

Natural Resources

Winthrop is fortunate to be surrounded by exceptional natural beauty and a high-quality environment. This makes it easy to take the town's natural resources for granted. Yet Winthrop's natural resources are responsible for productive forest and farmland, clean water for recreation and drinking, and wildlife habitat. Arguably, the most important and noticeable natural resource in Winthrop is the abundance of lakes found throughout town. These lakes serve as the economic engine that drives the local economy, as tourism is Winthrop's top industry. The waterfront properties around the lakes contribute significantly to the town's tax base because they are appraised at a higher value than non-waterfront properties. The subsequent tax base is necessary to support public services, municipal government, and public schools. All of that contributes to the overall quality and natural beauty of the town.

One of the functions of this plan is to ensure that growth and development can occur concurrent with preservation of the natural environment. It is possible, but it requires foresight. Some forms of development have greater potential for negative environmental impacts, resulting in some locations that are more suitable for development than others. It is in the town's best interest to ensure that future development is appropriate and in locations to allow maintenance of the natural assets so valued by the town's residents and by visitors.

This chapter identifies and documents Winthrop's natural and water resources and identifies the physical limitations the natural environment imposes on the planning process for future development.

Geology and Soils

Winthrop's soils – and the rock that supports them – influence the topography and the type of vegetation, and constrain endeavors of development, farming, and forestry.

The advance and retreat of glaciers molded Winthrop's landscape. As glaciers advanced, the ice mass scoured the ground. Retreating, they left a mixture of sand, silt, clay, and stones. Today, much of Winthrop is covered by this glacial till, consisting of a heterogeneous mixture of sand, silt, clay, and stones. Till usually overlies bedrock but may underlie or include sand and gravel. Additionally, glacially formed hills may consist of till deposits over 100 feet thick.

One variety of till in Winthrop is fine-grained and compact with low permeability and poor drainage. The other is loose, sandy, and stony, with moderate permeability and fair to good drainage. The till blanket is interrupted by bedrock outcrops. Some of Winthrop is underlain by a glacial delta, which was formed as glacial meltwater washed into the ocean. Winthrop was once a coastal town.

Winthrop soils are typical of western Kennebec County. With a few exceptions, Winthrop soils fall into the Hollis-Paxton-Charlton-Woodbridge association. These are sandy loams, typically found in hill and ridge areas at elevations of 200 to 700 feet above sea level. While Hollis soils are shallow and do not retain water well, Paxton-Charlton-Woodbridge soils are deep and moderately well drained. Soils such as these are valued for forest land, hay, pasture, orchards, cultivated crops, and homebuilding. The “delta area” – Winthrop village to the south and west – is a different soil association. Buxton-Scio-Scantic association are deep soils, with drainage capabilities and development potential depending a lot on the slope of the land.

Soil characteristics are particularly important to farming, roadbuilding, construction, and septic system installation.

Most soils in Winthrop are Woodbridge and Paxton stony fine sandy loams with 3 percent to 15 percent slopes. These soils are rated as having moderately high potential for low-intensity development where slopes do not exceed 8 percent. Scantic and Scio soils are common around Annabessacook Lake and are typically associated with wetland areas. Although these soils can be used for agriculture, the high-water table creates severe limitations for residential and commercial development.

From this list of soils, it is immediately apparent that flat, well-drained land is good for both farming and development, and there is an inherent conflict between competing land uses that farming, because of low economic returns, usually loses.

The State Plumbing code also has its list of soils that are unsuitable for subsurface waste disposal. The plumbing code concentrates on those soils in which septic systems will not function, because water is too near the surface, or the slope is too steep. Soils with water too near the surface are:

Biddeford silt loam
Leicester stony loam

Monarda silt loam
Peat and muck

Walpole fine sandy loam
Limerick silt loam

Winthrop’s **Soils Map** (Appendix) shows soils by type and location. Maps of these soils involve a degree of generalization. A mapped area of poor soil does not by itself exclude development; however, it does make potential developers aware of challenges.

Regardless of soil type, when cleared of vegetation, all soils are subject to accelerated erosion. Eroding soil contributes to the degradation of water quality. Silt can reduce visibility, harm fish populations, and contribute phosphorus and other destabilizing nutrients into waterbodies. Phosphorus is a naturally occurring nutrient that, when present in high concentrations, can cause algal blooms. Eroding soil and unmanaged stormwater runoff have been documented as the primary source of increased phosphorus levels in Maine’s lakes, resulting in reduced property values and recreational opportunities.

Winthrop's Zoning Ordinance contains performance standards to protect against excessive erosion during and after construction. Article IV- Performance Standards, General Requirements, E, sets performance standards that include erosion control. Under sections J. Stormwater Runoff, and K. Water Quality Protection of the General requirements section are other standards to reduce stormwater runoff and water quality degradation.

Topography

Winthrop has often-challenging topography, as depicted on the [Topographic Map](#) (Appendix). The land west of Maranacook Lake is elevated and steep. Several hills exceed 500 feet in elevation, topped by Mount Pisgah at 809 feet. The eastern part of town is just as hilly, but with a lesser elevation. South of U.S. Route 202, some of the land is flatter and more level.

The lakes represent the low points of topography. Apple Valley Lake, in the shadow of Mt. Pisgah, is the loftiest, at 318 feet. The Cobbossee chain begins with Maranacook, at 211', and drops to Cobbossee Lake, at approximately 166 feet above sea level.

The topography of an individual site accounts for much of the cost, difficulty, and potential adverse impact of land development. Development on slopes greater than 15 percent accelerates stormwater runoff velocity, erosion, and sedimentation, particularly in sensitive watersheds. The state Plumbing Code limits the installation of septic systems to land with an original slope of 20 percent or less. Road construction on steep slopes becomes expensive and road maintenance costs increase significantly. Therefore, large contiguous areas with slopes of more than 20 percent are impractical for new construction.

Areas of slope exceeding 20 percent show up on topographic maps, but those are only as accurate as the scale of the map. Development of steep slopes may best be regulated on a site-specific basis. Winthrop's Zoning Ordinance classifies areas of two or more contiguous acres, with sustained slopes of 20 percent or greater, as a Resource Protection District. Resource Protection Districts fall under the state's mandatory Shoreland Zoning guidelines, which include standards governing allowable land uses for these areas.

The topography of the land is responsible for the array of lakes and drainage basins or watersheds. A watershed is the area of land within which all precipitation drains to a single water body. The delineation of watersheds ([Water Resources Map](#)) shows how water runs off the land, where it accumulates, and how it collects into larger bodies of surface water. Winthrop has all or part of 12 separate watersheds.

Since planning for lake water quality is closely integrated with watershed planning, information on watersheds can be found in the analysis of each waterbody.

Scenic Resources:

Topography is also often the primary component of scenic vistas. While it is said that the quality of a scenic vista is “in the eye of the beholder,” it is often the case that varied topography and overlooking perspectives rank consistently high. In Winthrop, several vistas are notable:

- The view across the bog to Little Cobbossee Lake in East Winthrop,
- The view down Annabessacook Lake from Route 202 south of the village,
- The view of Maranacook Lake from Norcross Point, and
- The panoramic view from Mt. Pisgah.

All these locally important views originate from public property, and none are threatened by development. Mt. Pisgah, of course, is wooded and must be maintained to preserve the view.

Floodplains:

Floodplains do not play a significant role in planning for Winthrop, but are a function of local topography, so are included here.

A floodplain is an area adjacent to a water body that is subject to periodic flooding. Winthrop’s 100-year floodplains are depicted on the *Critical Natural Resources Map* in the Appendix. A 100-year flood is one in which there is a 1-percent chance of flooding in any given year. The 100-year designation is significant because federal law requires local regulation of 100-year floodplains. Winthrop has an approved local Floodplain Management Ordinance, which is enforced, consistent with state and federal standards, and requires periodic reviews and updates.

Winthrop can thank its naturally hilly topography for minimizing the number of floodplains adjacent to its larger waterbodies. Most of the floodplain areas are already boglands. There are two small areas of concern: the land adjacent to Hoyt Brook, just west of downtown, and along Mill Stream inside the village. Fortunately, the village area is built out, without infringing on the floodplain, so there have not been many cases in which regulation has been imposed.

Groundwater:

Local groundwater is the source of drinking water for all residents not serviced by the public water system, as well as several summer camps and other businesses. Groundwater is also a potential future source for public supplies. A “significant aquifer” provides a water supply in large enough volumes for commercial use, but all groundwater in the town should be protected from potential contamination by oil, chemicals, or other sources.

In Winthrop, one significant sand and gravel aquifer is defined. It has an estimated yield of 10 to 50 gallons per minute and is located west of Annabessacook Lake. There are no

existing public water supply wells in this aquifer. A public water supply is one that serves 15 or more individual hookups or 25 or more people from a single source.

Outside of the aquifer, 15 wells serve as public water supplies at nine locations. The following is a summary of public water supplies from groundwater in Winthrop, as reported by the Maine Department of Human Services, Bureau of Health Drinking Water Program, which regulates public water supplies. There are an additional three drinking water supplies from surface waters.

- ASSOCIATION OF CAMPOWNERS (east shore of Annabessacook Lake), 110' drilled well.
- CAMP MECHUWANA, three wells, serving a seasonal campground: 434' drilled well (high risk for coliform but none reported), 125' drilled well, 135' drilled well.
- AUGUSTA WEST CAMPGROUND, 120' drilled well.
- COBBOSSEE MOTEL, drilled well (high risk for coliform, none reported)
- DOROTHY EGG FARMS, 350' drilled well (high existing risk of contamination).
- 184 SOUTH ROAD (site of the former Flickers Restaurant), 325' drilled well (moderate existing risk of contamination).
- LAKES REGION MOBILE VILLAGE, five wells, all unknown depth (all high future risk of contamination).
- STATE YMCA CAMP, unknown depth drilled well.

The Drinking Water Program promotes the establishment of Wellhead Protection Planning for public water supplies. Plans are prepared by the well owners but should be implemented with the cooperation of the town. A minimum 300-foot radius of restricted land use around a wellhead (more for larger systems) is recommended, although most existing water supplies do not have this level of control or protected area. The DWP provides source water assessments for public water supplies in Maine towns, as well as maps showing potential threats to public water sources ([Public Water Sources Map](#) in the Appendix).

Winthrop's proactive approach on protecting groundwater and surface water supplies includes provisions in both the Zoning Ordinance and the Subdivision Ordinance. The Zoning Ordinance's, Article IV- Performance Standards, 12 General Provisions, H. Sanitary Provisions, and K. Water Quality Protection contain a routine prohibition on discharging waste into waterbodies. Winthrop's Subdivision Ordinance, Section VIII, B.6, requires a study of the concentration of nitrates in the groundwater in certain cases.

In addition to manmade conditions, there is potential for numerous natural elements to contaminate private well water, causing health concerns. Two known environmental contaminants present in Winthrop are Arsenic (As) and Radon (Rn). Both are known carcinogens that can be found in almost any drinking water supply throughout Maine, with certain towns having a higher documented concentration than others. Both Arsenic and Radon are naturally occurring in the environment, although Arsenic can also be the result of human activities such as industrial and agricultural practices. The state and town can offer guidance for residents on dealing with these environmental contaminants.

Emerging well water contaminants that are not naturally occurring are Per- and Polyfluoroalkyl Substances (PFAS). Historically, these manmade chemicals were used in many different applications and products. Because of how slowly they breakdown and their persistence in the environment, they have earned the name “forever chemicals.” PFAS have been documented in agricultural sites, drinking water supplies, landfills, wastewater, sludge and septage spreading sites, and remediation and cleanup sites. As these contaminants are a newer concern than Radon and Arsenic, the U.S. Environmental Protection Agency has yet to determine a Maximum Contamination Level (MCL). Standards, guidelines, and remediation measures are still becoming available to Maine residents.

Surface Waters:

An interconnected system of surface waters begins as tiny brooks on hillsides and flows through a system of streams, ponds, and wetlands, eventually reaching the sea. Wetlands and lakes are critical points along the network of surface waters. Wetlands serve important natural functions such as wildlife habitat and stormwater regulation and are susceptible to development. Lakes contribute to natural beauty, are an attraction for residents and economic development, and are a center for recreation. They are vulnerable to pollution and overuse, which in turn lowers property values. Currently, 30.8% of Winthrop’s property value is on the waterfront. However, that figure is likely artificially low. Winthrop’s last property revaluation occurred in 2007. Market prices on the waterfront have skyrocketed since 2020. As of October 2023, the Town is planning a revaluation, which is likely to cause that percentage to rise.

Many land-use practices can impact surface water quality. Improperly functioning or unsuitably located systems for sanitary waste may cause bacteria to contaminate surface waters. Poor agricultural practices can result in nutrient enrichment of ponds and lakes (e.g., phosphorus). Construction creates erosion and siltation, potentially reaching waterbodies. Any improperly managed land use or land-based activity can accelerate degradation of water quality. The first step in managing the community’s surface waters is to understand the systems, their existing quality, and factors that influence their quality.

Rivers and Streams:

There are several perennial streams in Winthrop; however, because the chain of lakes is so pronounced, they are often not the focal point. In addition to enhancing the scenic landscape, flowing water provides a unique habitat for numerous wildlife species and plays an essential role in the drainage of land areas during storms or snow melt. Streams also serve as the flushing and refill conduits for the larger, open waterbodies to which they are connected.

The state has four classifications for freshwater rivers, streams, and brooks: AA, A, B, and C. All streams and brooks in Winthrop are Class B. The classification system should be viewed as a hierarchy of risk more than for use or quality assessment. As an example,

a Class B stream is considered more at risk than a Class A stream. The risk is the possibility of a breakdown of the ecosystem and loss of use due to either natural or human-caused events. Ecosystems that are more natural in their structure and function can be expected to be more resilient to new stressors and to show more rapid recovery.

Class B waterbodies are suitable for drinking water supply, recreation in and on the water, fishing, industrial processes and cooling water supply, hydroelectric power generation, navigation and an unimpaired habitat for fish and other aquatic life.

The **Water Resources Map** (Appendix) shows Winthrop's streams, lakes, ponds, and wetlands. Most streams are bounded by the Stream Protection District, as set forth in the Zoning Ordinance. The Stream Protection District establishes a 75-foot building setback from the stream high-water mark.

Lakes and Ponds:

Winthrop's lakes and ponds are the defining feature of the town's landscape. Large, open bodies of water provide scenic views, a variety of recreational opportunities, important fish and wildlife habitats, sources of drinking water, and prime real estate development opportunities.

The quality of water in any lake or pond depends on many factors, including the surface area and depth of the lake; the flushing rate of the lake; the size of the watershed surrounding the lake; the extent of development along the shore; the extent of agricultural activity in the watershed; and the degree to which obvious sources of pollution, such as septic effluent, sewage, agricultural fertilizers, and manure are kept from entering the water body.

The state designates waterbodies encompassing 10 acres or more as Great Ponds. Great Ponds and their shorelands are subject to special regulations through Shoreland Zoning and Maine's Natural Resources Protection Act. The state has one standard of classification for both Great Ponds and natural lakes and ponds less than 10 acres in size; this classification is GPA. The water quality attainment goal for Class GPA waterbodies is that they are suitable for drinking water, recreation, fishing, hydro-electric power generation and as natural habitat for fish and other aquatic life. If a water body is not meeting its attainment goal, it is described as a "nonattainment" lake.

None of Winthrop's waterbodies currently meet the GPA classification for a variety of reasons. As with the water classification system for rivers, the classification should be viewed as hierarchy for risk, rather than for use or quality assessment, with the risk being the possibility of a breakdown of the ecosystem and loss of use due to either natural or human-caused events.

The following section describes the natural features and characteristics of the 11 great ponds and lakes in Winthrop. Included in these descriptions are an assessment of water

quality based on eight indicators. Those indicators are listed along with the State's averages below.

Water Quality Assessment and State Averages	
Transparency	Transparency is set at a certain water depth. Factors that reduce water clarity are algal blooms, zooplankton, the color of the water, and silt, with algae being the most abundant. In Maine, the current overall average for transparency is 5.3 meters.
Chlorophyll	This test measures the green pigment found in plants, including microscopic algae. This measure is used to estimate algal biomass -- the higher the chlorophyll content, the higher the quantity of algae in the lake. In Maine, the average is 5.7 parts per billion (ppb).
Phosphorous	Phosphorus is a major plant nutrient needed for growth; however, high phosphorus levels are often a sign of pollutants entering the waterbody. As levels of phosphorus increase, the quantity of algae increases, resulting in reduced water quality. The average in Maine is 11.2 ppb.
Color	This measure refers to the amount of dissolved organic acids such as tannins and lignin, resulting in tea-colored water. The unit of measure for color is Standard Platinum Units or SPU. Color reduces the lake's transparency and increases phosphorus readings. The average color reading in Maine is 20.1 SPU.
Alkalinity	This is the measure of the capacity of the water to neutralize acids (called buffering). A waterbody's ability to buffer acids is affected by the natural geology of the surrounding area, and the presence of naturally available bicarbonate, carbonate, and hydroxide ions. It is measured in milligrams per liter (mg/L). The average alkalinity is 11.1 mg/L in Maine.
pH	Like alkalinity, pH is the measure of acidity of the water. How acidic or basic the water is will determine which plant and animal life will be present. The measure of acidity is on a scale of 1 to 14, with 7 indicating neutral acidity, 1 being highly acidic, and 14 being highly basic. A one-unit change in pH represents a 10-fold change in the concentration of hydrogen ions (H ⁺), which determines the acidity of the water. The average pH in Maine is 7.23.
Conductivity	Specific conductivity measures the ability of the water to carry an electrical current and is related to the dissolved ions (charged particles) in the water. Conductivity is measured in microSiemens per centimeter. This quality is used to calculate fish yield estimates. Specific conductivity will increase if there is an increase in pollutants entering the water, usually in the form of runoff from urban or residential areas and roadways. Maine's average specific conductivity is usually below 95.3 micro-Siemens per centimeter.
Dissolved Oxygen	Adequate levels of dissolved oxygen (DO) in water bodies are essential to most life in the water. DO is an important indicator of water

	quality and it influences water chemistry. DO levels are strongly affected by water temperature: warmer water is less dense and its ability to hold oxygen is reduced.
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Berry Pond

Direct Drainage Area: approximately 2,080 acres in Winthrop

Area: 175 acres

Maximum Depth: 25 feet

Mean Depth: 14 feet

Invasive species: unknown

Fisheries management: warmwater

Fish species:

Largemouth Bass (<i>Micropterus salmoides</i>)	Brown Bullhead (<i>Ameiurus nebulosus</i>)
Yellow Perch (<i>Perca flavescens</i>)	Golden Shiner (<i>Notemigonus crysoleucas</i>)
Chain Pickerel (<i>Esox niger</i>)	Pumpkinseed (<i>Lepomis gibbosus</i>)
White Sucker (<i>Catostomus commersoni</i>)	Brook trout (<i>Salvelinus fontinalis</i>)
American Eel (<i>Anguilla rostrata</i>)	Minnow species (<i>Cyprinidae</i> family)
Northern Pike (<i>Esox lucius</i>)	Smallmouth bass (<i>Micropterus dolomieu</i>)
White Perch (<i>Morone americana</i>)	

Source: Lakes of Maine

Plant species: (not an exhaustive list) aquatic moss, bladderwort, coontail, muskgrass, pickerel weed, pondweed, water lily, water marigold, waterweed, and wild celery.

Mussels and Crayfish: No information available.

Loon counts have taken place on Berry Pond sporadically since 1983. The loon population has varied over the years, but the current population appears to be holding stable.

Year	# Adults	# Chicks	Year	# Adults	# Chicks
1983	2	1	2001	6	2
1984	2	0	2008	6	0
1985	0	0	2009	2	0
1987	2	0	2010	2	0
1990	2	2	2012	1	0
1991	2	3	2014	2	0
1992	8	0	2021	4	0
1999	1	0			

Source: Lakes of Maine

Water Quality Assessment:

Variable	State Average	Berry Pond
Transparency	5.3 M	4.5 M
Chlorophyll	5.7 ppb	4.2 ppb
Phosphorous	11.2 ppb	12 ppb
Color	20.1 SPU	27 SPU
Alkalinity	11.11 mg/L	19.0 mg/L
pH	7.23	6.94
Conductivity	52.6 μ S/cm	61 μ S/cm

Source: *Lakes of Maine*

Dissolved Oxygen: Adequate levels of dissolved oxygen (DO) in waterbodies are essential to most life in the lake. DO is an important indicator of water quality and it influences water chemistry. DO levels are strongly affected by water temperature: warmer water is less dense and its ability to hold oxygen is reduced. Berry Pond appears to have reduced DO levels during warmer months, as expected, but the levels of DO are stable in cooler months.

All the above information indicates that Berry Pond has average levels of phosphorus, color, chlorophyll, and alkalinity. The transparency and chlorophyll levels that are higher than state average indicated reduced water quality.

Berry Pond and Dexter Pond (covered below) are of comparable size and located next to each other in Wayne and Winthrop. Berry Pond has 2,080 acres of drainage area in Winthrop while Dexter Pond has 390 acres of drainage area in Winthrop.

Both ponds show dissolved oxygen depletion in the bottom waters during summer months, which may facilitate the internal recycling of phosphorus from bottom sediments during these periods.

Dexter Pond

Direct Drainage Area: approximately 390 acres in Winthrop.

Area: 113 acres

Maximum Depth: 25 feet

Mean Depth: 13 feet

Invasive species: unknown

Fisheries management: warmwater

Fish species:

Largemouth Bass (<i>Micropterus salmoides</i>)	Brown Bullhead (<i>Ameiurus nebulosus</i>)
Yellow Perch (<i>Perca flavescens</i>)	Golden Shiner (<i>Notemigonus crysoleucas</i>)
Chain Pickerel (<i>Esox niger</i>)	Pumpkinseed (<i>Lepomis gibbosus</i>)
White Sucker (<i>Catostomus commersoni</i>)	Minnow species (<i>Cyprinidae</i> family)

American Eel (<i>Anguilla rostrata</i>)	Smallmouth bass (<i>Micropterus dolomieu</i>)
White Perch (<i>Morone americana</i>)	

Source: Lakes of Maine

Plant Species: (not an exhaustive list) arrowhead, bladderwort, bur-reed, metaphyton, pickerel weed, pondweed, rush, water lily, watershield, and wild celery.

Mussels & Crayfish: No information available.

Loon counts have taken place on Dexter Pond sporadically since 1983. The loon population has varied over the years, but the current population appears to be holding stable.

Year	# Adults	# Chicks	Year	# Adults	# Chicks
1983	1	0	1996	3	0
1984	1	0	1998	3	0
1987	2	0	1999	3	0
1990	4	0	2020	2	0
1993	4	0	2021	2	0
1994	1	0	2022	1	0
1995	2	0			

Source: Lakes of Maine

Water Quality Assessment:

Variable	State Average	Dexter Pond
Transparency	5.3 M	5.0 M
Chlorophyll	5.7 ppb	4.6 ppb
Phosphorous	11.2 ppb	11 ppb
Color	20.1 SPU	22 SPU
Alkalinity	11.11 mg/L	17.6 mg/L
pH	7.23	7.05
Conductivity	52.6 μ S/cm	67 μ S/cm

Source: Lakes of Maine

Dissolved Oxygen: Dexter Pond has reduced DO levels during warmer months, as expected, but the levels of DO increase in colder months, as stated above.

Based on the comparison of Dexter Pond's water quality to the averages for the State of Maine, Dexter Pond has below average transparency, color, alkalinity, and conductivity. Dexter Pond had above average chlorophyll levels, phosphorus levels, and pH level.

Dexter Pond is listed on the Nonpoint Source Priority Watershed List as Watch List and "Sensitive, Sensitive due to Sediment Chemistry" under the Threatened Lakes Priority

List. It is not, however, listed under Impaired. Lakes are listed on the Watch List if they were recently impaired and still sensitive, or data suggests their water quality is near the impairment threshold.

Dexter Pond is listed as “Sensitive due to sediment chemistry” because it has been determined to be susceptible to internal phosphorus release because the ionic soil composition does not readily bind and hold phosphorus. Rather, phosphorus is released into the waterbody from the soil chemistry.

Dexter Pond is listed as “Sensitive” to additional phosphorus input due to the pond’s hydrology and threats in the watershed.

Carlton Pond

Direct Drainage: 1,383 acres

Area: 223 acres

Maximum Depth: 57 feet

Mean Depth: 24 feet

Invasive species: unknown

Fisheries management: no fishery

Fish species:	
Banded Killifish (<i>Fundulus diaphanous</i>)	Brown Bullhead (<i>Ameiurus nebulosus</i>)
Chain Pickerel (<i>Esox niger</i>)	Rainbow Smelt (<i>Osmerus mordax</i>)
Redbreasted Sunfish (<i>Lepomis auratus</i>)	Smallmouth Bass (<i>Micropterus dolomieu</i>)
White Perch (<i>Morone americana</i>)	

Source: Lakes of Maine

Crayfish Species: Virile crayfish (*Orconectes viriles*)

The Lakes of Maine website did not have any information available on mussel species or plant species found in Carlton Pond.

Loon counts have taken place on Carlton Pond sporadically since 1983. The loon population has varied over the years.

Year	# Adults	# Chicks	Year	# Adults	# Chicks
1986	0	0	1995	0	0
1990	3	0	1996	1	0
1991	1	0	1997	0	0
1992	0	0	1999	0	0
1993	0	0			

Source: Lakes of Maine

Water Quality Assessment:

Variable	State Average	Carlton Pond
Transparency	5.3 M	6.1 M
Chlorophyll	5.7 ppb	4.5 ppb
Phosphorous	11.2 ppb	11 ppb
Color	20.1 SPU	16 SPU
Alkalinity	11.11 mg/L	13.5 mg/L
pH	7.23	6.96
Conductivity	52.6 μ S/cm	48 μ S/cm

Source: *Lakes of Maine*

Dissolved Oxygen: Carlton Pond has reduced DO levels during warmer months, as expected, but the levels of DO increase in colder months.

All the above information indicates that Carlton Pond has slightly above average water quality when compared to state averages.

Carlton Pond, located in Winthrop and Readfield, is the backup water supply for the Greater Augusta Utilities District (GAUD), which serves up to 40,000 people per day. It discharges into Upper Narrows Pond, which is the primary water supply for the town of Winthrop.

The watershed of the pond is well-protected. Between 1905 and 1908, the GAUD purchased approximately 600 acres in Readfield and 50 acres in Winthrop, and since that time has owned the entire perimeter of the pond. Today, the District owns 710 acres surrounding Carlton Pond. There are no current plans to sell or develop any of the district's ownership. Of that total, 125 acres are enrolled as Tree Growth and managed for timber production. Portions of the watershed are also a state game preserve and public access to the pond is highly restricted. The district also owns and operates the dam controlling the pond's water level, which is located at the outlet in Winthrop.

Carlton Pond is on the DEP's Non-Point Source (NPS) Priority Watershed Listing as a Threatened Lake because it is licensed by the Maine CDC Drinking Water Program as a "Public Water System" with a lake or pond as the surface water source. The DEP lists the pond as moderate-sensitive with a high level of protection for phosphorus loading. Its allowable phosphorus allocation is 0.052 pounds per year per acre. Carlton Pond is also on DEP's list of "Lakes Most at Risk from New Development" which requires projects in the watershed to meet additional standards (Chapter 502, *Stormwater Management Rule*).

The undeveloped nature of the watershed, including an undeveloped shoreline, forces consideration of major development impacts in the future. The Greater Augusta Utilities District owns substantial amounts of land in the watershed, which is also valuable as open space. The Zoning Ordinance sets stringent controls on land uses within 1,000 feet of Carlton Pond and Narrows Pond via the Public Water Supply District to protect these important resources.

Additionally, Carlton Pond is a Waterfowl Production Area, as it is one of the few areas in the state that provides nesting habitat for black terns (*Chlidonias niger*), which is a state-listed endangered species. Black tern populations have been monitored by the state since 1990, and MDIF&W manages their habitats by maintaining stable water levels in impoundments, taking efforts to deter predators, and using floating nest platforms.

Little Cobbosseecontee Lake (A.K.A Little Cobbossee Lake)

Direct Drainage: 1,724 acres

Area: 91 acres

Maximum Depth: 33 feet

Mean Depth: 17 feet

Invasive species: unknown

Fisheries management: warmwater

Fish species:	
American Eel (<i>Anguilla rostrata</i>)	Fourspine Stickleback (<i>Apeltes quadracus</i>)
Banded Killifish (<i>Fundulus diaphanous</i>)	Brown Bullhead (<i>Ameiurus nebulosus</i>)
Chain Pickerel (<i>Esox niger</i>)	Rainbow Smelt (<i>Osmerus mordax</i>)
Golden shiner (<i>Notemigonus crysoleucas</i>)	Largemouth Bass (<i>Micropterus salmoides</i>)
Redbreasted Sunfish (<i>Lepomis auratus</i>)	Smallmouth Bass (<i>Micropterus dolomieu</i>)
White Perch (<i>Morone americana</i>)	Pumpkinseed (<i>Lepomis gibbosus</i>)
Northern Pike (<i>Esox lucius</i>)	White Sucker (<i>Catostomus commersoni</i>)
Yellow Perch (<i>Perca flavescens</i>)	

Source: Lakes of Maine

The Lakes of Maine website did not have any information available on mussel species or crayfish species found in Little Cobbosseecontee Lake.

Plant Species: (not an exhaustive list) common waterweed, flat-stem pondweed, floating bur-reed, lesser duckweed, and stiff arrowhead.

Loon counts have taken place on Little Cobbossee sporadically since 1983.

Year	# Adults	# Chicks	Year	# Adults	# Chicks
1983	1	2	2008	3	0
1991	2	1	2009	0	0
1992	2	0	2010	2	1
1993	0	0	2011	3	0
1994	1	0	2012	5	0
1995	1	0	2013	0	0
1996	0	0	2014	0	0
1997	0	0	2015	2	0

2000	0	0	2016	2	0
2001	0	0	2017	2	1
2002	0	0	2018	0	0
2003	0	0	2019	1	1
2004	3	0	2020	0	0
2005	0	0	2021	1	0
2006	0	0	2022	0	0
2007	0	0			

Source: Lakes of Maine

Water Quality Assessment:

Variable	State Average	Little Cobboosee Lake
Transparency	5.3 M	3.4 M
Chlorophyll	5.7 ppb	11.8 ppb
Phosphorous	11.2 ppb	36 ppb
Color	20.1 SPU	27 SPU
Alkalinity	11.11 mg/L	19.3 mg/L
pH	7.23	6.98
Conductivity	52.6 µS/cm	72 µS/cm

Source: Lakes of Maine

Dissolved Oxygen: Little Cobbossee Lake appears to have significantly reduced DO levels throughout much of the year except for colder months.

Of Little Cobboosee's 1,724-acre watershed, 41 percent (roughly 700 acres) are in northeast Winthrop. This lake is listed on the State of Maine Department of Environmental Protection 2018/2020/2022 Integrated Water Quality Monitoring and Assessment Report as "attaining some standards; assumed to meet others." The report also notes that water quality is improving, and algal blooms are rare.

Little Cobbossee is listed on the Nonpoint Source Priority Watershed List as "Watch List and Sensitive" under Threatened Lakes. It is not listed under Impaired. Lakes are listed on the "Watch List" if they were recently impaired and still sensitive, or data suggests their water quality is near the impairment threshold. The lake is listed as "Sensitive to additional phosphorus inputs", due to the lake's hydrology and threats in the watershed.

Little Cobbossee is also on the list of Direct Watershed of Lakes Most at Risk from New Development. A lake is considered most at risk from new development if it meets the criteria below. The criteria this determination is based upon is as follows:

1. The lake is a public water supply.
2. The Lake is identified by the Department of Environmental Protection as being in violation of class GPA water quality standards (GPA is the one classification for water quality for lakes and ponds in Maine) or as particularly sensitive to eutrophication based on:

- a. Current water quality.
 - b. Potential for internal recycling of phosphorus.
 - c. Potential as a cold-water fishery.
 - d. Volume and flushing rate,
 - e. Projected growth rate in the watershed.
3. Severely blooming lakes are a subset of lakes most at risk. A severely blooming lake has a history of algal blooms, and the reduction of existing watershed phosphorus sources sufficient to eliminate those algal blooms is expected to be so difficult that the addition of new, incompletely mitigated development sources may prevent successful restoration of the lake.

According to DEP's *Phosphorus Control Action Plan and Total Maximum Daily (Annual Phosphorus) Load Report, Little Cobbossee Lake, Kennebec County, Maine (2005) (Little Cobbossee Lake PCAP-TDML Report)*, at the time, there was a history of excessive amounts of algae in the late summer-early fall, due in large part to the contribution of phosphorus prevalent in the soils that eroded and accumulated in the sediments. The frequency of algal blooms in the early 2000's spurred federal, state, county, and local groups to work together in addressing this nonpoint source water pollution problem. This resulted in the 2005 *Little Cobbossee Lake PCAP-TDML Report*.

TMDL is an acronym for Total Maximum Daily Load, which represents the total amount of a pollutant (e.g., phosphorus) that a waterbody can receive on an annual basis and still meet water-quality standards. According to this report, the TMDL target goal at time of writing was 15 ppb total phosphorus a year. Also, at the time of the report, the amount of total phosphorus loading into Little Cobbossee generated by the watershed was approximately 20 ppb. That has since grown to 36 ppb.

It was noted in the previous Comprehensive Plan that the lake bloomed on a near-annual basis and water quality was listed as poor.

Maranacook Lake (northern and southern basins*)

Direct Drainage: southern: 2,907 acres (49.2 percent in Winthrop), northern: 6,604 acres (18 percent in Winthrop)

Area: 1,844 acres

Maximum Depth: 128 feet

Mean Depth: 30 feet

Invasive species: Chinese Mystery Snail (*Cipangopalundina chinensis malleatus*)

Fisheries management: warm & cold-water

*The Lakes of Maine website does not differentiate data between the northern and southern basins of Maranacook Lake.

Fish Species:	
Brown Trout (<i>Salmo trutta</i>)	Banded Killifish (<i>Fundulus diaphanous</i>)
American Eel (<i>Anguilla rostrata</i>)	Black Crappie (<i>Pomoxis nigromaculatus</i>)
Brook Trout (<i>Salvelinus fontinalis</i>)	Fallfish (<i>Semotilus corporalis</i>)
Brown Bullhead (<i>Ameiurus nebulosus</i>)	Lake Trout (<i>Salvelinus namaycush</i>)

Chain Pickerel (<i>Esox niger</i>)	Golden Shiner (<i>Notemigonus crysoleucas</i>)
Largemouth Bass (<i>Micropterus salmoides</i>)	Pumpkinseed (<i>Lepomis gibbosus</i>)
Landlocked Salmon (<i>Salmo salar</i>)	Rainbow smelt (<i>Osmerus mordax</i>)
Redbreasted Sunfish (<i>Lepomis auratus</i>)	Slimy Sculpin (<i>Cottus cognatus</i>)
Smallmouth Bass (<i>Micropterus dolomieu</i>)	White Perch (<i>Morone americana</i>)
White Sucker (<i>Catostomus commersoni</i>)	Yellow Perch (<i>Perca flavescens</i>)

Source: Lakes of Maine

Plant Species: (not an exhaustive list) bladderwort, bryozoan, bur-reed, coontail, pickerel weed, pipewort, pondweed, waterweed, and wild celery.

Mussels & Crayfish: Eastern elliptio and Eastern floater; crayfish are present.

Loon counts have been done regularly since 1983. Since that time, the loon population has stayed relatively stable.

Year	# Adults	# Chicks	Year	# Adults	# Chicks	Year	# Adults	# Chicks
1983	4	0	1998	14	0	2010	27	2
1984	6	0	1999	20	2	2011	31	2
1987	6	0	2000	25	2	2012	23	1
1989	13	1	2001	24	3	2013	28	2
1990	15	2	2002	21	3	2015	33	1
1991	18	1	2003	30	1	2016	25	4
1992	18	2	2004	21	0	2017	23	1
1993	15	1	2005	36	1	2018	9	3
1994	15	2	2006	23	0	2019	24	2
1995	29	0	2007	27	1	2020	43	0
1996	18	0	2008	23	2	2021	27	2
1997	16	0	2009	29	1	2022	26	2

Source: Lakes of Maine

Water Quality Assessment:

Variable	State Average	Maranacook Lake
Transparency	5.3 M	5.5 M
Chlorophyll	5.7 ppb	4.5 ppb
Phosphorous	11.2 ppb	10 ppb
Color	20.1 SPU	17 SPU
Alkalinity	11.11 mg/L	16 mg/L
pH	7.23	6.92
Conductivity	52.6 µS/cm	60 µS/cm

Source: Lakes of Maine

Dissolved Oxygen: data shows that dissolved oxygen is reduced drastically in warmer months of the year. In cooler months, there is a slight rebound in DO in the upper portions of the lake, but is depleted in the deeper parts, which is normal. Overall, Maranacook Lake's water quality is lower than average for the state.

Maranacook Lake is composed of two distinct basins, although the Lakes of Maine website does not present the data as two different lakes. The northern basin located in Readfield is smaller and shallower and exhibits water quality that is slightly below average for Maine lakes. The possibility of excessive watershed phosphorus loading and the potential for internal phosphorus recycling are concerns for the future water quality of this basin.

The southern basin of Maranacook Lake is located partially in Readfield and primarily in Winthrop, directly downstream of the northern basin. Maranacook Lake is a secondary water supply for Winthrop and is used as a source of drinking water by some lakefront owners. It is a large, deep lake. During stratification it remains well-oxygenated to the bottom depths, providing a large volume of water to support a cold-water fishery.

Together the basins of Maranacook Lake and their watersheds pose the greatest challenge to water quality management in Winthrop and Readfield. The lake is rated "moderate-sensitive" and is classified as a "Lake Most at Risk from Development" by the DEP. The watershed in Readfield consists of over 9,500 acres (almost half of Readfield's land area) and includes both Readfield Village and the Depot, the more densely settled areas. There are extensive areas of recent development within Winthrop's 2,600-acre watershed, as well. Concerns expressed by the Cobbossee Watershed District (CWD) range from erosion along camp roads to runoff from the school parking lots.

The CWD completed a Watershed Management Plan for Maranacook Lake in 2008, outlining prescribed actions for citizens and officials in Winthrop and Readfield to ensure future protection of the lake.

Maranacook Lake is listed under the Threatened Lake Priority List by the DEP as "Sensitive" due to sediment chemistry, the lake's hydrology, and threats in the watershed. This listing is based on predictions for the lake's phosphorus concentration increasing due to watershed growth projections and watershed threats. The DEP listed the water quality category as moderate-sensitive regarding phosphorus loading and the level of protection as high. The south basin has an allowable limit of 0.052 pounds phosphorus per year, per acre, while the north basin has an allowable limit of 0.032 pounds per year, per acre.

Apple Valley Lake (aka Nancy's Bog)

Area: 101 acres

Invasive species: unknown

Fisheries management: n/a

The Lakes of Maine website did not have information on fish species, aquatic plants, loons, mussels, or crayfish for Apple Valley Lake. Nor was information available on water quality.

Description: Apple Valley Lake is an isolated reservoir just east of Mount Pisgah, with virtually no development activity in its direct watershed. Also known as Nancy's Bog, it was controlled by an earthen dam until the dam failed in 1997, causing a dramatic reduction in pond volume. Prior to that, the pond had a depth of 25 feet; it has not been measured since the dam failure. It was previously listed as having "moderate/sensitive" water quality.

Annabessacook Lake

Direct Drainage: 13,543 acres (33.6% in Readfield)

Area: 1,415 acres

Maximum Depth: 49 feet

Mean Depth: 21 feet

Invasive species: variable-leaf milfoil (*Myriophyllum heterophyllum*), confirmed in 2014, and Chinese Mystery Snail (*Cipangopalundina chinensis malleatus*)

Fisheries management: warm-water

Fish species:	
Brown Trout (<i>Salmo trutta</i>)	American Eel (<i>Anguilla rostrata</i>)
Banded Killifish (<i>Fundulus diaphanous</i>)	Common Shiner (<i>Luxilus cornutus</i>)
Brook Trout (<i>Salvelinus fontinalis</i>)	Brown Bullhead (<i>Ameiurus nebulosus</i>)
Smallmouth Bass (<i>Micropterus dolomieu</i>)	Northern Pike (<i>Esox lucius</i>)
Chain Pickerel (<i>Esox niger</i>)	Golden Shiner (<i>Notemigonus crysoleucas</i>)
Largemouth Bass (<i>Micropterus salmoides</i>)	Pumpkinseed (<i>Lepomis gibbosus</i>)
Rainbow Smelt (<i>Osmerus mordax</i>)	Redbreasted Sunfish (<i>Lepomis auratus</i>)
White Perch (<i>Morone americana</i>)	White Sucker (<i>Catostomus commersoni</i>)
Yellow Perch (<i>Perca flavescens</i>)	

Source: Lakes of Maine

Plant species: (not an exhaustive list) aquatic moss, arrowhead, bladderwort, bulrush, pickerel weed, pondweed, coontail, and waterlily.

Mussels & Crayfish: No information available.

Loon counts have been done regularly since 1983. Since that time, the loon population has increased slightly over the years.

Year	# Adults	# Chicks	Year	# Adults	# Chicks	Year	# Adults	# Chicks
1983	5	0	1996	14	1	2010	33	1
1984	5	1	1998	18	4	2011	34	3
1985	6	1	1999	10	0	2012	21	0
1986	6	1	2000	5	1	2013	34	2

1987	2	0	2001	21	2	2014	29	5
1988	9	1	2002	12	3	2015	29	0
1989	9	2	2003	16	2	2016	37	4
1990	11	0	2004	25	4	2017	29	1
1991	21	3	2005	18	0	2018	18	2
1992	11	2	2006	15	0	2019	22	3
1993	15	3	2007	28	0	2020	33	0
1994	16	3	2008	22	3	2021	36	0
1995	17	2	2009	24	0	2022	34	0

Source: Lakes of Maine

Water Quality Assessment:

Variable	State Average	Annabessacook Lake
Transparency	5.3 M	3.3 M
Chlorophyll	5.7 ppb	11.4 ppb
Phosphorous	11.2 ppb	22 ppb
Color	20.1 SPU	18 SPU
Alkalinity	11.11 mg/L	16.6 mg/L
pH	7.23	7.01
Conductivity	52.6 µS/cm	61 µS/cm

Source: Lakes of Maine

Dissolved Oxygen: In warmer months, data shows that dissolved oxygen is reduced at approximately 26 feet and continues to decline until it reaches zero at the depths of the lake. In cooler months, the level of dissolved oxygen is not depleted entirely. These circumstances are not unusual for a lake of this depth. Typically, the dissolved oxygen content is higher in the upper levels of lakes large enough to stratify, while they are reduced at depths.

Annabessacook Lake lies in the southwestern corner of town. It covers 1,420 acres and has a direct watershed area within Winthrop of more than 4,400 acres. The total Annabessacook watershed, including four upstream lakes (Maranacook, Cochnewagon, Wilson, and Lower Narrows) is 83.5 square miles. The shoreline is well-developed on the southern and western shores, but there is less dense development along the eastern shore.

Annabessacook Lake has a history of supporting excessive amounts of algae in the late summer, due in large part to the contribution of phosphorus in the form of nonpoint source pollution caused by erosion. As soil particles wash from the watershed into the lake, they also bring phosphorus, which acts as a fertilizer for plant growth, decreasing water clarity. Excessive phosphorus can harm fish habitat and lead to nuisance algal blooms.

Nonpoint source pollution (NPS), as described above, is the main reason for declining water quality in Annabessacook Lake. NPS can result from the development of residential dwellings (seasonal and year-round occupancy), and recreational pursuits, including boating, fishing, hunting, camping, swimming, and the beach area. Further, agricultural activities, which are numerous, are another source of nonpoint source pollution.

In the 2018/2020/2022 Integrated Water Quality Report, Maine DEP included this information: “Annabessacook Lake (1,420 acres) in Monmouth [Winthrop] is technically meeting the attainment criteria of not blooming in more than half of the 10-year assessment period and could be delisted on that basis. However, discussions with the Cobbossee Watershed District (CWD), the primary stakeholder, revealed that they continue to be concerned with the depression of annual transparency means which occurred during the middle of this assessment period, and the slight reversal of improving trend over the last few years. Thus, it was decided to continue tracking improvement to increase confidence in any listing changes.”

As of March 2023, Annabessacook Lake was one of the state’s 22 lakes listed on the Nonpoint Source Priority Watershed List as “Impaired,” due to its status in the 2018/2020/2022 Integrated Water Quality Report, by Maine DEP.

Annabessacook Lake is also on DEP’s list of Maine Lakes at Risk of having an Algal Bloom. Its frequency is “often,” and risk level is “high.” Annabessacook Lake is also on DEP’s list of Direct Watersheds of Lakes Most at Risk from New Development. The criteria this determination is based on is as follows:

1. The lake is a public water supply,
2. The Lake is identified by the department as being in violation of class GPA water quality standards or as particularly sensitive to eutrophication based on:
 - a. Current water quality,
 - b. Potential for internal recycling of phosphorus,
 - c. Potential as a cold-water fishery,
 - d. Volume and flushing rate, or
 - e. Projected growth rate in the watershed.
3. Severely blooming lakes are a subset of lakes most at risk. A severely blooming lake has a history of algal blooms, and the reduction of existing watershed phosphorus sources sufficient to eliminate those algal blooms is expected to be so difficult that the addition of new, incompletely mitigated development sources may prevent successful restoration of the lake.

Under these criteria, Annabessacook Lake is noted as “severely blooming.” However, with the restoration initiatives and several updates to the watershed-based management plan through the Cobbossee Watershed District, the water quality in Annabessacook Lake is slowly showing signs of improvement. Although the water quality is still considered poor, it is gradually improving, based on historic measures of Secchi Disk Transparencies, total phosphorus, and chlorophyll a. The noted improvements are likely because of the CWD’s 2004 Phosphorus Control Action Plan - Total Maximum Daily Load Report, required by the EPA.

Cobbossee (Cobbosseecontee) Lake:

Direct Drainage: 20,608 acres

Area: 5,516 acres

Maximum Depth: 100 feet

Mean Depth: 37 feet

Invasive species: Eurasian watermilfoil (*Myriophyllum spicatum* L.) and European frog's bit (*Hydrocharis morsus-ranae*), both confirmed in 2018.

Fisheries management: warm and cold-water

Fish species:	
Brown Trout (<i>Salmo trutta</i>)	American Eel (<i>Anguilla rostrata</i>)
Banded Killifish (<i>Fundulus diaphanous</i>)	Brown Bullhead (<i>Ameiurus nebulosus</i>)
Brook Trout (<i>Salvelinus fontinalis</i>)	Emerald Shiner (<i>Notropis atherinoides</i>)
Black Crappie (<i>Pomoxis nigromaculatus</i>)	Northern Pike (<i>Esox lucius</i>)
Smallmouth Bass (<i>Micropterus dolomieu</i>)	Golden Shiner (<i>Notemigonus crysoleucas</i>)
Chain Pickerel (<i>Esox niger</i>)	Pumpkinseed (<i>Lepomis gibbosus</i>)
Largemouth Bass (<i>Micropterus salmoides</i>)	Redbreasted Sunfish (<i>Lepomis auratus</i>)
Rainbow Smelt (<i>Osmerus mordax</i>)	White Sucker (<i>Catostomus commersoni</i>)
White Perch (<i>Morone americana</i>)	Fourspine Stickleback (<i>Apeltes quadracus</i>)
Yellow Perch (<i>Perca flavescens</i>)	Rudd (<i>Scardinius erythrophthalmus</i>)
Landlocked Alewife (<i>Alosa pseudoharengus</i>)	

Source: Lakes of Maine

Plant species: (not an exhaustive list) aquatic moss, bladderwort, coontail, pickerel weed, pondweed, and waterlily.

Mussels: Eastern elliptio (*Elliptio capanata*), Eastern lampmussel (*Lampsilis radiata*)

Crayfish: No information available.

Loon counts have been done regularly since 1983. Since that time, the loon population has increased.

Year	# Adults	# Chicks	Year	# Adults	# Chicks	Year	# Adults	# Chicks
1983	27	2	1996	23	0	2009	66	3
1984	30	2	1997	15	1	2010	77	3
1985	37	6	1998	44	2	2011	68	2
1986	55	9	1999	35	3	2012	73	5
1987	37	5	2000	38	2	2013	82	3
1988	2	0	2001	38	3	2014	83	8
1989	33	1	2002	26	3	2015	73	9
1990	33	4	2003	31	7	2016	95	9
1991	39	2	2004	58	8	2017	47	8
1992	28	0	2005	51	8	2018	54	3

1993	26	5	2006	56	3	2019	72	11
1994	33	3	2007	53	2	2020	84	8
1995	40	7	2008	51	4	2022	73	2

Source: Lakes of Maine

Water Quality Assessment:

Variable	State Average	Cobboosee Lake
Transparency	5.3 M	4.0 M
Chlorophyll	5.7 ppb	8.8 ppb
Phosphorous	11.2 ppb	16 ppb
Color	20.1 SPU	16 SPU
Alkalinity	11.11 mg/L	18.1 mg/L
pH	7.23	7.04
Conductivity	52.6 µS/cm	62 µS/cm

Source: Lakes of Maine

Dissolved Oxygen: Cobbosseecontee Lake shows signs of depleted dissolved oxygen in cooler months and in warmer months, typically indicative of degraded water quality.

Cobbossee Lake is the largest of the Winthrop lakes, with shoreline shared by Manchester, West Gardiner, and Monmouth. The lake drains Annabeessacook Lake, but despite its size, the direct watershed covers only 2,250 acres in eastern Winthrop. Five other towns contribute to the watershed. Both the shore frontage and the larger watershed of Cobbossee are moderately well-developed, making it extremely sensitive to additional development.

Cobbossee Lake has annual or near annual algal blooms and is listed by the DEP as a moderate risk for future algal blooms.

Cobbossee Lake is also on DEP's list of Maine Lakes Most at Risk from New Development, as it relates to algal blooms. The criteria this determination is based on is as follows:

1. The lake is a public water supply,
2. The Lake is identified by the department as being in violation of class GPA water quality standards or as particularly sensitive to eutrophication based on:
 - a. Current water quality,
 - b. Potential for internal recycling of phosphorus,
 - c. Potential as a cold-water fishery,
 - d. Volume and flushing rate, or
 - e. Projected growth rate in the watershed.
3. Severely blooming lakes are a subset of lakes most at risk. A severely blooming lake has a history of algal blooms, and the reduction of existing watershed phosphorus sources sufficient to eliminate those algal blooms is expected to be so

difficult that the addition of new, incompletely mitigated development sources may prevent successful restoration of the lake.

The lake is also listed as a Threatened Lake under DEP's Nonpoint Source Priority Watershed List. On this list, the Lake is marked under "Watch List," "Sensitive," and "Sensitive – Sediment Chemistry." The "Watch List" classification includes lakes that were recently impaired and therefore still sensitive, or data suggesting their water quality is near the impairment threshold. Lakes classified as "Sensitive" are sensitive to additional phosphorus inputs due to the lake's hydrology and threats in the watershed. Lakes that are "Sensitive due to Sediment Chemistry" are those in which the sediment chemistry has been analyzed and found to be susceptible to internal phosphorus release, leading to internal phosphorus loading.

This lake is listed on the State of Maine Department of Environmental Protection 2018/2020/2022 Integrated Water Quality Monitoring and Assessment Report as "attaining some standards; assumed to meet others." The report also notes that water quality shows persistent improvement. This improvement is largely due to the monumental efforts of the Cobbossee Watershed District in reducing phosphorus loading into the lake. Cobbossee Lake has been showing steady signs of improvement since the 1990s, and in 2006, the state removed Cobbossee from the list of impaired waterbodies and awarded CWD with the DEP's Outstanding Achievement award for three decades of aggressive effort.

Upper Narrows Pond:

Direct Drainage: 2,729 acres

Area: 239 acres

Maximum Depth: 54 feet

Mean Depth: 25 feet

Invasive species: Unknown

Fisheries management: warm- and cold-water

Fish species:	
Banded Killifish (<i>Fundulus diaphanous</i>)	American Eel (<i>Anguilla rostrata</i>)
Brook Trout (<i>Salvelinus fontinalis</i>)	Brown Bullhead (<i>Ameiurus nebulosus</i>)
Smallmouth Bass (<i>Micropterus dolomieu</i>)	Northern Pike (<i>Esox lucius</i>)
Chain Pickerel (<i>Esox niger</i>)	Golden Shiner (<i>Notemigonus crysoleucas</i>)
Largemouth Bass (<i>Micropterus salmoides</i>)	Pumpkinseed (<i>Lepomis gibbosus</i>)
Rainbow Smelt (<i>Osmerus mordax</i>)	Redbreasted Sunfish (<i>Lepomis auratus</i>)
White Perch (<i>Morone americana</i>)	White Sucker (<i>Catostomus commersoni</i>)
Yellow Perch (<i>Perca flavescens</i>)	Slimy Sculpin (<i>Cottus cognatus</i>)
Landlocked Salmon (<i>Salmo salar</i>)	Lake Trout (<i>Salvelinus namaycush</i>)
Fallfish (<i>Semotilus corporalis</i>)	

Source: Lakes of Maine

Plant species: (not an exhaustive list) bladderwort, pondweed, water lily, and waterweed.

No information is available for mussels or crayfish.

Loon counts have been done regularly since 1983. Since that time, the loon population has stayed stable.

Year	# Adults	# Chicks	Year	# Adults	# Chicks	Year	# Adults	# Chicks
1983	2	2	1996	2	0	2010	2	0
1984	2	0	1997	2	0	2011	2	0
1985	3	1	1998	2	0	2012	2	1
1986	2	1	2000	2	0	2013	2	2
1987	3	0	2002	2	0	2014	2	0
1989	2	1	2003	2	0	2015	0	0
1990	2	1	2004	4	1	2016	0	0
1991	2	0	2005	2	2	2020	0	0
1992	2	1	2006	2	1	2021	5	0
1993	4	1	2007	2	1	2022	5	0
1994	4	0	2008	2	0			
1995	4	0	2009	2	0			

Source: Lakes of Maine

Water Quality Assessment:

Variable	State Average	Upper Narrows Pond
Transparency	5.3 M	6.4 M
Chlorophyll	5.7 ppb	4.2 ppb
Phosphorous	11.2 ppb	9 ppb
Color	20.1 SPU	20 SPU
Alkalinity	11.11 mg/L	17.3 mg/L
pH	7.23	6.98
Conductivity	52.6 μ S/cm	98 μ S/cm

Source: Lakes of Maine

Dissolved Oxygen: Upper Narrows Pond shows signs of depleted dissolved oxygen in warmer months, while dissolved oxygen levels are typically maintained in cooler months.

According to the 2004 Upper Narrows Pond *Phosphorus Control Action Plan and Total Maximum Daily (Annual Phosphorus) Load Report* by Maine DEP, this water body has experienced a decline in water quality over the last three decades, in terms of significant depletion in dissolved oxygen in deep areas of the lake. In fact, the dissolved oxygen was reduced to minimum levels, which threatens the cold-water fishery. This decline is due to the contribution of phosphorus found in area soils and transported into the water body via runoff.

Maine DEP's 2018/2020/2022 Integrated Water Quality Report lists Upper Narrows Pond as "Attaining some standards; assumed to attain others," and that data indicates a stable trend.

Upper Narrows Pond is on DEP's Nonpoint Source Priority Watershed List under Threatened Lakes Priority List. On this, it is listed under "Public Water Supply System" because it is the primary source of water for the Winthrop Utilities District, thus it requires a high level of protection. Winthrop's Zoning Ordinance includes both Upper and Lower Narrows Ponds in its Public Water Supply District, which requires stringent controls on land uses within 1,000 feet horizontally of the shorelines of these ponds and the streams linking them. Upper Narrows Pond is also listed on the Nonpoint Source Priority Watershed List as "Watch List" and "Sensitive" because it is a public water supply source.

Upper Narrows Pond is also on DEP's list of Lakes Most at Risk from New Development because it is a public water supply system.

Lower Narrows Pond:

Direct Drainage: over 2,729 acres

Area: 223 acres

Maximum Depth: 106 feet

Mean Depth: 31 feet

Invasive species: Unknown

Fisheries management: Warm- and cold-water

Fish species:	
Brook Trout (<i>Salvelinus fontinalis</i>)	Brown Bullhead (<i>Ameiurus nebulosus</i>)
Smallmouth Bass (<i>Micropterus dolomieu</i>)	Northern Pike (<i>Esox lucius</i>)
Chain Pickerel (<i>Esox niger</i>)	Golden Shiner (<i>Notemigonus crysoleucas</i>)
Largemouth Bass (<i>Micropterus salmoides</i>)	Pumpkinseed (<i>Lepomis gibbosus</i>)
Rainbow Smelt (<i>Osmerus mordax</i>)	Redbreasted Sunfish (<i>Lepomis auratus</i>)
White Perch (<i>Morone americana</i>)	White Sucker (<i>Catostomus commersoni</i>)
Yellow Perch (<i>Perca flavescens</i>)	Slimy Sculpin (<i>Cottus cognatus</i>)
Landlocked Salmon (<i>Salmo salar</i>)	Lake Trout (<i>Salvelinus namaycush</i>)
Fallfish (<i>Semotilus corporalis</i>)	

Source: Lakes of Maine

Plant species: (not an exhaustive list) pondweed, water lily, and waterweed.

No information is available on mussels or crayfish.

Loon counts have been done regularly since 1983. Since that time, the loon population has stayed relatively stable.

Year	# Adults	# Chicks	Year	# Adults	# Chicks	Year	# Adults	# Chicks
1983	3	0	1996	1	0	2014	1	0

1984	3	0	1997	3	0	2015	2	0
1985	3	0	2004	2	1	2016	0	0
1986	8	3	2005	6	0	2017	2	0
1987	2	0	2006	2	0	2018	1	0
1989	2	1	2007	3	0	2019	3	0
1990	2	0	2008	2	0	2020	1	0
1991	1	0	2009	3	1	2021	0	0
1992	1	0	2010	1	0	2022	0	0
1993	3	0	2012	4	0			

Source: Lakes of Maine

Water Quality Assessment:

Variable	State Average	Lower Narrows Pond
Transparency	5.3 M	6.8 M
Chlorophyll	5.7 ppb	5.7 ppb
Phosphorous	11.2 ppb	8 ppb
Color	20.1 SPU	14 SPU
Alkalinity	11.11 mg/L	17.2 mg/L
pH	7.23	7.04
Conductivity	52.6 μ S/cm	73 μ S/cm

Source: Lakes of Maine

Dissolved Oxygen: Lower Narrows Pond shows signs of depleted dissolved oxygen in warmer months, while dissolved oxygen levels are typically maintained in cooler months.

In the comparison between water quality at Lower Narrows Pond and the state's averages, it appears that Lower Narrows Pond's water quality is slightly above average.

Lower Narrows Pond is on the Nonpoint Source Priority Watershed List, under Threatened Lakes Priority List as "Sensitive" to additional phosphorus inputs due to the lake's hydrology and threats in the watershed. This lake is also on the DEP's list of Direct Watershed of Lakes Most at Risk from New Development, likely because of its proximity to Upper Narrows Pond, which is a public water supply source.

Upper and Lower Narrows Ponds are in the central part of town, and each has its own distinct, direct watershed separated by the causeway of Narrows Pond Road.

Watersheds:

A watershed is a natural drainage basin that collects precipitation and sends it to a body of water through an interconnected system of streams, brooks, and other wetlands. Unmanaged or improper human activities in any part of a watershed can negatively affect the water quality of the waterbody into which the watershed drains.

Several of Winthrop's lakes are within the Cobbossee Lakes system and thus within the jurisdiction of the Cobbossee Watershed District (CWD), of which Winthrop is a member. The CWD provides technical assistance and review of development applications as well as volunteer lake water-quality monitoring and management of lake water levels. Even though these lakes may not be wholly or even partially in Winthrop, their watershed lies within the town's boundaries, so they are included in this chapter.

The Town of Winthrop, in cooperation with CWD and DEP, has collaborated on several programs to maintain and improve water quality in the numerous lakes and watersheds in Winthrop. Additionally, the town has participated in numerous restoration and phosphorus mitigation projects.

Wilson Pond

Wilson Pond lies upstream from Annabessacook, in Monmouth and Wayne. The watershed of Wilson Pond covers about 1,700 acres in Winthrop, and a total direct drainage area of 4,304 acres. The total Wilson Pond drainage area, inclusive of associated sub-watersheds of Berry and Dexter ponds is approximately 15.2 square miles.

The pond has had good water quality in the past but has declined steadily. The DEP's 2018/2020/2022 Integrated Water Quality Monitoring and Assessment Report lists Wilson Pond as a lake that is impaired or threatened for one or more designated uses but does not yet require development of a Total Maximum Daily Load. Typically, lakes that fall into this category are so placed due to internal phosphorus loading. For this reason, Wilson Pond is on the Impaired Lakes Priority List under the DEP's list of Lakes Most at Risk from New Development, due to sensitivity for phosphorus loading.

The CWD surveyed the watershed in 2005-06, identifying locations of existing and potential phosphorus runoff. The state listed Wilson Pond as Impaired in 2006. CWD and partners completed the Phosphorus Control Action Plan – Total Daily Maximum Daily Load Report in 2007.

Wetlands:

Wetlands serve many essential functions, such as stormwater storage areas, surface water filtration systems, and critical wildlife habitat and essential breeding grounds. They also serve as important travel corridors for many species of wildlife. In addition, wetlands provide open space for some forms of recreational enjoyment and/or aesthetic appreciation.

There are at least 20 such wetlands in Winthrop (*Water Resources Map*, *Critical Natural Features Map* in the Appendix). The most significant are often associated with open water; Annabessacook Lake, Apple Valley Lake, Upper Narrows Pond, and Little

Cobbossee Lake all have wetlands connected to them. There is also an extensive wetland along Case Road.

Among other standards, the Winthrop Zoning Ordinance provides protection of wetlands through setback requirements consistent with the mandatory Shoreland Zoning Ordinance.

Vernal Pools:

A vernal pool is defined as a naturally occurring, temporary to permanent inland body of water that forms in a shallow depression and typically fills during the spring or fall and may dry during the summer. Vernal pools contain no viable populations of predatory fish, and it provides the primary breeding habitat for wood frogs, spotted salamanders, blue spotted salamanders, and fairy shrimp. The presence of any one or more of these species is usually conclusive evidence of a vernal pool.

Vernal pools do not fall under the protection provided to wetlands by Maine Natural Areas Program, a facet of the Department of Agriculture, Conservation and Forestry that maintains a database of areas designated as ecological reserves. But, as of September 2007, significant vernal pool habitats are protected under the Natural Resources Protection Act (NRPA). A vernal pool is considered “significant” if it has a high habitat value, either because 1) a state-listed threatened or endangered species uses it to complete a critical part of its life history, or 2) there is a notable abundance of specific wildlife. This regulation protects areas within a 250-foot radius of the spring or fall high-water mark of a significant vernal pool, which is considered critical terrestrial habitat. Any activity on, in, or over these areas must be approved by the Maine DEP and requires either a Permit by Rule or individual NRPA approval.

To date, significant vernal pools have yet to be mapped. And unfortunately, the Beginning with Habitat data does not have significant vernal pools information for every town, Winthrop included.

With new attention to their importance in the ecosystem, the town should consider conducting a vernal pool survey and incorporating some protection for vernal pools into its development standards. Extra protection through Shoreland Zoning is a consideration for these sites, as well.

Threats to Winthrop’s Water Resources:

The quality of water in any lake or pond depends on many factors, including the surface area and depth of the lake; the flushing rate of the lake; the size of the watershed surrounding the lake; the extent of development along the shore; the extent of agricultural activity in the watershed; and the degree to which obvious sources of pollution can enter the water body.

The single greatest threat to water quality at present is the introduction of phosphorus into a waterbody through runoff within the watershed. Phosphorus is a naturally occurring element and a plant nutrient. Excessive phosphorus is responsible for causing nuisance algae blooms and excessive aquatic plant growth. When severe enough, algal blooms reduce dissolved oxygen levels and could result in fish die-offs.

The level of phosphorus entering a waterbody is a direct function of disruption in the watershed, primarily from human-induced activities. Since most of Winthrop is encompassed in lake watersheds, this can have a major constraint on development.

Sources of potential threats to water quality are too numerous to list extensively, but a few include increased and poorly managed development, impervious surfaces related to development, faulty or failing septic systems, agricultural fertilizers, poor stormwater management, erosion, and much more. Typically, the erosion related to poorly maintained camp roads and gravel driveways within watersheds are the biggest contributors to runoff and increased phosphorus intake in waterbodies.

Increased impervious surfaces can cause runoff and result in erosion during precipitation events if not effectively managed. When the water runs off impervious surfaces, it collects pollutants that end up in stormwater drains and eventually find their way into waterbodies.

Faulty or failing septic systems in older or seasonal homes in the Shoreland Zone are another threat to water quality. Many seasonal homes that have been converted to year-round use may have septic systems that cannot adequately manage year-round use. Many older homes may have faulty septic systems. The state now has a requirement of filing a septic inspection report for any transfer of title within a Shoreland Zone. The purpose of this requirement is to provide proof of inspection to ensure subsurface waste disposal systems in Shoreland Zones remain in good working condition to prevent water quality degradation. While some towns require that a copy of the inspection report also be submitted to the town, Winthrop does not yet have such a requirement.

This requirement has limitations, however. One example is when a property within the Shoreland Zone is passed down generationally without benefit of officially changing documented ownership, the requirement of a septic inspection is not triggered.

Fertilizer associated with agricultural activities can run off land into surface water, resulting in algal blooms. If severe enough, algal blooms can drastically reduce water quality.

Additionally, what was traditionally considered a well-manicured lawn sloping down to a lakeshore is also a source of pollutants. Lawn maintenance, in particular fertilizers, and lack of a natural vegetative buffer are increasingly known to cause water quality degradation.

Work on public infrastructure near and in the water is managed to avoid erosion and sedimentation. Careful consideration must be given to the miles of ditching, and hundreds of road culverts that are town-maintained. Public supplies of salted sand are stored in a

Maine DEP-approved building and erodible materials are stored away from drainage areas and waterbodies. Best Management Practices (BMPs) for activities such as culvert replacement, street sweeping, public works garage operations, and salt/sand pile maintenance are essential in protecting water quality. BMPs and strategies are gathered and utilized from many sources but primarily from Maine DOT.

Winthrop's Public Works Department takes careful measures to incorporate BMPs into their daily work routines.

An increasing concern in relation to water quality is the threat of invasive water plants. Maine, for years isolated from the plague of milfoil, is now seeing increasingly frequent occurrences. Eurasian watermilfoil (*Myriophyllum spicatum* L.), the most aggressive species, was found in Cobbosseecontee Lake in 2018, along with European frog's bit (*Hydrocharis morsus-ranae*). Variable leaf watermilfoil (*Myriophyllum heterophyllum*) has been found in Annabessacook Lake. Farther south in Monmouth, another infestation of Variable leaf watermilfoil was identified in Jug Stream, a connector between Annabessacook Lake and Cobbosseecontee Lake.

The State has initiated several measures aimed at preventing further spread of invasive aquatic plants, including posting signs at strategic points, and supporting courtesy boat inspections at most public boat landings. In addition, the CWD has the *Maranacook Watershed Management Plan*, completed in 2008, which outlines strategies to control the introduction of invasive plants. The Annabessacook Association in conjunction with the Friends of the Cobbossee Watershed and the CWD have invested heavily over several years in the extraction of invasive milfoil from the lake. These efforts continue.

Point and Nonpoint Source Pollution:

Point Source Pollution can be linked back to one location, or point, such as a leaking oil tank. Point sources come from a direct source and are easily identified and managed.

Nonpoint Source Pollution cannot be traced to one sole source. One example is stormwater runoff. Stormwater can come from anywhere, especially impervious surfaces. Stormwater is water that does not soak into the ground during a precipitation event, but flows on top of the ground instead, to a body of water. As this water travels across the surface of the ground, it collects pollutants such as petroleum products, heavy metals, fertilizers and manure, which can originate from any location within a watershed. Where stormwater runoff erodes soil, the soil itself transports phosphorus into waterbodies.

Several of Winthrop's lakes and watersheds of lakes that lie within town boundaries have been the subject of nonpoint source pollution remediation projects. A few of these include Cobbossee Lake, Annabessacook Lake, and Wilson Pond.

Winthrop has language in its Zoning Ordinance that sets standards that require the management of stormwater and are based on state standards. Surface and subsurface drainage systems are options for minimizing stormwater runoff, as is minimizing bare soil

within a Shoreland Zone. In addition, the town partners with local watershed districts to address gravel road issues. This is done through education and volunteer erosion control efforts.

Remediation Sites:

Winthrop has 12 remediation sites listed by the DEP, all in various stages of progress. The following sites are listed as “remedy in place: closed - undertaking post-closure obligations”:

- Winthrop Landfill, 294 Annabessacook Road (2007) (Brownfield Site)
- Turkey Lane, near Jacobs Lane (2009)
- Former Audettes Hardware, corner of Bowdoin and Main streets (2005)
- Inmont Summer Street at 30 Summer Street (2000)
- Old Bonafide Industries Dump on Royal Street (2001)
- Northeast Industrial, 40 Winada Drive (2005)

Listed as “Investigation Stage - Ongoing” are 2 sites:

- Squire Hill Dry Cleaning, 399 Main Street (2013)
- Seaway Boats, 1109 ME-100 (1998)

Other:

- Quaker Lace Company on Royal Street is listed as in the remediation stage, awaiting resources (2019).
- Comtel Poleyard on Royal Street is listed as complaint investigated, reviewing preliminary site information (2017).
- Progressive Ironworks on Western Avenue is listed as complaint investigated- unsubstantiated (2009).
- An upland area near Winthrop landfill is listed as being in the investigation stage- ongoing (2016).

Winthrop Landfill is a Brownfield Site, which the United States Environmental Protection Agency (USEPA) defines as “a property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant.”

Background Information on Winthrop Landfill:

The 13-acre Winthrop Landfill site is located off of Annabessacook Road on the west side of Annabessacook Lake. The site consists of two adjacent properties owned by the Town of Winthrop and a local family. A sand and gravel pit initially operated on site in the 1920s, and by the 1930s, parts of the site received municipal, commercial, and industrial wastes. The site accepted hazardous substances between the early 1950s and mid-1970s.

In late 1979, the Town of Winthrop attempted to expand the landfill. Upon further assessment, it was determined that chemicals had been disposed of at the site. The Town decided to close the landfill and construct a transfer station on the site.

The site was listed on the National Priorities List in December 1982 and cleanup activities were subsequently implemented through United States EPA and Maine Department of Environmental Protection oversight. Cleanup activities generally included installation of a landfill cap, installation and operation of a groundwater extraction and treatment system, extension of public water service, activity and use limitations (e.g., restricting groundwater use in the immediate vicinity of the site, etc.) and other engineered systems to protect human health and the environment.

What Is the Current Site Status?

Based on the EPA's most recent evaluation of the site (Seventh Five-Year Review Report, August 2022), the site continues to be protective of human health and the environment. Biennial inspections and long-term maintenance of the landfill cap and cover system continues. The cap and perimeter fence are maintained annually and are in serviceable condition. Long-term monitoring of groundwater, surface water, and sediment also continues.

Wildlife Habitat:

Waterbodies, watercourses (ex. streams and brooks), and wetlands are necessary habitats for the continued survival of many wildlife species. Unfragmented blocks of land are as essential to high-quality habitat as the many watercourses and wetlands found in Winthrop because they provide sanctuary for woodland birds, and other wildlife species, including critical habitat for some rare or endangered species.

The extent and quality of wildlife habitat is an indicator of not just the richness and diversity of the flora and fauna in Winthrop, but the overall health of the ecosystem. The availability of high-quality habitat for plants, animals, and fish is essential to maintaining abundant and diverse populations for ecological, economic, and recreational purposes.

The Maine Department of Inland Fisheries and Wildlife (MDIF&W) administers a program called Beginning with Habitat (BwH) to identify significant wildlife habitat and critical natural areas under the National Resources Protection Act.

BwH, a collaborative program of federal, state, and local agencies and non-governmental organizations, is a habitat-based approach to conserving wildlife and plant habitat on a landscape scale. The goal of the program is to maintain sufficient habitat to support all native plant and animal species currently growing and breeding in Maine. BwH compiles habitat information from multiple sources, integrates it into one package, and makes it accessible to towns, land trusts, conservation organizations, and others to use in a proactive approach to conservation. This information can be seen on Winthrop's **Critical Natural Resources Map** in the Appendix, with descriptions of essential features below.

Significant habitats, as defined by MDIF&W, includes species appearing on the official state or federal list of endangered or threatened species, high and moderate value deer wintering areas, and high and moderate value waterfowl and wading bird habitats.

Before conducting any activities in, on, or over significant wildlife habitats, a National Resources Protection Act (NRPA) permit must be obtained. Activities include construction, repair, or alteration of any permanent structure; dredging, bulldozing, removing or displacing soil, sand, or vegetation; and drainage or filling. The standard for protecting significant habitats highlights mitigation and compensation. Actions must be taken to A) avoid negative impacts on habitats, B) minimize the impacts if unavoidable, C) restore or rehabilitate impacted habitats, D) reduce an impact over time, or E) replace the affected habitat.

Deer Wintering Areas:

Although white-tailed deer (*Odocoileus virginianus*) are common in Winthrop, their existence is predicated on sufficient habitat. Summer habitat is commonly referred to as “edge habitat,” which includes farm fields, orchards, and open areas adjacent to forested lands. The habitat limitations for deer occur in the winter when there is heavy snow and extreme cold. Deer wintering areas (DWA) are defined as a forested area used by deer when snow depth in the open/hardwoods exceeds 12 inches; deer sinking depth in the open/hardwoods exceeds eight inches and mean daily temperatures are below 32° F. Non-forested wetlands, non-stocked clear cuts, hardwood types, and stands predominated by Eastern Larch are included in DWAs only if less than 10 acres in size. Agricultural and development areas within DWAs are excluded regardless of size. Deer wintering areas that have yet to be confirmed through professional survey are considered “Candidate Deer Wintering Areas” until otherwise verified through a survey.

Winthrop has approximately eight “Candidate Deer Wintering Areas,” either entirely or partially within town boundaries. They have yet to be confirmed through a survey. They are scattered throughout town in no uniform way (see **Critical Natural Resources Map** in Appendix).

Other Wildlife:

Raccoon, beaver, and red fox are the most abundant species of furbearers in Winthrop. Other abundant species include mink, fisher, coyote, otter and various waterfowl species.

Accurate or even estimated population counts of waterfowl populations are not available, aside from the loon survey by the Maine Audubon Society. The Maine Department of Inland Fisheries and Wildlife has been conducting an ongoing survey of wild duck populations, of which the information is not yet available.

Other than generalized habitat protection measures, primarily for wetlands, the state has no coordinated program for maintaining species populations. Various conservation

groups and lake associations engage in programs to promote local populations such as putting out nesting boxes for ducks or platforms for loons.

There are numerous waterfowl and wading bird habitats scattered throughout Winthrop, varying in size. These habitats provide breeding, migration, and wintering grounds for a multitude of bird species. Since 2006, Maine's Shoreland Zoning Regulation requires that waterfowl and wading bird habitats, as designated by MDIF&W, must be protected by a 250-foot buffer.

Winthrop has upwards of 20 known inland waterfowl/wading bird habitats designated by MDIF&W; they can be seen on the [Critical Natural Resources Map](#) in Appendix. They are around Winthrop's numerous lakes, ponds, and wetland areas.

The BwH maps also show an abundance of wetland areas valuable for wildlife that are not regulated as inland waterfowl and wading bird habitats, so they are not afforded the protection of the 250-foot buffer.

Rare, Endangered, and Valuable Species and Habitats:

Beginning with Habitat compiles data on rare, endangered, and valuable species and habitats in Winthrop (see [Critical Natural Resources Map](#) in Appendix). This information includes rare, threatened, or endangered wildlife, rare or exemplary plants and natural communities, essential wildlife habitats, and significant wildlife habitats.

Animals:

One site containing an endangered animal is identified at the northern end of Cobbosseecontee Lake. The species' identity has been withheld for its own protection.

A Great Blue Heron (*Ardea herodias*) has been identified between Route 135 and Cobbosseecontee Lake. Great Blue Herons are a species of Special Concern in Maine. A species of Special Concern is any species of fish or wildlife that does not meet the criteria of an endangered or threatened species but is particularly vulnerable, and could easily become endangered, threatened, or extirpated due to restricted distribution, low or declining numbers, specialized habitat needs or limits, or other factors. Special Concern species are established by policy, not by regulation, and are used for



planning and informational purposes; they do not have the legal weight of endangered and threatened species. The Maine Department of Inland Fisheries and Wildlife reviews the list of Special Concern species at the beginning of each calendar year and based on criteria in the Maine Endangered and Threatened Species Listing Handbook, revises the list as appropriate.

Plants:

Maine Natural Areas Program (MNAP) through Maine Department of Agriculture, Conservation & Forestry (DACF) ranks species on both a global level and a state level. A 5-point ranking system from critically imperiled (1) to secure (5) facilitates a quick assessment of a species or habitat type's rarity. Each species or habitat is assigned both a state (S) or global (G) ranking on the scale of 1-5. Factors such as range extent, the number of occurrences, intensity of threats, as well as other factors, contribute to the assignment of state and global ranks. The definitions for state and global ranks are comparable but applied at different geographic scales; for example, something that is state imperiled may be globally secure.

There are four locations in Winthrop providing habitats for rare plants and/or natural communities.

- **Water Stargrass (*Heteranthera dubia*)**, a plant with a state status of Species of Special Concern has been identified at two locations in the northern part of the Upper Narrows Pond. Its state ranking is S3 which is vulnerable in Maine and at a moderate risk of extirpation due to a fairly restricted range, very few populations or occurrences, recent and widespread declines, threats, or other factors. The Water Stargrass's global ranking is G5 which means it is globally secure and at a very low risk for extinction globally due to a very extensive range, abundant populations, or occurrences, and little to no concern from decline or threats.
 - **Habitat:** damp sands, often submerged in quiet waters.
 - **Ecological Characteristics:** In Maine, this species may occur along shallow shorelines or in open water.
 - **Range:** Southern Quebec to North Dakota and Washington, south to Cuba and South America.
 - **Known Distributions in Maine:** This rare plant has been documented in a total of 15 towns in the following counties: Aroostook, Hancock, Kennebec, Penobscot, Somerset, Waldo.
 - **Phenology:** Flowers June - September.
 - **Reasons for Rarity:** At northern limit of range.



- **Conservation Considerations:** Maintain water quality in the lakes and ponds in which it occurs.

- **Stiff Arrowhead (*Sagittaria rigida*)** is a plant species classified as Special Concern. It has been identified off the northern end of Cobbosseecontee Lake. Its state ranking is S2 which is high risk for extirpation in Maine due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors. This plant's global ranking is G5, which means it is globally secure and at a low risk for extinction globally due to an extensive range, abundant populations, or occurrences, and little to no concern from decline or threats.



- **Habitat:** Calcareous or brackish mud or water.
- **Ecological Characteristics:** In Maine, this species is typically found in fresh to brackish tidal mud flats.
- **Range:** Maine and Quebec to Minnesota, south to Virginia, Tennessee, Missouri, and Nebraska.
- **Known Distribution in Maine:** This rare plant has been documented in a total of 13 towns in Kennebec, Lincoln, Penobscot, Sagadahoc, and York counties.
- **Phenology:** Flowers July – September.
- **Reasons for Rarity:** At northern limit of range.
- **Conservation Considerations:** Prevent degradation of marsh and estuary habitat from adjacent land uses.

- **Columbia Water-meal (*Wolffia columbiana*)**, a plant with a state status as Species of Special Concern has been identified in the downtown area, at the northern end of Annabessacook Lake. Its state ranking is S2, which means it is imperiled in Maine and at a high risk of extirpation due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors. The Columbia Water-meal's global ranking is G5, which means it is globally secure and at a low risk for extinction globally due to an extensive range, abundant populations, or occurrences, and little to no concern from decline or threats.



- **Habitat:** Ponds and still waters.
- **Ecological Characteristics:** Columbia water-meal often grows in association with *Lemna* species (duckweed).
- **Range:** Southern Maine to southern Ontario and Minnesota, south to South America.
- **Known Distributions in Maine:** This rare plant has been documented in a total of nine towns in the following counties: Cumberland, Kennebec, Knox, York.
- **Phenology:** Reproduces by vegetative budding. Flowers are rarely produced.
- **Reasons for Rarity:** At northern limit of range.
- **Conservation Considerations:** Possibly under-reported in southern Maine.

Important Habitat:

Also noted by BwH is an Exemplary Natural Community, with the common name Enriched Northern Hardwood Forest, that has been identified on the shared boundary between Winthrop and Wayne. Sometimes referred to as “cove forests,” these closed canopy forests are dominated by sugar maple, with beech and/or yellow birch subordinate. Basswood and white ash are typical indicators but are not necessarily abundant, and they are often absent in northwest Maine. The shrub layer is usually sparse and dominated by saplings of the



canopy species. The lush herb layer may contain species that are strong indicators of this forest type, such as maidenhair fern, blue cohosh, Dutchman's breeches, grape fern, spring beauty, and silvery spleenwort. These and many rare species are characteristic of forests with relatively nutrient rich soils.

The Enriched Northern Hardwood Forest has a state ranking of S3, which means it is vulnerable in Maine, and at moderate risk of extirpation due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors.

Undeveloped Habitat Blocks, Connectors, and Conserved Land:

There is a distinct, direct relationship between the quantity and variety of wildlife and the size of their habitat. Of course, there is urban wildlife such as skunks and mourning doves that do not require significant portions of land to thrive. However, many other types of animals are much less conspicuous and depend upon unbroken stretches of forest for survival. As roads, farms, and houses intrude on the habitat of these creatures, the large habitat blocks become fragmented, displacing the wildlife that relies on them.

Development in rural areas often causes these fragmentations, reducing the land's value as wildlife habitat. Wildlife travel corridors linking individual habitat blocks together are critical to accommodate animal movement. Ensuring wildlife travel corridors helps preserve the region's biodiversity and maintains rural community character. Limiting development at the edges of unfragmented habitat also helps maintain environmental integrity by giving forest-dwelling creatures a natural buffer.

The Beginning with Habitat program maps these unfragmented habitat blocks. The BwH maps include information such as who owns the habitat block and how it is conserved (federally protected, state protected, municipally owned and protected, or through conservation easement). The **Critical Natural Resources Map** in the Appendix shows these unfragmented blocks, as well.

By far, the largest unfragmented block in Winthrop is the Mt. Pisgah Conservation Area with over 900 acres of conserved land, including the portions in Wayne. This large, unfragmented block is in the southwest corner of the town. The Kennebec Land Trust holds the Mt. Pisgah Conservation Area.

In the northeast corner is the second largest, unfragmented block of land, all combined at approximately 470 acres. Maine Woodland Owner holds the Georgia Fuller Wiesendanger Wildlife Protection Area, which consists of 271 acres between Winthrop and Readfield. It is adjacent to an additional 30 acres of woodlot, also held by Maine Woodland Owner. Other land holdings adjacent to this block are: 57 acres held by KLT and Little Cobbossee Outway Preserve, and 58 and 62 acres, all held by KLT.

Other smaller conserved land holdings exist around Winthrop. The most notable of these are the islands in Cobbosseecontee Lake, all held by the KLT.

The two largest unfragmented blocks of land in Winthrop both contain several candidate deer wintering areas, inland wading bird and waterfowl habitats, the exemplary natural community, and several plant species of Special Concern, underscoring the importance of unfragmented habitat blocks. These two blocks are protected by ownership and have no known risks of destructive development.

Natural resources, particularly waterbodies, are inevitably threatened everywhere in Maine, to varying degrees. Winthrop's Zoning Ordinance, which includes the Shoreland Zoning, has protective measures aimed at reducing these threats. In addition, Friends of the Cobbossee Watershed are proactive in trying to address erosion issues and invasive plant infestations to protect and preserve Winthrop's waterbodies. The Kennebec Land Trust actively works to preserve and maintain large blocks of land throughout town to ensure unfragmented habitat blocks.

Regulatory Protections:

In addition to state and federal standards to protect water quality, Winthrop's Zoning Ordinance includes language to provide further protection of natural and water resources (see Existing Land Use chapter for more information). The Zoning Ordinance includes Shoreland Zoning requirements that are consistent with state guidelines.

The Zoning Ordinance designates four zoning districts for the purpose of protecting water resources:

Resource Protection District (RP): includes areas in which development would adversely affect water quality, productive habitat, biological ecosystems, or scenic and natural values. This district shall include the following areas when they occur within the limits of the shoreland zone, exclusive of the Stream Protection District, except that areas which are currently developed and areas which meet the criteria for the Limited Commercial District need not be included within the Resource Protection District.

- a) Areas within 250 feet, horizontal distance, of the upland edge of freshwater wetlands and wetlands associated with great ponds and rivers, which are rated "moderate" or "high" value waterfowl and wading bird habitat, including nesting and feeding areas, by the Maine Department of Inland Fisheries and Wildlife (MDIF&W) that are depicted on a Geographic Information System (GIS) data layer maintained by either MDIF&W or the Department of Environmental Protection as of December 31, 2008. For the purposes of this paragraph "wetlands associated with great ponds and rivers" shall mean areas characterized by non-forested wetland vegetation and hydric soils that are contiguous with a great pond or river and have a surface elevation at or below the water level of the great pond or river during the period of normal high water. "Wetlands associated with great ponds or rivers" are considered to be part of that great pond or river.
- b) Floodplains along rivers and floodplains along artificially formed great ponds along rivers, defined by the 100-year floodplain as designated on the Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Maps or Flood Hazard

Boundary Maps, or the flood of record, or in the absence of these, by soil types identified as recent floodplain soils.

- c) Areas of two (2) or more contiguous acres with sustained slopes of 20% or greater.
- d) Areas of two (2) or more contiguous acres supporting wetland vegetation and hydric soils, which are not part of a freshwater wetland as defined, and which are not surficially connected to a water body during the period of normal high water.
- e) Land areas along rivers subject to severe bank erosion, undercutting, or riverbed movement.

Shoreland District (S): includes those areas within 250 feet, horizontal distance from the normal high-water line of great ponds and are suitable for residential and recreational development. It includes areas other than those in the Resource Protection District, or Stream Protection District.

Stream Protection District (SP): includes all land areas within seventy-five (75) feet, horizontal distance, of the normal high-water line of a stream, exclusive of those areas within two hundred and fifty (250) feet, horizontal distance, of the normal high-water line of a great pond, or river, or within two hundred and fifty (250) feet, horizontal distance, of the upland edge of a freshwater wetland. Where a stream and its associated shoreland area are located within two hundred and fifty (250) feet, horizontal distance, of the above waterbodies or wetlands, that land area shall be regulated under the terms of the shoreland district associated with that water body or wetland.

Public Water Supply District (PW): surrounds ponds which serve as water supplies to Augusta and Winthrop. The use of Carlton and Narrows Ponds as water supplies, and the fact that these ponds have a low capacity for assimilating pollutants necessitates additional protective measures around them. Since runoff from agricultural and development activity is apt to cause water quality problems, more stringent controls on such activities are applied to land areas within 1,000 horizontal feet of the shorelines of these ponds and the streams linking them.

Rural District (RD): includes land presently characterized by low density development, forests, abandoned fields, and farms. This District seeks to protect the existing open space, forestry, agricultural and residential uses, and to restrict commercial activities.

Winthrop's Zoning and Subdivision Ordinances are the first lines of protection for watersheds and water quality, since development and other human-related activities within a watershed are the largest contributors to degraded water quality. Development can be designed to minimize phosphorus runoff, by mandating BMPs for construction and Low Impact Development (LID) design criteria (*LID Guidance Manual for Maine Communities, Approaches for Implementation of Low Impact Development Practices at the Local Level*, 2007). LID describes land planning and engineering design approaches to manage stormwater runoff that mimics natural processes, resulting in the infiltration, evapotranspiration, or use of stormwater to protect water quality and associated aquatic habitats.

To preserve and protect water quality, it is imperative that the Zoning and Subdivision ordinances are reviewed and updated regularly. Regular updates will ensure the most current standards and practices are included, such as LID and BMPs for phosphorus control and stormwater management.

Another layer of protection is the Cobbossee Watershed District. It provides technical assistance and review of development applications, performs volunteer lake water-quality monitoring, and educates the public about maintaining water quality.

The Winthrop Zoning Ordinance does not currently require applicants to identify or protect rare and/or endangered species and/or natural communities. The Subdivision Ordinance (Section VIII.B.11) permits the Planning Board to require open space to be set aside for “rare and irreplaceable natural areas ...”

Local and Regional Coordination:

Local Partners:

Winthrop’s Conservation Commission

Regional Partners:

The Kennebec Land Trust (KLT) is a non-profit organization that collaborates with landowners and communities to protect the Kennebec Valley’s natural features, working landscapes, and fragile ecosystems. The properties entrusted to the KLT are usually open to the public. The KLT works to preserve natural resources through land protection, stewardship, education, advocacy, and cooperation. The KLT is active in Winthrop, offering landowner assistance with conservation easements and accepting donations of property.

Winthrop is a member of the Cobbossee Watershed District (CWD). The CWD provides technical assistance and review of development applications as well as volunteer lake water-quality monitoring and management of lake water levels.

Of the 11 lakes with water in Winthrop, five have lake associations that work to protect those waterbodies from invasive plants and to preserve water quality. Those five associations are: Friends of the Cobbossee Watershed, the Maranacook Lake Association, the Annabessacook Lake Association, the Narrows Pond Improvement Association, and the Berry, Dexter, Wilson Ponds Watershed Association.

Analysis:

Winthrop is a place of abundant natural beauty with numerous waterbodies, wetlands, critical natural areas, forested habitat, as well as important natural resources, all deserving of protection. The Zoning Ordinance, including the Shoreland Zoning language, offers a degree of protection through setting particular requirements and standards in each zoning districts; however, the ordinance could be updated to provide stronger protection to sensitive areas.

Several plant species of Special Concern, one bird species of Special Concern and one endangered species make their home in the rich habitat Winthrop offers. Protecting these species comes down to protecting their habitat. With the two largest, unfragmented habitat blocks and several others scattered throughout town, Winthrop has begun to take these measures.

The biggest threat to natural resources is residential development, particularly in rural areas or open spaces. The town has little in the way of nonregulatory incentives to encourage development in appropriate, designated growth areas. This is explored more extensively in the Existing and Future Land Use chapters. Winthrop will need to find a balance between the need to draw people to town, economic development pressures, and the importance of preserving the essential natural resources outlined here.

Additionally, natural resources do not stop at the town's boundaries, nor are they the exclusive responsibility of the town. Successful protection of valuable resources depends on cooperation with neighboring towns, conservation organizations, and private landowners. Winthrop's Conservation Commission is also charged with coordinating activities with other conservation-related organizations, such as the Kennebec Land Trust.

Future Considerations:

- ❖ Should Winthrop partner with other towns in developing a regional Open Space Plan?
- ❖ What parts of town should be prioritized for preserving natural resources?
- ❖ Are there any specific pieces of property the town would like to prioritize in preserving, if they become available?
- ❖ How can the town better promote the importance of conserved land and wildlife corridors?
- ❖ Should Winthrop do more to protect its wildlife habitat land such as deer wintering yards and other land that is not formally conserved?
- ❖ Should Winthrop do more to protect its rural areas?
- ❖ How can the town further support private landowners to manage their Farm and Open Space and Tree Growth parcels? These lands are key for wildlife habitat and wildlife corridors.