NATURAL RESOURCES

For the Town of Bow

The Natural Resources Chapter describes Bow's natural features, including land, water and wildlife. The protection, preservation, and enhancement of the natural environment are important to the residents of Bow. The most desirable feature in Bow, according to residents taking the Community Survey or attending the Visioning Session, is its rural character or quality, which is directly linked to the conservation and preservation of the natural environment. The Survey also asked if the conservation of natural resources is important and the majority of residents responded positively. When asked what resource protection activities the Town should pursue or expand, residents gave the highest priority to the protection of water resources, followed by protection of forests and wetlands. Overall, residents identified a healthy and diverse natural environment as important to the quality of life they enjoy in Bow and it is important to not only continue efforts to protect natural areas but to find new opportunities to engage and educate citizens on the value and function of natural resources.

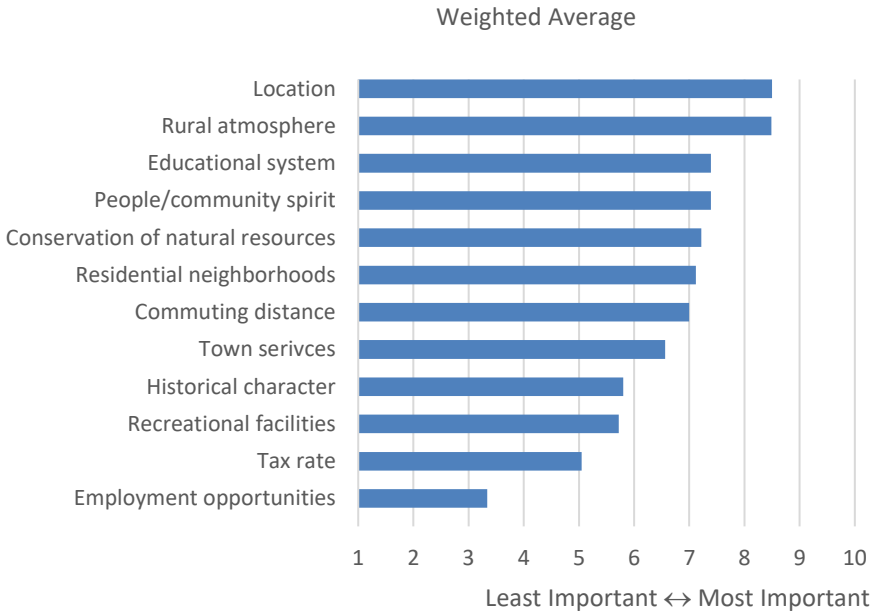
This Chapter also identifies current threats to Bow's natural resources. These threats can be used to help prioritize actions, including resource protection efforts and target certain recommendations. To achieve success in implementing recommendations, it is necessary to transform words into action.

The overall Master Plan document is designed to give Bow the tools to implement its recommendations and forge effective partnerships. For natural resources, this Chapter serves as a lens focusing attention on certain critical environmental and resource issues that need to be monitored, studied or addressed. The idea is to increase the information base about Bow's natural resources and make that information available to the public and decision makers to not only be used to refine existing management plans but to support more informed land use decisions. This information can also be helpful in identifying areas where additional data or research is still needed. It is useful to think of this Chapter as adaptive in the sense that it can be responsive to new information and research as we continue to learn more about the environment in which we live.

COMMUNITY SURVEY RESULTS

Like many NH communities, Bow has a long history of residents with strong ties and commitment to their community; 64% of those who responded to the Survey have lived in Bow more than ten years. The following questions taken from the Community Survey best represent residents' opinions on natural resources.

Community Survey Question 7:
What are the most desirable features that you value about Bow? (Please rank on a scale of 1 to 10, 10 being the most important and 1 being the least important).



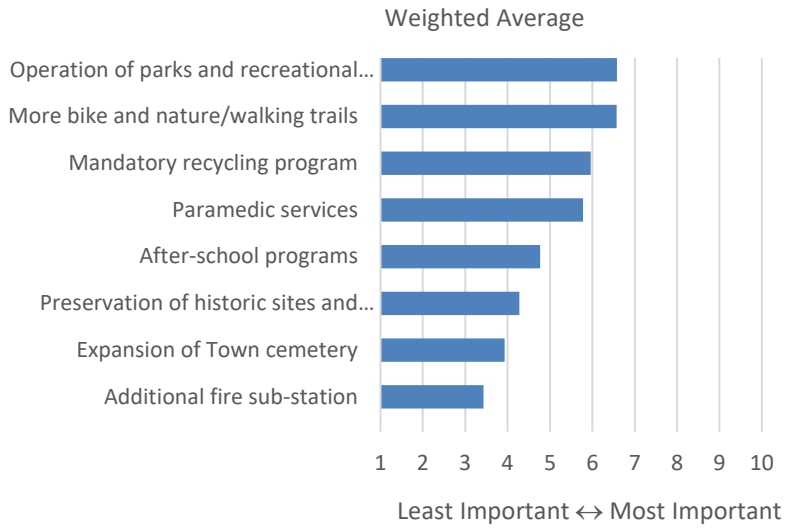
CHAPTER VISION

Bow continues to support stewardship of its natural resources by:

- Working to preserve and maintain the abundant natural resources that contribute to the Town's rural character;
- Building capacity to bring awareness of Bow's land and water resources that sustain wildlife, biodiversity and water quality to residents and ensure that the benefits of the natural environment are maintained for future generations; and
- Promoting efficient transportation and well-designed development that sustain a clean and healthy community by preserving the natural environment and the ecological function of natural resources.

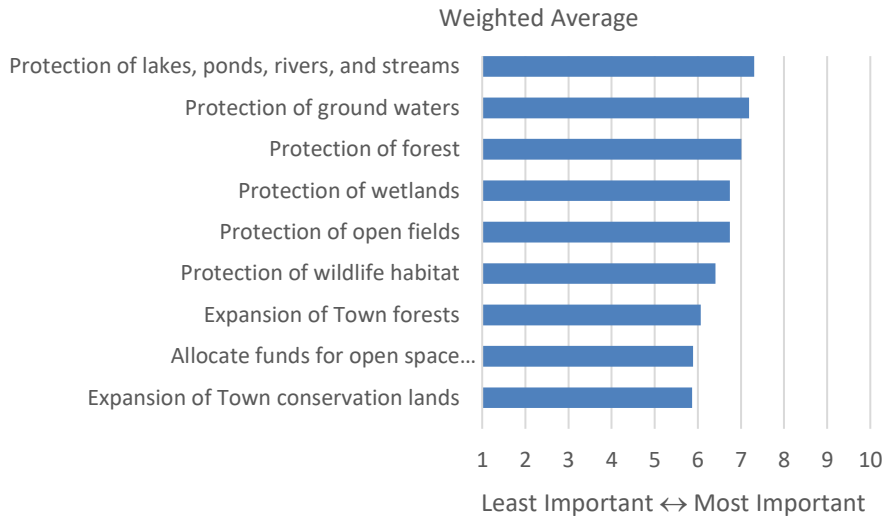
Community Survey Question 13:

Please indicate what community services and facilities you would like the Town to develop and/or improve. (Please rank on a scale of 1 to 10, 10 being the most important and 1 being least important).



Community Survey Question 14:

Please indicate what resource protection activities you would like the Town to pursue or expand? (Please rank on a scale of 1 to 10, 10 being the most important and 1 being the least important).



BOW COMMUNITY VISIONING SESSION

Attendees at the Visioning Session shared their appreciation of the Town's natural resources, many mentioning open space, walking trails, and water resources as specific qualities they appreciate the most. It was agreed upon by those in attendance that more information on the trails in Town should be available, including location and public access. Most were in favor of establishing a Trails Map that would be available either online or at community buildings.

It was recommended by attendees that a Natural Resources Inventory (NRI) be completed as the first step in identifying where critical resources are located, what areas are significant and how to include the information in land conservation planning and zoning. New regulations were also recommended for added protection to the Town's drinking water.

LAND RESOURCES

This section describes the landforms in Bow that are the product of the bedrock and surficial deposits, particularly as they affect biological resources and future development potential. An analysis of Bow's terrain and the underlying deposits gives important clues about constraints for development in certain areas. Using this information as part of an analysis of site suitability is an important step in land use planning and drafting regulations, as assessing potential constraints can identify areas more suited to a particular use than others.

CLIMATE

Land resources and how they are developed can have a direct/indirect impact on climate. As an example, land use decisions that lead to sprawling development patterns result in more paved surfaces, less forest cover and open space, and reliance on automobiles to access needed services, leading to more generated heat, runoff and erosion, as well as energy consumption and emissions.

Broader climate events, associated with the frequency and intensity of storm events, have occurred throughout New Hampshire (NH), leading to increases in annual average precipitation and the amount of rainfall associated with storm events. These extreme precipitation events can cause damage to infrastructure, homes, businesses, drinking water supplies, recreation areas, and our ecosystems. Making informed land use decisions that evaluate potential flooding, erosion, and impacts to key natural resources, ecosystems and habitats is an important goal of creating a resilient, healthy community. For a full discussion of natural hazard risks, please refer to Bow's Hazard Mitigation Plan.

GEOLOGY AND SOILS

Understanding the geology of an area is important for a variety of reasons:

- The potential hazards posed by natural features on the landscape (floods, groundwater contamination, erosion, naturally occurring contaminants);
- The suitability of a site for development that may be proposed (on site waste disposal, availability of drinking water) ;
- The presence of valuable resources for construction (such as sand and gravel); and
- The presence of resources that may warrant long term protection (such as groundwater)

BEDROCK

Approximately 70% (12,323 acres) of Bow is underlain by the Upper and Lower Rangeley Formation of undifferentiated schists and gneisses. Binary granite, known as Concord Granite (5,776 acres), underlies a few areas of Bow, including one area along the northeast bordering Concord, Hopkinton and Dunbarton and a small area running south central towards Pembroke. Please refer to the **Bedrock Geology Map** for the geologic features in Bow.

SURFICIAL GEOLOGY

The upper layers of geological materials (surficial deposits) on the bedrock (the crustal rock under the soil) were deposited by the last glaciation (Pleistocene), particularly the Wisconsinan stage. As the

ice melted, the glacial debris formed two types of deposits: direct deposits falling or dumped by the ice as unsorted glacial till; and outwash deposits of sand, gravel, silt, and clay sorted out by the meltwater running from the ice (glacio-fluvial). These latter deposits were carried farther by streams and rivers into the valleys.

The following describes the glacial landscape features:

Direct Deposits (Till):

- *Ground Moraine:* Mostly till overlying bedrock but includes outcrops of uncovered bedrock. It is the unsorted, glacially ground-up debris of clay, silt, sand, gravel, and boulders dumped under the glacial ice and now covering bedrock. It was not distributed by meltwater. Morphologically, it is a zone of small hills and basins.
- *Drumlins:* Low, humpbacked elliptical hills or mounds of till deposited and shaped by the moving glacier; the long axis is parallel to the ice motion. Drumlins are oriented in a northwest-southeast position, the direction that the glaciers moved. Drumlins may be found throughout Bow, including to the north and south of the top of Wood Hill and near Greylore Farm Pond.

Outwash Deposits (sand, gravel, silt and clay):

- *Outwash Plains:* A broad almost flat-topped deposit of sorted sand and gravel layers, built up by the streams of glacial meltwater flowing from the stagnant glacier.
- *Kame and Kame Terraces:* A hill, hummock, or short irregular ridge of stratified sand and gravel deposited in contact with the glacial ice; when the ice melted, the deposit settled to its present form. They range from 5 to 100 feet high. A kame terrace is a body of crudely sorted sand and gravel deposited between the glacier and an adjacent valley wall, thus forming the rather flat-topped terraces. Kame terraces are found near Turee Pond.
- *Eskers:* Narrow, sinuous ridges of crudely stratified gravel and sandy gravel 10 to 100 feet high, deposited by meltwater streams flowing beneath the glacier in stream tunnels.
- *Varved Clays:* Glacial clays of alternating sandy silt and silty layers, deposited in glacial lakes.

Stratified sand and silt from glacial outwash and recent stream deposits lay within the land adjacent to the Merrimack River. Stratified gravel and sandy gravel deposits are found throughout town in kame terraces, valley trains, eskers, and outwash plains.

Soils

One of the most important natural resources and determinants of land use are soils. Information about soil characteristics assists in making sound land planning decisions.

Since the last glacial ice melted away 14,500 years ago, three major types of soil deposits have developed:

- *Organic Deposits:* Peat and muck soils found in marshes, swamps, bogs, and other wetlands; they represent formerly or presently ponded depressions where plant remains have accumulated and decayed over time.
- *Floodplain Deposits:* Large areas of sandy or silty alluvium (stream deposits) left by previous flood waters; usually broad

and flat due to the slow accumulation of this alluvium during the waning stages of each flood.

- *Topsoil:* Generally less than one foot thick composed of weathered glacial deposits and organic matter (humus).

The overall health of the soil in reference to the physical, mineral and biological conditions and its potential to sustain biological functioning, absorb water and promote plant and animal nutrition and health are critically important. Healthy, resilient soils are better able to retain function during, and recover after, stress or disturbance - such as too much or too little rain.

Healthy soil can be achieved through a combination of sound water management and a biodiversity of functional vegetation. Productive soils for farming and forestry are often prime development sites, that when built upon, become unavailable for those important uses.

Agricultural Land and Soils

The Natural Resource Conservation Service (NRCS) soil mapping program inventories the complex patterns of soils and organizes them into groupings as a useful and understandable planning tool. Please refer to the **Forestry and Prime Farmland Soils Map** for the locations of the different soils groups in Bow.

Prime farmland soils and forestry soils in Bow are identified in the following Tables, using NRCS derived data compiled in GRANIT's database. Prime farmland soils are described nationally as land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and are also available for these uses. The **Forestry and Prime Farmland Soils Map** shows areas of significant concentration of prime farmland soils. While Bow has only a small percentage (2%) of prime farmland soils scattered throughout Town, one key location of these soils is along the Merrimack River. Forest soils are organized into categories that identify important forest soil groups, using characteristics such as depth to bedrock, texture, saturated hydraulic conductivity, available water capacity, drainage class, and

Table 5.1: Prime Farmland Soils in Bow

Type	Acres	Percent*
Montauk fine sandy loam	52	0.3%
Ninigret fine sandy loam	23	0.1%
Occum very fine sandy loam	96	0.5%
Paxton fine sandy loam	142	0.8%
Scituate fine sandy loam	7	0.0%
Woodbridge fine sandy loam	38	0.2%
Total/Percent of Bow Acreage	358	2.0%

Source: NH GRANIT, Soil Survey Geographic (SSURGO) database for New Hampshire

**Based on a total land acreage of 17,929*

Table 5.2: Forestry Soils in Bow

Type	Acres	Percent*
Forestry Soil IA	4,358	24.3%
Forestry Soil IB	7,500	41.8%
Forestry Soil IC	1,317	7.3%
Forestry Soil IIA	1,435	8.0%
Forestry Soil IIB	1,150	6.4%
Total/Percent of Bow Acreage	15,760	87.9%

Source: NH GRANIT, Soil Survey Geographic (SSURGO) database for New Hampshire

**Based on a total land acreage of 17,929*

slope. These groupings can help in evaluating the relative productivity of soils and how soil and site interactions can influence management or land use decisions. There are definitions for each soil grouping with Group 1 soils having the highest potential for commercial forest products, suitability for native tree growth, and overall forest use and management. All soils have been grouped into one of six categories, including the category of developed or urban soils (see Table 5.2 for the forestry soils). For a complete list of definitions, please refer to UNH Cooperative Extension.

Sand and Gravel Deposits

Large deposits of sand and gravel are important for two reasons; they are permeable and therefore can hold and transmit groundwater in large quantities, so as to serve as an aquifer and location of water supply wells, and they also can be a valuable source of construction material. Because of their permeability, it also makes sand and gravel deposits very vulnerable to contamination; once contaminants are spilled or dumped, they can quickly spread. Therefore, special attention should be given to regulating land uses over sand and gravel deposits. Bow has an aquifer protection overlay district to address this situation.

The Town of Bow issues permits for commercial sand and gravel excavation under New Hampshire's state statute (RSA 155-E:4-a) and through Section 7.15 Excavation of Earth Materials in the Bow Zoning Ordinance.

There are currently 6 privately owned sand and gravel pit operations that will need to be reclaimed once all of the financially viable deposits have been removed. Reclamation means the restoring of an excavation site to a standard at least equal to those outlined in Town regulations. There is also one municipal site located on Allen Road. Since the conditions present in active and abandoned excavation areas can provide unique and important wildlife habitat, reclamation should provide for leaving some of these areas open for wildlife. For more detail on excavation sites in Bow, please refer to the Existing and Future Land Use Chapter.

Table 5.3: Current Excavations

Owner	Lot Acreage	Estimated Percent Excavated*
Ryan Stacy LLC	24.15	44%
Continental Paving	193.31	17%
146C Dunklee LLC	35.25	59%
Coastal Bow	66.40	14%
JDS Properties	26.79	5%
New Site Works	15.79	11%

Source: Town of Bow Assessing Department

**Percentage is based on estimated acreage calculations from aerial imagery.*

TERRESTRIAL RESOURCES

Forests

Forests serve a number of functions in both the community and the region, including protecting public water supplies and surface waters, serving as a source of renewable energy, providing lumber and other forest products, wildlife habitat, providing outdoor recreational opportunities, and contributing to the rural character of the community.

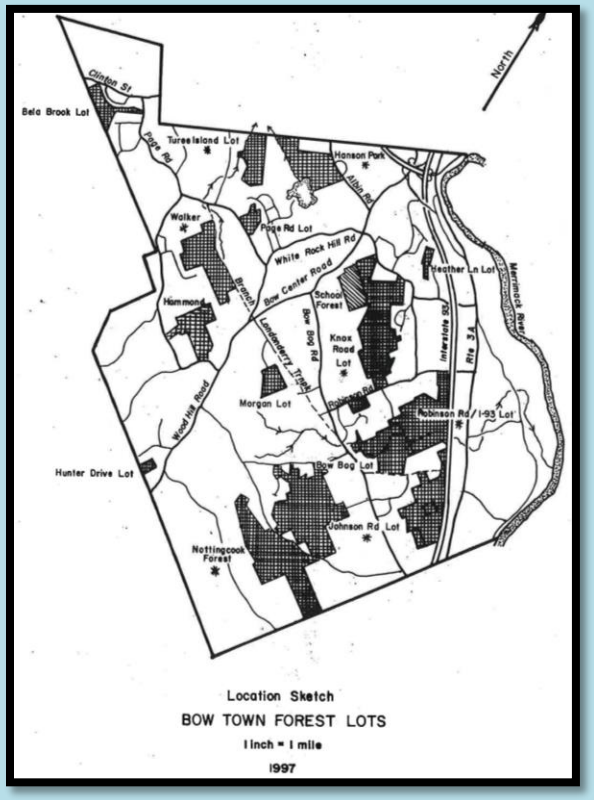
In the Town of Bow, there are both publicly and privately managed forests. Bow has an active Forest Management Program that allows for the protection of habitat, the selective cutting of timber, and the conservation of open space. Within the Town's Forest system, recreational opportunities allowed include hiking, wildlife observation, cross-country skiing, mountain biking, snowmobiling, and hunting. The "Protection of Town Forests" and "Expansion of Town Forests" are community services that Survey respondents wanted to see pursued or expanded.

Bow is located in the forest region characterized as mainly comprised of Appalachian Oak-Pine Forest and Hemlock Hardwood-Pine Forest by the NH Wildlife Action Plan (WAP). Typical Appalachian Oak-Pine Forests contain oak, hickory, mountain laurel and sugar maples and many wildlife species use these forests including black bears, whip-poor-wills, ruffed grouse and eastern hognose snakes. Hemlock Hardwood-Pine Forests are comprised mostly of hemlock, white pine, beech and oak trees. This forest type is the most common in NH, covering nearly 50% of the state and providing habitat for wildlife species such as the Eastern Box turtle, Wood Thrush, Canada Warbler and American Woodcock. See the WAP for more detailed information on these habitats.

The Town of Bow has forested lands that are managed for multiple uses. In the Walker Town Forest, a small but old black gum tree swamp was discovered. The black gum tree is a hardwood tree that may grow up to 75-80 feet tall and lives more than 400 years. These trees prefer the acid content of swamps and wetlands in which to grow. This is a rare species to be growing in Bow and should continue to be protected.

"TIMBER CRUISE AND FOREST MANAGEMENT PLAN"

In 1996, the Bow Conservation Commission re-wrote the Town's Forest Management Plan to reflect a change in management focus from timber production to a more "multiple use" type program. The Plan was most recently updated in 2011 to reflect changes brought on by timber harvests and land acquisitions.



Bow Town Forest Lots, 1997

Duckbill Rock, Nottingcook Forest. Photo by Sandy Crystall.

The Bow Town Forest system of approximately 2,684 acres includes 15 lots scattered throughout the Town. They range in size from 15 to 771 acres and are currently managed by the Bow Conservation Commission. Most of the lots contain wetlands, three are crossed by power lines, and two also include ball fields. Many are protected by conservation easements. In the 1990's, the management focus of the Bow Conservation Commission changed from timber production to a more "multiple use" approach. The Town Forests are managed as a multiple-use resource where consideration is given to timber harvesting, recreational opportunities, wildlife habitat, watershed protection, education, and preservation. Income from timber sales is placed in a Conservation Fund to help manage the forests and purchase other conservation land.

The privately owned wood lots in Town are managed by landowners, often with the aid of professional foresters. A Tree Farm is a privately owned forest managed to produce timber with added benefits of improved wildlife habitat, water quality, recreation, and scenic values. The American Tree Farm System

WILDLIFE ACTION PLAN

The NH Fish and Game Department worked with partners in the conservation community to create the state's first Wildlife Action Plan (WAP) in 2005, and updated in 2015. The Plan identifies New Hampshire's wildlife habitats and presents conservation strategies and tools for restoring and maintaining critical habitats and populations of the state's species of concern. For purposes of prioritizing wildlife habitats for conservation across the state, a system was created to rank habitats. For each habitat type, the top ranking habitats are combined and titled Highest Ranked Wildlife Habitat in New Hampshire. Recognizing that NH has a wide range of conditions, both natural and human altered, the state was divided into biological regions. Highest Ranked Habitat in Biological Region includes the top 30% of all terrestrial and wetland habitats with the following exceptions: 100% of high elevation spruce-fir and floodplain habitats based on their ecological importance and rarity. Aquatic habitats are only ranked statewide and not ranked in this category.

In Bow, 2,936 acres (approximately 16%) of the Town's total land area is identified as Highest Ranked Wildlife Habitat in NH. In addition, approximately 17% (3,182 acres) of the Town's total land area is identified as Highest Ranked Habitat in the Biological Region. Please refer to the scoring map of Bow to view the habitat areas.

(ATFS) is the national tree farm program that encourages private forest owners to actively manage their forests in a sustainable manner for many values such as wildlife habitat, recreation, and water quality. Launched in 1942, its mission is to promote the growing and harvesting of renewable forest resources while protecting the environment and increasing public understanding of all benefits of productive forestry. Currently, there are over 14,300 tree farms in NH covering 38,600 acres of land. There are three properties in Bow (2,902 acres) enrolled in the tree farm program.

Several private, nonprofit organizations also manage their forests, such as the Forest Society, the New England Forestry Foundation, NH Audubon, the Nature Conservancy, and other local or regional land trusts. See Table 5.13 for more information on conservation lands in Bow.

Forestry-based manufacturing and forest-based recreation and tourism in the State not only supplement NH's economy but also provide a significant number of jobs for residents. In NH, the economic value of forest-based components of the economy was estimated at $2.259 billion annually, which is nearly 4% of the gross state product.[1] Forestry is also a renewable resource used by many and a source of income for many families in New Hampshire and Bow.

Forest Management

Owners of forested areas in NH are taxed under the real estate tax, since privately owned forested land is considered real estate. However, timber is only taxed at the time it is cut and at a rate that attempts to encourage the growth of forested areas. The timber tax collected in Bow is allocated into Bow's general fund. The timber tax collected in Bow has varied over the past ten years, with $12,750 collected in 2015.

Forest Connectivity

Corridors and greenways are used by wildlife and by people. Pursuing both recreational opportunities and conservation along the same corridor can sometimes result in unintended conflicts. In some cases, recreational use can degrade a corridor by compacting soil and creating less plant growth, leading to erosion and less food for wildlife. Maintaining viable and undeveloped corridors and monitoring human use ultimately improves the biological success of the animals, particularly larger mammals. The following corridors have been identified in Bow:

1) A large riparian corridor is located along the Merrimack River. The presence of water and adjacent lands form the basis for an animal travel corridor.

2) The Boston and Maine Railroad corridor follows the Merrimack River from Bow's southern Hooksett boundary to its northern Concord boundary. This old right-of-way provides a quiet but direct route for animals.

3) Other corridors bring utilities to Bow's households and businesses. Some of Bow's major utility corridors follow the Merrimack River and then cut southwest towards Dunbarton approximately one mile from the Bow-Hooksett border.

[1] The economic Importance of New Hampshire's Forest-Based Economy. Published by New Hampshire Division of Forests and Lands, 2011.

Table 5.4: Town-Owned Forest Lands

Forest Lands	Forested Acres
Bow Bog Lot	128
Johnson Road Lot	200
Robinson Road/I-93 Lot	283
Robinson Road Lot	20
Hunter Drive Lot	15
Morgan Lot	62
Knox Road Lot	288
Bela Brook Lot	63
Turee Island Lot	52
Page Road Lot	56
Hanson Park	44
Walker Lot	193
Hammond Lot	95
Heather Lane Lot	39
Nottingcook Forest	594
Total Acreage	2,132

Source: Timber Cruise and Forest Management Plan of the Bow Town Forest System, Revised January 2011

WILDLIFE

Protecting habitat for wildlife is important to Bow residents. When asked which resource protection activities the Town should pursue or expand (question #14 on the Survey), protecting habitat received an overall rated average of 6.41 out of 10. The challenge of conserving habitats to support healthy native wildlife populations is complicated by the varying habitat requirements of the diverse species located in Bow. Some species require less than an acre of undisturbed forest, while others need territories covering hundreds of acres. In addition, many species require several different habitat

"WILDLIFE ACTION PLAN"

The NH Fish and Game Department worked with partners in the conservation community to create the state's first Wildlife Action Plan (WAP) in 2005, and updated in 2015. The Plan identifies New Hampshire's wildlife habitats and presents conservation strategies and tools for restoring and maintaining critical habitats and populations of the state's species of concern. For purposes of prioritizing wildlife habitats for conservation across the state, a system was created to rank habitats. For each habitat type, the top ranking habitats are combined and titled Highest Ranked Wildlife Habitat in New Hampshire. Recognizing that NH has a wide range of conditions, both natural and human altered, the state was divided into biological regions. Highest Ranked Habitat in Biological Region includes the top 30% of all terrestrial and wetland habitats with the following exceptions: 100% of high elevation spruce-fir and floodplain habitats based on their ecological importance and rarity. Aquatic habitats are only ranked statewide and not ranked in this category.

In Bow, 2,936 acres (approximately 16%) of the Town's total land area is identified as Highest Ranked Wildlife Habitat in NH. In addition, approximately 17% (3,182 acres) of the Town's total land area is identified as Highest Ranked Habitat in the Biological Region. Please refer to the scoring map of Bow to view the habitat areas.

types through the course of the year. The more habitat diversity within the Town, the more likely it will support a diverse and abundant wildlife population.

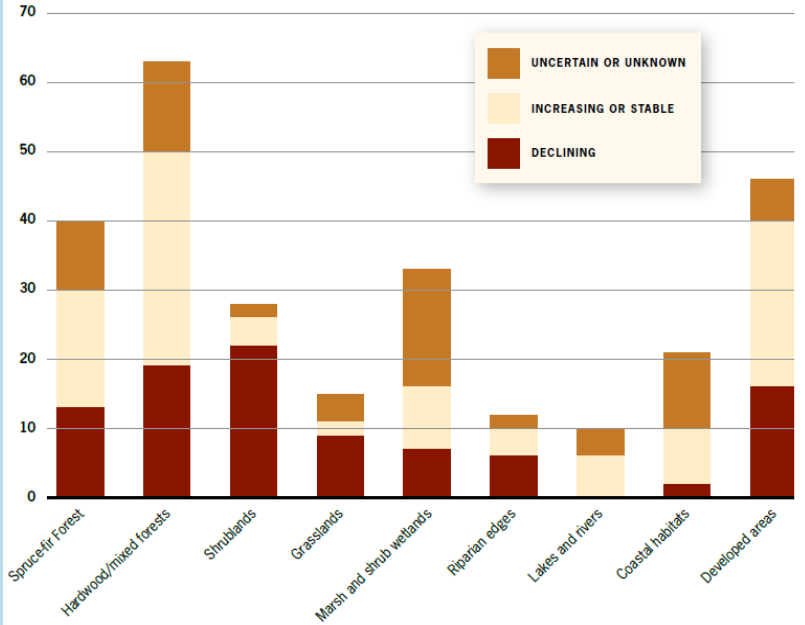
As described in the Bow Timber Cruise and Forest Management Plan, dense stands of young white pine and hemlock thickets should be protected and attempts should be made to establish or promote those forest types, as they provide critical winter shelter areas for deer, grouse, rabbit, and several other species. Quarter to half acre patches of hardwood forest could be clearcut to provide vigorous hardwood sprouting, as deer, moose, and rabbit depend on such browse for their winter and early spring food supply.

According to the Management Plan, one particular habitat found lacking in the Town's forest system is the "old field" type that primarily contains grasses and shrubs. The power line rights-of-way were the only areas that resembled the "old field" type as described in the Forest Management Plan, efforts should be taken to preserve the existing open space including periodic mowing, re-use of log yards during future harvest, and seeding and mulching of log yards upon completion.

Birds

Birds are an integral part of the ecosystem and habitat changes can have an impact on bird species. As habitat loss occurs, there are fewer species in some areas and more in others. According to NH Audubon, fluctuations in short term populations often occur due to seasonal variations in weather patterns, predators and food supply, but seeing long term trends of decline often indicate a potential threat to a species.

Figure 5.1: Comparison of Bird Population Trends Among Nine New Hampshire Habitats.



Source: The State of New Hampshire Birds, NH Audubon, 2011

- ***Uncertain or Unknown:*** *The data needed to fully evaluate the conservation status of these species are missing or unclear. Collected better data on their population trends is a critical first step in prioritizing them for future conservation.*
- ***Increasing or Stable:*** *These species do not appear to be in trouble, although it is important to continue monitoring their populations.*
- ***Declining****: These species are in long-term decline, and should be the focus of most conservation activity.*

In 2001, NH Audubon conducted a bird survey in Bow as part of a study on the impacts of development on breeding bird populations and nesting areas. Unfortunately, there is no comprehensive update available since that date, but there is some recorded information through the EBird website, hosted by the National Audubon Society and Cornell Laboratory of Ornithology, with three observation areas or "hotspots" in Bow where individuals report observations; River Road Boat Ramp, Merrimack River-Garvin Falls and Turee Pond.

Since 2006, twelve species have been spotted at the River Road Boat ramp including waterfowl such as Common and Hooded Merganser and Common Goldeneye. Other species reported include a Great Blue Heron, Bald Eagle and Red-tailed Hawk. Downy Woodpecker and American Crow and Robin have also been spotted over the years. Since 2012, 43 observations have been submitted for the Merrimack River-Garvin Falls area; waterfowl were seen the most, including Canada Goose and Hooded and Common Merganser, Bald Eagle and Red-tailed Hawk, numerous species of Woodpeckers, Thrushes and Wood Warblers. At Turee Pond, 34 sightings have been reported of different species since 2013, including numerous Chipping Sparrows and Wild Turkeys as well as Nuthatches, Woodpeckers and Wood-Warblers, including American Redstart, Pine Warbler and Common Yellowthroat. For a detailed overview of the species that are typically found in Bow's habitats, see Appendix B of the WAP.

In 2011, NH Audubon prepared "The State of New Hampshire's Birds – A Conservation Guide "that looked at the trends for the 186 species that are known to breed in NH. The document also discusses the reasons behind those trends and suggests conservation techniques and strategies to help mitigate these population

THE BALD EAGLE

After a 40 year absence in NH, Bald Eagles started to nest again in 1989. Bald eagles are present year round in NH with pairs breeding and raising young in the spring/summer and many wintering in areas with open water such as Great Bay and the Merrimack River.

New Hampshire Audubon (NHA) staff has an active management program that constructs metal predator guards, maintains reduced-disturbance buffer zones, and works with NH Fish & Game to advise private land owners on how to best protect and manage Eagle breeding sites. Currently, there are over 20 breeding pairs of Bald Eagles in NH, and the numbers are rising. The Bald Eagle was removed from the federal Threatened and Endangered (T&E) Species List in 2007, and downlisted from Endangered to Threatened on the New Hampshire T&E List in September 2008. Recovery of the Bald Eagle population along the Connecticut River watershed has been strong but areas along the Merrimack River have also been documented. NHA biologists and volunteers solicit public sightings, conduct field searches for new nests, determine breeding success and pinpoint critical habitat areas. This information is used by the NH Fish and Game Department and by conservation groups and land trusts to develop appropriate long-term conservation strategies. While there have not been any observation of Bald Eagles nesting in Bow, there have been sightings throughout the year, most notably at the River Road Boat Ramp.

Source: NH Audubon, various publications and newsletters

declines. The following excerpt from this publication discusses trends by habitat and whether associated species are increasing, stable or declining. These habitats generally follow the habitats identified in the WAP and can be used as general guidelines for Bow's existing habitats and should be considered as part of an overall conservation strategy to protect important habitat.

Excerpted from "The State of New Hampshire Birds:"

1. ***Significant declines have occurred among species dependent on shrub-land and grassland habitats.***
   As New Hampshire's economy has shifted away from rural agricultural, the associated field and farmland habitats are disappearing. Today, these formerly common habitats often occur only when landowners consciously create and manage their land specifically for wildlife dependent on early successional and grassland habitats.

2. ***Significant declines have occurred among forest-dependent species.***
   Key elements of these declines include changing forest management practices and the conversion of forest land to other uses. As suggested earlier, even a change that seems innocuous can affect breeding bird habitat, like a road through a forest that consumes only a fraction of the forest but in effect creates two forest where before there was only one uninterrupted tract. The impact is exacerbated when road-related activity follows, such as motorized vehicles, recreation, and development.

FISH

Both cold- and warm-water fish species populate New Hampshire's rivers and lakes, including trout, and bass. Warm water fish species include the pickerel, yellow perch, whitefish, and horned pout. Each species of fish has specific habitat requirements. Turee Pond is a popular fishing spot in summer evenings for warmwater fish.

Pollutants that are deposited into lakes and streams are consumed by fish and some bioaccumulate in their tissues. This bioaccumulation eventually impacts human health via the consumption of contaminated fish. Fish-eating birds, mammals, and reptiles have experienced a variety of adverse effects associated with all pollution.

Since August 2001, there has been a statewide fish consumption advisory in response to information about mercury contamination. Test results showed that most of the fish throughout New Hampshire had varying levels of mercury contamination. The largest contributors to mercury in the environment are emissions from coal-fired power plants, municipal waste combustors, and home heating systems.

RARE PLANTS, RARE ANIMALS, AND EXEMPLARY NATURAL COMMUNITIES (SPECIES OF SPECIAL CONCERN)

The New Hampshire Natural Heritage Bureau (NHB) is a state program within the NH Department of Resources and Economic Development's Division of Forest and Lands. The NHB maintains a database of known rare plant populations, rare wildlife populations, and exemplary natural community occurrences. Exemplary communities are distinctive communities of forests, wetlands, grasslands, etc., that are rare or are common communities that are in good condition. Species of concern are those species listed as threatened or endangered under the New Hampshire Endangered

Species Conservation Act of 1979 or under the New Hampshire Native Plant Protection Act of 1987.

The ten rare animal species that have been observed and documented in Bow are listed in Table 5.5. Other special, undisturbed lands are essential for the biological diversity of plants and animals. The more biodiversity found within an area, the more valuable and self-sustaining the community becomes from both ecological and economic perspectives.

The WAP also identifies over 174 species of greater conservation need (SGCN) as well as their 27 habitats that support these species. The WAP identifies SGCN as those species that are considered to be" in trouble" – declining in numbers, squeezed into smaller patches of habitat and generally threatened by a number of issues. For the complete listing, see the WAP.

Barred Owl. Photo by Sandy Crystall.

Table 5.5: Rare Plants, Rare Animals, and Exemplary Natural Communitie

	Listed?		# Reported in the last 20 years	
	Federal	State	Town	State
Natural Communities - Palustrine				
Drainage marsh- shrub swamp system	-	-	1	18
Poor level fen/bog system	-	-	1	29
Sand plain basin marsh system	-	-	1	17
Plants				
Dry Land Sedge (Carex siccata)	-	E	H	5
Sessile-Fruited Arrowhead (Sagittaria rigida)	-	E	H	7
Small Whorled Pogonia (Isotria medeoloides)	T	T	1	51
Vertebrates – Mammals, Birds, Reptiles, Fish				
New England Cottontail (Sylvilagus transitionalis)	-	E	1	21
Bald Eagle (Haliaeetus leucocephalus)	-	T	1	88
Blanding's Turtle (Emydoidea blandingii)	-	E	9	709
Eastern Hognose Snake (Heterodon platrihinos)	-	E	2	41
Northern Black Racer (Coluber constrictor constrictor)	-	T	1	54
Wood Turtle (Glyptemys insculpta)	-	SC	3	193
American Eel (Anguilla rostrate)	-	SC	1	177
Invertebrates- Dragonflies and Damselfies				
Blue-Fronted Dancer (Argia apicalis)	-	-	1	9
Rapids Clubtail (Gomphus quardricolor)	-	SC	1	9
Riverine Clubtail (Stylurus amnicola)	-	SC	1	11

E-Endangered T-Threatened SC-Special concern H-Historical

Source: Rare Plants, Rare Animals, and Exemplary Natural Communities in New Hampshire Towns, published by New Hampshire Natural Heritage Bureau, July 2013

Providing a variety of habitats and protecting them from development and negative environmental impacts will increase wildlife diversity in Bow. The Town should review the findings of the WAP and monitor the rare plants and animals status as part of a process to develop conservation priorities and prevent the loss of wildlife habitat and when managing properties for wildlife conservation.

Threats to Terrestrial Resources

Habitat Loss and Fragmentation

A major threat to wildlife diversity is sprawl - a dispersed and cumulative development pattern that consumes the rural landscape, causing habitat fragmentation through changes in the landscape from roads, driveways and lawns. Wildlife that issensitive to human encroachment become restricted to small areas of undisturbed land, resulting in a loss of native plants, a reduced breeding gene pool, a loss of natural predators, and an increase in animal's susceptibility to disease. Reducing the size of forest tracts affects many species, even if all other habitat features remain the same.

For optimum wildlife habitat, blocks of unfragmented land should be protected from significant human activity or development. Unfragmented lands are generally considered to be large pieces of land which are not bisected by a maintained (Class V or lower) road. These areas can include forests, meadows, open water, wetlands and agricultural fields and may include many different landowner parcels. Unfragmented lands often encompass multiple habitat types thus providing safe travel corridors and migratory pathways habitats.

Invasive Species

Invasive species pose an increasing threat to native plants and wildlife due to their ability to reproduce rapidly under a variety of site conditions and the lack of natural controls on growth and reproduction characteristics of native species. Their presence alters the way plants, animals, soil and water interact within native systems, often causing harm to other species and reducing ecological diversity.

Invasive Insects

- *Emerald Ash Borer (EAB)*
  The Emerald ash borer (EAB) has been found in various communities across the central portion of NH, including Bow in 2013. As a small beetle, adults average one to one a half centimeters in length and are metallic green in color. Active May through August, the beetles are found primarily in the bark of ash trees where they lay their eggs to live through the winter to emerge in May. Trees with infestations usually only survive three to five years.

  Currently, a quarantine of all hardwood firewood, ash wood-products and all ash nursery stock is in effect for Belknap, Hillsborough, Merrimack, and Rockingham counties.

- *Hemlock Woolly Adelgid*
  Hemlock woolly adelgid is a small insect that feeds on small hemlock twigs, damaging the tree and leaving the tree susceptible to damage from other pests. A tree, if left untreated, will typically have a lifespan of 4 to 10 years after infestation. Currently, hemlock woolly adelgid has been identified in many communities throughout the southeast and

the Lakes Region within NH, including Bow in 2015. Additionally, the NH Department of Agriculture, Markets & Food and the New Hampshire Department of Resources and Economic Development have maintained a joint quarantine on the movement of hemlock nursery stock and hemlock forest products within infested counties, including Merrimack County.

- *Elongate Hemlock Scale*
  Elongate hemlock scale is similar to hemlock woolly adelgid in that it feeds on the underside of the hemlock needles, draining tree fluids and diminishing tree health. Though Bow has had no presence of elongate hemlock scale, infestation of elongate hemlock scale can typically follow an infestation of hemlock woolly adelgid. Additionally, neighboring communities of Concord and Hopkinton are known to have elongate hemlock scale infestations first reported in 2012 and 2014.
- *Red Pine Scale*
  Red pine scale is a small insect which attacks red pine trees. As an invasive non-native species, the insect was first found in NH in 2012 in Bear Brook State Park in Allenstown. Though no infestation has been found in Bow, infestations have been found in the nearby communities of Allenstown, Concord, and Pembroke.

For additional information on invasive insects, please see NH Bugs for more detailed information.

INVASIVE PLANTS

- *Japanese Knotweed*
  Japanese knotweed is a plant with a hollow, bamboo-like stem that can grow up to ten feet in height. Found mostly in areas with full sunlight, it can be found along stream banks, roadways and waste disposal areas. It is known for forming dense thickets that can weaken or exclude native vegetation and also poses a threat to riparian areas. Manual, mechanical, and chemical

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. They may impact wildlife or alter habitat structure or function.

These maps, including the map for Bow, can be seen online.

New Hampshire Fish and Game:
http://www.wildlife.state.nh.us/invasives/index.html
"Picking our Battles, A Guide to Planning Successful Invasive Plant Management Projects", September 2015.

INVASIVE SPECIES IN TOWN FORESTS

"In past years it was thought that planting certain non-native berry-producing plants would improve wildlife habitat. Common species included autumn olive, multi-flora rose, Japanese barberry, and bittersweet. Although the plants produce berries, the local wildlife did not evolve with those plants, so their digestive systems do not extract the same amount of nutrition from berries as the wildlife that did. Also, the plant species that were introduced do not have any predators that help control growth. As a result, many of the plant species have overrun various sites throughout the State and crowded out local plant species, thereby destroying native habitats. "

-Timber Cruise and Forest Management Plan of the Bow Town Forest System, revised Jan. 2011

methods are all viable methods of control knotweed and in riparian areas should be controlled from the headwater downstream. Knotweed is a current invader in Bow.

- *Glossy Buckthorn*
  Glossy buckthorn can be identified as either a shrub or a small tree measuring more than 20 feet in height, and will produce small flowers and form fruits during the spring and summer months. Glossy Buckthorn can be found throughout NH as it is mainly spread by birds and small mammals who feed on the buckthorn's fruits. In addition, these fruits can cause nutritional deficiencies to wildlife when consumed. Glossy buckthorn will grow in wetlands and is present in Bow.

- *Oriental Bittersweet*
  Oriental bittersweet is a plant consisting of dense vines that can cause weakening or death of shrubs, small trees and other plants under the heavy weight of the vines and block sunlight needed for photosynthesis. With infestations throughout the northeast, including Bow, oriental bittersweet is commonly introduced with birds and small mammals feeding on its abundant fruits and excreting the seeds as they move from one area to another. It can also be introduced through human actives, including seasonal wreaths and decorations.

- *Norway Maple*
  In the last two decades, Norway maple has spread widely in urban woodlots and forest edge habitats throughout the Northeast and provinces of Canada. It prefers the same moist soils where sugar maple is often found. For this reason, Norway maple is recognized as an invasive species in New Hampshire and other Northeast states.

  The ecological impacts, loss of natural habitat and reduction of species diversity, is a result of Norway maple's ability to create dense shade from its overlapping broad leaves/canopy. They also negatively affect the natural successional changes of forest habitat by the release of chemicals that inhibit or prevent the establishment of other plants within the root-zone thus eliminating competition for water, nutrients, and light. These impacts to native vegetation are amplified by its ability to uptake large amounts of water from the soil. Norway maple is subject to fewer diseases and pest insects than the native sugar maple, which gives it a competitive edge over sugar maple.

- *Burning Bush*
  Burning bush, also known as winged Euonymus, is typically a multi-stemmed deciduous shrub that grows to 6-12' tall. It develops a dense branching habit and often is wider than it is tall. The bark of older stems is gray or brownish gray with small fissures/furrows. Probably one of the most popular landscaping shrubs, it now is spreading aggressively to natural areas, leading it to be on New Hampshire's list, banning its sale and transport in the state.
- *Invasive Milfoil*
  Variable milfoil is an aquatic plant that has made its way into many of NH's lakes and ponds, including Turee Pond. Once infested, variable milfoil can cause damage to the water's aquatic life and recreational use. The species spreads rapidly, killing native plant life and blocking sunshine from reaching the bottom of the water body. Known to reach 10-17 feet in height, the species can make fishing, swimming, kayaking, and other recreational activities very difficult.
- *Purple Loosestrife*
  Purple loosestrife was brought to New England as an ornamental plant in the early 1800s, and has since contributed to the degradation of wetland habitats across the United States. Easily identified by its purple flower spikes, each plant can produce millions of seeds, which are easily spread by wind or water. Stands of the species can reach thousands of acres in size and choke out native plants that provide a food source, and destroying open water habitat for many other wetland species.
- *Phragmites*
  Phragmites australis, or common reed, is native to Europe. In the northeast, common reed is a tall wetland grass that reaches up to 15 feet in height and has a distinctive purplish-brown plume that appears in late July. It thrives in sunny wetland habitats and prefers fresh or brackish water. Stands of common reed are established through dispersal of seeds or pieces of underground stems called rhizomes. The plant grows very quickly and spreads rapidly over wide areas, causing a decline in other types of marsh vegetation. Human-caused disturbances, including nutrient loading, sedimentation, road salt, and other types of pollution enhance the spread of common reed.

WATER RESOURCES

This section on water resources includes information on surface water, groundwater, drinking water supplies, wetlands, and floodplains located in the Town of Bow. The health and function of the Town's water resources are critically important to ensure adequate and safe drinking water and provide healthy habitats for wildlife. It is important to acknowledge the importance of connectivity of small streams and wetlands to the integrity of downstream waters.

Conservation of natural resources was ranked as a highly desirable feature by those residents taking the Community Survey.

SURFACE WATER RESOURCES

WATERSHEDS

Bow, and the rest of the Central New Hampshire Region, is within the large Merrimack River watershed which stretches from the White Mountains south to Newburyport, Massachusetts. The

Merrimack River watershed comprises an estimated 40% of the state.

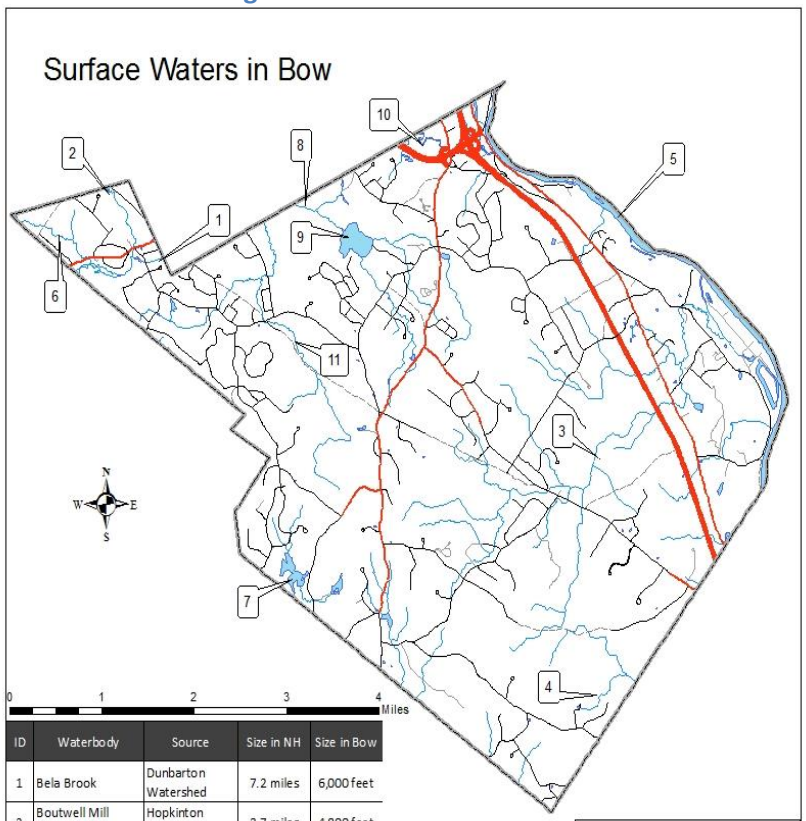
A watershed is an area of land where all waters flow to another river or ocean (such as the Atlantic Ocean). This includes precipitation, surface water, groundwater, wastewater discharges, and surface water runoff from natural and urban areas. Water bodies within a watershed include seasonal and perennial streams, rivers, ponds, vernal pools, and lakes.

Rivers and Streams

Bow's surface waters drain to the Merrimack River through tributaries that drain both to the north and south. The Merrimack River also represents the eastern municipal boundary of Bow. The portion of the river north of Garvins Falls, referred to as the Upper Merrimack, is a designated river under the state's Rivers Management and Protection Program.

The NH Rivers Management and Protection Program was established in 1988 with the passage of RSA 483 to recognize and designate rivers to be protected for their outstanding natural and cultural resources. A rigorous process is followed in order for a river to achieve state designation, including approval by the NHDES Commissioner, NH Legislature, and Governor. In 1990, the Upper Merrimack was one of the state's first designated rivers. After designation, a management plan was created (amended in 2007) that recommends ways to protect resources identified during the nomination process. The Plan is developed and implemented by a local river management advisory committee that conducts a variety of programs and projects through the watershed. The Upper Merrimack River Local Advisory Committee (UMRLAC) includes

Figure 5.2: Bow's Waterbodies



ID	Waterbody	Source	Size in NH	Size in Bow
1	Bela Brook	Dunbarton Watershed	7.2 miles	6,000 feet
2	Boutwell Mill Brook	Hopkinton Watershed	3.7 miles	4,800 feet
3	Bow Bog Brook	Bow Watershed	6.4 miles	6.4 miles
4	Brickyard Brook (Bow)	Concord	2.59 miles	3,200 feet
5	Merrimack River	Pemigewasset/ Winnipesaukee Rivers	66 miles	6.1 miles
6	One Stack Brook	Bow/Hopkinton Watershed	1.02 miles	3.2 miles
7	Putney Ponds and Meadows	Bow Watershed	Temporarily Drained	20 acres
8	Turee Brook (N & S tributaries and White Brook)	Turee Pond	11.14 miles	9.64 miles
9	Turee Pond	Bow Watershed	52 acres	52 acres
10	Turkey River	Turkey Pond	17.85 miles	1.51 miles
11	White Brook	Bow Watershed	3 miles	13,000 feet

Source: 1989 Water Resource Management Protection Plan Town of Bow; USGS Topo quads; 1998 CNHRPC Natural, Cultural, and Historic Resources Inventory; USGS, CNHRPC GIS

representatives from Bow. Volunteer water quality monitoring in the Upper Merrimack is a major part of the UMRLAC's activity.

Lakes and Ponds

Past Town documents have named Turee Pond, Bow Bog Brook, Putney Pond, and Putney Meadows as important water resources within the Town. Turee Pond, a 52 acre pond in northern Bow, serves as a tributary to Turee Brook. Bow Bog Brook flows 6.4 miles easterly until it joins with the Merrimack River. It was rerouted from its original course in order to accommodate the Eversource coal-fired power plant. Seven smaller tributaries also flow into Bow Bog Brook before the Brook's confluence with the Merrimack River. Putney Pond and Meadows (approximately 20 acres in size) are located on the Bow-Dunbarton Town line. The outlet flows into Dunbarton and is a major source of water for Kimball Pond - a Conservation Pond and a centerpiece of the Dunbarton Kimball Pond Conservation Area. The Putney Pond and Meadows have been drained, because the dam was deemed unsafe and removed.

Surface waters are not a likely potential municipal water supply. The estimated costs of meeting State and Federal standards of treatment are too high and the Town has no control over upstream land uses that could negatively affect the quality of water within the Merrimack River.

Protecting land and proper land management are essential for maintaining a healthy ecosystem within a watershed. Conservation efforts in the past have helped to protect these resource values through the Town's ordinances and through the acquisition of conservation land or easements. It is important for the Town to continue taking proactive steps to ensure that the quality and aesthetic value of the Town's surface water resources are protected, enhanced, and valued in the future.

A LAND CONSERVATION PLAN FOR THE MERRIMACK RIVER WATERSHED

The Merrimack Conservation Plan is the final product of a two year effort facilitated by the Society for the Protection of New Hampshire Forests, working with conservation and planning professionals representing 33 private agencies in New Hampshire and Massachusetts.

As the plan explains, the US Forest Service identified the Merrimack watershed as the most threatened in the nation in terms of projected loss of private forest land over the next 20 years. This projection was based on an expectation of continued robust population growth coupled with a land-intensive suburban development pattern.

Between 2000 and 2010, the New Hampshire portion of the Merrimack watershed, which comprises 19% of the state's land area, absorbed almost 42,000 new residents, or 52% of all the population growth in the state. Even with the watershed's increase in population, almost two-thirds of the watershed remains largely undeveloped and available for development, increasing the vulnerability to the loss of private forest land.

Source: NH Forest Society

TUREE POND

Used by residents and visitors, Turee Pond provides scenic beauty and recreation, such as canoeing, kayaking, and fishing. The water quality of Turee Pond has been monitored through the NHDES Volunteer Lake Assessment Program (VLAP) from 1996 to 2002, 2007 to 2015, and now again from 2017.

Turee Pond's most recent VLAP report was released in 2015. Using data from the six year period between 2008 and 2015, water quality levels were rated as "good" or "very good" for aquatic life and primary contact recreation, with the exception *of Escherichia coli (E. Coli bacteria)* rated as "encouraging," dissolved oxygen rated as "cautionary," and pH and dissolved oxygen saturation rated as "slightly bad." Much of the water quality statistics were found to have improved over the past year, with chlorophyll-a, E.coli, transparency, and turbidity all decreased compared to levels measured in 2014. Conductivity/chloride and total phosphorus levels remained elevated and higher than NH median values.

In 2015, variable milfoil, an invasive aquatic plant was discovered in Turee Pond. There are few houses around Turee Pond, but there is a fairly high use of Turee Pond by transient boaters. Visitors also fish from the shore. While initial chemical treatment of the pond was conducted in June 2016, continual monitoring and management of the pond will be necessary to minimize impacts of milfoil herein. In addition, ensuring the boaters follow a "Clean, Drain and Dry" approach to removing any vegetation and potential invasive aquatic animals from their boats before they leave the pond area will reduce the chances for spreading milfoil and other exotic species elsewhere. In 2016, the Conservation Commission in collaboration with the Merrimack County Conservation District obtained a Lake Host grant from the New Hampshire Lakes Association. This grant provides funding for an individual to conduct voluntary inspections of entering and departing boats for any milfoil or other possible invasive species. For additional information, please refer to the Variable Milfoil Management Plan.

UPPER MERRIMACK MONITORING PROGRAM

The Upper Merrimack Monitoring Program, organized by the Upper Merrimack River Local Advisory Committee (UMRLAC) has been monitoring water quality of the river through 17 testing sites over the past ten years. Two of these testing sites for water sampling and macroinvertebrate ("aquatic bugs") collection are located in Bow, above and below Garvins Falls Dam. Citizen scientists also assist with sorting and identification of collected "bugs" at sessions held during the winter. For more information please refer to the Upper Merrimack Monitoring Program's website.

Table 5.6: 2015 Average Water Quality Data for Turee Pond

	2015 Data Epilimnion	NH Median Values
Alkalinity (mg/L)	12.4	4.9
Chlorophyll-a (ug/l)	2.36	4.58
Chloride (mg/L)	56	4
Conductivity (uS/cm)	260.0	40.0
Total Phosphorus (ug/l)	17	12
Transparency (m)	2.3	3.2
Turbidity (ntu)	1.24	N/A
pH	N/A	6.6

Source: 2015 Turee Pond VLAP Report

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.

As defined by state and federal regulations, a wetland is an area that is inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal conditions does support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands include, but are not limited to swamps, bogs, marshes, and similar areas.

Many wetlands have water present because the soils are poorly drained or the water table is very high. Bow has a significant number of wetlands. Large wetland systems that provide significant water quality and wildlife benefits can be found throughout the Town. Wetlands provide a multitude of services that include flood control, fish and wildlife habitat, pollutant removal, recreation, groundwater protection, and soil stabilization. The primary impacts facing wetlands in Bow today are the effects of development within the wetlands or the adjacent buffer areas needed to protect them.

While some larger and wetter wetlands can be identified from interpretation of aerial photographs, most wetlands must be identified "in the field" where the soils characteristics, evidence of water, and plant species present can be evaluated.

Bow contains over 1,700 acres in wetlands, which are classified into three different wetland types. Palustrine wetlands are vegetated nontidal wetlands areas characterized by the presence of trees, shrubs or emergent vegetation (rooted below water but grows above the surface).. These wetlands are typically referred to as marsh, swamp, or bog and represent the most abundant wetland type present in Bow. The second type of wetland, lacustrine wetlands are large, open water-dominated systems such as ponds and lakes.

The third type of wetland present is riverine wetlands, those wetlands and deepwater habitats contained within a channel with flowing water. The wetlands listed in Table 5.7 provides the total acreage of each type in Bow. Historically, wetlands were viewed as areas with little economic value and were subjected to unchecked filling, draining, and dumping with little regard for the consequences. There is now a greater understanding of the services that wetlands provide, including:

- *Flood Control* - Wetlands act as a giant sponge during periods of high run-off or flooding and then release this stored water slowly during drier periods.
- *Water Storage and Groundwater Recharge* - The water in the wetlands can move up by means of evaporation, laterally by flowing in streams, and downwards, thus recharging groundwater.
- *Erosion and Sediment Control* - Because vegetated wetlands absorb and slow down the rate of runoff, the water's erosive powers are decreased.
- *Pollution Filtration* - Wetland vegetation and microorganisms reduce the harmful potential of pollutants such as bacteria, and nutrients found in runoff.

- *Wildlife* – The wetlands vegetation and water provides food, habitats, and breeding grounds for a wide variety of wildlife and fish.

- *Education and Recreation* - Wetlands provide natural areas of study for all ages as they offer innumerable flora, fauna, and wildlife habitat. Wetlands often represent the only remaining natural lands left in a Town and serve as excellent sites for photography, canoeing, snowshoeing, hiking, fishing, and hunting.

- *Plant and Animal Diversity* - Generally, only wetland plants can tolerate wet soils it creates unique habitats for wildlife.

Table 5.7: Wetland Acreages by Type

Type of Wetland	Acreage	Total % of Town
Palustrine	1,481.9	8.1%
Lacustrine	112.9	0.6%
Riverine	144.2	0.8%
Total	1,739.0	9.5%

Source: National Wetlands Inventory GIS Database

Prime Wetlands

In 1979, NH's wetlands law was amended to provide an option for municipalities to designate high value wetlands for greater protection.

Bow took the opportunity and identified those wetlands that met the prime wetlands criterion (very poorly drained soils). Of the 60 such wetlands identified, the Conservation Commission narrowed the scope of the evaluation to wetlands that provide critical services. The most important criterion chosen by the Conservation Commission was the ability of the wetlands to provide quality groundwater for private and public drinking water supplies. The Conservation Commission also considered their ability to stabilize sediment, filter toxic chemicals, remove/transform nutrients, provide wildlife habitat and absorb floodwaters. Eventually, eight wetlands were designated as prime wetlands after Town Meeting vote. These wetlands include various wetlands in the Bow Bog Brook, White Brook/Turkey River, and Turkey River watersheds. Most were chosen for their value as groundwater recharge areas. See the **Surface Water Map** for more information and the locations of these wetlands.

Activities in wetlands are regulated primarily though permitting at the state level by the NHDES Wetlands Bureau. For construction within a predetermined distance from a wetland, Bow has adopted a Wetlands Conservation Overlay District. With the exception of timber harvesting operations which are permitted uses under RSA 674:1 (subject to certain subdivision/development requirements), a conditional use permit is required for uses and activities in this District. Table 5.8 summarizes wetland buffer and setback requirements for Bow and neighboring communities.

Vernal Pools

Vernal pools are wetland depressions characterized by their small size, subject to seasonal filling and drying and may be physically isolated from other wetlands. Because they typically dry each year, no fish can survive. Some unique wildlife species are dependent on vernal pools especially for breeding. These include fairy shrimp, wood frog, and "mole salamanders" such as the blue-spotted salamander and yellow spotted salamander.

Vernal Pool in Bow. Photo by Sandy Crystall.

Table 5.8: Wetland Ordinances of Bow and Abutting Communities

Community	Ordinance	Wetlands Buffer Details
Bow	Wetlands Conservation Overlay District	Setbacks are: prime –150-200 feet; surface waters, bogs, wetlands with poorly drained soils – 75-200 feet; vernal pools and wetlands .25 and larger – 50-200 feet; other wetlands <0.25 acres – 30-200 feet, agriculture and logging allowed under certain conditions as well as other uses such as passive recreation; if construction, forestry or agricultural activity within 100 feet of any wetlands, special care to avoid erosion and siltation, could require an erosion control plan.
Allenstown	No separate ordinance	Stormwater management plan required for disturbances over 20,000 square feet and plan requires a 50 foot buffer around wetlands.
Dunbarton	Wetlands Conservation District	Covers certain ponds/brooks and adjacent Group 1 soils. Setback 125 feet for structures, septic tanks and leach field; additions are allowed.
Hopkinton	Wetlands Conservation Overlay District	Buffer 75 feet from any wetlands – no septic, leach field, structures or alteration of natural surface configuration. Applies to wetlands ≥ one acre or any size if adjacent to surface waters.
Hooksett	Article 18: Wetlands Conservation Overlay District	Setbacks are: prime – 100 feet with no roadway crossing or other special exceptions permitted; wetlands ≥ 1 acres in size- 40 feet to any structure or paved area and 75 feet for septic tank or leach field, and 100 foot for construction, forestry and agricultural activities; wetlands of special concern – 100 foot vegetative buffer and building setback.
Pembroke	143.72 Wetlands Protection Overlay District	Buffer ranges from 20 to 50 feet depending on structure and no septic closer than 75 feet. Wetlands defined as any size adjacent to surface water, vernal pools over 500 square feet and other wetlands over 1000 square feet.

Source: Municipal Regulations Review by CNHRPC

When the amphibians finish their breeding in the pool, they return to adjacent upland areas, sometimes as much as 1,000 feet away from the pool, for the rest of the year.

Loss of vernal pool habitat due to development is a threat, as is degradation, filling, or altered hydrology of surrounding land. Vernal pools are vulnerable to being overlooked during certain seasons or drier years due to the seasonal nature of filling and drying cycles. Because of this, locations of vernal pools can be challenging to identify. In order to protect vernal pools within the Town, buffer and setback guidelines have been established for vernal pools within the Wetland Conservation Overlay District outlined in the Town's zoning ordinance. These guidelines require a 50 foot buffer and a setback ranging from 50 to 200 feet depending on the use and activities for all vernal pools.

FLOODPLAINS

Floodplains are areas of low-lying ground adjacent to a river or stream that become inundated when heavy precipitation occurs upstream within the watershed. Retaining a floodplain in its natural state is the most cost-effective way of protecting life and property by reducing flood damages, and has been found to be far less expensive than dams, channelization, and other structural methods. Undeveloped vegetated floodplains also trap sediments and pollution and reduce erosion, whereas development within the floodplain leads to higher peak flows and more rapid movement of pollutants into the stream channel, which degrades water quality. See the **Surface Water Map** for the location of floodplains in Bow.

As development continues to occur within a watershed, the runoff volume and rate of flow increases due to the larger areas of paved and other impervious surfaces (e.g. roofs, roads and driveways). Flooding can consequently become more frequent and floodwaters more damaging since they are moving at higher velocities.

WHAT IS AN AQUIFER?

An aquifer is defined as an underground body of porous materials, such as sand, gravel, or fractured rock, filled with water and capable of supplying useful quantities of water to a well or spring. The two main types of aquifers, bedrock and stratified drift aquifers vary in composition and the amount of water accessible. Stratified drift aquifers are typically used for public water supplies in New Hampshire, including industrial, commercial, and domestic uses.

AQUIFER PROTECTION DISTRICT

In 1990, an Aquifer Protection (AP) Overlay District was established within the Town's zoning ordinance to preserve and maintain groundwater supplies, aquifers, and groundwater recharge areas. Amended in 2005, 2009, and 2012 the ordinance outlines performance standards as well as permitted, prohibited, and conditional uses allowed by a conditional use permit from the Bow Planning Board. The most recent amendment in 2012 expanded the areas of the district to include the well head protection area for the Bow municipal water system.

Please refer to the Existing and Future Land Use Chapter for additional information.

Preserving floodplains becomes increasingly important as the cumulative impacts of development continue along with decreased capacity to store floodwaters. Bow participates in the National Flood Insurance Program (NFIP) and has a Floodplain Overlay District in the Town's zoning ordinance to regulate development in floodplain areas to meet the requirements of the NFIP.

This Overlay District sets standards and practices for development with the intent of reducing the hazards of flooding and enabling the floodplain to absorb, transmit, and store runoff. A conditional use permit is required for any development in this District. For additional information, please refer to the Existing and Future Land Use Chapter or the Town's zoning ordinance.

Fluvial Geomorphic Features and Fluvial Erosion Hazards

Fluvial geomorphology is the study of how processes of flowing water in rivers work to shape river channels and the land around them. The sinuous bends of rivers illustrate how the river reduces the energy within the system. A migrating river has the potential to impact nearby structures (berms, dams, buildings, etc.) or infrastructure such as river/stream crossings (culverts and bridges) or transportation features (roads, drainage structures, rail, etc.) in its migration path.

The Town of Bow participated in the New Hampshire Geological Survey's fluvial geomorphology assessment (conducted by Field Geology Services) for designated river segments, called river reaches, along sections of the Turkey River in Bow and Concord. The data collected covered 1.3 miles of the Turkey River within Bow, and was included as an addendum in 2015 to Bow's Hazard Mitigation Plan.

Though review and analysis of the data collected, several areas of concern were identified. In addition, four action items were recommended to address these fluvial hazard issues, presented below.

1. Initiate discussions with NHDOT regarding the South Street Bridge and I-89 on-ramps and off-ramps over the Turkey River.
2. Produce an educational program for future development to place appropriate erosion control measures on site.
3. Evaluate potential risk to the water pump station on the Turkey River with a vulnerability assessment.
4. Revise Town regulations to insert required engineering analysis for new development's erosion control measures on site shown within the Turkey River fluvial erosion hazard (FEH) meander belts.

Please refer to Bow's Hazard Mitigation Plan for additional information.

Groundwater

Groundwater is an important resource as it is provides the drinking water for the majority of Town residents. Groundwater is typically hydrologically connected to surface waters, and thus affects the quantity and quality of them. It is defined as the subsurface water, which saturates sand, gravel and other soil deposits, and fills the cracks within the underlying bedrock. The top surface of this saturated zone is called the water table, which may be just below the surface or at some depth. In some wetlands, the visible surface

of the water may reflect the level of the groundwater of the adjacent land. Groundwater is replenished largely by rainwater and snowmelt, which percolates downward through the unsaturated soil. Other sources of replenishment, or recharge, may come from streams, lakes and ponds. Some groundwater discharges to wetlands, streams, ponds, and lakes and then becomes part of the surface water runoff. Although rainfall will percolate into all soil and weathered rock surfaces to some extent, areas of more porous sand and gravel will allow a greater amount of infiltration, and are specifically noted as "recharge zones" to signify their importance in recharging groundwater reservoirs. Therefore, it is important to identify and protect these areas from certain land uses that may prevent the recharge of groundwater or be a significant threat of subsurface contamination.

In addition, if recharge areas are covered by impervious material, then the recharge of the underlying aquifers could be reduced. In addition, impervious surfaces such as roads and rooftops, increase stormwater runoff, carrying with it salt, chemicals and excess nutrients which can contaminate surface and groundwater.

The productive aquifers in NH are in the deeper deposits of sand and gravel that were deposited by glacial streams. Other important characteristics are the area, extent, and thickness of the aquifer. Most of the highly productive aquifers in NH consist of unconsolidated deposits of gravel and sand, floodplains, abandoned river beds and alluvial valleys.

Within Bow is one of the largest and most productive stratified drift aquifers in the south-central areas of the state studied by the United States Geological Survey (USGS). The Bow aquifer is a buried

SOURCE WATER PROTECTION PLAN AND THE DRINKING WATER PROTECTION COMMITTEE

Since its establishment in 2005, the Drinking Water Protection Committee has been working to protect Bow's groundwater supply and educate homeowners about drinking water and practices to protect it.

The Committee has developed:

- A Source Water Protection Plan to guide its actions;
- A Wellhead Protection Plan to ensure all municipal sources of drinking water (including the library, municipal building, and schools) are protected and being tested;
- A Wellhead Protection Program Implementation Plan for the Town's first municipal water supply; and
- Criteria to evaluate potential lands for protection for drinking water supplies.

The Committee has:

- Participated in a local private well testing effort with Dartmouth aimed at highlighting the presence of arsenic in local groundwater and the importance of testing and reducing exposure and impacts on health;
- Studied local water quality issues in response to residents' complaints about corrosion; and
- Conducted outreach for private well testing at schools and town meetings.

valley filled with highly permeable sand, gravel, and minor silt deposited as a ridge of gravel and sand. In Bow, the coarse-grained deposits, which are more than 90 feet thick in some places, are hydrologically connected to the Merrimack River. The 3.4 square mile aquifer extends southward from the confluence of the Soucook and Merrimack Rivers into Bow immediately north of the Eversource coal-fired power plant. The coarse-grained deposits are bordered to the east and the west by younger, fine-grained lake-bottom deposits associated with glacial Lake Hooksett which was formed by glacial meltwaters.

USGS estimated the amount of water in this part of the Bow aquifer, calculating that water availability to range from 1.6 –1.9 million gallons per day. The higher estimates might be achieved if gravel-packed production wells are installed in the coarse deposits of the aquifer and within a few hundred feet of the Merrimack River to induce recharge from the River. The aquifer underlies many residences and commercial and industrial businesses and it is important that current and future development not adversely impact the health of this valuable groundwater resource. Since this USGS study, a municipal water supply in this area has been developed and permitted in Bow.

See the **Significant Ground Water Resources Map** for the known locations of aquifers in Bow.

WATER USE AND CONSUMPTION

PRIVATE WATER SYSTEMS

Water supply, which is essential for residents, businesses and local agriculture, is typically collected and distributed through two different methods: a public water system or a private water system. Typically, public water systems are found in densely populated communities, and provide water via piping for a large area with a high number of homes and businesses. Private water supply systems, also known as wells, usually service one area, typically a household or business.

Bow residents and businesses depend primarily on groundwater for their water supply, with an estimated 1,471 wells registered in Bow, according to NHDES. The majority of private water supplies are from drilled wells in bedrock. According to NHDES, approximately 40 percent of NH's population depends on domestic wells for water supply, and more than 75 percent of those wells are drilled bedrock wells. USGS has also mapped lineaments which are fractures that indicate the potential for adequate water supplies from bedrock. The lineaments are shown on the **Significant Ground Water Resources Map** and can indicated improved chances of locating bedrock water supplies in areas that are not stratified drift aquifers.

There are naturally occurring water quality concerns with bedrock aquifers in NH, most notably arsenic and radon. Arsenic can have an adverse effect on human health and occurs in groundwater throughout NH, originating from minerals within the rocks of the region. Former pesticide use, treated lumber, and manufacturing also are potential sources of arsenic and may also be a contributing factor to ground-water contamination.

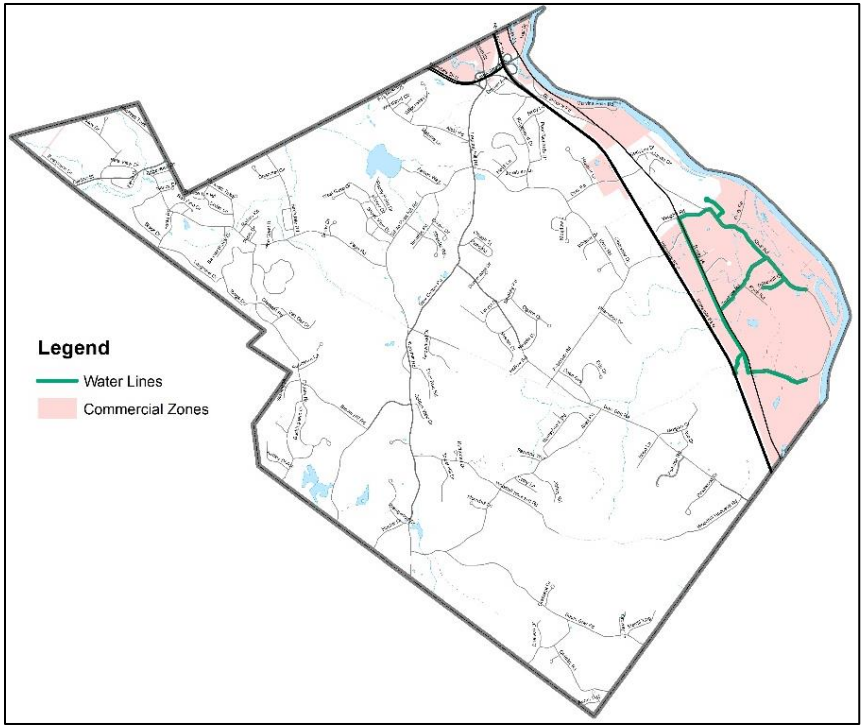
Radon is a naturally occurring radioactive gas that is commonly found in bedrock and in water from bedrock (drilled) wells in NH. Radon in water from bedrock wells is released into indoor air during showering, dishwashing and doing laundry, as well as directly as a

gas from bedrock. Exposure to radon poses an increased risk of developing certain types of cancer, primarily lung cancer and stomach cancer. Testing your water every three to five years is recommended by NHDES.

Community Water Systems

Many studies have been conducted to determine potential sources for a municipal groundwater supply. Studies conducted by Dufrense-Henry (1981), SEA Consultants, Inc. (1987), and Stearns & Wheeler (1992) concluded that the Bow aquifer has great potential for development as a municipal water supply.

Figure 5.3: Bow Municipal Water Lines, 2015



In the Bow 1989 Water Resource Management and Protection Plan, the Merrimack and Turkey River aquifers, as well as the Bow Bog and White Brook aquifers were recommended as sites for exploration for a future municipal water supply. In fact, the 1995 USGS found that 6 square miles of Bow or 22% of the Town is underlain by stratified drift aquifers.

At the request of the Bow Business Development Commission, Marin Environmental conducted a study in 2001 to examine the potential for development of the sand and gravel aquifers in the NH Route 3A Study Area. Marin Environmental concluded that the Bow

Table 5.9: Types of Public Water Supplies

Type of Public Water Supply	Number of Systems in Bow
Community Water System *A public water system that supplies water to the same population year-round. Includes single family residences, senior housing, and for fire protection.*	7
Non-Transient Non-Community Water System *A public water system that regularly supplies water to at least 25 of the same people at least six months per year. Includes schools, daycares, industrial facilities, and commercial properties.*	19
Transient Non-Community Water System *A public water system that provides water in a place such as a gas station or campground where people do not remain for long periods of time. Includes recreation and education facility, historical site, businesses, restaurants, service stations, libraries, police and fire, churches, and medical offices.*	13
Inactive Systems	9

Source: New Hampshire Department of Environmental Services Onestop Data, 2015

Aquifer, particularly in the area north of Old Ferry Road, had the potential to be a water supply. The high transmissivity (rate at which water transmitted through soil) and hydraulic connection of the Bow Aquifer with the Merrimack River are characteristics that are very favorable for development as a municipal water supply.

In 2010, the NHDES issued the Town of Bow a ten-year large groundwater withdrawal permit to provide a long-term water source for a new community water system. Located approximately one mile south of Bow Junction in Bow, the well is permitted to withdraw up to 1,008,000 gallons (7,000 gallons per minute) over a 24 hour period. See the Municipal Water Supply Map (Figure 5.3) for more information.

There are 46 active water systems in Bow classified as Community Public Water Supplies. These systems service businesses and larger residential developments that have 15 or more connections and/or serve more than 25 people daily.

DAMS

There are currently five active structures listed for the Town of Bow in the NHDES Dam Bureau's database. According to RSA 482:2 II, a dam is any artificial barrier which impounds or diverts water, has a height of four feet or more or has a storage capacity of two acre-feet or more, or is located at the outlet of a great pond. There are 18 inactive dams listed in Bow that do not meet the above definition and may be in ruins, breached, removed, or never built.

Every dam is categorized into one of four classifications, which are differentiated by the degree of potential damages that a failure of the dam is expected to cause. The classifications are designated as High Hazard, Significant Hazard, Low Hazard, and Non-Menacing. As can be seen below, Bow has one High Hazard, two Low Hazard, and two Non-Menacing dams.

Table 5.10: Active Dams in the Town of Bow

Hazard Class	Name	Water body Approximate Location	Type	Status	Owner
High	Garvins Falls Dam	Turkey River, near Garvin Falls Road	Concrete	Active	Public Service of New Hampshire
Low	Bow Fire Pond Dam	Morgan Brook/Logging Hill Road	Concrete	Active	Town of Bow
Low	Putney Meadow Pond Dam	TR Black Brook/Southwestern portion of Town near the Town line	Earth	Active	Private
Non-Menacing	Mckay Fish Pond Dam	Natural swale/Western portion of Town near Page Road	Earth	Active	Private
Non-Menacing	Fire Pond	Runoff/Logging Hill Road	Concrete	Active	Private

Source: Town of Bow Hazard Mitigation Plan Update 2013

Dams can provide an array of benefits, including enhanced recreation, fire protection, hydropower production, water supply, and flood control. However, some dams, which may be old, unsafe and uneconomical, may provide greater benefits by being removed. When the costs associated with a dam outweigh its benefits, dam removal may be the best decision, resulting in significant environmental, economic, and social benefits. These benefits include eliminating a public safety hazard, providing cost savings to taxpayers and dam owners, improving water quality, eliminating barriers to fish and other aquatic species, restoring river habitats, and creating river-based recreational opportunities.

THREATS TO SURFACE WATER AND GROUNDWATER

Development of all types has the potential to adversely impact natural resources, especially water resources. Many commercial and industrial enterprises use various chemicals in everyday operations, which, if not properly handled and disposed of, can pollute water supplies. Therefore, development where groundwater recharge areas and aquifer areas exist should be thoroughly evaluated and any potential development controls should be identified so that development proceeds where the least potential for aquifer recharge exists.

POINT SOURCE POLLUTION

In addition to naturally occurring contaminants, contaminants from various land uses, or activities business (e.g. fuel or oil spills), industry (e.g. improper use and disposal of hazardous materials/waste) and households (e.g. improper use and disposal of herbicides) also present threats to current and potential water supplies. Point source pollution, which is defined as any single identifiable source of pollution, such as a pipe or ditch, is a concern to local residents and business owners as it may have many different routes of entry. Leaking above and below-ground storage tanks, floor drains that directly release into the ground or water body, dry wells, burying waste, and inadequate septic systems are all examples of contamination entry methods. Larger point sources include industrial factories, sewage treatment plants, oil refineries, food processing, and pulp and paper mills.

As contaminated groundwater and surface water gathered by household wells can cause health issues, NH has taken many precautionary steps in the form of regulation of potential contaminants. This includes permits for the discharge of anything other than normal household waste to an on-site sanitary disposal system (e.g. floor drains) and for the discharge directly into surface waters.

According to the NH Department of Environmental Services**,** potential sources of contamination exist in Bow. These include hazardous waste generators, underground storage tanks, aboveground storage tanks, and solid waste facilities. The chart below lists the types of existing and potential sources of contamination that are located in Bow.

Because of the continuing need for clean, safe, and available drinking water for the residents of the Town, there needs to be an awareness and emphasis placed on protecting this important resource.

Private wells are susceptible to the same pollutants as public water supplies; however, there are no state requirements regulating the quality of the water gathered through private systems. Common,

naturally occurring contaminants, such as arsenic, radon and uranium, may be present in water derived from wells. A report published in 2013 on Water Supply Infrastructure and Protection by NHDES estimated about 55% of private well systems in NH exceed the state's radon limits and 20% exceed EPA's arsenic contamination level. Private wells should be tested regularly and appropriate treatment systems installed when necessary in order to protect public health. Public awareness through education of the importance of private well testing is critical.

National Pollutant Discharge Elimination System (NPDES) Permitting

For treatment facilities having stormwater discharges associated with industrial activity, an NPDES permit is required. The NPDES permit regulates the volume and characteristics of effluent discharge from a point source directly into a water body from treatment facilities through a permit process valid for five year increments. The program consists of two phases, the first associated with large municipal separate storm sewer systems (MS4), industrial activity, and construction sites larger than five acres. The second phase is associated with small MS4s, municipally owned industrial sites, and construction sites larger than one acre. New Hampshire is one of four states in the country viewed as a non-authorized state, meaning all effluent discharge permits for the state must be directly issued by the EPA.

In 2013, Bow received a waiver from EPA exempting the Town from the requirements of the small municipal separate storm sewer system (MS4) permit requirements. The waiver was approved as it was determined that Bow's small MS4 is located in a jurisdiction with a population under 1,000 within the urbanized area. It is possible that Bow may be held to these requirements in the future

STORMWATER RUNOFF

Stormwater runoff occurs when water from intense rain and snowmelt flows over land instead of soaking into the ground. As the water flows, it picks up contaminants, including sediment, suspended solids, nutrients, heavy metals, pathogens, toxins, and other floating materials that then pollute the water body or groundwater the runoff enters.

Increases in stormwater can increase flooding in the watershed, creating new flooding patterns, channel erosion, and potentially causing harm to surrounding habitats. Flooding also can cause damage in developed areas where there is not adequate stormwater management.

Stormwater infrastructure consists of a system with pipes and inlets, redirecting stormwater to a nearby stream, river, or main wastewater channel to be treated and released. Even though more urbanized communities are more at risk for stormwater runoff, the increase of projected extreme storms and events could cause current culverts, ditches, and dams to be undersized causing impacts on the infrastructure's performance and design life.

Table 5.11: Potential Sources of Contamination

Potential Sources of Contamination	# of Locations
Solid Waste Site	5
Above Ground Storage Tanks	10
Underground Storage Tanks	10
Hazardous Waste Generators	146
Total	171

Source: NHDES Onestop, Nov. 2015

if the conditions of the waiver change or EPA's regulations are amended at a later date. For additional information, please refer to the EPA website.

Nonpoint Source Pollution

Unlike point source pollution, non-point source pollution cannot be traced back to any specific source. It is water pollution that is caused by widely dispersed sources of pollutants that are carried by runoff from rain and snow melt.

Its effects are magnified by impervious surfaces, such as building roofs and paved surfaces. Water cannot infiltrate these surfaces, causing more water to run off over the land. As water washes over the land, it picks up oil, pesticides, nutrients, sediment, and other pollutants. The runoff water flows into storm drains or directly into water bodies, carrying the pollutants that have been deposited. As little as 10% impervious surfaces on a lot or larger area can begin to negatively impact a waterway. Thus, the more intensively used a piece of land is, the more nearby waterways are negatively affected by polluted runoff.

Protection from nonpoint source pollution is challenging for many communities like Bow. Low impact development (LID) is one method used to reduce nonpoint source pollution, and focuses on reducing impervious areas, using the natural landscape to manage runoff, decentralizing drainage infrastructure. Methods of LID design include infiltration trenches, rain gardens, permeable pavements and protecting sensitive areas.

Winter Road Maintenance (Sand and Salt)

Sand and salt used in winter road maintenance during winter weather is often attributed to the high levels of salt (sodium and chloride ions) found in watersheds through runoff of road, driveway, and parking surfaces. Due to chloride's highly soluble nature, it often settles at the bottom of a water body, where it can become toxic to aquatic life once a high enough concentration is reached. Sodium, due to its chemical properties, often undergoes ion exchange, which can alter the soil chemistry by replacing and releasing nutrients, including calcium, magnesium and potassium into groundwater and surface water.

In order to provide safe travel while being considerate of any environmental impact, the Town of Bow developed a Winter Maintenance Policy regarding winter road maintenance. The policy discusses current equipment status, treatments of roads, materials used, a frequently asked question section, and guidelines for winter safety. In addition, public work employees have become state certified under the "Green Snow Pro" training program implemented by NHDES and UNH.

Air Resources

Air resources play a critical role in the overall health of a community. Air quality affects the quality of natural resources, such as water, wildlife, and vegetation. In addition, air quality has a direct impact on the quality of human health. The air we breathe can become contaminated with pollutants from a variety of sources. Children, the elderly, and people suffering from heart or lung disease are at a higher risk. Air quality is determined by interactions between natural and human activities; for example, some land uses, such as construction, may generate large amounts of dust and smoke that travel great distances on global wind currents. The benefits of forest cover are many, and should be part of a

community's commitment to addressing air quality and maintaining open space.

Air pollutants are emitted from a variety of sources. The major contributing sources include power plants, automobiles, and businesses. The human health effects of toxic air pollutants are as varied as the pollutants which cause them. In general, children are more sensitive to air pollution than healthy adults because they breathe 50 percent more air per pound of bodyweight than adults.

NH has monitored ambient (outdoor) air quality since the early 1960's. NHDES has continually improved its Program to comply with federal requirements and operates a network of air quality monitors throughout the state to measure levels of ozone, sulfur dioxide, nitrogen dioxide, carbon monoxide, and particulate matter, as well as other pollutants, in the outdoor (ambient) air. The Town of Bow is not a location for air quality monitoring; the closest location is Concord. However, there are ten stationary sources of air pollution within Bow that are required to have an air permit to operate. These ten include major point sources (Eversource power plant) to area sources (manufacturing and fabrication sources). Included in this number are permits for three emergency generators.

Mobile sources such as cars, buses and trucks generate the major pollutants of hydrocarbons, or volatile organic compounds (VOCs), nitrogen oxides (NOx), carbon monoxide (CO) and particulate matter (PM). VOCs react with NOx in the presence of sunlight and elevated temperatures to form ground-level ozone, a major component of smog which is one of the most serious air pollution problems in NH, particularly in portions of the more densely populated counties of Merrimack, Hillsborough, Rockingham and Strafford. According to NHDES, transportation accounts for over half of these air pollutants, leading to the importance of individual choices on traveling options such as carpooling, reducing daily trips and unnecessary idling, as well as encouraging land use patterns that discourage sprawl.

CONSERVATION CONSIDERATIONS

STEEP SLOPES

Steep slopes are often defined as land areas with a slope of 15% or greater. Steep slopes are notable for their challenges to development and the lack of capability and suitability of those areas to support development, as it relates to the site and the building, septic system and building design costs, and environmental impacts. Steep slopes are also identified for their increased potential for erosion and rockslides, particularly along highways. Slope is the ratio of change in vertical elevation in relation to the change in horizontal distance, multiplied by 100 in order to be represented as a percent. In Bow, there are a few areas with steep slopes, as can be seen on the **Steep Slopes and Scenic Vistas Map.**

Table 5.12: Slope Requirements in Bow

Land Use	Slope Permitted
Buildable land	33% or less
Driveways	12% or less (zoning ordinance) 10% or less (subdivision regulations)

Source: CNHRPC review of Site Plan and Subdivision Regulations in the Town of Bow.

SCENIC VIEWS

The landscape of a community defines its cultural, natural, and historical heritage and thus provides the residents of a community with a sense of identity. Bow's identity is marked by the views of fields, water bodies, the Merrimack River, as well as its overall hilly topography, offering numerous scenic views of rolling hills, ponds, and streams.

A scenic resource evaluation, from Vermont's "Mad River Resource Protection Plan," provides a list of key scenic attributes that transfer well to Bow. These key scenic attributes include:

Physical Features

- Hills and hillsides
- Rivers, ponds, streams, and wetlands
- Vegetation, greenery, foliage, and wildflowers
- Agricultural Lands
- Wildlife

Important Aspects of Views

- Diversity and contrast within a view, such as a patchwork of open and wooded land
- Location of open space adjacent to historic New England housing, hedgerows, and stonewalls, etc.
- Continuous views that "follow" you as you travel along the road or are deep views
- Lack of scattered development or other disturbances in views
- Vantage points – the point or area that provides access to the view

Bow has a diversity of scenic views and vistas, most of which are protected only by the willingness and desires of the landowners. No comprehensive inventory or analysis exists of Bow's scenic views and vistas. As more development occurs within the Town, the scenic views, and locations to observe such views, will become more endangered.

In the "1998 Natural, Cultural, and Historical Resources Inventory" and "2000 Open Space Trail System Plan," the following locations were identified as scenic roads and vistas:

- Allen Road passes through a wet, heavily forested area.
- Brown Hill provides scenic hilltop views.
- Greylore Pond area is a scenic open space that combines views of water and undeveloped land.
- Picked Hill (915 feet) is a rugged area with steep slopes and rocky soils. Scenic views of the White Mountains and the Concord area can be seen from the ridge line and above.
- Putney Pond and meadows with the marshy and forested lands that surround it provide important wildlife habitats and scenic views (the pond has been drained as a result of the breaching of the dam).
- The Wood Hill area provides scenic views of the White Mountains.
- Woodhill Hooksett Road passes through a variety of terrains, and provides a variety of pleasing scenery. When at upper elevations, scenic views of the valley and of

mountains can be seen. When at low elevations, the road passes alongside the Hornbeam Swamp area.

- Turee Pond boat ramp area provides scenic views of Mount Kearsarge, especially at sunset.

See the **Steep Slopes and Scenic Vistas Map** for the location of these and other scenic areas in Bow.

OPEN SPACE

Access to outdoor recreation is important to the health and quality of life for residents. Protecting open space and ensuring public access, as well as providing information on recreation opportunities can be important for connecting people to the outdoors and promoting a healthy lifestyle. Recreation, scenic views, and appreciation of natural resources all play a role in the economy either through tourism or attracting the people who choose to live in this areas for the quality of life, based on an appreciation of natural resources, environment, and recreation in the area.

In its simplest definition, open space is land that has not been developed or converted to other uses. It includes forests, fields, river corridors, wetlands, wildlife habitat, and greenway corridors, as well Town parks or recreation areas. These are features that make Bow a special place to live.

Open space is a very important part of any community. It provides aesthetic and scenic values, wildlife habitat, and helps to minimize impact from development. Recreational opportunities on open land include walking, hunting, fishing, biking, wildlife viewing, and photography.

BOW OPEN SPACES

Bow Open Spaces, Inc. was established in 1997 to protect property that has been donated to or purchased by the Town of Bow for conservation and recreation purposes for the benefit of the citizens of Bow and its neighboring communities.

The mission of Bow Open Spaces, Inc. is to acquire, conserve, manage and dispose of land and interest in land within and surrounding the Town of Bow in order to preserve and protect wildlife habitat, farm land, forests, wetlands and other lands of conservation value and the natural scenic, recreational, ecological and productive features of such land for the benefit of the citizens of Bow and the State of New Hampshire.

Though trends statewide and in Bow point towards slower development and slower population growth, it is important to protect open space areas to allow residents to continue to access the desirable rural character that originally attracted them to the Town. One of the essential reasons to plan for open space is to set a course for the Town of coordinated development that maintains Bow's high quality of life. Many times decisions are made on land use without the benefit of a unifying plan to coordinate the actions. The result is development that does not take into account the Town's and/or region's unique characteristics and sense of place.

CONSERVATION LANDS

Tracts of land under conservation easement can be permanently protected from future development as part of the parcel's deed restrictions or they can be under temporary conservation for a

limited period of time. The Town owns approximately 2,388 acres of properties with conservation easements. Other Town owned parcels (approximately 304 acres) are considered open space and/or conservation land and are used as such but there are not conservation easements on these properties. The State of New Hampshire, Town of Bow, Federal Government, Bow Open Spaces, or private owners own and or manage approximately 610 acres of conservation land in Bow. Table 5.13 displays those parcels.

See the **Conservation Lands Map** for the location of these lands.

CORRIDORS AND CORRIDOR TRAVEL

Greenways are corridors of open space managed for conservation and recreational purposes, which are often permanently protected parcels of land. Greenways often follow natural land or water features, and link nature reserves, open space, farms and forest land, parks, cultural features, and historic sites with each other as well as with populated areas. Some greenways are publicly owned, some are privately owned, and some are the result of public and private partnerships. In more developed areas, greenways can encompass natural or built features and can be managed primarily for resource conservation or recreation. In more rural areas, greenways are natural corridors linking large unfragmented natural areas, preserving wildlife habitats and providing a corridor for wildlife to travel from one habitat to another. Greenways servings as wildlife corridors can be virtually any type of traversable land, preferably of at least 200 feet in width.

Common tracts of land that can be used as greenways include Class VI roads, railroad right-of-ways, and buffer areas along

Table 5.13: Open Space and Conservation Lands

Conservation Land Name	Acreage	Town Owned*
Protected Conservation Lands		
105 Bow Bog Road	18.4	Yes
Boucher Easement	44.5	No
Bow School Forest	105.2	Yes
Bow Town Forest	620.9	Yes
Cilley State Forest	34.2	No
Hallinan Easement	134.4	No
Hammond Nature Reserve	142.6	Yes
McNichol Lane Easement	3.7	Yes
Nottingcook Town Forest	760.3	Yes
Old Johnson Road Town Forest	232.1	Yes
Pages Corner State Forest	83.4	No
Richard Hanson Memorial Recreation Area	170.2	Yes
Richardson Easement (1)	66.8	No
Richardson Easement (2)	45.7	Yes
Titus Easement	220.9	No
Town of Bow Land	92.7	Yes
Walker Forest	196.6	Yes
Unnamed parcels	50.6	-
Conservation Land Without Easements		
Beaver Brook Open Space	11.7	Yes
Bow Bog Road Open Space	8.8	Yes
Buckingham Drive Open Space	25.7	No
Dunbarton Road Open Space	34.5	Yes
Hampshire Hills	5.1	Yes
Hunter Drive Open Space	15.1	Yes
Merrill Crossing Open Space	11.6	Yes
Morgan Town Forest	61.0	Yes
Mountain Farm Road Open Space	0.7	Yes
Municipal Well Site	18.4	Yes
Nathaniel Drive Open Space	3.5	Yes
Rosewood Drive Open Space	3.8	Yes

Table 5.13: Open Space and Conservation Lands (Cont.)

Tower Hill Drive Open Space	1.5	Yes
Town Forest	129.2	Yes
Unnamed parcels	196.8	-

**Not Town Owned includes State of New Hampshire, nonprofits, and private.*
Source: NH GRANIT, Town of Bow, Bow Open Spaces

agricultural/forestry lands. Creating and maintaining a greenway system can also help prevent those parcels of open space, which include forest, wetland, and agricultural lands, from becoming isolated parcels, detached from one another and surrounded by development.

TRAILS AND TRAIL MANAGEMENT

Trails create opportunities to access open land and allow residents and tourists to get outdoors to enjoy natural, scenic, and recreational areas. A multi-use trail is defined as any trail that is used by more than one user group, or for more than one trail activity. Trail-user groups include pedestrians, hikers, equestrians, mountain bikers, and snowmobilers. These groups benefit from multi-use trails through exercise, recreation, and nature viewing.

The Town of Bow created an "Open Space Trail System Plan" in 2000 that focuses on protecting Bow's open space and creating a trail system. The Open Space Trail System Plan inventoried existing public lands, easements, rights-of-way, trails, determined where linkages to the lands and trails should be, and provided recommendations on how to obtain linkages and maintain a trail system. After the extensive inventorying and data collection process, a series of recommendations were made to help the Town retain its rural character, create a trail system, and encourage a greater sense of community. This Plan has not been updated since its original publication date of 2000. See the "2000 Open Space Trail System Plan" for more details. The importance of trails and the lack of easy availability of information on access to them was a focus point of discussion at Bow's Visioning Session held on May 11, 2016.

Trails are either classified as official or unofficial trails. Official trails are those owned and maintained by the state, town, or other entity, such as a nonprofit environmental organization or school that are developed and maintained through an official agreement. Unofficial trails are those trails that are not maintained by any entity but they are used by the public. Many unofficial trails are present on land in current use within Bow. A good example of an unofficial trail includes the use of the power line corridors or Class VI roads.

In 2014, Bow Open Spaces received a recreational trails grant through the NH Department of Resources and Economic Development, which allowed for the installation of two new kiosks in the Knox Road Town Forest and a parking lot on Robinson Road. The grant also allowed for an updated trail map that is centered on each kiosk and available to users. Additionally, new signs were placed throughout the Forest as well as roadside signs that let motorist know they are approaching the new parking area. These additions can be used as a model for other trailheads present in Bow.

Many organizations play a role in managing the trails in Bow, including Bow Open Spaces, Bow Pioneers, and the Town of Bow. Input received at the Visioning Session indicates residents' desires for more information on the trails in Town, as many attendees

expressed confusion on the location of trails and public access. Interest was also expressed in a map that locates all lands held by the Town and other nonprofits, including information on trailheads and signage.

Heritage Trail

Planning for a regional Heritage Trail linking Massachusetts, New Hampshire, and Canada began in 1989. The Heritage Trail is to follow the Merrimack River from the Massachusetts border north to the Pemigewasset River and on through Franconia Notch and up the Connecticut River to the Canadian border.

In Bow, the Heritage Trail is proposed to follow along the bike path off of I-93 and I-89, travel down Valley Road, and turn onto Grandview Road. It then skips over to Garvins Falls Road, down Old Ferry Road to River Road, and continues to the Class VI portion of River Road to the Hooksett Town line. At this point, no substantial progress has been made to create this portion of the Heritage Trail in Bow. To make the NH Heritage Trail a success, each municipality along the trail would be responsible for the section of trail that runs through their community and for the linkage with its neighbors to the north and south." Though little of the Heritage Trail has been completed to date, the planning done so far provides a good starting point for local trail initiatives.

Motorized Activities

Snowmobiling

All of the legal motorized vehicle trails within Town are for winter snowmobiling use only, except where posted otherwise by private property owners. An extensive snowmobile network spans the northern to southern end of Town. These snowmobile trails are organized and maintained by the Bow Pioneers. The Bow Pioneers are a group of individuals who continue to work on recruiting new volunteers to help with the maintenance and signage of trails. In order to protect the interests and agreements of both the Bow Pioneers and the private landowners that have allowed snowmobile access, individuals must not use these trails during the summer without explicit landowner permission. In addition, private property owners are encouraged to post their property for the uses that they allow. Participants at the Visioning Session emphasized that easy access to snowmobile trails is one factor that makes Bow a desirable place to live.

Since the late 1980's, the Planning Board has been encouraging the donation of recreational easements to the Town or to the Bow Pioneers, when developers submit major subdivision plans (subdivisions larger than 3 lots). The developer is encouraged to respect the integrity of existing trails and easements. If the subdivision infringes upon the use of a trail, then it must be relocated or money must be given to the Town in its place. These easements are granted both to protect open space and to preserve trail linkages.

Class A and B Trails

A Class VI road is one of the best types of rights-of-way to consider for an officially designated recreational trail system: there are no inherent liability concerns, the pathway has been established, and public access is allowed. Typically, Class VI Roads are public rights-of-way that are used for recreational purposes, for through travel, for driveway access, and for other uses, such as agricultural and forestry uses. The owners of the properties abutting the Class VI road are not liable for damages or injuries sustained to users of the

road, although they may choose to maintain the road for access to their property.

In 1993, the State authorized NH RSA 231-A, which allows municipalities to designate Class V and VI roadways as either “Class A” or “Class B” trails. With either designation, the roadways are established as municipal trails. This designation will create ownership and responsibility for the trail by the Town. Class A Trails allow abutting landowners continued use of the right-of-way for vehicular use to existing structures, timber, or agricultural operations, but any new building or development is prohibited. Class B Trails are more restrictive and give landowners no special rights pertaining to the trail. Essentially, landowners lose all rights and privileges associated with the trail right-of-way, except as those permitted by the trail designation. Because of this, the law prohibits the conversion of any right-of-way to Class B trail status, where the right of way is the sole access point to a parcel, without written consent of all abutting landowners.

Class A and B trails can be established at the annual Town Meeting by including a warrant article on the specific proposal. In most Towns, the proposal needs a simple majority in order to pass. In addition, Class A and B trail status can be rescinded through a vote at the Town Meeting.

Trails that are located within Town forests and conservation lands should be maintained and expanded. Whether these trails are used for walking, bicycling, horseback riding, cross-country skiing, snow shoeing, or some other form of recreation, they help to form an important link between the natural environment and the built environment by allowing people to access and enjoy nature in a low-impact manner. There are also probably many "unofficial" trails throughout the Town that are used by the public. Designating these trails as official trails will aid in providing maintenance by establishing who is responsible for the management of the trails.

The **Trails Map** shows the existing trails throughout Town. The Town should take a proactive approach to officially creating a system that links all the Town's conservation and open space lands.

LAND AND WATER CONSERVATION STRATEGIES

The following strategies could be employed to help meet the conservation recommendations that are listed throughout this Chapter.

FUNDING SOURCES

Sometimes the best and simplest way to protect a key parcel of land is through outright acquisition and management. Acquisition may be through donations or purchases and ensures that the property stays in the use that the donor prefers.

BONDS

The Town may approve funds for open space/conservation acquisitions through municipal bonds.

CONSERVATION FUNDS

Many Towns have created dedicated conservation funds or open space acquisition funds specifically for the purpose of paying for land acquisition. These funds may come from budget appropriations, land use change taxes, or proceeds from managing or selling Town property.

- *Appropriation from Town Budget* - The Town can set aside money for a conservation fund in their annual Town budgeting process. The Town could consider funding a capital reserve account, through the Capital Improvement Program (CIP), to fund the acquisition of easements and conservation lands. These funds could also be used for match requirements when opportunities arise in which other agencies are funding most of the cost.

- *Land Use Change Tax* - When a property that has been paying the lower Current Use Tax rate is removed from that program, the land use change tax penalty is paid to the Town. The penalty is 10% of the full market value of the land when it leaves the current use program. Many Towns, including Bow, place all of this money directly into the conservation fund.

- *"Municipal Bill Round-Up"* - An additional funding source for a variety of activities, such as greenway acquisition, easement acquisition, and creating bike trails and sidewalks, is the use of a "round up" program for tax bills, utility bills, and registration fees. Under such a program, the taxpayer could voluntarily round his/her bill payment up to a designated amount above the actual bill and designate it to any of the desired programs listed.

- *Proceeds from Managing or Selling Surplus Town Property* - Towns that have property or resources that they manage often can provide income to the Town, as well as the conservation fund. This is frequently through timber harvest operations on mature forest land owned by the Town. The proceeds from the sale of surplus Town property can also be dedicated to the conservation fund. Currently, the Bow Conservation Commission conducts timber sales in Town Forests as per the Forest Management Plan.

Cooperative Ventures with Private Organizations

When the interests of the Town to conserve open space match with the interests of a private organization, the potential for a cooperative partnership to protect land exists. This tactic will require some creative thinking and introductory discussions by Town officials with area organizations who have, or could develop, an interest in conserving open space.

Grants from Foundations

Bow would need to research available grants and develop proposals to seek funding to conserve a particular piece of property or type of resource within the Town. Funding could be sought from foundations at the local, state, regional, and national level.

Land and Community Heritage Investment Program (LCHIP)

This state fund is designed to assist communities that want to conserve outstanding natural, historic, and cultural resources. There will be the requirement that the Towns match the state money from this fund with a 50% match from other sources, some of which can be an "in kind" match, as well as funds from other sources.

Land and Water Conservation Fund

The Land and Water Conservation Fund is a federally funded program administered through the Department of Resources and Economic Department. Eligible projects must be outdoor related and can include land acquisition for conservation, open space, or

the development of an active recreation area, and the expansion or rehabilitation of existing areas.

Land Trusts

The Town could support nonprofit land trusts such as Bow Open Spaces and Five Rivers Trust that accept and pursue property and easements for land of special significance.

Tax Deeds

When a Town acquires property because the owner has not paid all of the taxes on the property, the Town can keep and manage the land and include it as part of the Town's conservation plan.

Town Surplus Funds

The Town can apply funds, if they are available, that are left over from prior years budgets to fund conservation projects.

Regulatory /non-regulatory Techniques

There are many types of suggestions for how to put a master plan to work and to transform ideas into action. Specific steps can include those techniques that require changes to ordinances and regulations or more voluntary approaches that focus on education, training and actions by landowners.

Conservation Easement

Conservation easements are restrictions that landowners voluntarily place upon their property that legally bind the present and future owners of that property, restricting their ability to use some of those rights in order to protect the natural features of the land. Each conservation easement is custom tailored to the interests of the landowner, the receiving entity and the unique characteristics of the property. The land can be sold or deeded by the original owner and subsequent owners, but the restrictions of the easement are binding on all future owners. Typically conservation easements prevent development of land uses such as construction, subdivision and mining, but allow uses such as agriculture, forestry, wildlife habitat, scenic views, watershed protection and education. Conservation easements may or may not allow public access.

The conservation easement exists between a willing landowner and a qualified recipient, which can be the Town, state government or various conservation organizations. Many public agencies and private organizations make these permanent agreements with landowners and oversee their compliance. Bow Open Spaces (BOS), is a nonprofit local land protection organization created and run by a dedicated group of volunteers. BOS holds easements on many Town owned lands. The public use of land with easements that are held by Bow Open Spaces are forestry and outdoor recreation. Five Rivers Conservation Trust is another organization that acquires and manages conservation easements.

Current Use Tax Program

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. Open space conservation is beneficial to the region as it preserves the land as well as maintains natural features and habitat. 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

Figure 5.4: Current Use in Bow, 2005 and 2015

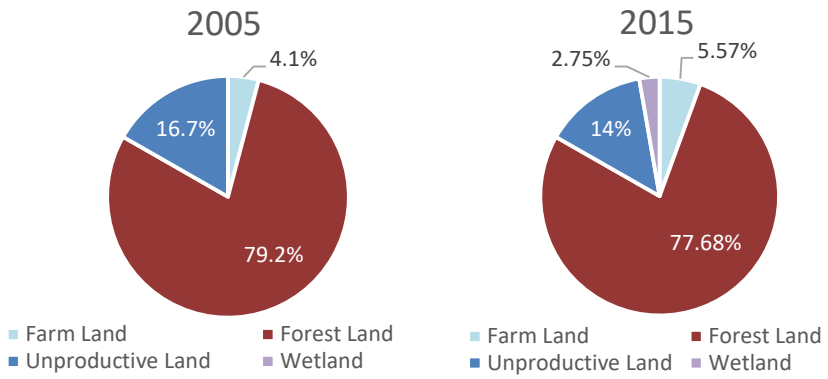
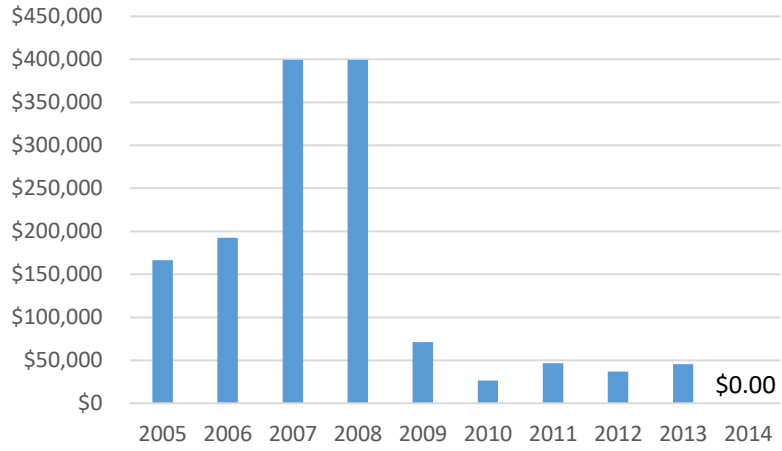


Figure 5.5: Land Use Change Tax Collected



Source: New Hampshire Department of Revenue, Current Use Reports

Table 5.14: Current Use Acreage in Bow, 2006-2015

Year	Farm Land	Forest Land	Unproductive Land	Wetland	**Total**
2006	211.44	3,975.13	847.66	0.00	**5,034.23**
2007	228.56	3,807.20	795.58	0.00	**4,831.34**
2008	209.71	3,889.20	729.41	0.00	**4,828.32**
2009	204.97	3,732.39	691.14	40.24	**4,668.74**
2010	207.37	3,726.32	670.81	57.74	**4,662.24**
2011	267.69	3,666.07	648.32	128.06	**4,710.14**
2012	265.69	3,667.04	648.32	129.32	**4,710.37**
2013	265.35	3,663.27	660.32	129.32	**4,718.26**
2014	261.44	3,649.49	657.62	129.32	**4,697.87**
2015	261.44	3,664.3	713.51	129.32	**4,768.57**

Source: New Hampshire Department of Revenue, Current Use Reports

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 the Current Use Taxation program. For more information on Current Use, visit NH Department of Revenue Administration. See Table 5.14 for Current Use acreage for the Town of Bow for years 2005-2015. 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 Bow, 100% of the proceeds from the Land Use Change Tax are dedicated to open space through the Conservation Commission.

Currently, all of this funding is being used to pay down the bond used to purchase the Hammond Nature Preserve that was purchased in 2007. The bond is scheduled to be fully repaid in the Town's 2022/2023 fiscal year. Figure 5.5 shows the Land Use Change Tax collected from 2005-2014.

Landowner Education

Publications such as brochures/fact sheets could be part of an education program that would provide information on the advantages to the landowner and to the community of conserving land and the opportunities available for property owners to conserve the property via conservation easements or sale. Many other topics could be developed, particularly targeting some of the threats to resources identified in this Chapter.

Mitigation

For the purposes of administering sensitive areas, mitigation includes rectifying the impact by repairing, rehabilitating, or restoring the affected environment; reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and compensating for the impact by replacing or providing substitute resources or environments.

Conservation Subdivision Design

Rather than consume all developable land with houses centered on uniformly sized lots, this development strategy focuses the construction in a smaller portion of the total land being developed, and provides for permanent protection of the open space not used for construction. The land selected for permanent open space protection should be designed to fulfill the open space interests of the entire community. Bow currently allows Planned Open Space Residential Development.

Environmental Characteristic Regulations

Science-based land use regulations are based directly upon measurable characteristics of the land-base of the community. Regulations based on the characteristics of the land may reflect the actual ability of the land base to handle development and are often easier to defend against legal challenges than those arbitrarily created. Examples of this technique include the wetlands conservation district and ridgeline protection zoning.

Multi-Density Zoning

Techniques such as transfer of development rights (TDR) and density transfer credits (DTC) are not new concepts in zoning and can be used to redirect further development away from areas where development may be physically feasible, but not desirable for reasons often related to ecological value. Density Transfer Credit is a more streamlined version of multi-density zoning and is a voluntary mechanism that allow developers to purchase density for additional house lots in one part of a zone (a receiving zone) and a

Town can then use revenue from the added density to purchase land or conservation easements in another part of the Town (sending zone), typically an area with significant ecological value. DTC could be a consideration in Bow once there is consensus and supporting documentation that certain areas have high natural resource value and should be protected through some mechanism.

SUMMARY

The primary focus of this Chapter is to identify the natural resources in Town, recognize the role they play in giving the Town of Bow its character, and decide what strategies would best maintain that character. Bow's natural resources include soil, geologic formations, water, forests, open space, and wildlife; developed resources include recreational facilities, trails and other passive recreational areas. Most of the Town's resources are interconnected and any change to one can and will have a significant impact on the others. As the population increases, demands on many of these resources continue, some to the point of threatening the quality and quantity of the resource. It is the goal of this Chapter to help develop a balance between development and resource protection within the Town.

There needs to be the recognition that many natural resources do not end at the Town's boundaries and that a regional approach in dealing with their protection may be the preferable alternative. Some of our natural resources are considered renewable, such as forest land, while others, like soil, are not. Appropriate measures need to be taken to prevent contamination, erosion, depletion, and large scale overuse and misuse of those resources that are non-renewable, and even those that are considered renewable.

The Town's existing open space consists mainly of forests and wetlands. Most of the dedicated conservation lands are carefully managed, though there are no management requirements for privately owned land other than what are found in the current use regulations. Any development pressure that is currently being felt by the Town is focused on privately owned open space. Because such lands can be targeted for development, it is important that the Town prioritize critical habitats, greenways, and corridors that should be protected through purchase, easements, or other means. These actions will help to reduce land fragmentation, protect water quality, and help maintain the rural, cultural, and historic character of the Town that makes Bow the place it is today and the vision of what it wants to be tomorrow.

CHAPTER OBJECTIVES AND RECOMMENDATIONS

There are several recommendations for natural resources and they are organized by the Chapter's topic areas to help in identifying what specific areas are targeted for implementation recommendations. The following broad objectives apply to the recommendations that were developed for each topic area.

OBJECTIVE 1

To promote healthy flora and fauna and enhance the quality of life for residents by planning for and supporting the preservation and conservation of Bow's abundant natural resources.

OBJECTIVE 2

To raise awareness through an informed citizen base that understands the strengths and vulnerabilities of Bow's natural resources.

OBJECTIVE 3

To effectively facilitate conservation acquisition priorities and stewardship of existing conservation areas.

OBJECTIVE 4

To continue to maintain and enhance the rural character of Bow through a balance of developed and undeveloped areas.

RECOMMENDATIONS BY TOPIC AREA:

Sand and Gravel Deposits

- → Acquire easements at current excavation sites after reclamation takes place, which can serve as recreational areas and/or provide river access for residents.
- → Evaluate any reuse of the sand and gravel pits located within the Town for the appropriateness of the proposed activity, and best management practices should be used to prevent contamination of subsurface water bodies, as well as adjacent streams, ponds, rivers, and/or wetlands.

Water Resources

- → Pursue a regional initiative for source water protection that includes partnerships with adjacent communities, the NH Department of Environmental Services, and nonprofit conservation organizations. Ensure that development within the source water protection areas is conducted in such a way that protects the water resource.
- → Complete evaluation of all potential prime wetlands.
- → Continue to provide for comprehensive protection of shorelands through regulatory, educational, and voluntary efforts.
- → Conduct an annual review of ordinances and regulations to adequately address the issues of stormwater management, erosion, and sediment control to improve the quality of the Town's waterbodies to incorporate best management practices.
- → Periodically review existing regulations of the Aquifer Protection District to ensure that requirements rely on best management practices and the newest technology.
- → Create an option for developers to mitigate wetland impacts through a financial contribution to the Town for conservation land purchases.
- → Encourage landowners to consider water resources while managing their properties.
- → Identify opportunities or mechanisms to improve outreach to residents on water resources and the importance of understanding the tools, resources and strategies available for protection of these resources.

Potential Sources of Contamination

- → Review the existing allowed uses in the Commercial District, Industrial Districts, and the Business Development District to ensure that uses with contamination potential are limited to those specific Districts and that they are compatible with the surrounding natural resources.

Wildlife Habitat and Species

→ Encourage property owners to consider wildlife while managing their properties. Educate landowners on the location of wildlife corridors and conservation and land maintenance techniques that they can employ to help preserve and protect these areas.

→ Acquire conservation easements or purchase the land where species of concern exists. Special priority should be given to those corridors that connect currently protected parcels of land in the Town or abutting Towns.

→ Implement a public education campaign or combine with other efforts to educate the public about invasive species as well as the presence of endangered, threatened, and/or species of special concern located within the Town of Bow, and the benefits for preserving such species.

Forests

→ Update the Town Forest Management Plan at least every ten years in order to assess the Plan's effectiveness and adjust the management to the changing demands on the forest resource. The public should be involved in the process to ensure that all concerns regarding the management of the Town Forests are addressed.

→ Continue notification by Conservation Commission of abutters prior to the start of a timber harvest in Town Forests. The Selectmen's office should also be kept abreast of all planned activities in order to provide information to the public in a timely manner.

→ Provide forest management information to private woodland owners to encourage sustainable forestry practices and long-term planning and consideration of all aspects of the forest ecosystem, including wildlife and watershed concerns.

→ Dedicate the timber tax collected by the Town for forest management, conservation, natural resources education, and land acquisition activities.

Steep Slopes and Scenic Views

→ Conduct a comprehensive inventory and assessment of scenic areas in Bow.

→ Review the current slope development standards to ensure the protection of the environment and safety in both the short and long term, as well as the aesthetics from both near and far observation points within the Town.

Conservation Land and Open Space

→ Conduct a Natural Resource Inventory to provide the basis for management of current land and future land acquisition and protection. Engage the public throughout the project.

→ Develop a system to identify and rank potential parcels for protection of ecological and cultural resources.

→ Evaluate the funding required for land stewardship for each easement under consideration by the Conservation Commission; funding should be set aside each year for this purpose.

→ Identify existing and potential greenways within Bow as well as those that are in abutting Towns for future protection strategies.

→ Investigate the use of Class VI roads and discontinued rail beds as greenway/trail/wildlife corridors that could be used to link existing open space and recreational lands.

Trails

→ Establish a coordinated approach to trail management and development that is sensitive to natural areas.

→ Undertake an on-foot survey of all Class VI roads within Town to gauge their ability to sustain certain types of trail usage.

→ Seek volunteers to establish a trail committee tasked with developing a trails plan, as well as facilitating, maintaining, building, and signing trails and trailheads on public and private property in the Town of Bow.

→ Work with private landowners to obtain written permission or easements for publicly accessible trails on private property, and with the State of NH on state owned land. Foster positive relationships with landowners.

→ Establish trail connections between existing trail networks. Knox/School forest, Nottingcook forest, and other locations that have a significant but isolated network of trails that would benefit from new connections and better access from neighborhoods and schools.

→ Work to formalize existing trails and footpaths in order to make them more available to the public.

→ Develop trail maps for public distribution online, in print, and at trailhead kiosks.

→ Work with adjacent communities to create trail systems that span Town lines, including connections into Concord's recreational trail network.

→ Monitor for opportunities for Bow to connect into the Concord to Manchester portion of the Granite State Rail Trail. Bow should also monitor the feasibility of ambitious long-term options such as a pedestrian bridge over the Merrimack near Hall Street as described in the Regional Trails Plan 2012 for the Salem to Concord Corridor.

Air Resources

→ Increase public education on air quality issues and specific actions to help improve and maintain air quality in Bow.

→ Research alternative forms of energy for municipally-owned buildings, as well as energy efficient design and products.

→ Encourage energy efficient design of new buildings in the Site Plan Regulations for the Business Development District.

→ Capitalize on opportunities to make Bow more pedestrian and bicycle-friendly to reduce motor vehicle use and encourage physical activity.