8 NATURAL RESOURCES

TOPICS INCLUDE:

Understanding Pembroke's natural resources

Challenges & opportunities going forward

Summary of Pembroke's natural resources

This chapter focuses on natural resources and their contribution to the sense of place that is unique to Pembroke. These natural resources, including land, water and wildlife, shape how residents and visitors not only experience Pembroke but provide opportunities to deepen an understanding and appreciation for how these resources function and enhance quality of life. The 2010 Open Space Plan, the 2017 Natural Resources Chapter and the 2016 Natural Resources Inventory include extensive information on the town's natural resources and readers should refer directly to these reports for more detail. These documents are incorporated into this plan by reference (See Appendix A).

.

Pembroke is…

a community with strong environmental stewardship of its natural resources. We value our rural character, reflected by the connected network of open space and agricultural lands, forests, water resources and stone walls that provide opportunities for residents to enjoy clean air and water, recreational opportunities, diverse plant and wildlife habitat, and the connections these resources provide to our overall quality of life.

WHAT THE COMMUNITY SAID…

Public responses from Pembroke's outreach process (community survey and visioning session) provided a clear and consistent direction for the town's future preservation of its rural character and its natural resources. Throughout successive master plans, residents have consistently voiced support for the protection and conservation of Pembroke's natural resources. Residents identified rural character, protection of surface and groundwater, land conservation, scenic quality, and access to the community's natural areas and resources as important features in Pembroke. Proximity/location is also important.

Balancing the protection of key natural areas with development, and access to and use of these resources, is an important concern that was mentioned in the survey and the visioning session.

The following charts briefly summarize comments and input received throughout the public outreach process. Results of these engagement opportunities provided a direction for the objectives and recommendations identified in the chapter.

Table 8.1: Residents ranked the following NR features as very important/important

Identified Feature	Very Important	Important
Small Town/Rural Atmosphere	76%	19%
Location	72%	25%
Natural Resources and Open Space	70%	24%
People/Community Spirit	65%	28%
Public Parks and Town Forests	59%	32%
Rivers	57%	32%
Scenic Areas	51%	39%

Table 8.2: Residents ranked the importance of protecting the following features

Identified Feature	Important	Somewhat Important
Streams/Rivers	86%	13%
Surface/Groundwater	85%	13%
Fields/Agriculture	75%	21%
Town Forests	69%	25%
Recreational Trails	70%	23%
Fish and Wildlife	69%	24%
Stormwater/Runoff	67%	27%
Wetlands	63%	28%
Scenic Views	57%	31%
Scenic/Range Roads	54%	30%

Table 8.3: Support for natural resource protection

Protection Type	Yes
Acquisition of conservation lands/easements	65%
Acquisition for trails	59%
Acquisition for parks	55%
Acquisition for fields	48%
Recreational Trails	70%
Zoning to increase wetland setbacks	79%
Zoning to increase groundwater/aquifer setbacks	81%

Other notable responses to the survey included 82% of Pembroke's residents supporting a trail along the Merrimack River as important or somewhat important. Some 66 percent of respondents identified the preservation of existing Class VI roads as important or somewhat important. The majority of respondents favored the placement of new businesses and services along the Routes 3 and 106 corridors, with less than 23% favoring placement in the Buck St. or North Pembroke areas. Less than 36 percent of survey respondents would support the upgrading of class VI roads to provide for more buildable lots in Pembroke or to alleviate traffic congestion on Pembroke Street.

Themes that can be identified from the visioning session and community survey include:

- Importance of natural resources to overall quality of life;
- Need for balance between economic development and conservation;
- Interest in focusing new development near existing development to retain Pembroke's rural character;
- Desire to maintain rural aspects of Pembroke to preserve the quality of life and community character; and
- Desire to maintain and enhance community connectivity to natural resources through support of conservation protection efforts.

CHALLENGES AND OPPORTUNITIES

STEWARDSHIP

Stewardship of natural resources requires a multi-faceted approach. Conservation lands and trails; rivers and streams; wildlife; agricultural fields; and the aquifer are all ecologically intertwined, but each have their own unique challenges that require management plans for protection. Active stewards who assume the responsibility of natural resources are charged with protecting, managing and providing education about these resources. Active participation and investment by community leaders can inspire others to get involved. Neighborhoods that border natural resources can also serve as stewards and can organize into "Friends" groups to support responsible use of natural resources. Community education and awareness of natural resources and their threats will be important to cultivating stewardship in the community.

VOLUNTEERISM

Stewardship cannot exist without volunteerism. Volunteerism plays an important role in the success or failure of conservation activities. It's easy to ask people if they care about conservation. The vast majority of people agree that conservation initiatives are important to the town. The survey results confirm that Pembroke residents absolutely value conservation. The challenge is getting enough of those people involved as volunteers on a regular basis. With all of modern life's responsibilities and stressors, it can be difficult to convince people to add more to their already full plates.

The opportunity in conservation-based volunteerism is that people can incorporate many beneficial conservation activities into their existing routines. If you walk your dog or run on the same trail every day, maybe you become a steward of that trail, meaning you pick up trash as you walk, or you keep a look out and report any illicit behavior you come across. Maybe you lead your child's scout troop and see an opportunity to build a trail kiosk as part of their Eagle Scout project. These are seemingly small changes to one's life that can make a big difference in the conservation goals of the community. Participating in small ways can nurture a larger interest and may inspire people to get involved in a larger capacity, for example sitting on a committee, organizing a community event, or getting involved in fundraising. In natural resource protection there are many ways to become a volunteer that fit individual interests and lifestyles.

FUNDING

Funding plays a significant role in natural resource preservation. Land acquisition, property clean up, stormwater infrastructure, trail engineering, and invasive species removal all come with associated costs. Conservation projects usually require a unique funding strategy combining town resources, grant money, and private donations. Community awareness and volunteerism, as touched on previously, play an integral role in garnering support and funding for projects that promote natural resource preservation. Grant opportunities are competitive but available, like the Land and Community Heritage Program (LCHIP), Transportation Alternative Program (TAP) and the Moose Plate grant. Many times, private donors have interest in donating to conservation of property that has special meaning to them. Environmental foundations may donate to projects that fulfill ecological goals they support. Knowing

where to find funding and piecing together different funding sources is a challenge for natural resource projects, but with dedicated volunteers and community support it is not out of reach.

HABITAT LOSS AND FRAGMENTATION

Habitat loss and fragmentation of open space is a challenge that many communities face. Ideally, we would like to have a contiguous network of open space for the purposes of wildlife migration and ecological connectivity. Practically, this can't always be the case due to the variety of ways that open space parcels are acquired. A cohesive open space plan and criteria for high value natural resources can help strategize which properties to focus on for connectivity and habitat purposes.

HERBACEOUS RIVER CHANNEL ALONG THE MERRIMACK RIVER, A UNIQUE NATURAL COMMUNITY IN PEMBROKE

Habitat loss occurs most frequently through sprawl, a dispersed and cumulative development pattern that can consume the landscape. Since Pembroke is home to many threatened species, it is especially important to preserve habitat where those species are found. Bald eagles and hognose snakes, for example, are threatened in New Hampshire and both are found in Pembroke. It is important to create awareness about the threats to these species and strategize plans for habitat protection.

It is also important to preserve ecologically fragile and significant habitat, like wetlands and vernal pools, which serve as feeding and breeding areas for many species. Actively maintaining Pembroke's natural resources and wildlife will help to maintain Pembroke's rural character. Maintaining an accurate list of wetlands that would benefit from restoration efforts and/or are particularly vulnerable to habitat loss is also important.

The NRI identified five separate land blocks in Pembroke that exceed 1,000 acres in size. The largest block lies along the Merrimack River and extends both across and up and down the river. The next largest block lies north of North Pembroke Road and includes portions of Epsom and Chichester in the northeast corner of town. The smallest 1000+-acre block is the unbroken forested tract that spans the Soucook River near the Concord Well Field. This lowland forest includes critical habitat for the pitch pine barrens species. For a more detailed look at these lands, please see the **Unfragmented Lands Map**.

INVASIVE SPECIES

Invasive species are an increasing concern in NH communities, particularly as a threat to native plants and wildlife due to their ability to reproduce rapidly under a variety of conditions. Some are less vulnerable to diseases than native species and their presence alters the way plants, animals, soil and water interact within native systems, thereby decreasing ecological diversity and native habitat. According to the Natural Resource Inventory completed in 2016, of the 28 listed invasive plant species in the state, 23 of them have been located in town. Appendix B contains a list of the more common invasive species in NH.

INVASIVES -PICKING OUR BATTLES

Picking Our Battles is a collaboration of NH Fish and Game, the NH Natural Heritage Bureau, and Great Bay National Estuarine Research Reserve who teamed up with representatives from over 120 communities, natural resource managers, and academics to develop a statewide strategic prioritization plan for the control of upland, wetland, and intertidal invasive plant species.

This statewide project has been used to develop a customized invasive plant control strategy for each NH municipality, including a map showing priority areas where invasive plant removal will have the most immediate impact and most effectively protect our native natural resources in the long-term. They also show a customized "early detection" list of plant species just coming into each community and are most easily manageable before becoming fully established in the community. Invasive plants can cause significant ecological and economic harm and can impact wildlife or alter habitat structure or function.

These maps, including the map for Pembroke, can be viewed online.

Source: New Hampshire Fish and Game

WATER QUALITY & STORMWATER MANAGEMENT

Water quality and stormwater management go hand in hand. Nearly everyone has seen the effects of stormwater at one time or another: streets and basements flood, erosion threatens properties, and drinking water sources become compromised. However, there are other implications of stormwater that are not so easily seen. For example, without properly maintained stormwater infrastructure, oils and sediments enter the municipal drainage system and are eventually deposited into the Merrimack River, deteriorating the water quality of our New Hampshire rivers to the detriment of plants, wildlife, and the people who enjoy them. Additionally, without proper stormwater management, the quantity and quality of the aquifer, our drinking supply, is also threatened.

So what can be done? Educating the community about water quality and stormwater should be a priority so that people become aware of why they should care about stormwater. Stormwater management bylaws and regulations, utilizing best management practices, for both commercial and residential development should be adopted and enforced. Identifying wetlands that contribute to water quality protection is another strategy. In fact, with the rollout of the EPA's MS4 Permit process over the next few years, municipalities will be responsible for any illicit stormwater discharges and the quality of those discharges, resulting in fines if not compliant. This master plan is a good opportunity to prioritize these issues so that as a community we can start exploring and drafting bylaws to regulate and manage

stormwater and water quality for the protection of the aquifer, rivers and streams, and personal property.

PERMANENT LAND PROTECTION

One major challenge to natural resource protection unique to Pembroke is a lack of permanent protection on conservation properties. While the town owns many properties with the intent of preserving them as conservation land, these properties lack the legal protection required (through deed restriction or easement holding) to preserve the land in its natural state in perpetuity. Without permanent protection, these properties, which were chosen for their ecological significance, are susceptible to future development by the town or others.

Another challenge is finding non-profit organizations to hold easements on town property. There is such a demand for easement holding that many of these organizations are now bogged down with requests and lack the resources to take on all of the easements offered to them. Something the town can do is work with a land use attorney to identify properties that need permanent protection, explore options to protect them in perpetuity (i.e. easements, conservation deed restrictions), and draft deed language that protects the parcels from development but that allows appropriate uses (i.e. trail maintenance, non-motorized use, etc.)

TRAIL MANAGEMENT

Trails create opportunities to access land and water for residents and tourists to enjoy natural, scenic and recreational areas. Access to recreational trails was identified as a priority by those who participated in the master plan survey and the visioning session. Pembroke's extensive Range Road network, comprised of over 16 miles of unmaintained Class VI roads, is enjoyed by hikers, bicyclists, horseback riders, snowmobilers, off-road vehicles and other users. These multi-use areas can often lead to overuse with areas subject to rutting, erosion and other types of damage. The 2016 Natural Resource Inventory treated the Class VI range roads as a fragmenting feature since it was quite evident from the roadside surveys that these roads receive a fairly high degree of traffic during most

Photo from Pembroke's Natural Resources Inventory, 2016

THE 'RANGE ROADS' AREA OF PEMBROKE INCLUDES A NUMBER OF CLASS VI ROADS THAT GET VARYING DEGREES OF USE YEAR-ROUND, INCLUDING WINTER-TIME SNOWMOBILES AND SUMMER TIME OHRV'S.

seasons. The town should evaluate the use and condition of these Range Roads and other Class VI roads and consider policies that maintain adequate access for landowners, allow for recreation opportunities, respect environmental concerns, and address quality of life issues that may arise from unmitigated ATV/OHRV use. There may also be interest in reclassifying certain portions of the Range Roads from Class VI to Class A or B trails. (See Transportation Chapter and Community Heritage and Sense of Place Chapter).

Many other town properties, including the town forests, have trails that are marked for users to enjoy. These trails are maintained either by the conservation commission or volunteers. There are occasional snowmobile trails that cross the town forests but none are part of any organized trail system.

Discussed in more detail in the Transportation Chapter, the Pembroke Rail Trail could be an important community resource, and could also become part of a larger network of connected multi-use trails spanning much of the state. The proposed Granite State Rail Trail would link up local rail trails along abandoned railroad corridors to form a 115 mile long trail from Salem to Lebanon, plus additional connecting trails. The Granite State Rail Trail is largely completed north of Concord, and several miles of trail are from Manchester south. Pembroke's trail would energize efforts to complete the Manchester to Concord connection.

CHAPTER OBJECTIVES & RECOMMENDATIONS

OBJECTIVE 1 **Preserve open space through use of land acquisition and easements**	→ Continue to identify, inventory, and assess natural areas in town and employ parcel assessment methodologies to rank the value of parcels for acquisition or conservation easements. → Actively seek out grant opportunities, donations and bequeathments to fund the acquisition of, or easement establishment on high-value parcels.
OBJECTIVE 2 **Use regulatory and non-regulatory strategies to preserve open space**	→ Utilize open-space subdivision, and other zoning options to establish and preserve high-value wetlands, shorelines, wildlife habitat, and trails on private lands. → Condition the granting of variances and special exceptions to zoning ordinances on the establishment of conservation easements on subdivisions. → Keep existing town-owned conservation areas protected from transfer to alternative uses by the establishment of conservation easements with non-profit trusts such as the Five Rivers Conservation Trust.
OBJECTIVE 3 **Preserve surface-water and ground-water quantity and quality**	→ Identify and monitor potential threats to the integrity, sustainability and potential use of water resources in Pembroke, including but not limited to: i. Storm-water runoff and its potential effect on groundwater recharge and water quality ii. Surface-water withdrawal and its potential to reduce groundwater recharge iii. The storage of hazardous materials that could negatively affect groundwater supplies → Utilize data and mapping from the Pembroke NRI to identify surface water areas of significance in order to enhance protective regulations under the current Shoreland Protection District, including but not limited to: i. Maintenance of the 125-foot setback for all uses including agriculture and forestry ii. Disallowance of any earth-moving activities or other soil disturbances within the 125-foot shoreland zone iii. Identification and mapping of those areas that by virtue of their proximity to the Shoreland Protection Zone may require even greater setback accommodations for the purposes of protecting special habitats, aquifers, floodplains, etc. → Perform sufficiently detailed aquifer-yield studies, to establish their sustainable level of groundwater withdrawal, in order to protect the long-term viability of the groundwater resource in the town.
OBJECTIVE 4 **Preserve prime agricultural lands and**	→ Establish an Agricultural Conservation District that discourages conversion of prime agricultural land to development, and provides tax incentives, beyond the Current Use assessment, to support locally grown food products.

soils, and retain agricultural land uses	→ Engage the conservation commission to promote long-term protection of these areas by purchasing development rights and securing restrictive easement. → Establish an agricultural commission pursuant to RSA 674:44-e to promote local agriculture and advocate for the protection of agricultural resources. → Review zoning ordinance and other regulations to ensure that agricultural uses, businesses, and operations are not unintentionally restricted and are consistent with RSA 21:34-a and RSA 674: 32-a-d.
OBJECTIVE 5 **Preserve forest lands**	→ Establish a Forest Land Conservation District that discourages fragmentation, encourages cooperative management agreements among and between private landowners, and provides tax incentives, beyond the Current Use assessment, for owners of parcels that lie within a potential large-lot zoning district. → Engage the conservation commission to promote long-term protection of the large lots within unfragmented forest areas of the town. → Monitor the implementation of the 2019 Forest Management Plan and update as needed.
OBJECTIVE 6 **Preserve wildlife habitat**	→ Utilize data and mapping from the Pembroke NRI, to prioritize high-quality wildlife habitat for protection by the town. → Identify and seek to protect "green infrastructure areas" to avoid habitat fragmentation and its disruption to native flora and fauna and to act as corridors for the movement of wildlife assets. → Condition future gravel operations along the Soucook River to those which employ reclamation strategies leading to the permanent protection of riparian habitat and the regeneration of the native Pitch Pine-Scrub Oak Woodland described in the town's NRI.
OBJECTIVE 7 **Preserve high-value wetlands**	→ Use the existing wetland assessment study (completed as part of the NRI) to nominate high-valued wetlands for classification under the State's Prime Wetlands designation so that these wetlands, and their riparian buffer areas, may be targeted for heightened protection. i. Establish larger general setbacks (e.g. 100 feet) for prime wetlands by town ordinance. ii. Eliminate the allowance of forestry activities within prime wetlands and their protective buffer zones. iii. Require suitable wetland assessment studies for those projects that intend to impact prime wetlands or their buffers by demonstrating no net loss of functional value as a result of such impacts. iv. Provide for the allowance of on-site, permittee-responsible mitigation for prime wetland impacts in order to dovetail with state

	and federal permitting requirements. v. Maintain a priority list of wetlands that are important to water quality protection or could benefit from restoration efforts to improve their functional value. → Update the existing Wetlands Protection District section of the zoning ordinance to do the following: i. Identify the District more clearly with language that defines wetlands within the first subsection. ii. Eliminate the "encouraging uses" subsection A. (4).
OBJECTIVE 8 **Preserve scenic views**	→ Use data from the Natural Resources Inventory and other sources to further assess and rank the scenic assets of Pembroke and to recommend potential preservation opportunities to the planning board and board of selectmen. → Authorize the public works department to provide roadside pull-offs where informal viewing of scenic vistas can take place in a safe and unobtrusive way. → Consider entering into agreements with private landowners to provide public access to exemplary viewsheds in return for tax benefits that offset the high valuations (view tax) of publicly used viewsheds.
OBJECTIVE 9 **Protect and maintain scenic roads, trails, and public access**	→ Investigate the feasibility of additional traffic restrictions on Class VI roads to ensure that they are preserved in conditions suitable for a use by a broad range of agricultural, forestry, and recreational activities. → Conduct a feasibility study of conversion of portions of the Class VI road network to Class A trails in accordance with the provisions of RSA: 231-A in the most scenic or unique environments, in order to limit uses to those which minimize environmental disturbance. → Give priority to the acquisition of lands or easements along the Merrimack shoreline in order to facilitate completion of the river rail-to-trails project and the Heritage Trail through Pembroke. → Review existing conservation lands in Pembroke to determine areas that are suitable for public trails, layout proposed trails in accordance with sound soil conservation practices, and seek out grants and volunteer programs to implement them. → Consider promoting and developing an interpretive signage program (i.e. nature trail) with area schools (or as an eagle-scout project) at a suitable conservation property such as Ames Brook. → Consider establishing designated parking areas for more of the town's larger conservation lands.

NATURAL RESOURCES

Pembroke lies at the confluence of the Soucook, Suncook and Merrimack Rivers which has shaped its unique landscape and the associated natural resources. The 2017 Natural Resources Chapter of the Master Plan and the 2016 Natural Resources Inventory contain detailed information on the water resources, topography, agriculture, soils and development constraints are both available in Appendix A. A summary of Pembroke's natural resources follows, using information and data from those documents.

GEOLOGY AND WATER RESOURCES

Understanding geology is important to land use as it helps identify sources of groundwater, site development suitability and location of natural hazards. The bedrock geology of Pembroke is underlain mostly by mica schist of the Silurian Rangeley Formation and it contains an extensive fracture network that forms an aquifer system that is mostly utilized to provide domestic water supplies for the town's rural areas. Please refer to the **Geologic Resources Map** for more details.

The surficial geology is typical of many NH communities, containing a mix of glacial till and sands and gravels closer to the three rivers. The most important resources provided by these deposits are high-quality water that provides the major public water supply for the town and sand and gravel deposits that have been used for construction and road building. Please refer to the **Water Resources Map** for more details.

Pembroke's public water system is fed through five well sites; three are located in close proximity to the Soucook Rivers and two are sited near the Suncook River. These wells serve the downtown area, Buck Street and properties along Routes 3 and 106; the remainder of the town is served by private wells. These water-bearing layers range from 40 feet to over 80 feet in some locales. Both the Concord wellfields and the four Pembroke Water Works wells tap into this abundant source of groundwater. Based on models that utilized several geophysical tools, the stratified drift aquifers in Pembroke have yields of between several hundred and over 9,000 square feet per day. These yields are calculated on the basis of a 0.0969 transmissivity rate per cubic foot of aquifer thickness (Ayotte and Toppin 1995). The highest yield area is mapped for a small area at the mouth of the Soucook River where deep sands within the 100-year floodplain exceed 9999 ft^2/day of recoverable groundwater. This area is mostly undeveloped, but does have a current residence and the Merrimack River rail trail running nearby. White Sands Conservation Area lies within the southern edge of this map unit. Other high yield sites include the Soucook River bend area west of Associated Grocers of New England (AGNE), the Pembroke Water Works well #2 just across Pembroke Street, and the Concord Wellfields along the Soucook River at North Pembroke Street. The latter is the highest yielding well that serves the City of Concord with drinking water supplies.

RIVERS

Pembroke has an extensive interconnected system of surface water resources (see the **Water Resources Map**). The health and function of these water resources needs to be maintained to ensure high quality water and a well-maintained ecosystem. Rivers are the defining natural resource characteristic for Pembroke. Over 60% of the town's boundaries are bordered by a river, nearly all of the prime farmland

is associated with a river, and most of the historic travel, settlement, and commercial success of Pembroke was brought about by virtue of a river. It is difficult to find any spot in town that is farther than a few hundred feet from any given stream or river. The three major rivers that border Pembroke are the Merrimack, Soucook and the Suncook, with the Soucook being the longest. The connection between rivers, vernal pools and wetlands to the quality of downstream waters also needs to be acknowledged and evaluated when looking at ecosystems.

EXPOSED SANDBAR ALONG THE SOUCOOK RIVER, WEST OF THE ASSOCIATED GROCERS PROPERTY

WETLANDS

Wetlands are areas where water is present at or near the soil surface for at least part of the growing season and influences the plants that can grow there, as well as the soil characteristics. There is now a much greater understanding of the function that wetlands provide, including flood control, water storage, groundwater recharge, erosion and sediment control, pollution filtration and wildlife habitat. As part of the NRI, a total of 3,951 wetlands representing 1,587 acres were mapped in Pembroke and the half-mile extended study area. Accordingly, 7% of Pembroke's landscape was classified as wetland, with

VERNAL POOL AT BUTTERFIELD TOWN FOREST

FORESTED FLOODPLAIN WETLAND NEAR GARVIN FALLS ROAD WITH RED MAPLE, AMERICAN ELM AND GREEN ASH

open water areas representing an additional 2% of the town's area. The most common wetland type in Pembroke is the forested swamp. Over three-quarters of the non-water wetland types had a predominance of trees in the canopy. One benefit of forested swamps is their frequent support of vernal pools. These small wetland depressions are subject to seasonal filling and dying and contain unique species such as fairy shrimp, wood and the blue-spotted salamander that use these pools especially for breeding. A total of 173 vernal pools were mapped as part of the NRI, many of them through field survey.

Some of the most important wetland types in Pembroke are those that provide direct protection to residences and businesses in the form of floodwater storage. Virtually all of the forested and scrub-shrub wetlands along the Soucook and Suncook Rivers offer this type of benefit for downstream residents. Most lie within the 100-year floodplain, if not within the 25-year floodplain. Given the increase in the frequency and magnitude of flooding events in the last decade, these wetlands have and will continue to save town residents millions of dollars in future flood damage.

Part of the NRI work included a wetlands evaluation and ranking based upon 11 attributes important to Pembroke (See Appendix A for more detailed information). This can include their potential to serve as flood storage, groundwater recharge areas and wildlife habitat. The NRI study also utilized a well-established methodology that looks at more specific assessments, including additional functional attributes, in order to fully understand which wetlands had the highest value for Pembroke and potentially warranted greater protection under the state's Prime Wetland designation. The 31 WEUs that had point rankings above the mean of 27 were selected for more detailed evaluations, including field assessments. These wetlands were then evaluated for the following set of functions using the NH Method.[1]

1. Ecological Integrity
2. Wetland-Dependent Wildlife Habitat
3. Fish and Aquatic Life Habitat
4. Scenic Quality
5. Educational Potential
6. Wetland-Based Recreation
7. Flood Storage
8. Groundwater Recharge
9. Sediment Trapping
10. Nutrient Retention &Transformation
11. Shoreline Anchoring
12. Noteworthiness

Appendix A contains the NRI results of the NH Method assessments on the 31 top-ranked wetlands from the assessment. The **Topography and Wetlands Map** shows the location of these wetlands. The NRI results are an important tool for the conservation commission as it looks at identifying wetlands that have high value that could be candidates for designation as prime wetlands through the state process.

[1] *Method for the Inventory and Evaluation of Freshwater Wetlands in New Hampshire* (Stone, Mitchell, Van de Poll, & Rendall 2015).

The NH Method assessment resulted in some clear delineations of value among the largest wetlands in Pembroke. For example, those wetland complexes that were beaver-mediated and lay along one of the large perennial streams were among the highest scoring wetlands. This included Confluence Marsh, West Pettengill Mainstem Marsh, West Branch Pettengill Brook Beaver Ponds, East Pettengill Mainstem Marsh, Lower Frenchs Brook Beaver Pond, Middle Frenchs Brook Beaver Pond, West Fowler Brook Tributary, and Upper Fowler Brook Marsh Complex. The latter two wetlands actually had a 'perfect score' for Ecological Integrity, or 10 points each.

Relatively isolated wetlands that acted as good flood storage sites were also highly ranked by the NH Method, such as the Beck-Clark Swamp Complex, Merrimack River Oxbow East, and Borough Road Marsh East. The Beck-Clark Swamp Complex served to capture stormwater runoff from Pembroke Street, Fairway Drive, and Terri Drive. This single swamp system was found to act as a 'trap' for sediments, nutrients, and stormwater that flowed into two separate perennial streams above the Merrimack River.

Wetlands highly valued for groundwater recharge included the Central Soucook River, the Soucook Kame Basin, and the Old Soucook Oxbows in the lower Soucook River aquifer. These WEU's all scored above eight points for this function. For the Merrimack River aquifer, the singular WEU that served as a significant recharge area was Merrimack River Oxbow East. For the Suncook River aquifer, Buck Street Old Field Swamp, Hillman Farm Ditches, and Lower Ames Brook Complex all scored 7.2 points for this function. Each of these wetlands sits atop deep beds of layered sands and gravels, and likely contributes directly to the recharge of potential drinking water supplies.

AGRICULTURAL LANDS AND SOILS

Pembroke is comprised of at least 30 different soil types among 677 units, not including the "Urban Land" complexes that have been previously disturbed (see Appendix A). Over 90% of the soils are non-

CORN GROWING ON LAVALLEY FARM

hydric, upland soils. Most of the upland soils are derived from glacial till, and therefore contain a mixture of particle sizes from silts to fine sands and gravel to medium-sized stones.

Highly rated soils for agriculture are ranked in three classes: prime farmland soils, soils of statewide importance, and soils of local importance. Prime agricultural soils (see the **Agricultural Soils Map**) occupy 5.5% of Pembroke, of which only about 31% are in agricultural use. Soils of local importance represent the largest of the good farmland soils in Pembroke, about 64% of the town. In total, only about 550 acres of the different classes of agricultural soils are in active agricultural uses. This is less than 4% of the landscape of the town, and just over 5% of all of the good farmland soils. Of additional note is the fact that just 32 acres of prime farmland, and 94 acres of soils of local importance are permanently protected from development. Pembroke has a few active farms, including a horse and cattle farm (Gelinas), the Pritchard dairy farm and Found Well Farm (plants).

FOREST LANDS AND SOILS

Forests serve a number of functions in both the community and the surrounding region, including protecting water supplies and surface waters, serving as a source of forest projects, wildlife habitat, providing outdoor recreational opportunities, and contributing to the rural character of Pembroke. The **Forestry Soils Map** shows the relative productivity of soils for forestry to help landowners and resource professionals with management decisions. The predominant forest cover type in Pembroke is a mixed hardwoods-softwoods forest, otherwise known as the Hemlock-Hardwood-Pine Forest (WAP 2015). At least 80% of the forests of Pembroke are comprised of this forest type, which happens to be the most common forest type in the state. The second most common forest type in Pembroke is the Appalachian Oak-Pine Forest, the most common type of forest in central and southern New England and found on the moderate to steep south-facing slopes along Frenchs Brook, Ames Brook and Pettengill Brook in the norther part of town. The third principal type in the Pitch Pine Forest type, located in two or three patches along the Soucook River, in what is known as the Concord Pine Barrens.


Photo from Pembroke's Natural Resources Inventory, 2016

CLASSIC HEMLOCK BEECH-OAK-PINE FOREST, BUTTERFIELD CONSERVATION AREA

The current forest condition in Pembroke can be generally characterized as recently cut-over and high-graded timber stands of a generally young age. The exception to this generalization are those forest areas where white pine has been allowed to regenerate almost to the exclusion of other species and the current level of stocking is sufficient to provide modest timber value. Other examples of harvestable timber stands are also found along the 'Range Roads,' where mixed hardwoods and hemlock appeared in a more mature condition (e.g. > 120 year old trees). The proximity of these stands to extensive wetlands in this part of town, in part, has been the reason they have been allowed to grow for as long as they have.

Most of the town forests were once farmland with evidence of farming activity found within most of the lots. Stone walls, rock dumps and cellar holes are located on three of the town forests, including Whittemore and Butterfield. Whittemore, at 133 acres, is located between the Fifth and Sixth Range Roads, on the north side of Kimball Road. There is a Timber Cruise and Forest Management Plan for the Pembroke Town Forest System that was revised in 2019.

WILDLIFE

Protecting habitat for wildlife is important to Pembroke residents. The challenge of conserving habitats to support healthy, native wildlife is complicated by the varying habitat requirements of individual species. Some species require less than an acre while others need areas comprised of hundreds of areas; some even require different habitat types throughout the year. The more habitat diversity within the town, the more likely it will support a healthy and diverse wildlife population. Certain areas of town contained multiple species in a single locale. Most notable among these was the coincidence of 10 rare plants and 28 rare invertebrate species with the state-ranked exemplary Pitch Pine-Scrub Oak Woodland found along the Soucook River. Coupled with the rare amphibian, snake and turtle species, not to mention the state-listed fish (rainbow smelt, redfin pickerel and bridled shiner) in the Soucook River, it is clear that this area of Pembroke holds one of the highest value sites for rare and endangered species.

The Merrimack River is also a rich site for rare plants and wildlife. The discovery of flatleaf pondweed, thread-like naiad, and red-root flat sedge in the Pembroke reach of the river underscored its potential for harboring a high number of state-listed rare plants. The documented presence of bald eagle, great blue heron, American eel and the probable downstream occurrence of redfin pickerel and bridled shiner also highlights a system that provides multiple benefits for rare and endangered species. Detailed information on Pembroke's wildlife (birds, mammals, plants, fish, etc.) is located in Appendix A.

SCENIC VIEWS

The **Scenic Views Map** shows the location of 35 different viewpoints that offer mostly medium to long-range views of picturesque landscapes in Pembroke. These were compiled during survey work for the NRI that took place between March 2014 and April 2015, with most taking place during leaf-off condition. Some viewpoints may, therefore, be partly obstructed during the leaf-on season, although certain ones (e.g. #19 at the end of Ryan Drive), may actually be enhanced by colorful fall foliage. Table 8.4 describes each of these viewpoints.

Table 8.4: Summary of Scenic Viewpoints recorded for Pembroke

Id	Location	Map Location	View Distance (ft)
1	Town Hall	1	150
2	Keniston Conservation Area	2	750
3	Mary Bartlett Grange view	3	250
4	Academy Road Marsh	4	800
5	Soucook River at Sheep Davis	5	500
6	Soucook River at North Pembroke Road	6	375
7	North Pembroke Road/ Lower Ames Brook	7	450
8	Suncook River, bridge at Mills	8	500
9	RR bridge at lower Bridge Street	9	100
10	Entrance into Memorial Park	10	500
11	Suncook-Merrimack Rivers confluence	11	1750
12	Merrimack River at bend	12	2500
13	Upper Pembroke Pines Golf Course	13	1750
14	Upper Ames Brook Conservation Area	14	2000
15	Lower Ames Brook at Batchelder Road	15	575
16	Lower Batchelder Road near Suncook River	16	2000
17	Suncook River from Old Bear Brook Road	17	400
18	Hillman Farm from Buck Street	18	3000
19	Lower Pettengill River from end of Ryan Drive	19	1850
20	Suncook River Bend Marsh from Buck Street	20	600
21	Open fields off northeast Olympic Fields Drive	21	1350
22	Riparian slough fields off Gooses Way	22	700
23	Upper Bragfield Pond from Brickett Hill Road	23	850
24	Vernal pond at Butterfield Conservation Area	24	200
25	AGNE pond and fields at Conservation Area	25	800
26	Lower White Sands view of Merrimack	26	4000
27	North end of Bragfield Pond from edge	27	750
28	Lower Suncook River from Memorial Park	28	850
29	Merrimack River from White Sands	29	3500
30	Lower Soucook River from rail trail	30	750
31	West fork of Hartford Bk Academy Rd	31	1100
32	Kimball & Sixth Range Roads Marsh	32	350
33	Soucook River from Pembroke Street Water Works	33	450
34	Sixth Range Road, field edge	34	475
35	Upper Brush Road, field edge	35	650

VIEWPOINT OF THE OLD AGRICULTURAL FIELDS BELOW THE AGNE CONSERVATION EASEMENT, VIEWPOINT #25

Each of the viewpoints above were categorized in the NRI by approximate distance, with short being viewpoints of less than 300 feet, medium for viewpoints of between 300 and 1000 feet, and long for viewpoints that had distances of greater than 1000 feet. The longer-distance viewpoints tended to be found either near the Suncook or Merrimack Rivers, or from selected high ground vantage points off North Pembroke Road. Given the current absence of agricultural fields on most of the Range Roads, most of these viewsheds were of medium length. Longer distance views were available where agricultural fields were prevalent, such as along Buck Street, Academy Street, Fourth Range Road and east part of North Pembroke Road. Although a considerable number of excellent vista points existed beyond roadside viewpoints, especially at large wetland complexes, these were mostly excluded from the above list (with a couple of 4WD exceptions). More detailed assessments of scenic quality for these 'viewing-by-foot-only' vistas can be found in the NH Method data sheets in Appendix A of the full NRI Report.

The longest distance viewpoints that provide regional views extending beyond the town are not shown on the map but can be found on Pembroke's highest hills, including along Fourth Range Road on Pembroke Hill and on Plausawa Hill Road on Plausawa Hill. Northern sections of Fourth Range road afford limited northwesterly views spans across the Merrimack Valley to high elevations in Henniker, Bradfield and Warner. Fourth Range Road at the Gelinas and Robinson Farms offers limited northeasterly view spans to the high elevations of Pittsfield and Strafford. The top of Plausawa Hill offers panoramic views of the entire region.

OPEN SPACE LANDS/CURRENT USE

Protecting open space is important to maintaining the rural character of Pembroke. Open space conservation is beneficial to the community and to the region as it preserves the land as well as maintains natural features and habitat. Beyond conservation strategies such as easements and acquisition, there is the voluntary current use program for landowners. The current use program is a tool that landowners can use to reduce the amount of property tax that they pay on open space within their property limits as an incentive to keep the land in its traditional use. The current use value is the assessed valuation per acre of open space land based upon the income-producing capability of the land in its current use – not its real estate market value. This valuation shall be determined by the

municipality's assessor in accordance with the range of current use values established by the state's Current Use Board (CUB) and in accordance with the class, type, grade, and location of land. Property owners can file for reduced property taxes though this program.

By allowing open space land to be classified as current use, it acts as an incentive for landowners not to develop property. Owners of parcels of land which are not anticipated to be used for a different type of use in the future can apply at municipal offices, and in accordance with RSA 79-A:2, the definitions of eligible land type are farm land (cleared land devoted or capable of agricultural or horticultural uses), forest land (land growing trees), unproductive land (land, including non-forested wetlands, which by its nature is incapable of producing agricultural or forest products) and wet lands (areas of farm, forest, and unproductive land that are inundated or saturated by surface water or groundwater that is able to support a prevalence of vegetation).

Further noted in RSA 79-A:7, when land is removed from Current Use, ten percent of the full and true value of the land, not the Current Use assessed value, must be paid as a Current Use Land Change Tax. It is important to understand that the Current Use classification can be placed on, or removed from, land at the landowner's discretion which is why these lands vary from conservation lands. In Pembroke, 100% of the proceeds from the Land Use Change Tax are dedicated to open space through the conservation commission.

As of 2016, Pembroke private property owners had enrolled about 8,186 acres (57%) of all land in town into the "current use" system. Acting from a concern that more local lands need to be permanently preserved from development, the 2002 Pembroke Town Meeting voted to place all future monies collected from Current Use Change Taxes into the town's conservation fund where it may then be used by the conservation commission to acquire and preserve land for open space and conservation purposes. Since that time, the conservation commission has begun a land and easement acquisition effort which targets the most appropriate lands for preservation.

Table 8.5 shows the Land Use Change Tax collected for land removed from Current Use for the period of 2010 to 2017. Although the monies collected have not been consistent, this does provide a source of income to the town for natural resource protection and conservation purposes.

Table 8.5: Land Use Change Tax Collected, 2010-2017

Year	Tax Revenue
2010	$7,740
2011	$1,320
2012	0
2013	$6,370
2014	$8,299
2015	$17,850
2016	$7,480
2017	$3,800

CONSERVATION LANDS

The **Conservation Lands Map** illustrates where conservation lands are located in Pembroke. Table 8.6 lists the 30 recognized conservation properties. These properties total approximately 714 acres, with a minimum size of .24 acres (Robert Frost Park) and a maximum size of 138 acres (Whittemore Town Forest). The total number of conservation parcels owned by the town is 24. One parcel is owned by the State, one by the City of Concord, and four by the private sector with easements held by the town. It should be noted that the following list does not include other town property, such as Memorial Park, Broadway Park, the church properties, the Town Hall/Library parcels, and Pembroke Academy land.

Three of the 24 town-owned properties have additional protection (conservation easements) in place to permanently protect the properties as conservation land. Although many of the properties were obtained for the purposes of conservation, there is no legal protection to keep them in that status. Pembroke should work towards permanent protection of these properties through easements help by conservation non-profits such as the Five Rivers Conservation Trust. As part of the NRI, a review of Pembroke's conservation lands was conducted and results, including more detail on the status and condition of each of these properties, can be found in Appendix A.

Table 8.6: Conservation Lands of Pembroke

Name	Alternate Name	Size (Acres)	Type	Land Owner	Easement Holder
Associated Grocers of New England (AGNE)	AGNE Easement	11.0	CE	AGNE	Town
Ames Brook Conservation Area		48.8	FO	Town	none
Anderson	Bragfield Pond Conservation Area	26.8	FO	Town	NHDES
Baxter		1.5	FO	Town	none
Beacon Hill Conservation Area		42.3	FO	Town	none
Beck Conservation Area		34.3	FO	Town	none
Brittany Conservation Area		10.5	FO	Town	none
Clark Conservation Area		5.0	FO	Town	none
Concord Wellfield		55.5	FO	Concord	none
Doherty Conservation Area		5.1	FO	Town	none
Gamlin Conservation Area		2.5	FO	Town	none
Girard	Robert Frost Park	.24	FO	Town	none
Hillman Farm		46.9	FO	Town	FRCT
Keniston Conservation Area	Keniston Easement	2.7	CE	Topliff	Town
Pembroke Town Forest - Butterfield Tract	Butterfield Conservation Area	22.7	FO	Town	SPNHF
Pembroke Pines Subdivision		33.3	FO	Town	None
Pembroke Water Works		16.0	FO	Town	none
Pembroke Water Works		12.9	FO	Town	none

Table 8.6: Conservation Lands of Pembroke Continued

Name	Alternate Name	Size (Acres)	Type	Land Owner	Easement Holder
Poirier		87.2	FO	Town	none
Richard Conservation Area		1.3	FO	Town	none
Schuett Conservation Area		7.3	FO	Town	none
Scripture	Scripture Easement	10.0	CE	Tyler	Town
Suncook River Access		3.8	FO	NHF&G	none
Stoney Brook Conservation Area		0.7	FO	Town	
Taylor Homes Easement	Taylor Conservation Area	7.8	CE	Taylor Homes	Town
Town of Pembroke		11.0	CE	Town	
White Sands Conservation Area		31.7	FO	Town	none
Whittemore Town Forest	Whittemore Conservation Area	138.0	FO	Town	none
356-372 Academy Road		31.5	FO	Town	none
617-619 Sixth Range Road		5.6	FO	Town	none

FO = full ownership; CO = conservation easement; FRCT = Five Rivers Conservation Trust; SPNHF = Society for the Protection of New Hampshire Forests; NHF&G = NH Fish and Game; NHDES= NH Department of Environmental Services.