Natural Resources

Belgrade is fortunate to be surrounded by large expanses of lakes that form the lifeblood of the town and region. Belgrade's natural resources are responsible for significant portions of the town's economy, productive forests, and clean water for recreations and drinking. Arguably, the most important resource in the town is it's large lakes and corresponding wetlands. It is important to not take these resources for granted and to encourage the preservation and protection of them for years to come. These lakes serve as the economic engine driving a large portion of the local economy through eco-tourism, recreation and sporting opportunities.

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

The following chapter identifies and documents Belgrade's natural and water resources and identifies the physical limitations which the natural environment imposes on the planning process for future development.

Natural Land Resources

Geology And Soils

Belgrade's soils, and the rock below, influence the topography, the type of vegetation and therefore wildlife, and available options for development, farming, and forestry.

The advance and retreat of glaciers long ago have molded Belgrade's landscape. As glaciers advanced, the ice mass scoured the ground. As they retreated, they left a mixture of sand, silt, clay, and stones.

-----SOIL INFORMATION----

From this list, 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, farming 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	Monarda silt loam	Walpole fine sandy loam
Leicester stony loam	Peat and Muck	Limerick silt loam

Belgrade'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.

The United States Department of Agriculture, Natural Resources Conservation Service maps soil type and publishes it to use in mapping. The type, quantity, and quality of minerals and organic particles are what determines a soil type. In different sizes and ratios, these particles form soil types that may be well suited for a variety of uses, and ill-suited for others. Some soil is particularly fertile, making it particularly well suited for agriculture, some types are a very stable combination of sand, silt, and clay particles making it ideally suited for building homes, businesses, and roads. But still some other types of soil, especially those which are saturated for an extended part of the year, are unsuitable for development, while at the same time provide great environmental value. The Maine State Plumbing Code takes these ratings into account when determining which soil types may be or may not be suitable for subsurface wastewater disposal systems. While Belgrade has large areas where the soil is not suitable for development, there are large tracts, formed by glacial activity during the last ice age, that contribute to the town's economy in other ways.

Two types of geologic formations formed by glacial activity are found in Belgrade are eskers and morraines. Eskers are long gravel ridges, up to 100 miles, that formed when gravel and sand accumulated in tunnels in glaciers. When the glaciers retreated, the gravel was left. Morraine's are an accumulation of sediment and other material formed a ridge that marks the end of the ice sheet. These features show where glaciers paused or moved forward at various points in time.

The esker system in Maine is considered one of the finest in the United States with the Belgrade Esker System being one of the very best. The Belgrade system also contains a series of kettlehole ponds and wetlands forming several rare and exemplary natural habitats which will be discussed later on. A major threat to the esker system is gravel

and sand mining. Most of the esker has already been lost to extraction, the few portions that remain are worthy of conservation.

Topography

The developed portion of Belgrade is primarily located in a low-lying area between Belgrade Mountain to the north, Attean Mountain to the south-west and another unnamed peak to the south. As such, the majority of the town is composed of rugged and mountainous terrain. The slope percentage of land plays an important role. Development on slopes greater than 15% accelerates stormwater runoff velocity, erosion, and sedimentation, particularly in sensitive watersheds. Plumbing Code limits the installation of septic systems to land with an original slope of 20% or less. Steep slopes also present problems for the construction of basements, septic systems, roads, and storm drainage systems.

Areas of steep slopes (greater than 25%), are scattered across Belgrade. Development on slopes of this steep level can lead to environmental problems including erosion, removal of vegetation, and the subsequent pollution of water bodies from sediment run-off. Locations with lesser or even no slopes pose a different challenge to development. These areas are typically associated with poor draining soils or floodplain soils. These soils also present poor construction conditions for similar reasons as steep slopes.

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.

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

Slopes and Landslide Risks

Landslides and slumping are a known hazard in Maine. Soil creep is the most common type of slide, but many other types, such as flows, spreads, and rotational slumps are possible. Landslides are most likely to occur along river corridors (especially cut banks), bluffs with active erosion and areas with unconsolidated surficial materials, especially the Presumpscot formation. Events are also more likely to occur in areas where the base of the slope has been undermined, such as where roads have been cut into hillsides or development sites. Areas that have not been manipulated by humans can also fail after significant events like intense storms or water saturated soils in spring. As climate change brings more extreme weather events, the risk of landslides will increase. Landslides are most likely to occur in Spring and early summer due to snowpack melt and/or spring rains. But they can happen at any time of year when significant amounts of water flow through an area. (see "Maine Landslide Guide" by Lindsay J. Spigel (digitalmaine.com))

While the steep slopes constrain development, it can be beneficial due to the value that these slopes bring to the aesthetic beauty of the town. The scenic views from these slopes are an asset valued by town residents and should be preserved and protected from development.

Scenic Resources

As with much of Maine, the local topography is a primary component of scenic resources. 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. While the relatively flat topography of Belgrade does not lend itself to high peaks and valleys, the abundance of wetlands and lakes give as many opportunities for scenic views as in mountainous areas.

On Route 27 in the Depot area of town, there is an excellent view looking northeast through Belgrade Stream, across the large freshwater marsh system and on to Messalonskee Lake. There are many of such vistas across the community and are a part of the draw the Belgrade's lakes have.

Floodplains

A floodplain is an area adjacent to a waterbody that is subject to periodic flooding. Belgrade'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. Belgrade has an approved local Floodplain Management Ordinance, which is enforced, consistent with state and federal standards, and requires periodic reviews and updates.

The Federal Emergency Management Agency is responsible for mapping floodplains in the United States and managing the National Flood Insurance Program. The last floodplain mapping for Belgrade was conducted in 2011 with the Flood Insurance Rate Maps becoming effective in 1985.

The existing maps for Belgrade distribute land into two zones:

- Zone A – Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage
- Zone AE – The base floodplain where base flood elevations are provided

According to the maps, all locations identified as being in Zone A lie along the borders of bodies of water such as on both sides of the Moose River, the bank of Wood Pond and along the several small streams and brooks.

The town of Belgrade has developed a floodplain ordinance. Article II of the Floodplain Management Ordinance mandates that prior to any construction or other development, including the placement of manufactured homes, a Flood Hazard Development Permit must be obtained from the town Planning Board.

Are there any specific areas of concern for Belgrade?

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.

All of Belgrade lies within the Lower Kennebec Watershed. This basin spans 2,195,636 acres across Central Maine. This watershed contains much of the Kennebec River from Wyman Lake down to where it meets the tidal waters near Richmond. The Lower Kennebec Watershed is also broken into subwatersheds, of which Belgrade lies entirely within the Belgrade Lakes-Messalonskee Stream watershed which cover 133,852 acres. This sub watershed is also broken down further into 4 minor watersheds, 3 of which make up Belgrade:

Table 1: Watersheds in Belgrade

Minor Watershed	Acreage
Long Pond	27,853
Messalonskee Lake	33,875
Salmon Pond-Great Pond	34,666

Source: Lakes Environmental Association

The Salmon Pond-Great Pond watershed area includes four municipalities with the largest of land area lying in Belgrade (54%) and Rome (35%). Of the direct watershed area approximately 70% of the land area is forested with another 16% comprised of freshwater wetlands, especially the north and south ends of Great Pond. Following those uses, 10% of the watershed is estimated to be developed with the final 4% used for agricultural purposes.

Development in the greater Messalonskee Stream – Belgrade Lakes watershed is significant and expected to continue. The shores of lakes in the watershed are comprised of marinas, year round home, seasonal residences, summer camps and other businesses.

The Messalonskee Lake, Long Pond and Salmon Lake watersheds are all considered to be direct watersheds most at risk from new development. Lakes are granted this label with they are a public water supply OR 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.

Groundwater

Ground Water typically comes from one of two sources--water flowing through cracks and fissures in the bedrock, and from sand and gravel aquifers. Local groundwater is the source of drinking water for all residents who are not serviced by the public drinking water system along with local businesses. Groundwater is also a potential future source for public drinking water supplies. All groundwater should be protected from contamination by oil, chemicals, or other sources.

Last updated in 2020, the Maine Geological Survey shows numerous aquifers in Belgrade. Several of the largest aquifers stretch from Great Pond southeast to almost the Kennebec River in Augusta. These are rated at 10-50 gallons per minute and all contain numerous pockets of non-plotting within. There are three other smaller aquifers along the eastern and northern shores of Great Pond, all rated at 10-50 gallons per minute. Gallons per minute is the rate at which water percolates into the ground and is dependent on the porosity of the soil and bedrock.

There are significant risks to the larger aquifers in Belgrade due to the current land use. Sitting directly above the aquifer is the Depot region of town which contains the majority of light commercial activities as well as the rail line. There are also numerous above and underground storage tanks in town containing petroleum products. There are always risks associated with chemical storage tanks, both above and below ground. Leaks are possible due to the age of tanks, the effects of weather, damage through weather events or even accidental or intentional tampering.

In addition, there are a number of sand and gravel pits present in the town, and these can be indicators of underground aquifers. The rapid permeability of soil around sand and gravel aquifers can allow pollutants to travel through the soil and into groundwater. Stormwater runoff containing chemicals, leaks from underground tanks, material spill along roadways, malfunctioning septic systems, and improper disposal of hazardous materials all pose a threat to groundwater quality. Land around these pits should be treated as potential aquifers and protections implemented until such a time that further study indicates no aquifer is present.

The Drinking Water Program, a division of the Maine Center for Disease Control. 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).

In Belgrade, there are 16 public drinking water systems. The following is a summary of public water supplies in Belgrade as reported by the DWP.

Table 2: Public Water Sources in Belgrade

Public Water Sources		
NC-Transient NTNC	*Non-Community, Non-Transient*	*C-Community*
System Name	**System Type**	**Source**
RS 18 Belgrade Central School	NTNC	560' Bedrock Well - 12/26/2001 @ 12GPM
Camp Modin	NC	470' Bedrock Well - 1980's @ 25GPM
New England Golf and Tennis Camp	NC	200' DR Well - 1991 @ 20GPM
Camp Runoia	NC	384' DR Well - 9/12/2003 @ 40GPM
Center for All Seasons	NC	50' Drilled Well in a Pit
Castle Island Camps	NC	51' Drilled Well - Circa 1929 @ 10GPM
The Village Inn	NC	200' Drilled Well
Sunset Grille	NC	165' DR Well
Woodland Condo Association	NC	300' BR Well - 5/23/19 @ 5GPM
Belgrade Lakes Seafood	NC	85' Drilled Well
Belgrade Lakes Golf Club	NC	624' Bedrock Well - 4/23/98 @ 15GPM
Hammond Lumber Company	NTNC	304' Bedrock Well - 1/13/00 @ 17.5 GPM
Becket Academy Learning Center	NTNC	400' Bedrock Well - 6/26/04 @ 5GPM
Belgrade Health Center	NC	270' Bedrock Well 11/15/05 @ 25GPM
Sandy Cove Association	NC	100+' Drilled Well
Camp Modin – Pioneer Bunkhouse	NC	440' Bedrock Well 8/19/14 @ 40GPM

Source: Maine Drinking Water Program

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).

The Department of Health and Human Services, Bureau of Health, Division of Health Engineering, oversees the Drinking Water Program (DWP), based on the Federal Safe Drinking Water Act (SDWA). The SDWA requires each state to complete an assessment for each public water source, which identifies and describes conditions that may threaten the quality of water available. The DWP is responsible for these assessments

through the Maine Source Water Assessment Program (SWAP), which include current and potential future risks to public water supply sources.

The assessment evaluation is based on the Environmental Protection Agency's (EPA) approved evaluation methodology. Categories evaluated include risk based on:

- Well type and geology;
- Existing and future risk of acute contamination; and
- Existing and future risk of chronic contamination.

While no drinking water source is completely free from threats to water quality, some wells, by nature of their construction and the geology of their site, are more at risk than others. For example, dug wells and springs test positive for coliform bacteria more frequently than drilled wells; thus, drilled wells are evaluated as being a lower risk for contamination.

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 Belgrade 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.

In 2018 residents in the area of Oakland, Cemetery, and Augusta roads reported increased levels of chloride in their well water. Attributed to run off from winter road treatments and the storage of salt by the town and state nearby, this has led to wells testing well above the chloride public drinking water standard.

SURFACE WATERS

Belgrade's ponds and rivers have long contributed to the town's social, economic, and cultural history and development. These bodies of water are key contributing factors to

recreational opportunities, important ecosystems, and habitats, drinking water and development opportunities. This region of Maine is known as the Belgrade Lakes region. Comprised of a group of seven lakes that are all connected and eventually flow into the Kennebec River forming critical habitats and recreational opportunities.

There are five significant bodies of surface water in Belgrade making up a large portion of the Belgrade Lakes chain. Long Pond forms much of the western border of Belgrade and is made of two distinct basins, a north and south. Great Pond forms almost all of the northern border of the town and connects to Long Pond by a small channel. The eastern border of Belgrade is delineated by Ellis (Salmon) Pond, McGrath Pond, and Messalonskee Lake.

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 Belgrade'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.

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.

All water bodies are required by state law to be locally protected through the Shoreland Zoning Ordinance. Belgrade has a 250-foot shoreland area established under the state guidelines, along its larger wetlands, rivers, and streams. These restrictions affect what people may do with their land in the immediate vicinity of the shoreland to protect water quality. The *Water Resources Map (Appendix)* shows Belgrade's streams, lakes, ponds, and wetlands. As set forth in the town's Shoreland Zoning ordinance, in section 13A. Resource Protection District, areas classified as where development would adversely affect water quality, productive habitat, biological systems, or scenic and natural values. This encompasses areas:

1. Within 250 feet, horizontal distance, or the upland edge of freshwater wetlands and wetlands associated with great ponds and rivers which are rated “moderate” or “high” value by Maine Department of Inland Fisheries and Wildlife.
2. Flood plains along rivers, defined by the 100 year flood plain as designated on the 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 flood plain soils.
3. Areas of two or more contiguous acres with sustained slopes of 20% or greater. Areas meeting these criteria shall be in a subdistrict designated Resource Protected-Slope District.
4. 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 connected to a water body during normal spring high water.
5. Land areas along rivers subject to sever bank erosion, undercutting, or river bed movement.
6. Areas designated by federal, state, or municipal governments as natural areas of significant to be protected from development.

Also, in the Shoreland Zoning ordinance section 13 is E. Stream Protection District. This district includes all land areas withing 75 feet horizontal distance of the normal high-water line of a stream, exclusive of those areas within section A. If that stream and it’s 75 foot buffer is located withing the 250 foot buffer as described in section A. it is then regulated the same as the associated water body or wetland.

Lakes and Ponds:

Water Quality Assessment is based off a number of factors that are explained below. Each factor is a key determinant of the health of species dependent on the lake as well as a guide for future development and protection measures.

Table 3: Water Quality Assessment

Water Quality Assessment	
Transparency	Transparency is a measure of how clear the lake water is. Factors that reduce water clarity are algal blooms, zooplankton, water color, and silt, with algae being the most abundant.
Chlorophyll	This test measures the green pigment found in all plants including microscopic plants such as algae. For this reason, it is used to estimate algal biomass; the higher the chlorophyll content, the higher the algae in the lake.
Phosphorous	This is one of the major nutrients plants need for growth. While it is often the limiting factor in aquatic plant growth, high phosphorous levels are often a sign of pollutants entering the waterbody. As levels of phosphorous increase, the amount of algae increases, resulting in reduced water quality.

Color	This measure refers to the amount of dissolved organic acids such as tannins and lignins, which make water look tea colored. The unit of measure for color is Standard Platinum Units or SPU. Color reduces the lake's transparency and increases phosphorus readings.
Alkalinity	This is the measure of the capacity of the water to neutralize acids, or the buffering capacity. A lake'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 mg/L.
pH	Similar to 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 1-14 with 7 indicating neutral acidity. 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.
Conductivity	Specific conductivity measures the ability of the water to carry an electrical current and is directly 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 waterbody, usually in the form of runoff from urban or residential areas and roadways.
Dissolved Oxygen	Adequate levels of dissolved oxygen (DO) in waterbodies is 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. Carleton Pond appears to have reduced DO levels during warmer months, as expected, but the levels of DO increase in colder months.

Source: Maine Lakes Association

Long Pond

Long Pond is 2,557 acres with a perimeter of 31 miles. Long Pond is divided into two distinct basins, north and south. The northern basin is fairly developed, especially along Route 27. There are also numerous camp roads containing both seasonal and year-round residences and one campground which is located at the neck between the north and south basins. The southern basin is less developed, with much of the shoreline comprised of wetlands. Long Pond is in a watershed of the same name comprising an area of 27,853 acres. Only about 1/3 of the Long Pond watershed is in Belgrade.

<u>Long Pond – MIDAS 5272</u>
Surface Area: 2,557 Acres
Maximum Depth: 106 ft
Mean Depth: 35 ft
Fisheries Management: Coldwater & Warmwater
Key Species:

Landlocked Salmon *(Salmo salar)*
Brook Trout *(Salvelinus fontinalis)*
Invasive Species: Northern Pike *(Esox Lucius)*

Table 4: Long Pond Water Quality Assessment Comparison

Variable	State Average	Long Pond
Transparency	5.3M	6.3 M
Chlorophyll	5.7 ppb	4.8 ppb
Phosphorous	11.2 ppb	8 ppb
Color	20.1 SPU	16 SPU
Alkalinity	11.11 mg/L	12.3 mg/l
pH	7.23	6.98
Conductivity	52.6 µS/cm	44 µS/cm
Flush Rate*	1-1.5	2.99-3.5

**flush rate is per year*

Long Pond is managed as a cold-water and warm-water fishery, home to a documented 20 fish species including Brook Trout *(Salvelinus Fontinalis)*, Landlocked Salmon *(Salmo salar), Brown Trout (Salmo trutta),* numerous species of panfish. There are numerous aquatic plant species such as Common Cattail *(Typha latifolia),* Pickerel weed *(Pentedaria cordata)* and Fragrant Water lily *(Nymphaea odorata).* The Maine Loon Project has been conducting surveys counting Common Loon's *(Gavia immer)* for over thirty years. A Loon survey on Long Pond has been conducted for the past four years counting 32 adult loons in 2022 down from 42 in 2021. One species of crayfish has been identified, the Virile crayfish *(Orconectes virilis)* and one species of freshwater mussel has been documented, the Eastern Floater *(Pyganodon cataracta).* One Bald Eagle *(Haliaeetus leucocephalus)* was documented in 2023 on the west shore of the southern basin of the pond.

Long Pond is listed on the Maine DEP Impaired Lakes Priority List as of March 2023.
Long Pond is not solely contained within Belgrade, adding an additional challenge to management. The municipal border of Belgrade runs from the channel connecting Long Pond to Great Pond south to the inlet. The remaining shoreline comprises the borders of Mt. Vernon and Rome.

Long Pond is accessible through a state owned boat launch at the southern basin located near Castle Island. While still a popular recreation destination, much of the shoreline is undeveloped, approximately 70%.

Great Pond

Great Pond is considerably more developed, most likely due to less shoreline being comprised of wetlands. The pond covers 8,533 acres with a perimeter of 46.1 miles. Great Pond is in the Salmon Pond-Great Pond watershed which covers 34,666 acres

with the majority of that withing the boundaries of Belgrade with small amounts in Rome and Smithfield.

Great Pond – MIDAS 5274
Surface Area: 8,533 Acres
Maximum Depth: 69 ft
Mean Depth: 21 ft
Fisheries Management: Coldwater & Warmwater
Key Species:
Brown Trout *(Salmo trutta)*
Invasive Species: Variable-Leaf Milfoil *(Myriophyllum hetreophyllum),* Northern Pike *(Esox Lucius)*
Water Quality Assessment

Table 5: Great Pond Water Quality Assessment Comparison

Variable	State Average	Long Pond
Transparency	5.3M	2.4M
Chlorophyll	5.7 ppb	3.9 ppb
Phosphorous	11.2 ppb	14 ppb
Color	20.1 SPU	47 SPU
Alkalinity	11.11 mg/L	9.0 mg/l
pH	7.23	7.10
Conductivity	52.6 µS/cm	30 µS/cm
Flush Rate*	1-1.5	.43

**flush rate is per year*

Great Pond is home to a large variety of species. The Pond is managed as a coldwater and warmwater fishery due to the populations of Brown Trout. The lake is more suited to a warmwater fishery due to the homothermos nature and relatively shallow nature. Other fish species that have been documented in the lake include Rainbow Smelt *(Osmerus mordax),* Fallfish (*Semotilus corporalis),* and Yellow Perch *(Perca flacesecns).* There are a number of common plant species present, Pickerel Weed *(Pontedaria cordata),* Fragrant Water Lily *(Nymphaea ordorata),* and Pipewort *(Eriocaulon aquaticum).* In addition to plant life there are two species of freshwater mussels present, the Eastern Elliptio *(Elliptio complanate)* and the Eastern Floater *(Pyganodon cataracta)*. There are also two species of crayfish documented, the Rusty Crayfish *(Orconectus rusticus)* and Virile Crayfish *(Orconectes virilis).* The last loon count was in 2022, by volunteers with the Maine Loon Society, documented 76 adult loons and 3 chicks. There is one identified Bald Eagle *(Haliaeetus leucocephalus)* on the northern edge of the lake.

Great Pond lies in the Salmon Pond – Great Pond watershed which comprises of 34,666 square miles. The shoreline is much more developed when compared to Long Pond. Two marinas are located on Great Pond as well as one summer camp. Much of

the shoreline is privately owned with a mixture of year-round and seasonal residences. There is one public access launch that is maintained by the state of Maine Department of Agriculture, Conservation and Forestry. The launch is fully hardscaped and has ample parking.

Ellis Pond (Salmon Lake)

Ellis Pond – MIDAS 5352
Surface Area: 695 Acres
Maximum Depth: 57 ft
Mean Depth: 23 ft
Fisheries Management: Coldwater & Warmwater
Key Species:
Brown Trout *(Salmo trutta)*
Rainbow Smelt *(Osmerus mordax)*
Invasive Species: Northern Pike *(Esox Lucius)*
Water Quality Assessment

Table 6: Ellis Pond Water Quality Assessment Comparison

Variable	State Average	Long Pond
Transparency	5.3M	5.0M
Chlorophyll	5.7 ppb	6.6 ppb
Phosphorous	11.2 ppb	15 ppb
Color	20.1 SPU	16 SPU
Alkalinity	11.11 mg/L	18.7 mg/l
pH	7.23	7.17
Conductivity	52.6 µS/cm	65 µS/cm
Flush Rate*	1-1.5	.54

**flush rate is per year*

Ellis Pond was once a thriving salmon fishery however due to algal bloom in the 1930's caused a significant decline in water quality. Work in the 1970's and 1980's was used to develop a restoration plan and watershed protection plan. This plan and the practices it has put into place have helped restore the water quality significantly, however neither the Maine Department of Inland Fisheries and Wildlife or Lake Stewards of Maine document there an existing population of salmon.

The Brown Trout fishery is exemplary due to a very healthy smelt population. The warmwater fisheries revolves around the populations of Black Crappie *(Pomoxis nigromaculatus),* Largemouth Bass *(Micropterus salmoides)*, and Smallmouth Bass *(Micropterus dolomieu).* Ellis Pond also has a remarkably diverse aquatic plant life make up with over 40 plant species identified. These include multiple species of waterweed *(Elodea spp.)*, spikerush *(Eleocharis spp)*, and more. There are no recorded species of crayfish or mussels present. The 2022 Loon count found 4 adult loons and

no chicks present. One Bald Eagle nest was counted in 2023.

Ellis Pond is in the Salmon Lake-Great Pond watershed and forms part of the border of Belgrade and Oakland. Ellis Pond is accessible through a smaller hardscaped launch located off Route 8 in Belgrade. While there are several seasonal cottage rental businesses and one summer camp on the south western shore of Ellis Pond, there is less development on the north western shore leading to the channel connecting Ellis to McGrath.

Messalonskee Lake (Snow Pond)

Messalonskee Lake – MIDAS 5280
Surface Area: 3,691 Acres
Maximum Depth: 113 ft
Mean Depth: 33 ft
Fisheries Management: Coldwater & Warmwater
Key Species:
Brown Trout *(Salmo trutta)*
Rainbow Smelt *(Osmerus mordax)*
Invasive Species: Variable-Leaf Milfoil *(Myriophyllum hetreophyllum),* Northern Pike *(Esox Lucius)*
Water Quality Assessment

Table 7: Messalonskee Lake Water Quality Assessment Comparison

Variable	State Average	Messalonskee Lake
Transparency	5.3M	5.3M
Chlorophyll	5.7 ppb	4.0 ppb
Phosphorous	11.2 ppb	9 ppb
Color	20.1 SPU	25 SPU
Alkalinity	11.11 mg/L	11.8 mg/l
pH	7.23	7.10
Conductivity	52.6 µS/cm	50 µS/cm
Flush Rate*	1-1.5	1.59

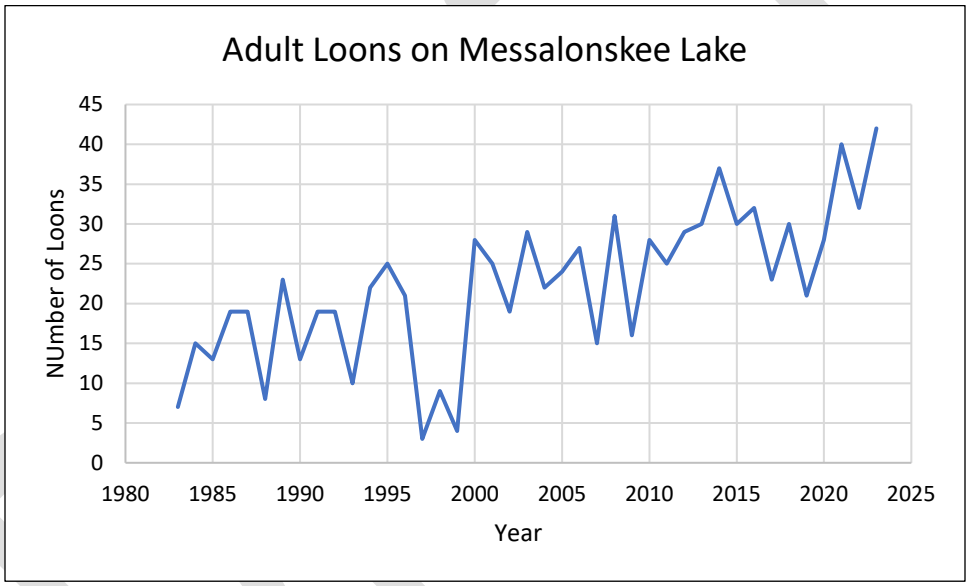
**flush rate is per year*

The second largest of the Belgrade Lakes, Messalonskee Lake forms part of the town line of Belgrade, Sidney, and Oakland. While the principle fishery is warmwater species, there is some coldwater fishery potential, mostly due to the deep waters in the middle area of the lake. Messalonskee Lake is the lowest of the Belgrade Lakes chain, draining through the Messalonskee Stream to the Kennebec River in Waterville.

Landlocked Salmon *(Salmo salar)* and Brook Trout *(Salvelinus nigromaculatus)* are the principle cold water fisheries, with Small *(Micropterus dolomieu)* and Largemouth Bass *(Micropterus salmoides)*, Yellow *(Perca flavescens)* and White Perch *(Morone*

americana) and various panfish supporting the warmwater fishery. Messalonskee Lake is known in the region for it's Northern Pike *(Esox Lucius)* fishing. These fish can grow upward of 40 inches in length and have no natural predators.

The plant life is similar to that of the upper lakes in the chain, with the addition of the invasive Variable Leaf Milfoil *(Myriophyllum heterophyllum).* There have been two eagle nests identified, one in the south western corner of the lake and another on an island in the norther more narrow portion. Messalonskee Lake is heavily developed with numerous summer camps, event centers and both year round and seasonal residences. Also, just across Route 27 and the extensive marsh system at the southern end of the lake is the Depot area of Belgrade which contains the commercial manufacturing businesses of Hammond Lumber and Gagne and Sons Concrete. There are two boat launches providing public access to Belgrade, one in the northern tip in Oakland and another in Belgrade next to Route 27 in the far southern end. There were 42 adult loons and 4 juveniles counted in 2023.



Source: Lakes of Maine

McGrath Pond

<u>McGrath Pond – MIDAS 5348</u>
Surface Area: 467 Acres
Maximum Depth: 27 ft
Mean Depth: 16 ft
Fisheries Management: Coldwater & Warmwater
Key Species:
Brown Trout *(Salmo trutta)*
Rainbow Smelt *(Osmerus mordax)*
Invasive Species: None known
<u>Water Quality Assessment</u>

Table 8: McGrath Pond Water Quality Assessment Comparison

Variable	State Average	Messalonskee Lake
Transparency	5.3M	5.7M
Chlorophyll	5.7 ppb	3.2 ppb
Phosphorous	11.2 ppb	11 ppb
Color	20.1 SPU	15 SPU
Alkalinity	11.11 mg/L	22.9 mg/l
pH	7.23	7.26
Conductivity	52.6 µS/cm	79 µS/cm
Flush Rate*	1-1.5	.69

**flush rate is per year*

McGrath Pond is the smallest of the Belgrade Lakes, as such it has maintained a lower profile than its bustling neighbors. The pond is publicly accessible through a launch on the north end of the pond, also providing access to Ellis Pond. Historically McGrath was a coldwater fishery, however due to excessive nutrient loads it is now predominantly a warmwater fishery. Brown Trout *(Salmo trutta)* are stocked by MIFW, while populations of Smallmouth *(Micropterus dolomieu)* and Largemouth *(Micropterus salmoides)* Bass and Chain Pickerel *(Esox niger)* and Black Crappie *(Pomoxis nigromaculatus).*

McGrath has similar plant life to it's neighboring lakes, with the variation of more shallow water plants due to the ponds more shallow nature. The loon count identified 12 adult's in 2023 and 7 in 2022 with 2 juveniles in 2022. There are no identified Bald Eagle nests on McGrath.

Whether due to it's smaller size, or the lack of commodities available lakeside, McGrath has avoided commercial and recreational development for the most part. Camp Tracy and Woodrest Cottages lie on the western shore with the remaining shoreline being developed by residences both seasonal and year-round.

Rivers and Streams

The largest stream in Belgrade, Belgrade Stream, connects Long Pond and Messalonskee Lake. There are significant spans of freshwater marshes at both the inlet and the outlet of the stream as well as the length. The much smaller Mill Stream connects Long Pond with Great Pond, cutting through the Belgrade Village.

There are several perennial streams in Belgrade; however, because of the topography, 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 Water Resources Map (Appendix) shows Belgrade's streams, lakes, ponds, and wetlands. Most streams are bounded by the Shoreland Zone or the Critical Resource Conservation District, as set forth in the Shoreland Zoning Ordinance. The Stream Protection District includes all land areas within seventy-five (75) feet, horizontally, of the normal high water mark of a pond or river or 250ft horizontally of a freshwater wetland.

The state has four classifications for freshwater rivers, streams, and brooks: AA, A, B, and C. The classification system should be viewed as a hierarchy of risk more than for use or quality assessment. 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. The state has four classifications for freshwater rivers, streams, and brooks: AA, A, B, and C. The classification system should be viewed as a hierarchy of risk more than for use or quality assessment. 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. The classifications are detailed below.

- **Classes AA** involve little risk since activities such as waste discharge and impoundment are prohibited. The expectation to achieve natural conditions is high and degradation is unlikely.
- **Class A** waters allow impoundments and very restricted discharges, so the risk of degradation, while quite small, does increase since there is some small human intervention in the maintenance of the ecosystem.
- **Classes B** has fewer restrictions on activities but still maintain high water quality criteria. Class B 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.
- **Classes C** has the least restrictions on use and the lowest (but not low) water quality criteria. Classes C waters are still good quality, but the margin for error before significant degradation might occur in these waters in the event of an additional stress being introduced (such as a spill or a drought) is the least.

All brooks, streams, and rivers in Belgrade are class B. These 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.

Wetlands

Wetlands serve many important functions. As natural low points, they absorb floodwater, they act as stormwater storage areas and surface water filtration systems. They also provide critical habitat for certain species of birds, fish and aquatic mammals and are particularly important as breeding grounds. Wetlands are unique environments necessary for certain aquatic vegetation as well as providing open space for some forms of recreational enjoyment or aesthetic appreciation. Wetlands are also crucial for

preserving water quality since they have been proven to hold sediments, nutrients, and other pollutants from waters before they reach streams and rivers.

While a precise definition of a wetland is not universally accepted, making it difficult for local authorities to enforce the laws, wetlands share three essential elements. They all have non-permeable soils, a water table at or near the surface, and there is a presence of water-loving vegetation (rushes, cattails, red maple).

The National Wetlands Inventory maps and categorizes America's wetlands. These categories are broken down by size, fresh or saltwater, dominant vegetation type and acidity. While all are freshwater, Belgrade has wetlands where the dominant vegetation species are classified as Forested, Forested/Scrub, and Emergent species. Forested wetlands are classified as those with woody vegetation that is 6m tall or taller, Forested/Scrub wetlands are comprised of woody vegetation that is less than 6m tall, typically saplings, shrubs, or trees that have been stunted due to environmental conditions. Emergent species are typically herbaceous perennials, excluding mosses and lichens.

Wetlands in Belgrade span across all of the above classifications. Most are classified as forested or forested/scrub however there are large sections of emergent wetlands located primarily at the southern end of Messalonskee Lake and scattered along Belgrade Stream. The wetland system located at the southern end of Messalonskee Lake spans over 1,300 acres and provides critical habitat for several rare and uncommon species.

Among other standards, the Belgrade Shoreland 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.

Maine Natural Area Program has mapped significant vernal pools in some Maine towns, including Belgrade. There are two mapped vernal pools that are considered significant, one near the southern end of Great Pond and another in North Belgrade near Ellis Pond. 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.

LAND RESOURCES

Land Cover

Most of Belgrade is covered by forest. The large majority of forested land is privately owned and actively managed by private homeowners. Some parcels are entered into tax relief programs that require forest management plans, while others are not managed at all.

The combination of varying terrain, and extensive water components, results in that Belgrade does not have any large-scale commercial farming in the town. There are a handful of farms that sell goods at small local stores, farm stands and farmers markets. Despite the lack of any large-scale agricultural use, there are numerous areas of town that are classified as being prime farmland. These parcels of land are not concentrated in any area of Belgrade, with the largest parcels located along Manchester rd. and Oakland rd.

WILDLIFE HABITAT

Belgrade is home to a diverse range of species including several rare and endangered species. Whitetail deer, bald eagles, golden eagles, lynx, bobcat, osprey, moose, river otters, black bears, beavers, snowshoe hare, rare terns, and loons are all known to live in and around Belgrade.

The extent and quality of wildlife habitat is an indicator of not just the richness and diversity of the flora and fauna in Belgrade, 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 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 Belgrade'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 many other parts of Maine, the population is small in the Belgrade region. The summer habitat of the White-tailed Deer 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.

Belgrade has four deer wintering areas, with three located in North Belgrade and one in the western half of town next to Long Pond. There are no identified candidate deer wintering areas. Deer wintering areas are a particularly important resource in this area of the state because the high snow depth is a limiting factor for the deer population. The town should develop methods to protect both candidate and identified deer wintering areas.

Rare, Endangered and Valuable Species and Habitats

Beginning with Habitat compiles data on rare, endangered, and valuable species and habitats in Belgrade (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.

Fish & Wildlife

Data from the Beginning with Habitat Program, managed by the Maine Natural Areas Program documents two bald eagle nests in the Belgrade area, a nest on the east shore of Long Pond, and a nest on the western shore of Messalonskee Lake.

The large marsh system at the south end of Messalonskee Lake has been classified as key Inland Waterfowl/ Wading Bird Habitat. This marsh supports numerous bird, plant, animal and fish species, including the endangered Black Tern *(Chlidonias niger)* and Least Bittern *(Ixobrychus exilis)*. This area is one of only a dozen known nesting sites in Maine for the black tern. The Belgrade colony is one of the longest established and largest colonies in Maine. The least bittern is a secretive species, with only 18 documented populations in Maine at the time of the last study.

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 no known rare or endangered plant species in Belgrade.

Undeveloped Habitat Blocks, Connectors and Conserved Land

Flora and Fauna species depend on undeveloped and undisturbed blocks of habitat specific to the species feeding, breeding and behavioral or ecological needs. 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.

Referencing maps of Belgrade shows that not only are the majority of lots large and forested, but the majority of Belgrade is also privately owned and managed. The 7 Lakes Alliance is a regional land conservation organization and has entered over 9,400 acres of land in the Belgrade Lakes region into permanent conservation.

As land changes ownership and becomes more parceled and fragmented, there will be more of a need to actively regulate development and land use activities to preserve the wildlife composition. 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.

Natural Areas

As stated in the topography portion of this chapter, Belgrade contains one of the finest examples of the Kettlehole Bog-pond ecosystems in the state of Maine. This ecosystem is characterized by flat peatlands in circular depressions, typically deeper than they are wide.

There is also an area of an Unpatterned Fen ecosystem. This system is similar to that of the Kettlehole Bod system, with the main differentiation being the presence of flowing water. This exposes the plants present to a higher level of nutrients creating a more diverse system.

REGULATORY PROTECTIONS

In addition to state and federal standards to protect water quality, Belgrade's Shoreland Zoning Ordinance was last updated in 2018, as such it is in compliance with the Chapter 1000 Guidelines for Municipal Shoreland Zoning Ordinances. The Shoreland Zoning Ordinance delineates five districts for the purpose of protecting water resources.

Resource Protection District – The RPD 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 shoreland zone, exclusive of the Streat Protection District:

1. 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 by the Maine Department of Inland Fisheries and Wildlife (MDIF&W) as of 2018.
2. Flood plains along river, defined by the 100 year flood plan as designated on the Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Maps

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

3. Areas of two or more contiguous acres with sustained slopes of 20% or greater. Areas meeting these criteria shall be in a subdistrict designated Resource Protection-Slope District.
4. 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 connected to a water body during normal spring high water.
5. Land areas along rivers subject to severe bank erosion, undercutting, or river bed movement
6. Areas designated by federal, state, or municipal governments as natural areas of significance to be protected from development.

Limited Residential – encompasses those areas suitable for residential or recreational development. It includes areas other than those in the Resource Protection District, or Stream Protection District, and areas which are used less intensively that those in the Limited Commercial District, or the General Development District.

Limited Commercial – Includes areas of mixed light commercial and residential uses, exclusive of the Stream Protection District, which should not be developed as intensively as the General Development District. This district includes areas of two or more contiguous acres in size devoted to a mix of residential and low intensity business and commercial uses. Industrial uses are prohibited.

General Development District – The general development district includes the following types of areas:

1. Areas of two or more contiguous acres devoted to commercial, industrial, or intensive recreational activities including, but not limited to, the following:
    a. Areas devoted to manufacturing, fabricating, or other industrial activities;
    b. Areas devoted wholesaling, warehousing, retail trade and service activities, or other commercial activities;
    c. Areas devoted to intensive recreational development and activities such as but not limited to amusement parks, race tracks and fairgrounds.
2. Areas otherwise discernable as having patterns of intensive commercial, industrial or recreational uses;
    a. Portions of the general development district may also include residential development. However, no area shall be designated as a General Development District based solely on residential use.
    b. In areas adjacent to great ponds and adjacent to rivers flowing to great ponds, the designation of an area as a General Development District shall be based upon uses existing at the time of adoption of this Ordinance. There shall be no newly established General Development Districts or expansions in area of existing general development district adjacent to great ponds, and adjacent to river with flow to great ponds.

Stream Protection District – The Stream Protection District 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 is located within two-hundred and fifty (250) feet, horizontal distance, of the above water bodies or wetlands, that land area shall be regulated under the terms of the shoreland district associated with that water body or wetland.

Belgrade's 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 ordinances regulating development 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.

THREATS TO RESOURCES

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.

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 Belgrade is encompassed in lake watersheds, this can have a major constraint on development.

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 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 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.

Naturally Occurring

While Belgrade is known for its natural setting, there are natural elements that pose a risk to residents. Two known contaminants in the environment that may be present in Arsenic (As) and Radon (Rn). Both elements are known carcinogens that can be found in the air and drinking water. Some locations have higher concentrations due to the soil and bedrock. Arsenic is also produced due to manmade industrial and agricultural practices.

Of increasing concern is the threat of the introduction of invasive species. Unfortunately, Belgrade has become the epicenter of the invasive Northern Pike's *(Esox Lucius)* presence in the state. This voracious predator was introduced illegally into the Belgrade Lakes in the 1970's, likely to create an exciting sport fishing opportunity. Pike are able to

grow over 40 inches long and tipping the scales at 30 pounds or more, this species is the largest freshwater fish in Maine. Northern pike are damaging to native populations not only due to their large size and fast growth rate, but also to their predatory nature. While young, the pike consume key forage fish species but also cornerstones of natural fisheries such as trout and salmon. Maine Department of Inland Fisheries and Wildlife does not actively manage northern pike fishing, there are no bag limits or size limits on pike. Management plans have historically been contentious, some anglers desire the hard fighting fish and encourage the release of smaller specimens to let them grow. The state encourages the removal of any northern pike caught, and anyone found releasing an invasive species could be subject to fines.

Several bodies of water in Belgrade are also home to variable water-milfoil *(Myriophyllum heterophyllum).* Messalonskee Lake, Belgrade Stream, and Great Pond are all known to have infestations of the weed. All forms of milfoil are aggressive growers and will quickly spread through a body of water. Once established, the plant will crowd out native species and, if not managed, will begin to change the quality of the waterbody and fish species that are able to survive. There are several programs working to slow the spread of milfoil in Belgrade. Local watershed associations provide a courtesy boat inspection service. This program deploys a mixed staff of volunteer and paid staff to boat launches to inspect boats, both motorized and non-motorized, trailers, fishing gear, and other equipment to check for the presence of invasive species as they both exit and enter the water.

While Belgrade is not isolated from invasive populations of both plant and wildlife species, the introduction to new locations and spread within a body of water, while either intentional or accidental, is a threat to native populations. Measures should continue to be taken and supported to further protect the resources of Belgrade.

Manmade

Marinas, industrial contractors, and other locations that have generators, fuels, and chemicals on site all pose a level of risk to the environment and groundwater. As products are used in the course of day to day operation they area at risk to be impacted by storms causing runoff into adjacent bodies of water and in some cases produce leachate into aquifers. Belgrade's largest aquifer runs directly through the Depot area of Belgrade which contains the largest commercial entities in town.

An ongoing and constantly emerging pollution concern is the presence of so called "forever chemicals". Forever chemicals refer to the group of man-made chemicals that include those known as PFAS. Studies have found accumulation of these chemicals in samples of water, soil, wildlife, and fish across Maine. A few common ways that PFAS has been introduced into the environment is in the spreading of sludge, septage and landfill material, as well as through the use of some fire-fighting foams commonly found at airports. Due to the long lifespan of these chemicals, they are able to build up in natural systems.

There are four sites that have been mapped by the Maine Department of Environmental Protection to have had sludge utilized in Belgrade. All three are located in North Belgrade, off the Smithfield Road. There are two more locations where septage was applied to farmland, off the Penney Road. Numerous wells across town have been tested, with all results coming back under the adopted standard of 20 nanograms/liter. While overall, standards, guidelines, and remediation measures are still in the process of being developed and being made available to Maine residents, if a resident's well tests above the standard, there is a process to have a filtration system installed.

Point Source/Non-Point 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.

--Point/Non-Point source pollution locations in Belgrade?

Remediation Sites

Maine DEP files indicate that there are three locations in Belgrade involved in a contamination remediation program. There is one site in the Brownfields Program as of the writing of this plan. Three sites are closed Voluntary Response Action Program locations, while the municipal landfill took place in the State's landfill closure program.

Table 9: Contamination Sites in Belgrade

Known Contamination Sites in Belgrade						
Site	**Site Name**	**Address**	**Program**	**Status Date**	**Status**	**IC Control**
REM03399	Gagne Precast	28 Old Rt,27	VRAP	5/24/2023	Undertaking Post Closure Obligations	False
REM00032	Belgrade Municipal Landfill	Dunn Rd.	Landfill Closure	7/30/1993	Undertaking Post Closure Obligations	True
REM02707	Chandler Road Landfill	86 Chandler Road	Landfill Closure	10/18/2015	Undertaking Post Closure Obligations	False

Source: Maine Department of Environmental Protection

LOCAL AND REGIONAL COORDINATION

Belgrade is fortunate to have multiple local and regional partners who are dedicated to ensuring the enduring quality of the towns water and natural resources. There are numerous Pond/Lake Associations that through education, advocacy and volunteer efforts work to protect the waterbody and watershed against destructive or otherwise harmful impacts. These associations include:

- McGrath Pond and Salmon Lake Association
- Friends of Messalonskee
- 7 Lakes Alliance
- Belgrade Lakes Association

The 7 Lakes Alliance also works to purchase land and conservation easements throughout Belgrade to preserve land with a high ecological value. At the time of this update, over 9,400 acres in the Belgrade Lakes region has been entered into various permanent conservation easements or purchases.

ANALYSIS

- Belgrade's abundant natural resources play a vital role in the town's tourism- and resource- based economy,
- The town has implemented several restrictions that would prevent damage to land and water bodies.
- Aquifers in Belgrade were mapped in 2000. A number of land uses above or adjacent to the aquifer pose a significant threat of contamination.
- Belgrade adopted a subdivision ordinance which contains measures to protect ground and surface water.
- Belgrade has shoreland zoning however does not have other zoning regulations in place.
- Belgrade is fortunate to have very large unfragmented blocks of land needed for wildlife habitat. However, where most of this land is privately owned, the town should be active in its conservation efforts.

FUTURE CONSIDERATIONS

Climate change is expected to bring more extreme weather events that will worsen any existing deficiencies in stormwater management, erosion control, and development on steep slopes. This may cause damage to infrastructure or buildings in low-lying areas of town.