CHAPTER IV
NATURAL RESOURCES

A. LAND RESOURCES

1. Forest Resources

Windham has abundant forest cover throughout the Town. The Town is fortunate that it retains several areas of large, unbroken forest. In 2001, Windham's citizens voted to amend the Windham Zoning Regulations to create four Forest zoning districts within the town. These areas are shown on the future land use map that is included in this Plan. It is the policy of the Town of Windham that land uses and development in these Forest Resource districts be limited to forestry, agriculture, recreation, and low density residential uses, as specified in the zoning regulation. Commercial and industrial* uses other than those related to the foregoing are not permitted in the Forest districts. In the case of any ambiguity, State regulatory boards and commissions, including the Act 250 commissions, Public Service Board and Public Service Department, and other users of this plan, shall consider both the provisions of this Plan and the provisions of the Windham Zoning Bylaw when making determinations for the future use and development of the lands within the Forest districts.

The Town's forestland is managed by private landowners. The Stiles Brook Tract, currently owned by Meadowsend Timberlands, is one of the largest contiguous, privately owned parcels of forestland in Windham County. The parcel contains approximately 3500 acres in Windham and 1500 adjoining acres in Grafton. It is currently managed for long term timber production. Another accumulation of parcels on the west side of town totaling roughly the same amount is owned by McGraw Family Holdings. With so much forest land in private ownership, the challenge for Windham is to ensure the health of its forest ecosystems, water quality, scenic ridgelines, natural resources and wildlife while also sustaining the economic health of the forest industry.

With over 90% percent of the Town made up of forestland, careful consideration must be given to the sustainability of this resource in the town planning process. Further, it is important to note that as of 2013, 60% of Windham's land area is enrolled in Vermont's Use Value Appraisal Program. (see Table 9.) While it is important to track the resources or potential resources in each forest parcel, it is also critical to look beyond parcel lines and understand the forest landscape without divisions. Below are the important aspects that Windham's Town Plan is designed and written to protect:

a. ***Wildlife Habitat*** - Diversity of forest type is essential in preserving wildlife habitats. It is important to evaluate existing wildlife habitats and to consider those in the forest planning process so as to avoid forest use conflicting with wildlife preservation. Special care must be taken to protect wildlife, including critical moose wintering areas, deer yards, bear and bobcat ranges, habitat of the endangered American Marten, beaver and other fur bearing animals, and a large number of upland songbirds, especially the endangered Bicknell's Thrush and other necessary wildlife habitat and endangered species. Knowledgeable hunters and wildlife professionals estimate that lands to the east of town contain more moose than any comparable area in Southern Vermont. Any development that endangers or adversely affects these and similar populations as

discussed in Paragraph A.5 is prohibited.

*(*Throughout this Plan a commercial operation is defined as an enterprise that is carried on for profit by the owner, lessee or licensee; and industrial uses are defined as the processing, treatment and/or conversion of raw or semi-finished materials into a different form or state, excluding forestry and agricultural goods raised on the premises.) .*

b. ***Recreation*** - Windham's natural environment is a tremendous resource in regards to outdoor recreation. Residents have enjoyed the use of forest land belonging to many private landowners. Recreational use requires tracts of connected land. Windham's forested land offers recreational opportunities such as camping, wildlife viewing, hunting, and fishing. Informal and formal trails provide for camping, hiking, biking, skiing, snowmobiling, and other recreational pursuits.

c. ***Aesthetic Features*** - Scenic landscape is an important core resource for the town. Distance (foreground, middle, and background), topography (slope, ridgelines, contrasts providing shape and texture), forest cover, forest districts, ridgelines special features, visibility and protective screening are features that are essential to the well-being of the Town and its residents and must be protected.

d. ***Forest based Industry*** - Windham has a sustainable forest resource which can and does provide quality forest products. A forest-based economy supports employment and provides landowners with financial returns through planned timber harvesting. These interests are promoted and protected in the Forest district areas, where prohibited activities include structures above tree height and/or tall enough to require FAA lighting, mineral resource extraction, and commercial and industrial wind towers and meteorological towers. See Zoning Regulations Section 204 for additional uses prohibited which are specifically authorized and incorporated within this Plan.

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2. Agriculture

The US Department of Agriculture has identified soil types that are best suited to crop production based on soil quality, growing season and moisture supply. These areas, called prime agricultural soils, are likely to produce the highest crop yields using the least amount of economic resources and causing the least environmental impact. Windham has a very small area of prime agricultural soils but its residents have been successful at farming on the secondary agricultural soils.

Windham allows agricultural activity in any part of Town. Although agriculture is not extensive in Windham, the remaining agricultural areas are important resources that serve many essential functions including providing local seasonal produce and planting materials; providing open space, serving as an educational resource, and contributing to the rural character of the Town.

The largest active farming operation in Windham is the Dutton Farm, which has been a dairy farm for several generations, encompassing 230 acres. The farm continues under family ownership, and has been converted from dairying to the production of fruits and berries. Farming operations in Windham in 2013 include:

Table 8: Farming Operations in Windham

Owner	***Agricultural Products***
Corriveau	cattle, chickens, hay
Dutton	fruits, berries, hay
Lemay	hay
Partridge	sheep, rabbits, horses
Pease	Christmas trees
Merinoff	cows, bees, sheep, llama, poultry, exotic birds

(Source: Windham Planning Commission)

3. Use Value Appraisal Program (also known as Current Use)

The Use Value Appraisal Program was established by the Vermont Legislature in 1977 in recognition that the high tax burdens placed on farm and forest lands was contributing to the rapid development of prime agricultural and forest lands across the state. The Current Use program allows farm and forest lands to be taxed on their resource production rather than their value for development purposes. The program includes a Land Use Change Tax as a disincentive to develop land. For forest land to be eligible, participating owners must have a minimum of 25 contiguous acres to enroll in the program (not counting the 2 acres surrounding any dwelling) and must manage the forest land according to the provisions of a 10 year forest management plan. Agricultural land has a different set of eligibility requirements; however, the land must be at least 25 acres, not counting the 2 acres surrounding a dwelling.

Table 9 indicates that there were 41 properties enrolled in the Use Value Appraisal Program in 2013 for a total of 10,450 acres, over half of the Town's acreage. Most of the land in the Current Use program is contained within the adopted Forest Zoning District, further supporting the desire to maintain these areas as rural and undeveloped.

Table 9: 2013 Use Value Enrollments in Windham

Number of Properties	Total Program Acres	Forest Acres	Agricultural Acres
41	10,450	10,264	186

(Source: VT Dept. of Taxes)

4. Soils and Topography

Soils are one of the most important environmental factors that governs the use of land in rural areas. Soils are classified on the basis of structure, form, composition, and suitability for various types of development. Four characteristics are of primary concern when doing land use planning: bearing capacity, erodability, drainage, and resource value.

The Town's agriculture and forestry depends upon the availability of high quality soils in large, adjoining parcels. The Windham County Soil Survey has ranked soils in Windham. Approximately 1,130 acres are categorized as having important farmland soils with about 15 acres being ranked as prime soils. However, only 44% of the important farmland soils are located on lands that are classified as open. The majority of Windham's important agricultural soils are located along the Town's streams and brooks and major transportation routes, as shown on the

Earth Resources Map.

Forestry soils are important to maintaining the forest and timber resources that are a part of Windham's identity. Many activities, such as timber harvesting, tree farming and maple sugaring, are dependent on the presence of quality soils. Using USDA Soil Conservation Service soil data, soils in Vermont have been assigned a productivity class for application in the state's Use Value Appraisal Program. Windham's soils are predominantly classified as Site I, the most productive sites. Table 10 shows the breakdown of the percent of land area by each forest productivity site classification:

Table 10: Forest Productivity Classes for Use Value Appraisal Program in Windham

Site Classification	Potential Productivity (per acre per year)	Percent of land area
Site I	>85 cubic feet	54%
Site II	50-85 cubic feet	37%
Site III	20-49 cubic feet	6%
Site IV	<20 cubic feet	3%

(Source: WRC GIS)

The slope of the land is also an important determinant of development capability. Slopes of less than 8 percent are generally most suitable for building. The erosion potential of such slightly sloping land is low, its ability to absorb runoff is high, and soils are usually of adequate depth and composition for septic systems. Exceptions are extremely flat areas, some of which may be classified as wetlands, where drainage is poor. As slopes increase, the suitability of the land for development decreases. In areas of steep slopes, the velocity of runoff, and therefore the potential for erosion, increases. The ability of the soil to filter septic leachate is decreased.

Overcoming site constraints becomes increasingly costly. Slopes of 15 to 20 percent present extremely significant constraints and under certain conditions may not be acceptable for certain types of development. Commercial and industrial development are prohibited on slopes exceeding 20%. (Refer to Slope Map in Chapter XIV)

5. Wildlife

Windham provides habitat for a wide diversity of plant and animal species. Windham's unfragmented forest land provides some of the most valuable wildlife habitat in the region. Fragmented habitat inhibits wildlife migrations to seasonal food sources, localized climate conditions (winter grounds), and habitat specific activities such as birthing young. Habitat Fragmentation can isolate breeding populations, prohibit sub adult dispersion and increase the impact of human interaction, all of which can seriously endanger specific species. Large blocks of habitat have an exponential benefit. One 1,000 acre tract is more productive than ten 100 acre blocks. A primary characteristic of habitat that is not fragmented is the absence of roads. Roads often are a barrier to wildlife movement and can be a cause of mortality. The impact of roads can vary with their type and intensity. A dirt road that is not maintained does not represent the same threat to wildlife as most paved highways for several reasons. Dirt roads tend to be narrower, necessitating lower speeds and lessening the chances of automobile-wildlife contacts. Narrow dirt roads in wooded areas also allow the tree canopy to extend over the road, thereby retaining a

greater degree of forest cover and habitat for many species of wildlife, particularly birds. Although vehicle traffic is less of a problem on these smaller roads, any travel route subjected to frequent unnatural compaction has the potential to disrupt the balance between prey and predator species for whom ground surface composition is a vital part of species preservation. Careful consideration of road placement and configuration is therefore one of the most important steps that can be taken to safeguard significant blocks of wildlife habitat.

In addition to the large forest blocks, other important wildlife habitat areas include the woodland, wetland, and surface waters in and around Burbee Pond. Abundant wildlife has been sighted in this area including, but not limited to beaver, bear, deer, moose, otter, mink, fox, fisher, Canada goose, osprey, blue heron, red-tail hawk, bald eagle, cormorants, and American bittern.

6. Earth and Mineral Extraction

Windham has a history of mining activities with both talc and marble having been mined in the Town. Talc mining operations ceased in the mid-1980s. A green marble quarry, located at the end of Abbott Road and Wheeler Road, is also no longer in operation. Planned amended zoning regulations prohibit mineral resource extraction. (See Zoning Regulations, Section 204 for additional uses prohibited).

Inactive talc mine sites continue to pose health and safety hazards, not only on the property, but for neighboring properties as well. Flooding from the open pits may pose serious problems. (Refer to Emergency Management Planning Chapter III for recent mitigation steps.) In addition, unsecured mine shafts and abandoned equipment must be addressed by property owners and comply with all applicable state and federal regulations.

7. Ridgelines

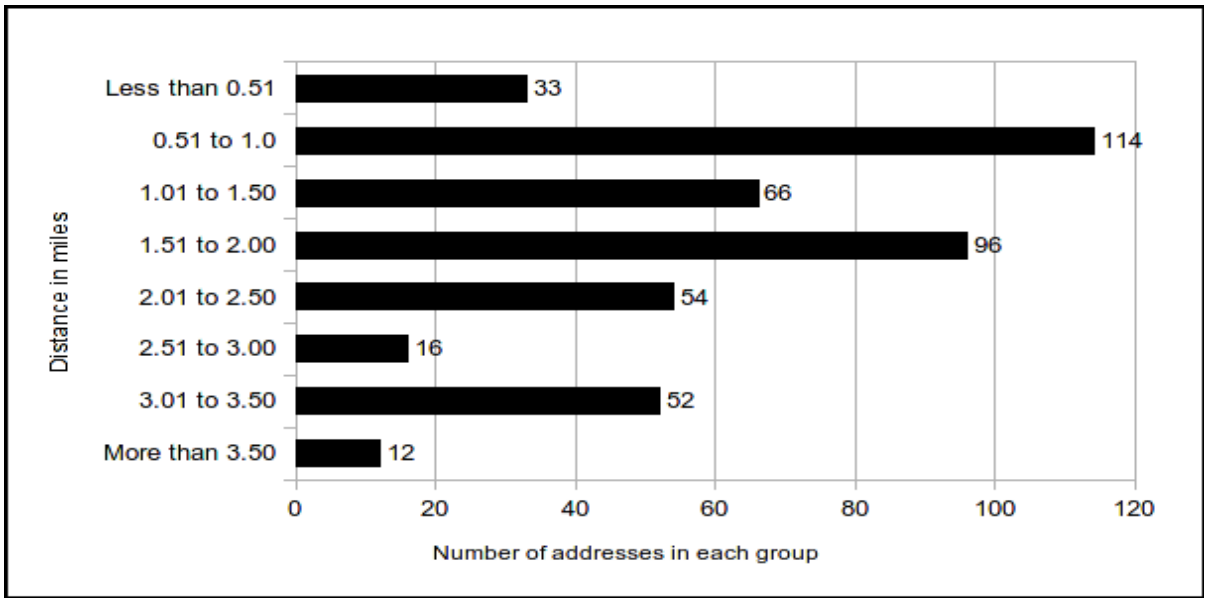
Windham's ridgelines contribute significantly to the scenic landscape of the town. Parallel north-south ridges run almost the entire length of Windham. The main north-south road, Windham Hill Road, is located in a high-elevation valley that runs between the two ridges. To the west of Windham Hill Road is Glebe Mountain which rises steeply in elevation. To the east of Windham Hill Road and south of Route 121 is a series of lower elevation hills that form a distinct horizon with many points of significant elevation and very steep slopes located in very close proximity to residences. (Reference Windham Settlement Graph below and Map 10 in Chapter XIV.) Both of these features, shown on the Utilities and Community Resources Map, form a forested backdrop for views from lower areas and also provide high elevations for viewing distant ridges. Settlement has occurred in harmony with this landscape. West Windham, South Windham, and Windham were settled on flatter terrain with views of the hillsides in the foreground.

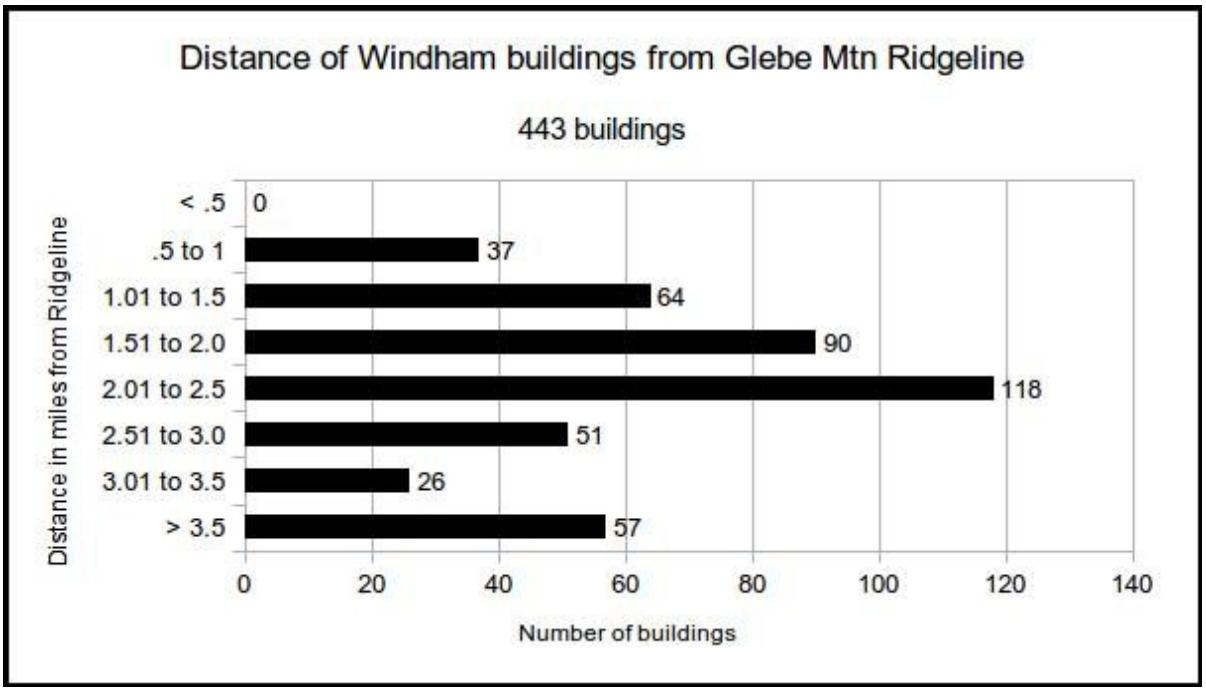
All of Windham sits at elevations of 1500 feet or above. To the west of Town, Glebe Mountain reaches to a peak of 2900 feet while the highest points to the east barely reach 2500 feet. Traditional settlement has expanded along existing roads which are primarily located in the lower elevations in close proximity to the ridges. The Windham Meeting House in the Hamlet has a geodetic marker of 2000 feet, which serves to emphasize that the difference between the highest elevations in Town and the settlement areas is much less than in most other mountain communities. The narrowness of the valley results in uniquely close proximity of the settled areas to the steep slopes rising to the high points on either side.

The following two graphics give an appreciation of the number of residences in Windham at various distances from the highest points on the ridges east and west of Windham Hill Road. (For additional reference Map 11: Settlement Patterns Relative to Topography).

WINDHAM SETTLEMENT PATTERNS

Distances of Windham buildings to the highest elevation points east of WHR





Not only are these ridgelines highly visible from lower elevations in Windham, they serve an

important ecological function as headwater areas. The cumulative effects of development in these sensitive areas (which include significant destruction of the scenic beauty of the community, degradation of water quality, increased downstream runoff and flooding problems, destruction of roads and bridges, loss of habitat linkages, and erosion) would have a substantial impact on the character and environmental quality of Windham and the Region. Consequently, these areas referred to in graphic #1 above have been included in the Forest District to limit development and prohibit all commercial and industrial use except that which is already permitted in the Zoning Bylaw. (See Zoning Regulations Section 204 for additional uses prohibited.)

Policy 1: Direct development away from unsuitable areas.

Actions

1. Prohibit development in areas where the topography and soil conditions may cause contamination of surface, sub-surface waters or wells or failure of waste disposal systems.
2. Prohibit development on slopes of 20 percent or greater.
3. Minimize areas of earth disturbance, grading, and clearing of vegetation on slopes over 15%. Evaluate erosion and sedimentation control measures in areas where development occurs on slopes over 8% during Site Plan Review.
4. Only proven technologies for stormwater mitigation will be allowed.
5. Further delineate ridgelines and other visible high-elevation areas requiring protection.
6. Revise Zoning Bylaws to prohibit visible development and permit only allowable activities on ridgelines.
7. Prohibit development in areas of wetlands and vernal pools.
8. Prohibit development in rare and irreplaceable natural areas, areas with necessary wildlife habitat and/or critical wildlife populations, and areas with endangered species. (Reference Title 10 Section 6086(a)(8)(A).

Policy 2: Enhance the economic viability of agriculture and forestry activity in Windham.

Actions

1. Maintain the purpose of the Forest District primarily for forestry activities.
2. Work with the Vermont Land Trust, or other appropriate non-profit organizations to encourage the voluntary protection of productive agricultural, forest lands and critical natural areas. Techniques such as conservation easements or donation of land should be actively explored.
3. Continue to evaluate timber harvesting practices during the site plan review process to ensure that natural resources, including surface waters, wildlife habitat, wetlands, vernal pools, shorelines, streams and stream banks are protected.
4. Continue to allow agriculture in all districts in Town.
5. Encourage participation in the Vermont Land Use Appraisal Program to support the viability and maintenance of farm and forest land.

Policy 3: Preserve and protect the natural scenic beauty and related natural resources in Windham.

Actions

1. Site buildings and structures below the ridgelines so as not to intrude upon the skyline.
2. Create additional conditional use standards for the Forest District that will be designed to prevent erosion and sedimentation associated with stormwater runoff; to ensure that new

development allowable in the forest districts is sited and landscaped in a manner which limits the visual impact of ridgeline development; and to avoid adverse impacts to natural resources, including water quality and headwater supplies and streams, wetlands and vernal pools.

3. Amend the Zoning Regulations to require that all proposals for earth and mineral extraction include a site rehabilitation plan that ensures the future use of the land.

B. WATER RESOURCES

1. Headwaters and Watersheds

Headwaters within the Town of Windham are critical resources to the Town and the region and are intended to be protected by this Plan and the Town's Zoning Bylaws discussed in Section 2 below.

A watershed, also known as a drainage area, is a land area which collects precipitation and contributes runoff to a receiving body of water or point along the watercourse. Watersheds are delineated by identifying the highest topographic points in a given area, and determining the direction in which water will flow from these points. Land uses within a watershed can affect water quality. Because the drainage area of any given water body may extend beyond the Town's borders, inter-municipal coordination of land uses is essential to ensure effective management and protection of the water resource.

Lands within Windham drain into the West, Williams and Saxtons Rivers watersheds, with sub-watersheds including Cobb Brook, Turkey Mountain Brook, Tannery Brook, Stiles Brook, Willie Brook, Howe Brook, Saxtons River headwaters, South Branch Williams River, and Middle Branch Williams River (see Map 3: Watershed Map). These three watersheds are identified by the state Agency of Natural Resources, for planning and management purposes, as Basin 11. In fact, Windham contains many of the headwater areas of this basin. The Agency of Natural Resources adopted a Basin 11 Management Plan (available at: http://www.watershedmanagement.vt.gov/planning/docs/pl_basin11%20Plan.6-08.pdf. This was developed through a public process that inventoried uses and problems and developed strategies for maintaining or enhancing water quality; identified strategies to remedy problems, and was supposed to assign Water Management Types to maintain or attain desired water quality, but that part of the project was not completed. The Agency of Natural Resources, however, has been given the authority to assign types to watersheds with the support of the Town Government. (See discussion of the Tier system below.) Issues such as water quality, erosion control, stormwater runoff, deforestation and buffer loss, and flow regulation and flood control are addressed within the basin planning process.

2. Surface Waters

The surface waters and vernal pools of Windham include lakes, ponds, rivers, streams, and wetlands (see Map 4: Natural Resources Map http://windhamregional.org/images/maps/watershed/regionwaters36x48.pdf) and represent a critical natural resource to the Town and its residents. Surface water resources serve many functions for a community and its region. Windham's surface waters provide for water storage, groundwater recharge and water supply which are critical to human and wildlife inhabitants of Windham as well as nearby towns.

Headwater streams and wetland areas are the birth place of our surface water resources. They constitute the greatest percentage of total stream length in an undisturbed river system. They are vitally important for providing clean and cold water, habitat, and food control; however, they can only provide such services if they are protected from disturbance. Headwater streams offer the greatest opportunity for interaction between water and land; and it is with this interaction that numerous biological, chemical, and physical processes are constantly occurring to clean storm water runoff. These are the processes which are responsible for maintaining water quality downstream. Windham's location at the headwaters of many of the areas brooks and rivers means that each headwater watershed in Windham plays a very important role in determining the water quality in the downstream, lower elevation areas of Basin 11. The downstream water quality is established here at the headwaters in Windham. Of particular note is the Cobb Brook watershed, a Class A1 stream by recognition of the State of Vermont. In the 1991 decision to reclassify Cobb Brook, it was noted that the Cobb water quality was among the very highest in the state and the level of sedimentation was among the lowest of streams in the state. Turkey Mountain Brook includes a spectacular gorge on its way downstream to Jamaica and encompasses another notable resource in Windham, namely Burbee Pond. Covering 50 surface acres, Burbee Pond is a source of constant wildlife sightings of Bald Eagles, hawks, osprey, otter, beaver, blue heron, deer, moose, mink, ducks, and geese. It is also a popular canoeing and fishing location. The upper reaches of the pond offer diverse wetland habitat, which supports this rich diversity of wildlife. Other critical surface water resources include Saxton's River, South Branch of Williams River, Middle Branch of Williams River, Howe Brook, Wiley Brook, Stiles Brook, and Tannery Brook.

The water quality of Windham's surface water is protected under the Vermont Agency of Natural Resources Anti-Degradation Implementation Procedure (http://www.vermontwaterquality.org/ww/Rules/101012VTANRDECInterimAntiDegradationImplementationProcedure.pdf). The Policy establishes three tiers of protection for water resources. Tier I is described as the protection and maintenance of existing designated uses such as fishing, swimming, and/or aquatic biota, and the water quality supporting those uses. For all waters, a Tier I level of protection must be maintained and therefore existing uses may not be diminished. Tier II is a level of protection applied at locations where the quality of the water exceeds the applicable water quality standards, which is often the case in headwater stream and wetlands. Any lowering of Tier II water quality is prohibited unless it is necessary to support important economic or social development. Tier III protection is offered for waters of the most exceptional value, as previously noted for Cobb Brook.

All headwater areas above 2,500 feet are currently afforded the highest level of protection as they are classified as A1 waters according to the Vermont Water Quality Standards. Many headwater seeps and 1st order streams exist at lower elevations. These headwater areas can be just as sensitive and valuable as headwaters above 2,500 feet, but are not by regulation afforded the same level of protection by the ANR as those higher headwater areas. These lower elevation headwater areas may have water quality that is far greater than the minimum Class B standards and therefore the Town concludes they shall be afforded the higher level of protection. The Vermont Agency of Natural Resources now has the ability to reclassify waters provided the reclassification is supported by the Town and by scientific findings.

3. Wetlands

Wetlands are lands that are saturated with water at least part of the year and include marshes, swamps, sloughs, fens, mud flats, vernal pools, seeps, and bogs. Wetlands serve many critical functions for the Town. They store large quantities of water during periods of high runoff and gradually release water during low flow periods. Loss of the storage capacity will not only adversely affect stream behavior but will also increase floods and reduce stream flow during crucial low flow periods. Wetlands are critical during periods of unusual behavior such as what we are seeing as a result of climate change. Wetlands are also significant for the maintenance of water quality. The biological activity of a wetland area enables the absorption and assimilation of nutrients and thus purifies, to some extent the water which is discharged. Wetlands are centers of ecological activity and support many kinds of wildlife and their habitat. Several state and federal laws also provide protection for wetlands including the US Army Corps of Engineers permits, Act 250, and the Vermont Wetlands Rules.

Windham has extensive wetlands providing the essential functions identified above. Some examples of the wetlands include the upper reaches of Burbee Pond, an extensive wetland complex which provides for diverse wildlife. Also, in Windham Center, an excellent chain of wetlands begins just north of the Village and stretches along the east side of Windham Hill Road all the way to Route 121. An active beaver population there maintains open water for wildlife and habitat similar to the Burbee Pond area.

There are also important wetlands to the east of Windham Hill Road in Howe Brook, Willie Brook, Stiles Brook, and Turkey Mountain Brook watersheds. Cobb Brook headwaters emerge on Glebe Mountain. In addition, east of Windham Hill Road and below the ridgeline that parallels it, there are significant wetlands to the south of the Meeting House. This collection of seeps, bogs, streams and beaver meadows (both active and inactive) drain southward through a low area that crosses several smaller private parcels in which these features are relatively undisturbed. The system crosses Windham Hill Road near Abbott Road and drains into Burbee Pond and continues into Turkey Mountain Brook.

These wetlands described above are likely to provide a high function and value for filtering water, providing flood control, recharging ground water, and mitigating erosion and sedimentation. It is likely many other high quality wetlands exist within the Town which have not been formally mapped and assessed but which provide the functions identified above and deserve protection.

Many of Windham's significant wetlands are created, inhabited by and dependent on beavers. Beaver wetlands, or flowages, support a remarkable density and diversity of life. They provide sites for hunting, fishing, wildlife viewing and environmental education. Flowages also abate flood damage by acting like giant sponges, holding vast amounts of water during floods and then releasing it slowly over subsequent weeks. In the absence of beavers, dams decay and wetlands eventually disappear and become forested .The Vermont Fish & Wildlife Department recognizes the value of beaver flowages for the variety of ecological benefits they provide. The cycle of beaver maintains an ever changing diversity of habitat benefiting a whole host of species. For this reason, the Department strives to maintain beaver-influenced wetlands across landscape whenever possible.

Conflicts with beavers usually come in the form of clogged road culverts resulting in water encroaching on yards or roads. There are three ways of approaching the issue: trap and relocate the beavers, kill the beavers, or make use of high quality flow-control devices. Well built and designed flow devices are a superior tool for both ecological and economic reasons.

4. Flood Hazard Areas

The floodplains in Windham are primarily related to seasonal high water flow in the middle and south branches of the Williams River and the Saxtons River. Floodplains are low-lying terraces adjacent to rivers and streams which are periodically inundated when swollen waterways exceed their bank-full capacities. Federal mapping indicates that floodplains exist in the central and northern portion of the Town. There are also areas along rivers and streams subject to risk of erosion, particularly in high flow events, known as Fluvial Erosion Hazard (FEH) Zones. These areas have been and are being defined through the State River Management Program protocols in cooperation with FEMA. State maps are not yet available for all towns due to lack of funding, but remain a part of the goals of the River Management Program and could be released during 2014. Once defined, these areas should be included in the town's flood hazard area regulations to protect the public and the river corridor environment from adverse consequences of development there. A detailed discussion of FEH Zones can be found here:
*www.vtwaterquality.org/**river**s/docs/rv_vtfehqa.pdf*

5. Groundwater

Groundwater is an extremely valuable natural resource in the Town of Windham because it provides the primary source of potable drinking water for residents. Groundwater is water that has infiltrated into the soil through sand, gravel, or rock. The area where groundwater is stored is called an aquifer. Groundwater occurring in fractured bedrock is highly susceptible to contamination. Failed or inadequately designed septic systems are potential sources of groundwater pollution. Aquifer recharge areas for Windham are not currently mapped. Regardless, it is important to note that the entire Town is an important groundwater recharge area for the Town and the region.

Of particular concern in Windham is the safety of groundwater supplies in the areas where the talc mines were operated. The network of mine shafts was extensive and their exact locations are not well known. Since the closure of the mines, the water table has returned to a higher level, flooding the mine shafts. There remains a possibility that a water supply system might tap into one of the mine shafts and the water may not be potable. Any parcel of land with mineral rights has the potential to be impacted by an underground mine shaft.

A third area of concern is any development that requires significant blasting that could impact residential water supplies. Commercial and industrial development is prohibited that could affect groundwater supplies as a result of techniques including but not limited to blasting, drilling, and hydro-fracking.

In 2008 ground water protection waters in Vermont were strengthened when the legislature designated ground water as a public trust resource. The result of this designation is that ground water must now be managed for the benefit of all citizens. The 2008 law and the interim implementation procedure put forth by the Vermont ANR in 2011, proclaims that certain activities present a heightened risk to ground water quality and that changes must be made at the

regulatory level to require applicants to clearly demonstrate proposed actions do not harm water quality. The Town of Windham fully supports the declaration of groundwater as a public trust and ANRs interim procedure to strengthen groundwater protections and make people accountable for damage to this critical public resource.

6. Surface Water Quality

There are several threats to surface water and ground water quality. The two main categories of pollution are point source and non-point source pollution. Point sources are those that can be traced to a specific source, such as a pipe or sewer outfall. Non-point sources of pollution are more diffuse in origin. They can include storm water runoff, septic system effluent, snow dumps, road salt, soil erosion, etc.

Water quality is greatly impacted by the presence of impervious surfaces that are associated with development. Impervious surfaces include buildings, paved roads, driveways, industrial platforms and parking lots. These surfaces reduce the natural infiltration of stormwater into the ground, thereby reducing the recharge of groundwater resources. Where increased imperviousness results in direct stormwater discharge into streams or rivers, the result is often the alteration of the natural flow of the stream, causing erosion and sedimentation, pollution, loss of aquatic wildlife habitat, and increased flood hazards. The most significant and on going source of sediment discharge to streams and ponds in Windham is sand and gravel washed off of gravel surfaced town roads. The erosion of road surface material into watercourses damages both the watercourse and the road, and is wasteful of public funds. The material eroded int o the watercourses must continually be replaced in order to maintain the road surface.

Often runoff from private roads and driveways is directed into the public road drainage system resulting in concentration and increased volume of runoff that contributes to erosion and flooding problems. In addition, inadequately maintained private driveways and road ditches and culverts are vulnerable to failure during storm events as available area for runoff is compromised and erosion results in instability of the traveled surface. In some instances failure of private infrastructure propagates downstream to the public right-of-away resulting in much more significant and costly damages to this public infrastructure.

In 2013, the Lake Champlain Basin Program released a report on the effects of unpaved roads on Lake Champlain water quality. The report findings suggest that 31% of the annual average Winooski River suspended sediment load and 11% of the annual average phosphorus load can be directly attributed to the unpaved road network. In addition, the findings demonstrated that the magnitude of the erosion and pollutant production increased as road grade increased. In Windham, the higher grade roads are more prevalent at the higher elevations.

Many new advances are occurring with how storm water is managed from developed sites. Green storm water infrastructure as defined by the Vermont Agency of Natural Resources is “a wide range of multi-functional, natural and semi-natural landscape elements located within, around, and between developed areas at all spatial scales.” Green stormwater infrastructure or GSI are Best Management Practice tools which can be used to effectively restore and maintain natural hydrologic processes when developing land. The core benefit of these systems is that runoff generated from development is infiltrated, evaporated or recycled rather than polluting downstream resources.

In 2011 the Vermont Agency of Natural Resources released the Green Infrastructure Strategic Plan which has the over arching goal of restoring and maintaining the pre-development hydrology of the State's watersheds through the use of GSI. Objective 2 of the Plan states that "municipalities understand the impacts of stormwater runoff and work to mitigate the effects." Notably to accomplish this objective according to the Plan, the Town will regulate land use with an understanding of the impacts on water quality and natural hydrologic systems and should coordinate with the ANR for local GSI implementation. The Town of Windham recognizes the importance of GSI for preserving hydrology and protecting its sensitive water resources relative to the region's watersheds. The Town supports ANR's mission of promoting the use of GSI at the municipal level by informing its citizens, applying GSI to municipal projects, and requiring GSI implementation for development projects.

This advance in stormwater treatment has also spurred regulatory changes. The Vermont ANR is in the process of updating the current Vermont Storm Water Management Manuel ("VSMM"), which was developed originally in 2002. The VSMM regulates the creation of impervious surfaces. New standards being discussed are focused on integrating infiltration-based GSI requirements. The Town of Windham will stay abreast of changes in this area and modify its plan, policies, and zoning regulations as appropriate.

The Town of Windham is fully aware of the evolution of new regulations and scientific advancement in stormwater management. The Town understands many professionals including regulators at the State and Federal level are of the opinion that current techniques and regulations have not been adequate to preserve existing hydrological conditions. The Town supports the development and implementation of new GSI-based regulatory tools to better protect water resources.

Recent research has revealed new understanding of the effect of the loss of forest cover. Newly developed estimates suggest that water sinks into the soil under trees at 67x the rate at which it sinks into the soil under grass. (Impermeable surfaces represent even starker contrasts. M.R. Marshall et al, 2013. The impact of rural land management changes on soil hydraulic properties and runoff processes: results from experimental plots in upland UK. Hydrological Processes, DOI:10.1002/hyp.9826.http.//onlinelibrary.wiley.com/doi/10.1002/hyp.9826/abstract).

7. Wastewater and Potable Water Supply

In 2002, the State passed new Wastewater System and Potable Water Supply Rules. As part of those rules, the State of Vermont has had the sole responsibility for issuing septic permits unless the Town of Windham decides to seek approval to be delegated that responsibility. As a part of the new rules, all permits, licensed certifications of design and installation, and installer certifications of installation related to the Wastewater System and Potable Water Supply Rules generated by the state will be required to be filed in the municipal land use records.

8. Culvert Design

Proper culvert design allows for passage of aquatic organisms and sediment through the culvert to maintain geomorphic equilibrium. Historically, stream crossing structures have provided a block to organism passage as perched structures that are disconnected from the stream channel. Further, inadequately sized structures do not allow for the passage of sediment and debris downstream causing the stream to aggrade or build up on the inlet end of the structure and to degrade or scour on the outlet end of the structure resulting in a loss of equilibrium. Current

guidance including in the Vermont Fish and Wildlife Guidelines for the Design of Stream/Road Crossings for Passage of Aquatic Organisms in Vermont provides technical standards for retrofit of existing culverts and the installation of new structures. The Town will support proper culvert design by following these procedures for municipal projects and requiring new development projects to follow the standards as well. Assessment and retrofit of existing problem culverts will be completed as funding becomes available for such projects.

9. Buffers

Stream, lake, and wetland (including vernal pools) buffers provide many critical functions that serve to protect water quality, including the stabilization of banks and shorelines, shading, habitat, and filtration and infiltration of runoff and pollutants. To protect buffer zones during the development evaluation and permitting process, the document titled Guidance For Agency Act 250 and Section 248 Comments Regarding Riparian Buffers provides technical guidance on determining the appropriateness of buffers widths depending on specific site conditions. According to the policy, the State will recommend a minimum of 100 foot undisturbed vegetated buffer for lakes, and either 50 or 100 feet of undisturbed buffer for streams. In some instances, even greater buffer widths would be warranted for especially sensitive streams with 1.) the potential for significant lateral or vertical adjustment, 2.) significant wildlife travel corridors, riparian dependent species, and/or significant natural communities in close proximity, and 3.) site characteristic indicative of increased erosion risk and/or potential for overland flow of pollutants. In the Town of Windham for any development project a riparian management plan must be prepared by a development project applicant and approved by the Town. The Town supports the buffer policy and will require mandatory minimum buffers on streams, lakes, wetlands and vernal pools to the ANR standards at a minimum.

Policy 1: Maintain and enhance the chemical, physical and biological quality of Windham's surface and ground waters.

Actions

1. Support the Agency of Natural Resources Green Infrastructure Strategic Plan by:
    a. Evaluating a by-law within the Town regulatory framework to require GSI for new development projects and to integrate GSI such as rain gardens and filter strips at existing Town facilities.
    b. Reviewing new development projects for jurisdiction under State Stormwater Operational standards and requiring that the terms of the permit, including the installation and maintenance of GSI systems, are complied with by the project owner.
2. Assess existing river crossing structures in need of repair and prioritize retrofit or replacement based on aquatic organism passage and sediment transport considerations depending on financial resources and Agency support.
3. The Town will request that the Vermont Agency of Natural Resources complete an assessment of high-quality water resources including streams, wetlands and vernal pools, especially in headwater areas, for additional protection through the Agency's reclassification program.
4. On-site septic systems are to be designed and then permitted by the State.
5. Use road maintenance methods and materials that will maintain or improve water quality, such as those described in the *Vermont Better Backroads Manual.*
6. Evaluate standards for private roads and driveways including minimum culvert sizing, culvert spacing, as well as roadside ditch construction and erosion control to reduce the

energy and volume of runoff entering the public right-of-way thereby reducing the likelihood of erosion and sedimentation to surface waters.

7. Maintain the Forest District which prohibits commercial and industrial development in:
    a. Headwaters and Watersheds of upland streams
    b. Headwaters and Watersheds characterized by steep slopes and shallow soils
    c. Areas supplying large amounts of recharge waters to aquifers.

Policy 2: Preserve the natural condition of watercourses and their shorelines.

Actions

1. Devote lands within flood-hazard areas to agricultural, forestry, and open space uses. Windham has enacted a Flood Hazard Bylaw and should continue its enrollment in the National Flood Insurance Program.
2. Require that site plans identify all water features, including but not limited to rivers and streams, wetlands, vernal pools, and lakes and ponds. Use the Zoning Bylaw to require maintenance of undisturbed, naturally vegetated buffers sufficient to protect water quality and other natural resources. Buffer areas, including the depth and type of buffer, shall be shown on the site plan.
3. Require a riparian management plan for development projects and/or where sensitive streams including headwater areas are potentially threatened by development. In cases where buffers are comprised, the Town will institute a " no net buffer loss" standard, meaning that greater buffer areas must be preserved to compensate for areas lost.

Policy 3: Retain wetland areas and vernal pools and their buffers in their natural state for the provision of wildlife habitats, retention areas for surface runoff, recreation and resource value.

Action

1. Require independent field studies to identify and better understand and protect wetlands and vernal pools before permitting any development in forested areas involving or adjacent to wetlands or vernal pools.
2. Study the means and implications of reclassification of Windham's critical surface waters described in Section 2 Surface Waters.
3. Create a subcommittee to inventory headwaters, wetlands and vernal pools and how the Town can ensure protection into the future.
4. Develop zoning regulations to protect Windham wetlands to the minimum ANR standards.

Policy 4: **Stay informed of new State and Federal data and mapping resources related to Flood Hazard Areas and work with downstream communities to mitigate possible flood hazards.**

Policy 5: Windham supports and encourages the use of flow control devices ("beaver deceivers") in preference to extermination or relocation to maintain beaver flowages whenever the circumstances allow.

C. AIR RESOURCES

Windham's air resources and air quality are generally good. There are no major noise sources so that the predominant sounds are natural. This contributes significantly to the high quality of life in Windham, as well as the health and the well-being of its residents. Air resources should be protected and improved to protect these values.

1. Air Quality

Windham air quality is impacted by local, regional and global pollutants. Windham is a rural community with few local air pollution sources. There are no industrial sources of air pollution, and minimal contributions from commercial properties. While Windham's air quality is considered high, some pollutants are emitted from home heating and vehicle transportation. These same pollutants contribute to local and regional environmental problems, and on a global scale to climate change.

Policy 1: Protect Windham's air quality by reducing current energy use and ensuring that new development does not degrade air quality.

Actions

1. Activate the Town's Energy Coordinator and Conservation Commission to seek ways to utilize more sustainable, clean, local, small scale energy sources and reduce energy use in residential and town buildings by working in conjunction with the Energy Coordinator or Committee.
2. The Energy Coordinator and Conservation Commission should seek and apply for grants to reduce energy use at public facilities in Windham including the school, town office, library, Meeting House, and garage.

D. NOISE

Introduction to Windham Noise Standards

Noise pollution tends to be a fairly localized pollutant. As such, Windham has exceptional natural quiet. Commercial and industrial noise is very limited in Windham, with occasional forestry operations the only significant source of noise. Transportation related noise is also very limited, due to the lack of major highways and slower travel speeds. As a result, Windham's acoustic environment is exceptionally pristine, particularly in the evenings, night time, and on weekends and deserves the most protection. In Windham, over large areas and for long periods of time, no anthropogenic noise can be heard. Quiet is a highly prized characteristic of rural residential life in Windham, allowing people to better experience nature and natural sounds, and to better enjoy their property without acoustic intrusion from the surrounding lands.

Property line noise standards are a common way to protect the acoustic environment, and also provide more effective protection of soundscapes in districts, and not just around residences. Decibel based noise standards are also important for developers, so that they can know with certainty the design criteria they must meet.

In this Plan, Windham seeks to protect and preserve the full use and value of all residential, and potential residential, properties from encroachment by disturbing types and levels of noise. In order to protect all lands, a "property line standard" for noise and setbacks, which are used in noise regulations throughout the country, are used.

This Plan also seeks to protect both health and aesthetics. We are mindful that the clinical definitions of the health hazards from sound are under investigation and remain epidemiologically unsettled. In addition, noise need not rise to the level of a proven health hazard to represent a significant deprivation of use and value in nearby properties.

The Plan has relied upon the World Health Organization Night Noise Guidelines to set noise and setback limits. Night Noise Guidelines recommends 40 dBA Lnight outside to protect against sleep interference and health effects. The Plan has also relied upon the US EPA Levels Document recommendations adjusted using the correction factors in Table D-7. For Windham, that results in a recommended level of 35 dBA Ldn.

In developing its noise standards, Windham has sought to implement levels which both correspond well with those recommended by scientists at the WHO and EPA, while recognizing that the metrics used by those agencies are not workable as enforcement conditions. Yearly or nightly average levels and background levels cannot be easily measured or enforced. In fact, even one hour average levels are difficult to enforce because there can be significant contaminating background noise over one hour. Therefore, Windham has relied on a Fast Lmax and minimum setbacks as the easiest and most cost effective enforcement metrics, and increased the criterion level to account for variations in noise levels that are masked by averaging.

Windham's Policies recognize that noise measurement and setback distance requirements must be used conjunctively to insure adequate protections. The Town also recognizes that noise monitoring can be prohibitively expensive particularly for small towns and individual property owners. The Town of Windham therefore requires that industrial wind generators, should they be installed anywhere within the Town, be placed at least 2,500 feet from property lines and noise levels not exceed 45 dBA Fast Lmax. The setback is designed to result in a similar noise level to the decibel standard, since noise decreases with distance. Most importantly the setback is easily measured and compliance is easily insured.

Finally, for noise sources that have a significant low frequency noise component, decibel level does not adequately reflect or predict health and well-being effects. Low frequency noise is of particular concern because it travels further and is not easily blocked by buildings. Therefore, it can have a greater impact on residents. The WHO noted this when they recommended lower thresholds for noises with low frequency components. In cases of low frequency noise, a lower criterion level shall be used.

In arriving at these standards the Town has reviewed a variety of publications including but not limited to the EPA "Levels Document" (nepis.**epa**.gov/Exe/ZyPURL.cgi?Dockey=20012HG5.TXT) and A Brief Review of Wind Power in Denmark, Germany, Sweden, Vermont and Maine: Possible Lessons for Massachusetts by Mill and Manwell, January 11, 2012. The latter is a condensed review of standards used in Northern European countries with decades of experience with policies designed to accommodate renewable generation facilities without doing harm to the population.

Policy 1: **Protect the acoustic environment of Windham with noise standards enforced at or beyond the property line of the source.**

Actions

1. Limit property line noise from sundown to sunup to 45 dBA Fast Lmax.
2. Limit source noise dBC Fast Lmax minus dBA Fast Lmax to less than 15 dB beyond the property line and inside homes, schools, and town offices and buildings.

Policy 2: Protect the health and well-being of all people residing in Windham or staying in Windham, regardless of the frequency or duration of their stay.

Actions

1. Prohibit noise that is plainly audible within a residential structure (one that is used for sleeping and is occupied either full or part time).
2. To control noise pollution, placement of commercial/industrial development facilities within the stated minimum setback requirements (see Energy Chapter V Community Standards) is prohibited.
3. Specific Community Standards for setbacks of wind turbines have been established (reference pages 62-67) to protect properties against noticeable shadowing, shadow flicker and the risk of ice throw landing on neighboring properties or tower collapse affecting neighboring properties.