



# **2015 Open Space Plan**

**Town of Greenwich, CT**

**Recommended for Adoption as an  
Addendum to the 2009 Plan of Conservation and  
Development**

**By the Conservation Commission**

**March 9, 2015**

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## Chapter I: Introduction

The responsibility of a local municipality is to ensure the quality of life for its residents and nothing gets more to the heart of quality of life issues than open space. Open space has long been recognized as an important part of the Greenwich landscape. Whether the land is in public or private ownership, open space provides clean water, clean air, wildlife habitat and biodiversity, moderation of temperatures, flood storage, scenic vistas, recreation, and education. From manicured parks to undeveloped natural areas, our residents enjoy the many tangible and intangible benefits of open space.

Open space means many things to many people. To some, it is a forested landscape that provides for wildlife habitat and hiking trails. To others, it is a highly developed public park with ball fields, picnic areas, and a concession stand. Generally, it is land that is recognized as “green”, has not been developed for commercial or residential use, and provides some public benefit.

Greenwich adopted its last Open Space Plan in 2002 at a time when the first Geographic Information System (GIS) was introduced in the Town of Greenwich. The 2002 plan focused on using the new technology to digitize the open space inventory for the first time. Since then, the Town has adopted a 2009 Plan of Conservation and Development, has enhanced its GIS capabilities, and has worked with partners to add major tracts to Greenwich’s open space inventory including Calf Island, Treetops and Pomerance-Tuchman properties. In addition, large land owners – both public and private – have begun to look at best management practices for stewardship of their open space.

The 2015 Open Space Plan factors in all these changes and recommends the Town focus on two key areas:

1. Increasing the amount of permanently protected open space to meet or exceed the state goal of 21%;
2. Improving the management of existing open space to maximize overall public benefits.



Beach and coastal habitat at Greenwich Point Park.

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The 2015 OSP contains analysis of the current status of Greenwich's open space. Although the plan overlaps with other environmental concerns including watershed management, it is focused specifically on open space protection and management and is intended to compliment but not replace other resource planning documents. Rather it sets a goal for open space protection and makes recommendations for actions needed to reach this goal. It also recognizes that it is not just enough to protect open space but that stewardship of the protected land is important. Additional resources developed for inclusion in this OSP include a map layer for conservation easements, the beginning of a database of deed information about open space

protections, and a natural resources inventory for discussion of future open space protection.

Greenwich should be proud of its success over the past twelve years in protecting and managing open space. Cooperation, commitment and public/private partnerships have all contributed to that success. With today's high land values, changing demographics, and competing land uses, it is essential that Greenwich plan for the protection and proper management of open space to ensure that its benefits will be available for future generations. What better legacy could we leave our children than clean air, clean water, the flight of a shorebird, or the solace of a wooded trail.



"Secret Garden" overlooking the pond on the Town-owned Pomerance property.

## Chapter II: Existing Conditions/ Natural Resource Inventory

### Introduction

The Town of Greenwich is fortunate to have a wealth of natural resources within its borders. From water to woodlands and from wildlife to glacial erratics, our natural resources give character to our community and provide residents with many benefits including ecosystem services and recreational opportunities. An inventory of our existing natural resources and an understanding of their importance and their threats are essential parts of updating the Open Space Plan.

### Topography and Geology

The complex geologic history of the northeastern United States coastal area has produced the essential character of the land forms in Greenwich. Greenwich is located at the intersection of two major geological formations: the southern portion of town lies in the Atlantic Coastal Plain, or Iapetus Terrane, while the "back country" in northwest Greenwich is at the edge of the New England Upland, or Proto-North American Terrane. The intersection of these two terranes is known as Cameron's Line, where between 450 and 320 million years ago, several collisions of the two terranes resulted in metamorphism, faulting, and mountain building. In the areas northwest of Cameron's Line, heat and pressure from these collisions transformed existing rock

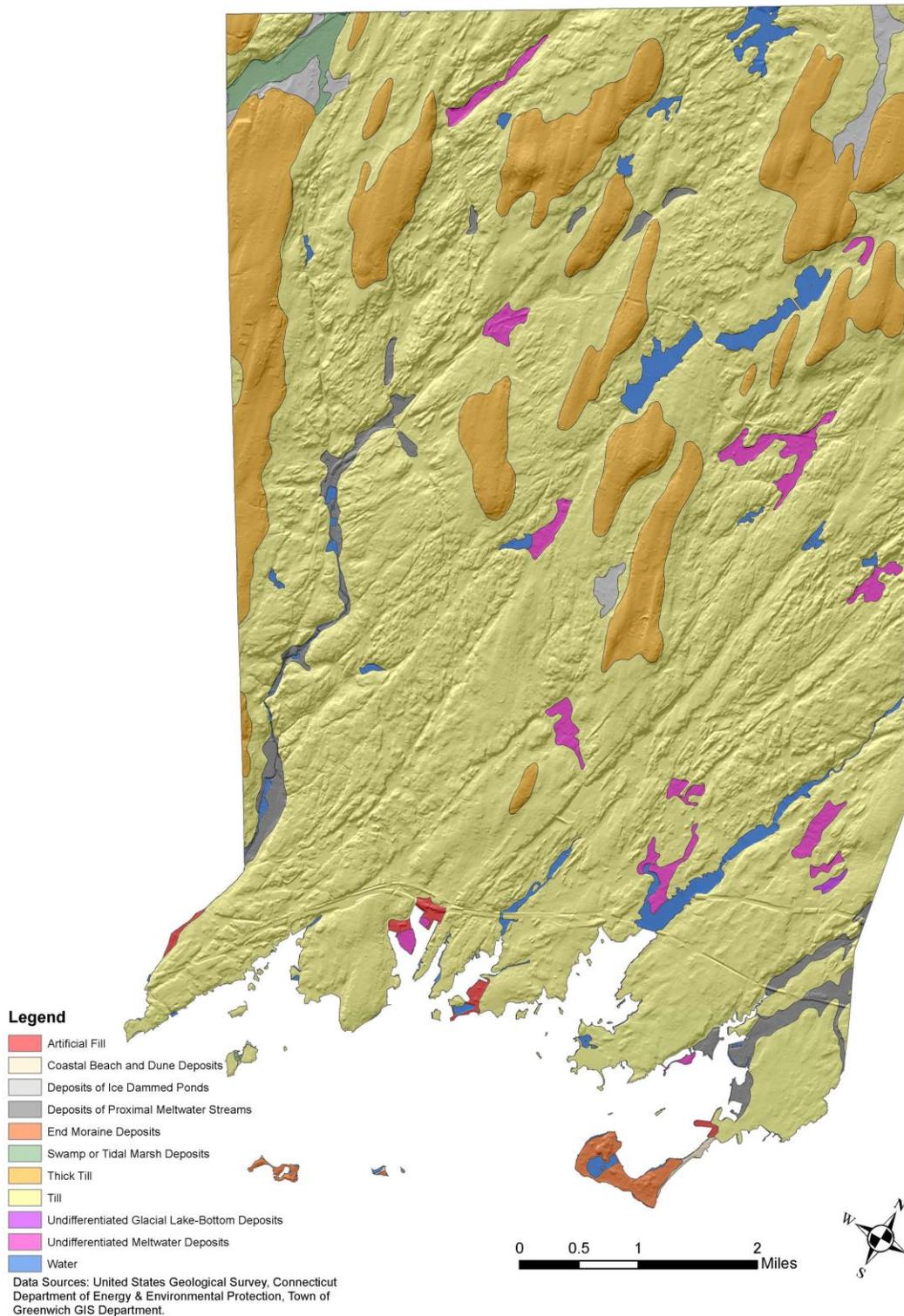
into Manhattan Schist, Fordham Gneiss, Inwood Marble, and Lowerre Quartzite. Southeast of the line, the Greenwich landscape is dominated by Harrison Gneiss and the Hartland Formation, which were shaped as the sea-floor was pushed up against the mainland.

The differences in the fracturing and weathering of each of the rock formations have strong influences on the local topography of Greenwich. An example of this localized topography can be seen on the northern part of Riversville Road, where it cuts across a valley and swampland that is underlain by a band of Inwood Marble. The marble is both softer and more soluble than the surrounding rock formations, and therefore, is worn down closer to sea level.

During the last great glacial period, continental glaciers flowed across New England, sculpting the landscape. They carved the surface as they advanced, pressing the bedrock into the earth's mantle by virtue of the great weight of the ice, and scraping up and carrying enormous quantities of soil and rock that is referred to as surface debris. Much of this debris was transported great distances by the glaciers; notable examples of this include huge boulders, known as glacial erratics, that appear to be out of place scattered throughout the Greenwich landscape.

Around 17,000 years ago, the last (Wisconsin) glacier retreated from Connecticut. As the glaciers melted and retreated, glacial debris was deposited forming the terminal moraine that we

# TOWN OF GREENWICH, CONNECTICUT Quaternary (Glacial) Geology



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now know as Long Island and creating a fresh water lake known as Glacial Lake Connecticut. As the ice continued to melt and the sea level rose, the terminal moraine was breached and salt water entered Glacial Lake Connecticut, beginning the formation of the Long Island Sound coastline that we have today.

The retreat of the glaciers did not happen all at once. They retreated and advanced and then retreated again, forming successional moraines that in part form many of the islands in Long Island Sound. As the glaciers retreated, they also left behind great masses of glacial deposition in north-south bands, which correspond to the series of north-south running hills,

alternating with stream-filled valleys throughout Connecticut. These hills, known as drumlins, are dominant landscape features in Greenwich. One of the more prominent drumlins is Quaker Ridge along Riversville Road in northwest Greenwich.

Perhaps the most visually and historically significant aspect of the physical geography of Greenwich is its position on Long Island Sound. The Greenwich shoreline can be described as a drowned coastline. This means that at one time, when much of the world's water supply was locked up in the glaciers, the water level of the ocean was much lower than it is today. As the glaciers melted, the level of the ocean rose, filling in many of the



Bedrock outcrop at the town-owned Babcock Preserve.

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glacial valleys, but leaving the high points dry. The resulting coastline is quite complex and typical of New England; if a straight line were drawn between Greenwich's east and west boundaries across the Long Island Sound frontage, the line would be about six miles in length; however, the Greenwich coastline is actually around 35 miles in length, with an additional 7.6 miles of coastal frontage on offshore islands.

In summary, the basic visual impression of Greenwich's topography is that of a coastal town with an interior sharply undulating landscape. A low lying yet jagged relief is broken up by north-south bands of rolling glacial till. The high point of Greenwich, located near where Round Hill Road crosses the border into New York State, is about 600 feet above sea level, meaning that the land rises to the inland at an average rate of about 70 feet per mile. More details on the local geology and topography can be found in the booklet "[The Geology of Greenwich, Connecticut](#)" by Reed A. Schwimmer 1987 produced by the Greenwich Conservation Commission.

## Soils

Soil is defined as an unconsolidated mixture of minerals, organic material, water, and gases that is on the immediate surface of the earth. It is a dynamic ecosystem, which serves as a natural medium for the growth of terrestrial

plants. There is a great variety of soil types, each with different properties that can influence drainage patterns as well as the type of plants that grow in an area. While there are 45 different types of soil found in Greenwich, 76 percent of the land area is composed of just 8 types of soil which have a major impact on flora and fauna.

Generally, the dominant soil types in Greenwich have a depth of less than 40 inches to bedrock or other restrictive layer. This includes a number of soil complexes with rock outcrops as a component; these features are characterized by a depth of 0 to 4 inches to bedrock. However, other dominant soil types that include Canton, Charlton, Leicester, and Udorthents components, may have depths greater than 80 inches to bedrock or another restrictive layer. The water table is generally close to the surface in most areas of Greenwich and consequently there are very few aquifers of appreciable size in surficial deposits due to the shallow bedrock. This is an important factor to consider when assessing the supply of groundwater in Greenwich.

The majority of the dominant soil types in Greenwich are considered to be well drained soils. However, 11.43 percent of the land area in Greenwich is covered by poorly drained or very poorly drained soils including the Ridgebury, Leicester

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<b>Major soil types in Greenwich</b>			
<b>Soil Type</b>	<b>Acreage</b>	<b>Percent Area</b>	<b>Drainage Classification</b>
Charlton Chatfield Complex	6701.87	21.76	Well Drained to Somewhat Excessively Drained
Hollis-Chatfield Rock Outcrop Complex	5701.96	18.51	Well Drained to Excessively Drained
Paxton and Montauk Soils	2780.51	9.03	Well Drained
Woodbridge Fine Sandy Loam	2022.16	6.56	Moderately Well Drained
Ridgebury Leicester and Whitman Soils	1957.70	6.36	Poorly Drained to Very Poorly Drained
Udorthents-Urban Land Complex	1668.70	5.42	Moderately Well Drained to Excessively Drained
Urban Land-Charlton-Chatfield Complex	1511.35	4.91	Well Drained to Somewhat Excessively Drained
Canton and Charlton Soils	1217.34	3.95	Well Drained
Other Soils	7242.53	23.5	Various

and Whitman soils, as well as a variety of other minority soil types.

The soils in the southern portion of town reflect the higher levels of development and urbanization present in this region. This region is dominated by the Udorthents-Urban Land Complex and the Urban Land Charlton Chatfield Complex. Urban soils frequently exist as some variation of other soil complexes that have been altered through urbanization and development. These urban soils generally exhibit some degree of disturbance which

may include some or all of the following: mixing, compaction, low organic content, contamination, and the presence of fill and construction debris.

Healthy soils are a vital component of all ecosystems. Soil quality in Greenwich is impacted by a number of man-made and natural pressures including land use change, land management practices, and climate change. In many areas of Town, soils have been lost, drastically altered, or covered up by development. Because degraded soils may have a reduced ability

to carry out their natural functions and they are often very difficult to restore once impaired, it is vital to protect and properly manage these important resources.

### Water Resources

#### *Long Island Sound*

Forming the southern boundary of Greenwich, the Long Island Sound estuary is one of the Town's most significant and beautiful natural resources. An estuary is defined as a semi-enclosed coastal body of water, which has a free connection with the open sea and forms a transition zone between marine and freshwater environments.

Long Island Sound extends 110 miles east to west, separating Connecticut and Long Island. At its widest point, the Sound is 21 miles wide; off of Greenwich the width is approximately 7 miles. The US Environmental Protection Agency has designated Long Island Sound as an estuary of national significance, whose estuarine waters, natural ecosystems, and economic activities have been deemed by Congress to be critical to the environmental health and economic well-being of the nation.

Long Island Sound provides a diverse array of habitat types including beaches, dunes, rocky intertidal areas, deep and shallow open water habitats, eelgrass

beds, and tidal wetlands. The wide variety of habitats support a diverse assemblage of plant and animal species and also provide a myriad of ecosystem services. One critically important and especially vulnerable habitat type is tidal wetlands, which are among the most productive ecosystems on earth. Tidal wetlands are wetlands that are periodically flooded and exposed by the rising and falling tides. Greenwich has approximately 44.5 acres of tidal wetlands as defined by their hydric soil type.

Tidal wetlands provide important foraging, nesting, and refuge areas for many species of birds, critical nursery habitat for fish species, as well as important habitat for many other organisms that inhabit the Long Island Sound coast. They also offer several other ecosystem services including trapping sediments and nutrients, reducing turbidity, filtering out heavy metals and other toxins, buffering against flooding, as well as reducing the impacts of storm and wave energy.

Long Island Sound is a tremendously productive estuary that supports a number of important commercial and recreational fisheries. More than 120 species of finfish inhabit the sound and it provides important spawning habitat for more than 50 of these species. Long Island Sound also supports more than 1,200 species of invertebrates, including several recreationally and commercially

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important species such as oysters, scallops, clams, lobster, and other shellfish. Greenwich's coastal waters support a variety of shellfish including oysters, hard and soft shell clams, and blue mussels, however poor water quality in Long Island Sound prompted the closure of these beds in 1960 by the CT Department of Agriculture. In 1986, 14 years after the passage of the federal Clean Water Act, the Greenwich Shellfish Commission was formed and began working to re-open the town's shellfish beds. Today, through careful management and improvements in water quality, the beds are open and support an important recreational shellfishery for town residents.

The natural beauty and diversity offered by Long Island Sound's coastline attracts many recreational boaters, beachgoers, and naturalists who, in turn, form an important component of the local economy. The Town of Greenwich owns and manages 8 coastal parks: Greenwich Point Park, Byram Beach, Grass Island, Island Beach, Great Captain's Island, Bruce Park, Roger Sherman Baldwin Park, and the newly restored Cos Cob Power Plant site. It also has 3 marinas: Greenwich Point Marina, Mianus River Marina, and the Grass Island Marina.

One of the biggest challenges Greenwich residents will face in the coming years is finding ways to deal with the rising sea levels and increased frequency of severe

storms that are anticipated in association with global climate change. It is estimated that sea levels have risen about 0.8 feet over the past 100 years in Long Island Sound. This trend is expected to continue, and even low sea level rise projections of 1-2 feet by the end of this century would result in the loss of between 38 and 83 acres of Greenwich's current shoreline. This will impact the entire Greenwich coastline including all of our coastal parks and the recreational opportunities and ecosystems they support.

## *Rivers, Streams, and Watersheds*

A watershed is an area of land where all of the water that falls on it or drains off of it flows out to a common waterbody. Most watersheds are drained by a river or stream, though some are drained by direct surface runoff or groundwater flow. All of the land in Greenwich is within the Long Island Sound Watershed. In Greenwich, the land area is further divided into six subregional watersheds with their associated streams, as well as an area of land that drains directly into Long Island Sound.

## **Byram River Watershed**

The Byram River Watershed is approximately 30 square miles and is spread over portions of Greenwich and

five other towns in Westchester County, New York. The headwaters of the Byram River are located in North Castle NY. The Byram River drains into Long Island Sound and serves as the boundary between Greenwich and Port Chester, NY. The Route 1 Bridge is considered to be the boundary between freshwater and estuarine sections of the river.

Water quality of the Byram River is generally fair and varies throughout the watershed. The mainstem Byram River received a surface water quality classification of B. The east branch of the Byram River as well as Pemberwick Brook received a classification of A, indicating higher quality. The tidal portion of the river is classified as SB indicating impairment.

The hydrology of the Byram River watershed is heavily influenced by dams. Over 40 dams are present in the watershed today; most of these are historic mill dams that are relicts of the area's agricultural and industrial past. Despite the presence of these dams and other human alterations to the river channel, portions of the Byram River watershed still have functional floodplains that are subject to periodic riverine flooding.

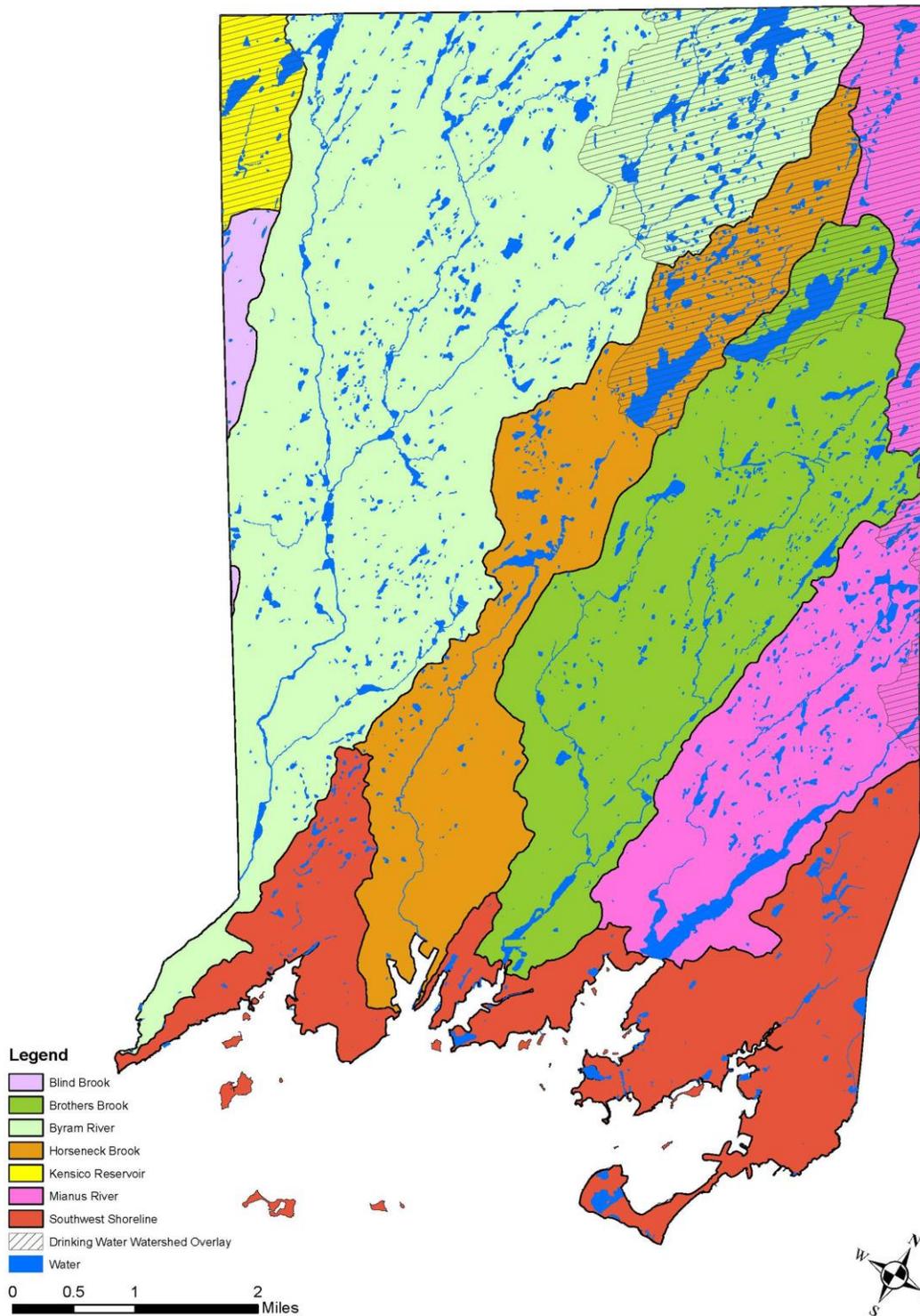
The Byram River Watershed Coalition completed a [watershed management plan](#) for the Byram River in fall 2011. This plan provides a detailed evaluation of non-point pollution sources and offers advice

## Connecticut Water Quality Classifications

Under Connecticut's Water Quality Standards, classifications have been established to provide guidance in the regulation of surface and ground waters such that water quality is maintained or improved. The classes as well as their associated designated uses are listed in the table below.

Class	Designated Uses
<b>Inland Surface Waters</b>	
AA	Existing or proposed drinking water supply, fish & wildlife habitat, recreation, agricultural & industrial water supply
A	Potential drinking water supply, fish & wildlife habitat, recreation, agricultural & industrial water supply, navigation
B	Fish & wildlife habitat, recreational use, agricultural & industrial water supply, navigation
<b>Coastal &amp; Marine Surface Waters</b>	
SA	Marine fish, shellfish, & wildlife habitat, shell fish harvesting for direct human consumption, recreation, navigation
SB	Marine fish, shellfish, & wildlife habitat, shellfish harvesting for transfer to approved areas for purification prior to human consumption, recreation, navigation
<b>Groundwater</b>	
GAA	Existing or potential public supply of water suitable for drinking without treatment; baseflow for hydraulically connected surface water bodies
GA	Existing private and potential public or private supplies of water suitable for drinking without treatment; baseflow for hydraulically connected surface water bodies.
GB	Industrial process water and cooling waters; baseflow for hydraulically connected surface water bodies; presumed not suitable for human consumption without treatment
GC	Assimilation of discharge authorized by the Commissioner pursuant to Section 22a-430 of the General Statutes.

## TOWN OF GREENWICH, CONNECTICUT Watersheds and Water Features



Data Sources: United States Geological Survey, Connecticut Department of Energy & Environmental Protection, Town of Greenwich GIS Department

on minimizing their impacts with good land management practices.

## **Mianus River Watershed**

The Mianus River Watershed drains approximately 34 square miles and is the public drinking water supply for Greenwich and surrounding communities. The headwaters of the watershed are found in North Castle and Bedford, NY. The majority of the watershed is found in Stamford, CT, North Castle, Bedford, and Pound Ridge of Westchester County, NY.

The Mianus River watershed is fragmented by a number of dams that greatly influence the watershed's hydrology. Notable dams in the watershed are the Samuel Bargh Reservoir Dam in northern Stamford and the Mianus Mill Pond Dam in Greenwich, which serve as storage and diversion points for the Aquarion Water Company, as well as the Mianus Pond Dam, which forms a barrier between freshwater and marine environments. A fishway at the Mianus Pond Dam forms a critical link for many aquatic organisms between the Mianus River watershed and Long Island Sound. Strickland Brook is a major tributary that joins the Mianus River in the lower portion of the watershed and is subject to a combination of tidal and riverine flooding after rain events.

Water quality in the Mianus River is good to excellent, receiving the highest rating of AA. Under the direction of the Southwest Regional Planning Agency, and in coordination with the Town of Greenwich and the Mianus River Watershed Council, a [watershed management plan](#) was completed for the Mianus River in 2012.

## **Horseneck Brook Watershed**

Horseneck Brook Watershed is approximately 6.52 square miles and is contained entirely within Greenwich. The watershed begins in northeastern Greenwich just above Upper Cross Road and extends southwest to where it drains into Long Island Sound in the vicinity of Shore Road. The public water supply reservoir Putnam Lake is found in the watershed just south of the Merritt



A small section of Horseneck Brook flowing through a high quality riparian area.

Parkway. Water quality in the Horseneck Brook watershed is good to excellent. Those waters that drain into Putnam Lake received a rating of AA, while those waters that flow from Putnam Lake received a rating of A.

## **Brother's Brook Watershed**

Brother's Brook Watershed is approximately 8.89 square miles and is contained entirely in Greenwich. The watershed begins just north of Lower Cross Road and extends southwest to where it drains into Long Island Sound in the vicinity of Bruce Park. The public water supply reservoir Rockwood Lake is found in the upper portions of the watershed. Water quality in the Brother's Brook watershed is good to excellent. Those waters that drain into Rockwood Lake received a rating of AA, while those waters that flow from Rockwood Lake received a rating of A.

## **Southwest Shoreline Watershed**

The Southwest Shoreline Watershed is composed of areas near the coast that tend to drain directly into Long Island Sound as surface runoff or as groundwater flow. Most of the Southwest Shoreline watershed is heavily developed and in close proximity to the coast. Streams in this watershed, such as Cider Mill Brook, area heavily influenced by tidal cycles and

area especially prone to flooding. The portion of the Southwest Shoreline watershed located within Greenwich has an area of approximately 11 square miles.

## **Other Watersheds**

There are small portions of the Blind Brook and Kensico Reservoir watersheds in the northwest corner of Greenwich. The Blind Brook watershed has an area of approximately 10 square miles, of which less than .5 square miles is in Greenwich. The Kensico Reservoir watershed has an area of approximately 13 square miles, of which approximately .9 square miles is in Greenwich that drains into the Kensico Reservoir system which is part of the drinking water supply for New York City residents.

## ***Lakes, Ponds, and Reservoirs***

Greenwich has an abundance of fresh water resources, including still waters that range in size from small ponds and to large public water supply reservoirs. Many of these lakes and ponds, however, were manmade by placing dams and creating impoundments of local streams. Most of these are small ponds on private properties created either as farm ponds or for aesthetics. Although they provide for open water habitat that is different from streams, they are subject to sedimentation and eutrophication.

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The largest lakes in Greenwich are the public water supply reservoirs, Putnam and Rockwood lakes. Putnam Lake has an area of approximately 100 acres and Rockwood Lake has an area of approximately 105 acres. These lakes and much of the surrounding land area are private property owned and maintained by Aquarion Water Company. These lakes supply water to a number of Greenwich and NY residents. The 51-acre Mianus Pond is the only publicly owned pond of appreciable size. It supports an important pond habitat for alewife. Mianus Pond also provides recreational opportunities including fishing and kayaking.

### *Inland Wetlands and Watercourses*

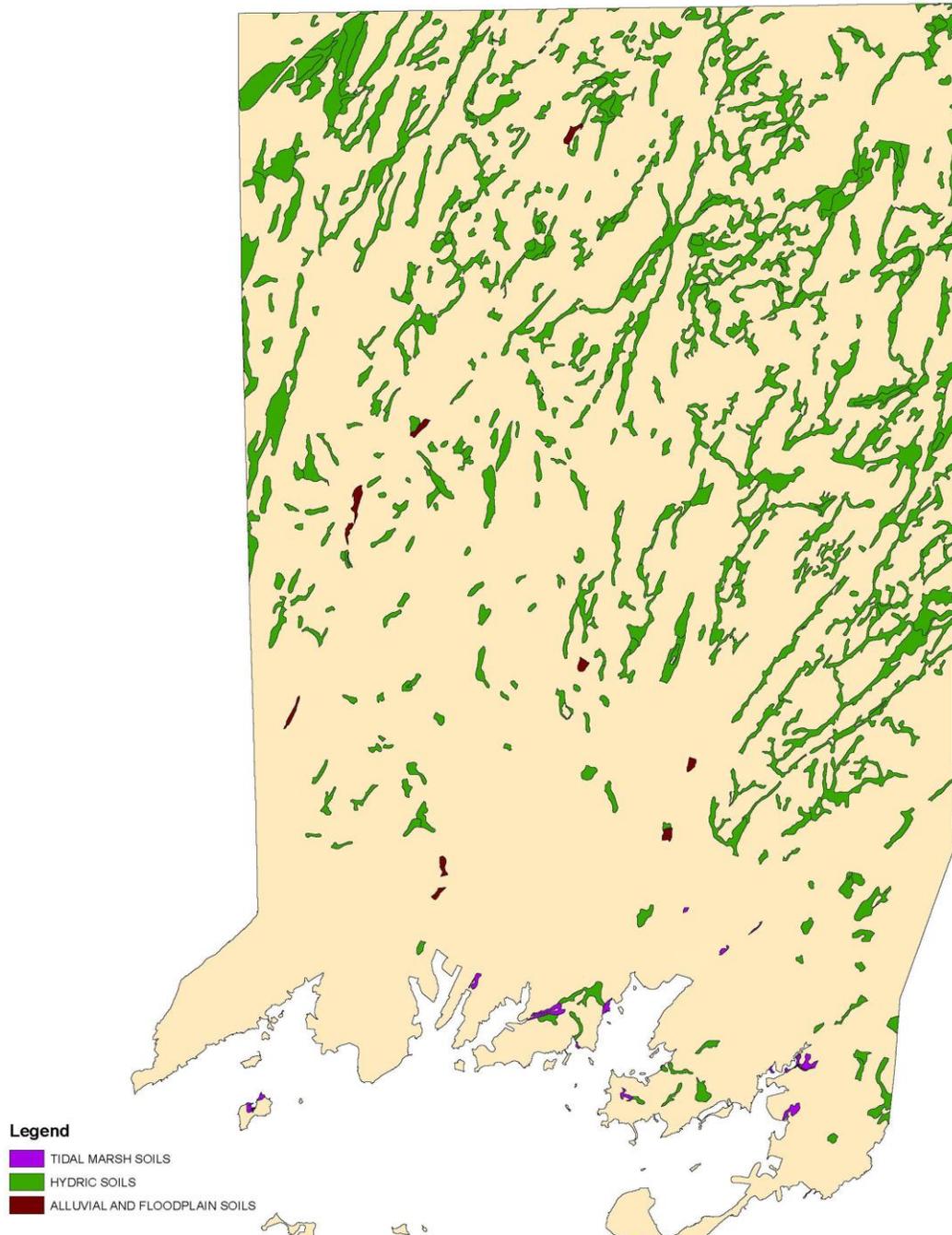
Inland wetlands provide a multitude of ecosystem services and are an invaluable asset to the town. They help to maintain surface and groundwater supplies, control flooding, and mitigate pollutants. They also provide important habitat. In Connecticut, inland wetlands are defined by soil type, as outlined in the CT Inland Wetlands and Watercourses Act (IWWA). Using the Natural Resources Conservation Service (NRCS) soil classification system, wetland soils are those that are classified as poorly drained, very poorly drained, alluvial, and floodplain soils. There are approximately 3890.5 acres of inland wetland soils in Greenwich.

Many of the largest intact wetlands in Greenwich are found on open space properties. Notable wetland features in Greenwich include the approximately 300 acre Tamarack Swamp in the northwest corner of Town near Interstate 684. There are also an abundance of wetland features in the upper reaches of the Horseneck Brook watershed, including those found in the town-owned Babcock Preserve. The red maple swamp is the most prevalent type of wetland in Greenwich.

Vernal pools are a unique type of wetlands that are defined not only their hydrology but by the wildlife they support. Due to the natural topography and shallow to bedrock soils in Greenwich, vernal pools are scattered throughout the forested upland landscape. Examples of vernal pool habitat can be found on most of the Town owned open space parcels north of the post road including Babcock Preserve, Mianus River Park, and Montgomery Pinetum/Pomerance/Tuchman properties.

Vernal pools are temporary bodies of water that form in small depressions during the spring due to snowmelt, precipitation, and elevated water tables and do not support fish populations. They provide a unique habitat that supports obligate species that only vernal pool. In Connecticut these include Jefferson, blue spotted, marbled, and spotted salamanders, wood frogs, fairy shrimp, and, the State endangered eastern

## TOWN OF GREENWICH, CONNECTICUT Wetland Soils



\*In the State of Connecticut, wetlands are defined based on soil type. Under the Connecticut Inland Wetlands and Watercourses Act, wetland soils consist of poorly drained and very poorly drained soils, known as hydric soils, as well as alluvial and floodplain soils. Some alluvial and floodplain soils are also hydric, though for the purposes of this map these soils are shown as hydric soils.  
Data Sources: United States Department of Agriculture Web Soil Survey, Town of Greenwich GIS Department



spadefoot toad. Since vernal pools are often small and may be dry for much of the year, they are frequently overlooked as important wetlands. This makes them especially vulnerable to degradation.

### *Hydrogeology and Groundwater*

Groundwater, or water that is located beneath the earth's surface, is a critically important resource in Greenwich and plays an integral role in both human and natural environments. Typical uses of extracted groundwater include drinking, bathing, sanitary use, watering of lawn, filling of swimming pools, and other miscellaneous uses such as washing cars. Groundwater also supplies a substantial amount of water to Greenwich's streams and it is estimated to make up 35 percent of total annual stream flow.

Groundwater enters the earth's surface through infiltration of precipitation. After ground water enters the earth's surface, it is stored in and flows through pore spaces in permeable rock or unconsolidated material known as aquifers. Aquifers can form in both surficial deposits as well as fractures in crystalline bedrock. Surficial deposits in Greenwich are composed primarily of till, a non-sorted mixture of gravel, sand, silt, and clay deposited by glaciers. The poorly sorted and compacted nature of till reduces the amount of pore space available to groundwater. Glacial stratified deposits, on the other hand,

consist of sorted layers of gravel, sand, silt, and clay deposited in the melt water from a retreating glacier. The sorted nature of these deposits gives them a relatively high level of pore space, making them among the most productive aquifers. Glacial stratified deposits exist in only a few isolated areas of Greenwich, the largest of which can be found beneath the Tamarack Swamp and in the Banksville section of town.

Groundwater supplies are recharged primarily from October to May during the non-growing season. Groundwater quantities usually decline due to increased evapotranspiration and loss of soil moisture during the growing season. The amount of groundwater recharge is also impacted by landscape factors such as slope, vegetative cover, variations in geology, and soil moisture. Human activities can impact the amount of groundwater recharge. Impervious surfaces can limit the amount of recharge by preventing infiltration and causing an increase in the amount of surface runoff. Interestingly, septic systems can lead to an increase in the amount of recharge in certain circumstances. The water flowing from septic systems can represent a net increase in the amount of groundwater in those areas of Town where households are served by the public water supply system and have a septic system. This occurs since the water from the public water supply system originates from an outside area.

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In a 2002 report by USGS, groundwater recharge rates in Greenwich were estimated to range from 3.9 to 7.5 in/mi<sup>2</sup>/year. The areas with the highest recharge were generally found in the northern sections of town. The more urbanized southern section of town had the lowest recharge rates, likely as a result of the higher percentage of impervious surfaces. Despite the low recharge rates, groundwater supplies are under relatively little stress in the southern section of town, as this area is largely served by the public water supply and it receives very little groundwater withdrawal. The average amount of residential groundwater withdrawals was estimated to range from 0 to .16 million gallons/mi<sup>2</sup>/day. The areas with the highest amount of residential groundwater withdrawals were found in the upper reaches of the East Branch of the Byram River watershed as well as the upper reaches of the Mianus River watershed. These areas of Town as well as most of “backcountry” Greenwich are characterized by large lot and dwelling sizes and consume more water than households in other sections of Town. The above estimates of groundwater consumption do not include the groundwater that is withdrawn by large consumers such as golf courses or schools. Further study is needed to determine the level of withdrawal exhibited by these consumers. As development continues in

Greenwich, groundwater supplies will become increasingly important.

### *Drinking Water*

Drinking water in Greenwich is supplied by both surface and groundwater. Depending on their location in town, Greenwich residents receive their drinking water supply from either private groundwater wells or public water supply reservoirs. By *area*, the majority of the town is served by private wells; however the portions of town served by public water supply have a much higher density of households. As such, the majority of Greenwich *households* receive their water from the public water supply.

Households served by the public water supply receive their water from a series of three reservoirs owned and operated by Aquarion and is referenced as the Greenwich System. Putnam and Rockwood Reservoirs are located in Greenwich while the Samuel Bargh Reservoir is located in Stamford. All three reservoirs receive the highest water quality rating of AA. The Greenwich System is a regional water supply and also serves residents of Port Chester, Rye, and Rye Brook, NY and some residents of Stamford.

Twelve percent of households receive their drinking water from private wells. Private wells in Greenwich primarily

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access groundwater stored in bedrock aquifers, as the extent of highly productive glacial stratified aquifers is limited. Groundwater quality in Greenwich is generally excellent, with the exception of a narrow band through the most developed portion of town. As a whole, Greenwich received a rating of GA or GAA. Groundwater rated GA or GAA is suitable for drinking without treatment. The narrow band through the most developed portion of town received a rating of GB and is presumed to be not suitable for human consumption without treatment.

## *Impacts to Water and Water Quality*

The water quality of any body of water is inexorably linked to the natural character and use of the land in its watershed. In Greenwich, a number of these factors negatively influence water quality and quantity. Some of the biggest concerns in Greenwich are detailed below.

### **Impervious Cover**

Impervious cover is defined as any surface that does not allow for the infiltration rainwater into the soil. Common types of impervious surfaces include roads, parking lots, driveways, sidewalks, buildings, pools, and tennis courts. It may also include lawns and other areas if the soil has become

compacted. By area, Greenwich is over 17 percent impervious cover based on data taken from the Town of Greenwich landcover dataset. The impervious features are not evenly distributed throughout Greenwich. The southern portions of Greenwich below Route 1 are heavily developed and have a much higher percent impervious cover than the rest of town. Some sub-basins in the region have greater than 70 percent impervious cover. The northern portions of town are less heavily developed and characterized by a blend of single family residential housing on larger lots and large open space properties with more natural cover. While there are sub-basins in each watershed that are below the impairment threshold of 12 percent impervious cover, no watershed as a whole is below the threshold. Only the Mianus River watershed is close at an even 12 percent impervious cover.

Impervious cover prevents infiltration of

<b>Watershed</b>	<b>Area (acres)</b>	<b>Percent Impervious</b>
Byram River	18878	19
Mianus River	21916	12
Brothers Brook	5689	16
Horseneck Brook	4173	21
Southwest Shoreline	6988	21

precipitation and leads to an increase in the amount and rate of surface runoff compared to natural cover types. This reduces the amount of groundwater infiltration and causes stream levels to be more “flashy” in response to precipitation. Increased levels of impervious cover can increase the frequency and severity of riverine flooding due to the increased surface runoff.

Water quality has been demonstrated to be negatively impacted in streams whose watersheds contain a high percentage of impervious cover. High levels of impervious cover increase the amount of stormwater delivered to streams. Stormwater contains a variety of pollutants which include but are not limited to chemical pollutants, fertilizers, pesticides, petroleum products, and human/animal waste. A 2008 report on moderately developed watersheds by the CT DEEP found that no watersheds with greater than 12 percent impervious cover met the Aquatic Life Use Support (ALUS) goals under the Connecticut Clean Water Act.

## **Turf Grass**

Turf grass/lawn is very common feature in the Greenwich landscape covering approximately 50 percent of the Town. Turf grass is typically found on private residential properties, golf courses, ball

fields, town parks, as well as school and corporate campuses. Areas of turf grass are frequently treated with fertilizers and pesticides in order to enhance their aesthetic appeal. These substances are frequently washed into streams during precipitation and are harmful non-point source pollutants. Excessive nutrient inputs from fertilizers washed into streams and ponds often result in extensive algal blooms and increased growth of aquatic plants. This boom in production is often followed by a drop in dissolved oxygen and subsequent fish kills as the plant material dies and decomposes.

Large areas of turf grass within a watershed can also alter drainage patterns. While turf grass is more permeable than impervious cover, it generates more surface runoff and permits less infiltration compared to natural forest cover. This is especially true if the soil under the turf grass was compacted during construction. Since 2008, the Town has managed its turf and playing fields organically to reduce the overall amount of pesticides and herbicides; some golf clubs and homeowners have also begun to manage their turf more ecologically.

## **Dams and Impoundments**

Dams are pervasive features in the Greenwich and greater Connecticut

## Town of Greenwich - Open Space Plan 2015

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landscape. In Greenwich alone, there are 87 documented dams of varying sizes that impound several miles of local streams. Throughout history, dams have served a number of purposes in Greenwich.

In the 18th and 19th centuries, dams supplied power to mills and helped support a burgeoning mill industry. Dams were also commonly used to create ponds to provide ice that was harvested for refrigeration. The 45 ft. tall Pemberwick Dam on the Byram River was constructed in 1867. Today, it is listed as a recreational dam in the US Army Corps of Engineers National Inventory of Dams (NID). The 24 ft. tall Mianus Pond Dam was constructed in the 1920s to provide cooling water to the Cos Cob Power Plant. Today most of these dams no longer serve their original purposes that they were designed for, but still impact local rivers.

Dams fragment stream habitats and act as barriers to the movements of aquatic organisms. Many species of fish and other aquatic organisms need to migrate to different habitats throughout their lives for feeding, spawning, and refuge. Most notably, migrations of diadromous fish such as alewife and blueback herring are blocked by dams. Diadromous fish are species that cannot complete their life cycle without migrating between fresh and saltwater. In the absence of fish passage structures, such as the fishway and eelpasses found at the Mianus Pond

Dam, diadromous fish populations would collapse in many Connecticut streams.

In addition to fragmenting stream habitat, dams can also greatly alter the physical characteristics of a stream. Dams often widen stream channels and slow the flow of water, allowing sediment particles to sink and settle out of the water column. This results in a gradual infilling of the streambed and ponded areas upstream, as well as a reduction in the amount of sediments available to be transported downstream. Consequently, many downstream habitats such as river banks and estuarine salt marshes, which are maintained through sediment deposition, are at increased risk of being lost through erosion.

Dams also can alter the natural thermal regime in streams. Dams often form ponds that are much wider than unaltered stream channels. As a result, surface waters are exposed to increased levels of solar radiation. Ponds may undergo thermal stratification, where the water separates into distinct layers; warm at the surface and cold at the bottom. Streams located below dams that release surface waters are often much warmer than before the dams were put in place, whereas streams below bottom release dams can be considerably colder. Water temperature is a major factor in determining which species of aquatic organisms can survive in a stream.

## **Septic Systems**

In Greenwich, there are a total of 6,210 properties covering 21,225 acres that utilize septic systems. The majority of septic properties are found in the northern two thirds of town. However there are still areas below Route 1 that use septic systems.

Septic systems are a potential source of nutrients and pathogens to streams and groundwater. Poorly maintained septic systems may not effectively treat waste and the outflow water may still contain excess levels of nutrients and fecal coliform. Untreated waste can also leach out of leaky septic systems and ultimately be delivered to streams through baseflow.

Although well drained soils generally are suitable for septic system installation, some are not. Specifically, soils that are shallow to bedrock and/or are excessively well drained often allow for rapid movement through the soil with little water quality renovation taking place. These problems may be exacerbated during storms.

## **Impacts of Domestic Animals and Wildlife**

Properties that house domestic animals or tend to attract concentrations of wildlife can create conditions that negatively

impact water quality. Heavy foot traffic and excessive grazing in these areas can lead to a breakdown in soil structure and reduced vegetative cover. Consequently, soils in these areas are subject to increased levels of erosion, which can result in increased nutrient and sediment loads in local waterways. In some locations with high animal concentrations, bacteria-containing fecal deposits can become excessive. Along with soils, these deposits can also be washed into local waterways during rain events, especially in areas without vegetated buffers.

While there are no large scale commercial livestock farms in Greenwich, there are some areas where concentrations of animals may contribute to a decline in water quality. Of particular concern are parks, beaches, and grassy areas near waterways where geese tend to congregate as well as urban areas where pets are frequently walked. The area near the Town transfer station has also been identified as an area where gulls roost and leave excessive fecal deposits. In the northern portion of Town, there are several horse farms that cover large tracts of land. Best management practices with regards to landscaping and fertilizing, manure management and limiting access to sensitive areas can help keep water quality impacts from these farms to a minimum.

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## Flora and Fauna Resources

The flora (vegetation) and fauna (wildlife) seen in Greenwich today is a result of natural and cultural influences. The layers of geology, topography, soils, and water resources, in combination with climate, have provided conditions to form a wide variety of ecosystems and habitats that support a diversity of species. Following glaciation, Greenwich evolved to become primarily a forested landscape with grasslands in the form of tidal wetlands along the coast.

Although the first people are known to have existed in New England by 10,000 YBP, significant human impacts on a landscape scale most likely began during the Woodland Period ( 3,000 YBP to 1700) where Woodland peoples practiced slash/burn agriculture and lived in large villages. Since the arrival of the Europeans in the early 1600's, the landscape of Greenwich has undergone a number of major changes. The land was systematically clear cut to create fields for agriculture and husbandry, turning most of the landscape in Greenwich from forest to farm by the mid-1800s. Between 1850 and 1950, farmland in Connecticut began reverting back to forest at a faster rate than land was developed, resulting in net gain in forestland. The stone walls serve as a reminder of the land's agrarian past.

Over the course of the 20th and 21st centuries, the rural character of Greenwich has been increasingly

converted to a more suburban and even urban environment. Throughout the Town, larger lots have been subdivided leading to an increased housing density. The intense development and associated re-grading has led to changes of topography in some areas. In some cases, native top soils are stripped and replaced with fill and covered with sod in order to create lawn areas where natural vegetation stood previously. Both of these factors combine to alter drainage and infiltration patterns of precipitation.

In 1940 Greenwich had a population of 35,509, by the 2010 census the population had grown to 61,171 people. This increase in population and land use resulted in the downward trend in forest cover beginning in the 1950's. It was at this time that the loss of the forest to urban development outpaced farmland conversion to forests with a negative net in forest cover. Development also took its toll on coastal resources where from 1880 to 1970, it is estimated that over 61% of the tidal wetlands in Fairfield County were destroyed, mostly by fill from construction projects including the railway. While the town's population has remained relatively stable in recent years, land development and sprawl continues to impact the natural resources of the town. It is within this context that the flora and fauna exist on the Greenwich landscape.

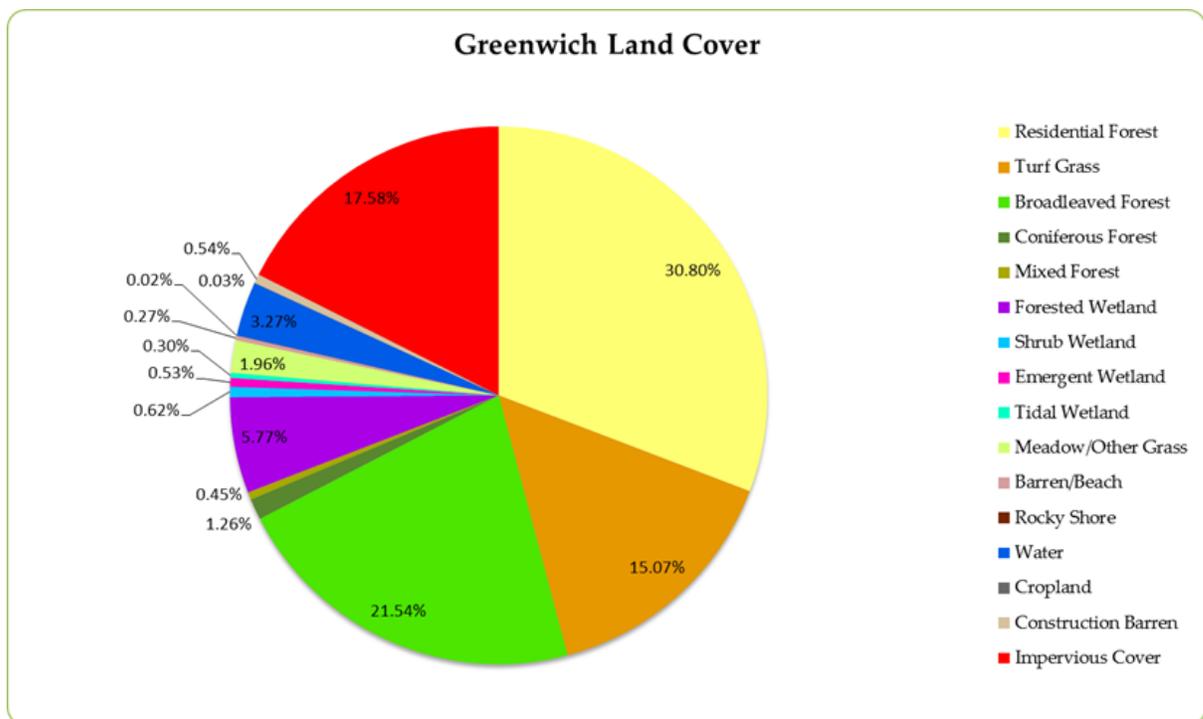
# Town of Greenwich - Open Space Plan 2015

## Vegetative Cover Types

In 2008, the Town completed a new aerial photography flight to update the GIS layers. This included infra-red photos that were used to create a detailed land cover layer for the Town that includes an inventory of major vegetative cover (See Appendix E). Approximately 29% of Greenwich is covered by natural forest. The most prevalent is upland broadleaved forest, covering 21.5% of the land, followed by forested wetland, which largely consists of red maple swamps and covers approximately 5.8% of the land area. Only 1.7% of the land is in conifers or mixed stands. The largest contiguous areas of broadleaved forest are found on open space properties in the northern portion of town.

The forest cover in Connecticut, in

general, and in Greenwich particularly, consists of a unique blend of forest tree species. Greenwich is located in a transition zone between the northern hardwood –conifer forest type and central hardwood forest type. The intersection of these two forest types leads to a diversity of plant species not seen in other parts of the state. The most common association in the central hardwoods is the oak-hickory association, which, in Greenwich, is represented by white oak, black oak, northern red oak, chestnut oak, eastern red cedar, sugar maple, sassafras, sweetgum, blackgum (tupelo), black birch, yellow (tulip) poplar, shagbark-pignut-bitternut hickory, and formerly American chestnut. Sweetgum and tulip poplar, are present in Greenwich and are at the extreme northern limits of their natural range. Common tree species in the





Broadleaf forest is the most common type of natural vegetation found on Greenwich's open space properties.

understory include flowering dogwood, eastern redbud, and serviceberry. Typical understory shrubs of the central hardwoods include witch hazel, blueberries, mountain laurel, viburnum, and beaked hazel. Mountain laurel (the Connecticut State flower) and witch hazel are prevalent in the understory throughout Greenwich. Northern hardwood-conifer representatives found in Greenwich are northern pin oak, trembling aspen, bigtooth aspen, black cherry, paper birch, gray birch, yellow birch, eastern white pine, northern red oak, red maple, eastern hemlock, sugar maple, and American beech.

Areas of coniferous forest are generally small and scattered around Greenwich. There is an approximately 26 acre area of coniferous forest spread across multiple

properties in the vicinity of Audubon Lane. Other smaller stands of coniferous forest are found along the shore of Putnam Lake and on a number of golf courses in Greenwich. Common species include eastern hemlock, white pine, and northern white cedar. Pure stands of white pine trees are considered to be plantation grown in Greenwich.

Over 30% of the land area in Greenwich has been identified as residential forest or urban forest. In these areas, the tree canopy is maintained but the natural understory has been replaced by turf grass, ornamental plantings, and impervious cover. The term urban forest covers a broad range of woody vegetation that is integrated into the manmade landscape, generally isolated from naturally occurring areas of forest.

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Besides residential properties, urban forests also include trees that line streets and sidewalks, trees planted around buildings, and trees in landscaped public parks. Within the urban forest, individual trees take on an important role. As part of a managed landscape, tree species in urban forests include a variety of native and ornamental trees.

Urban forests provide a variety of sociological and environmental benefits. The presence of trees in urban settings has been demonstrated to decrease the stress of residents. Trees increase property values and enhance the aesthetic quality of streets. Urban forests reduce energy usage by providing shade in the summer and blocking cold winter winds. They improve air quality by removing CO<sub>2</sub> and

other gaseous pollutants, and producing oxygen. Notable examples of urban forest include the trees along Greenwich Avenue, Old Greenwich, and Byram. The Greenwich Tree Conservancy, a nonprofit organization dedicated to protecting and enhancing the town's tree and forest resources, has been a champion in preserving the Town's urban forest.

Although they provide many benefits, urban forests function differently than natural forests. Urban areas typically are characterized by high levels of impervious cover and turf grass, resulting in greater amounts of surface runoff and decreased groundwater infiltration. Urban trees may help mitigate for storm water runoff by absorbing rain water, intercepting rainfall with leaves, and preventing soil



Patch of urban forest near Greenwich Avenue.

erosion, but they do not provide all of the ecosystem services of a natural forest. Compared to natural forest, urban forest usually provides limited habitat for wildlife. One particular area of concern is the impact on pollinators caused by the prevalence of ornamental, non-native species.

Grasslands are a small (< 3 %) but important component of the Greenwich landscape and include upland meadows, emergent wetlands, and tidal marsh. Grassland are generally defined as open areas dominated by a diversity of non-woody vegetation. Healthy grasslands contain a variety of native grasses, forbs, and wildflowers and provide higher quality habitat than turf grass to birds and other species of wildlife. The grassland habitat is found in the northern portion of town on large properties where horses are often kept, on Greenwich Land Trust and Audubon properties, as well as along the coast including on the publically owned Greenwich Point and Great Captains Island.

## *Threats to Native Vegetation*

### **Forest Pests and Invasive Species**

Greenwich forests are being threatened by several insect species. Similar to the chestnut blight that nearly extirpated the American chestnut, infestations of these pests may have devastating consequences

for some native tree populations. The hemlock wooly adelgid is a species of insect that poses a serious threat to the population of eastern hemlock. The hemlock wooly adelgid feeds on the phloem of new hemlock shoots and can prevent new growth on hemlock trees. Trees afflicted with the hemlock wooly adelgid can be identified by the small fuzzy white egg sacs deposited on the underside of hemlock needles. These have been found in Greenwich where many of our hemlocks are already infected. The emerald ash borer is an invasive beetle that has the potential to decimate the population of ash species in our region. Although not yet documented in Greenwich, they have been found in Fairfield and Westchester counties. The State of CT is under quarantine for this species. The Asian longhorned beetle, is another pest that is being closely monitored. It has been found from New York City to Boston, although no populations have yet been discovered in Fairfield County. This pest attacks a variety of hardwood trees including sugar maples. The Town, working closely with our partners, is monitoring for these pests and has trained volunteers how to identify these threats.

Throughout Greenwich, the understory of forested areas has been heavily impacted by the spread of invasive plant species. This led to decreased diversity of native plant species and a loss of habitat function. Invasive plant species generally

reproduce and grow very quickly, and are able to outcompete native plants for nutrients and light. They are usually well adapted to quickly colonizing areas affected by human and natural disturbances. In Greenwich, forest fragmentation from land development further exacerbates the problem. Invasive species often have few natural predators in new environments. Left unchecked, invasive plant species can form monocultures, preventing native forest regeneration, impairing water quality, and diminishing the value of habitat to wildlife, especially songbirds. Common



Invasive Japanese Barberry.



Dense monoculture of Japanese barberry dominating the understory in an area of the Babcock Preserve.

invasive plant species in Greenwich include phragmites, Japanese knotweed, Japanese barberry, non-native honeysuckle, burning bush, multiflora rose, porcelain berry, mile-a-minute vine, and oriental bittersweet.

### **Deer Browse**

Our forests are further impacted by excessive deer browsing from an overabundant population of whitetail deer. The lack of understory in Greenwich's forest is clear indication of the major impact. The carrying capacity of our forests is between 10 and 12 deer/sq. mi. and Greenwich's deer population is estimated at over 60 deer/sq. mi. This not only facilitates the spread of invasive species, which the deer do not browse as readily, but has a huge impact on the forest ecosystem. Deer browse is responsible for the decline in diversity of native plants including wildflowers, loss of habitat for birds, and also reduces the ability of the natural forest to control stormwater runoff.

### **Storm Events and Climate Change**

Long term precipitation records are showing that our region is experiencing more intense storm events but also longer periods between precipitation events. In Greenwich, our forests are having to adapt to these changing climatic

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conditions. Additionally, recent high wind storm events have also taken a toll on our natural and urban forests. Hurricanes and severe winter storms have displaced thousands of trees in Greenwich. With little or no understory to easily regenerate, this is opening up new areas to spread of invasive species. During these events, trees from our urban forest also caused damage to utility lines, infrastructure, and private property, as well as threatening human health and safety. As a result our urban forests are no longer seen as assets, but as threats by some members of our community. The Town, together with partners like the Greenwich Tree Conservancy, is working to ensure that our urban forests are properly understood and managed.

### *Fauna and Habitats*

Greenwich's landscape is home to a variety of wildlife habitats ranging from intertidal flats to forested uplands and from vernal pools to sandy beach, and it supports a wide variety of fish and wildlife species. With over 63,000 residents, the land use and development patterns in Town have resulted in fragmented forest blocks, significant loss of tidal wetlands, and with residential forest/turf grass being the single largest land use.

Within this urban landscape are pockets of natural forest and coastal habitats that

provide the complex mixture of food, cover, water, space requirements, and environmental conditions that animals require to survive. These provide the most diversity when they are linked together by corridors or greenways that allow animal species to maintain healthy breeding populations and foraging ranges. The Mianus River Greenway is one such corridor the runs from the Mill Pond in Cos Cob to the Mianus River Gorge Preserve in New York and has been recognized by the State of Connecticut as an important greenway. It includes the Pomerance/Tuchman/Pinetum, the Mianus River Park (Greenwich/Stamford), Mianus River State Park, and the Gorge, which is the first property ever protected by the Nature Conservancy.

The Byram River Watershed is another corridor with open space starting at the Caroline Place Pond in Pemberwick and ending with the Audubon Center property on Riversville Road. This corridor includes properties owned by the Boy Scouts, Greenwich Land Trust and the Fairchild Gardens, another piece owned by Audubon. The watersheds of Horseneck Brook and Brothers Brook, north of Putnam and Rockwood Lakes also have a significant amount of contiguous open space. Significant coastal open space areas with important wildlife habitat include Greenwich Point Park, Bruce Park, Grass Island, Byram Beach, Great Captains Island, Calf Island, and Shell Island.

## **Mammals**

Mammals are among the most charismatic classes of animals. The mammals found in Greenwich are representative of a typical temperate deciduous forest. Frequently observed mammals include: bat species, chipmunk, cottontail rabbit, coyote, red fox, mice, gray squirrel, mole, muskrat, opossum, raccoon, striped skunk, whitetail deer, woodchuck, and vole. Less frequently observed but still normally occurring species include beaver, bobcat, black bear, flying squirrels, river otter, and harbor seal. In June 2011, a mountain lion was sighted in Greenwich. Based on DNA testing, the mountain lion is believed to have wandered to Greenwich from the Black Hills region of South Dakota. The mountain lion was killed in an automobile collision in Milford, CT.

## **Birds**

A great variety of birds can be observed in Greenwich, with over 245 species documented to date. The number of species present varies widely throughout the year due to the migratory nature of birds. Audubon Connecticut conducts annual bird surveys and maintains a checklist that details the relative abundance of bird species throughout the seasons in Greenwich. eBird is a citizen science based effort in which local birders upload bird sightings into an online

database that is monitored by professionals for accuracy.

There are three Important Bird Areas (IBAs) found in Greenwich; all are properties identified in the open space inventory. IBAs are part of an international effort to protect and conserve bird habitats. The National Audubon Society administers the IBA program in the USA. IBAs in Greenwich include:

*Great Captain's Island:* Owned by the Town of Greenwich, Great Captain's Island (GCI) has an area of 17 acres and is approximately a mile off the coast of Greenwich. With more than 300 nesting pairs, GCI is the home the largest heron and egret rookery in the State of CT. GCI has also been shown to be an important stopover point for migratory birds.

*Greenwich Point Park:* Greenwich Point Park (GP) is a popular coastal park owned by the Town of Greenwich. With an area of 146 acres, it is one of the largest open space properties in town. As a result of the park's peninsular geography, GP has a great diversity of habitat types. GP serves as an excellent stopover point for migrant species, as an overwintering area for waterfowl, and the nearby islands provide breeding habitat for a variety of species.

*Audubon Center:* With an area of 521 acres, the Audubon Center IBA is comprised of 5 parcels located in north central Greenwich. Owned by the

National Audubon Society, the Audubon center property is one of the largest open space properties in town. The property has a variety of habitats including: mixed deciduous forest, old fields, water features, and wet meadows. Because of its unique location on Quaker Ridge, the Center is ranked in the top two hawk watch locations in Connecticut with over 10,000 raptors counted each year. The diversity and size of the property create some of the best upland bird habitat available in Greenwich.

The stretch of river north of the Mianus Fishway is being considered as an IBA. The spring runs of anadromous herring provide an important prey resource for a number of birds including osprey, herons, and egret.

## **Reptiles**

As cold blooded animals, reptiles are more commonly associated with warmer climates. However a number of reptile species can be found in Greenwich including a variety of turtles and snakes. Commonly observed turtles include: common musk turtle, common snapping turtle, eastern painted turtle, and the diamondback terrapin, which is found in estuarine environments. The eastern box turtle and the wood turtle, both Species of Special Concern in CT, as well as the State Endangered bog turtle, may also be found in Greenwich. While they are rare in this

region, varieties of sea turtles are observed in Long Island Sound every year. Common snakes found in Greenwich include the garter snake, northern water snake, eastern rat snake, and eastern ribbon snake. The copperhead is the only venomous snake with a range in Greenwich.

## **Amphibians**

Amphibians are unique vertebrates that generally spend the first part of their life cycle as aquatic organisms before metamorphosing into land animals. Streams and ponds, wetland areas, vernal pools, and upland forests provide essential habitat for these species. Amphibians which may be found in Greenwich include spring peeper, wood frog, bull frog, green frog, pickerel frog, gray tree frog, American toad, Fowler's toad, spotted salamander, marbled salamander, red-backed salamander, slimy salamander, two-lined salamander, northern dusky salamander, four-toed salamander, and eastern newt.

## **Fish**

The abundant water features of Greenwich are populated by a diverse assemblage of fish species. Lake and pond communities are dominated by bluegill and largemouth bass, with other species such as yellow perch, golden shiner, chain



Alewife are keystone species that provide a critical component of the food web for many of Greenwich's freshwater, marine, and terrestrial predators.

pickerel, and brown bullhead being common. The Mianus and Byram Rivers are stocked by the CT DEEP with brook, brown, and rainbow trout. There is a Trout Management Area (TMA) within the Mianus River Park. The Mianus Pond fishway passes one of the strongest runs of alewife and blueback herring in the state, with more than 90,000 herring passed each of the last three years since 2012. Sea run brown trout fingerlings are stocked in the Mianus River. After feeding and growing at sea, adult sea run brown trout return to the Mianus Pond via the fishway. The catadromous American eel is also passed at the Mianus fishway and an upstream eel passage program is being developed on the Byram River with funds from the Long Island Sound Futures Fund. Common marine species found in Long Island Sound include: striped bass, bluefish, blackfish, porgy, summer flounder, bunker, Atlantic silverside, and mummichog.

### **Mollusks, Crustaceans, and Other Invertebrates**

The coastal areas of Greenwich are host to a variety of invertebrate species. Coastal habitats include beach/dune, intertidal mudflats, rocky intertidal zones, tidal wetlands, tidal ponds, and the pelagic zone. Mollusks found in Greenwich include hard clams, soft shell clams, razor clams, eastern oyster, blue mussels, striped mussels, slipper shells, conch, snails, and barnacles. Crustaceans include American lobster, blue crabs, spider crabs, green crabs, fiddler crabs, and hermit crabs. Horseshoe crabs, though not a true crab but in the arthropod family, use the intertidal zones to breed.

Greenwich has both commercial and recreational shellfish beds. The Greenwich Shellfish Commission oversees the recreational shellfish beds that are located at Greenwich Point, Great Captain Island, and Island Beach (aka Little Captain Island). In 2003 the Commission planted two million half-inch, disease-resistant, Blue Point oysters in the Cove in order to replenish the oyster population decimated in 1997 by two oyster diseases not harmful to humans, MSX and Dermo. The oyster populations are recovering and the Commission has opened the oyster beds for limited harvest. The Shellfish Commission samples water quality in and around the Cove and islands regularly at about 30 stations. The samples are taken to the State Bureau of Aquaculture in

Milford for analysis. The on-shore beds are open from mid-October to mid-May; the offshore beds are open year-round. Shellfishing is monitored regularly by 25 volunteer wardens.

Several trends in Long Island Sound are also being observed in Greenwich. Blue mussel populations were low across the Sound, but in the past several years seem to be recovering. Slipper shells are very abundant resulting in piles of shell deposits some beaches. Horseshoe crab populations are being monitored and are a concern throughout their range. They are being harvested as bait for a robust conch fishery. This activity has been observed in Greenwich Cove.

Mollusk, crustaceans, and other invertebrates are not limited to coastal habitat. Fresh water species include fresh water clams, fingernail clams, and crayfish.

A large category of invertebrates are insects and relatives. These are abundant throughout town. Of particular note are pollinators that include many species of bees, butterflies, moths, flies, and beetles. Loss of habitat, replacement of native species with ornamentals, and use of pesticides is taking its toll on these species. Many species use water bodies in part of their lifecycle including dragon flies, damsel flies, caddis flies, and mosquitos.

For a more detailed list of fauna found in Greenwich, see Appendix D.

## *Living with Wildlife in Greenwich*

Management of certain wildlife species in open spaces may be necessary to ensure that the ecosystem maintains a healthy balance and the intended use of the property is maintained. Within the Town of Greenwich and many other parts of the country, overabundant populations of whitetail deer and resident Canada geese have damaging impacts on habitats and can impair the intended use of an open space property. The Town of Greenwich has been proactive in managing these species and has made efforts to restore a natural balance.

## **Whitetail deer**

During the past several decades, a number of trends have combined to create an over-abundance of white-tailed deer in Greenwich and the surrounding region. The historical shift in local land use patterns, from agriculture to residential, has led to a wooded landscape that provides both ample shelter and forage for deer. The increased residential density has resulted in a change from rural to suburban communities with newer homeowners representing different lifestyles and values. Where once hunting was part of everyday life, it is now often

not accepted as common practice. Old pastures have grown up into mature forest and thickets or have been replaced by homes with yards and gardens, all providing plenty of shelter and food for deer.

It is clear that without sufficient checks on the deer population, such as predation, hunting, or food limitations, it will inevitably continue to increase and take its toll on the region. Three major problems related to deer density have been identified in this area: a high incidence of Lyme disease; a dramatic loss of forest biodiversity; and an increase in deer/vehicle accidents. All three problems clearly have major negative impacts on human and environmental health.

In 2000, the First Selectman asked the Conservation Commission to make recommendations on the deer management. The Conservation Commission subsequently began a study of the deer herd with the University of Connecticut's Wildlife Conservation and Research Center and the Connecticut DEEP. In early 2001, an aerial survey was done by DEEP, which determined that in the backcountry (north of the Merritt Parkway) there were approximately 68 deer/mi<sup>2</sup>. From the Merritt Parkway south to Putnam Avenue (mid-country) there were up to 52 deer/mi<sup>2</sup> and south of Putnam Avenue there were relatively few deer observed. The carrying capacity of the land is 10-12 deer/mi<sup>2</sup>. In May 2004,

### Deer Densities in Greenwich CT taken from Kilpatrick 2004

Location	Deer Density (deer/mi <sup>2</sup> )
Backcountry (North of Merritt)	68.1
South of Merritt to Route 1	52.3
Below Route 1	≈ 0

preliminary results of the deer study were presented to the Conservation Commission. The Commission completed its management report and recommended that the deer herd size in Greenwich be reduced. Large land owners, including Audubon and the Town have conducted deer herd reduction programs and have encouraged private land owners to allow for hunting on their property. Although this may be holding the population steady, no significant gains in reducing the herd have been made.

### Resident Canada Geese

Overabundant populations of resident geese are a problem on properties with areas of short grass and/or water features such as town parks, ball fields, corporate campuses, and schools. The most obvious problem caused by an overabundant resident goose population is their copious feces production. A single goose can produce one to two pounds of feces per



Resident Canada geese can be a nuisance if they become overabundant on open space properties.

day. Consequently, the aesthetic and recreational value of properties can be impaired by goose feces. Goose feces can lead to excessive nutrient loading in water bodies, as well as contamination with fecal coliform bacteria. During nesting season, geese can be very aggressive toward people and have known to occasionally cause injuries.

The Town of Greenwich has been very proactive and is a leader in the control of resident goose populations in the region. Each spring Conservation Commission staff and volunteers oil goose eggs as part of the United States Fish & Wildlife Service Geese Peace program. Egg oiling is considered to be the most humane and effective method of stabilizing the resident goose population. The method employed by the Town of Greenwich is approved by The Humane Society. The Commission oils over 200 eggs annually

and volunteer residents oil another 60-80 eggs on private properties. The egg oiling program has helped to prevent continued growth of the resident goose population; however it may not be fully effective in preventing geese from becoming problematic in all areas. On some open space properties, dog handlers are contracted to aid in maintaining the aesthetic appeal of specific areas by using trained border collies to drive away geese. The dogs do not harm the geese, but continually harass them, causing them to seek out alternative locations where they will not be disturbed.

### **Bears, Coyotes, Foxes, & Raccoons**

Species of predators such as coyote, red fox, and raccoon are a common part of the Greenwich landscape. Generally, healthy members of these species pose no threat to

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humans. Since 2010, more sightings of black bear have been reported and documented. Despite their imposing physical characteristics, black bears are inherently wary of humans and attacks on humans are extremely rare.

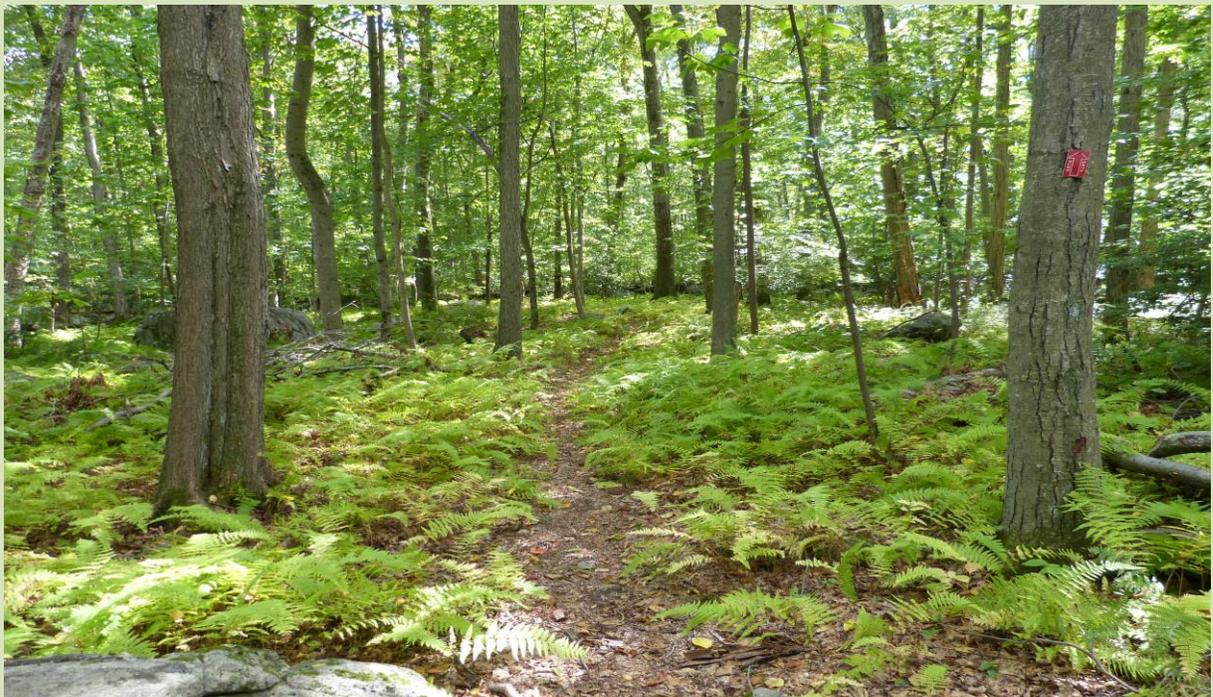
Problems may arise when people feel threatened by the presence of one of these species. Conflict can be avoided by eliminating food sources that would attract them to a property. Trash cans and pet food should be stored indoors and pets should not be fed outside. Bird feeders should be removed from April to November. Dumpsters, particularly in the back country, need to be bear secure. Although any mammal may carry rabies, raccoon and red fox are most likely to

become rabid. To avoid conflict with coyotes, keep small pets indoors and do not walk them from dusk till dawn as this is the time period where predators are most active. The Conservation Commission has created facts sheets for coyotes and black bear that are on the Town website at

[http://www.greenwichct.org/government/departments/conservation\\_commission/fish-and-wildlife-conservation-and-management/](http://www.greenwichct.org/government/departments/conservation_commission/fish-and-wildlife-conservation-and-management/)

Additional facts on wildlife species can be found on the CT DEEP Wildlife website at

<http://www.ct.gov/deep/cwp/view.asp?a=2723&q=326214>



A wooded pathway in the Babcock Preserve provides people with an opportunity to walk through a variety of wildlife habitats.

## Chapter III: Open Space Inventory

### Background

Greenwich adopted its last Open Space Plan in 2002. The completion of this plan was a major undertaking as no updates to the OSP had taken place since 1977, although an updated inventory map was completed in 1998.

In the twenty five years between plans, much had changed in Greenwich both on the landscape and in the land use planning office. Residential development was booming and the town had just acquired a new Geographic Information System. This provided the opportunity to analyze new land use data and digitize our existing open space inventory. It also created an opportunity to better refine how open space was categorized in town.

As part of the 2002 planning process, the definition and categorization of open space as either protected or un-protected was a key focus. The Commission has kept the definition of open space intentionally broad but was refined the categories that it uses for inventory purposes. In previous inventories, all large parcels of undeveloped land were classified by ownership and, regardless of deed restriction, were simply classified as open space. The 2002 OSP separated open space into protected and unprotected

### Open Space Definition

For the purposes of this plan, Open Space is generally defined, as "*Any area of land or inland water, including but not limited to, forest land, tidal and inland wetlands, and farm land, the preservation or restriction of the use of which would:*

- ❖ *Maintain and enhance the conservation of natural or scenic resources*
- ❖ *Protect natural streams or water supply*
- ❖ *Promote conservation of soils, wetlands, beaches, or tidal marshes*
- ❖ *Enhance the value or connectivity of wildlife habitat and greenways*
- ❖ *Enhance public recreational opportunities*
- ❖ *Preserve cultural landscapes*
- ❖ *Provide for resiliency against changing environmental conditions and storm events*
- ❖ *Promotes improved air quality."*

categories but noted that "*Open Space has various levels of protection depending on its ownership and/or deed restrictions.*" It recognized that parcels owned privately by individuals should be protected, but it was generally silent on land that was owned publicly or by an institution. It was evident that the dialogue on protected versus unprotected open space would continue and that the progress made in classification of open space in 2002 was just a beginning.

In 2009, the newly adopted Plan of Conservation and Development

# Town of Greenwich - Open Space Plan 2015

recognized that although the OSP was only six years old, there was more work to accomplish related to the inventory. It called for an update of the OSP specifically looking at increasing the acreage of permanently protected open space. A key task that was identified is updating the open space inventory/data base and including conservation easements.

## 2015 Open Space Inventory

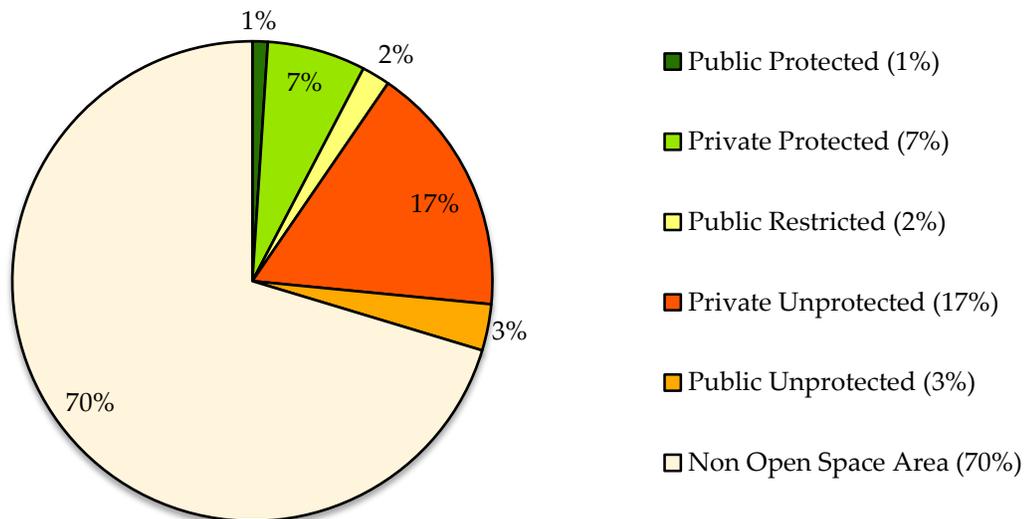
In 2010, the Open Space Plan Update Committee began its work on the inventory, building on the work of the 2002 OSP and using the open space definition as a guide. The now robust GIS system provided great opportunity to further improve the inventory and as a

result, the 2015 OSP inventory now includes: 1) a refinement of the categories of protected and unprotected open space, 2) a new GIS layer for conservation easements, and 3) the beginning of an open space database that includes references to deed restrictions as recorded on the land records.

Greenwich is a large town covering approximately 48.5 square miles or 31,045 acres. This plan has categorized approximately 30% of the town (9,208.5 acres) as either protected or unprotected open space as follows:

- **Public Protected:** town, state, or federally owned land with deed restrictions or designation as parkland.
- **Private Protected:** land in private ownership that has some level of deed restriction placed on it that precludes

### % Land in Greenwich as Open Space



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- development.
- **Public restricted:** town, state or federally owned land with some level of protection but does not preclude all development.
  - **Public unprotected:** town, state, or federally owned land that is used as open space but with no deed restrictions. This includes parks and undeveloped parcels that are part of public school property.
  - **Private unprotected:** private ownership that has no deed restriction placed on it. This includes parcels owned by various organizations where there is no permanent deed restriction. It also includes large parcels of land 10 acres or greater that do not have any structures.

The 2002 OSP categorized approximately 50% of the inventoried open space as protected. Using the more refined definitions above, the 2015 plan now accurately indicates that of the 9,208.5 acres defined as open space only 33% is protected or restricted. This represents just 9.73% of the total land area in Greenwich as having some level of protection and only 7.83% having more permanent deed restrictions.

A major accomplishment of the 2015 plan is the creation of a new GIS layer for conservation easements. Because easements represent only a portion of a particular land parcel, a separate GIS layer has been created from the land records showing all conservation easements that are held by the Town and

non-governmental organizations. Private conservation easements that do not provide permanent protection are not reflected in the inventory.

A final step in the 2015 inventory update was the beginning of a database that references the various deed restrictions in place on protected open space parcels. This ties into the GIS and will become a permanent part of the information on each parcel. See map in Appendix E.

Land Category	Acres
<b>Protected Open Space</b>	
Public	319.49
Private	2,110.46
<b>Total Protected</b>	<b>2,429.95</b>
<b>Restricted Open Space</b>	
Public	591.62
Private	0.00
<b>Total Restricted</b>	<b>591.62</b>
<b>Unprotected Open Space</b>	
Public	969.78
Private	5,217.14
<b>Total Unprotected</b>	<b>6,186.92</b>
<b>Total Acres of Open Space</b>	<b>9,208.50</b>
<b>Total Land Non Open Space</b>	<b>21,836.50</b>
<b>Total Land Acres in Greenwich</b>	<b>31,045.00</b>

**IV. Recommendations for Open Space Protection and Management**

Greenwich residents understand the importance of open space to the overall quality of life in town. They also understand that the Town needs an open space plan with measurable goals to ensure that the benefits of open space continue. For purposes of this plan, these goals have been divided into two key areas: 1) open space protection and 2) open space management.

**1. Open Space Protection**

**Goal - Permanently protect at least 21% of the land area in Greenwich to meet or exceed the State goal.**

The Town of Greenwich is one of the largest municipalities in Connecticut both in geographic size (48.5 sq. mi.) and demographics (63,000). Although it is located in the greater New York City metro area, one of the most densely populated regions of the United States, approximately 30% (9,208.5 acres) of its land area has been identified as open space. This provides a great opportunity for the town to reach the goal set by State of Connecticut of 21% (6,520 acres) of protected open space.

Open Space	Acres	Percentage
Protected	2,429.95	7.8
Restricted	591.62	1.9
Unprotected	6,186.92	19.9
Total Open Space	9208.5	29.7
Total Land Area	3,1045.0	100.0
<b>Total for Goal</b>	<b>6,519.5</b>	<b>21.0</b>

To date, only 33% of the Town’s open space land has some type of protective deed restriction. This represents 9.73% (of the total land area (~ 3,022 acres). Of this, only 2,429.95 acres are permanently protected and 591.62 acres are in need of more permanent protection. The 6,186.92 acres of open space that are not protected includes lands owned by the Town, utilities, and non-governmental groups. Only about one third is in residential ownership. It is recommended that the Conservation Commission coordinate a strategic effort that involves 3 tasks: 1) Identify non-residential parcels that should have permanent protection and develop a strategy to protect them. Two key Town parcels that are examples of open space that is not protected are Greenwich Point and the Babcock Preserve; 2) Complete a more detailed inventory of all residential open space to better understand the functions that each parcel provides; and 3) Conduct an analysis for each neighborhood south of the Post Road to ensure that there is adequate protected open space and green space in our more urban centers.

## Town of Greenwich - Open Space Plan 2015

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Generally, land can be protected as open space in two ways; 1) land acquisition/fee simple ownership; or 2) a conservation easement placed on the land but with land ownership remaining the same. In both cases, the permanent preservation is accomplished by the placing of deed restrictions on the land and recording them on the land record. Open space deed restrictions prohibit or limit development and use of property in order to protect the benefits and eco-system services that the open space provides. To make sure that the land is permanently protected, it is strongly recommended that a third party, with a land preservation mission, such as the Town's Conservation Commission or the Greenwich Land Trust, hold the deed restriction.

In Greenwich, most deed restricted open space is secured through either fee simple land purchase, purchase of development easements, donation of land or easement, and/or the land use regulatory process. In order to reach the goal of 21% permanently protected open space, the Town needs to make sure that all of these land protection tools are available as properties become available for protection. Specifically, the Town should consider establishing an open space fund as part of a public/private partnership with the Greenwich Land Trust and other agencies or groups. Since the 2002 Open Space Plan, the privately funded Greenwich Land Trust has preserved an

additional 19 properties, providing expansion of existing wildlife corridors and new pockets of open space in the community. These additional properties range from Old Greenwich to backcountry and from Cos Cob to Glenville and bring the total acres under the protection of the Greenwich Land Trust to 741 acres.

Additionally, the Town's land use agencies should review existing land protection regulations and policies and make recommendations that would help to reach the goal. This should include, at a minimum, a thorough review and update of the conservation zone regulations and a review of all deed restrictions placed on properties during the land use process.

# Town of Greenwich - Open Space Plan 2015

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**Goal 1: Permanently protect at least 21% of the land area in Greenwich to meet or exceed the State goal.**

**Objective A: Identify and prioritize parcels for permanent protection**

- Task A -1: Identify all unprotected Town-owned open space that should be permanently protected through deed restrictions and recommend for protection. (CC & PR)
- Task A -2: Develop a strategy for promoting the permanent protection of unprotected private institutional open space. (CC)
- Task A -3: Prioritize unprotected private open space properties (e.g. PA 490 properties) and identify for either acquisition and/or easement. (CC)
- Task A -4: Conduct an analysis of open space in higher density neighborhoods to identify need for green space/pocket parks in these areas. (CC & PZ)

**Objective B: Review and implement changes in land use policies**

- Task B -1: Development new policy/procedures for deed restrictions resulting from the land use process that includes 3<sup>rd</sup> party holders of deeds to ensure permanence. (LU)
- Task B -2: Review the Conservation Zone regulations and adopt changes to make them more effective through better incentives and viable alternatives. (CC & PZ)
- Task B -3: Improve the quality of set asides by developing new standards for both regular and conservation zone parcels. (CC & PZ)

**Objective C: Develop and implement financing strategies**

- Task C -1: Develop and recommend for adoption Town funding strategies for open space, including, but not limited to, a fee in lieu of open space set asides from subdivisions. (CC)
- Task C -2: Review and strengthen public/private partnerships for open space protection. (CC)
- Task C -3: Support tax incentives for conservation sales and donation of land and/or conservation easements. (CC)

Lead agencies for implementing tasks as follows: Conservation Commission (CC), Planning & Zoning (PZ), Land Use Department (LU – includes CC, PZ, & Inland Wetlands & Watercourses Agency), Parks & Recreation (PR)

## 2. Open Space Management

**Goal - Improve the active stewardship of all open space parcels to ensure their integrity through education, outreach, and implementation of best management practices strategies.**

Resource managers now understand that in our urbanized environment, open space lands need to be actively managed in order to preserve their many benefits. No longer can we simply purchase an open space parcel and assume that our work is done. Threats to open space include habitat degradation from pollution, invasive species and problem species, storm events, and human activities; encroachment by adjacent property owners; and/or violations of deed restrictions. Balancing the multiple use functions of our parklands is critically important in order to maintain the integrity of the parcel as open space.

One of the greatest threats is the proliferation of invasive plant species. They are pervasive across the Greenwich landscape and are having a negative impact on our open space lands. Managing and controlling invasive species on large tracts of land is usually difficult and expensive. Landowners will need to monitor and evaluate the presence of invasive plants on their properties and prioritize areas where resources can be most effective. This may include planning for remediation of an infestation that has resulted in a mono-culture or actively monitoring a healthy site to prevent a problem in the future. Additionally, increasing the bio-diversity of our natural areas through plantings and proper management is essential to the overall health of these areas. The invasive plant and biodiversity concerns are also impacted by overgrazing of our forest understory by white-tailed deer. The overgrazing reduces the effectiveness of open space areas to control and clean

### Problems with Invasive Plants

- Potential for rapid and widespread dispersal and establishment
- Potential to exist in high numbers when not intensively managed
- Can outcompete native plants



### Benefits of Native Plants

- Species diversity
- Ecosystem health
- Attract pollinators
- Provide habitat and food for native wildlife
- Locally adapted to environmental conditions

## Town of Greenwich - Open Space Plan 2015

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storm water runoff.

Illegal encroachment onto open space by adjacent landowners is also a widespread concern. In response to this growing problem, the Connecticut General Assembly passed legislation in 2006 making it illegal to encroach on open space that is owned by the state, town, or conservation organization. This provides an important legal tool sometimes needed by property managers. Monitoring of property boundaries, however, is an important first step for prevention and early detection of encroachment. The Greenwich Land Trust has established a program for routine monitoring of all of their properties. The Town and other organizations are encouraged to establish similar programs for their open space lands possibly through a public/private partnership that utilizes a trained volunteer corps.

A similar problem but one unique to the Town is the monitoring of conservation land protected as part of the land use process. Here the threat is often from the landowner violating a deed restriction that is placed on private property. Because these lands are often under private ownership, they are not monitored for compliance with the deed restrictions that have been placed on the land records as part of a land use decision. The Town needs to develop language to insert into the deed restriction that requires routine monitoring of the site.

For existing properties, the Town needs to establish a monitoring program, once again using a public-private partnership model. The new inventory of all conservation easements will assist with this task. The final major management issue on both public and private properties is managing properties for multiple uses. This is particularly challenging for public lands that often provide recreation opportunities that may be in direct conflict with other resource management concerns. "Loving our parks to death" is a common phrase used by land managers working to find the right balance. Greenwich is fortunate to have numerous public and private open space areas that provide for public access. With a population of 63,000 people, many who enjoy the parks with their dog(s), management is key to a successful balance. Management plans need to provide quality recreational opportunities without impacting water supplies or many of the other benefits associated with open space.

**Goal 2: Improve the active stewardship of all open space parcels to ensure their integrity through education, outreach, and implementation of best management practices strategies.**

**Objective A: Increase active stewardship of all open space.**

- Task A -1: Conduct inventory of key open space holders to identify level of stewardship. (CC)
- Task A -2: Develop benchmark criteria for evaluating progress toward stewardship goals. (CC & PR)
- Task A -3: Building on Greenwich Land Trust boundary monitoring program, develop and implement monitoring program on all Town-owned open space. Encourage similar program by other large landowners. (CC & PR)

**Objective B: Encourage land stewardship projects that protect ecosystem services, wildlife habitat, and cultural resources.**

- Task B -1: Review and/or develop source water protection plans for open space parcels in our public drinking water supply watersheds. (CC & PZ)
- Task B -2: Encourage large land owners to work at a landscape scale when managing properties for various habitats, looking at how their open space parcel fits into a regional context.
- Task B -3: Implement a monitoring plan for invasive plant species on all Town-owned parcels and develop a remediation/restoration schedule. (CC)
- Task B -4: Provide private landowners and contractors with technical information on invasive species best management practices coordinating outreach efforts with partners. (PR CC)
- Task B -5: Continue to monitor deer populations and support appropriate deer management on all open space parcels. (CC)
- Task B -6: Continue and expand Canada goose management program on both public and private lands using the GeesePeace program methodologies or similar methodologies. (CC)
- Task B -7: Create incentives to encourage good stewardship practices among landowners and contractors as well as provide them with information about federal cost share programs such as the [USDA-NRCS EQIP](#) program. (CC)
- Task B -8: Conduct an inventory of historic and archaeological resources and develop a plan for their protection. (CC)

Lead agencies for implementing tasks as follows: Conservation Commission (CC), Planning & Zoning (PZ), Land Use Department (LU – includes CC, PZ, & Inland Wetlands & Watercourses Agency), Parks & Recreation (PR)

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**Goal 2 (continued): Improve the active stewardship of all open space parcels to ensure their integrity through education, outreach, and implementation of best management practices strategies.**

**Objective C: Review and update land use regulations to improve the quality and biodiversity of open space**

Task C -1: Review land use regulations and revise to discourage forest fragmentation and promote habitat connectivity. (LU)

Task C -2: Require all land use applications to use native plantings in open space and encourage them in adjacent areas. (LU)

Task C -3: Establish monitoring program for land protected through the regulatory process and incorporate into new deeds. (LU)

**Objective D: Support increased stewardship for Town owned open space parks.**

Task D -1: Conduct use survey for all Town owned open space parks. (PR & CC)

Task D -2: Continue to develop and implement management plans for the Town's open space parks building upon the work that is Parks and Recreation has already started. (PR & CC)

Task D -3: Increase public awareness of the Town's open space properties (e.g. updating Our Common Ground, providing online maps of open space properties). (CC & PR)

Lead agencies for implementing tasks as follows: Conservation Commission (CC), Planning & Zoning (PZ), Land Use Department (LU – includes CC, PZ, & Inland Wetlands & Watercourses Agency), Parks & Recreation (PR)

The Conservation Commission is the lead agency on open space for the Town and will coordinate with other town departments and private partners on the implementation of the 2015 Open Space Plan. As part of this effort, the Commission will include tasks from this OSP in its annual Operational Plan as part of its required submission during the budget process. It will also specifically provide an update of progress related to these tasks in both the Annual Report and the Operational Plan each year.

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## **Appendix A:**

In the previous iterations of this plan, open space properties were categorized as public vs. private or protected vs. unprotected. The 2015 Open Space Plan uses a refined classification system that combines elements from each of the older classification systems. The new system takes into account both ownership information and the level of deed restriction placed on a property. The changes in the classification systems can be seen in the table below.

<b>1994 Plan Classification System</b>	<b>2002 Plan Classification System</b>	<b>2015 Plan Classification System</b>
<b>Public</b>	<b>Protected Open Space</b>	<b>Public Protected</b>
Parks, Playgrounds, Islands, Other Lands	Public Open Space (Parks, Playgrounds, Islands, State)	Town Land
Schools		State Land
Hospitals	Town Owned Conservation Easements	Federal Land
State Land	Audubon Greenwich	<b>Private Protected</b>
<b>Semi-Public</b>	Cemeteries	Association
National Audubon Society	Conservation Reserve Areas	Greenwich Land Trust
Greenwich Audubon Society	Subdivision Reserve Areas	Audubon Greenwich
Greenwich Land Trust	The Greenwich Land Trust	Other Non-Governmental Organizations
<b>Semi-Private</b>	The Nature Conservancy	Private Recreation
Conservation Reserve Area	Water Company Reservoirs and Land	<b>Public Restricted</b>
Subdivision Reserve Area (Parks and Playgrounds)	<b>Unprotected Open Space</b>	Town Land
Conservation Easement	PA490 Open Space	<b>Public Unprotected</b>
	PA490 Farm&Forest	Town Land
<b>Private:</b>	Country Clubs not under PA490 Open Space	Public Schools
Churches, Cemeteries	Private Recreation Areas	<b>Private Unprotected</b>
Recreation Clubs, Recreation Organizations, Scouts	Private Schools	Audubon Greenwich
Schools	Public Schools	Cemeteries
Utilities	Residential Properties over 10 acres	Country Club
Corporate Campus	Churches	Other Non-Governmental Organizations
Residential		PA 490 Farm & Forest
		PA 490 Open Space
		Private Recreation
		Private Schools
		Religious Institutions
		Residential Properties > 10 acres
		Water Company Land

## **Appendix B:**

### **Evaluation Methodology for Acquisition, Sale, Lease, and Preservation of Properties for Open Space Classification**

In order to determine whether a particular piece of property warrants protection for open space purposes, the following point system is recommended in the evaluation process for procurement, easements, leases, management, or protection of properties for both public and private owners.

1) FLOOD CONTROL- floodplains present opportunities to become a major component of a linked open space system

- a) 3 – High natural valley storage capacity
- b) 2 – Medium storage capacity
- c) 1 – Low storage capacity/linkage to other open space areas
- d) 0 – No flood control benefit

2) WATER SUPPLY- protects and adds to water supply storage facilities in town; provide sites to protect surface and subsurface water resources

- a) 3 – Capable of producing a yield for public drinking water supply/or water bodies feeding into the public reservoirs
- b) 2 – Providing or protecting emergency drinking water supply
- c) 1 – Protection of ground water recharge areas or aquifers
- d) 0 – No potential as a water supply source or recharge area

3) PROTECTION OF WATER QUALITY (from pollutants and soil erosion)

- a) 3 – Protects Class A waters
- b) 2 – Protects Class B waters
- c) 1 – Protects Class C waters
- d) 0 – Not adjacent to any waterway

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## 4) PROTECTION AND MAINTENANCE OF BIOLOGICAL DIVERSITY, WOODLANDS, AND WILDLIFE HABITAT CORRIDORS

- a) 3 – Site located in CT Natural Diversity Database area, Critical Habitat Area, and/or creates a corridor connecting or expanding open space
- b) 2 – Site has local significance as a habitat area – rare or unique features
- c) 1 – Site of common distinction – no rare or unique features
- d) 0 – Site does not provide a significant habitat function

## 5) BUFFER BETWEEN LAND USES

- a) 3 – Site buffers between public uses (i.e. school, road, railroad, commercial) and sensitive adjacent land uses (protects from lights, unsightly views, noise, or odors)
- b) 2 – Site buffers between small private sensitive uses from adjacent uses and properties
- c) 1 – Site buffers and protects important environmental features on adjoining properties
- d) 0 – Site does not serve a buffering role

## 6) RECREATIONAL OPPORTUNITY

- a) 3 – Site is a destination point drawing people for recreational activity ( hiking, nature appreciation, hunting, fishing, picnicking, biking, boating, horseback riding, active playing fields)
- b) 2 – Site meets a priority for future need mentioned in the Open Space Plan or in other planning documents such as the Plan of Conservation and Development or neighborhood plans
- c) 1 – Site not mentioned in any current planning documents, but is important for public purposes – or provides greenways or green buffers between properties.
- d) 0 – Not applicable

## 7) SCENIC VIEWS/VISUAL CHARACTER OF THE COMMUNITY

- a) 3 – Site provides or protects distinctive and historic landscape value, scenic views, or unobstructed views
- b) 2 – Site recognized as a distinctive visual element in town
- c) 1 – Site provides interesting landscape features that are not readily accessible (must hike in to view)
- d) 0 – Site does not provide scenic qualities

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## 8) HISTORIC AND CULTURAL LANDSCAPES

- a) 3 – Site contains historic or archaeological landscape features listed on state or federal register of historic places or documented ancient uses of site are present
- b) 2 – Site contains landscape features listed on a local inventory or maps of potential significant historic, cultural, or archeological value
- c) 1 – Site contains landscape features not listed on an inventory but contain significant historic, cultural, or archeological value
- d) 0 – Not applicable

## 9) LONG ISLAND SOUND – PROTECTION OF COASTAL RESOURCES AND WATER QUALITY

- a) 3 – Site is directly on Long Island Sound
- b) 2 – Site is along a watercourse which feeds into Long Island Sound or is capable of rejuvenating storm water runoff
- c) 1 – Site is a connecting link between the Sound and open space, or within 100 feet of coastal resources
- d) 0 – Not applicable

## 10) EDUCATION

- a) 3 – Site currently serves or is planned to serve as a destination for organized environmental educational programs (e.g. interpretive trails, outdoor classroom, observational platforms)
- b) 2 – Site has potential as educational resource (proximity to school, existing trail system in place, demonstrates a range of educational lesson opportunities, and is scarce
- c) 1 – Site has potential to supplement existing environmental education areas or other comparable sites which are available in Town
- d) 0 – Not much potential or needs may be met by other sites in Town

Adapted from the Lincoln Institute of Land Policy Working Paper (WP98PB1), A Methodology for Valuing Town Conservation Land, by Pamela J. Brown and Charles J Fausold 1998.

**Appendix C:**

**The Open Space Plan Committee**

**2015 Members**

William Rutherford, Conservation Commission Chairman

Eric Brower, Conservation Commission

Lisette Henrey, Conservation Commission

Virginia Gwynn, Greenwich Land Trust

Katie DeLuca, Town Planner

Denise Savageau, Conservation Director

Bruce Spaman, Supt. of Parks and Trees

Matthew Goclowski, Conservation Resource Manager I

**Past Members**

Karen Sadik-Khan, Conservation Commission

Cynthia Ehlinger, Naturalist

Ann Sawyer, Greenwich Land Trust

Diane Fox, Town Planner

Joseph Cassone, Conservation Assistant

**Appendix D:**

**List of Wildlife Recently Documented or Likely to Occur in Greenwich**

**Mammals**

Common Name	Scientific Name	Common Name	Scientific Name
Beaver	<i>Castor canadensis</i>	Northern Short-tailed Shrew	<i>Blarina brevicauda</i>
Big Brown Bat	<i>Eptesicus fuscus</i>	Northern Water Shrew	<i>Sorex palustris</i>
Black Bear	<i>Ursus americanus</i>	Norway Rat	<i>Rattus norvegicus</i>
Bobcat	<i>Felis rufus</i>	Raccoon	<i>Procyon lotor</i>
Coyote	<i>Canis latrans</i>	Red Bat	<i>Lasiurus borealis</i>
Eastern Chipmunk	<i>Tamias striatus</i>	Red Fox	<i>Vulpes vulpes</i>
Eastern Cottontail	<i>Sylvilagus floridanus</i>	Red Squirrel	<i>Tamiasciurus hudsonicus</i>
Eastern Gray Squirrel	<i>Sciurus carolinensis</i>	River Otter	<i>Lutra canadensis</i>
Eastern Mole	<i>Scalopus aquaticus</i>	Short-tailed Weasel	<i>Mustela erminea</i>
Eastern Pipistrelle	<i>Pipistrellus subflavus</i>	Silver-haired Bat	<i>Lasionycteris noctivagans</i>
Fisher	<i>Martes pennanti</i>	Smoky Shrew	<i>Sorex fumeus</i>
Gray Fox	<i>Urocyon cinereoargenteus</i>	Snowshoe Hare	<i>Lepus americanus</i>
Harbor Seal	<i>Phoca vitulina</i>	Southern Bog Lemming	<i>Synaptomys cooperi</i>
Hoary Bat	<i>Lasiurus cinereus</i>	Southern Flying Squirrel	<i>Glaucomys volans</i>
House Mouse	<i>Mus musculus</i>	Southern Red-backed Vole	<i>Clethrionomys gapperi</i>
Little Brown Bat	<i>Myotis lucifugus</i>	Star-nosed Mole	<i>Condylura cristata</i>
Long-tailed Weasel	<i>Mustela frenata</i>	Striped Skunk	<i>Mephitis mephitis</i>
Masked Shrew	<i>Sorex cinereus</i>	Virginia Opossum	<i>Didelphis virginiana</i>
Meadow Jumping Mouse	<i>Zapus hudsonius</i>	White-footed Mouse	<i>Peromyscus leucopus</i>
Meadow Vole	<i>Microtus pennsylvanicus</i>	White-tailed Deer	<i>Odocoileus virginianus</i>
Mink	<i>Mustela vison</i>	Woodchuck	<i>Marmota monax</i>
Mountain Lion	<i>Puma concolor</i>	Woodland Jumping Mouse	<i>Napaeozapus insignis</i>
Muskrat	<i>Ondatra zibethicus</i>	Woodland Vole	<i>Microtus pinetorum</i>
Northern Long-eared Bat	<i>Myotis septentrionalis</i>		

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## Birds

Common Name	Scientific Name	Common Name	Scientific Name
Acadian Flycatcher	<i>Empidonax vireescens</i>	Black-legged Kittiwake	<i>Rissa tridactyla</i>
Alder Flycatcher	<i>Empidonax alnorum</i>	Blackpoll Warbler	<i>Dendroica striata</i>
American Avocet	<i>Recurvirostra americana</i>	Black-throated Blue Warbler	<i>Dendroica caerulescens</i>
American Bittern	<i>Botaurus lentiginosus</i>	Black-throated Green Warbler	<i>Dendroica virens</i>
American Black Duck	<i>Anas rubripes</i>	Blue Grosbeak	<i>Guiraca caerulea</i>
American Coot	<i>Fulica americana</i>	Blue Jay	<i>Cyanocitta cristata</i>
American Crow	<i>Corvus brachyrhynchos</i>	Blue-gray Gnatcatcher	<i>Polioptila caerulea</i>
American Golden-plover	<i>Pluvialis dominica</i>	Blue-headed Vireo	<i>Vireo solitarius</i>
American Goldfinch	<i>Carduelis tristis</i>	Blue-winged Teal	<i>Anas discors</i>
American Kestrel	<i>Falco sparverius</i>	Blue-winged Warbler	<i>Vermivora pinus</i>
American Oystercatcher	<i>Haematopus palliatus</i>	Boat-tailed Grackle	<i>Quiscalus major</i>
American Pipit	<i>Anthus rubescens</i>	Bobolink	<i>Dolichonyx oryzivorus</i>
American Redstart	<i>Setophaga ruticilla</i>	Bonaparte's Gull	<i>Larus philadelphia</i>
American Robin	<i>Turdus migratorius</i>	Brant	<i>Branta bernicla</i>
American Tree Sparrow	<i>Spizella arborea</i>	Broad-winged Hawk	<i>Buteo platypterus</i>
American Wigeon	<i>Anas americana</i>	Brown Creeper	<i>Certhia americana</i>
American Woodcock	<i>Scolopax minor</i>	Brown Thrasher	<i>Toxostoma rufum</i>
Baird's Sandpiper	<i>Calidris bairdii</i>	Brown-headed Cowbird	<i>Molothrus ater</i>
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Bufflehead	<i>Bucephala albeola</i>
Baltimore Oriole	<i>Icterus galbula</i>	Canada Goose	<i>Branta canadensis</i>
Bank Swallow	<i>Riparia riparia</i>	Canada Warbler	<i>Wilsonia canadensis</i>
Barn Owl	<i>Tyto alba</i>	Canvasback	<i>Aythya valisineria</i>
Barn Swallow	<i>Hirundo rustica</i>	Cape May Warbler	<i>Dendroica tigrina</i>
Barred Owl	<i>Strix varia</i>	Carolina Wren	<i>Thryothorus ludovicianus</i>
Bay-breasted Warbler	<i>Dendroica castanea</i>	Caspian Tern	<i>Sterna caspia</i>
Belted Kingfisher	<i>Ceryle alcyon</i>	Cattle Egret	<i>Bubulcus ibis</i>
Bicknell's Thrush	<i>Catharus bicknelli</i>	Cedar Waxwing	<i>Bombycilla cedrorum</i>
Black Scoter	<i>Melanitta nigra</i>	Cerulean Warbler	<i>Dendroica cerulea</i>
Black Skimmer	<i>Rynchops niger</i>	Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>
Black Tern	<i>Chlidonias niger</i>	Chimney Swift	<i>Chaetura pelagica</i>
Black Vulture	<i>Coragyps atratus</i>	Chipping Sparrow	<i>Spizella passerina</i>
Black-and-white Warbler	<i>Mniotilta varia</i>	Chuck-will's-widow	<i>Caprimulgus carolinensis</i>
Black-bellied Plover	<i>Pluvialis squatarola</i>	Clapper Rail	<i>Rallus longirostris</i>
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>	Clay-colored Sparrow	<i>Spizella pallida</i>
Blackburnian Warbler	<i>Dendroica fusca</i>	Cliff Swallow	<i>Petrochelidon pyrrhonota</i>
Black-capped Chickadee	<i>Poecile atricapillus</i>	Common Black-headed Gull	<i>Larus ridibundus</i>
Black-crowned Night-heron	<i>Nycticorax nycticorax</i>	Common Eider	<i>Somateria mollissima</i>

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## Birds (continued)

Common Name	Scientific Name	Common Name	Scientific Name
Common Goldeneye	<i>Bucephala clangula</i>	Grasshopper Sparrow	<i>Ammodramus savannarum</i>
Common Grackle	<i>Quiscalus quiscula</i>	Gray Catbird	<i>Dumetella carolinensis</i>
Common Loon	<i>Gavia immer</i>	Gray-cheeked Thrush	<i>Catharus minimus</i>
Common Merganser	<i>Mergus merganser</i>	Great Black-backed Gull	<i>Larus marinus</i>
Common Moorhen	<i>Gallinula chloropus</i>	Great Blue Heron	<i>Ardea herodias</i>
Common Nighthawk	<i>Chordeiles minor</i>	Great Cormorant	<i>Phalacrocorax carbo</i>
Common Raven	<i>Corvus corax</i>	Great Crested Flycatcher	<i>Myiarchus crinitus</i>
Common Redpoll	<i>Carduelis flammea</i>	Great Egret	<i>Ardea alba</i>
Common Tern	<i>Sterna hirundo</i>	Great Horned Owl	<i>Bubo virginianus</i>
Common Yellowthroat	<i>Geothlypis trichas</i>	Greater Scaup	<i>Aythya marila</i>
Connecticut Warbler	<i>Oporornis agilis</i>	Greater White-fronted Goose	<i>Anser albifrons</i>
Cooper's Hawk	<i>Accipiter cooperii</i>	Greater Yellowlegs	<i>Tringa melanoleuca</i>
Dark-eyed Junco	<i>Junco hyemalis</i>	Green Heron	<i>Butorides virescens</i>
Dickcissel	<i>Spiza americana</i>	Green-winged Teal	<i>Anas crecca</i>
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	Gull-billed Tern	<i>Sterna nilotica</i>
Downy Woodpecker	<i>Picoides pubescens</i>	Hairy Woodpecker	<i>Picoides villosus</i>
Dunlin	<i>Calidris alpina</i>	Harlequin Duck	<i>Histrionicus histrionicus</i>
Eared Grebe	<i>Podiceps nigricollis</i>	Hermit Thrush	<i>Catharus guttatus</i>
Eastern Bluebird	<i>Sialia sialis</i>	Herring Gull	<i>Larus argentatus</i>
Eastern Kingbird	<i>Tyrannus tyrannus</i>	Hooded Merganser	<i>Lophodytes cucullatus</i>
Eastern Meadowlark	<i>Sturnella magna</i>	Hooded Warbler	<i>Wilsonia citrina</i>
Eastern Phoebe	<i>Sayornis phoebe</i>	Horned Grebe	<i>Podiceps auritus</i>
Eastern Screech-owl	<i>Otus asio</i>	Horned Lark	<i>Eremophila alpestris</i>
Eastern Towhee	<i>Pipilo erythrophthalmus</i>	House Finch	<i>Carpodacus mexicanus</i>
Eastern Wood-pewee	<i>Contopus virens</i>	House Sparrow	<i>Passer domesticus</i>
European Starling	<i>Sturnus vulgaris</i>	House Wren	<i>Troglodytes aedon</i>
Evening Grosbeak	<i>Coccothraustes vespertinus</i>	Hudsonian Godwit	<i>Limosa haemastica</i>
Field Sparrow	<i>Spizella pusilla</i>	Iceland Gull	<i>Larus glaucoides</i>
Fish Crow	<i>Corvus ossifragus</i>	Indigo Bunting	<i>Passerina cyanea</i>
Forster's Tern	<i>Sterna forsteri</i>	Kentucky Warbler	<i>Oporornis formosus</i>
Fox Sparrow	<i>Passerella iliaca</i>	Killdeer	<i>Charadrius vociferus</i>
Gadwall	<i>Anas strepera</i>	King Eider	<i>Somateria spectabilis</i>
Glaucous Gull	<i>Larus hyperboreus</i>	King Rail	<i>Rallus elegans</i>
Glossy Ibis	<i>Plegadis falcinellus</i>	Laughing Gull	<i>Larus atricilla</i>
Golden Eagle	<i>Aquila chrysaetos</i>	Leach's Storm-petrel	<i>Oceanodroma leucorhoa</i>
Golden-crowned Kinglet	<i>Regulus satrapa</i>	Least Bittern	<i>Ixobrychus exilis</i>
Golden-winged Warbler	<i>Vermivora chrysoptera</i>	Least Flycatcher	<i>Empidonax minimus</i>

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## Birds (continued)

Common Name	Scientific Name	Common Name	Scientific Name
Least Sandpiper	<i>Calidris minutilla</i>	Northern Waterthrush	<i>Seiurus noveboracensis</i>
Least Tern	<i>Sterna antillarum</i>	Olive-sided Flycatcher	<i>Contopus borealis</i>
Lesser Black-backed Gull	<i>Larus fuscus</i>	Orange-crowned Warbler	<i>Vermivora celata</i>
Lesser Scaup	<i>Aythya affinis</i>	Orchard Oriole	<i>Icterus spurius</i>
Lesser Yellowlegs	<i>Tringa flavipes</i>	Osprey	<i>Pandion haliaetus</i>
Lincoln's Sparrow	<i>Melospiza lincolnii</i>	Ovenbird	<i>Seiurus aurocapillus</i>
Little Blue Heron	<i>Egretta caerulea</i>	Palm Warbler	<i>Dendroica palmarum</i>
Little Gull	<i>Larus minutus</i>	Pectoral Sandpiper	<i>Calidris melanotos</i>
Loggerhead Shrike	<i>Lanius ludovicianus</i>	Peregrine Falcon	<i>Falco peregrinus</i>
Long-billed Dowitcher	<i>Limnodromus scolopaceus</i>	Philadelphia Vireo	<i>Vireo philadelphicus</i>
Long-eared Owl	<i>Asio otus</i>	Pied-billed Grebe	<i>Podilymbus podiceps</i>
Long-tailed Duck	<i>Clangula hyemalis</i>	Pileated Woodpecker	<i>Dryocopus pileatus</i>
Louisiana Waterthrush	<i>Seiurus motacilla</i>	Pine Grosbeak	<i>Pinicola enucleator</i>
Magnolia Warbler	<i>Dendroica magnolia</i>	Pine Siskin	<i>Carduelis pinus</i>
Mallard	<i>Anas platyrhynchos</i>	Pine Warbler	<i>Dendroica pinus</i>
Manx Shearwater	<i>Puffinus puffinus</i>	Piping Plover	<i>Charadrius melodus</i>
Marbled Godwit	<i>Limosa fedoa</i>	Prairie Warbler	<i>Dendroica discolor</i>
Marsh Wren	<i>Cistothorus palustris</i>	Prothonotary Warbler	<i>Protonotaria citrea</i>
Merlin	<i>Falco columbarius</i>	Purple Finch	<i>Carpodacus purpureus</i>
Monk Parakeet	<i>Myiopsitta monachus</i>	Purple Martin	<i>Progne subis</i>
Mourning Dove	<i>Zenaidura macroura</i>	Purple Sandpiper	<i>Calidris maritima</i>
Mourning Warbler	<i>Oporornis philadelphia</i>	Red Crossbill	<i>Loxia curvirostra</i>
Mute Swan	<i>Cygnus olor</i>	Red Knot	<i>Calidris canutus</i>
Nashville Warbler	<i>Vermivora ruficapilla</i>	Red-bellied Woodpecker	<i>Melanerpes carolinus</i>
Nelson's Sharp-tailed Sparrow	<i>Ammodramus nelsoni</i>	Red-breasted Merganser	<i>Mergus serrator</i>
Northern Cardinal	<i>Cardinalis cardinalis</i>	Red-breasted Nuthatch	<i>Sitta canadensis</i>
Northern Flicker	<i>Colaptes auratus</i>	Red-eyed Vireo	<i>Vireo olivaceus</i>
Northern Gannet	<i>Morus bassanus</i>	Redhead	<i>Aythya americana</i>
Northern Goshawk	<i>Accipiter gentilis</i>	Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>
Northern Harrier	<i>Circus cyaneus</i>	Red-necked Grebe	<i>Podiceps grisegena</i>
Northern Mockingbird	<i>Mimus polyglottos</i>	Red-necked Phalarope	<i>Phalaropus lobatus</i>
Northern Parula	<i>Parula americana</i>	Red-shouldered Hawk	<i>Buteo lineatus</i>
Northern Pintail	<i>Anas acuta</i>	Red-tailed Hawk	<i>Buteo jamaicensis</i>
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>	Red-throated Loon	<i>Gavia stellata</i>
Northern Saw-whet Owl	<i>Aegolius acadicus</i>	Red-winged Blackbird	<i>Agelaius phoeniceus</i>
Northern Shoveler	<i>Anas clypeata</i>	Ring-billed Gull	<i>Larus delawarensis</i>
Northern Shrike	<i>Lanius excubitor</i>	Ring-necked Duck	<i>Aythya collaris</i>

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## Birds (continued)

Common Name	Scientific Name	Common Name	Scientific Name
Ring-necked Pheasant	<i>Phasianus colchicus</i>	Tennessee Warbler	<i>Vermivora peregrina</i>
Rock Dove	<i>Columba livia</i>	Thick-billed Murre	<i>Uria lomvia</i>
Roseate Tern	<i>Sterna dougallii</i>	Tree Swallow	<i>Tachycineta bicolor</i>
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	Tricolored Heron	<i>Egretta tricolor</i>
Rough-legged Hawk	<i>Buteo lagopus</i>	Tufted Titmouse	<i>Baeolophus bicolor</i>
Royal Tern	<i>Sterna maxima</i>	Tundra Swan	<i>Cygnus columbianus</i>
Ruby-crowned Kinglet	<i>Regulus calendula</i>	Turkey Vulture	<i>Cathartes aura</i>
Ruby-throated Hummingbird	<i>Archilochus colubris</i>	Upland Sandpiper	<i>Bartramia longicauda</i>
Ruddy Duck	<i>Oxyura jamaicensis</i>	Veery	<i>Catharus fuscescens</i>
Ruddy Turnstone	<i>Arenaria interpres</i>	Vesper Sparrow	<i>Poocetes gramineus</i>
Ruffed Grouse	<i>Bonasa umbellus</i>	Virginia Rail	<i>Rallus limicola</i>
Rusty Blackbird	<i>Euphagus carolinus</i>	Warbling Vireo	<i>Vireo gilvus</i>
Saltmarsh Sharp-tailed Sparrow	<i>Ammodramus caudacutus</i>	Western Kingbird	<i>Tyrannus verticalis</i>
Sanderling	<i>Calidris alba</i>	Whimbrel	<i>Numenius phaeopus</i>
Sandhill Crane	<i>Grus canadensis</i>	Whip-poor-will	<i>Caprimulgus vociferus</i>
Savannah Sparrow	<i>Passerculus sandwichensis</i>	White-breasted Nuthatch	<i>Sitta carolinensis</i>
Scarlet Tanager	<i>Piranga olivacea</i>	White-crowned Sparrow	<i>Zonotrichia leucophrys</i>
Seaside Sparrow	<i>Ammodramus maritimus</i>	White-eyed Vireo	<i>Vireo griseus</i>
Sedge Wren	<i>Cistothorus platensis</i>	White-rumped Sandpiper	<i>Calidris fuscicollis</i>
Semipalmated Plover	<i>Charadrius semipalmatus</i>	White-throated Sparrow	<i>Zonotrichia albicollis</i>
Semipalmated Sandpiper	<i>Calidris pusilla</i>	White-winged Crossbill	<i>Loxia leucoptera</i>
Sharp-shinned Hawk	<i>Accipiter striatus</i>	White-winged Scoter	<i>Melanitta fusca</i>
Short-billed Dowitcher	<i>Limnodromus griseus</i>	Wild Turkey	<i>Meleagris gallopavo</i>
Short-eared Owl	<i>Asio flammeus</i>	Willet	<i>Catoptrophorus semipalmatus</i>
Snow Bunting	<i>Plectrophenax nivalis</i>	Willow Flycatcher	<i>Empidonax traillii</i>
Snow Goose	<i>Chen caerulescens</i>	Wilson's Phalarope	<i>Phalaropus tricolor</i>
Snowy Egret	<i>Egretta thula</i>	Wilson's Plover	<i>Charadrius wilsonia</i>
Snowy Owl	<i>Nyctea scandiaca</i>	Wilson's Snipe	<i>Gallinago delicata</i>
Solitary Sandpiper	<i>Tringa solitaria</i>	Wilson's Storm-petrel	<i>Oceanites oceanicus</i>
Song Sparrow	<i>Melospiza melodia</i>	Wilson's Warbler	<i>Wilsonia pusilla</i>
Sora	<i>Porzana carolina</i>	Winter Wren	<i>Troglodytes troglodytes</i>
Spotted Sandpiper	<i>Actitis macularia</i>	Wood Duck	<i>Aix sponsa</i>
Stilt Sandpiper	<i>Calidris himantopus</i>	Wood Thrush	<i>Hylocichla mustelina</i>
Summer Tanager	<i>Piranga rubra</i>	Worm-eating Warbler	<i>Helmitheros vermivorus</i>
Surf Scoter	<i>Melanitta perspicillata</i>	Yellow Rail	<i>Coturnicops noveboracensis</i>
Swainson's Thrush	<i>Catharus ustulatus</i>	Yellow Warbler	<i>Dendroica petechia</i>
Swamp Sparrow	<i>Melospiza georgiana</i>	Yellow-bellied Flycatcher	<i>Empidonax flaviventris</i>

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## Birds (continued)

Common Name	Scientific Name	Common Name	Scientific Name
Yellow-bellied Sapsucker	<i>Sphyrapicus varius</i>	Yellow-rumped Warbler	<i>Dendroica coronata</i>
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	Yellow-throated Vireo	<i>Vireo flavifrons</i>
Yellow-breasted Chat	<i>Icteria virens</i>	Yellow-throated Warbler	<i>Dendroica dominica</i>
Yellow-crowned Night-heron	<i>Nyctanassa violacea</i>		

## Reptiles & Amphibians

Common Name	Scientific Name	Common Name	Scientific Name
American Bullfrog	<i>Rana catesbeiana</i>	Jefferson Salamander	<i>Ambystoma jeffersonianum</i>
American Toad	<i>Bufo americanus</i>	Marbled Salamander	<i>Ambystoma opacum</i>
Bog Turtle	<i>Clemmys muhlenbergii</i>	Milk Snake	<i>Lampropeltis triangulum</i>
Common Gartersnake	<i>Thamnophis sirtalis</i>	Northern Dusky Salamander	<i>Desmognathus fuscus</i>
Copperhead	<i>Agkistrodon contortrix</i>	Northern Slimy Salamander	<i>Plethodon glutinosus</i>
Dekay's Brown Snake	<i>Storeria dekayi</i>	Northern Two-lined Salamander	<i>Eurycea bislineata</i>
Diamond-backed Terrapin	<i>Malaclemys terrapin</i>	Northern Watersnake	<i>Nerodia sipedon</i>
Eastern Box Turtle	<i>Terrapene carolina</i>	Painted Turtle	<i>Chrysemys picta</i>
Eastern Hog-nosed Snake	<i>Heterodon platirhinos</i>	Pickerel Frog	<i>Rana palustris</i>
Eastern Newt	<i>Notophthalmus viridescens</i>	Ring-necked Snake	<i>Diadophis punctatus</i>
Eastern Racer	<i>Coluber constrictor</i>	Smooth Greensnake	<i>Opheodrys vernalis</i>
Eastern Rat Snake	<i>Elaphe alleghaniensis</i>	Snapping Turtle	<i>Chelydra serpentina</i>
Eastern Red-backed Salamander	<i>Plethodon cinereus</i>	Spotted Salamander	<i>Ambystoma maculatum</i>
Eastern Ribbonsnake	<i>Thamnophis sauritus</i>	Spotted Turtle	<i>Clemmys guttata</i>
Eastern Wormsnake	<i>Carphophis amoenus</i>	Spring Peeper	<i>Pseudacris crucifer</i>
Four-toed Salamander	<i>Hemidactylium scutatum</i>	Stinkpot	<i>Sternotherus odoratus</i>
Fowler's Toad	<i>Bufo fowleri</i>	Wood Frog	<i>Rana sylvatica</i>
Gray Treefrog	<i>Hyla versicolor</i>	Wood Turtle	<i>Glyptemys insculpta</i>
Green Frog	<i>Rana clamitans</i>		

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## Fish

Common Name	Scientific Name	Common Name	Scientific Name
Alewife	<i>Alosa pseudoharengus</i>	Naked Goby	<i>Gobiosoma boscii</i>
American Eel	<i>Anguilla rostrata</i>	Ninespine Stickleback	<i>Pungitius pungitius</i>
Atlantic Herring	<i>Clupea harengus</i>	Northern Kingfish	<i>Menticirrhus saxatilis</i>
Atlantic Mackerel	<i>Scomber scombrus</i>	Northern Puffer	<i>Spherooides maculatus</i>
Atlantic Silversides	<i>Menidia menidia</i>	Northern Searobin	<i>Prionotus carolinus</i>
Banded Killifish	<i>Fundulus diaphanus</i>	Oyster Toadfish	<i>Opsanus tau</i>
Bay Anchovy	<i>Anchoa mitchilli</i>	Pipefish	<i>Syngnathus fuscus</i>
Black Crappie	<i>Pomoxis nigromaculatus</i>	Pumpkinseed	<i>Lepomis gibbosus</i>
Black Sea Bass	<i>Centropristes striata</i>	Rainbow Smelt	<i>Osmerus mordax</i>
Blacknose Dace	<i>Rhinichthys atratulus</i>	Rainbow Trout	<i>Oncorhynchus mykiss</i>
Blueback Herring	<i>Alosa aestivalis</i>	Redbreast Sunfish	<i>Lepomis auritus</i>
Bluefish	<i>Pomatomus saltatrix</i>	Redfin Pickerel	<i>Esox americanus</i>
Bluegill	<i>Lepomis macrochirus</i>	Rock Bass	<i>Ambloplites rupestris</i>
Bluntnose Minnow	<i>Pimephales notatus</i>	Sand Lance	<i>Ammodytes americanus</i>
Brook Trout	<i>Salvelinus fontinalis</i>	Sandbar Shark	<i>Carcharhinus plumbeus</i>
Brown Bullhead	<i>Ameiurus nebulosus</i>	Scup	<i>Stenotomus chrysops</i>
Brown Trout	<i>Salmo trutta</i>	Sea Raven	<i>Hemitripterus americanus</i>
Butterfish	<i>Peprilus triacanthus</i>	Sheepshead Minnow	<i>Cyprinodon variegatus</i>
Chain Pickerel	<i>Esox niger</i>	Silver Hake	<i>Merluccius bilinearis</i>
Common Carp	<i>Cyprinus carpio</i>	Smallmouth Bass	<i>Micropterus dolomieu</i>
Common Shiner	<i>Luxilus cornutus</i>	Smallmouth Flounder	<i>Etropus microstomus</i>
Creek Chub	<i>Semotilus atromaculatus</i>	Smooth Dogfish	<i>Mustelis canis</i>
Creek Chubsucker	<i>Erimyzon oblongus</i>	Spot	<i>Leiostomus xanthurus</i>
Cunner	<i>Tautoglabrus adspersus</i>	Spottail Shiner	<i>Notropis hudsonius</i>
Cutlips Minnow	<i>Exoglossum maxillingua</i>	Striped Bass	<i>Morone saxatilis</i>
Fallfish	<i>Semotilus corporalis</i>	Striped killifish	<i>Fundulus majalis</i>
Fourspine Stickleback	<i>Apeltes quadracus</i>	Striped Searobin	<i>Prionotus evolans</i>
Gizzard Shad	<i>Dorsoma cepedianum</i>	Summer Flounder	<i>Paralichthys dentatus</i>
Golden Shiner	<i>Notemigonus crysoleucas</i>	Tautog	<i>Tautoga onitis</i>
Goldfish	<i>Carassius auratus</i>	Tessellated Darter	<i>Etheostoma olmstedii</i>
Grass Carp	<i>Ctenopharyngodon idella</i>	Threespine Stickleback	<i>Gasterosteus aculeatus</i>
Green Sunfish	<i>Lepomis cyanellus</i>	Weakfish	<i>Cynoscion regalis</i>
Grubby	<i>Myoxocephalus aeneus</i>	White Perch	<i>Morone americana</i>
Inland Silverside	<i>Menidia beryllina</i>	White Sucker	<i>Catostomus commersoni</i>
Largemouth Bass	<i>Micropterus salmoides</i>	Winter Flounder	<i>Pseudopleuronectes americanus</i>
Little Skate	<i>Leucoraja erinacea</i>	Winter Skate	<i>Leucoraja ocellata</i>
Menhaden	<i>Brevoortia tyrannus</i>	Yellow Perch	<i>Perca flavescens</i>
Mummichog	<i>Fundulus heteroclitus</i>		

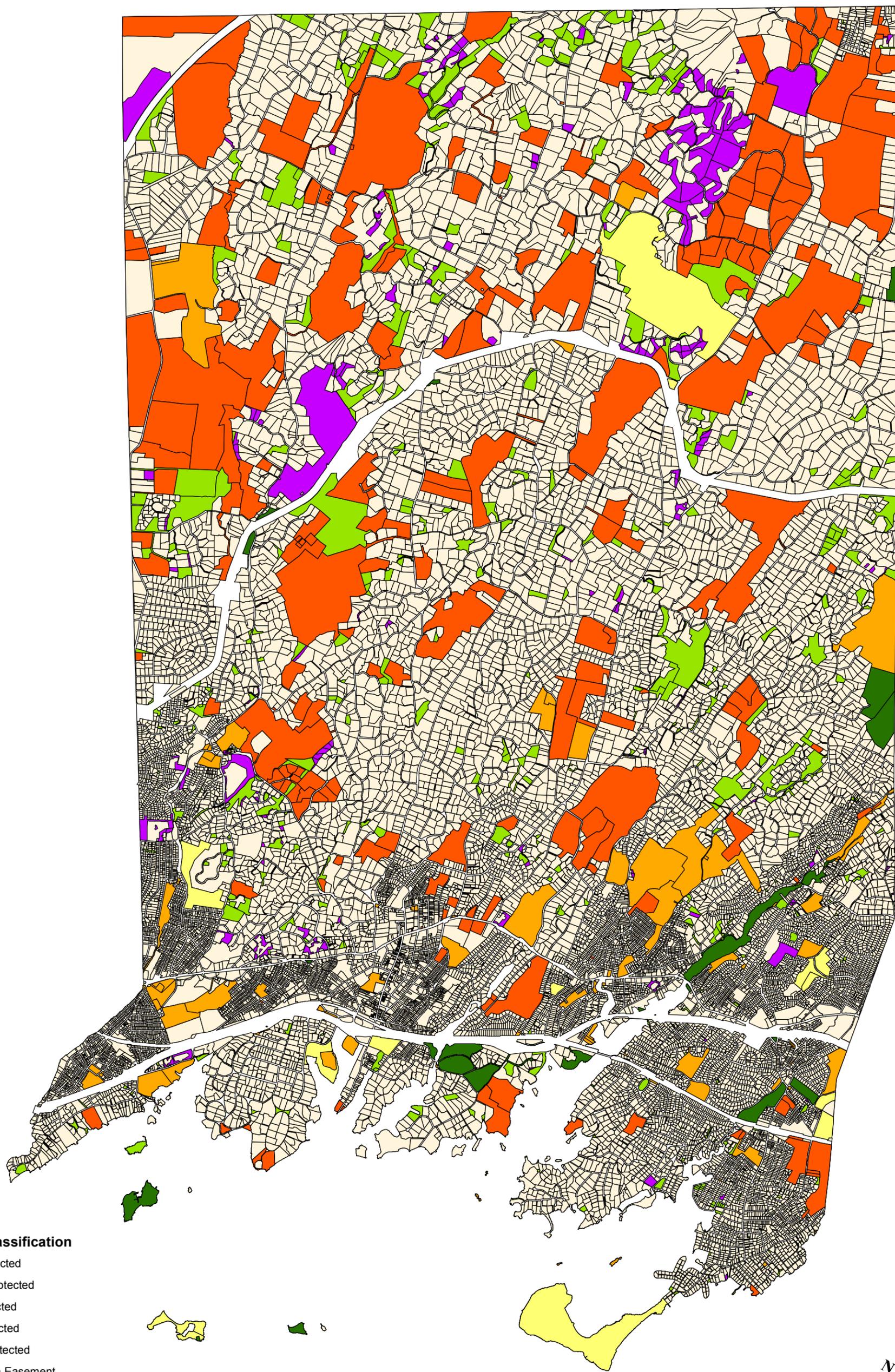
**Appendix E:**

**Large Format Maps**

- Town of Greenwich, Connecticut Open Space 2015
- Town of Greenwich, Connecticut Land Cover

# TOWN OF GREENWICH, CONNECTICUT

## Open Space 2015



### Legend

#### Open Space Classification

- Private Protected
- Private Unprotected
- Public Protected
- Public Restricted
- Public Unprotected
- Conservation Easement
- Non Open Space

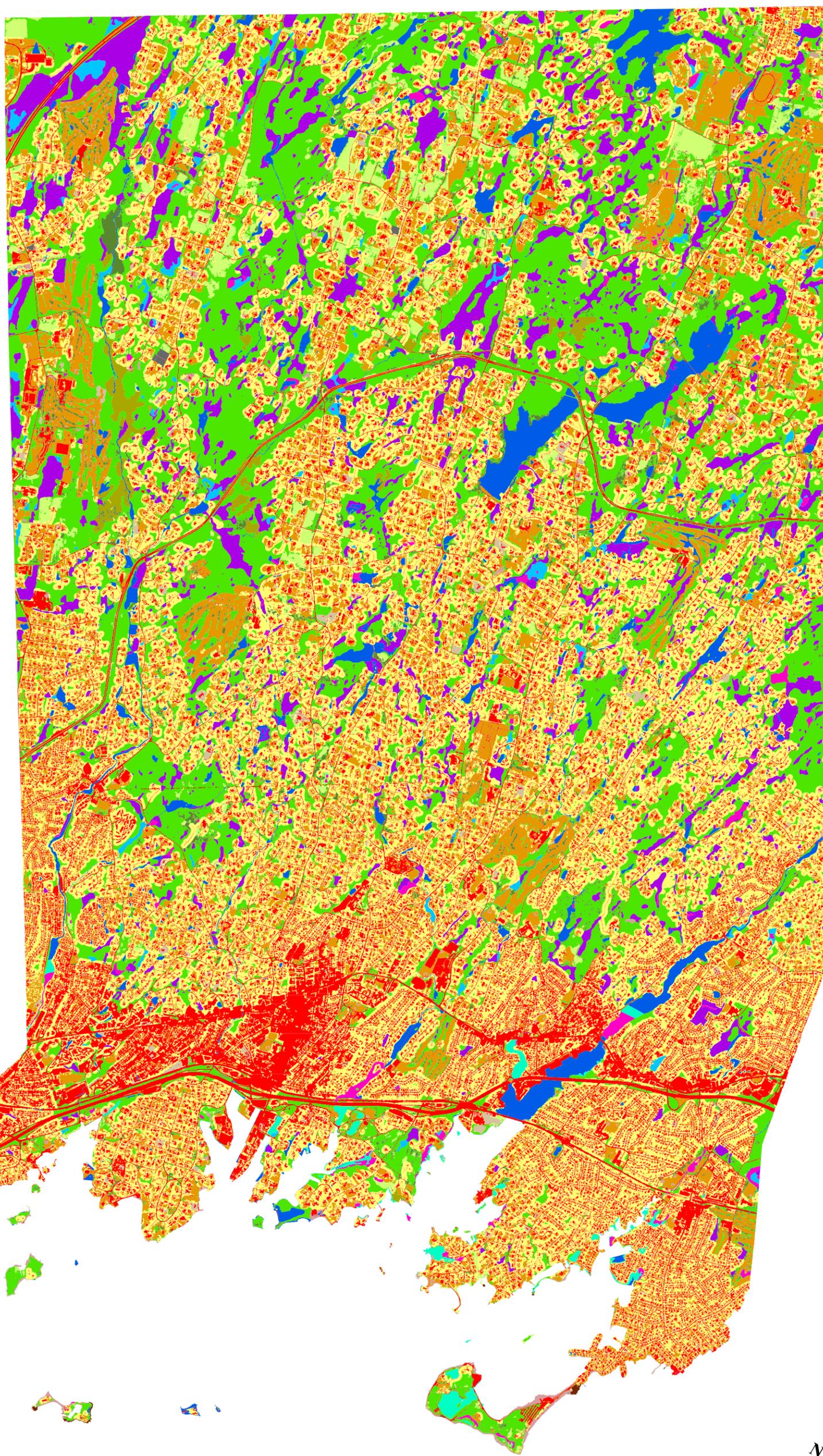
0 0.5 1 2 Miles

Data Source: Town of Greenwich GIS Department



# TOWN OF GREENWICH, CONNECTICUT

## Land Cover



### Legend

#### Landcover Type

- Barren/Beach
- Broadleaved Forest
- Coniferous Forest
- Construction Barren
- Cropland
- Emergent Wetland
- Forested Wetland
- Impervious
- Mixed Forest
- Other Grass/Meadow
- Residential Forest
- Rocky Shore
- Shrub Wetland
- Tidal Wetland
- Turf Grass
- Water

0 0.5 1 2 Miles



Data Source: Town of Greenwich GIS Department