quality of life are encouraged while industry or industrial growth that is in conflict with this vision is restricted.
- open space preservation is encouraged for enhancement of out-door recreational opportunities, protection of natural resources including drinking water quality, and enhancement of the quality of life for residents and visitors.

Conservation Goals

Additional goals relative to natural resource conservation were also developed by the Washington Conservation Commission in order to help guide Town decisions regarding conservation in the future, to guide the implementation of the Conservation Plan, and to set priorities for resource allocation. The following is the list of Conservation Goals:

1. To promote the conservation, protection and responsible management of the natural resources of the Town

2. To protect and enhance the ecological integrity of the Town's diverse natural communities and wildlife habitats

3. To protect the Town's water quality, wetlands and aquifers

4. To protect the natural ability of the landscape to withstand flooding, thus reducing the risk to residential and recreational areas

5. To protect and help sustain small farms in the present and in the future

6. To protect the productive capacity of forest land for its current and future benefits

7. To maintain recreational opportunities through protection and connection

8. To protect the Town's historic sites and rural landscapes

9. To sustain the quality of life and rural character of the Town

Introduction to Washington

The area now known as the town of Washington was settled in 1768. On December 9, 1776 it was incorporated as a town, taking the name of a soon-to-be-famous Revolutionary War general George Washington. Washington is situated in the southeast corner of Sullivan County, and covers approximately 30, 371 acres, or 47.6 square miles. The elevation in Washington ranges from a low of 880 ft. in the lower Shedd Brook area on the Windsor town line, to a high of 2,473 ft. at the summit of Lovell Mountain. As of the 2000 census Washington had 895 residents.

The terrain in the town and it's relative remoteness from large population areas have contributed to the quiet, rural character it maintains today. In its history, natural resources, and quality of life, Washington, New Hampshire is unique. Its development pattern has been that of two traditional small town centers surrounded by farms, lakes and ponds, large areas of forest and undeveloped open space. Historically important for its forestry resources in such areas as "Cherry Valley", large un-fragmented forest blocks still comprise much of the town - highly valuable for wildlife, forestry and recreation. Washington's natural resource base is rich and varied; important on a local and State-wide level.

In the past several decades traditional land uses have come under pressure from development, and fundamental permanent change is potentially at hand. There are approximately 1,000 lots available in town and new applications for subdivisions occur monthly. The accelerating rate of subdivisions means that the planning options available today will not be available forever. It is a vital time to take stock of the important resources of the Town.

A. Natural and Cultural Resource Inventory

Introduction

The structure of this Natural and Cultural Resource Inventory is organized according to the order of presentation and treatment of data shown on the accompanying maps. The project relied heavily on the use of ArcView version 3x, a Geographic Information System program created and licensed by ESRI. Stock data and custom data created specially for this project were incorporated into the maps. A series of 13 paper / mylar maps were printed in large format on 36" by 40" stock.

Purpose

The purpose of the present study is to provide the Town of Washington with a comprehensive inventory of its natural, cultural and historic resources, and an analysis of these resources in combination with other factors to inform land and resource use decisions by the municipal officials of the Town of Washington. The scope of the project was determined with the Conservation Goals articulated by the Washington Conservation Commission in mind. All of the natural resources of the town that are specifically addressed in the Conservation Goals were documented in the Natural and Cultural Resource Inventory.

Research

Reference works, studies, web-based resources, Town documents including the Master Plan, Subdivision Regulations, Land Use Ordinance, published Town histories and other documents contributed to this plan. Numerous discussions and personal communications with the Conservation Commission and other members of the Washington public informed various parts of the project, and helped greatly toward the completion of this project. A complete list of sources can be found in Appendix A.

Field Work and Other Activities

A three-day field work portion resulted in new data being incorporated into this report. Records of rare and unusual species and natural communities were studied. GIS was used to analyze landscape features and other physical characteristics that are detectable with available data at this scale. An inclusive set of sites were thus selected for field investigation as being relatively more likely to support rare species or natural communities. A more detailed discussion of methods and results of this field work can be found in Appendix B.

A field trip was hosted by the Washington Conservation Commission to the Ulrich Road area and the wetlands and forest communities at the top of this drainage. A number of local residents attended. Two areas identified by the Wildlife Action Plan as priority wetland habitats were visited and discussed, along with the importance and potential for land conservation in the area. Other results of the Natural and Cultural Resource Inventory were also discussed in relation to this part of town.

A presentation was also made to the public as a part of a hearing by the Washington Planning Board regarding the Conservation Plan associated with this Natural and Cultural Resource Inventory. Maps were displayed, and a formal summary of the results of the project and the conservation recommendations that were developed was presented to about 70 members of the public in attendance.

General Explanation of Maps

A reduction of the original 36" x 40" maps are included in this report at the end of each chapter that applies. All maps for this project were produced at a scale of 1:18,000 and cover the full extent of the Town of Washington. With the exception of the Parcel Overlay all maps also include a 2,500 ft. buffer extending into all adjoining towns to provide context for the natural and cultural features, protected lands and conservation planning. Map format is 36" x 40", with the exception of the Co-occurrence Analysis map, which is 36" x 48".

"GIS", short for Geographic Information System, is a very powerful tool designed to utilize computer hardware, specialized software, and digital geographic data for the capture, management, analysis and display of many forms of information that is geographically referenced. Virtually any kind of data that is associated with a geographical location or area can be used to gain perspectives of the data in a new way. The particular GIS software environment used for this project is ArcView 3.x, created by Environmental Systems Research Institute, or ESRI.

Three forms of data are utilized by GIS. *Map data* supply spatial information associated with objects; *Attribute data* in table form supply numerical and descriptive information associated with objects; *Image data* allow simultaneous viewing of static photographic and map images such as aerial photography with the other forms of data.

Most data used in this project are stock public data compiled from a variety of sources and made available through NH GRANIT, the statewide clearinghouse for an array of GIS geospatial data and services. Original sources of data include NH Fish & Game Dept., NH Department of Transportation, the US Geological Survey, NH Department of Environmental Services, and Natural Resource Conservation Service of the USDA, to name a few.

In several instances custom datasets were created by the authors from local information, including active agricultural lands, historic and cultural features and snowmobile trails in a process known as digitizing. All data used in GIS must be in digital form, and in the case of the custom data this is created at the computer in a format that is compatible with the system, in the visual form of points, lines or shapes. These spatial data are then associated with text and numerical data as needed and available. New data thus created can be utilized by subsequent users of GIS for planning and other purposes.

The details relative to the sources, units, formats, creators, parameters and other aspects of the data are encapsulated in the file associated with the prime data. This is known as Metadata. Metadata for the GIS files used in this project, including the sources of the data, are presented in Appendix H.

NH GRANIT

The New Hampshire Geographically Referenced Analysis and Information Transfer System (NH GRANIT) is a cooperative project to create, maintain, and make available a statewide geographic data base serving the information needs of state, regional, and local decision-makers. A collaborative effort between the University of New Hampshire and the NH Office of Energy and Planning, the core GRANIT System is housed at the UNH Institute for the Study of Earth, Oceans, and Space in Durham. It includes a geographic database, hardware and software to build, manage, and access the database, and a staff of experts knowledgeable in geographic information systems, image processing, and computer analysis. In addition to database development and maintenance, the GRANIT staff offers a range of application development, training, and related technical services to GIS users in the state and the region.

The GRANIT approach to a statewide GIS depends upon the cooperative efforts of a host of agencies, collaborating on various elements of database design and construction as well as application development. The collaboration occurs formally through the NH GIS Advisory Committee, and informally through daily interactions between the growing body of GIS users in the state and the region.

Map Components: Base Layers

All maps in this Natural and Cultural Resource Inventory with the exception of the two overlays include the following common "Base Layers":

Town and County Boundaries as provided by NHGRANIT. Towns and USGS do not always agree as to the exact location of Town boundaries. In cases where tax parcels include a portion of the Washington Town boundary that does not agree with the USGS boundary, the parcel lines were adjusted to coincide with the Town boundary. Town and County names are also displayed.

Roads as provided by NHGRANIT displayed by NHDOT functional classifications. This includes State highways, Town roads, private roads and un-maintained roads including Class 6 and jeep trails. In a few cases the DOT classification was erroneous or incomplete, and local roads were digitized and/or re-classed to improve accuracy. Road name labels are also displayed.

Surface Waters (lakes, ponds and rivers) and streams based on United States Geological Survey (USGS) data, and **Wetlands** based on National Wetlands Inventory (NWI) data. Streams are displayed as either perennial or intermittent, and all wetlands are displayed the same regardless of type. In cases where these features have a place name associated with them, this is also displayed.

Conservation and Public Lands as provided by NHGRANIT (March 2003 release) and labeled by name. Additional parcels were added to this layer as this information became available. Conservation land boundaries were adjusted to coincide with the Washington tax parcel boundaries and town lines. These lands include Town-owned properties considered conservation land, conservation easements, deed restrictions and conservation properties held in fee by the State of New Hampshire or private organizations such as the Society for the Protection of New Hampshire Forests. Town-owned properties are displayed on the maps differently than other conservation lands for clarity.

Natural Resource Inventory Components

1. Aerial Photography

Map: Aerial Photography Base Map

If a picture is worth a thousand words, an aerial photograph of an entire town must be worth many volumes. The daily view of the earth available to humans is one from the ground, looking more-or-less up or down to the immediate surrounding landscape. However, when seen in its entirety at once from the point of view of over 1,000 ft. in the air, a town takes on a completely different appearance. Parts of Town previously viewed independently on the ground, and connected by linear views of connecting roads are suddenly seen to interrelate spatially in a very different way.

Any photograph is by definition a "snapshot" of an object in time and space. Thus, the 1998 imagery shown on the accompanying map will not reflect all changes, whether sudden or gradual, that have taken place in the intervening 10 years. However, signatures of the more gradual changes that have taken place on the landscape over the last 100 years or so are still quite visible even now. Open agricultural lands, developed areas, wetlands and water bodies stand out in sharp relief against the backdrop of the predominantly forested context of Washington. Settlement patterns that show clusters of residences and the associated farmlands are still clearly visible, especially in Washington Village and East Washington. More recent residential and seasonal development are clearly seen as well, most notably near Highland Lake, Ashuelot Pond, Millen Lake and Island Pond.

The accompanying aerial base map combines a composite of the 1998 black and white Digital Orthophoto Quads with the five base layers: roads, town and county boundaries, surface waters and wetlands, and conservation lands. The scale of the original imagery is 1:12,000. The resolution of the photography is approximately 1 meter, represented by pixels that depict a gray scale value of 1 square meter in area on the ground. The photography was taken in leaf-off condition with little or no snow cover, enhancing the contrasting appearance of conifer and hardwood forest areas.

Map 1. Aerial Photo

2. Forest Productivity and Biodiversity

Map: Forest Soils and Biodiversity

Values of Forests and Wetlands

Taken together, forest and wetlands are the dominant natural land cover types of New Hampshire. Forests alone account for over 80% of the total land cover of the state. The character and ecology of the state is in large measure that of its forests and wetlands. Soils are intimately associated with forests and wetlands, both determining the structure and composition of the plant communities they support, and being altered themselves over time by the communities on which they depend. The economy of the state is also linked to its forests and wetlands, as growth gradually reduces the productive forest cover while at the same time isolating jurisdictional wetlands in an increasingly built environment.

Jed Schwartz

Purling Beck Brook near site of the old Creamery in East Washington

Values of Forest Productivity

The economic benefits of forestlands to the state of New Hampshire are well known. According to the 2008 Washington Annual Report $11,642 of revenue were received by the Town from timber tax receipts in tax year 2007. Significant private income is derived from forestry town-wide, making it a major sector of the local economy.

In a town as rural as Washington with little in the way of commercial development, local sources of income are relatively limited. Keeping forest land in productive use provides a economically viable alternative to more intensive uses such as residential development. Forest land offers additional benefits as well, including preservation of rural character, wildlife habitat, water quality protection, recreational opportunities, hunting and fishing access, and scenic enjoyment among others.

Soils are the basis of productive forestland, but not all soils are created equal in their capacity to grow forests. Areas with soils that are classed by the Natural Resource Conservation Service (NRCS) as more productive than others for their suitability to support some of the most economically valuable species such as white pine and red oa, and are especially important to preserve. These so-called Important Forest Soils are designations under which numerous particular soils units are grouped according to common traits such as moisture, depth of soil, and soil texture. Each of the 10 Counties in the state has its own particular classification. The six Important Forest Soils classes in Sullivan County are explained below.

Soils that are especially productive for the purposes of agriculture are also mapped, but as some of these are also coded as Important Forest Soils, they are treated in the Soils in subsequent Chapter 6 – Soils. Soils in general will be discussed in more detail in that section as well.

Table 1. Important Forest Soils and Their Productivity Types

Soil Class	Acres	Productivity Type
IA	8,607	Optimal for Northern Hardwoods
IB	11,302	Optimal for Beech / Hardwoods
IC	163	Optimal for Pine / Spruce / Hemlock
IIA	12,914	Other Hardwood Production
IIB	1,395	Other Softwood Production
NC	3,478	Not Classified

Source: GIS analysis, Kane & Ingraham, 2007

Important Forest Soils

Some soils are especially suitable for the growth of forests, but the species of trees they excel at growing varies by soil type. A woodlot that grows superior white pine will not necessarily be as productive for northern hardwoods, for instance. This has not gone unnoticed by the humans who depend on forests for their livelihood. It is the particular soils that underlay a particular woodlot that in large measure can make it better than another for the production of certain high quality wood products. The majority of soil areas in New Hampshire have been mapped and classified according to their relative productive capacity to grow trees. Six classes of productive qualities were developed by the NRCS for this purpose. The six classes and the forest types they are most suitable for growing in Sullivan County are explained below.

Descriptions of Important Forest Soils Classes

IA Deeper, loamy textured, moderately well and well drained soils that support a variety of hardwood species such as beech, sugar and red maple, yellow and white birch, white ash and red oak, with spruces, hemlock and balsam fir also present.

IB Moderately well and well drained soils that are sandier in texture, generally less moist and less fertile than 1A soils. The tree species found on these soils are similar to those on 1A soils, but productivity is not as high.

IC These soils are moderately well drained, to well drained and excessively well drained outwash sands and gravels. These soils favor the growth of softwoods such as white pine, balsam fir, red spruce and hemlock, while some hardwoods such as red maple, aspen and white birch may also be present.

IIA These soils are the same as those in IA and IB, but certain physical attributes such as steep terrain, bedrock outcrops, surface boulders and erosive textures limit forest management operability.

IIB High water tables and poorly drained qualities make these soils less suited for forest production. Red maple, hemlock, balsam fir and spruce are typical species. Forest management and harvest is difficult except during frozen conditions.

NC These soils are not classified due to high variability or low productive capacity.

Discussion

The valuable and productive soils in Class IA and IB are well represented in Washington. IC, optimal for the growth of conifers such as pine, however, is uncommon. This is likely due to the fact that Washington is relatively high in elevation, and does not contain large areas of outwash associated with rivers and glacial melt runoff. Two of these IC soil areas occur on conservation land, but the largest area north of Halfmoon Pond is un-protected. Large areas of IA soils are located north and south of Millen Lake, near E. Washington, and along the border with Stoddard. Smaller areas occur to the north, including some areas in Pillsbury State Park. Areas with these three most productive forest soils are important to protect in order to keep them as viable commercial forestry assets.

Wetlands

Value of Wetlands

Wetlands in general are a common feature of the New Hampshire landscape. They are so common, that it is easy to overlook the many ways that they benefit people. The services that wetlands provide are often referred to as functions.

These functions include benefits to drinking water, as aquifer recharge areas, sediment capture and control, and nutrient cycling to lock up excess nutrients such as nitrogen and phosphorus. They help minimize and prevent shoreline erosion by stabilizing the banks of lakes streams, and allow for storm and flood water storage to buffer the effects of flooding during high-water events. They provide critical habitat during at least a part of the life cycle of many animal species, and are hotspots of plant and animal biodiversity. They also provide more obvious contributions to the quality of life we enjoy in New Hampshire, including distant scenic views of wetlands and surrounding hills, as well as hunting and fishing opportunities.

Jed Schwartz

Beaver Marsh (Palustrine wetland with persistent emergent vegetation)

These functions, and the human values they equate to are provided virtually free by our numerous wetlands. Destruction or serious alteration of wetlands diminishes their effectiveness in supporting a healthy and safe community and high quality of life.

Wetlands deserve to be protected as much as possible, whether by force of law or by means of (wet)land protection.

Table 2. Wetlands in Washington by General Type and Acreage

Acres	General Wetland Type	Code	Local Example
426	Marsh	PEM1	E of Rte 31 / Mill St. intersection
14	Riverine (uncommon)	R2	Ashuelot River where it enters from Lempster
196	Shallow pond	PUBH PUBF	Mill Pond, E. Washington
385	Shrub: Broad-leaved Deciduous	PSS1	N side of Rte 31 at Windsor town line
159	Shrub: Broad-leaved Evergreen	PSS3	NW of Lookout Rd. / Valley Rd. intersection
27	Shrub: Mixed (uncommon)	PSS1/3 PSS1/4	Both sides of Rte. 31 just S or E. Washington Rd.
16	Shrub: Needle-leaved Evergreen (uncommon)	PSS4	Rte. 31 just N of Highland Haven Rd.
26	Swamp: Dead Trees (uncommon)	PFO5Fb	S end of Halfmoon Pond
229	Swamp: Hardwood	PFO1E	N side of Marlow Rd. near Marlow town line
21	Swamp: Mixed (uncommon)	PFO1/4E	N end of Smith Pond
226	Swamp: Softwood	PFO4	Between E. Washington Rd, and Island Pond
1,942	Lake	L1UBH	Millen Lake
3,667	Total		

Source: National Wetlands Inventory, data collected from 1971 to 1992.

National Wetlands Inventory

The National Wetlands Inventory or "NWI" is a map series based on the classification of wetlands developed by Lewis Cowardin and others according to a suite of common characteristics such as the dominant vegetation type, the depth of the water, the composition of the wetland bottom, and a variety of other traits. The U.S. Fish and

Wildlife Service published this comprehensive classification in 1979 in recognition of the need for a consistent and standardized approach to wetland classification. This was followed by a major mapping project, which by 2001 had produced an enormous map series scaled to 1:58,000, showing wetlands and deepwater habitat areas of over 90% of the lower 48 states. Wetlands were mapped primarily using aerial photo interpretation of 1985 and 1986 aerial photos. The maps were subsequently digitized and made publicly available. According to the U.S. Fish and Wildlife Service, "The goal of the National Wetlands Inventory is to provide the citizens of the United States and its Trust Territories with current geospatially referenced information on the status, extent, characteristics and functions of wetland, riparian, deepwater and related aquatic habitats in priority areas to promote the understanding and conservation of these resources". (Cowardin et al, 1979).

Wetlands in Washington

The NWI Classification considers all water bodies wetlands. All wetlands belong to one of five major wetland Systems: Lacustrine (lakes and ponds); Riverine (rivers and streams); Marine (deep water saltwater environments); Estuarine (shallow tidal-influenced saltwater wetlands) and Palustrine (everything else such as marshes, swamps, shallow ponds, etc). Within each System, Classes and Sub-Classes further subdivide wetlands according to common attributes. Each individual mapped wetland was assigned a code representing its System, Class and Subclass. Appendix C contains a key to the Cowardin wetland classification codes.

Lacustrine, Riverine and Palustrine wetlands all occur in Washington. Approximately 1,506 acres of the town are Palustrine wetlands, making them the most numerous and widely distributed type in town. 1,282 acres of Lacustrine wetlands are the second largest wetlands group in acreage in town, which is not surprising given the abundance of lakes and ponds. The least common wetland type in Washington is Riverine, represented by a mere 14 acres along the Ashuelot River. The accompanying Table 2 above displays the general wetlands types that occur in Washington and how common each is relative to others in Washington, as well as basic Cowardin Codes associated with these types, and the location of notable local examples.

Discussion

The least common wetland types in Washington are Riverine Wetland, *R2UBH; R3UBH* (14 ac. total); Mixed Shrub, *PSS1/3; PSS1/4* (27 ac. total); Needle-leaved Evergreen Shrub Wetland, *PSS4* (16 ac. total); Swamp: Dead Trees, *PFO5Fb* (26 ac. total); and Mixed Swamp, *PFO1/4* (21 ac. total). Some of these wetland types are especially uncommon habitat for wildlife. For instance, Swamp: Dead Trees is a rather transitory wetland type that occurs typically several years after flooding, often by beavers. Great Blue Herons require isolated swamps such as these for their sturdy stick nests, and as such are worthy of consideration for protection.

The largest wetland areas in Washington:

- Along Shedd Brook on the Windsor town line
- In the area between Rte. 31 and Valley Road, and crossing over Rte. 31 just south of Washington Village
- A series of wetlands east of Ashuelot Pond
- A series of wetlands north of Ashuelot Pond and near Farnsworth Hill Town Forest
- A series of wetlands associated with Bog Brook and Halfmoon Pond
- A wetland on the upper reaches of Woodward Brook west of Ayers Pond Road

Status of Protection of Wetlands

Wetlands in New Hampshire are afforded more protection in general than in many states. New Hampshire was among the first states to enact laws and regulations to limit activities in wetlands. State law however allows for an application process to alter wetlands, most of which are granted to some degree. Jurisdiction by the State is limited to the area delineated as wetland, however, and does not extend to adjacent upland, non-wetland areas.

Land conservation protects approximately 410 acres of wetlands in Washington, under a variety of terms depending on the particular method of protection. Large areas of wetlands remain outside such conservation areas, however. Protection of a diversity of wetland types, and especially wetland systems that contain multiple types will help guarantee that the diversity of habitat and services that they provide over time will be available into the future.

Prime Wetlands Designation

New Hampshire law provides for extra protections to wetlands that are designated by a Town as Prime Wetlands according to the requirements of RSA 482-A: 15 and Chapter Env-Wt 700 of the DES administrative rules. Limitations to use within 100 feet of such wetlands are then applicable, including the classification of all such project as major projects, mandatory field inspections by DES, and a public hearing before the DES. Prime wetland designation typically relies on an evaluation of a sub-set of wetlands that receive individual study using the *Method for Comparative Evaluation of Non-tidal Wetlands in New Hampshire* (1991) or *Method for the Evaluation and Inventory of Vegetated Tidal Marshes in New Hampshire (Coastal Method)* (1993), updates of which are currently pending.

Map, written and field data are used for the Prime Wetland evaluation process. Often with the assistance of a wetland scientist, the municipality evaluates approximately 14 of the functions and values of the identified wetlands. Once the community has selected wetlands to designate as prime, the municipality holds a public hearing before the residents of the community vote on the designation, and provides to the DES Wetlands Bureau a copy of the study and tax maps with the designated prime wetlands identified. As of this writing 26 municipalities in New Hampshire have officially designated Prime Wetlands in their community.

Data Discussion

Forest productivity potential is displayed on this map by including the Important Forest Soils layer. Wetlands are important features of the landscape from a biodiversity standpoint, as they provide habitat for a proportionately large number of both plant and animal species. In order to capture this diversity and the location of local wetlands, the NWI wetlands layer with each wetland labeled with its NWI code was included. An accompanying table on the map provides code translation.

Map 2. Forest Soils and Biodiversity

3. Water Resources

Map: Water Resources

Lakes and Ponds

Values of Lakes and Ponds

Lakes and ponds provide many benefits to the public, as well as to their natural constituents. Public benefits include recreational activities such as fishing, swimming and boating. Lakes and ponds also provide habitat for aquatic plant and animal species which depend on them solely for survival, but also to many other species of animals that rely on this resource for at least a portion of their life cycle.

This Component addresses water resources including surface waters and groundwater in the context of HUC 12 Level Watersheds. Groundwater resources are displayed by utilizing the Stratified Drift Aquifers layer (variably shaded according to transmissivity; ≥1,000, ≥2,000 or ≥3,000 ft^2 / day), Potentially Favorable Gravel Well Areas (PFGWA), and Present & Future Drinking Well Supply Sources (with .25 mi. radius) datasets. Potential threats to surface waters are addressed by display a 250 ft. buffer surrounding qualifying surface waters as defined by the Comprehensive Shoreline Protection Act (CSPA). Recent revisions to the CSPA extended this protection to the Ashuelot River and Beards Brook below Mill Pond.

Although palustrine wetlands (wetlands other than lakes, ponds and streams) are important water resources, they are displayed and addressed in more detail in the Biodiversity and Forest Productivity map component to avoid display conflicts. Potential threats to existing public water supplies are displayed as Wellhead Protection Zones. Existing active Dams are shown. HUC12 watershed boundaries are shown as dotted blue line, and are labeled. Summits and 20 ft. topographic contours are also displayed to aid in interpretation of surface waters and watersheds.

Lakes and Ponds in Washington

Washington has a fairly large number of lakes and ponds of various sizes. Several of these straddle the town line. The most significant of these in terms of size are Ashuelot Pond (361 ac.), Island Pond (192 ac.), Millen Lake (135 ac.), May Pond (158 ac.), Halfmoon Pond (76 ac.) and the Washington portion of Highland Lake (243 ac.). A total of 13 Great Ponds occur in Washington, such designation afforded to bodies of water that are generally maintained at an area of 10 acres of more. Certain land use restrictions apply to Great Ponds, including forestry laws and the Comprehensive Shoreland Protection Act. Public beaches are maintained at *Mill Pond in E. Washington, and at the east end of Millen Lake at Camp Morgan. See Table 3 below.

* See Appendix D: Results and Recommendations from NHDES TMDL Study of Mill Pond.

Table 3. Great Ponds in Washington

Name	Acres
Long Pond	121.3
Ashuelot Pond	361.5
Millen Lake	135.1
North Pond	81.6
May Pond	158.5
Ayers Pond	23.3
Frog Pond	23.9
Halfmoon Pond	76.5
(Un-named Pond)	29.1
Island Pond	192.2
Smith Pond	28.2
Shedd Brook	25.8
Highland Lake	243.3
Total:	1500

Source: GIS analysis, Kane & Ingraham, 2007

Comprehensive Shoreland Protection Act

The Comprehensive Shoreland Protection Act (CSPA) specifies distances from certain significant bodies of water in which some activities are limited or prohibited. The purpose of the act is to protect public waters through the interception of surface runoff, wastewater flow, subsurface flow, and groundwater flow through the minimization of the effects of nutrients, sediment, organic matter, pesticides, and other pollutants, and through the moderation of water temperature. The Water Resources map displays buffers on adjacent uplands within 250 feet of lakes or ponds 10 acres in area or larger, and streams or rivers of fourth order and above. This includes the entire course of the Ashuelot River, and Beard Brook downstream of Mill Pond, areas that were added to the CSPA in a recent revision.

Status of Protection of Lakes and Ponds in Washington

Ten named ponds in Pillsbury State Park, most notably Butterfield / May Pond (combined acreage 152), and North Pond (56 ac.) are protected from development and major impacts by virtue of their ownership by the State of New Hampshire. With the exception the Town-owned Camp Morgan at the eastern end of Millen Lake, and a small frontage on the north shore of Island Pond owned by the Society for the Protection of New Hampshire Forests, the shores of the other major water bodies in Washington are unprotected by conservation lands. Much of this frontage is already developed, but significant areas remain un-built today. As mentioned above, limitations on land use near qualified water bodies including great Ponds (10 acres and over) are enacted through the Comprehensive Shoreland Protection Act or CSPA. None-the-less, CSPA enforcement is variable, and should not be relied upon solely as a mechanism for shoreland protection.

Rivers and Streams

Values of Rivers and Streams

Streams and rivers provide wildlife habitat in the form of direct support for aquatic species, but also as corridors of travel to a variety of species. They also provide recreational opportunities for fishing, swimming and boating Water quality of flowing waters is largely dependent on the condition of the surrounding landscape, as well as the condition of ground and surface water inputs. As water sources for lakes and ponds it is important that streams and rivers be preserved in their natural state to the extent possible. Forestry, agricultural, commercial and residential activities all have the potential to degrade water quality.

Rivers and Streams in Washington

Washington has approximately 74 miles of intermittent or seasonal streams, and 44 miles of perennial streams, the vast majority of them un-named. Many of the reaches of these streams are in un-developed, relatively pristine condition. While most of the stretches of streams in Washington are single tributaries to larger streams or water bodies, several are of a higher order. Stream order is determined by the number of tributaries contributing to a stream. Thus, a 1st order stream has no tributaries. A 2nd order stream is made when two 1st order streams combine. A 3rd order stream is made up of 2 or more 2nd order steams, and so on. There are no streams larger than 4th order in Washington. Certain regulations apply to areas adjacent to 4th or higher order streams, including forestry laws.

4th Order Streams in Washington *(according to official DES list):*

1. Beards Brook at and below junction with Woodward Brook in East Washington

2. Ashuelot River at and below junction with Richardson Brook in Lempster, and then flowing southwesterly back into Washington

3. Shedd Brook below junction with and un-named 4th order stream

4. Un-named stream or river – outflow of Highland Lake (added to list in 2008)

Source: New Hampshire Department of Environmental Services. 2008. DES List of Fourth Order and Higher Streams


Jed Schwartz

Ashuelot Pond

Named Streams in Washington

While most streams in Washington are un-named, several are. Cherry Brook flows south from Goshen into North Pond in Pillsbury State Park, and supplies the headwaters of the Ashuelot River. Aptly named Bog Brook also flows south from the heart of Pillsbury State Park, meandering through wetland complexes to arrive at Halfmoon Pond. Woodward Brook starts at Ayers Pond that straddles the Bradford / Washington line, and continues southerly to Mill Pond in East Washington. Beards Brook originates at the outflow of the east side of Island Pond, and continues easterly to East Washington where it is joined by Woodward Brook in the vicinity of Mill Pond and continues south into Hillsborough. Shedd Brook has its origin near the Town of Windsor near the southeast corner of Washington, and occupies level terrain as it flows easterly through broad associated wetlands. Barney Brook originates in north Stoddard, and flows through numerous small beavers wetlands northward to Ashuelot Pond.

Ashuelot River

From the headwaters at Butterfield Pond in Pillsbury State Park, the Ashuelot flows southwest into the Town of Lempster, then back across the line into Washington, and continues more-or-less southwesterly through Ashuelot Pond and Russell Mill Pond into the Town of Marlow, ultimately arriving at the Connecticut River in Hinsdale. The

Ashuelot is the major river of this region of the state, and situated as it is at the headwaters of this river, land use and protection in Washington are of considerable importance to the river and all the communities downstream that benefit from it.

Jed Schwartz

Ashuelot River below Lake Ashuelot

Status of Protection of Streams and Rivers in Washington

0.58 mi. of the Southeast frontage of the Ashuelot River are protected by Farnsworth Hill Town Forest. The remaining 0.94 miles above and below this protected frontage, as well as the entire Northwest frontage of this stretch of the river remain unprotected. None of the Ashuelot River frontage is protected downstream of Ashuelot Pond. Protection of stream corridors yields multiple benefits for resource conservation by limiting uses that might otherwise impact the surrounding uplands that directly affect the water courses themselves. These benefits include water quality protection, scenic enjoyment, recreation attractiveness, and wildlife habitat protection among others.

Ground Water

Aquifers

Aquifers are exceptional underground repositories of drinking water. Virtually all portions of the landscape are capable of transmitting and storing some volume of water, but so-called "High-Yield" or stratified drift aquifers are more reliable, higher quality source areas for drinking water. As such, they should be targets for protection to preserve their potential as reliable, high-quality drinking water sources. Land use in high-quality aquifer areas can adversely affect groundwater, as pollutants may taint them to the point of making them unsuitable as drinking water sources.

Aquifer data is generated by the NH Department of Environmental Services through sampling of ground water wells. Aquifers are ranked in terms of transmissivity, or the rate at which water percolates through the substrate. In this case, the data represent a prediction of the minimum volume of water that a given aquifer area will allow to be transmitted through itself per day, expressed in cubic feet of water. Potentially favorable gravel well areas are high-transmissivity locales largely unaffected by potential pollution sources.

Table 4. High Yield Aquifers in Washington

Transmissivity of Groundwater in ft^3 / day	Acres
≤1000	3,424
≤2000	902
≤3000	313
Total:	4,639

Source: GIS analysis, Kane & Ingraham, 2007

Aquifer Areas in Washington

There are a relatively few discrete high yield aquifer areas in Washington. The most significant in size is the 228 acre Washington portion of a large aquifer in E. Washington that straddles the Hillsboro line. Another area on both sides of the north lobe of Ashuelot Pond is 114 in size, and includes portions that are the highest yield rate in town. The remaining major area occurs along the drainage basin of Shedd Brook, and the Washington portion of this aquifer is 40 acres in size. Only two other very small high yield aquifer areas are mapped in Washington.

Potentially Favorable Gravel Well Areas (PFGWA)

PFGWA's are gravel areas that are predicted based on landscape position, substrate and other physical characteristics to be potentially favorable areas for the removal of drinking water. Potential and known contamination sources are excluded from this data coverage, and thus the mapping represents actual area projected to be suitable for the siting of wells.

A total of 172 acres of such areas were identified in the town of Washington. These are located in the same areas as two of the high yield aquifers. The largest by far is in E. Washington, with a smaller area on the west shore of the north lobe of Ashuelot Pond. When considered together, the Ashuelot Pond west shore and the E. Washington aquifer / gravel well area are the most valuable high-quality ground water sources in Washington.

Existing Public Drinking Water Supplies

There is currently one public water supply that is subject to a State-regulated ¼ mile sanitary radius buffer zone. This is centered at the Washington Elementary School. The restrictions that apply to this sanitary radius are explained in Section B: Developed Lands and Constraints to Development.

Dams

The NHDES Dam Bureau inspects and documents dams at regular intervals on a state-wide basis. According to the data there are 19 active dams in the Town. An additional eight other sites are either remains of old dams, or sites of removed dams. The 1872 stone dam at the outlet of Ashuelot Pond, one of the oldest in town still functioning, is shown below. Recent flood events have underlined the risks that can be associated with dams and the waters they impound, making awareness of the location and condition of dams important not only for the cultural and recreational reasons, but also for public safety.

Jed Schwartz

1872 dam at outlet of Ashuelot Pond

Map 3. Water Resources

4. Wildlife Habitat

Map: Wildlife Habitat

Values of Wildlife Habitat

Habitat for wildlife provides food, shelter, water and space for animal species to survive and thrive. Every species has unique habitat requirements and preferences. Virtually all portions of the landscape provide some form of wildlife habitat from time to time, yet some habitat areas are disproportionately important either to a particular species, or to a diversity of species. Unfortunately, many of these important habitat types are relatively uncommon to begin with, and some are disappearing due to conversion or alteration by humans. Uncommon wildlife species often depend on unusual habitat, making conservation of these habitats especially important. The Wildlife Action Plan described below makes connections between these species and communities, and has mapped areas where they are predicted to occur.

Jed Schwartz

Beaver dam, Ulrich Road area (E. Washington)

This very robust project component includes several data layers that can be indicators of various types of potential wildlife habitat. Active Agricultural Lands (newly digitized based on local input) are also displayed to help indicate relative value to wildlife. Areas with South-facing Slopes and Steep Slopes were derived from digital elevation / aspect data. All NWI wetlands are also displayed as a single category. Important Forest Soils are also included in this component primarily for ease of map interpretation, but they are described and treated in Chapter 6, Soils.

NH Deer Yard maps were never produced for the Town of Washington, therefore this data was not included. Un-fragmented Lands have been identified and ranked by acreage class. Roads not included in the stock DOT Roads layer was also digitized, and roads that were erroneously classed by DOT were adjusted to improve the accuracy of the Un-fragmented Lands analysis that appears as a shaded sub-model insert. This ranking follows the classification recently set forth by The Nature Conservancy and NH Fish & Game, that qualifies forest blocks in terms beyond mere acreage.

NH Wildlife Action Plan

In the most comprehensive and sophisticated study yet undertaken in New Hampshire for wildlife habitat mapping and conservation planning, the New Hampshire Fish & Game Department unveiled its Wildlife Acton Plan (WAP) in late 2006. Recently updated, and subject to continuous refinement, it is an important tool for Towns and organizations to use in planning the conservation of high quality and/or imperiled wildlife habitat, rare plant habitat and exemplary natural communities and systems.

WAP Small Scale Priority Wildlife Habitat Areas

The recent Wildlife Action Plan used predictive modeling to predict where examples of significant habitat groupings would occur in New Hampshire. According to their findings, Washington has examples of four *Small Scale Priority Habitat Types:* Marsh Complex (Wet Meadow/Shrub Wetland), Peatland, Grassland (25+ ac) and Floodplain Forest. These habitats, while represented in Washington by relatively small areas are considered by this study to be especially critical habitats for wildlife as well as being in many cases relatively uncommon. Field surveys are recommended by the WAP to verify the accuracy of the predictive model mapping.

WAP Large Grasslands in Washington

Large grasslands are typically created and maintained by humans, but they provide critical habitat for a variety of common, and some uncommon species. As forests gradually reclaimed what were once extensive agricultural areas, and as fire suppression prevented most wildfires, grasslands have now become uncommon. Northern harrier, upland sandpiper, purple martin, eastern meadowlark, grasshopper sparrow, horned lark, vesper sparrow, northern leopard frog and wood turtle are all uncommon species that depend on grassland habitat in New Hampshire.

Four large grasslands were identified by the WAP in Washington. The largest of these by far is a 80 acre grassland / field complex in East Washington on the Eckhardt Farm. Others occur on Bailey Road, Lempster Mtn. Road and Valley Road.

WAP Peatlands in Washington

Peatlands are a category of wetlands that accumulate slowly decomposing vegetative matter as peat. This habitat grouping category contains dozens of natural wetland communities, a number of which are rare in NH. Rare plant species are often associated with peatlands. Associated uncommon wildlife species of note include ringed boghaunter dragonfly, palm warbler, mink frog, and northern bog lemming.

Peatlands are predicted by the WAP in only a few, mostly small and discrete locations in Washington. The most significant is the 30 acre peatland on the west end of Halfmoon Pond. Other smaller areas are mapped in the general vicinity of Island Pond, near Shedd Brook, and in association with Frog and Bacon Ponds, among others.

WAP Marsh and Shrub Wetlands in Washington

This large habitat group includes dozens of natural wetland community types. Significant wildlife species associated with these areas include American black duck, American bittern, American woodcock, Blanding's turtle, common moorhen, eastern red bat, great blue heron, least bittern, New England cottontail, northern harrier, osprey, pied-billed grebe, ringed bog-haunter dragonfly, rusty blackbird, sedge wren, silver haired bat and spotted turtle.

Examples of Marsh and Shrub Wetlands are actually fairly common in Washington according the WAP, occurring in all portions of the town. Notable large marsh and shrub wetlands are located between Rte. 31 and Valley Road, on either side of King St., on Woodward Brook west of Ayers Pond Rd., and in Pillsbury State Park in association with North Pond and Butterfield Pond.

Floodplain Forests in Washington

Associated with larger streams and rivers, floodplain forests areas contain a wide variety of natural communities that provide important habitat for uncommon species. Red-shouldered hawk, veery, cerulean warbler, American redstart, chestnut-sided warbler, Baltimore oriole, beaver, mink, river otter, wood turtle, Blandings turtle and spotted turtle all depend on such habitat. Many floodplain forest areas have been cleared and converted to agriculture, as the soils tend to be suitable for this use. Primarily for this reason, intact examples of this habitat are much less common than they once were.

Floodplain forests were identified by the WAP in two locations in Washington. The most extensive of these is associated with Shedd Brook, and another is located along the Ashuelot River downstream of Ashuelot Pond.

Other Mapped Wildlife Habitats

Active Agricultural Areas

A small number of locations in Washington remain in active agricultural use. For the most part, they are sources of hay or feed corn, or grazing areas for cattle and sheep. Undoubtedly, additional acreages would have been used for agriculture in the past, but farming has been steadily declined in New Hampshire since the wide-spread wool sheep farming industry that peaked in the 1830's.

The vast majority of Washington is forested, making open fields now a relatively rare phenomenon. Diversity of wildlife is enriched by the retention of active agriculture and the incidental habitat it provides. Wildlife species typically associated with active agriculture rely on open habitat and also benefit to some degree from the crops and byproducts of farming. Many of the uncommon species are the same as those identified by the Wildlife Action Plan for the Grassland Priority Habitat, including northern harrier, upland sandpiper, purple marten, eastern meadowlark, horned lark, grasshopper sparrow, vesper sparrow, northern leopard frog, and wood turtle.

Jed Schwartz

Cows in Marshall's pasture, view from top of hill at Ayer's Pond Road (E. Washington) looking south west.

Deer and turkey are frequent visitors to corn fields, especially for the residual corn left over after harvesting. Hayfields, especially large ones are required habitat for a suite of grassland birds, such as the ebullient bobolink and the field sparrow, signature species of open hayfields. Old fields in the early stages of abandonment are preferred by other species of birds, such as the indigo bunting and blue-winged warbler.

The most significant concentration of active agricultural areas is located in East Washington, with other important areas scattered to the west of Rte. 31. See the attached Wildlife Habitat map for specific active agricultural areas.

Steep and South-Facing Slopes

Steep slopes may have relatively loose rocky substrate that periodically slumps and resettles, encouraging the creation of small cavities useful for wildlife den and cover sites. Porcupine in particular create their dens in naturally occurring cavities in loose rocky slopes. Certain species of wildlife are also attracted to the sun exposure and warmth of slopes that are generally south to southwest facing. Snakes and bobcats are especially reliant on such areas for resting and heat conservation. Turkey vultures often make their nests in the bouldery cover of semi-exposed rocky slopes.

To display steep slopes, the National Elevation Dataset (NED) was processed to create a subset of portions of the town that had at least 15% slope. These areas are displayed on the map as medium gray polygons. These areas are distributed widely across the town, but are especially common in the north portion of Washington.

For south-facing slopes, The NED was used to derive slope (%) and aspect. Areas greater than or equal to 15% slope were selected. Areas with aspects between 135° (southeast) and 247.5° (west southwest) were selected from steep slopes and displayed to represent steep, south-facing slopes. These areas are displayed on the map as dark gray polygons. Notable concentrations of these south-facing slopes occur from Rte. 31 easterly to the Hillsboro and Windsor town lines, east of Highland Lake, northeast of Ashuelot Pond, on the southwest south and southeast flanks of Lovell Mountain, and in Pillsbury State Park south of the Goshen town line.

Un-fragmented Open Space Blocks

Undeveloped open space blocks are recognized for their significance as intact biological habitat areas and for general open space values. These undeveloped areas are without maintained or regularly used roads. They do contain natural lands cover types such as forest, wetlands and surface waters, as well as undeveloped agricultural lands and other un-improved human-disturbed areas such as gravel pits.

Fragmentation primarily from road use has a well-documented influence on wildlife, both by direct death or injury from vehicles, and by more environmental effects such as noise, and terrain and light disturbance. Certain migrant songbird species, and several species of larger mammals are known to avoid areas with significant fragmentation, while conversely being attracted to large un-fragmented areas.

Consideration of the fragmentation that can result from un-planned development, and guiding such development to areas that will have less fragmenting impact can result in the conservation of these important areas.

An area representing a 500-ft.-wide buffer along all roads was excluded from this analysis, to account for a typical existing or future house lot and its structures, and a disturbance area along maintained roads. Class 6 and some Class 5 Town roads, private driveways and trails were not included as fragmenting features for this analysis, and thus are not displayed within the unfragmented areas.

The remaining un-fragmented area of the Washington environ was then analyzed by GIS to determine where the remaining unfragmented blocks between roads were located and how large they were. Blocks of un-fragmented lands do not stop at political boundaries, and thus the analysis considered blocks that occur in Washington that in most cases also extend into neighboring towns.

Significant Open Space Blocks in Washington

Thresholds of 500 ac., 1,000 ac., 10,000 ac. and 20,000 ac. were established in ranking the blocks. The analysis identified one block of 500 to 999 acres, two blocks of 1,000 to 9,999 acres, three blocks of 10,000 to 19,999 acres and one block over 20,000 acres. It is especially noteworthy that the large block in the north part of town virtually abuts one of the large blocks in the southwest part of town. This would point toward the value of conserving the areas that would help to consolidate this connection. Unfragmented blocks were calculated on the basis of total size irregardless of political boundaries, thus some blocks extend beyond the boundaries of Washington and acreages in these other towns are included in the calculation and ranking.

Wildlife in Washington

Summer Bat Survey

In 2002 the US Fish & Wildlife Service secured the services of Bat Conservation and Management of Pennsylvania to conduct field surveys for woodland bats in New Hampshire. One of the survey sites was located on the western border of Washington on Twin Bridges Road, an un-maintained road that is the nexus of several wetlands. On the night of July 18, 2002 a series of four mist nets and one harp trap were set up along the road and on the bridge, and were monitored for bat captures. A total of 25 bats were captured and recorded as to species, sex, size, and a variety of other attributes.

Three species were recorded at the survey location; little brown bat, *Myotis lucifugus*; big brown bat, *Eptesicus fuscus*; and northern long-eared bat, *Myotis septentrionalis*. Big brown bats frequently come into contact with humans, as they are known to utilize attics, barns and bridges as summer roosting areas. Female little brown bats prefer to colonize in buildings and bridges as well, but the colony sites prefered by males is unknown. Northern long-eared bats are more solitary in their habits than the other two species. They roost during the day in a variety of sheltered locations including tree bark, bridges, and buildings, while preferring caves for night-time roosts.

All three species are generally considered common seasonal residents of New Hampshire, that migrate to other areas during the winter. The preference of cave roosts for Northern long-eared bats suggest that suitable cave habitat may exist in the vicinity of the survey site. The documented use of bridges as roosting sites also points to the likelihood that the Twin Bridges themselves are a roosting location.

Rare and Uncommon Species and Natural Communities

Rare and uncommon plant and animal species have been documented in the Town of Washington in the past, and this data is maintained by the New Hampshire Natural Heritage Bureau of DRED, in cooperation with the New Hampshire Fish & Game's Non-Game and Endangered Wildlife Program. Generalized information on the presence of these species and communities is available from the Natural Heritage Bureau. According to the Bureau's "Rare Plants, Rare Animals and Exemplary Natural Communities in New Hampshire Towns" the following species and natural communities/systems are now or were at one time documented to exist in the town of Washington.

<u>Plants</u>
Carex baileyi, Bailey's Sedge (Historic)
Hippuris vulgaris, Common Mare's Tail (Historic)
Myriophyllum farewellii, Farwell's Water Milfoil (Historic)
Utricularia resupinata, Reversed Bladderwort (Historic)

<u>Animals</u>
Gavia immer, Common Loon
Ardea herodias, Great Blue Heron (rookery)
Clemmys insculpta, Wood Turtle

<u>Natural Communities / Systems</u>
Emergent marsh – shrub swamp system
Medium level fen system

According to *Identifying and Protecting New Hampshire's Significant Wildlife Habitat* published by the Non-Game and Endangered Wildlife Program of the New Hampshire Fish & Game Department, two species are likely to occur in the town of Washington based on known occurrences of species and the mapping of their preferred habitat. *Alasmidonata varicosa*, the Brook Floater mussel is state endangered. *Alasmidonata heterodon,* the Dwarf Wedge Mussel is state and federally endangered. Both species are predicted by the Fish & Game publication to be potentially present in stretches of the Ashuelot River that have a firm, fine sandy bottom.

There is the potential for numerous other species of concern to occur in Washington, based on known species ranges and the existence of appropriate habitat. Field surveys in the Town that target the documentation of such species are recommended to verify whether these species occur in Washington, in which case measures could be taken to conserve critical habitat.

Specific location data on these resources is not currently available on a Town-wide basis, however. In addition, the Town has never been systematically and comprehensively inventoried for the presence of rare or uncommon species or natural communities, and thus the current data should not be considered a complete record in this regard. A brief field survey was conducted as a part of this project for the purpose of identifying undocumented rare or uncommon species or communities in Washington. The results of this effort can be found in Appendix B. Further field-based inventory efforts would help to enhance the results of this project, and would provide the finer level of detail that is necessary for the identification and protection of such potential resources.

Map 4. Wildlife Habitat

5. Historical and Cultural Resources

Map: Historic and Cultural Resources

Values of Historic and Cultural Resources

Every town or city has its own unique history and story, contributing to a shared sense of community, and of place and time. This legacy is continually being added to, and this accumulation of local experience and knowledge can enrich the lives of the inhabitants. Over time, certain features will endure and be celebrated, while others will change and gradually disappear. In an effort to record what are recognized to be the most important of these features, this Chapter identifies and maps many of them. Open space provides context for historical, cultural and natural features in Washington, and much of this open space has been preserved by conservation easements, fee ownership or other means. These Conservation and Public Lands help to maintain the rural character of the town, and are included in this Chapter as cultural resources..

Jed Schwartz

Baptist church, East Washington

Sources of Information

This Section combines locally-collected information with existing datasets to display the location of features deemed to be historically or culturally important by the Town. As existing location GIS data on most of these features was unavailable, features of historical or cultural significance were newly digitizing, and combined to create new data layers. Existing data included dams and designated public hiking trails. Town representatives consulted with interested and knowledgeable Washington citizens to collect local information on features and locations, and these were incorporated into the maps and report.

Town histories were consulted as well, especially the exceptional pair of histories written about the town. The Washington History Committee published its "History of Washington" account of the earliest days of the Town in 1886, which was reprinted in 1976. Also published in 1776, Ron and Grace Jager's history "Portrait of a Hill Town" picks up where the earlier 1886 history leaves off. Together they encompass the period of the early settlement of the town in 1768 to the year of the country's Bicentennial in 1976.

New GIS layers were created for this project to show designated snowmobile trails, historic public buildings, schools, old school and mill sites, churches, cemeteries, public beaches and recreational facilities, and Town-owned properties such as Town Forests. Conservation Lands and Public Lands, which appear as base layers on most maps are also addressed here in recognition of the cultural resources that they provide and protect.

Early Washington

James and Martha Minot, representing the British granted a charter to the area now known as Washington to sixty original proprietors in 1752, reserving, however "…all White Pine Trees growing on Said Tract fit for Masting his Majesty's Royal Navy…" as the property of his Majesty the King. Known at the time by the decidedly generic name of "No. 8" (alternatively New Concord or Camden), in September 1776 the citizens petitioned the General Assembly of New Hampshire, seated in Exeter at the time, to incorporate as a Town by the name of Washington. This request was granted on December 9, 1776, making the Town the first of the many thus-named municipalities to bear the name of the famous general and first president, George Washington.

Notable Chapters in the History of Washington

First Seventh Day Adventist Church

From its roots in 1842 as "The First Christian Society in New Hampshire", and with the inspirational presence of a new Seventh-day Baptist worshipper in the fold, the Seventh-day Adventist Movement was born in Washington 1844 when a member of the congregation arose to announce his intentions to "observe the seventh-day Sabbath". After 18 years as a rather informal group of so-called "Sabbathkeepers", the fellowship organized in 1862 into a Seventh-day Adventist Church. The original 1842 church building and cemetery for these early pioneers of the Seventh-day Adventist Church, that was destined to attract a huge following and spread its message far and wide, remains to this day on a quiet gravel stretch of King Street in the south part of town.

Chris Kane

First Seventh Day Adventist Church and Cemetery, King Street

Cherry Valley Logging Camps

The glory days of logging so often chronicled and set in the White Mountains far to the north include a chapter closer to home in Washington. The northern part of town – remote, hilly, stony and generally unsuited and undesirable for productive farming did not escape the notice of commercial logging companies. Starting in 1883, "Cherry Valley" as it was known became the focus of considerable activity as the Cheney Company set to harvest the considerable timber of the area. Mills and a logging village sprung up in short order. As was the norm at the time, trees were harvested to the maximum extent possible, with no thought to the future of the stands. As quickly as it appeared, the steam saw mill that had been so active shut down abruptly in 1888, the 800 acres of virgin forest having been heavily cut.

A new company arrived with hopes of producing different forest products, and from 1901 to 1918 tennis racquets, chair parts and bobbins were produced from wood in the valley. After the departure of the last company many of the logging buildings still survived, however, and by the 1920's the public was invited to visit and camp there. Around 1920 portable saw mills came into common use, and a new era of logging ensued in Cherry Valley. In 1921 a large property in the valley was deeded to the State of New Hampshire by Albert E. Pillsbury, ushering in the start of a new regime of recreation in the area under the auspices of the State, and Pillsbury State Park was born.

Real Estate Boom of the 1960's

While not the first time that quiet Washington became the destination of tourists and seasonal residents, the boom period of development subdivisions in the 1960's introduced development pressures of an entirely unprecedented order. While summer cottages and retirement homes had had a modest impact on the town previously, the intensive subdivision into small lots along the western shores of Highland Lake in the 1950's served as a prescient warning that even remote Washington, with only about 165 inhabitants at the time, could not remain largely undiscovered forever.

A casual observer of the tax map of the town will not fail to notice the legacy of the next decade. In that time, before the Town Land Use Ordinance of 1974 required a minimum lot size of 2 acres, two huge developments of small lots with access to two of the Town's largest water bodies were approved. First the 1966 Washington Lake Estates development on Island Pond, followed a few years later in 1969 by the Lake Ashuelot Estates development, they added hundreds of lots to the tax map in short order. Both projects were the brainchildren not of an out-of-state developer, but of an entrepreneur born-and-raised in neighboring Hillsboro. Today, numerous homes stand on many of these lots, while many others remain vacant and un-built to this day.

Chris Kane

Old Town Cemetery

Table 5. Historical and Cultural Features

Historic Features in Washington

ID	Name of Feature	Type	Date	Source	Comments
1	#6 School Site	school		RJ/GJ	approximate location of #6 School, now residence
2	#8 / 10 School Site	school site		RJ/GJ	approximate location of District 8 / 10 School
3	# 10 / 8 School Site	school site		RJ/GJ	approximate location of District 10 or 8 School
4	#5 School	school	1849	RJ/GJ & aerial	District #5 School house - maintained
5	Methodist Church (Purling Beck Hall)	church	1859	RJ/GJ	Methodist Church, maintained
6	Calvinist Baptist Church	church	1877	RJ/GJ	Baptist Church, maintained
7	Carr's Mill Site	mill site		RJ/GJ	approximate site of old mill
8	Lovell Creamery Site	mill site	1886	RJ/GJ	approximate site of old mill
9	Tipping Rock	geological		GPS	GPS points taken at rock (rock is in Bradford)
10	Old Cemetery	cemetery		WCC	approximate location of old cemetery
11	#7 School Site	school site		RJ/GJ	approximate location of site #7 school was moved to
12	#3 School Site	school site		RJ/GJ	approximate first location of #3 School
13	Thissell Cemetery	cemetery		WCC	approximate location of cemetery
14	#4 School Site	school site	1827	RJ/GJ	approximate location of old brick school house
15	#3 School Site	school site		RJ/GJ	approximate second location of #3 School
16	Twin Bridges	bridge site		WCC & GPS	2 rock foundations for bridges
17	Devil's Chair	geological		WCC	approximate location of rock feature
18	Butterfield Mill	mill site	1842	RJ/GJ	site of Butterfield Mill, and dam
19	#9 School Site	school site	1846	RJ/GJ	approximate location of school site

20	Cherry Valley Mill Site	mill site	1883	RJ/GJ	approximate location of mill site
21	Gove's Mill Site	mill site	1842	RJ/GJ	approximate location of mill site
22	Cherryvale School Site	school site	1901	RJ/GJ	approximate location of school site
23	Old Dam	dam		WCC	
24	School Site	school site		RJ map	
25	#2 School	school site	1813	RJ/GJ	site of District #2 school
26	Dole Cemetery	cemetery		WCC	
27	Town House	town hall	1789	RJ/GJ	Town House - maintained and used
28	#1 School	school		RJ/GJ	School house - maintained
29	Congregational Church	church		RJ/GJ	Congregational Church actively used
30	Lovell House Hotel Site	old inn site	1891	RJ/GJ	site of inn expanded from old house
31	Shedd Free Library	library	1869	aerial	actively used library
32	Crescent Mill Site	mill site	1830	RJ/GJ	site of old mill
33	Washington Manufacturing Co. Site	mill site	1880	RJ/GJ	site of old mill and factory
34	Newman & Wiley Mills Site	mill site	1850	RJ/GJ	site of old mills, also called Gage's Mill
35	Old Dam Site	dam site		GPS	old dam foundations below present dam
36	Seventh Day Adventist Church	church	1841	RJ/GJ & GPS	Seventh Day Adventist Church, maintained
37	Seventh Day Adventist Cemetery	cemetery		RJ/GJ & GPS	Seventh Day Adventist Cemetery - maintained
38	Old Town Cemetery	cemetery		GPS	old cemetery - maintained
39	New Town Cemetery	cemetery		GPS	new cemetery - maintained
40	Old Mill Site	mill site		GPS	old stone foundations of mill
41	Montford Retreat and Chapel	chapel		TT	
42	Mays Tavern & Croydon Turnpike Gate	tavern	1820	TT	

43	Tavern Site on Old County Road	tavern site		TT	
44	Willey Family infant graves	cemetery		TT	
45	Towne's Mill Site	mill site	1875	TT	
46	Methodist Church Site	church site		TT	
47	Robert L. Moore Memorial Marker	monument	1941	TT	
48	Faxon House	house		TT	
49	NH Civil War Monument	monument		TT	First Civil War monument in the Country
50	Site of Dickey's Lumber Mill	mill site		TT	
51	Site of Marshall's Cooper Shop	shop site		TT	
52	Baptismal Steps for Baptist Church	church site		TT	
53	Old Brick Factory	factory site		TT	
54	Collins Mill Site and Dam Site	mill site		TT	
55	Old Mill Site	mill site		TT	
56	Washington Elementary School	school		TT	current elementary school
57	Site of Town Poor Farm	farm site		TT	
58	Old Mill Site	mill site		TT	
59	Old Mill Site	mill site		TT	
60	A.P. Dam Site	dam site	1872	TT	
61	Site of Old Brick Factory	factory site		TT	
62	Site of Old Starch Mill & Dam	mill site		TT	
63	Camp Morgan Lodge and Beach	lodge & beach		TT	Public beach
64	Paul P. Morgan Memorial	monument		TT	

Soueces:	RJ/GJ =	Jager, R. & G. Jager. 1977. Portrait of a Hill Town: A History of Washington, N.H. 1876-1976.
	GPS =	Mapped using GPS unit in the field
	TT =	Tom Taylor
	WCC =	Washington Conservation Commission
	Aerial =	1998 Black & White Digital Orthoquad photo

Recreational Resources

One of the most attractive aspects of the town of Washington is its accessibility for recreational pursuits. Trails, beaches, mountain peaks, lakes and scenic farm vistas beckon to inhabitant and visitor alike. Luckily, enjoying rural Washington is relatively easy, as the town is endowed with an extensive network of trails that support a variety of recreational uses by hikers, bicyclists, skiers and snowmobilers, as well as public water access points for boating, swimming and fishing.

Pillsbury State Park

Albert Enoch Pillsbury, an original founder of the Society for the Protection of New Hampshire Forests, deeded some 2,400 acres of the land in what was once commonly referred to as "Cherry Valley" to the State of New Hampshire in 1921. A relatively remote valley that had seen considerable commercial logging in the days starting around 1883, this new public property became the kernel for what would eventually grow to over 5,000 acres of remote, wilderness landscape that is today's Pillsbury State Park. Dominating the northern portion of Washington, and spilling over into neighboring towns, the park provides a true wilderness experience with primitive camping, remote hiking trails and isolated wild ponds and peaks.

Lovell Mountain

At 2,496 ft. Lovell Mountain, also known as "Lovewell" Mountain is the highest point in Washington. Commanding a view of much of Washington and surrounding towns, it is accessible by the Monadnock-Sunapee Greenway and other trails. While a housing development now climbs the flanks of a portion of the mountain, much of the upper slopes are protected by a combination of State-owned parkland and privately held conservation lands.

Trails

A major section of the Monadnock-Sunapee Greenway Trail crosses from south to north through Washington. This regional hiking trail is the major through-hiking route in this part of New Hampshire. A useful guidebook is available to those who have an interest in following the well-known and well-maintained trail across the high country of southeast New Hampshire (Hardy, D. 1991). Numerous other trails have been laid out in Washington, including approximately 57 miles of snowmobile trails and 60 miles of other multi-purpose hiking trails. The routes of these trails were specially mapped for this project, and they can be seen on the Historic and Cultural Resources map.

Water Access

Numerous lakes and ponds in Washington provide opportunities for swimming, boating and fishing. Town-owned public access is available at Mill Pond in East Washington and at Camp Morgan beach at the eastern end of Millen Lake for all these activities. The

State of NH maintains a public ramp at May Pond in Pillsbury State Park, and other public access points are located at Smith Pond, Island Pond, Ashuelot Pond and Millen Lake.

Jed Schwartz

Lake Ashuelot, boat ramp on right

Table 6. Conservation and Public Lands in Washington

Name	Type	Acres	Grantee	Grantee Type
Wild Pond Easement (portion)	CE	282	SPNHF	Private Organization
New Forestry LLC	CE	969	SPNHF	Private Organization
Pillsbury-Sunapee Corridor	FO	589	DRED	State Agency
Ashuelot Wildlife Sanctuary	FO	25	ASNH	Private Organization
Farnsworth Hill Town Forest	FO	146	Washington	Town
Huntley Mountain Town Forest	FO	106	Washington	Town
Barrett Pond Town Forest	FO	191	Washington	Town
Back Mountain Town Forest	FO	65	Washington	Town

New Road Town Forest	FO	45	Washington	Town
Old Meadow Town Forest	FO	10	Washington	Town
Camp Morgan	FO	157	Washington	Town
Pillsbury State Park (Washington portion)	FO	5000	DRED	State Agency
Clark Robinson Memorial Forest	FO	243	NEFF	Private Organization
Highland Lake Island	FO	1	SPNHF	Private Organization
Andrews - LVT	FO	40	SPNHF	Private Organization
Journeys End	FO	202	SPNHF	Private Organization
Webb Forest Preserve LLC	CE	730	SPNHF	Private Organization
Andorra Forest (Washington portion)	CE	792	SPNHF	Private Organization

Source: GIS analysis, Kane & Ingraham, 2007

Conservation and Public Lands

Conservation and Public Lands protect open space and traditional uses. These lands typically have no buildings or other complex man-made structures in current service. The lands may remain in their natural state to serve important environmental and/or aesthetic functions, or they may be used for agriculture, forestry and/or outdoor recreation. Either way, they ensure the continued functioning of natural processes and recreational resources that are essential to sustaining Washington's quality of life. Open space lands may also have historic structures or may have supported former uses that are important elements of Washington's history. Table 6 above shows the current list of Conservation and Public Lands in Washington.

Washington Town Forests

The Town Forest properties are held by the Town and have traditionally been used for recreation and forestry. In the case of Camp Morgan, uses and improvements also include a school, beach, ball field and lodge. A very thorough plan was commissioned by the Town of Washington and produced by Lionel Chute and Garrett Dubois in 1999. See a discussion of the Town Forest Management Plan in the accompanying Conservation Plan document.

The continued use of these properties for conservation purposes is not guaranteed, however. The Town is not legally bound to continue this use, and in fact has the right to change this use to include other municipal uses with structures and improvements, and even sale to private owners. For this reason, numerous municipalities in New Hampshire have placed conservation easements held by third-party trusts such as a land trust on their Town conservation lands. This ensures that future Town boards would not be able to sell or improve these lands for non-conservation purposes, in perpetuity.

Map 5. Historical and Cultural Features

6. Soils

Map: Soils

Values of Soils

Much of the settlement patterns, land use history and ecology of the town of Washington has been determined by the character and placement of its soils. The soils underlying the town today originated as mineral materials transported by water or glacial melt-down at the end of the last Ice Age, approximately 14,000 years ago. Altered over time by moisture, the addition of organic materials and chemical oxidation/reduction, they provide a diverse substrate to today's activities and processes both natural and cultural.

Soils are classed by the Natural Resources Conservation Service (NRCS) according to many criteria, and for various purposes including construction, forestry and agriculture. In this study, special attention was paid to Important Forest Soils and Significant Agricultural Soils. As the foundation of much of the historical economy of the town, and as a continuing source of both private and public revenue, commercial activities in large measure depend on these especially productive soils for their success. Soils cannot be practicably replaced or recreated once they are degraded or removed, and thus the conservation of the soils themselves, as well as the land on which they occur should be an important consideration of the town.

Soils in Washington

All soils in Washington are displayed on the map as unique color values, labeled with their NRCS codes. A hatched overlay indicates Designated Prime Soils, Agricultural Soils of Statewide Significance or Agricultural Soils of Local Significance. Active Agricultural Areas are also be indicated. The map also distinguishes areas and classes of Hydric Soils. Important Forest Soils are displayed on the Forest Productivity and Biodiversity Map, and are addressed in more detail in Chapter 2, Forest Productivity and Biodiversity Chapter.

Important Agricultural Soils in Washington

The Farmland Protection Policy Act of 1981 was established to ensure that federal programs are compatible with state and local efforts to limit the conversion of farmland to other uses. The states and counties followed suit shortly thereafter by bestowing their own designations on state and locally important soils. The classes mapped in New Hampshire and available from the GRANIT GIS data system are Prime Soils, Soils of Statewide Importance and Soils of Local Importance. 5,446 acres of all combined designations of Important Agricultural Soils are mapped by NRCS in Washington, representing 17.9% of the total area of the town. The designations and the criteria upon which they are developed are outlined below.

Prime Soil Designation

These superior agricultural soils are deep and arable, with the ability to sustain commonly grown cultivated crops 7 or more years out of 10. These soils are suitable for a variety of agricultural uses, and are of the highest quality designation. The USDA Land Use Policy of 1983 that established the Prime Soils designation describes these highest quality soils as follows:

> *Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is also available for these uses (the land could be cropland, pastureland, rangeland, forest land, or other land but not urban built-up land or water). It has the soil quality, growing season, and moisture supply needed to produce, economically, sustained high yields of crops when treated and managed, including water management, according to acceptable farming methods. In general, prime farmlands have an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt and sodium content, and few or no rocks. They are permeable to water and air. Prime farmlands are not excessively erodible or saturated with water for a long period of time, and they either do not flood frequently or are protected from flooding.*

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Corn field #5, Eckard farm, E. Washington

Soils of Statewide Importance

These soils are deemed significant for the production food, feed, fiber, forage and oilseed crops in New Hampshire. Determination of Statewide Importance ranking is made by a state committee with representatives of the Department of Agriculture, Markets and Foods, UNH Cooperative Extension, NH Association of Conservation Commissions and the NH Office of State Planning. Originally established in 1983, the criteria for designation were updated in 2000.

Soils that are not otherwise designated as either prime or unique must meet the following criteria for inclusion in the Statewide Importance ranking:

- Have slopes of less than 15%
- Are not stony, very stony or bouldery
- Are not very poorly, somewhat poorly, or poorly drained
- Are included in soil complexes comprised of less than 30% shallow soils and rock outcrop and slopes that do not exceed 8%
- Are not excessively well drained soils developed in stratified drift, and that generally have low available water holding capacity

Table 7. Important Agricultural Soils in Washington

Important Agricultural Soils	
Acres	**Soil Ranking**
326	All Areas are Prime Farmland
246	Farmland of Statewide Importance
4,875	Farmland of Local Importance
5,446	Total

Source: Natural Resources Conservation Service Soil Survey 2001

Soils of Local Importance

Soils of Local Significance are soils that are not otherwise designated prime, unique or of statewide importance that are deemed by each of the County Conservation District Boards as being locally important for the production of food, feed, fiber and forage. In Sullivan County these are:

- Soils that are poorly drained, have artificial drainage established, and are being farmed

- Specific soil map units identified from the NRCS county soil survey legend, as determined by the Conservation District Board.

Protection of Significant Agricultural Soils

Washington has very few acres that are designated Prime or of Statewide Significance (326 acres and 246 acres respectably). Several areas where important agricultural soils are located in Washington have already been converted to non-agricultural use to residential use. Notable examples are southwest of Ashuelot Pond, the Washington Village district, and parts of East Washington. Only 5.1% of the important agricultural soils in Washington are currently under some sort of protection in conservation areas that would prevent such development. The relative scarcity of such soils in the town highlights the need for proactive conservation efforts to preserve the remaining undeveloped high-quality agricultural soils.

Active Agricultural Areas

The remaining actively-used agricultural areas in Washington provide several values to the town, including scenic enjoyment, economic benefit and preservation of a reminder of an agrarian past. Wildlife also benefit greatly from the retention of such open lands, a topic discussed in the previous Wildlife chapter.

276 acres of actively maintained agricultural areas were identified in the Town based on the interpretation of the 1998 aerial photography and local input. They are shown in a horizontal violet hatch on the Wildlife Map. These areas, 37 in all, range in size from less than one acre to 42 acres. In several cases these areas are clustered together but separated by roads or un-managed margins. The most significant areas in terms of combined size is the concentration of 17 zones in East Washington which in combination total 130 acres. Other areas are scattered across the central portion of the Town. At merely 1.04% of the total land cover of the town, actively-used agricultural land is quite scarce in Washington.

Hydric Soils

Hydric soils in general are soils that were formed under conditions of saturation, flooding, or ponding for a long enough period during the growing season to develop anaerobic conditions in the upper part. These soils are sufficiently saturated or inundated long enough during the growing season to support the growth and reproduction of vegetation that predominates in hydric conditions (hydrophytic vegetation).

In 1993 the Soil Survey Division Staff in its 1993 Soil Survey Manual identified seven natural drainage classes for soils in the United States: excessively drained, somewhat excessively well drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained. The two classes at the wetter end of this spectrum are normally associated with wetlands and hydrophytic vegetation. The Soil Survey Manual includes the following generalized descriptions of these soil classes:

> ***Poorly drained.*** *Water is removed so slowly that the soil is wet at shallow depths periodically during the growing season or remains wet for long periods. The occurrence of internal free water is shallow or very shallow and common or persistent. Free water is commonly at or near the surface long enough during the growing season so that most mesophytic crops cannot be grown, unless the soil is artificially drained. The soil, however, is not continuously wet directly below plow-depth. Free water at shallow depth is usually present. This water table is commonly the result of low or very low saturated hydraulic conductivity of nearly continuous rainfall, or of a combination of these.*
>
> ***Very poorly drained.*** *Water is removed from the soil so slowly that free water remains at or very near the ground surface during much of the growing season. The occurrence of internal free water is very shallow and persistent or permanent. Unless the soil is artificially drained, most mesophytic crops cannot be grown. The soils are commonly level or depressed and frequently ponded. If rainfall is high or nearly continuous, slope gradients may be greater.*

Hydric soils are mapped widely in Washington, normally in the same locations as the wetlands that they underlay. Mapping standards are somewhat more precise for hydric soil units mapped by the Soils Service than for the wetlands mapped by the National Wetlands Inventory, which used aerial photography almost exclusively to delineate wetlands. Reference to both coverages will provide a more comprehensive understanding of the location and extent of wetlands in Washington.

Map 6. Soils

7. Tax Parcels

Map: Tax Parcel Overlay

Tax Parcel Overlay

An overlay map was produced to display digital tax map data as a series of parcel outlines, with map and lot codes in most cases, printed on a transparent mylar sheet at the same scale as all other project maps. Where parcels are small and densely arranged, lot number labels were impractical and were thus omitted. The tax parcel data was current as of 2005, and was provided by Terra Map. This overlay map will be useful to determine how important resources are associated with specific parcels. It will also be useful for general planning and Town board purposes. Existing parcels as of 2005 and potential future parcels are further discussed in Chapter II, Build Out Analysis herein.

There were approximately 2,200 separate tax parcels in Washington as of the time of this report. Large areas of the northern portion of the town are in conservation, either as a part of State-held lands such as Pillsbury State Park, or in conservation easements held by conservation organizations such as the Society for the Protection of New Hampshire Forests on private lands. Parcels in private ownership vary in size from under one-tenth acre in seasonal home areas such as Ashuelot Pond, to over 500 acres in less settled parts of town. Several areas in the south two-thirds of the town are intensely parcelized, whereas much of the surrounding landscape remains in relatively large, undeveloped parcels.

Map 7. Parcel Overlay

8. Watersheds

Map: Watershed Boundaries Overlay

Introduction

Municipal, County and State boundaries in and of themselves are irrelevant or non-existent from the standpoint of plants and animals, and the physical landscape and elements that interact and co-exist with humans. However, delineations of the landscape that are based on real physical characteristics have meaning and utility, and can reflect the differences that are observable at various scales. One such delineation that has utility is that of watersheds.

Every part of the terrestrial portions of the earth are contained in watersheds. Watersheds exist at an almost infinite range of scales, from the tiniest tributary stream that does not show on any map, to major continent-draining rivers. Thus one location in Washington could be in the watershed of a small un-named stream, that is also nested in the somewhat larger watershed of the Marlow Tributaries to the Ashuelot River, that is in turn nested in the much larger watershed of the Ashuelot River, which is in turn nested in the huge, regional Connecticut River watershed.

In some instances the dividing lines between major drainages form real biological boundaries for the organisms and natural systems that occur there. In other instances, watershed boundaries are more useful to indicate subtler distinctions, such as likely concentrations and routes of migrating wildlife, or nutrient cycles reflective of forest condition. Regardless of the application of them, watersheds are a convenient and physically definable way to parse the landscape into smaller units. The question becomes one of scale and which might be more useful for a particular purpose.

HUC 12 and SPARROW Watersheds

In the accompanying map, HUC 12, or 12-digit sub-watershed level boundaries are displayed as bold dotted blue lines on a to-scale transparent mylar overlay for use with the other maps. Because the level of HUC watershed distinction is limited at the town scale, the boundaries in the SPARROW Watersheds data layer were added as finer lines to indicate finer watershed divisions.

In the 12 digit HUC delineation major river basins are divided into smaller hydrogeographic regions based upon a coding system developed by the United States Geological Survey and adopted by the State of New Hampshire. This numbering scheme is called the Hydrologic Unit Code (HUC). Each Hydrologic Unit is further divided into smaller sections, or watersheds, and each watershed is assigned a 3-digit code. For convenience and easy recognition the watersheds are also referred to by name, usually associated with a significant waterbody within the watershed.

The HUC watershed divisions are labeled the accompanying map on both sides of the divides with the name of the watershed drainage. The lines shown delineate the various sub-divisions of watersheds by indicating divisions between adjacent watersheds. Thus, the boundaries always follow the highest points of the terrain that separate adjacent watersheds. To interpret the watersheds on this overlay, it is best to view it with the underlying streams and surface waters showing on another map, and with topographic contours.

SPARROW (SPAtially Referenced Regressions On Watershed attributes) is a watershed modeling technique for relating water-quality measurements to attributes of the watersheds. The model predicts contaminant flux, concentration, and yield in streams and has been used to evaluate alternative hypotheses about the important contaminant sources and watershed properties that control transport over large spatial scales. (2008, USGS Website)

On the Cusp of Major Watersheds

The portions of HUC level watersheds that occur in Washington are Upper Warner River, Highland Lake, Ashuelot Pond, South Branch, Beards Brook, Shedd Brook and the Marlow Tributaries to the Ashuelot River. Situated as it is on the highlands between Mt. Sunapee and Mt. Monadnock, Washington straddles the dividing line between the Connecticut River drainage and the Merrimack River drainage. The dividing line between these two regional watersheds follows a roughly north-south line that passes a short distance to the west of Washington Village. By virtue of its topographical location, Washington is truly connected hydrologically not only with the rest of southern New Hampshire, but also with the other states of Vermont, Connecticut and Massachusetts.

Map 8. Watersheds

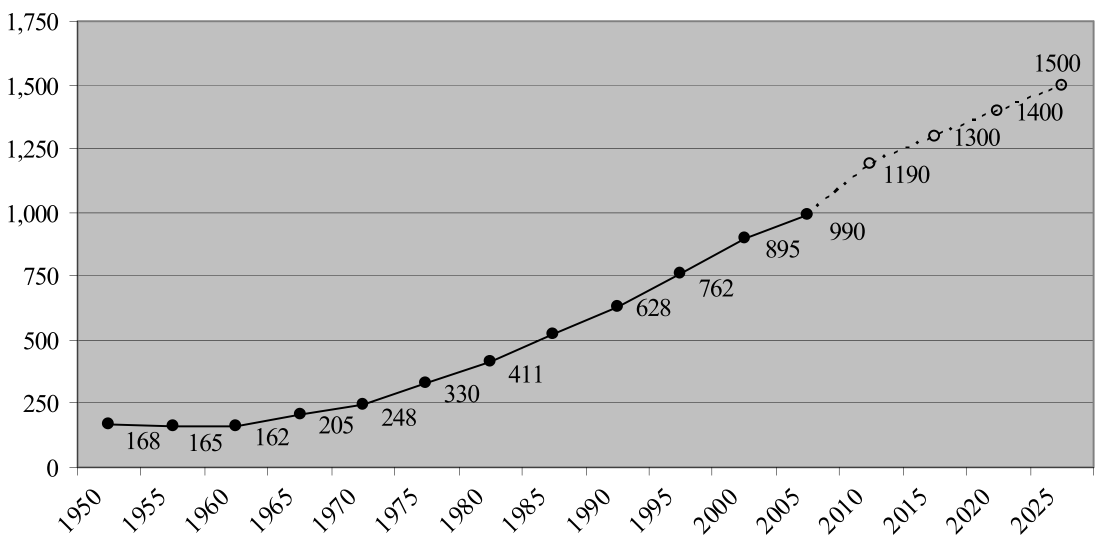
B. Developed Lands and Considerations for Further Development

Introduction

Development of any kind (roadways, housing, commercial, or industrial) can have effects on natural resource values from water quality to wildlife habitat to forest health. As part of this Natural Resource Inventory the authors took a careful look at development and other factors which might have potential negative effects on Washington's natural resource values or rural character. We did this mainly through three primary analyses, each of which are described in this Chapter:

1. Inventory current developed lands
2. Mapping of constraints to development
3. Build-out analysis

Table 8. Washington, NH Population, 1950 - 2025



(NOTE: 2005 – 2025 estimates represent NH Office of Energy and Planning predictions)

Background

Broadly speaking, housing and commercial development are directly proportional to population growth[1]. Washington's population, though small, has increased steadily since 1950. The 1950-2000 trend represents a four-fold increase (approximately 40% growth every decade), far greater than New Hampshire as a whole at an approximate doubling of population over the same period. While this rate of growth is predicted to slacken

[1] *New Hampshire's Changing Landscape, 2005*, Society for the Protection of New Hampshire Forests

between 2005 and 2025, a population growth of approximately 550 people can be expected. (see Table 8: Washington, NH Population, 1950-2025)

The effect of this kind of growth varies over time and space, but necessarily comes with an increase in housing and the associated services and effects on the transportation network. In a statistical model created for *NH's Changing Landscape, 2005* Washington is predicted to lose about 500 more acres of forestland (it's primary landcover and natural resource) by 2025, primarily to residential development.

9. Developed Lands and Constraints to Development

Map: Constraints to Development

Introduction

To plan for both conservation and future growth concurrently, it is critical to consider existing developed areas and development suitability. Development represents significant barriers to ecological flows (wildlife corridors, continuous forest, watershed intactness) and, while theoretically reversible, such areas are for all intents and purposes permanently removed from the natural resource base. To map the potential for total development in Washington, and to focus conservation efforts on areas most vulnerable to development, constraints to development were mapped. These constraints represent both undeveloped areas with such physical limitations as steep slopes or Comprehensive Shoreland Protection Act zones, and areas unavailable to development due to their status as conservation land, for instance.

The analyses described below include an inventory of Washington's currently developed areas and a mapping of other constraints to development.

Developed Lands

This map shows development-related features, and areas with physical and/or regulatory restrictions to new development. Developed lands were mapped through interpretation of remotely sensed data and local knowledge. Developed features were digitized based on three data sources: 1998 digital orthophotos produced by GRANIT, 2003 National Aerial Imagery Program orthophotos produced by the USDA, and digital USGS topographic maps. Developed features included any manufactured structure or surface such as homes, commercial establishments, parking lots, paved roads, athletic courts, and landscaped areas directly associated with and adjacent to structures. (See Appendix H, Metadata for further descriptions.)

Constraints to Development

Absolute Constraints

The mapped areas below are generally considered to be places where development can not occur because of severe site limitations or regulatory restriction.

Wetlands: Wetlands over ½ acre are restricted from development in New Hampshire. Areas include all palustrine (open and forested freshwater wetlands not associated with rivers, lakes, or ponds), lacustrine (open water wetlands), and riverine wetlands mapped as part of the US Fish and Wildlife Service National Wetlands Inventory. Wetlands are under the jurisdiction of the New Hampshire Department of Environmental Services, which requires a permit to cross or disturb most wetlands. A Minimum Impact

Expedited Permit is required for the construction of a seasonal slip or dock, a culvert for a single-family driveway, construction of a small pond, or crossing a perennial stream for a single-family residence. Other uses require a Standard Dredge and Fill Permit, and permit requirements increase at the 3,000 and 20,000 square foot thresholds of square footage disturbance, depending on the proposed purpose.

Well Head Protection Areas: Wellhead Protection Areas (WHPA's) for public water supplies, mapped by NH Department of Environmental Services, are meant to protect areas with influence on drinking water quality. WHPA's are delineated based on NH DES source water protection priorities; radii for wells are based on intake volume; surface water intakes are based on partial watershed delineations. Development in WHPA's is restricted.

Steep Slopes (> 25% slopes): Areas of very steep slope are assumed to be cost-prohibitive enough to restrict development entirely, because of the high cost of site and structural engineering, access, water withdrawal, and septic design and engineering.

Permanently Protected Conservation Lands: Permanently conserved lands are, by definition, not available for development, and therefore completely constrain development. It is important to note that permanently conserved lands do not include all conservation lands; for instance, several town forests in Washington are not permanently protected and therefore may potentially be developed.

Partial Constraints

The following mapped areas are considered to be developable, but are either unattractive to development because of site characteristics or are subject to regulatory hurdles.

The Comprehensive Shoreland Protection Act Zones (CSPA): The CSPA prohibits certain development within 250 feet of any waterbody 10 acres or greater, or streams fourth order or greater. Development is subject to more strict erosion control, setbacks, lot size limitation, landscaping practices, and septic standards. In addition, vegetated buffers are required in some areas. The CSPA restricts uses along the shores of most water bodies, and two streams in Washington. All major water bodies with the exception of May Pond have significant concentrations of residences within the 250 foot buffer area that the CSPA applies to.

Town Forests: Several town forests in Washington are not permanently protected by law, and thus are not mapped as areas with absolute constraints to development. While they are unlikely to be developed without approval from the citizens of Washington, they can potentially be developed for schools, town offices, etc. or sold to private entities without restrictions.

Cemeteries, School yards, and Other Town-owned Lands: These lands are subject to the same caveats and assumptions as currently developed lands and town forests.

FEMA Floodplains: Areas prone to flooding are mapped by the Federal Emergency Management Agency (FEMA) in co-operation with NH GRANIT. Mapped areas include the 100 year floodplain, *i.e.* any area with a 1% probability of flooding in any given year. The most extensive areas are the corridor of the Ashuelot River above Ashuelot Pond, Bog Brook, and a source brook at the southeast corner of Ashuelot Pond. In two areas, concentrations of residences occur in mapped flood zones – the northeast shore of Ashuelot Pond, and the north end of Highland Lake.

Steep Slopes (15 - 25% slopes): While potentially developable, these slopes have lower potential for favorable septic designs, may not have ideal access, and are at a higher risk for erosion.

Map 9. Constraints to Development

10. Potential Threats to Natural Resources Model

Introduction: Patterns of Development

Early development of the Town of Washington was concentrated on the relatively few areas of productive farmland, locales suitable as mill sites, and along the main roads in town. Thus, development was relatively clustered in the villages and scattered along transportation routes. The cultural, technological and economic underpinnings of this pattern have been altered since the advent of internal combustion engines and automobiles, which allowed convenient and quick access to Washington from more distant locations. Farming and small industrial activities have now diminished in importance, to be largely supplanted by tourism and seasonal vacation activities and increasingly suburban development. Considerable subdivision projects were approved in Washington in the vicinity of Ashuelot Pond and Island Pond in the 1960's, and this trend is expected to continue at some level.

Concept of Threats Model

Conservation planning necessarily rests on identifying resources worth protecting through analysis, prioritization, and ranking of conservation targets. This qualitative analysis of threats to natural resources offers a way to prioritize within those targets deemed important.

The concept behind this model is that places more attractive for development are more likely to be developed. We hypothesize that natural resources which overlap those places more likely to be developed are more threatened and, depending on the resources that they contain, may be more urgently worthy of conservation than equally important but less threatened resources.

This model took into consideration the various factors that make one parcel of land more suitable for development than another, and extended this logic to identify areas of the town that were more likely to be developed than others. The model included developed lands, or those locales with a high-potential to be developed based on proximity to existing roads, low elevation, modest slope, and soils favorable for development. Again, identifying development-related threats to Washington's landscape will be critical to protecting natural resources and functioning ecosystems.

This model was created to take a simple, non-quantitative look at how attractive it would be to develop a place. It is meant to provide general guidance for conservation prioritization. Depending on the situation, it may be useful as a "tie-breaker" in cases where multiple, otherwise equally compelling conservation projects are competing for funds. The model is not meant to be a quantitative, probabilistic, or predictive model of development. Though the final map output does use a numeric index, one should not assume that a locale scoring 2 is twice as likely to be developed as a locale scoring 1.

Figure 1: Threats Model Map

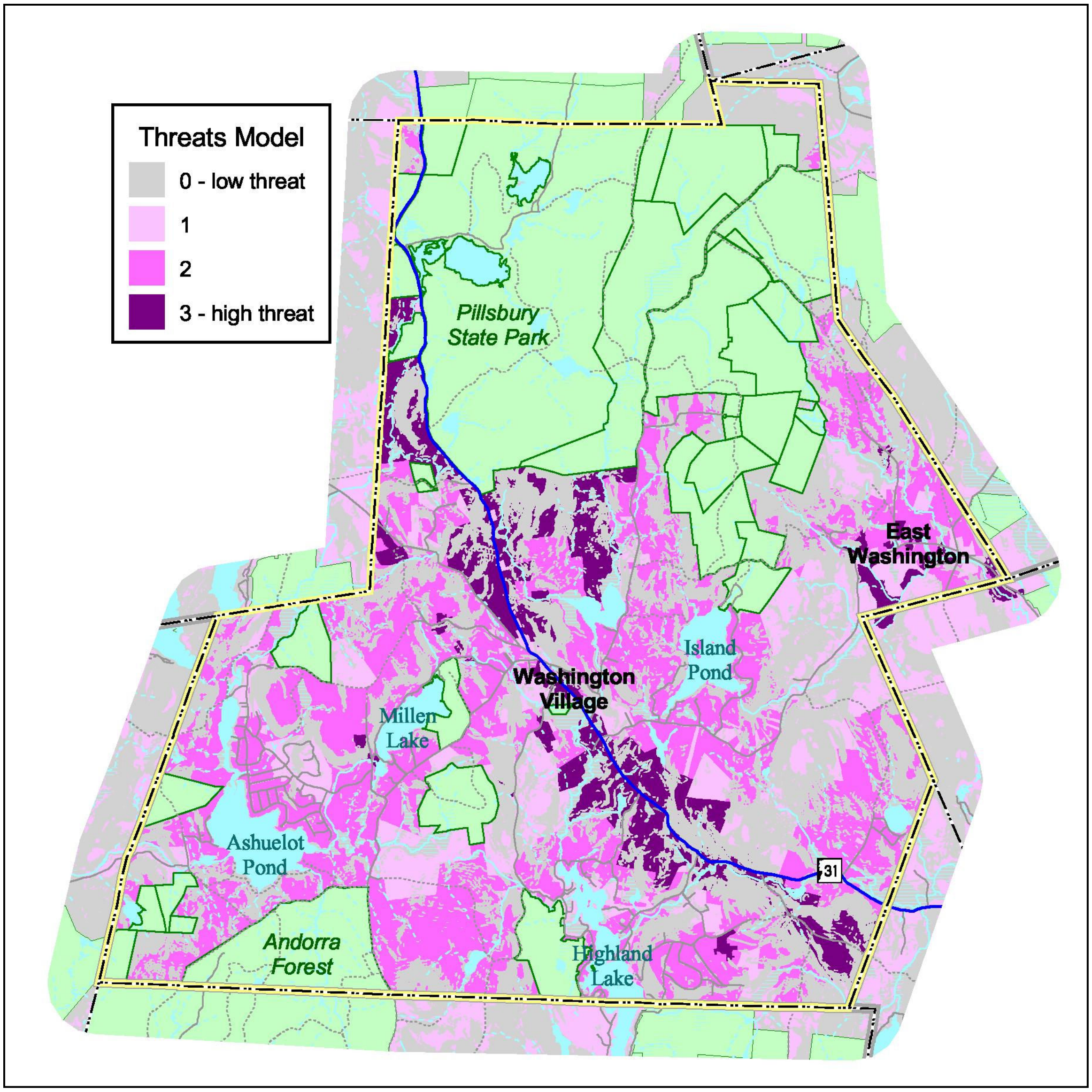


Table 9 describes the various factors incorporated into the model, listed from most attractive for development to least attractive. Generally speaking, places considered more threatened are easily developed (low slope, deep soil, no subdivision needed for example) or provided better access to cultural, recreational, or commercial amenities. Places considered less threatened are less accessible from roads and more expensive to develop due to factors such as higher slopes or less favorable soils.

All of the geographic factors were combined into a single dataset. To arrive at the final model, the maximum point value at a given place was used as the final model score. For example, if a locale was an agricultural field (3 points) located within ½ mile of a village center (2 points), the locale would score 3 points. Figure 1 graphically displays the results of the final model.

Table 9. Threats to Model Scoring

Points	Geography	Key Metric	Justification
3	Agricultural lands (crops)	tilled/hayed field	simple engineering, fewer septic issues, land cleared
3	Developable highway frontage lot	Frontage lot on NH 31 AND developable (ie. Not steep or wet)	highest traffic locale in town, most attractive for retail, commercial space, no subdivision needed for residential development, minimal permitting, most profit potential for development
3	Developable lake frontage lot	Lakefront AND developable	attractive second home potential
2	Developable frontage lot	Frontage lot AND developable (ie. Not steep or wet)	no subdivision needed, minimal permitting, most profit potential for development
2	Frontage lot near town center / village centers	within 1/2 mile	provides "village living", walking access to current or future amenities
2	Lake access	within 1/4 mile	attractive second home potential
1	Accessible backlots	back lot with easy access to road (one undeveloped lot from road, 'easy access')	second tier potential for subdivision
1	Easy access (no wetlands/steep slope crossings)	no wetlands/steep slope crossings w/in 1/2 mile of road	simple engineering, higher profit potential for developer
1	Hilltop / Ridgetop	1/4 mile from selected summit / ridge	view potential
1	Ideal soils	All well-drained classes, low slope (<8%)	simple engineering, few septic issues, higher profit potential for developer
1	Low slope	<5%	simple engineering, higher profit potential for developer
1	Unprotected Conservation Lands	conservation lands not protected by easement or organizational/agency	could be attractive for future income from sale, development for municipal/state /private facilities

		mission	
0	Steep Slopes	>15%	unlikely to be developed
0	Wetlands	Wetland / Hydric Soil	not developable
0	Water	Surface water	not developable

11. Build-out Analysis

This component of the project used a series of factors, both physical and regulatory, to arrive at a projection of the number of new lots that could be created under the ordinances and regulations currently in effect in Washington. The final number of lots, while not explicitly mapped in this analysis, will inform planning projections for various social, economic, and natural resource effects.

This analysis for Washington, New Hampshire incorporates current assessor's lots, developed features, and constraints to development, both absolute and partial. The various constraints incorporated into this analysis fall into the categories of developed and conserved lands, physical factors and regulatory limits. A consideration of development-related features allows a more precise total buildable lot figure and allows users a better sense of which lots are highly-buildable and therefore potentially more threatened in a natural resource conservation sense. In this analysis, it is assumed that absolute constraints completely restrict development; partial constraints are assumed to suppress the total number of buildable lots, in this case by an estimated factor of about 15%.

Assumptions and Explanation of Analysis

1. Minimum Lot Size and Frontage

The Minimum Lot Size for virtually all new lots currently and recently approved is 2 ac. under the customarily applied town ordinance. The minimum lot road frontage is currently 200 ft. For non-subdividable lots the minimum frontage was considered in the calculation.

2. Development Features Multiplier of 0.9

This figure attempts to factor in a 10% average loss of total potential new lots within matrix lots due to lack of features such as road frontage, close proximity to street intersections, need for excessive cul-de-sac length, etc.

3. Minimum Buildable Area of 0.5 acres

This factor attempts to account for an average loss of buildable area within matrix lots due to absolute constraints including steep slopes (>15%), wetlands, developed areas and conservation restrictions. The residual area left after removal for constraints is projected to be 0.5 acres per 2 acre lot, assumed to be an adequate area for the construction of residential structures.

4. Partial Constraints Multiplier of 0.85

As a consideration of the effect partial constraints including well-head protection areas, flood-prone areas, and moderately steep slopes (>10%) have on new development, 15% of the residual matrix lot area was then removed from consideration to account for these limitations.

Results of Build-out Analysis

Using this analysis, approximately 4,400 new lots could be built in Washington, resulting in approximately 6,600 total lots, or a tripling of the current count of 2,200. This result is of course an informed estimate, and actual site conditions and the application of Town ordinances and regulations to specific proposed projects would affect the number of actual new lots.

C. Analysis of Natural Resource Areas for Conservation Planning Purposes

12. Resource Co-occurrence Analysis

Map: Resource Co-Occurrence Analysis

Introduction and Rationale for Analysis

Given limited funding, time, and volunteer hours, conservation action must be strategically focused. This co-occurrence model helps to do that by focusing conservation action on resource-rich locales and by maximizing the number of resources protected per acre. This map represents the combination of all the preceding natural resources in a single model; it assigns high value to areas where there is significant coincidence of natural resources. Based on discussion and decision-making of Washington Conservation Commission members, values to individual contributing resources were assigned based on the commission's conservation goals and objectives.

Explanation of Analysis

The results of the mapping of important individual resources in the towns were combined into one map, and the areas in effect overlaid. Areas with the most coincident resources thus score higher than those areas with fewer coincident resources. Acknowledging that all resources should not necessarily be considered of equal importance, a relative weighting process was followed. In consultation with the authors, the Conservation Commission assigned points to each factor, and set sub-totals for each of the four resource groups. A total maximum cumulative value of 100 was set, and individual factors were assigned values according to their relative importance, totaling 100 points. Thus for example, Prime Agricultural Lands were assigned a score of 5, while Soils of Local Importance were assigned a score of 2. Resource Groups also have individual cumulative scores reflecting their relative importance. See Appendix F for a list of resource factors and a complete breakdown of factor scores.

Seven Water Resource factors were included:

> Aquifers, CSPA Buffers, Undeveloped SPARROW watersheds, NWI Wetlands with 100' buffer, Potentially Favorable Gravel Well Areas, Public Water Supplies, and Well Head Protection Areas. Total points – 40.

Seven Soil / Agriculture Resource Factors were included:

> Active Agricultural Areas, Prime Farmland, Farmland of Statewide Importance, Farmland of Local Importance, Important Forest Soils IA, Important Forest Soils IB, Important Forest Soils IC. Total points - 25

Eight Wildlife Habitat Resource Factors were included:

Undeveloped Lake Shores, Riparian Corridors, Un-fragmented Lands >1,000 acres, Wildlife Action Plan Grasslands, Wildlife Action Plan Floodplain Forests, Wildlife Action Plan Marsh /Shrub Wetlands, Wildlife Action Plan Peatlands, and South Facing Slopes. Total points – 25.

Two Recreation Resource Factors were included:

Monadnock-Sunapee Greenway Trail, and Other Trails. Total points – 10.

Conclusions of Resource Co-occurrence Analysis

The mapped results of this analysis show at a glance the areas of town with the highest number of combined important resources. Smaller inset maps at the bottom margin of the map, below the main model show sub-models that display the totals for three of the resource groups separately. Resource factors were grouped into four categories – Water Resources, Soils / Agricultural, Wildlife, and Recreation. By referring to these sub-models, the viewer can start to determine how different resource groupings contribute to the total model scoring. The results of the Co-Occurrence Model, when used in concert with the other resource maps, will help reveal areas of the Town that may be designated as priorities for conservation.

Some of the areas that scored the highest in this analysis are as follows:

- Barden Pond area
- North lobe of Ashuelot Pond
- Streams on east and west ends of Ashuelot Pond
- Barrett Pond
- Andorra Forest easement
- The vicinity east and west of Farnsworth Hill Town Forest
- The areas immediately west and north of New Road Town Forest
- Shorelines of ponds and riparian corridors in Pillsbury State Park
- The upper and lower riparian corridor of Bog Brook
- Nearly the entire shoreline of Halfmoon Pond
- The Freezeland Pond area

- The western shore of Island Pond
- The farm lands and Beard Brook corridor in East Washington
- Wetland areas along the upper and middle portions of Woodward Brook
- Smith Pond
- The Shedd Brook area near the Windsor line

Please refer to the accompanying map *Resource Co-Occurrence Analysis* for more detailed results and other high scoring areas.

Map 10. Co-occurrence Analysis

13. Natural Resource Greenways Analysis

Concept and Assumptions of Greenways Model

This follow-on to the Resource Co-occurrence Analysis takes an innovative and forward looking approach to conservation prioritization. While the co-occurrence approach identifies areas of high resource value, this model takes that a step further and focuses on resource-rich connections between existing conservation lands that suggest linking opportunities.

Every place is connected in some way to the other places nearby. Places are related by ecological systems, natural populations, habitat attributes, ground or surface water, or recreational opportunities. Similarly, the conservation of a tract, and therefore the natural processes that occur on that tract, cannot be separated from surrounding tracts and the natural processes thereon.

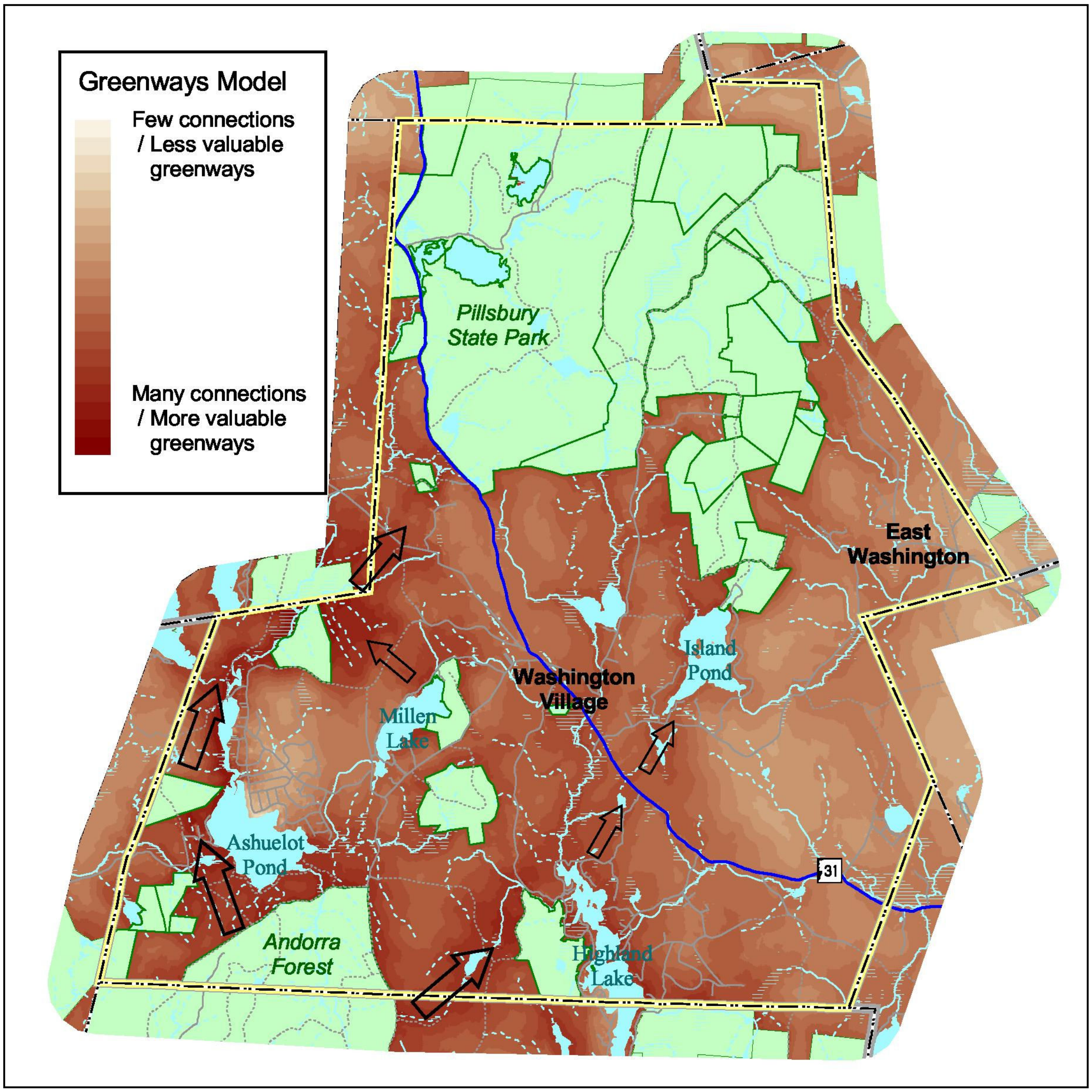
The greenways model created for this natural resource inventory aims to map important connections between existing conservation lands. The model rests on the widely-held principle that large conservation areas are more important for protecting ecological systems (and their inherent benefits to people) and are more likely to be viable in the long term. It is also assumed here that connections between conservation lands are most fruitfully made along corridors of high natural resource values.

The model assigns "gravity" to conservation lands based on size; that is, areas near large conservation lands are worth more than areas near small conservation lands (or no conservation lands) – the further away from conservation lands a mapped area is, the lower its value in the model. As the effects of gravity are additive, areas near multiple conservation lands are worth more than areas near a single conservation area. Also, since the model is meant to prioritize connections between conservation lands (with presumably high resource values), it emphasizes connections through unprotected areas with high resource values. (The specific mechanics of the model are described in Appendix G.)

The primary benefit of this model is to draw attention to places where conservation lands could be connected via areas of high resource value. These connections are most significant for recreational opportunities like trail systems. These connections are also potentially important for maintaining ecological connections such as migration corridors.

The results of the model can be seen in Figure 2 below. Darker brown areas signify more important greenways as determined by the model. Lighter brown areas indicate places with less importance for connecting conservation lands according to the model. Arrows indicate possible areas for creating connections in Washington: Andorra Forest to Highland Lake to Island Pond; Andorra Forest to Huntley Mountain Town Forest to Farnsworth Hill Town Forest; and Millen Lake to Farnsworth Hill Town Forest to New Road Town Forest and Pillsbury State Park.

Figure 2: Greenways Model



The map above indicates that the best place to build greenways in Washington is in the southwest corner of the town; there are several proximal conservation tracts there including the ~18,000 acre complex around Andorra Forest, and they are surrounded by many important resources (including riparian corridors, wetlands, and a large unfragmented block. It is interesting to note that model values near the Pillsbury State Forest complex (also about 18,000 acres) are not as high, largely because there are fewer conservation tracts nearby and fewer high-value resources.

Depending on the threshold of values used in interpreting the model, other connections will become apparent, such as the Beards Brook corridor and farmlands in East Washington, the Wild Pond easement west of Highland Lake to Clarke Robinson

Memorial Forest and Camp Morgan, and the north shore of Highland Lake. The Greenways Analysis is one tool of many that should be used to view the resources of the Town from a new perspective, and to set priorities and make decisions regarding where to focus proactive land protection.

Conclusions from Natural and Cultural Resource Inventory

The results of this Natural and Cultural Resource Inventory offer a new perspective of the Town of Washington. By using GIS mapping technology, and the abundant data that is available for GIS, the Town can be seen for the first time as a complex system of physical and natural processes, at play both independently and in interaction with humans and their activities. The project offered a comparative view of each of the resource groups, highlighting the most significant examples of these resources in Washington. In several cases, these resources are significant not only on the local level, but also at the state and regional levels as well.

Here is a list of select findings that are especially noteworthy.

- High quality, high-yield groundwater aquifers are very uncommon in Town;
- The entire Town was mapped as being significant on a state-wide or state-regional basis by the 2005 NH Fish and Game Wildlife Action Plan, an exceptional finding;
- Numerous undeveloped ponds and associated tributaries still exist in most parts of Town;
- Much of the town is protected, but conservation areas south of Pillsbury State Park are unconnected;
- Several flood prone areas already have residences and other structures within the floodway areas;
- Washington and East Washington villages remain largely intact, with important civic, religious and residential structures preserved in their original style;
- None of the 316 acres of actively used, productive farmland in Town is protected from conversion to development;
- Approximately half of the 2,200 or so lots in Town are currently un-built;
- The most pristine portion of the entire Ashuelot River flows through Washington;
- Prime Agricultural Soils and Soils of State-wide Significance are very uncommon in Town.
- There are 57 miles of established snowmobile trails and 60 miles of hiking/skiing trails in Town;

Part of the rationale for this Natural and Cultural Resource Inventory was to identify resources and resource areas that are especially important for a variety of reasons, and that are worthy of protection. This information provides the basis for the follow-on Conservation Plan, which will make specific references to these resources and resource areas and will make recommendations for their protection. A balanced approach to resource protection will be most successful if the citizenry and its human needs and desires are taken into consideration when planning the protection and management of the natural resources on which the citizenry depends. Prioritization of what resources are most in need of protection will become and ongoing discussion. Hopefully this project has helped to inform this discussion.

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Appendix B. Field Research

There are few existing records of rare species or natural communities in Washington. Several of those that do exist are considered to old to be reliable. Chapter 4, Wildlife Habitat lists the records of these uncommon features. In an effort to begin to more completely document potential rare features, three days of field work focused on areas of Washington with the potential of containing uncommon, threatened or endangered species or natural communities. These target areas were determined by a combination of research, predictive modeling and solicitation of local knowledge.

The priority for this project field work was to use landscape analysis, predictive modeling and anecdotal information to guide field visits to areas that offer the highest probability of supporting species and natural communities tracked by the NH Natural Heritage Bureau, which is responsible for the management of this data on a state-wide basis.

Methods

Publications of the NH Natural Heritage Bureau that reference Washington were reviewed, especially the 2006 *Rare Plants, Rare Animals and Exemplary Natural Communities in New Hampshire Towns.* The Priority Habitats predicted to occur and mapped in Washington by the Wildlife Action Plan were also reviewed. Anecdotal information from several local citizens was collected. GIS data was used to identify areas of the town with the potential of having unusual natural habitat suitable for rare species and natural communities. The location of steep slopes, unusual wetland types, active agricultural areas, and other factors were considered. Based on previously known occurrences of these features in Washington or in adjacent towns, and the likelihood of suitable habitat, a list of target features was developed.

The following species and natural communities were identified as targets:

Eastern meadowlark
Purple martin
Northeastern bulrush, *Scirpus ancistrochaetus*
Mare's tail, *Hippuris vulgaris*
Farwell's water-milfoil, *Myriophyllum farwellii*
Hemlock – spruce - northern hardwood forest (old growth condition)
Rich mesic forest
Inland Atlantic white cedar swamp
Black spruce – larch swamp
Black gum – red maple basin swamp

The target sites were prioritized according to their predicted habitat quality, and the significance of the potential species/community at the site. Landowner permissions for access were requested for a select subset of these areas, and others were accessed from either public lands or directly from public roadways. The resulting list of sites were visited in the field, with the following findings resulting.

Results

A unusual pocket wetland on the east side of Washington Drive, east of Island Pond was found. It is a very small, atypical variant of *black gum – red maple basin swamp*, ranked as S1/S2 (State endangered / threatened). Its small size and location directly next to the road, as well as it's atypical species composition makes it more of an interesting curiosity than a conservation priority. Black gum, *Nyssa sylvatica* is very uncommon this far north in New Hampshire, where it is beyond its normal range.

An unreported old mill site on the stream outlet to Island Pond was discovered. The substantial stone work remaining on both sides of this steep section of the stream suggest that several buildings were at one time present.

Chris Kane

Old mill site on outlet stream, Island Pond

At the height of land on the northeast side of Lempster Mtn. Road Rd. a small isolated peatland was found. According to the NH Natural Heritage Bureau's Classification of Natural Communities, it is a small example of "Sphagnum rubellum – small cranberry moss carpet". The characteristic reddish color of the *Sphagnum rubellum,* along with several small shrub species such as small cranberry, *Vaccinium oxycoccus*, and unusual graminoids including white-beak rush *Rhyncospora alba* contribute to the exotic appearance of this unusual peatland.

Three small isolated peatlands near upper part of Ulrich Road were also verified. These peatlands were mapped as predicted priority habitats by the WAP. These are small pocket wetlands that form in small basins in otherwise upland habitat. *Sphagnum* moss species form a carpet of soggy green below shrubs such as winterberry holly, *Ilex verticillata* and mountain holly, *Nemopanthus mucronata* with red maple, yellow birch and a scattering of the uncommon tree black ash, *Fraxinus nigra*. While not state-rare communities, they are a locally uncommon wetland type in Washington.

Chris Kane

Sphagnum rubellum – small cranberry moss carpet *natural community, Lempster Mtn. Rd.*

The major open field areas in town were also visited for their potential to support uncommon field bird species, but none were observed. The nature of the crops on most of these fields, feed corn, are not particularly well suited to these species, which prefer grasslands of significant size.

A relatively mature and intact example of Hemlock – spruce - northern hardwood forest was documented on a remote portion of Twin Bridges Road.


Chris Kane

Black ash trees in peatland near Ulrich Road

Several large and relatively old canopy hardwoods in a context of a mixed aged stand were observed. No evidence of previous logging was evident, and old growth characteristics were moderately well developed, with some older coarse woody debris including dead and rotting canopy trees.

Chris Kane

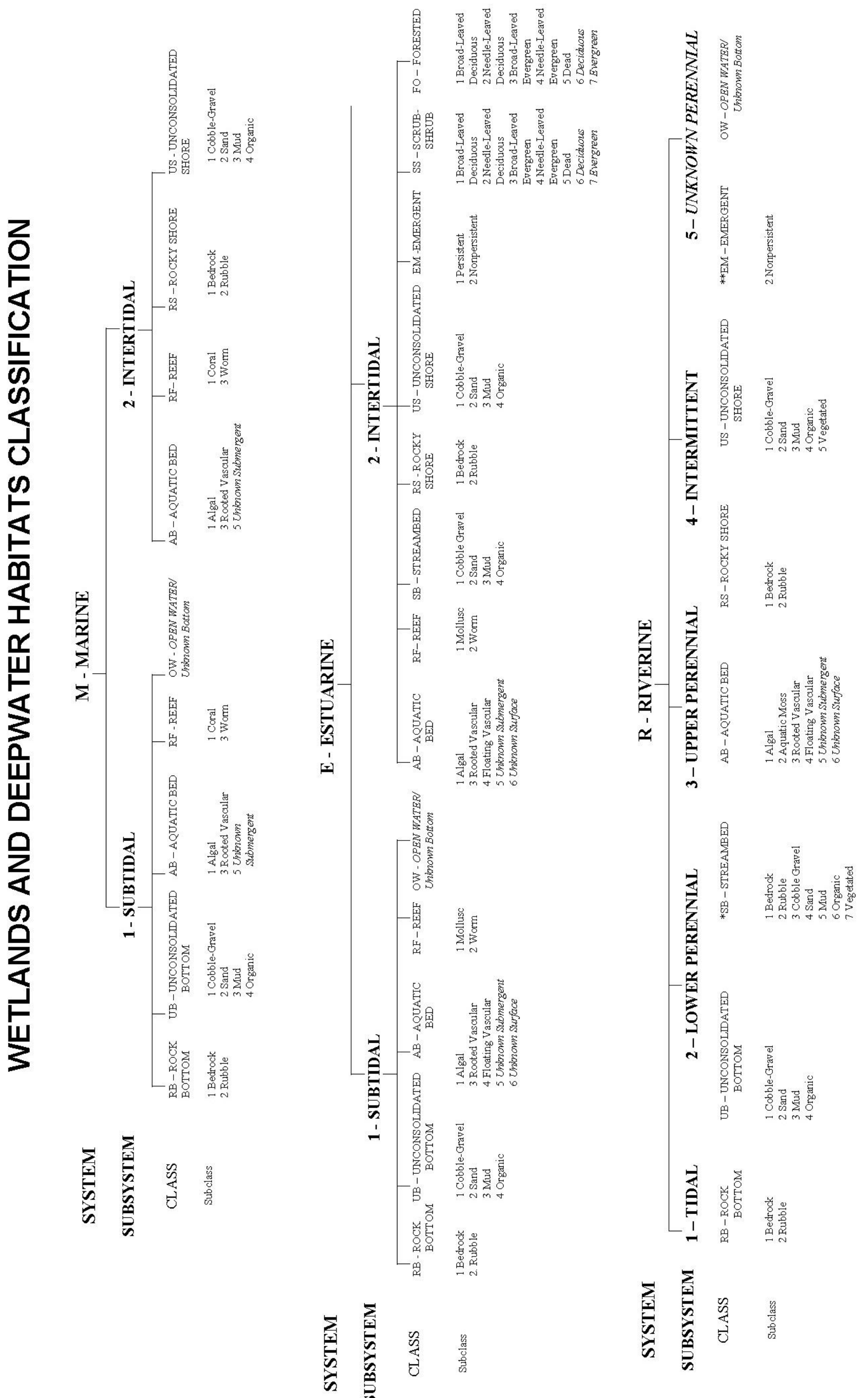
A relatively mature and intact example of Hemlock – spruce - northern hardwood forest with old growth characteristics on Twin Bridges Road

Another remnant patch of potential old growth forest was found on steep, bouldery terrain on the east flank of Lovell Mountain. The canopy tree species here are primarily sugar maple, *Acer saccharum*, with red maple, *Acer rubrum,* white ash, *Fraxinus americana* and scattered red oak, *Quercus rubra* also present. Striped maple, *Acer pensylvanicum* in the understory, and mountain maple, *Acer spicatum* occur in rockier talus portions. No signs of earlier logging were observed. The natural community appears to be a variant of the *Semi-rich mesic sugar maple forest* community. Further study of land use history records, and age distribution of these old forest areas are needed to determine with more certainty their potential status as old growth.

Chris Kane

Remnant patch of potential old growth forest on east flank of Lovell Mtn. landmass

Appendix C: National Wetlands Inventory / Cowardin wetland classification codes



* STREAMBED is limited to TIDAL and INTERMITTENT SUBSYSTEMS, and comprises the only CLASS in the INTERMITTENT SUBSYSTEM.
** EMERGENT is limited to TIDAL and LOWER PERENNIAL SUBSYSTEMS.

Classification of Wetlands and Deepwater Habitats of the United States
Cowardin ET AL. 1979 as modified for National Wetland Inventory Mapping Convention

WETLANDS AND DEEPWATER HABITATS CLASSIFICATION

SYSTEM: L- LACUSTRINE

SUBSYSTEM: 1 - LIMNETIC

CLASS	RB – ROCK BOTTOM	UB – UNCONSOLIDATED BOTTOM	AB – AQUATIC BED	OW – *OPEN WATER/ Unknown Bottom*
Subclass	1 Bedrock 2. Rubble	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic	1 Algal 2 Aquatic Moss 3 Rooted Vascular 4 Floating Vascular 5 *Unknown Submergent* 6 *Unknown Surface*	

SUBSYSTEM: 2 - LITTORAL

CLASS	RB – ROCK BOTTOM	UB – UNCONSOLIDATED BOTTOM	AB – AQUATIC BED	RS – ROCKY SHORE	US – UNCONSOLIDATED SHORE	EM – EMERGENT	OW – *OPEN WATER/ Unknown Bottom*
Subclass	1 Bedrock 2. Rubble	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic	1 Algal 2 Aquatic Moss 3 Rooted Vascular 4 Floating Vascular 5 *Unknown Submergent* 6 *Unknown Surface*	1 Bedrock 2. Rubble	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic 5 Vegetated	2 Nonpersistent	

SYSTEM: P - PALUSTRINE

CLASS	RB – ROCK BOTTOM	UB – UNCONSOLIDATED BOTTOM	AB – AQUATIC BED	US – UNCONSOLIDATED SHORE	ML – MOSS-LICHEN	EM – EMERGENT	SS – SCRUB-SHRUB	FO – FORESTED	OW – *OPEN WATER/ Unknown Bottom*
Subclass	1 Bedrock 2. Rubble	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic	1 Algal 2 Aquatic Moss 3 Rooted Vascular 4 Floating Vascular 5 *Unknown Submergent* 6 *Unknown Surface*	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic 5 Vegetated	1 Moss 2 Lichen	1 Persistent 2 Nonpersistent	1 Broad-Leaved Deciduous 2 Needle-Leaved Deciduous 3 Broad-Leaved Evergreen 4 Needle-Leaved Evergreen 5 Dead 6 *Deciduous* 7 *Evergreen*	1 Broad-Leaved Deciduous 2 Needle-Leaved Deciduous 3 Broad-Leaved Evergreen 4 Needle-Leaved Evergreen 5 Dead 6 *Deciduous* 7 *Evergreen*	

MODIFIERS

In order to more adequately describe the wetland and deepwater habitats one or more of the water regime, water chemistry, soil, or special modifiers may be applied at the class or lower level in the hierarchy. The farmed modifier may also be applied to the ecological system.

WATER REGIME				WATER CHEMISTRY			SOIL	SPECIAL MODIFIERS	
Non-Tidal		**Tidal**		**Coastal Halinity**	**Inland Salinity**	**pH Modifiers for all Fresh Water**			
A Temporarily Flooded B Saturated C Seasonally Flooded D *Seasonally Flooded/ Well Drained* E *Seasonally Flooded/ Saturated* F Semipermanently Flooded G Intermittently Exposed	H Permanently Flooded J Intermittently Flooded K Artificially Flooded W Intermittently Flooded/Temporary Y Saturated/Semipermanent/ Seasonal Z Intermittently Exposed/Permanent U *Unknown*	K *Artificially Flooded* L Subtidal M Irregularly Exposed N Regularly Flooded P Irregularly Flooded	*S Temporary-Tidal *R Seasonal-Tidal *T Semipermanent-Tidal *V Permanent-Tidal U *Unknown* *These water regimes are only used in tidally influenced, freshwater systems.	1 Hyperhaline 2 Euthaline 3 Mixohaline *(Brackish)* 4 Polyhaline 5 Mesohaline 6 Oligohaline 0 Fresh	7 Hypersaline 8 Eusaline 9 Mixosaline 0 Fresh	a Acid t Circumneutral i Alkaline	g Organic n Mineral	b *Beaver* d *Partially Drained/Ditched* f Farmed	h *Diked/Impounded* r Artificial Substrate s *Spoil* x Excavated

NOTE: Italicized terms were added for mapping by the National Wetlands Inventory program.

Appendix D: Results and Recommendations from NHDES Report: TMDL Study of Mill Pond.

2006 DES TMDL Study of Mill Pond:

Mill Pond in East Washington was studied by the New Hampshire Department of Environmental Services because of concerns regarding water quality. The pond has a small public swimming beach, and is fed by several tributaries including Woodward Brook and Beard Brook. The study determined the Total Maximum Daily Loads ("TMDL's") for several pollutants. The total maximum daily load is the maximum daily load a waterbody can assimilate and still meet water quality standards. The results of most concern given the expected uses of the pond for swimming were elevated levels of *E. coli* bacteria. Waters with elevated bacteria levels can result in swimmer's itch and gastrointestinal illnesses if ingested. A summary of the recommendations of the study are as follows:

Paraphrased Recommendations for Mill Pond from DES Study:

1. Post warning sign and close beach when it rains. In such conditions swimmers are at risk from elevated bacteria levels in the water.

2. Investigate and implement methods to minimize number of water fowl frequenting pond and surrounding areas. This includes wild waterfowl at the beach and on the shore of the pond itself, and domestic waterfowl near the tributaries to the pond including Beard Brook.

3. Prevent livestock from accessing Mill Pond, as well as Beard Brook, Woodward Brook and other tributaries and sub-tributaries to the pond. Manure should also be properly managed to minimize runoff to these water bodies.

4. Control pet waste in immediate area of Mill Pond, by erecting signs encouraging "pooper scooper" habits. The Town may want to consider an ordinance requiring this measure.

5. Investigate potential illicit sewer connections or failed systems in the vicinity of Mill Pond and its tributaries. None were located during the study, but analysis of the results indicates that they are likely to exist in the vicinity.

Appendix E. Threats Model Mechanics

Development Threats Model

Geography	Key Metric	Points	Dataset	Justification	Dataset	Field
Agricultural lands (crops)	tilled/hayed field	3	agricultural lands	simple engineering, few septic issues, land already cleared, higher profit potential for developer	Active_Ag.shp	Threat_Ag
Developable highway frontage lot	Frontage lot on NH 31 AND developable (ie. Not steep or wet)	3	tax parcels	highest traffic locale in town, most attractive for retail, commercial space, no subdivision needed for residential development, minimal permitting, most profit potential for development	hiway_frontage.shp	Threat_HF
Developable lake frontage lot	Lakefront AND developable	3	tax parcels	attractive second home potential	lake_frontage.shp	Threat_LF
Developable frontage lot	Frontage lot AND developable (ie. Not steep or wet)	2	tax parcels	no subdivision needed, minimal permitting, most profit potential for development	developable_frontage.shp	Threat_DF
Frontage lot near town center / village centers	within 1/2 mile	2	tax parcels	provides "village living", walking access to current or future amenities	town_lots.shp	Threat_TL

Lake access	within 1/4 mile	2	tax parcels	attractive second home potential	lake_access.shp	Threat_LA
Accessible backlots	back lot with easy access to road (one undeveloped lot from road, 'easy access')	1	tax parcels	second tier potential for subdivision	accessible_backlots.shp	Threat_AB
Easy access (no wetlands/steep slope crossings)	no wetlands/steep slope crossings w/in 1/2 mile of road	1	NWI, slope (DEM)	simple engineering, higher profit potential for developer	easy_access.shp	Threat_EA
Hilltop / Ridgetop	1/4 mile from selected summit / ridge	1	DEM, GNIS	view potential	hilltop.shp	Threat_HT
Ideal soils	All well-drained classes, low slope <8	1	NRCS soils	simple engineering, few septic issues, higher profit potential for developer	ideal_soils.shp	Threat_SOI
Low slope	<5%	1	slope (DEM)	simple engineering, higher profit potential for developer	Slope_5-.shp	Threat_SL
Unprotected Conservation Lands	conservation lands not protected by easement or organizational/agency mission	1	tax parcels, GRANIT conservation lands layer, commission input	could be attractive for future income from sale, development for municipal/state /private facilities - this is probably a good place to send this message about protecting unprotected town lands	unprotected_cons.shp	Threat_UC
Steep Slopes	>15%	0	slope (DEM)	unlikely to be developed	Slope_15+.shp	Threat_SH

Wetlands	Wetland / Hydric Soil	0	NWI, NRCS soils	not developable	NWI.shp	Threat_NWI
Water	Surface water	0	NHHD	not developable	NHHD_Waterbody.shp	

Points were assigned to the areas of Town that contained the above factors, and resulting map displays these areas by class of threat. The intent was to estimate suitability and desireability of all areas of the Town, and thus predict the areas that are most likley to attract development first based on the suite of physical factors. (high points = more threatened)

Appendix F. Co-occurrence Analysis Model Resource Factors and Weighting

Co-occurrence Analysis Resource Factors

		Score	Field	#
Water Resources	*Aquifer (>1000 ft^2/day)*	8	*Val_aq*	1
	CSPA Buffers	8	*Val_cspa*	2
	Undeveloped SPARROW watersheds	6	*Val_sparro*	3
	NWI Wetlands (w/100' buffer)	6	*Val_nwi*	4
	PFGWA	4	*Val_pfgwa*	5
	PWS (buffered on sanitary radius)	4	*Val_sanr*	6
	WHPA	4	*Val_whpa*	7
	Sub-total	**40**		
Soils	*Active Agriculture*	5	*Val_aga*	8
	Prime Farmland	5	*Val_agpf*	9
	Statewide Importance	3	*Val_agsi*	10
	Local Importance	2	*Val_agli*	11
	Important Forest Soils: IA	4	*Val_fsga*	12
	Important Forest Soils: IB	4	*Val_fsgb*	13
	Important Forest Soils: IC	2	*Val_fsgc*	14
	Sub-total	**25**		
Wildlife Habitat	*Undeveloped Lake Shore*	6	*Val_ulake*	15
	Riparian Corridor	6	*Val_rip*	16
	Unfragmented Lands >1,000 acres	4	*Val_unfrag*	17
	WAP: grassland	2	*Val_wapg*	18
	WAP: floodplain forest	2	*Val_wapf*	19
	WAP: marsh	2	*Val_wapm*	20
	WAP: peatland	2	*Val_wapp*	21
	South-facing Slopes	1	*Val_ss*	22
	Sub-total	**25**		
Recreation	*Monadnock-Sunapee*	6	*Val_trms*	23
	Other Trails	4	*Val_tro*	24
	Subtotal	**10**		
	GRAND TOTAL	***100***		

Appendix G. Greenways Model

Introduction

Connecting and expanding existing conservation and public lands has been a focus of strategic conservation planning at scales from local to regional to statewide. Thus, in building spatial models to target priority areas, some measure of proximity to permanently conserved lands can strengthen conservation strategies.

To this end, a geographic information systems (GIS) model which prioritizes areas proximal to conservation lands, and which emphasizes connections between neighboring complexes was designed. The primary benefit of such a model is to draw attention to places where conservation lands could be connected via areas of high resource value.

The model enhances the importance of larger conservation areas, both in terms of model weight and "reach" (the distance the model weight of large conservation areas extends). For larger conservation areas, not only are model values greater, but those values reach further than smaller classes, *i.e.* larger conservation areas have more "gravity". For all conservation area sizes, model weights decrease as distance from the conservation areas increases; this assigns more importance to areas directly adjacent to conservation lands and less importance to areas far from conservation lands.

It is important to recognize that connections between conservation lands are constrained by developed features. For instance, two conservation tracts may be separated by one mile. However, if there is a large commercial district in between them, there may be little functional connection between them from an ecological or recreational perspective. Alternatively, two different tracts separated by a mile of natural landcover may be closely related in terms of maintaining ecological processes, water quality, or recreational opportunities. Thus, the model also considers features constraining connections (such as developed lands, roads, and water bodies) as well as those features strengthening connections: important natural resources.

Methods

The general concept of the model is that a proximity value will be calculated for the area surrounding each conservation complex[2] by first calculating the distance from the complex and then converting the distance to a model value (through the use of an inverse decay curve). The shape of this curve is determined by the model weight of the conservation complex, which is in turn determined by acreage.

The model described here weights conservation lands by acreage; larger complexes are assigned a larger weight, *i.e.* more importance. We assume here that large conservation areas are more important for protecting ecological systems (and their inherent benefits to people) and are more likely to be viable in the long term.

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[2] By "conservation complex" we do not mean individual parcels of land, but aggregations of directly adjacent parcels. "Complex acreage" refers to the sum of the acreage of all included parcels.

Table 1: Complex Weight

Complex Acreage	Class / Weight	Maximum Reach (miles)	**Key Species** (acreage breakpoints are based on average home range area)
< 500	1	¼	cottontail
500 – 2,000	2	½	beaver, white-tailed deer, gray/red fox, porcupine
2,000 – 5,000	3	1	bobcat, mink, great horned owl, northern harrier
5,000 – 7,000	4	1 ½	black bear, moose, marten, coyote, bald eagle, peregrine falcon
7,000 – 10,000	5	2	lynx, fisher, red-tailed hawk
> 10,000	6	5	all listed species

Table 1 shows the weights which were used in the model. Complex acreage breakpoints are loosely determined by wildlife habitat and home range of numerous native wildlife. The acreage (and accompanying maximum reach) attempts to address the question, "how far would a member of a given species be likely to travel to find new habitat?" In this scheme, higher weights are assigned to larger acreage classes, again, based on the concept that larger conservation areas are more likely to be viable over the long term. Model values are determined by equation 1.

(1) $m_i = C * \sqrt{d_i} + w_i$

where,

m = complex model value
i = complex
C = -0.0369 (see equation 2)
d = distance to conservation complex[3]
w = class weight (*i.e.* weight where d = 0)

In this model the maximum distance (d_{max}) for the largest acreage class is set at 5 miles (26,400 feet). The constant C is determined by the slope of the curve at d_{max}, equation 2.

(2) $C = w_{max} / \sqrt{d_{max}}$

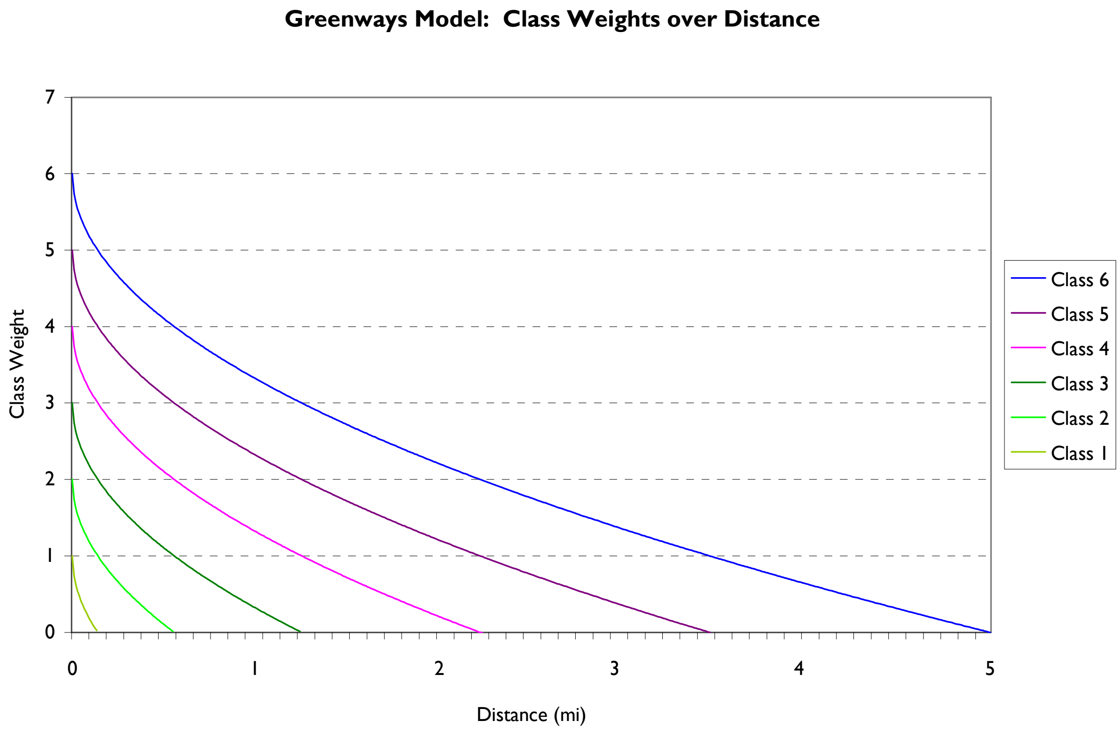
where,

w_{max} = the complex weight of the largest class
d_{max} = the maximum distance for the largest class

[3] The use of a non-linear, decaying curve (square root of *d*) emphasizes areas directly adjacent to conservation complexes (*i.e.* assigns an exponentially higher model weight proximal to conservation lands). Ideally, lands directly adjacent to existing conservation lands should be protected prior to more distant ones.

The effect of using the same constant for all complex weights is to shorten the reach of complexes with lower weights (see Table 1 / Figure 1). The curve created by equation 1 is shown for each acreage class in Figure 1.

Figure 1: Acreage Class Model Value



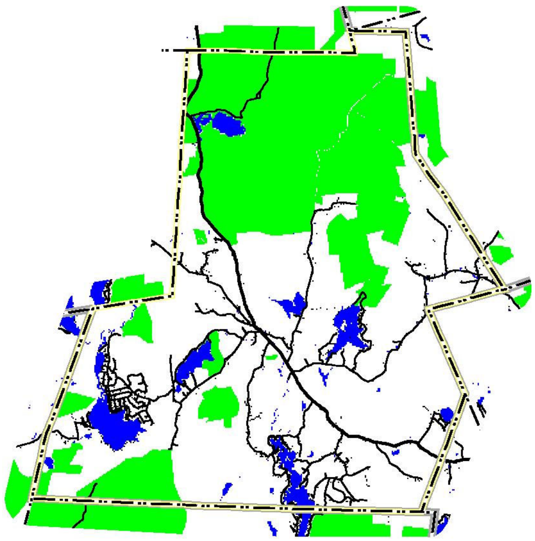
To arrive at a final proximity model (*M*), the individual complex model values are summed according to equation 3.

(3) $M = \Sigma m_i$

Geographic features which divide ecological systems were incorporated as "cost" surfaces in the spatial model, *i.e.* as model values extend outwards from a conservation complex and encounter a constraining feature their values are reduced according to the strength of the constraint. We used fragmenting roads, surface water, and developed lands as constraining features. Similarly we assigned a higher cost to places with low natural resource values (based on the co-occurrence model). These features can be seen graphically in Figure 2.

Figure 2: Constraints and Natural Resource Values

2b. Constraints (water, blue; roads and development, black)

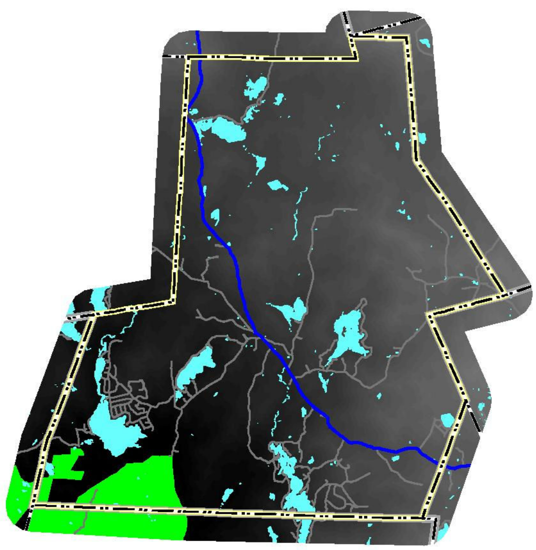


2a. Co-occurrence Model (high value areas are shown in darker red)

Distance calculations and model weights can be seen in Figure 3. Figure 4 shows the final model (the summation of all of the model weight grids shown in Figure 3).

Figure 3: Distance Calculations (*d*) and Model Weights (m_i)

3a. Distance to Andorra Forest complex (class 6)



3f. Model weight for Andorra Forest complex

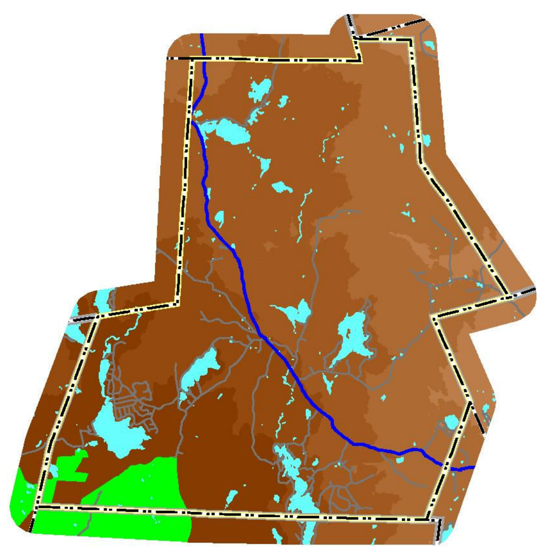
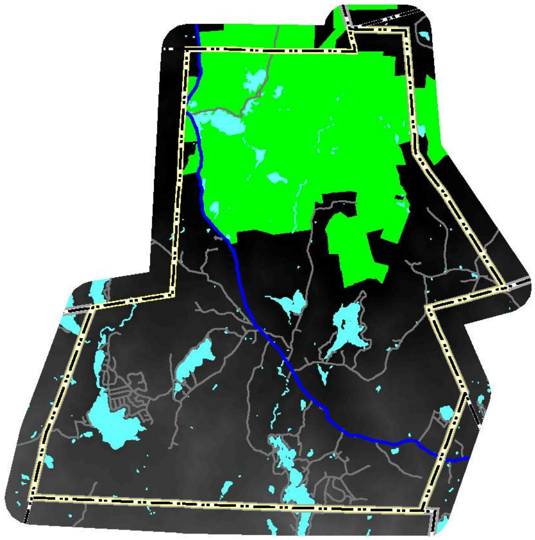
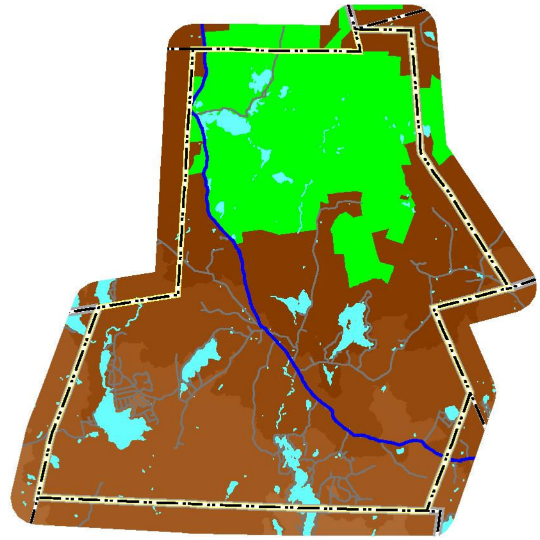


Figure 3, continued

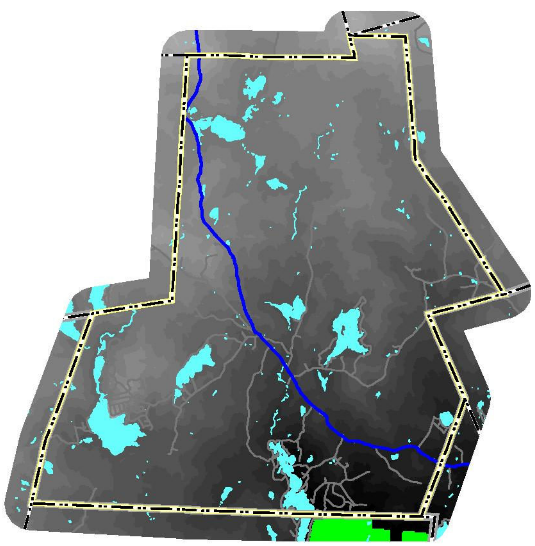
3b. Distance to Pillsbury State Park complex (class 6)



3g. Model weight for Pillsbury State Park complex



3c. Distance to class 5 complexes



3h. Model weight for class 5 complexes

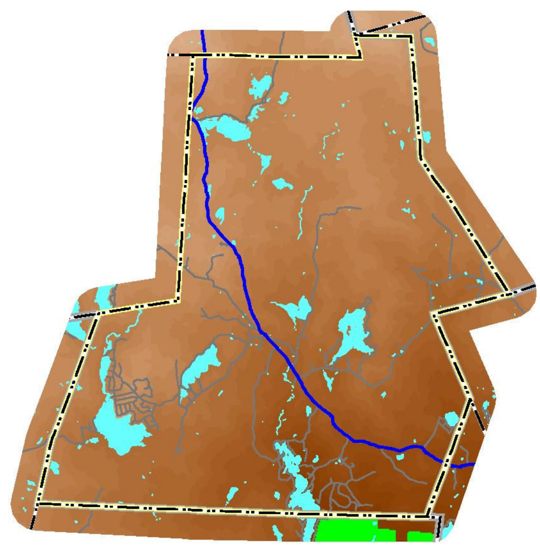
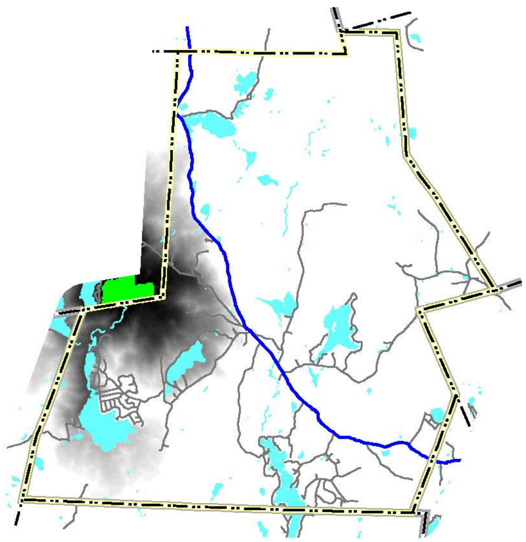
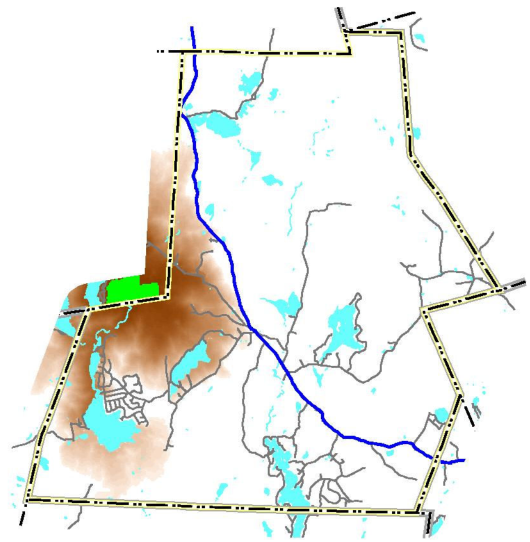


Figure 3, continued

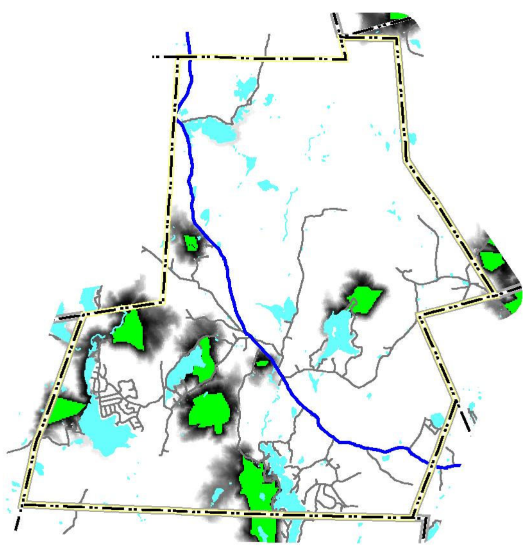
3d. Distance to class 2 complexes



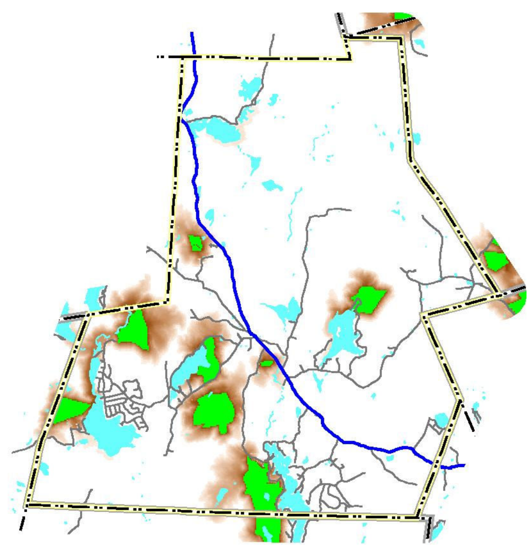
3i. Model weight for class 2 complexes



3e. Distance to class 1 complexes

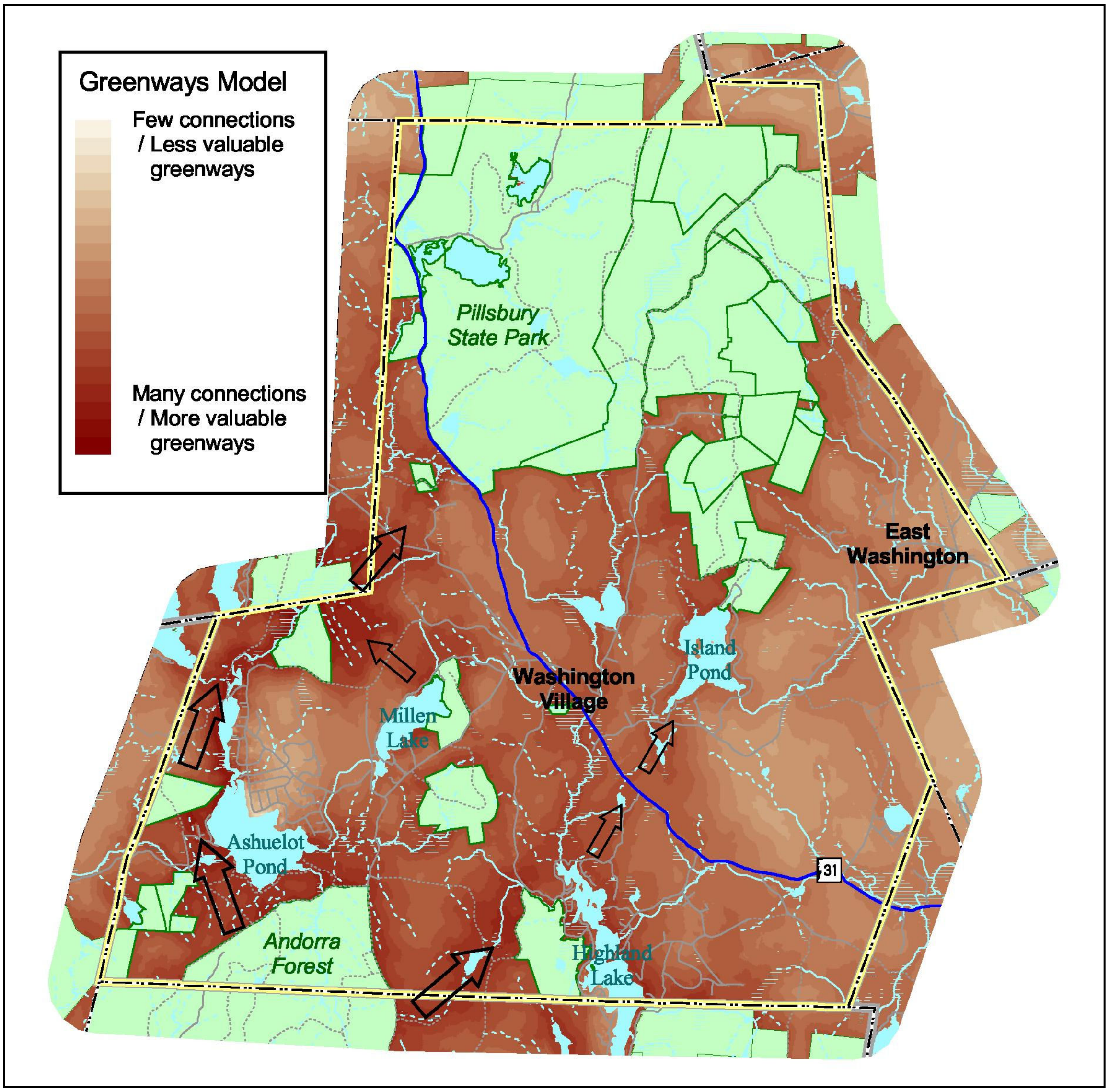


3j. Model weight for class 1 complexes



NOTE: there are no class 4 or class 3 complexes which fall directly in the study area.

Figure 4: Final Greenways Model



The final results of the model can be seen in Figure 4 above. Darker brown areas signify more important greenways. Lighter brown areas indicate places with less importance for connecting conservation lands. Arrows indicate the most important greenways in Washington. The map indicates that the best place to build greenways in Washington is in the southwest corner of the town; there are several proximal conservation tracts there including the ~18,000 acre complex around Andorra Forest, and they are surrounded by many important resources there including riparian corridors, wetlands, and a large unfragmented block. It is interesting to note that model values near the Pillsbury State Forest complex, also about 18,000 acres, are not as high, largely because there are fewer conservation tracts nearby and fewer high-value resources.

Appendix H. GIS Metadata

Stock Datasets

The following datasets were acquired from GRANIT, New Hampshire's GIS data clearinghouse:

1998 Aerial Photo:
http://www.granit.unh.edu/data/metadata?file=98doq/98doq146ne/98doq146ne.html

Conservation and Public Lands:
http://www.granit.unh.edu/data/metadata?file=cons/nh/cons.html

Sullivan County Digital Flood Insurance Rate Map Database:
http://www.granit.unh.edu/data/metadata?file=flood/flood19/flood19.html

Geographic Names Information System (GNIS) Database:
http://www.granit.unh.edu/data/metadata?file=gnis/nh/gnis.html

New Hampshire Hydrography Dataset Shapefile Extract:
http://www.granit.unh.edu/data/metadata?file=nhhd/nh/nhhd.html

National Wetlands Inventory:
http://www.granit.unh.edu/data/metadata?file=nwi/nh/nwi.html

NH Political Boundaries:
http://www.granit.unh.edu/data/metadata?file=pb/nh/pb.html

NH Department of Transportation Roads:
http://www.granit.unh.edu/data/metadata?file=roads_dot/nh/roads_dot.html

NH Wildlife Action Plan Floodplain Forest:
http://www.granit.unh.edu/data/metadata?file=wap05_floodplain_500complex/nh/wap05_floodplain_500complex.html

NH Wildlife Action Plan Floodplain Grassland:
http://www.granit.unh.edu/data/metadata?file=wap05_grasslands25/nh/wap05_grasslands25.html

NH Wildlife Action Plan Marsh:
http://www.granit.unh.edu/data/metadata?file=wap05_marshes_250complex/nh/wap05_marshes_250complex.html

NH Wildlife Action Plan Peatland:
http://www.granit.unh.edu/data/metadata?file=wap05_peatlands_250complex/nh/wap05_peatlands_250complex.html

HUC12 Watersheds:
http://www.granit.unh.edu/data/metadata?file=wshed/nh/wshed.html

NH Dams Database:
http://www.granit.unh.edu/data/metadata?file=dams/nh/dams.html

The following datasets were provided by the NH Department of Environmental Services:

Public Water Supplies:
http://www.granit.unh.edu/data/metadata?file=publicwatersupplies/nh/publicwatersupplies.html

Wellhead Protection Areas:
http://www.granit.unh.edu/data/metadata?file=wellhead_protection_areas/nh/wellhead_protection_areas.html

Aquifer (transmissivity):
http://www.granit.unh.edu/data/datacat/pages/tra.pdf

Soils data were acquired from the USDA Natural Resource Conservation Service of New Hampshire:
http://www.nh.nrcs.usda.gov/Soil_Data/attribute_data/sullivan.html

The following datasets were provided by the United States Geological Survey

SPARROW was provided by USGS:
http://nh.water.usgs.gov/projects/sparrow/

The $^{1}/_{3}$ arcsecond (10m) National Elevation Dataset:
http://ned.usgs.gov/

Tax Parcel data were provided by the Washington Conservation Commission:

Terra Map produced the tax map data in AutoCAD. The map is seamless, was set to New Hampshire State Plane Coordinates (NAD 83) and has been converted to an ESRI shapefile. The ESRI polygons are identified by an 18-digit map and lot code.

Custom Datasets

The following custom datasets were created for this Natural Resource Inventory:

Comprehensive Shoreland Protection Act:

All public open surface waters (see NH Hydrography Dataset, above) greater than 10 acres were buffered by 250 feet, as per the NH Comprehensive Shoreland Protection Act (http://www.des.state.nh.us/cspa/483B.htm)

Potentially Favorable Gravel Well Areas:

A 150 gallon/minute analysis was used for this Natural Resource Inventory. Stratified drift aquifer data were selected to isolate minimum transmissivity of 2,000 $foot^2$/day. Known and potential contamination sources buffered 1,000 feet (U400des.shp, provided by NH DES) were used to erase aquifer data. Buffered roads and surface waters (hyt4nnn.shp, provided by NH DES) were used to erase aquifer data as well. The resulting dataset (fgwa.shp) represents areas unlikely to be contaminated and transmissive enough for a 150 gallon / minute well. For further information, please refer to the DES technical manual, *A Guide to Identifying Potentially Favorable Areas to Protect Future Municipal Wells in Stratified-Drift Aquifers*, NH Department of Environmental Services, Publication NHDES-WD-99-2. For general information on planning for municipal wells, see: http://www.des.state.nh.us/factsheets/ws/ws-22-12.htm

Unfragmented Lands:

NH DOT roads were checked for fragmentation status (by checking USGS topographic maps, local maps, and local input) and buffered 500 feet. These buffers were then erased from the surrounding landmass to arrive at the unfragmented lands dataset.

Steep Slopes:

The $^1/_3$ arcsecond (10m) National Elevation Dataset (NED) was used to derive slope (%). Areas greater than or equal to 15% were selected and displayed to represent steep slopes.

South-facing Slopes:

The NED was used to derive slope (%) and aspect. Areas greater than or equal to 15% were selected. Areas with aspects between 135° (southeast) and 247.5° (west southwest) were selected from steep slopes and displayed to represent steep, south-facing slopes.

Contour Lines:

The NED was converted to 20 foot interval contour lines. 100 foot index lines were identified for reference.

Trails:

Snowmobile trails were digitized on screen based on local snowmobile trail maps (using aerial photos, USGS topographic maps, and NH DOT roads for reference). Hiking and recreation trails were provided by the Society for the Protection of NH Forests.

Historic and Cultural Sites:

Sites were selected by members of the Washington Historical Society and the Washington Conservation Commission and identified on paper maps. Sites were then digitized on screen.

Developed Areas and Structures:

Developed Areas were digitized on screen based on 1998 digital orthographic photographs, 2003 USDA National Agricultural Imagery Program digital photographs, and USGS topographic maps. Developed areas were considered to be: any manufactured structure or surface such as homes, commercial establishments, parking lots, paved roads, athletic courts (such as tennis courts or basketball courts), and landscaped areas or mowed lawns directly associated and adjacent to structures. Agricultural areas, gravel or sand pits, or other similar artificial but not manufactured surfaces were not included. Structures were identified as points on aerial photographs and USGS topographic maps. In cases where the developed land around mapped structures could not be seen on aerial photographs a ¼ acre polygon was added to the developed lands dataset (¼ was determined to be the approximate mean area of developed land around typical homes in Washington based on a sample of 25 homes visible on aerial photographs).