MILFORD, CONNECTICUT

MILFORD OPEN SPACE STEERING COMMITTEE

NATURAL RESOURCE INVENTORY

REPORT AND RECOMMENDATIONS

MAY, 2002

Prepared by Bartley C. Block

for the

Milford Open Space Steering Committee

Milford Conservation Commission

TABLE OF CONTENTS

QUICK-FIND INDEX

ACKNOWLEDGMENTS

We would like to thank the many individuals who contributed to this project. Without their skills, knowledge, enthusiasm, and perseverance, this document would never have seen the light of day.

We are grateful to former Mayor Fred Lisman, who established the Open Space Steering Committee and saw it through its early years. We are also appreciative of the help provided by our current Mayor, Jim Richetelli, who has taken over the responsibility of overseeing the Open Space Steering Committee and has facilitated the cooperation of the Milford Engineering Department in developing the invaluable GIS maps that are included in this report. Special thanks are extended to Mark Goetz for his technical expertise, enthusiasm, and deep interest in the preparation of the GIS maps. Letty Malone and Judy Weyant have been instrumental in obtaining the help of Mark Goetz and others of the Milford GIS staff and in nurturing a mutually beneficial relationship with them.

The information distilled in this Natural Resource Inventory was gleaned after many hours of research on voluminous files of reports. This effort was shared by Bartley Block, who also compiled this Natural Resource Inventory, and by Judy Weyant, who was able to retrieve a multitude of relevant but initially missing reports. Other significant help was provided by Letty Malone, a guiding light in the protection of the natural resources of Milford, and by Barbara Milton, who not only provided her extensive knowledge but also lent her considerable organizational skills to the project.

We are also indebted to the Milford Conservation Commission, which, over the years, has sponsored numerous important studies of Milford's natural resources. The perspectives and information developed by the Conservation Commission have been an invaluable resource in its own right.

INTRODUCTION

The city of Milford is fortunate in that, to some extent, it still maintains a small-town flavor. Milford has 15 named beaches in approximately 14 miles of coastline bordering Long Island Sound. Milford contains a bustling harbor that is a mecca for recreational boating and commercial fishing. The city boasts the longest and one of the most beautiful greens in the state of Connecticut, if not in all of southern New England. The town possesses a plethora of first-class recreational facilities such as parks, ball fields, tennis courts, golf courses, horseback riding, a variety of significant Open Space land holdings, and some functioning farms and farmland. Major highways course through the city and commuter trains stop here. In addition, Milford is home to or visited by many shorebirds, raptors, waterfowl, and other forms of wildlife who live, feed, and rear their families in a wealth of habitats spread around the city. While there are few pristine lands left within the city, our wooded areas, wetlands, and remaining farms harken back to earlier times when Nature was supreme.

However, the most valuable natural resource in our city does not appear on any map in this survey and cannot be clearly defined or quantified by experts. This rare and elusive commodity is our *Quality of Life*. No other term encompasses the complete experience of living here. It is in the wooded lands and open fields we walk through, the soil we own, and the land left by benevolent ancestors for us to use communally.

But, naturally, we do not live in a nature preserve, we live in a city—a city that possesses a long and varied history and is populated by people of diverse classes, backgrounds, religions, ethnicities, and opinions. While Quality of Life means different things to different people, we mostly agree that it still contributes to what makes living in Milford a worthwhile experience.

At the present time, Open Space on which development can occur in Milford is extremely limited and we are entering the era of infill development, in which the old is torn down and replaced by the new. Because developable land is scarce, many proposed development projects are sited on marginal land in environmentally sensitive areas with greater densities than can be supported environmentally or economically and with variances usually required in order to build. This final rush of development poses an imminent threat not only to the environment and the various neighborhoods impacted by inappropriate projects but also diminishes our Quality of Life.

Like any natural resource, Quality of Life is subject to change; it can be depleted or degraded, or it can be enhanced. It is up to us, the citizens of this community, to cherish and maintain this valuable resource for ourselves and for future generations or it may slip from our grasp forever. Let us begin our quest by evaluating the considerable and significant natural resources that currently exist in our city.

A BRIEF ENVIRONMENTALLY-ORIENTED HISTORY OF MILFORD

According to the authors of the *History of Milford Connecticut 1639-1939*, the early settlers of Milford found that the Wepawaug River wound through meadow and woodland, spilling its waters by way of a deep, rocky gorge into a long arm of the sea. A half mile farther to the east was another small stream. Their two inlets almost completely surrounded a triangular neck of land. The inlet of what was later known as the Wepawaug River formed a natural harbor for more than a mile upstream, sufficiently deep to permit the entrance and anchorage of vessels. The other inlet, very shallow and at low tide a wide expanse of mud and marsh, formed the mouth of what would eventually be called the Indian River, later the eastern boundary of the settlement. The shoreline with its sweep of curving beaches and bluffs extended both eastward and westward from the mouth of the harbor. To the east, the coastline incorporated both steep hillsides and escarpments as well as low-lying sandy beaches extending to the Oyster River. Westward, the beaches formed a level ribbon along the shoreline to the Housatonic River.

A long narrow peninsula at the extreme west, now Milford Point, had been for many years the site of a large Indian village and the scene of many an Indian oyster feast. The shells were scattered thickly over nearly 24 acres. One and a half miles southwest from the mouth of the harbor, an island of about 19 acres, now called Charles Island, rose from the sea; a rocky bar awash at half-tide connected it with the mainland. The beaches abounded with clams; the harbor and the Indian River with blue crabs; and the waters of the Sound with lobsters and fish of many kinds.

Game was plentiful in the surrounding forests. There was an abundance of both hard and soft woods such as oak, chestnut, butternut, hickory, maple, red cedar, hemlock, and elm. Wild beach plums, growing in profusion along the shore, offered fruit for preserves and jelly.

During its first four years, Milford developed from a wilderness, inhabited by wild animals and Indians, to a healthy, thriving village. However, an early record shows an attempt at conservation of natural resources, or at least a recognition of the need. So much timber had apparently been destroyed by a fire set by the Indians in 1646 that, by 1655, the planters feared a shortage of building materials.

Agriculture was a primary activity and remained important up to about 1950. In the early years, everyone farmed, even those who had other occupations. It was necessary to grow most of one's own food, cut timber, build one's own house and barn, and make many of one's own tools, equipment, clothes, and household goods.

The early planters experimented with new crops. In 1657, one of the settlers requested and received permission from the town to purchase what is now known as Charles Island from another settler. The town specified that he must use the island only for tobacco raising.

During the last quarter of the seventeenth century and to the end of the colonial period, Milford was still primarily an agricultural community. The thrifty Milford farmers had horses, cattle, pork, beef, mutton, flour, and corn meal, as well as furs obtained in Indian trade, barrel and pipe staves and fish to ship away in exchange for sugar, rum, and molasses from the West Indies, manufactured goods from England, and wines from France. The well-protected harbor was navigable for the good-sized vessels that tied up at the wharf to load and unload.

The need for ships in which to carry these goods made Milford a busy shipbuilding port. The first shipyard was built just east of Fowler's Mill, where the sloping banks provided a suitable place for building and launching. Two other shipyards were also established nearby.

Oystering did not develop as an industry until about 1752. In that year, some 50 oystermen lived through the winter at Milford Point in small huts banked with seaweed. The industry was considered of sufficient importance for the town to pass a law in 1763 that imposed a penalty of one pound on anyone taking oysters from Milford waters between April and September. In 1767, the fine for taking oysters out of season was raised to five pounds, and at the same time the use of a rake or tongs was made unlawful. In 1768, the exclusive right to plant and take oysters in a limited area in Indian River was granted to specific individuals.

Fishing, especially on the Housatonic River, was an industry of importance. A dispute between Stratford and Milford over fishing rights in the Housatonic River was carried to the General Assembly in 1768, when Milford petitioned the Assembly to grant a certain section of the River for a fishing place to specified individuals.

During the years immediately following the Revolutionary War, a steadier demand for livestock was developing and dairy products found a ready market, resulting in a trend toward forage crops for dairy and beef animals. Opportunities for employment in agriculture, however, decreased as former croplands were converted into pasturage and hayfields.

By the beginning of the 19th century, oystering continued to hold its place as a local industry. Four ordinances that passed indicate the possible exhaustion of the oyster beds. In 1801, the fine for taking oysters out of season was set at seven dollars; another ordinance of the same year specified that "anyone who obtained a license to gather oysters should first pay, or secure to be paid, to the committee of any of its members, the sum of two cents per bushel for every bushel specified in the permit." In 1802, a law was passed prohibiting any inhabitant from taking oysters or clams for the purpose of vending or transporting them to anyone not a resident. In 1843, a number of instances are recorded where groups of individuals were granted the privilege of planting oysters in town waters and monopolizing the yield within designated bounds. The real expansion of the industry, however, came later in the century.

Shad-fishing in the Housatonic River afforded another seasonal occupation. Shad were caught by the thousands during April, May, and June. Between 1838 and 1840, as many as 12,000 fish were caught in a single day.

A significant change in the community center was the fencing of Milford Green in 1853. A public-spirited citizen and several associates petitioned the townsfolk for permission to fence the Green and agreed to perform the service at no expense to the town. Remembering that New Haven had replaced the two-rail wooden fence around New Haven Green with an enclosure of masonry posts and iron railing in 1846, the citizen volunteer and a helper went to New Haven and brought the second-hand fence on an ox-cart to Milford, where it was erected and gave public service for many years.

In the trying years of depression and slow national recovery that followed the Civil War, Milford had cause to be thankful for its diversified industries, its agriculture, and its bountiful supply of seafood. The success of the William M. Merwin & Sons Company with deep sea oyster beds led to a boom in the oyster business. In 1878, the town issued 41 permits, each for a two-acre oyster grant, 16 of them to women. In that year, the Merwin firm secured a permit to stake out 200 acres of oyster grounds near Pond Point in water

varying from 20 to 50 feet in depth. The firm continued to expand until, by 1888, its oyster beds had increased to 1,000 acres, yielding about 1,000,000 bushels yearly.

According to the account in *Only In Milford: an Illustrated History*, the Taylor Memorial Library was incorporated and the books that were saved from the Lyceum library fire of 1887 were transferred to their new home in 1893. This Richardsonian-Romanesque style building on the corner of Broad and River Streets stands today as the home of Milford's Chamber of Commerce. This library was built for the town by Henry R. Taylor, a summer resident. While the building was named after the Taylor family, different alcoves and stained glass windows were paid for and furnished by prominent Milford families, such as the Galdwins and the Merwins. Taylor's home, Island View on High Street, was renamed Lauralton Hall shortly after the death of his daughter, Laural. This home and property were purchased in 1905 by the Sisters of Mercy for a parochial school.

Meanwhile, Mary Hepburn Smith, who lived on West River Street, was unhappy with the commercial/industrial properties that surrounded her residential property. In a pique of frustration, she purchased all the land around her home and razed the existing structures. After filling in the north side of the acquired properties, she donated the land to the city as a park. Today, these ponds on the Wepawaug River are known as the North Duck Ponds, and are used every year to hold a trout fishing contest for local children.

Seeds had been raised for market in Milford since 1840. Frank H. Woodruff began the successful marketing of sweet corn seed in 1903.

The late 1800s saw the harbor dredged and a breakwater built at the opening of the harbor.

In 1932, no oyster set occurred in Milford waters; the last good set had been obtained in 1930. For several years, local oyster grounds had failed to produce a set and experiments had been conducted annually by the Connecticut Oyster Farms Company, on grounds within the Harbor leased from the town, to determine a method of more successful artificial propagation. The Oyster Pest Control, created by the Federal Government in 1935 for the elimination of starfish, was of great assistance to the industry.

Milford's oyster grounds are still capable of production after more than three centuries of use by white men and uncounted years of harvest by the Indians. The last of the Indians came to Milford Point from faraway Lake Champlain in 1831, to camp at the site of the fire pits of their forefathers, to feast on shellfish, and to exchange tales of the chase and tribal wars.

Milford's prehistoric memorial to the fertility of local oyster fields, an extensive shell heap covering 24 acres at Milford Point, is distinguished as the largest Indian kitchen midden in New England. Because Milford Point was once the site of one of the largest and most important Indian villages in New England, the pile is attributed to the Indians living there.

In 1935, 20 acres of Milford Point, at the mouth of the Housatonic River, including the sites of many of the excavations that uncovered the Indian village at the site, were donated to the state of Connecticut for a wildlife sanctuary by two women.

In 1930, Milford published a series of "Building Zone Regulations" as adopted by the Commission of Town Plan, in accordance with the General Statutes. This code, allowing for the industrial and commercial buildings already erected in the community and the chaotic

growth of certain summer colonies, was designed to prevent future congestion and the erection of unsightly buildings, and to regulate the growth of the town.

By the 1930s, beach colonies formed an almost continuous settlement along the Milford shore. East of the Harbor were Gulf Beach, Welch's Point, Pond Point Beach, Point Beach, Morningside, Farview Beach, Burwell's Beach, and Woodmont. West of the Harbor stretched Fort Trumbull Beach, Silver Beach, Myrtle Beach, Wildemere Beach, Laurel Beach, Cedar Beach, and Milford Point. Of these, Welch's Point was a private residential area, Gulf Beach was for public use, and Milford Point was a designated state bird sanctuary, while the remainder consisted of residential communities.

By 1990, Milford was a combination of residential, industrial, and commercial enterprises with a population of approximately 52,000, many of whom work as far away as New York City and New Jersey. They find it well worth the trip that brings them to the small town atmosphere called Quality of Life, which is still cherished in Milford.

Today, the oyster beds that are located off the shores of Milford take up 6,000 acres equal to 15% of the state's stock of cultivated oyster grounds. The oyster industry is the largest component of the state's aquaculture production with a value of $50 million in 1992, and Connecticut's oysters are highly prized as a result of their uniform size and shape.

The Milford Green as we know it today did not exist in the early days of the settlement. It was customary for an English village to have a common area for the grazing of livestock, the drilling of the local militia, and even for the dumping of refuse. It was likely littered with stones and stumps. The grassy park that we know today, with its flagpole, bandstand, and commemorative war memorial statues, is largely a product of the 19th century. At the present time, the Milford Green is probably the longest green in any of our state's communities.

Milford has many old and significant houses. A Historic District has been established under state law, and there are currently several properties on the National Register of Historic Places. Milford has no 17th century houses, except for a few that were begun in that century and were substantially rebuilt or renovated at later dates. These homes include the Eels-Stow House at 34 High Street, which is owned by the Milford Historical Society; the Clark (Stockade) House, now located at the Milford Historical Society's High Street property; and the Buckingham House at 61 North Street at the corner of Governors Avenue.

REGIONAL GEOLOGY

Bedrock geology

The beginning of Connecticut bedrock or "ledge" geology is linked to a period of tremendous mountain building that occurred between 500 million and 250 million years ago. This mountain building resulted in a world landscape unlike today's, because a single super-continent called Pangea was formed. This mountain-building activity is apparent in the eastern and western thirds of the state of Connecticut.

This super-continent existed for approximately 50 million years, following which it was forced apart during a process called rifting. During rifting, the Atlantic Ocean, as we know it, began to form, splitting North America from Africa and the rest of the present-day continents. Evidence of this rifting is seen in the central third of the state, with its trap rock ridges and red beds. The rifting left the Appalachian Mountains as the western edge of the ever-expanding Atlantic Ocean.

During the last 200 million years, erosion has reduced these once great mountains into the form they exhibit today. The eroded sediments from the Appalachian Mountains were deposited along the edge of the expanding Atlantic Ocean, forming a seaward thickening wedge of sediment. The landward portion is known as the coastal plain, and the submerged offshore component forms the continental shelf.

Most of the city of Milford lies in what is called the Orange-Milford Belt, which is a triangularly-shaped area extending from Milford northeast to about Bethany, due south to West Haven, and then back west to Milford. This belt is comprised of metamorphic gray-green to green phylites, schist, and greenstones formed between 500 and 400 million years ago.

Surficial Geology

The advance and retreat of glaciers resulting from shifts in world climate is a continuous process throughout the history of the Earth. As the Earth enters a period of cooling, large quantities of water, mostly from the oceans, are frozen into ice. The advancing glacier scrapes the loose material off of ridges and out of valleys, pushing it southward like an overloaded plow. As the climate becomes warmer and the ice melts, streams of water gush from the glacier, depositing boulders, rocks, gravel, sand, and silt.

During the last three million years, major North American glaciation began. Several glacial advances reached Connecticut; these glacial events removed significant amounts of material from the New England landscape. The last, or Wisconsinan, ice advance started in Canada about 85,000 years ago and reached Connecticut about 26,000 years ago. This glacial advance reached its maximum extent about 21,000 years ago, approaching what is now central Long Island and leaving a pile of glacial debris called a terminal moraine. When this Wisconsinan glacier was at its maximum size, sea level was about 300 feet lower than it is today, which resulted in a shoreline 50-70 miles south of Long Island along the continental shelf. By about 10,000 years ago, the ice had completely melted, and the land surface in Milford was much as it is today.

The clearest evidence of a glacier's cumbersome trail consists of the grooves and striations that it etches into exposed bedrock as it flows along. These lines are created by rocks embedded in the ice, under the enormous weight of the glacier, which may be hundreds of feet thick. The etched lines tell the direction the glacier was moving. The bedrock outcrops in

Milford are riddled with striations trending about S 35^0 W. The eastern half of the Milford area shows glacial grooves with a southeasterly orientation, suggesting that there were two distinct movements of ice in this area.

A glacier does not just move passively over existing ridges and valleys; it is also capable of reshaping the surface of the land. As the ice moves, it accumulates loose rock and soil and then redeposits it in different ways. Higher parts of the land are covered by till, an unsorted, disorganized blanket of rock fragments that is plastered to the ground by the base of the glacier as it churns forward. This till is composed of boulders, pebbles, and sand particles that originated from nearby bedrock. The grayish and olive granites, gneisses, and schists from which the till was produced create mildly to strongly acid soils.

Some interesting landforms are created from till, of which one is called a drumlin. Drumlins are streamlined in shape, similar to half a football, that have their long axis defined by the direction the glacier moved. There are several drumlins located in the areas of Foran High School and Eisenhower Park. Notably, Clark Hill Road and North Street traverse the long axis of two of these drumlins.

The glacier acts as a bulldozer; it pushes a vast amount of material at the front of the glacier. When the glacier stops progressing, it begins to melt and retreat, leaving a pile of debris. These piles are called end moraine deposits. Charles Island is a remnant of the Hammonasset-Ledyard-Queens River Moraine Deposit and is comprised of sandy till, sand and gravel, with some areas of dense surface boulders.

The Wepawaug River in Milford was diverted as a consequence of a glacial event. As the glacier on the higher ground to the north and east melted, the Old Wepawaug Valley remained blocked by a persistent chunk of ice. Meltwaters from the north gushing downstream were slowed by this ice body, so that they dropped great quantities of sand and gravel to form a natural dam, diverting the river to its present southerly course. The subsequent melting of the ice in the old Wepawaug channel further added to the deposits of sand and gravel, which reached a total thickness of 50-100 feet. Today, this ancestral valley is marked by a chain of swamps, where depressions or kettles left behind by the melting ice have become filled in by organic deposits. Beginning with Baldwin Swamp near the point of the original diversion, the chain continues southwest with Black Swamp and Bilberry Swamp, and then with the wetlands along the eastern edge of the Beaver Brook land—Dismal Swamp, Beaver Brook Marsh, and the marsh east of the Beaver Brook Reservoir.

SHORELINE ABUTTING LONG ISLAND SOUND

Beaches and Significant Shoreline Features

From west to east, the Milford beaches include Cedar, Laurel, Wildemere, Walnut, Myrtle, Silver, Ft. Trumbull, Gulf, Bayview, Pond Point, Point, Morningside, Fairview, and Burwells. Collectively, they represent a significant natural resource of Milford.

Overview of the Shoreline: The following information is based on the 1980 DEP *Study of Shore Erosion and Shore Protection in Milford, Connecticut*.

Milford Point, at the western end of Milford's shoreline, is the termination of a long sand spit oriented along a northeast/southwest axis. The spit, which is covered with low vegetated sand dunes at its western end and is backed by an extensive marsh area, remains relatively undeveloped. The eastern portion of the sand spit, known as Cedar Beach, is developed with single-family residential structures set just behind a narrow beach. Offshore, extensive shoaling has occurred as a result of the Housatonic River breakwater, which has trapped westerly moving drift material. Just beyond Cedar Beach, the shoreline consists of a stretch of beach that extends easterly to the barrier bar at Silver Sands State Park. This section of shoreline, which includes Laurel, Wildemere, and Walnut Beaches varies somewhat in width, being widest at Laurel Beach (which has been artificially nourished and retained with stone groins) and narrowest at Wildemere Beach. Just beyond Walnut Beach, a large barrier bar including Myrtle and Silver Beaches, extends easterly toward Fort Trumbull Beach. This barrier bar is bisected by a long tombolo extending seaward to Charles Island. The section of the barrier bar to the east of the tombolo (Silver Beach) is wide and sandy.

Just east of Silver Beach is Fort Trumbull Beach, which extends westerly to the tidal wetlands area located on the west side of the entrance to Milford Harbor at Burns Point. Fort Trumbull Beach is set at the foot of a higher glacial outwash deposit. Gulf Beach, across the harbor entrance from Burns Point, is formed largely as a result of the construction of a jetty and spur groin located at the north end of the beach. From the south end of Gulf Beach extending around Welches Point is a relatively steep bluff of unconsolidated glacial till material. Little sand is found at the foot of this bluff, which consists primarily of cobbles and large boulders. Various riprap structures protect the toe of the bank out toward Welches Point, while heavy protection in the form of slope paving, steel sheet piling, and riprap revetment protects the east side of Welches Point. Beyond this protected area lies a sandy stretch of beach including Bayview and Pond Point Beaches, which front the Calf Pen Meadow Creek area. East of these beaches, the elevation begins to rise to the headlands at Pond Point, with its rocky shoreline of cobbles and boulders. Further east, the backshore rises considerably higher to the cliff at Morningside. This cliff, which as suffered severe erosion in the past, is now protected by an extensive riprap revetment and slope paving. As the backshore area lowers to the north at Farview Beach, seawalls have been constructed to protect the homes built just above the rocky beach, where frequent outcrops of bedrock can be observed. The backshore continues to lower in elevation further northward to Burwell Beach, where low seawalls provide limited protection to residential structures. At the far eastern limits of the shoreline in Milford lies Merwin Beach, which fronts a marsh area and is flanked at both ends by large rock outcroppings, and Merwin Point, where there are large outcrops of rock that project seaward to form small sandy pocket beaches.

Beach Details: The following description of Milford's beaches is based on field inspections conducted throughout the summer and fall of 1980 by experts who conducted a *Study of*

Shore Erosion and Shore Protection, Milford, Connecticut. The description begins at Milford Point and progresses in an easterly direction, ending at Merwin Point.

Milford Point remains relatively undeveloped and under private ownership, with the exception of a small federally owned section near the landward end of the Housatonic River breakwater. The barrier beach is approximately 3000 feet in length. Above mean high water, the beach material consists of fine sand and gravel, while below mean high water (M.H.W)., the beach consists of coarse sand and gravel. A narrow band of rounded two-inch to four-inch stones approximately three feet in width was observed just below M.H.W., running along the beach. From Milford Point, the shore bends from a southwest to a northeast orientation. The top of the berm along the Point is generally vegetated with grass and shrubs. Between the edge of the berm and M.H.W., the beach averages 30 feet in width. Where the berm and beach meet, there is an exposed vertical face about two-three feet high, consisting of loose sand, gravel, and small stones. The only significant structure found along Milford Point is the Housatonic River breakwater, where an accretion of sand is evident on the east side. Some patches of tall beach grass were found west of the breakwater. At mean low water (M.L.W.), large deposits of coarse sandy material, extending from the breakwater as far east as Cedar Beach, become exposed for a good distance offshore.

Cedar Beach About 3000 feet in extent, 800 feet of Cedar Beach on its east side is owned by the state of Connecticut, while the remainder of the beach is privately owned. The beach consists of coarse sand, gravel, and cobbles. The houses and cottages located in this area are set back approximately 100 feet from M.H.W., except near Marsh Street where approximately 250 feet of beach narrows to approximately 30 feet. Although most are built at the existing beach level with no seawalls in front of them, many are set behind the grassy dunes that still remain. Below M.H.W., the beach slopes down to meet a large flatter area of shoals extending to an irregular M.L.W. line located 300 to 800 feet seaward of M.H.W.

Approximately 2200 feet in length, **Laurel Beach** is a relatively wide sandy beach in apparently good condition. The beach is compartmentalized by three stone groins and several small timber groins that, for the most part, are below the existing beach level. The houses along the beach are generally large summer cottages that appear to have been converted to year-round use. There is a curved face seawall fronting the cottages that is approximately 900 feet long. The level of the beach berm is about three to four feet below the top of the seawall, a marked change from 1949, when little or no beach existed. The width of the beach varies from 40 to 130 feet, with the widest sections found at the northeast sides of the stone groins where drift material has been accumulating. The narrowest widths are found on the downdrift sides of these stone groins, where the material is somewhat coarser than that found on the updrift sides. The material found on Laurel Beach above M.H.W. consists mostly of fine to medium-size sand. From M.H.W. to a point where the beach slope becomes much flatter, the material becomes coarser, containing a much larger percentage of gravel and small stones. Beyond this point, to and beyond M.L.W., the beach material is mostly fine sand. Southwest of the Fourth Avenue Groin, near Third Avenue, a gravel spit has formed, extending approximately 300 feet seaward of the end of the groin. This feature has been gradually growing larger.

Wildemere Beach is a narrow stretch of sand held by low, short timber groins spaced at frequent intervals. The width of the beach becomes narrower as one moves toward the east. At the westernmost end, there is approximately 50 feet of beach between M.H.W. and the existing seawalls, while at Waterbury Avenue, near the eastern end, there is only 20 feet to 30 feet of beach. In some places, where seawalls were built closer to the water, there is no beach visible at high tide. The seawalls fronting the houses are of varied types and conditions. The material along Wildemere Beach generally consists of fine sand and small

stones above M.H.W., with some small boulders in the vicinity of Bridgewater Avenue. Below M.H.W., the beach becomes coarser, containing a much larger percentage of gravel and small stones, until it flattens out just above M.L.W. where the material changes to a very fine composition. At a few locations along this beach, small pockets of drift material were observed on the eastern (updrift) sides of the timber groins.

Walnut Beach, which is contiguous to and northeast of Wildemere Beach, is approximately 2800 feet in extent. The beach begins to widen out in the area between Ann Street and Naugatuck avenue. In this area, fewer dwellings are located directly on the beach and these are fronted by concrete seawalls. The beach begins to narrow at the Walnut Beach Condominiums, where a riprap revetment has been placed to protect the beach berm. The beach was once approximately 30 feet in width and the riprap was almost completely covered with sand. However, rapid erosion has occurred so that the toe of the bank developed a scarp over one foot in height along its entire length and the remains of an old timber groin were exposed. Following a severe storm, the sand covering the riprap was completely removed and M.H.W. had advanced almost to the base of the riprap. The material at Walnut Beach is similar to that found along adjacent beaches, except for an area northeast of Naugatuck Avenue, where scattered boulders were observed.

Myrtle Beach, located to the northeast of Walnut Beach Condominiums, is a popular recreational area that is privately owned. The beach, which is about 3900 feet in length, widens considerably at this point. No significant structures are located in the beach area except for a riprap covered storm drain at Viscount Drive (which seems to have trapped some westward moving drift material) and the Nettleton Avenue storm drainage channel outlet jetties that form the easterly boundary of the beach. The beach material is fine to coarse sand with some gravel. Above M.H.W., the material consists of medium sand. Below M.H.W., the beach material grades from coarse to fine, similar to that described for Wildemere Beach.

Silver Beach, which is a part of Silver Sands State Park, is approximately 2200 feet in length, with the west beach at about 1800 feet and the east beach at about 400 feet in length. The beach is a barrier beach which fronts a wetland area that was largely devastated by a now-defunct sanitary landfill operation that had been conducted by the city of Milford. A bar or tombolo, which becomes exposed at low tide, extends approximately 3000 feet from the beach in a southeasterly direction to Charles Island. The western section of the beach is bounded on the east by the tombolo and on the west by two timber jetties that serve to confine a drainage channel outlet for stormwater runoff from the Nettleton Avenue area. There are two rubble stone groins in this section of the beach, one (eastern) located approximately 100 feet west of the tombolo and the other (western) located approximately 850 feet east of the Nettleton Avenue drainage outlet. The beach decreases in width from approximately 200 feet at the timber jetties to virtually no beach at a point approximately 125 feet west of the westerly groin. Between the two groins, along the old alignment of East Broadway, no beach exists at M.H.W., except for small pockets of beach material located on the east side of the westerly groin and on the east and west sides of the easterly groin. The bottom in this section is flat and consists of a fine sediment. The destruction of portions of East Broadway (closed to traffic) is evidence of the severe wave action and accelerated erosion in this area.

The Charles Island tombolo, which consists predominately of gravel, cobbles, and stones, has trapped fine sand and small gravel along its eastern side at both inner and outer ends. The distance from the Charles Island tombolo to Nettleton Avenue is approximately 2200 feet. A typical section of the Charles Island shoreline would show stones and small boulders extending up from M.L.W. for approximately 20 feet, beach grass for an additional 20-30 feet, and then more stones and boulders to the base of a vegetated bank. There is generally a

distance of 30-50 feet between the base of this bank and M.H.W. The bank appears to consist of a fine sandy loam that resists most forms of erosion. The finest beach material found along the Charles Island shoreline is on the north side, where scattered areas of sand and gravel were observed. For the most part, the bank around the island is generally steep and thickly vegetated.

Just to the east of the tombolo, the sandy beach along East Broadway widens to approximately 130 feet in width until it meets Silver Beach. Silver Beach, which is one of the better recreational beaches west of Milford Harbor, is generally 75-100 feet in width above M.H.W. The backshore area is completely developed, consisting generally of year-round homes and seasonal cottages. The material along the beach is typically fine to coarse sand above M.H.W., coarser material such as gravel and some small stones at the steepest portion of the beach, and then very fine material where the beach flattens out to M.L.W. The only significant structure in this area is the outlet pipe for Great Creek, which is at an elevation somewhat below the normal beach level. As a result, this outlet frequently becomes covered, preventing drainage and causing flooding of the streets north of East Broadway. An area of shoaling was observed to be forming both to the east and west of this outlet pipe.

West of the Great Creek outlet, the beach widens to approximately 150 feet in width, primarily due to a greater setback distance from M.H.W. to the existing dwellings. This particular area is known as **Fort Trumbull Beach**, and extends easterly all the way to the entrance of Milford Harbor at Burns Point, a distance of approximately 3500 feet. As one moves closer to the harbor entrance, the beach material becomes coarser and the width of the beach decreases where seawalls have been built closer to the water (within 20 feet of M.H.W. just east of Seaside Avenue). On the west of Seaside Avenue, there is a steep bank between the street and M.H.W. that shows evidence of some erosion. There are remains of various forms of bank protection that had been employed along portions of this area, ranging from sections of masonry wall to dumped boulders at the toe of the slope, to timber bulkheads, backfilled with dumped boulders. At Burns Point, there is an old low seawall in poor condition, with dumped granite to the east of the wall. The wall has protected the back well, but erosion has continued behind the dumped granite. The material below the bank is predominately gravel and cobbles that changes to a fine sand with small boulders at M.L.W. An area of tidal wetlands, which extends from Burns Point westerly for almost 1500 feet, is found in this location. It is the largest area of tidal wetlands in Milford that is located directly on Long Island Sound.

Gulf Beach, a municipally-owned recreation area, is about 1200 feet in extent. This beach has accreted to within one foot of the top of the easterly stone jetty and spur groin located at the entrance to Milford Harbor. This portion of Gulf Beach, which is oriented nearly east to west, consists generally of sand above M.H.W., which becomes coarser with more stones appearing below M.H.W. The beach varies in width from 100-200 feet adjacent to the stone jetty to between 20-30 feet at the southern end of the beach near the concession stand. The beach becomes less sandy as one walks toward Welches Point until it eventually becomes nearly completely composed of stones. At the southernmost end of Gulf Beach, there are the remains of an old boat-launching ramp. On each side of the precast concrete block ramp are piles of boulders that have captured drift material and widened the beach somewhat on both sides. This drift material found on the south side, however, was much more substantial than the amount on the north side.

South of Gulf Beach, to Welches Point, there is virtually no sand on the beach, which now consists primarily of gravel, cobbles, and boulders. The distance between M.H.W. and the toe of the bank in this section varies from 0 to 20 feet. Although the bank shows some indications of localized erosion, it appears to be well vegetated and fairly stable. Parallel to

Gulf Street, the bank is protected in some sections by old timber posts backfilled with dumped boulders. Further along the shoreline, there are remains of closely spaced stone groins that were built during the latter part of the 19th century. These appear to be having little effect, with no noticeable accumulation of drift material. The beach at this point is dominated by the presence of large stones and boulders.

The bank at the extreme end of Welches Point is well protected, with granite and mortar slope paving, steel sheet piling, and dumped boulder revetment. Three granite block spur groins, approximately 100 feet in length, are located on the east side of the Point. No significant accumulation was observed except a 2½-3-foot-wide gravel updrift area on the northeast side of the southernmost groin, the stone blocks of which have been displaced by wave action. Just north of the last spur groin, where no riprap was used, undermining of the granite block slope was observed. There is no beach in this area at M.H.W. The material at the base of the bank protection consists of gravel and small stones. As the beach turns to the east, however, the material becomes sandier and the beach becomes wider. This 225-foot section of the 100-foot-wide beach has been maintained by the Point Lookout Association, an organization of homeowners at Welches Point. The material at this location is fine to coarse sand with gravel and cobbles above M.H.W. Below M.H.W., there is a band of fine sand followed by a band of cobbles. There are timber sheet pile groins at both ends of this beach. The west groin is missing many of its planks, thus making it practically nonfunctional. There is a noticeable eastward drift at the east groin where the material generally is mostly cobbles and gravel. A much finer material is found on the west side.

East of Point Lookout is **Bayview Beach**, which runs from approximately 400 to 2100 feet west of Calf Pen Meadow Creek. At this point, there are a few timber groins holding a narrow beach. Drift material was found on the southwest side of each of these groins, indicating that beach material is moving to the east in this area. In each case, the material on the updrift side of the groin is finer than that on the downdrift side. The material also becomes finer as one moves toward the east. There are seawalls all along this beach where the houses are built close to the water. The width of the beach varies from 0 to 20 feet until it widens to approximately 225 feet between M.H.W. and Bayshore Drive at a beach owned by the Bayview Improvement Association. This beach is approximately 700 feet in length and is composed of sand, fine gravel, and some cobbles. At the eastern end of Bayview Beach, there are several homes seaward of Bayshore Drive that reduce the beach width to approximately 75 feet at M.H.W.

Just east of Bayview Beach, Calf Pen Meadow Creek discharges into Long Island Sound. Small stones have collected on both sides of the stream outlet. The existence of a timber jetty on the east side of the creek has resulted in a beach that is up to 3 1/2 feet higher in elevation than the beach on the west side of the creek.

Pond Point Beach, which begins on the east side of the creek, is about 2500 feet in total length. The beach decreases from approximately 160 feet in width at the creek to 10-20 feet along the low, continuous concrete seawall fronting a residential area. The beach steepens here, with the material at the west end being gravel and cobbles below M.H.W., and sand and gravel above M.H.W. Mussel beds were found throughout this area. There are three groins constructed of precast concrete blocks spaced at 300-foot intervals along the east end of the seawall. Drift from the west was observed at each of these groins. At Beachland Avenue, where the concrete seawall ends, the bank behind the beach begins to rise in elevation to a point 10-15 feet above the existing beach level. Timber bulkheads, dumped boulders, and higher seawalls are used for bank protection here. The beach averages approximately 25 feet in width, and undermining is evident where the toe of one of the seawalls is visible. The beach material is coarser here, except where the slope flattens out

above M.L.W. and fine sediment is found. Above M.H.W., the beach is gravelly to stony. There is practically no beach left at high tide in front of an area of unprotected bank, where signs of erosion are obvious. There are two bulldozed boulder groins here that show a slight easterly updrift. Just before the beach turns more southerly, there is a revetment of precast concrete sections protecting the bank. The beach width at this location is approximately 30 feet. Where the beach turns further south to Pond Point, there are three timber groins. The northernmost groin has an accumulation of stones on its southern side. The next groin to the south has a slight updrift on its north side, while the southern most groin had no significant drift on either side. At the back of the beach, there are low seawalls that show some signs of undermining. At high tide, there are approximately 20 feet of rocky beach in front of these wells.

The next most prominent feature along the shoreline is Pond Point, which has a 50-foot groin of three-foot stones, and two to three feet of gravel and cobbles on its southern (updrift) side. Point Beach, which is just east of Pond Point, is composed mostly of two to four inch or larger stones, with little sand. There are many closely spaced timber groins here in front of low seawalls of varying heights, some showing a slight accretion on their west sides. At high tide, there is up to 40 feet of beach in front of the seawalls, some of which show signs of undermining. Mussel beds were observed all along this area. The same beach conditions generally prevail for approximately 2500 feet east of Pond Point, with the exception of the seawalls, which increase in height toward the east. The general direction of drift here was observed to be toward the east.

The beach widens to approximately 40 feet just beyond the northeasterly termination of Point Beach Drive, where there is a steep unprotected bank, approximately 10 feet above the beach, extending almost 700 feet along the back of the beach to a point near the southwesterly terminus of the Morningside revetment. This bank, which appears to consist of gravel and sandy silt, rises at the east end, where it is approximately 20 feet higher in elevation than the rocky beach below. There are three fairly new homes near the top edge of the bank at this location, and the bank showed signs of erosion from wave action generated by a severe storm that occurred in October, 1980.

Morningside revetment begins at a point near Little Pond Road and extends northeasterly about 2500 feet toward Farview Beach. At low tide, there is a narrow gravel and cobble beach exposed below the toe of the stone revetment. In places, bulldozers are periodically utilized to form boulder groins, making some sections more suitable for bathing than others. The riprap revetment ends just below Norwood Road, where some signs of undermining of the wall are visible.

Farview Beach, which is just beyond the Morningside revetment, is approximately 2400 feet in extent. This beach is an extremely rocky section where many damaged seawall remains are found. These seawalls, which are generally built on ledge outcroppings, have toes that are above the existing beach level. At high tide, the water is at the base of the walls.

The beach becomes less rocky and wider to the north at **Burwell Beach**, which becomes somewhat sandier. The width is up to 30 feet at M.H.W. at the north end of this beach.

Merwin Beach, which is used for recreational purposes, is a pocket beach of about 2000 feet in length that lies between ledge outcroppings and varies in width from 100 feet at its southwesterly end to 20 feet at its extreme eastern end. Slight drifting to the northeast was observed at the ledge outcrops and storm drains found in the vicinity. The beach, which is sandy above M.H.W., becomes stony below M.H.W.

Three more small sandy pocket beaches are found between Merwin Beach and Merwin Point, a prominent rock outcropping. Each of these small sections of beach is protected by rock outcrops that flank either side.

Environmental Considerations Along the Shoreline: The following information is based on the 1980 DEP *Study of Shore Erosion and Shore Protection in Milford, Connecticut*.

Critical environmental areas that would be sensitive to ecological impacts of development and beach restoration projects include the following: (1) tidal wetlands; (2) the area off Welches Point and offshore from Charles Island, which support epifaunal and benthic communities; and (C) areas that support concentrations of shellfish such as clams and oysters.

Aside from protection, maintenance, and restoration of the beaches, the two wetland areas at Fort Trumbull Beach and Calf Pen Meadows Creek are critical environmental areas that require adequate protection. Fort Trumbull Beach is a relatively stable area that is not subjected to severe erosion problems. Calf Pen Meadow Creek is subjected to tidal action in the area of the wetlands. This area is not subjected to storm-induced erosion, however.

Epifaunal and benthic communities in the areas of Welches Point and offshore from Charles Island must be protected. These areas are favorable for populations of lobsters and must not be adversely impacted by any development or beach restoration project. Areas that support concentrations of shellfish such as oysters and clams should also be protected.

Shellfishing along the Milford shoreline is of two principal types: (1) recreational, and (2) commercial. The recreational type of shellfish consists primarily of hardshell clams, or Quohogs. These clams range in size from small cherrystone up to approximately four inches in diameter and prefer relatively shallow water depths and a sandy-silt environment. Some Quohogs have been found in shallow water that is exposed at low tide in the area between Milford Point and Welches Point. Although this area has been closed to recreational shellfishing because of bacterial pollution, local residents have been observed clamming at various times.

Commercial shellfishing areas between Milford Point and Merwin Point have been delineated as oyster grounds leased from the state of Connecticut. The primary purpose of these oyster leases is to provide seed oysters for commercial cultivation. These oyster grounds have been closed for use in harvesting market-sized oysters because of bacterial pollution; however, the small seed oysters are removed by dredging and replanted in clean growing areas, primarily Long Island, New York, until ready for harvesting.

Shellfish populations may be expected to fluctuate in numbers as well as in actual distribution. These fluctuations are due to environmental factors, disease, predation, and availability of a suitable food supply, especially for the larvae and young shellfish.

Waters near the shoreline of Milford are moderately productive in terms of nutrients that support growth of phytoplankton. Limited water chemistry data for salinity, dissolved oxygen, nitrate, orthophosphate, and pH reveal values that are typical for Long Island Sound waters.

Long Island Sound is an important nursery area for many species of finfish and at one time supported extensive commercial fisheries. Winter flounder represents a species that is important for recreational fishing in the area of Charles Island. Numerous recreational

fishers fish in the area between Charles Island and the Housatonic River, generally in the area of the 18-foot contour. During the summer months, sports fishers fish in the area of the mouth of Milford Harbor. They fish for snapper bluefish and bunkers, or menhaden. Menhaden are also a source of food for the predatory bluefish. In general, finfish and benthic populations are characteristic of inshore Long Island Sound communities that are not under environmental stress from pollutants.

The natural sources of beach material of the Milford beaches are the onshore and longshore dynamic processes within the littoral zone that transport, by action of waves and currents, sediment from the nearshore bottom and unconsolidated materials eroded from the beaches and bluffs along the shoreline, which are "unprotected" by manmade structures, and deposit such materials elsewhere in the littoral zone. In addition, the Housatonic River, immediately adjacent to the shoreline beaches, may carry significant volume of sediment eroded from upland areas and riverbanks out to Long Island Sound. However, the smaller rivers and creeks, including the Indian and Wepawaug Rivers, which discharge to the Gulf, and Calf Pen Meadow Creek, and Great Creek, which discharge directly to Long Island Sound, are not considered to be significant sources. Also, because of the lack of any major dune areas along the shoreline beaches, there are no significant windblown sources available.

The major part of the Milford shoreline has been modified by manmade structures in an attempt to protect the dwellings, commercial buildings, roadways, and other improvements built too close to the shore against destruction by the natural littoral processes, including storm-induced wave effects. The result has been an upsetting of the natural balance of beach erosion and accretion to the point where the natural sources of beach building materials have become extremely limited and are insufficient to maintain the shoreline beaches in equilibrium. It has therefore become increasingly necessary to adopt artificial means of nourishing the beaches by importing material from inland borrow pits or by dredging suitable material from nearby offshore borrow areas to provide protection to beachfront development or to maintain recreational opportunities. Thus, artificial beach material sources have largely supplemented natural sources. Where such artificial sources have not been employed on a periodic basis, major portions of beaches have been lost (i.e., Wildemere Beach and Silver Beach).

However, not all beach materials removed by the sink processes are irretrievably lost. For example, the material removed from a beach by longshore transport may be captured by a groin or natural feature at another part of the beach or at adjacent beaches. Also, material removed from a beach by the offshore transport process may be naturally returned to the beach under favorable conditions by onshore transport, or such materials may be deposited to form an offshore bar that can also act as a protective feature. Examples of all these recovery processes have been employed along the shoreline beaches of Milford.

Silver Sands State Park

Overview of the Park: Silver Sands State Park consists of a 310-acre tract of land. It is located in the Myrtle Beach and Silver Beach sections of Milford and has 3,000 feet of frontage on Long Island Sound with two excellent, sandy beaches for swimming. The Park is located on a protruding headland about midway between Fort Trumbull to the east and Milford Point to the west, along the western shorefront of Milford.

Picnicking and salt-water bathing are the principal recreational uses within the Park. In addition, there are accommodations for a small number of visitors to the Park for fishing, canoeing, and nature observation. Ninety-six acres of the Park lie within the Great Creek

tidal wetland and cannot be developed. Twenty-two acres comprise the Silver Sands Park-way access corridor from U.S. Route 1; 15 acres are beach and headland (seven acres of which are sandy beaches at mean tide level); 74 acres are freshwater and degraded tidal wetlands located in the western half of the Park; and 103 acres are developable filled land that is inclusive of the approximately 60-acre conical, capped portion of the former Milford landfill.

Silver Sands Beaches: The two Silver beaches, designated East Beach and West Beach, are separated by a low-lying, rounded headland. Headlands are defined as upland areas that protrude into a body of water. The Park headland is not vegetated but is characterized by remnants of various man-made structures, including seawalls, foundations, cement blocks, pipes, pilings, and broken pavement. Patches of exposed peat below the headland indicate that this area was once salt marsh, and two patches of *Spartina* still grow in protected areas. An abandoned paved road, formerly known as East Broadway, runs along the shore for the length of the park, separating the beaches from the Fletcher's Creek marsh. There is no vegetation on the beaches other than a narrow zone of sea rocket, golden rod, and grasses along the northern edge of West Beach. The wrack zone at the high tide line contained a variety of mollusc shells including blue mussel, ribbed mussel, jingle shell, slipper shell, oyster, round clam, soft shell clam, scallop, and cockle, together with lady crab and horseshoe crab exoskeletons. Pilings below the headland, outflow structures for Great Creek and Nettleton Creek, and two large stone groins provide solid substrates for the attachment of seaweeds and invertebrates. Both deer and raccoon tracks were noted in the sand at West Beach. The eastern end of East Broadway is still paved and is used for public parking. Even during late fall, there were many people using East Beach for viewing the Sound, walking, fishing, and other recreation. West Beach was also used by walkers and joggers, who reached the area from Myrtle Beach or Nettleton Avenue. At low tide, broad sand flats extend offshore. Shallow tide pools on the emergent flats attracted a variety of birds including herring gulls, black-backed gulls, killdeer, sand pipers, coots, swans, and black ducks. The tidal flats were well populated with mud snails and periwinkles.

The tidal flats: In the fall of 1979, a total of 14 species of demersal finfish were reported for the flats east of Charles Island. The dominant species were winter flounder (38.5% of the catch) and porgy (38.4% of the catch). Sixteen invertebrate species were also collected from the sandy bottom. Crustaceans included sand shrimp, lobster, and six crab species, dominated by lady crab. Molluscs included channel welk, blue mussel, and squid. Northern coral and starfish were also present. Ten additional invertebrate species were noted for the east side of Charles Island, including sea anemones, yellow sulfur sponge, oyster, quahog, sea urchin, oyster drill, and moon snail. A healthy and diverse community of invertebrates, fish, and birds was associated with intertidal and subtidal habitats offshore.

The tidal flats and subtidal bottom of Long Island Sound are leased for shell fishing offshore from the Park and beyond Charles Island. Near-shore intertidal flats produce round clams, soft-shell clams, and razor clams. Further offshore, oyster beds are harvested in 3 to 5 feet of water at low tide. The shoreline region east of Charles Island and the tombolo, known as the Gulf, is classified as a "restricted relay" shellfish growing area. Shellfish can be harvested from this area and transferred to an "approved" area for natural biological purification. The region west of the Island and tombolo is such an "approved area" that can be used for growing or harvesting shellfish for recreational use and direct marketing.

Great Creek Watershed: Great Creek drains a watershed of 504 acres in the south central part of Milford before emptying into Long Island Sound 1,900 feet to the east of Silver Sands State Park. The maximum dimensions of the watershed are approximately 7,000 feet north to south and 5,000 feet east to west. Residential development is the predominant land use

accounting for almost 60% of the watershed. Open Space, consisting mostly of the 105-acre Great Creek Marsh, is the other major land use.

Most of the Great Creek drainage basin lies at very low elevations. The highest point, 92 feet above mean sea level, is located at the northernmost point in the watershed near Tower Street. The lowest point occurs along the Long Island Sound shorefront. It is at the lower elevations that chronic flooding problems have been experienced. Virtually all of the Great Creek Marsh lies below elevation 5.0 feet, with the majority of it being less than 3.0 feet above mean sea level.

Great Creek and Fletcher's Creek Saltmarshes: In the early 1800s and as late as 1955, most of the Park area north of the beach consisted of a large saltmarsh drained by two tidal creeks. The marsh is now divided by a north-south haul road for the closed land fill, and by a portion of the east-west Temporary Service Road, which connects Nettleton Avenue to East Broadway. Both of the resulting marshes are dominated by common reed, a tall coarse plant that is indicative of disturbance, and has limited wildlife value, compared to indigenous saltmarsh species.

The marsh to the east is drained by Great Creek. This tidal creek was dredged and redirected through a self-regulating tide gate and outflow structure as part of an earlier flood control and marsh restoration project. As a consequence, some change in vegetation has occurred along the creek. Small patches of cord grass have become established along the banks for the full length of the new channel. The *Phragmites* within 10-15 feet of the creek is stunted and, in some areas, did not flower. However, most of the wetland remains dominated by tall vigorous strands of *Phragmites*. A few hardy shrubs such as Japanese knotweed, multiflora rose, and staghorn sumac were noted on higher ground. Birds using the creek included broadbill, mallard, Canada goose, and kingfisher. Invertebrate fauna included several worms, small crustaceans, grass shrimps, and barnacles. Molluscs included mud snail, ribbed mussel, blue mussel, round clam, and oyster.

The western marsh is drained by Fletcher's Creek, a small meandering stream that is connected to Long Island Sound by a pipe under East Beach. The pipe was cleaned out during the fall of 1992, thereby increasing tidal flushing. Salinities in the creek ranged from 22.4 ppt at the inflow pipe to 10.6 ppt at the upper end. Salinity in the small pools on the marsh surface was highly variable, ranging from 19.2 to 4.9 ppt. During the storm of December 11, 1992, the pipe was buried under the sand, trapping tidal water in the wetland. Vegetation in this marsh consisted of pure strands of *Phragmites*. Invertebrate species were not identified but can be expected to include many of the same organisms found in the Great Creek wetland. Birds noted in the Fletcher's Creek marsh included black duck, great blue heron, great egret, Wilson's phalarope, kestrel, and osprey. Most of this marsh contains large quantities of dumped trash, some of which is visible protruding from the soil. Presumably, this addition of fill has raised the marsh surface and, together with restricted tidal flow, has contributed to the invasion of *Phragmites*.

Between the marsh and the Temporary Service Road, there are several large dump sites that have developed into vegetated upland areas. There are also several small upland islands, apparently created by dumping, within the marsh. These uplands support dense vegetation (primarily tree-of-heaven, cottonwood, staghorn sumac, Japanese knotweed, and bittersweet) and serve an important function as wildlife habitat. A aggregation area for deer was noted on one of the upland knolls, and raccoon tracks were abundant. The uplands are bordered by a path and a drainage ditch parallel to the Temporary Service Road. Vegetation along this upland edge was highly diverse, with 31 plant species represented. Trees included oak, maple, birch, tree-of-heaven, catalpa, locust, cottonwood, and trembling aspen. The herb

community included field weeds such as milkweed, aster, thistle, and goldenrod, together with such wetland plants along the ditch as hardhack, woolgrass, and spikerush.

Charles Island: Charles Island, 18.7 acres in area, is part of Silver Sands State Park and is located 3,000 feet off the shore of Myrtle Beach and Silver Beach. The Island is tenuously connected to the headland by a 30- to 40-foot-wide sand bar or tombolo. The tombolo, which is evident on maps dating to 1892, is submerged at high tide and therefore only provides pedestrian access to the Island at low tide.

According to *History of Milford Connecticut,* Charles Deal requested and received permission from the town in 1657 to purchase the Island, then known as Poquehaug or Milford Island, from then owner Richard Bryan. The town specified that Mr. Deal had to use the island only for tobacco raising, and that he should not "sell or truck with either Indians, English, or Dutch nor suffer any disorderly resort of meetings of seamen or others there." This is one of the earliest recorded instances of tobacco raising in Connecticut by white men, although, ultimately, the venture turned out to be a failure.

Subsequently, the Island was used for a variety of purposes. For example, the George W. Miles Company leased part of Charles Island in 1868 to set up a plant for the manufacture of fish oil and fertilizer from menhaden, a bony fish found in great quantities in the Sound. The Miles Company made a superior product and received many awards in both the United States and the United Kingdom for the excellent quality of their oil.

At the present time, the Island is used as a favorite nesting place for a variety of important shorebirds. Based on a letter from Julie Victoria, a Wildlife Biologist for the DEP Franklin Wildlife Management Area, there were 303 nesting pairs of black-crowned night herons, 78 nesting pairs of snowy egrets, and 29 nesting pairs of great egrets on the Island in 2001. The bird colony is spread out through most of the interior of the Island. In addition, two adult deer and a fawn were also counted during the survey, which was conducted by the Connecticut Colonial Waterbird Survey.

SIGNIFICANT WATERCOURSES WITH ASSOCIATED GREENWAYS

The 1972 Plan of Development for Milford points out that each of the major watercourses running through the city constitutes a major Open Space system, or potential greenway. These greenways include the following:

- The Housatonic River Greenway, which includes established wetlands such as the D'Amato property, the McKinney National Wildlife Refuge at Milford Point and the adjoining Housatonic River with Pope's, Fowler, and Farm Flats Islands. This greenway includes areas for conservation and passive recreational development.

- The Beaver Brook Greenway, which includes the Mondo Ponds, the artesian springs, the Beaver Brook Marsh and trail, and the Beaver Brook Reservoir.

- The Wepawaug River Greenway, which includes Milford Harbor and adjacent wetlands and intertidal mudflats, Wilcox Park, numerous small parks along the lower Wepawaug River, the Platt Orchards Golf Course, Eisenhower Park, and Camp Katoya.

- The Indian River-Gulf Pond Greenway, which includes flood plain areas bordering the Indian River, the Clark's Pond Fishway, as well as Gulf Beach and Pond.

In addition and about four years ago, the Open Space Steering Committee decided to add an east/west greenway connection from the Wepawaug River Greenway to the Beaver Brook Greenway that included the Solomon Property, the Alter Property, and Wetland 1 of the Avalon at Milford Parcel.

We will now consider each of these formative greenways

Housatonic River Greenway

Housatonic River: According to *A Guide to the Housatonic River Estuary: Its Wildlife, History, Activities, Water Quality,* the Housatonic River begins its 149-mile journey to Long Island Sound at Muddy Point in Washington, Massachusetts. It flows south through western Massachusetts and Connecticut, becoming tidal just below the Derby/Shelton Dam. The River is tidal for a distance of 13 miles. . The River becomes estuarine, a mixture of both fresh and salt water, at approximately the Far Mill River in southern Connecticut, a distance of some 8 miles. Therefore, from the southern border of Shelton to the mouth of the River at Stratford and Milford, the River is a mix of both fresh and salt water. The entire Housatonic watershed is 1,948 square miles, with Connecticut's share at 1,234 square miles.

Estuaries are crucial breeding grounds for many marine animals, support a great variety of plant and animal life, and produce four times more organic matter than a fertilized cornfield. The Housatonic River estuary is made up of different habitats, each having its own community of plants and animals that have adapted to local conditions and are dependent upon on another. This estuary includes four types of habitat: uplands (well-drained soils with elevations up to 500 feet), tidal wetlands and mud flats, sand spits and barrier beaches, and Long Island Sound.

Specific habitat types within the Housatonic River system include aquatic estuarine habitat associated with the open waters of Marine Basin, mud flats along the River shorelines and tidal creeks, and emergent tidal salt marsh areas. The ecological value of

these habitats is further enhanced by the presence of adjacent beaches and the Wheeler Marsh (Nells Island) at Milford Point..

The significance of the Housatonic River, estuary, and watershed should not be underestimated. For example, the Housatonic River adds 11% of the freshwater that drains into Long Island Sound. In addition, 40% of Connecticut's seed oysters are cultivated in the Housatonic estuary. Furthermore, the Housatonic watershed is home to some of the best fishing, boating, canoeing, bicycling, hiking, and camping in the Northeast.

Milford Point: Bordering on salt marsh, mudflat, the mouth of the Housatonic River, barrier beach, and ocean habitats, Milford Point is considered one of the best bird watching areas in Connecticut. The mud flats, sand bars, and marshes provide waterfowl, shorebirds, and wading birds with a safe haven for feeding and resting during their long spring and fall migrations. Over 50 species of shorebirds, wading birds, and waterfowl have been seen using this refuge of some 900 acres. Several European species, including ruff and black-tailed godwit, have also been documented by the Connecticut Ornithological Association rare records committee. Barrier beaches, which protect the salt marshes, provide essential nesting and feeding habitat for several protected species. Piping plovers, least terns, and American oystercatchers now nest on the restored Point. The upland portions of Milford Point provide nesting sites for many species of songbirds. The brown thrasher has recently been confirmed as nesting at this location. During the spring and fall songbird migration, well over 100 passerine species have been documented.

The dimensions of the various beach and dune habitats on Milford Point are variable along its length due to the dynamics of wind and currents at the Point and the varying distances of the houses from the beach. According to the *Draft Biological Assessment of Impacts to the Piping Plover*, approximately half of the length of the nesting area of this threatened species (the western half closest to the mouth of the Housatonic River) has a back bay (tidal creeks of the Nells Island complex), while the other half is backed by residential development. Where houses occur along the beach, there tends to be a narrower vegetated dune above the beach, while areas without houses have wider dunes.

The ambient environment at Milford Point includes human recreational use in summer, adjacent permanent and seasonal residences, and overflights by aircraft approaching or departing Sikorsky Memorial Airport. A large contingent of birders and other nature lovers are drawn to the site by the Connecticut Audubon Center located near the Point.

Based on a description provided by the Bent of the River Sanctuary, the Wheeler Marsh at Milford point is approximately a 850-acre *Spartina*-dominated low salt marsh at the mouth of the Housatonic River. The Wheeler Marsh is a wildlife management area supervised by the State of Connecticut Department of Environmental Protection for waterfowl and marsh bird hunting and the benefit of other wildlife.

Milford Point, itself, is an 8.5-acre barrier beach with two large sandbars that are generally not covered by mean high water. The smaller of the two is often covered by storm or spring tides and the larger sandbar has recently become contiguous with the mainland. The sandbars are also state-owned, but ownership is currently disputed.

The Connecticut Audubon Society has a nature education center located on the barrier beach, and the U.S. Fish and Wildlife Service, as part of the Stewart B. McKinney National Wildlife Refuge, owns the 8.5-acre Point proper. The area has great potential for education and research and, since 1997, is the site of Manomet International Shorebird Surveys.

Birdbanding at Milford Point is concerned with migration, population, and usage of the site by passerines and shorebirds.

According the U.S. Fish & Wildlife Service, the westernmost curved peninsula is called the Milford Point unit, and is one of eight units that compose the Stewart B. McKinney National Wildlife Refuge along the coast of Connecticut from Westbrook to Norwalk. Refuge lands include five islands, barrier beaches, tidal salt marshes, shrub lands, and upland habitats. In addition to the Milford Point unit, the Wildlife Refuge consists of the Great Meadows unit in Stratford, the Norwalk Islands unit of 11 islands off the coast of Norwalk, the Falkner Island unit of five acres located three miles off the coast of Guilford, the Outer Island unit of five acres off the coast of Branford, and the Salt Meadow unit of 225 acres located in Westbrook. The entire Wildlife Refuge provides important resting, feeding, and nesting habitat for many species of wading birds, waterfowl, songbirds, shorebirds, and terns.

According to a DOT *Environmental Impact Statement and Evaluation*, Milford Point was acquired as one of the original components of the Stewart B. McKinney National Wildlife Refuge. This barrier beach is a historic and current nesting area for the federally-threatened piping plover and state-threatened least tern. The Milford Point peninsula is a major migratory stopover for shorebirds in spring and fall, and is one of the excellent examples of this critical habitat type in Connecticut. In addition, there are three state-threatened or endangered plants species and five plant species of special concern in the area. Threatened and endangered plant species include the coast violet, sickle-leaved golden aster, and beach needlegrass. Plant species of special concern include bayonet grass, perennial seapink, eastern prickly pear, sea-beach sandwort, and saltmarsh bulrush. Most of these plant species are associated with beaches, dunes, or grasslands.

Federally- and State-Listed Species: Plants and animals can be rare for a number of reasons. Habitat destruction and over-collecting are the most common causes of rarity, but natural events such as fire and erosion, to name a few, can also be contributing factors. Also, some species may be restricted to rate habitat types and therefore are regionally rare.

The Connecticut Natural Diversity Database is a compilation of the state's imperiled flora and fauna. The first Endangered Species list for Connecticut was finalized in 1992, subsequently reviewed in 1997, and a revised list was officially adopted in 1998. Based on the number of occurrences in the state (or designation at the federal level), listed species are assigned into the following categories:

- Endangered-fewer than six occurrences;
- Threatened-Six to nine occurrences;
- Species of Special Concern-Species possessing either a naturally restricted range or habitat, a low population level, high demand by humans, or extirpation from the state.

Birding at Milford Point: The marsh, sandbars, and barrier beach are one of the most important shorebird migratory stopover areas on Long Island Sound, providing foraging areas and resting areas for tens of thousands of shorebirds each year. Numbers of some species of migrating shorebirds, chiefly semipalmated and black-bellied plovers, may elevate this area to the level of national or even international significance.

The Atlantic coast piping plover, which is a federally-threatened species, is known to nest on Milford Point, and to feed on Nells Island (Wheeler's Marsh) and the Housatonic River.

Two other federally-listed species have been sighted in the area, the bald eagle and the peregrine falcon. One pair of peregrines is nesting at the NRG plant In addition, there are approximately 15 state-threatened or state-endangered bird species and about the same number of bird species of special concern. Most of these bird species are associated with the tidal marsh habitat of the Wheeler Marsh and Great Meadows units of the McKinney National Wildlife Refuge.

Two to five pairs of piping plovers nest in the area annually. Common and least terns have nested here also, with up to 100 pairs of each species in recent years. It is also an important tern staging area, including some roseate terns, with over 1,000 terns recorded annually.

Seaside and salt marsh sharp-tailed sparrows nest in the Marsh. The Marsh may be a globally significant summering area for saltmarsh sharp-tailed sparrow and an important migratory stopover for rarer Nelson's or Acadian race of this species; a high percentage of the world's population of the Acadian subspecies probably uses the Marsh in migration.

Two pairs of American oystercatchers nest in the area. Among the 10,000 to 20,000 shorebirds recorded annually are small numbers of red knot and significant numbers of black-bellied and semipalmated plovers. Regionally important clapper rail and willet nest in the area as well. Several species of rail are known to use the saltmarsh as an important migratory stopover.

Milford Point is an important waterfowl stopover and staging area, and one of Connecticut's most significant feeding areas for egrets and herons. The area is particularly important to black-crowned night herons. Yellow-crowned night herons are also seen in increasing numbers. The area also serves as a foraging area for peregrine falcons during migration and nesting seasons. In addition, it serves as a nesting area for the horned lark, and a foraging area for herons and egrets during nesting and post-nesting dispersal seasons. The Point is a regionally important stopover and wintering area for the short-eared owl, the northern harrier, and the American bittern. Ospreys use the area for nesting and stopover during migration. The barrier beach is one of Connecticut's primary wintering and migratory stopover habitats for the Ipswich race of the Savannah sparrow. Milford Point is also one of Connecticut's most visited bird viewing areas.

D'Amato Property: Purchased with the assistance of an *Open Space and Watershed Land Acquisition Grant*, the D'Amato property provides a valuable resource for recreation, forestry, fishing, wildlife habitat, and other natural resources. This parcel of approximately 37 acres is located in the northwest portion of Milford, situated west of Conrail tracks and east of the Housatonic River. This site preserves a natural wildlife habitat along the Housatonic River. It also provides opportunities for passive recreational activities including walking, hiking, and birding.

The site also provides potential access to water-based recreation, such as canoeing and small portable boats. These small boats can be brought on site and launched at the tidal flats area of the Housatonic River. There is in excess of 180 feet of water frontage for this type of activity.

Seven separate plant communities exist on the property, based on differences in vegetation composition and structure. These communities consist of an open agricultural field, mixed hardwoods, black birch/aspen dominated mixed hardwoods, an open brushy shrub cover, palustrine forested wetland, *Phragmites* marsh, and a tidal freshwater marsh.

An open agricultural field occupies the north central portion of the property. Shrub and small tree growth defines the edges of the field and creates an excellent environment for local wildlife species.

The mixed hardwood community occupies much of the northern portion of the property. There is a west-facing slope at the northern section of the parcel, and the slope is entirely wooded with some of the most impressive trees on the property. Species include red oak, black oak, sugar maple, American beech, black cherry, black birch, and white ash. Tree size ranges from four to six inches to greater than 24 inches in diameter at breast height (dbh). Shrubs and vines grow scattered under the tree canopy. Maple-leaved viburnum and Japanese barberry are the most common shrubs; fox grape and oriental bittersweet are the prevalent vine species.

The black birch/aspen dominated, mixed hardwood community is situated to the south of the open field in the western section of the parcel. The woodlands are second growth, and tree size ranges from two inches to 10 inches dbh. Although the birch and aspen are dominant, there are other tree species including red cedar, yellow birch, American beech, cottonwood, red oak, black oak, red maple, and sugar maple. The fact that red cedars persist along with the hardwoods is an indication that this area was also in agricultural use and that such use was abandoned approximately 30 to 40 years ago. Shrubs and vines in this area include Japanese honeysuckle, multiflora rose, Japanese barberry, bayberry, autumn olive, highbush blueberry, and sweet pepperbush. Spotted wintergreen and shinleaf are found in the herbaceous stratum. Within this community type, there are several open areas or clearings dominated by little bluestem grass. Patches of lichen, knapweed, and goldenrods are also found within the clearings. This landscape provides excellent wildlife habitat as it increases the overall edge effect between the woodlands, open areas, and adjacent marshlands.

Multiflora rose and autumn olive are the dominant shrubs within the open brushy habitat within the eastern sections of the property. Some small trees are also present, as are vines such as bittersweet and Japanese honeysuckle. Many of these species are non-native and are considered to be invasive; however, they are attractive to many avian species and provide food and dense cover for area wildlife. Many small mammals find refuge in the thick brush.

Areas of palustrine forested wetlands are located southeast of the open field. The wetlands are dominated by red maples and cottonwoods, and contain several stands of speckled alder and pussy willow. Silky dogwood, skunk cabbage, trout lily, jewelweed, common reed, soft rush, tussock sedge, and other species of sedge also grow within the wetland areas. This community occurs in association with Turkey Hill Brook. There are also wetlands that lie within depressed areas that are not associated with a watercourse.

Phragmites marshes are found in two locations on the property; specifically, the two westernmost areas that project out to the Housatonic River. These marshes are dominated by common reed, to the exclusion of other species. These monotypic stands provide habitat for animals such as red-winged blackbirds, muskrats, rails, and numerous invertebrate species.

One of the most interesting of the communities at the site is the tidal freshwater marsh that is found to the south of the southernmost *Phragmites* marsh. Species within the tidal freshwater marsh include cattail, skunk cabbage, sensitive fern, climbing hempweed, jewelweed, purple loosestrife, and bur marigold.

This tidal freshwater marsh shows a typical grouping of plants associated with an upper intertidal marsh. Ecological studies of tidal freshwater wetlands suggest that they are highly productive ecosystems. During the summer months, the marshes typically act as sinks for nutrients that enter from downstream flows and surface runoff. In winter, they export nutrients as decaying vegetation and soil sediments are carried into the estuary. Marshes such as this one with a high proportion of upper marsh may not export significant quantities of nutrients.

The freshwater tidal marsh is considered to be an unusual wetland type in Milford and the surrounding region. Approximately 1,040 acres of this wetland type are estimated to be in Connecticut. Marshes of this type are of limited distribution, and most of them occur along the Connecticut and Housatonic Rivers.

The wildlife habitat of this property is rich and varied. The open field surrounded by woodlands creates ideal habitat for raptor species. Bird life is particularly rich due to the proximity to the River, the different cover types, the presence of wetlands, and the abundance of food sources.

Mammalian life is also evident on the property. There are numerous deer tracks and obvious game trails. Other animal signs include raccoon tracks, rabbit scat, squirrel nests, and bones of a woodchuck. While many of these animals are typically found in suburban Connecticut, development pressures are squeezing the habitats; thus, the importance of Open Space in rapidly developing areas cannot be overemphasized.

Beaver Brook Greenway

Overview of Beaver Brook Watershed: Based on the Connecticut Water Quality Standards and Classifications Glossary, a watershed is that land area delineated by local land elevations that collects precipitation and transmits it as surface runoff to a specific stream or lake.

Beaver Brook arises south of the intersection of the Wilbur Cross Parkway and the Milford Parkway, and from there flows south some 2.5 miles to the Beaver Brook (Milford) Reservoir. Below the dam that forms the Reservoir, Beaver Brook continues southwest for about another mile. The Brook's narrow watershed, lying between those of the Housatonic River to the west and the Wepawaug River to the east, has a total area of about 2.5 miles.

Two main branches feed the Beaver Brook Reservoir. The northern reach of the Brook, draining about 0.8 square mile of watershed, flows through low-density residential areas, agricultural fields, and forested wetlands. Scarcely any of the Brook's course remains unaltered. Canals like that through the swamp on MI-10 have probably existed in some locations since colonial times to drain lowlands for use as pasture; more recent developments have brought pipes, storm drains, conduits, and further channeling.

Water from this branch of Beaver Brook is retained in a series of small ponds on MI-8, locally known as the Mondo Ponds. The largest of these, about 11 acres in size, is a gravel pit, excavated about 40-50 years ago and bisected by an earth-fill causeway. Below the large pond are three smaller ponds; these occupy a site at which ponds have existed for many years, but they were dug out and new dams constructed in 1952.

The several small springs that feed this part of the Brook, including one that is now submerged in the westernmost part of the Mondo Ponds, appear to be seasonal in their flow.

During the summer of drought years, the ponds have been dry, and even in years of normal rainfall, there is a drastic drop in water level in the ponds during the late summer.

Although the Mondo Ponds receive runoff from over half of the Reservoir's watershed, this branch of Beaver Brook is not its most important source of water. Instead, most of the water supply in the Beaver Brook Reservoir comes from groundwater sources in the eastern part of the watershed, including several large springs. In the "Dismal Swamp" on MI-7, spring water bubbles out of the ground dramatically to form three small, crystal-clear pools. The largest of these is about five feet deep, with an apparently "bottomless" hole near its center. At least 15 smaller "boils" can be seen in the three pools where groundwater bubbles forth, roiling the bottom sediments.

Water from the springs joints Beaver Brook and passes under the Connecticut Turnpike and West Avenue via a conduit. There, water from two wells dug on MI-6 in the mid-1950s used to be pumped into Beaver Brook to supplement its water supply during periods of low stream flow.

The relative amounts of runoff and infiltration depend on the rate and type of precipitation and the topography and surface characteristics of the watershed. A low, steady rain will produce less runoff than a sudden, hard downpour, and runoff from steep slopes will be greater than that from fairly flat areas.

The permeability of the soil is an important factor in determining the amount of runoff. Water readily penetrates the relatively porous sandy loams common in stratified drift. Two-thirds of the Beaver Brook watershed is covered by soils having a moderately high infiltration capacity; only 17% of the watershed is covered by soils with very low infiltration capacity.

Beaver Brook's water then enters a 3,500-foot canal along the northern edge of Beaver Brook Marsh on MI-4. Dug in the 1920s, this canal uncovered several large "boiling" springs, at least five within the lower 500 feet of its length, which were reported to materially increase the Brook's flow. The lower end of the marsh, once dammed to create a shallow reservoir or ice pond, has been artificially filled with earth and the water conducted underground through a conduit to empty into the upper portion of the Reservoir.

Beaver Brook Reservoir has a usable storage capacity of 22 million gallons of water, and a total capacity of over 26 million gallons. Based on the small size of the Reservoir and the area of its watershed, the Reservoir has been estimated to have a sustainable yield of 1,000,000 gallons per day. Supplemented by groundwater from the wells, the Reservoir produced an average of 1.75 million gallons per day from 1958 through 1961, and 1.45 million gallons per day during the record-setting drought years of the 1960s. In subsequent years, from 1966 until its use as public water supply was discontinued in 1977, the average daily yield of the Beaver Brook Reservoir was lower because it was out of service for varying periods of time for pumping station repairs or because of problems with water quality.

The Mondo Ponds: The Mondo Ponds offer the pleasures of fishing and of watching families of geese paddle about or rest one-legged, heads tucked beneath their wings, on rock islands. An inviting lakeside trail enters the cool woods, leading at last to a druidic grove of beech trees on a rocky knoll, where deep leaf litter absorbs footfalls and flecks of light dapple the smooth gray trunks. Within a short distance, very different forest experiences await, from dark, fragrant spruce plantations to verdant swamp forests to rocky oak woods.

Some 20 Canada geese, including at least two nesting pairs, spend the summer at the

Mondo Ponds, roosting securely on the bedrock islands that stud the large pond. The shallower ponds, surrounded by dense terrestrial vegetation to provide protective cover, are ideal habitat for dabbling ducks, such as black ducks and mallards, also observed nesting on the property. Swallows, swifts, and other songbird species feed on insects in the air above, while muskrats and raccoons seek food from the pond.

MI-7 Artesian Springs: The artesian springs on MI-7 are probably the largest in the state of Connecticut. At the bottom of three clear pools, their waters can be seen bubbling out of the ground in at least 17 places, the largest a hole over a foot in diameter

According to the report by the South Central Connecticut Regional Water Authority on *The Beaver Brook Property*, the conditions that have given rise to these springs are unusual. Water moving underground down an ancient river valley was forced up under pressure through gaps in the impermeable clay layer underlying a body that developed into a glacial kettle hole. Typical vegetation of the early stages of bog succession, including a large colony of round-leaved sundew, occur here, and watercress grows densely in the clear, cool outflow from the springs.

MI-4-The Beaver Brook Marsh: The Beaver Brook Marsh is a prime example of a wetland. Wetlands in Connecticut are defined by soil type. Underlying geology, past glaciation, and the process of alluviation have created pockets where water accumulates and soils hold water. The presence of water for extended periods reduces the oxygen content of the soil, resulting in color variations referred to as mottling; a soil scientist uses an auger to look for these signs when identifying wetlands in the field. Saturated wetland soils can vary from Adrian's peat and much, which are thick organic deposits of decomposing plants to Ridgebury and Whitman, poorly drained soils that possess thin layers of organic soils over oxygen-reduced mineral soils. Wetland soils are easily identified by the marshes and swamps that cover them. They can be found wherever tussock sedge, red maples, cattail, spicebush, or skunk cabbage are present.

Another important wetland type consists of the well-drained floodplain soils. These wetlands are difficult to identify at a casual glance because then often look no different than surrounding upland soils. However, they are quite important for a variety of reasons. Since they occur in floodplains, they should be avoided for development. They are quite permeable and are prone to rapid infiltration of pollutants. Lastly, they are rich agriculturally. Loaded with nutrient-rich sediments and host to seasonally extended biologic and microbial action, these soils often produce our greatest crop yields.

The significance of wetlands

Wetlands are important for the following reasons:

- Wetlands are one of the most productive ecosystems on Earth.
- They function by trapping sediments and nutrients as well as filtering pollutants.
- Wetlands are host to specialized plant life uniquely adapted to filter nutrients and heavy metals from water before they enter the soil and ultimately, the bedrock.
- Chemical reactions occurring within wetland soils act to bind pollutants, contributing further to the cleansing effect of a wetland.

- Wetlands act as storage basins during periods of heavy rainfall, moderating the effects of heavy flood-causing rainfall and allowing for infiltration.
- Wetlands slowly release their stored waters during times of drought.
- Some wetlands contribute waters that recharge the water table.
- Wetlands are an important carbon sink in the form of decaying trees.
- Wetlands play a role in the nitrogen cycle and are an important element contributing to the air we breathe.
- Wetlands provide essential habitat for numerous wildlife species, such as certain amphibians and birds, which are dependent on these lands.
- Many other wildlife species use wetlands for protective cover, breeding areas, foraging areas, or important corridors for movement.
- Wetlands may be areas of great scenic beauty and can provide opportunities for esthetic appreciation, not to mention educational benefits.

What were once considered noxious places and derelict wastelands are now known to be vital parts of the landscape. Without wetlands, our world would be a desolate and parched place.

The wetland known as Beaver Brook Marsh is a shrub marsh of approximately 35 acres surrounding an outstanding walking trail on the Beaver Brook property known formerly as MI (unit)-4. The property, which is currently owned by the Kingdom Life Christian Church, has limited protection as a result of a *Declaration of Conservation Restriction* between the Church and the city of Milford. The Conservation Restriction partially protects slightly more than 41 acres, which has been further subdivided into the Preservation Use area (PU Area) [the marsh and surrounding trail + 20 feet] and the Natural Resource Development and Conservation area (NRDC Area).

Based on the current Conservation Restriction governing the NRDC Area, the following activities are permitted:

- Picnicking and camping, including cookfires and campfires;
- Construction, maintenance, and use of small, rustic cabins or similar shelters, capable of being moved and without a permanent foundation, water, or sanitary facilities, to be used in conjunction with organized group activities by youth groups and adults;
- Construction of no more than three restrooms, including showers, the restrooms of which may be served by running water, electricity, and sewers, and which shall not exceed, in the aggregate, 400 square feet in size;
- Construction, maintenance, and use of one or more underground utilities;
- Installation of children's playgrounds;
- Horseback riding on the trail surrounding the Beaver Brook Marsh.

These permitted activities are testimony to the extremely limited protections afforded to this significant natural resource by the current *Declaration of Conservation Restriction*.

According to a review entitled, "*The Beaver Brook Property Milford, Connecticut* and published under the auspices of the South Central Connecticut Regional Water Authority,

the Beaver Brook Marsh was covered almost entirely by red maple swamp about 30 years ago. During that period, the water level rose about six inches after a filter was installed in the channel. As the maples died and were replaced by more immersion-tolerant shrubs, the shrub and emergent zones also underwent a change in water level and their species were replaced by those typical of an earlier, or deeper-water, community. The water level has since stabilized, and red maples are again sprouting over much of the marsh, both from new seedlings and by the production of new shoots from the ostensibly dead trees.

Areas of open water tend gradually to change from aquatic to terrestrial habitat. Rooted aquatic vegetation around the edges of a water body produces an accumulation of organic material that acts to fill in the water body and provides suitable habitat for the plants of the next successional stage. This process of succession can be observed in the zonation of aquatic plants growing around the edges of the Beaver Brook Marsh. Here, floating-leaved plants such as the bullhead lily give way in shallower water to emergents such as arrowhead, bulrushes, and the low aquatic shrub, water willow, and finally to cattails and other marsh species. Gradually, the area of open water will become smaller as the marsh encroaches on it though this successional process.

The Beaver Brook Marsh and its abundant vegetation provide suitable conditions for many kinds of aquatic animals, including insects and other invertebrates. Amphibians and reptiles are also abundant.

A mixture of forest types interspersed with small clearings in various stages of succession in the ecosystem upland of the Beaver Brook Marsh provides a valuable habitat for many animal species. Many smaller mammals are present, such as raccoons, opossums, woodchucks, squirrels, and cottontail rabbits. The upland forests also are home to a variety of birds, including the rose-breasted grosbeak, tufted titmouse, Baltimore oriole, cardinal, hairy woodpecker, and ruffled grouse, as well as lower vertebrates such as garter snakes, box turtles, and wood frogs. Hardwood forests provide both food and cover for these animals.

The Beaver Brook Trail: About 1.3 miles in overall length, the Beaver Brook Trail encircles the Beaver Brook Marsh, with one side-loop that runs along the Connecticut Turnpike. One portion of the otherwise continuous stonedust trail, an extensive, wooden footbridge, traverses one edge of the marsh. Wildlife can be seen frequently along the trail.

The path starts from the gravel parking lot along West Avenue onto the trail, with a long canal on the right and the extensive marshland on the left. The walk along the canal may flush out great blue herons, a few mallard ducks, and possibly other herons in the canal and the marsh pond during warmer weather. During the winter months, other birds may be seen taking shelter in the marsh growth, thick pines, and deciduous wood growth. Seasonal sightings may include crows, chickadees, robins, juncos, jays, and possibly hawks and owls quietly perched. The ground, if snow covered, may show the telltale tracks of smaller animals such as cats, foxes, dogs, mice, and voles. The pines rise a significant height along the sides of the canal, with the opposite side of the canal presenting a steep, densely covered slope.

The marsh waters teem with aquatic life, including an abundance of amphibians, such as toads and frogs, and reptiles, such as mud, musk, box, painted, and snapping turtles. Snakes may be seen searching out frogs and other delicacies.

Shorebirds abound and include marsh wrens, kingfishers, ducks, and herons. Sightings may also identify cedar waxwings, purple martins, ruffled grouse, marsh hawks, and great horned owls.

Plants and aquatic grasses abound in the marsh waters and canal. In addition, there is a profusion of flowering plants and shrubs.

A variety of ecosystems exist in the short expanse of 1500 feet. Included are a hardwood swamp, a cattail marsh, a grassed roadway, a canal with flowing water, a stand of pine trees, and an upland hardwood forest.

As the path proceeds, the marsh on the left becomes fully visible, with its water level close to the walkway surface. At the far edges of this open water, small and large herons may sometimes be seen standing quietly as they remain alert for food. On the right of the canal in this area is a stand of dense pine trees. The walk turns at this point and passes another wetland area to enter the pine stand. Suddenly the path emerges from the pine woods and into a few hardwoods.

The path turns back soon after this point, to link up with a wooden-planked footbridge that crosses the edge of the marsh. This part of the walk provides intimate glimpses of the marsh flora and fauna. There is a built-in bench almost half way along the footbridge for quiet contemplation and careful observation of insect and bird life.

At the opposite end of the footbridge, the trail continues through an upland forest in which a juvenile bald eagle has been spotted. Soon after the footbridge ends, the trail crosses an intermittent stream traversed by small wooden bridge. After this point, the trail slopes upward toward the outlet into the parking lot bordering West Avenue.

The Beaver Brook Reservoir: The Beaver Brook Reservoir, although too small to be practical as a public water supply and subject to the risk of pollution from nearby roads and railroads, is an attractive and healthy lake, albeit tiny, with a consistent supply of fairly high-quality water. Much of this water comes from groundwater sources, including a group of artesian springs that are perhaps Connecticut's largest. The springs are fed by an aquifer occupying a now-buried ancestral valley of the Wepawaug River and still receiving recharge from this River.

The other, much smaller source of the water supply at the Beaver Brook Reservoir comes from surface runoff. Most drainage from the Connecticut Turnpike and the railroad has been directed outside of the Reservoir watershed to preserve water quality, but some of these drains are not maintained, and water may now drain overland to the Reservoir. The Marsh to the east of the Reservoir, which once drained into it, has been blocked by dikes of earth and gravel to prevent highway runoff from entering

The Beaver Brook Reservoir generally has surprisingly good water quality for a small lake, probably due to the relatively high flow from groundwater sources. The most severe threat to its quality is contaminated surface-water runoff from the intensively developed areas of the Beaver Brook watershed and the risk of a major accident or spill on one of the adjacent transportation routes.

Amid the fast-food restaurants and used-car lots that line much of Route 1 in this area, the surprising vista of Beaver Brook reservoir sparkling below a wooded ridge is a refreshing sight. The view from the Boston Post Road reveals perhaps the most striking aspect of the Beaver Brook Reservoir. A deeper appreciation begins, however, when the visitor enters the property itself. From the outside, one appreciates the contrast, the visual relief the land provides, but once inside, its detail and diversity stimulate the eye and mind. Open oak woods offer views of the Reservoir below, and many secluded nooks along its western bank provide private spots to fish or contemplate the water. Resting in the softly carpeted, deep

shad of white pines along a canal lush with blooming watercress, the visitor can watch ibis, herons, and egrets search for food in the marsh.

Wepawaug River Greenway

Wepawaug River: To find the headwaters of the Wepawaug River, one must trace its course upstream through a series of finer and finer tributaries, to an area just south of Prospect Hill in Woodbridge. Drifting back downsteam, one discovers that the Wepawaug River journeys a distance of roughly 10 miles before finally reaching Long Island Sound by way of Milford Harbor. .

Intimately related to the River are the valley lands, or watershed, that it drains. Watershed boundaries are circumscribed by contour lines of the highest elevations along a river's course. The watershed of the Wepawaug River encompasses approximately 16 to 18 square miles.

Water from the Wepawaug feeds the pond at Eisenhower Park all year long through two points of entry on the northern shore. Likewise, water leaves the pond from two points on the west and south sides. Both exits have small dams and spillways.

Groundwater is stored in natural subterranean retention basins called aquifers. Beneath Eisenhower Park, especially in the gravel and sand beds of its ground soil, lies an important aquifer.

The significance of Aquifers*:*

Aquifers are underground rivers and streams. Aquifers are grouped into two major categories: bedrock and stratified drift.

Bedrock aquifers are like streams on the land's surface; they are the small streams of water flowing through a complex network of fractures in the bedrock. At lower housing densities, bedrock aquifers can generally be counted on to produce adequate water for single family residences.

In general, the consumptive use of water extracted from wells drilled into the bedrock is somewhat offset by septic systems returning water to the soil and, from there after renovation, into underlying bedrock fractures. However, extensive blasting can potentially disrupt the subtle network of fractures, and improperly maintained or poorly designed and constructed septic systems can fail to renovate domestic sewage prior to its entry into the bedrock. Excessive well development in zones of low yield bedrock aquifer can impact existing wells and result in water shortages during times of drought. Excessive large-scale irrigation using groundwater can also have a major impact on local water levels in times of drought.

The second type of aquifer is a stratified drift aquifer; these aquifers are the major rivers of our underground waterways. Past glacial periods have deposited layers of porous gravel along valley bottoms that allow for the accumulation and flow of water, often associated with surface rivers. Just as in the bedrock, these stratified drift aquifers are of variable capacity. Where gravel deposits are well graded, possessing a well-developed full array of particle sizes, these aquifers can yield up to 50 to 2,000 gallons per minute. Where gravel deposits are less well developed and surficial water is less abundant, these aquifers produce lower, although still considerable, volumes of water.

These aquifers are subject to extreme impact from surface events. Leaking fuel tanks, oil spills, salt and urban runoff can all enter the aquifer through permeable soils with long-lasting and serious consequences.

Eisenhower Park: Eisenhower Park is the largest tract of city-owned Open Space in Milford. It is located between West River and North Street, just south of the Orange town line.

The Park encompasses a total area of 207 acres, extending roughly one mile in length and ½ mile in width. The property consists of approximately 34 acres of cleared land, 48 acres of fields in various growth stages, and 90 acres of woodland. The creek-like Wepawaug River flows the entire length of Eisenhower Park, feeding a pond and several other wetlands along its way. Hardwood forests and colorful meadows are also to be found on a list of the Park's natural assets.

A variety of recreational facilities, such as six outdoor tennis courts, a large softball field, a jogging trail with exercise stations, and two handball courts are available to Milford residents. During the summer, community gardening and blueberry picking are popular pastimes. Eisenhower Park is also an ideal location for nature study.

An extensive network of trails, connecting nearly every portion of the Park, has been created by the feet of past hikers. Although the paths are not marked or maintained, continual use preserves their functional integrity.

Fields and meadows are common features of the Park. In most cases, they are found in abandoned agricultural sites. Occasional stone walls remind visitors of past agricultural land use. Several species of goldenrod, Queen Anne's lace, black-eyed Susan, milkweed, butter-n-eggs, bladder campion, and common mullein are frequently seen herbaceous plants. Common shrubs include wild rose, barberry, sumac, honeysuckle, raspberry, catbrier, and alder. In 10- to 20-year-old fields, abundant tree species include red cedar, black cherry, and black birch.

Three types of woodlands can be distinguished in Eisenhower Park: upland, mixed-hardwood forests, floodplain and swamp woods; and conifer isolates. Conifers are not abundant and, in most places, appear to have been planted. Most of the conifers are hemlocks. Clumps of these 80-foot trees dot the fields south of the softball diamond and in the southern portion of the Park. They probably mark locations of previous home sites.

Floodplain and swampy woods are characterized by species of herbs, shrubs, and trees that can tolerate wet soils. Jewelweed, stinging nettle, skunk cabbage, marsh marigold, trout lily, and false hellebore are frequently encountered. Pickerel weed, arrowhead, and cattail are common aquatic species. Ferns, mosses, and fungi also flourish. Sweet pepperbush, spicebush, and buttonbush are frequently encountered wetland shrubs. Trees include sycamore, red maple, and white ash.

Most of the wooded areas in Eisenhower Park belong to the upland, mixed hardwood association. These are second- and third-growth forests that have been cut for firewood and timber several times in the past. The tallest of canopy trees, having an average height of 60 feet, are the oaks and tulip poplars. In the sub-canopy levels, hickory and ash rise slightly above American beech and sugar maple. Dogwood and American hornbeam form the lowest canopy level.

Local examples of shrubs occurring under closed canopies are maple-leaved viburnum, mountain laurel, spice-bush, and dogwood. A list of expected herbs would include ferns, wild

lily-of-the-valley, wild ginger, spring beauties, Jack-in-the-pulpit, red trillium, and dwarf ginseng.

For open and sunny sites, shrubs to be found include honeysuckle, cat brier, American bittersweet, and poison ivy. Several kinds of asters are common in the herb layer, as are violets, silver rod, pokeweed, may-apple, rue anenome, and wild sasparilla.

Each of these plant communities provides an equally distinct wildlife habitat, based on food, shelter, and moisture requirements. On-site identifications have included at least 37 species of mammals. These mammals include moles, rabbits, chipmunks, squirrels, woodchucks, shrews, mice, voles, rats, foxes, raccoons, deer, opossums, minks, skunks, and otters. There are more than 131 species of birds such as woodpeckers, hawks, flycatchers, thrushes, vireos, warblers, meadowlarks, blackbirds, orioles, grosbeaks, finches, sparrows, and buntings.

Camp Katoya: Located in the northwest portion of Milford between the Wilbur Cross Parkway on the west and West River Street on the east, Camp Katoya consists of about 35 acres. Approximately one third of the acreage is owned by the City of Milford and the remainder is owned by the Girl Scouts of America. The Camp contains one large and one small pond and a series of significant ridges running lengthwise through its center.

Milford Harbor: Milford's ideal location along Long Island Sound has given it a rich history of successful maritime enterprise. Ship building, commercial fishing and, more recently, recreational boating have been key elements in this city's commercial viability. The following descriptions are based on the findings of the current *Milford Harbor Management Plan*.

The major freshwater flows in Milford are the Housatonic, Indian, and the Wepawaug Rivers. After flowing some 15 miles through the towns of Woodbridge, Orange, and Milford, the Wepawaug River spills under the old Jefferson Bridge, where it widens to form Milford Harbor. The harbor has a drainage area of approximately 20 square miles and is located in the Central Connecticut Regional Coastal Basin. Other freshwater flow sources are from Beards Creek and from many points of surface inflow such as those from storm drains, road drains, and street ends.

Milford harbor's water is suitable for all types of recreation including contact uses such as swimming and fishing. The bacterial level for the harbor meets current standards. However, the levels of dissolved oxygen (DO) in flood tide conditions have been found to be consistently higher than at ebb tide, indicating the DO-rich waters of Long Island Sound have been boosting levels during tidal mixing.

Significant areas of regulated tidal wetlands are found in several fringe locations throughout Milford Harbor. The most prominent areas are along the banks of Wilcox Park, south of the City Boat Ramp, at the mouth of Beards Creek on the western bank of the Harbor, and along the shores of the eastern basin near the mouth of the Harbor.

There are shellfish concentration areas within Milford Harbor limits and in the gulf beyond the Harbor mouth. The intertidal substrate of the east basin provides a natural bed for the production of Eastern Oyster brood stock. These 1 to 2 year seed oysters are commercially harvested and transplanted for development in non-polluted offshore waters.

Milford Harbor has many direct access points available to the public. These include all of Wilcox Park, the municipal boat ramp and dock, the jetties at the mouth of the harbor, and the property occupied by the city's defunct Town Meadows sewage treatment plant located

next to the Coast Guard Auxiliary building. In addition, access points include many quasi-public as well as currently under-utilized portals.

Milford Harbor has three commercial marinas that provide 520 boat slips; one marina has dry dock storage for about 75 boats. In addition, there are approximately 180 public anchorage moorings and private docks and facilities for the State Agricultural and National Marine Fisheries Laboratories.

Milford Harbor Intertidal Resources: Significant areas of regulated tidal wetlands are found in several fringe locations throughout Milford Harbor. The most prominent areas are along the tidal edge of Wilcox Nature Preserve, south of the City Boat Ramp, at the mouth of Beards Creek on the western bank of the Harbor, and along the shores of the eastern basin near the mouth of the Harbor.

Extensive and environmentally significant intertidal flats are found between the Milford Boat Works and Beards Creek, on the west edge of the Harbor near the head of the Harbor, and within the east basin. These areas are uniquely important because they provide habitat for a wide range of wildlife, waterfowl, and for aquatic and benthic organisms.

The significance of intertidal mudflats

Intertidal mudflats are soft to semisoft environments often found in close proximity to tidally inundated salt marshes. Mudflats are the result of sediment accumulations typically found in sheltered coastal embayments. The sheltering effect is often created by barrier beaches, man-made structures, or shoals. The mudflat is the result of current and wave protection and the subsequent alteration of sediment transport processes. These intertidal resources provide an ideal habitat for fish and birds that are native to the area as well as those that are migratory visitors.

Milford Harbor has been developed as a result of individual needs and goals. The result of this process has been the piecemeal and gradual modification of the Harbor. The majority of these modifications have occurred along the eastern/northern side of the Harbor, possibly as a result of the proximity of deep water and residential development pressure. Along the western/southern boundary of the Harbor, development has been more landward-oriented, except at those sites where water access was integral to the development. For this reason, the tidal flats and associated salt marshes extending from the Milford Wharf Company northward to the Milford Boat Works are well-established habitats only occasionally bisected by access channels used by riparian property owners. This, in turn, has allowed the area to remain mostly a productive mudflat supporting oysters, hard clams, soft shell clams, marine worms, winter flounder, “snapper” blue fish, and the biological systems that utilize adjacent resources to support those resident and migratory populations.

The sediment character of the Milford Harbor mudflat changes from a compact and stable sand-silt mixture at the northeastern end adjacent to the channel to an unstable, high water/high silt content mixture in the southwestern area. This variation in sediments provides habitat for a relatively wide variety of species that have become established there. In the northern area, the flats have supported a healthy population of hard clams with some eastern oysters. This population relationship shifts more to oysters farther down the Harbor. Unfortunately, much of the oyster population in the whole Harbor was killed during a June, 1982 rainstorm. The mortality seems to be the result of depressed salinity levels and the massive deposition of sediment carried down the Wepawaug River by the floodwaters.

The fate of the oysters is still visible by sampling anywhere along the mudflat, as the harder bottom areas are still littered with adult oyster shells buried only inches below the present day surface. In 1982 and 1983, oysters spawning elsewhere in Milford Harbor began the process of repopulating the mudflats. By the winter of 1983, the results of this recolonization effort were visible in the near-shore zone from Beard Creek northward.

Soft-shell clams are found in dense community concentrations scattered across the mudflats. These clams also experienced a relatively high level of mortality in the June, 1982 rainstorm but have had a number of good reproductive seasons since.

Collectively, these clam communities provide a balanced population that is not only resident in the sediments but actively processing the same sediment material of the mudflats to provide nutrients for other aquatic organisms that visit the area.

Some of the finfish visitors of the flats include juvenile winter flounder that move into the area during the late winter months and use the area for nursery habitat and feeding grounds. Adults arrive to use the area a short time later. As the water temperature rises in the spring, bait-fish spawned in the adjacent salt marshes and upper reaches of the tidal encroachment begin to move onto the flats to feed, as the tidal cycle allows. These species include the mimmichog, striped killifish, and the Atlantic silversides. Shrimp and amphipods also feed on the mudflats. These species, in turn, provide food for young bluefish, who mix these food species with young Atlantic menhaden or moss bunkers for a "balanced" diet. Other finfish visitors may include young striped bass, black fish, cunner, and skates.

Along the existing channel line, the mudflats slope downward to the centerline depth. The slopes have collected modest amounts of fine silt and so have a gentle undulation pattern extending down the channel line. Maintenance activity along both sides of the channel has created some sharper slopes but tidal action seems to be smoothing them rapidly. Previously, the channel bottom has been reported to be littered with organic material washed into the system from both the upland and offshore. Discharges from the defunct Head-of-Harbor sewage treatment plant (STP) have been found throughout the entire area of the mudflat. While visually inseparable from other sediments, the STP discharge includes small amounts of nutrients and bacteria. This is not unexpected since, even when operating within design capacity, STP facilities do not remove all the nutrients found in the process flow.

Much of the material presently found in the Harbor between the closed Head-of-Harbor STP and the city library appears to be upland in geological character. There has been some natural stabilizing of this area by the colonization and subsequent expansion of the salt marsh vegetation. Initially this vegetation became established as single sprigs and has expanded by growth runners and now serves as a natural barrier to erosion.

Wilcox Nature Preserve: Traditionally called Wilcox Park and, by an earlier designation, Harbor Woods, the preserve is a wooded area of about 20 acres on the east bank of Milford Harbor. Next to Long Island Sound, the park is wedged between Shipyard Lane and Harborside Drive. A timber and stone stairway forms the main entrance on one side of a bituminous parking area. There are walking paths, and current plans call for walkway expansion throughout the park. In addition, a viewing platform is to be constructed at one end of the park jutting into Milford Harbor.

The park is among the historic lands of our city. According to an account in *History of Milford Connecticut,* the nature preserve was added to the Milford park system in 1909 by deed from Clark Wilcox. Wilcox Nature Preserve is part of the original grant to William

Fowler, the first miller, and had been owned by the Fowler family until purchased by Mr. Wilcox in 1908. Over the years, significant improvements have been made. The Milford Garden Club has maintained a bird sanctuary there, with feeding stations and birdhouses throughout the preserve. This piece of extensive woodland, with its wealth of trees and flowering vines and bubbling springs of water, is a reaffirmation of the endowment of nature to forest and glen.

Indian River Greenway

Indian River/Clark's Pond Fishway: Other important natural resources of the Indian River ecosystem include the annual finfish and eel runs. Blueback herring and the alewife utilize the fish ladder installed in the 1980s with the help of Milford's Stripped Bass Club and the CT. DEP. The ladder permits fish that swim upstream to reach the swampy, weedy eutrophic spawning grounds found in Clark's Pond farther upstream.

Another related anadromous fish, hickory shad, has been observed in the area as well as white and yellow porch, large mouth bass, chain pickerel, sunfish, brown trout, and various species of minnows, i.e, mummichogs, killifish, and sticklebacks.

Another migrating fish, the American eel, is a catadromous species, one that spawns instead in saltwater and migrates to freshwater for development. The eel spends the majority of its life in the river. It is abundant in all life stages from elver to adult and is a nocturnal scavenger.

Historically, this area has supported a major run of "glass eels," which are the saltwater-inhabiting elvers prior to encountering freshwater.

The linear, interconnected estuarine and riverine systems that Indian River and other Milford rivers provide are important as migratory corridors not only for many fish species but for the wildlife dependent on the fish as a source of food and nutrition.

Otters have been observed along the Indian River and within the Gulf Pond environments. Local and migratory birds are also intimately connected to the run. Strong herring runs help to restore osprey to the region. One of Milford's seasoned herring monitors is usually alerted to the onset of a run not by direct observation of stream activity but rather by the black crowned night herrons that hug the riparian edge from Gulf Pond through the Indian River/Stubby Plain Marsh and northward.

Gulf Pond: Based on the account in *25 Birding Areas in Connecticut* by Noble Proctor, Gulf Pond is a showcase for ducks in Connecticut. The Pond usually produces the widest variety and the closest viewing range. From October through early March, the line-up of ducks includes regular ducks such as mallards, blacks, gadwalls, pintails, common-teals, American widgeons, shovelers, canvasbacks, greater scaups, common goldeneyes, buffleheads, and hooded mergansers, as well as sporadic ducks such as American mergansers, redheads, ring-necks, and lesser scaups.

Occasionally, a sick scoter seeks refuge here. Oldsquaw will come in to feed during severe storms and, at times, wood ducks have overwintered. In the spring, blue-winged teal may be observed along the grassy edges, and often a ruddy duck or two can be seen.

Canada geese spend the winter at Gulf Pond. Killdeer and lingering dunlin are occasionally found on the exposed mud in winter. Belted kingfishers hunt the waters as long as they remain open. This is also a good spot to see overwintering great blue herons. During

shorebird migration in spring and fall, the killdeer and dunlin are joined by black-bellied and semipalmated plovers, and by least and semipalmated sandpipers.

The first herons and ospreys arrive in late April. This appears to be a favorite spot for yellow-crowned night herons, and one or two can often be seen in the marsh east of the upper road. Great blues build up during this period, with flocks in excess of 20 in one location. May brings in the first green herons, which nest in the nearby woods, and the first transient snowy egrets. During the summer, the edges of the Pond may reveal clapper rails and, in May, king rails.

In September, this area is on a hawk flight lane. Sharp-shinned and American kestrels often pass in considerable numbers and ospreys occasionally drop in to feed.

Gulls are well represented. Beside the ring-billed and herring gulls, which are the most common, black backs are regular, and August brings numerous laughing gulls here. In the winter, glaucous and Iceland gulls are common visitors on the ice.

There is a commanding view of the lower Pond and the open water from the lower parking lot off Gulf Beach. In the lower Pond, common goldeneye often feed in the fast water of a lowering tide under the bridge, and even red-breasted mergansers will come in to feed. Mallard/black/American widgeon flocks can be observed on the west side of the Pond, attracted to the edge from feeding by the people living there. In this grouping, European widgeon occurs in the late fall.

Off Gulf Beach in the winter, red-throated and, at times, common loons can be seen. Horned grebes are abundant. In April, the horned grebes will begin to mass together in flocks of 150 or more. Eared grebes may sometimes be seen. This bird is present in the horned grebe masses along this coastal area for the last 40 years or so. Oldsquaw is another common winter bird here, as are flocks of red-breasted mergansers and common goldeneyes. Greater scaup often raft here is groups of well over 3,000. All three scoters occur with some regularity, the rarest being black.

East/West Greenway Connections

Solomon Property: Purchased by the city of Milford with Open Space funding, the Solomon property is in close proximity to Eisenhower Park, next to the Alter property, and situated within the most significant of the proposed east/west greenway corridors for Milford. This property is located west of West River Street approximately ¼ mile north of the junction with Fresh Meadow Road and West River Street. The latter forms a portion of the eastern boundary of the property. Wheelers Farm Road and Wolf Harbor Road are up-slope to the west and north, respectively, but are not adjacent to the property.

The natural community types consist of upland hardwood forests and low wetland areas. The highest ridges are considerably drier than the surrounding landscape and are dominated by red oak, black oak, white oak, and pignut hickory. Tulip tree and American beech become important species at lower elevations along the upland slopes. Forest structure across this parcel ranges from areas of very high stem density to areas of open park-like structure with little midstory vegetation.

Wetlands are also an important component of the Solomon Property. Woodland Seep/Stream Wetlands are found throughout the parcel and dominate a majority of the land area below 85 feet in elevation. Several intermittent, above-ground streams traverse the property from the south, east, and west, with a significant amount of flow entering into the

man-made impoundment just north of the Alter property. These streams are the result of run-off from the surrounding uplands where exposed bedrock and shallow soil do not allow rapid infiltration of water during storm events. Precipitation that does infiltrate the upland soils later seeps out from the bases of the upland slopes and combines with the above-ground streams to form several permanent wooded wetlands dominated by red maple, tulip tree, spicebush, sweet pepperbush, and jewelweed. The largest of these wetlands is located across the central portion of the parcel and covers approximately two acres of land area. The numerous vernal pools distributed throughout the landscape are another important wetland feature of the Solomon property. These temporary pools fill with standing water during spring thaw and rains, becoming important breeding habitat for many local herptiles.

The Solomon property also includes numerous exposed bedrock ridges that overlook the lower wetland areas. Although the schist and gneiss composition of the bedrock itself is common for the area, the high exposed ridges are not often encountered within Milford's coastal environment. Many of these ridges have steep drop-offs and are home to Christmas ferns and numerous lichen species. The most dramatic of these ridges looks east over the large central wetland and has a slope of approximately 36 percent over a distance of 100 feet.

The Solomon property also contains a significant acreage of well-established hardwood forest type that is not commonly represented in the city of Milford. The large American beech, tulip trees, and northern red oaks create a forest community that provides the atmosphere of an open park-like setting in some areas and envelops the hiker in a secluded woodland setting in other areas. Not only is this forest type majestic in stature, it is relatively easy to manage as Open Space, compared to some other community types. The well-established condition of the forest offers natural protection against the encroachment of weedy species that can degrade Open Space quality and require a continuous flow of management resources.

The Solomon property has the following intrinsic recreational and educational values: (1) an existing network of hiking trails with extraordinary views; (2) topographic isolation from road noise; and (3) land ideally suited to birding and ecological and botanical studies.

Alter Property: Purchased by the city of Milford with Open Space funding, the Alter property is similar to the Solomon property, with which it is adjacent.

The Alter property consists of two distinct natural community types occurring across a relatively steep gradient. The majority of the site consists of a dry-mesic oak-hickory community type. This community type is found throughout the hills and ridges of the property's southern, eastern, and central sections. The canopy in these areas is dominated by red oak, black oak, pignut hickory, and American beech. Important subcanopy species include sugar maple, sassafras, and black birch. Significant groundcover species include Canada Mayflower, Virginia creeper, wild sasparilla, and ground cedar.

Also occurring on the property's dry upland hills and ridges are scattered white pines and small, pure stands of eastern hemlock. The majority of these trees are large, mature individuals with diameters at breast height greater than 40 inches. Unfortunately, the health of many of the hemlocks has been adversely affected by the hemlock wooly Adelgid beetle.

The unique geology of the property is encountered across much of the dry upland hills and ridges. Exposed schist bedrock and huge boulders are found throughout the uplands. While the schist composition of the bedrock itself is common for the area, the high exposed ridges and boulders are atypical of Milford's coastal environment.

The second community type represented on the property is a woodland seep/stream wetland community type. This community type occurs along the west and northwest boundaries of the property. This community is the result of seepage and runoff from the surrounding hillsides collecting in a long, thin depression that runs approximately southward across the property. The dominant canopy species for this community are tulip tree, American beech, and bitternut hickory. Both the American beech and tulip trees are represented by large mature individuals with DBHs greater than 40 inches. There is also a diverse shrub layer consisting of spicebush, highbush blueberry, arrowwood, and nannyberry. Significant herbaceous species include jewelweed, southern lady fern, halbred-leaved tearthumb, and false nettle. Four amphibian species were also present in this community. These include the two-lined salamander, northern dusky salamander, green frog, and pickerel frog.

Very little above-ground water is confined to the two small pools at the lowest part of the wetland. However the presence of wetland species such as jewelweed, halbred-leaved tearthumb, swamp smartweed, skunk cabbage, and royal fern indicate that this area can be classified as a permanent wetland.

The wetland is formed by two streams or "seeps" that join together at the northwest corner of the property. The wetland then drains off the property across the north boundary and into a man-made impoundment about 250 feet away on the adjacent property. Water leaving this impoundment drains under West River Street and flows into the Wepawaug River. Protection of this wetland would have a direct beneficial effect on the overall water quality of the Wepawaug River.

The topography of this parcel is such that a steep gradient occurs between the dry upland community and the lower wetland community. Instead of one continuously level ridge, the uplands consist of seven knolls ranging in elevation from 89 feet to 118 feet. Four of these knolls drop off steeply to the wetland area, which averages 68 feet in elevation. Following these dropoffs, the delineation between the exclusion of dry upland species and the inclusion of wetland species occurs abruptly. This situation creates the potential for a diversity of wildlife species, both floral and faunal, that would not often live together on a piece of land this size in the Milford area. This, in turn, provides a rich and easily accessible environment for researchers or amateur naturalists interested in studying the ecology of these community types.

The property is accessed from West River Street along a dirt trail that originates at the southeast corner of the property. The trail climbs a steep ridge before branching off into a network of loop trails that wind through both the upland and wetland sections of the parcel. The varied contour of the land and the meandering nature of the trails will provide an interesting hiking opportunity that is not often enjoyed on a parcel of this size.

Wetland 1 of Avalon at Milford Parcel: Part of the Avalon at Milford parcel, this forested swamp is about 12 acres in area, of which roughly seven acres occur on the site. The wetland begins just south of the abandoned hotel site and extends off site to the south and west, towards Baldwin's swamp, which eventually drains into the Wepawaug River. Wetland 1 is recognized by the Milford Inland Wetlands and Watercourses Agency staff and others as outstanding and unique, in comparison to the majority of other wetlands within the city.

Soils in the northern and central sections are mostly moderately deep, level, very poorly drained Adrian and Palm mucks perched over till and bedrock. Poorly drained to somewhat poorly drained Leicester fine sandy loams occur on the wetland periphery and in the

southern section. Disturbed Aquents soils are found on the northern perimeter of the wetland and along the ditch that enters the wetland from the southwest.

Wetland 1 is classified as a "groundwater depression" because it is primarily supplied by groundwater discharge from springs. Because it also receives overland runoff from the hotel site and piped storm water runoff from Route 15, it also includes a "surface water depression" component.

Several hydrologic regimes occur in this wetland. The excavated ditch, 15 to 30 feet wide, which flows southerly through the wetland, does retain some water year round and is classified as "permanently flooded." It has a mucky fine sand substrate and a very low gradient. Pools and depressions in the northern portion of the wetland are up to 2.5 feet deep in early spring; they are "seasonally flooded."

The ditch from the northwest is also seasonally flooded, but flooding duration is longer; it held four to five inches of water, trapped by a low berm across the ditch, when adjacent depressions were dry. Hummocks in the northern and eastern part of the swamp and most of the southern end of the swamp are "seasonally saturated." Shallow depressions often support a "temporarily flooded" hydrologic regime. In the southern portion of Wetland 1, many small upland inclusions occur on hummocks and rises.

Vegetation in Wetland 1 varies according to hydrologic regimes. In the northern portion of the swamp, vegetation is stressed by the wide hydrologic fluctuations. Trees are susceptible to windthrow because the hummocks supporting highly buttressed tree bases have become hollow as higher elevation peat has oxidized during prolonged summer drawdowns. Hollow hummocks provide poor tree support, though they do offer wildlife shelter. The swamp is crisscrossed with logs of trees that have already fallen.

Canopy cover ranges from 85% to about 60%. The dominant trees are red maple, American elm, and green ash. The shrub stratum is dense on hummocks but absent from seasonally inundated hollows; sweet pepperbush is dominant, intermixed with arrowwood, highbush blueberry, ash saplings, and azalea.

During the summer, the herbaceous stratum was moderately dense on the swamp periphery and shallower depressions, but sparse to absent in the few deeper depressions. The dominant herb species were characteristic of floodplains: cinnamon fern, sensitive fern, wood reed grass, false nettle, follicled sedge, narrow-leaf sedge, and star or inland sedge. Virginia creeper, catbrier, and poison ivy are rooted on higher elevation hummocks, and comprise part of the canopy as well as the herb stratum.

Invasive species were noted only along the disturbed northern edge of Wetland 1. Such species include the multiflora rose, Japanese knotweed, and cottonwood. Trout lily, jewelweed, Virginia creeper, and Jack-in-the-pulpit form a dense herb stratum on the irregular moist soil in this area that grades into the strip of disturbed upland forest that borders Wetland 1 to the north.

Vegetation in the southern portion of Wetland 1 differs significantly in structure, but includes many of the same dominant species listed for the northern swamp, with a few additions. Maples, elms, and ashes are joined by tupelo. Shrub density is high, with nearly impenetrable sweet pepperbush thickets in some areas and more spicebush. The herbaceous stratum is dense, rather that sparse, in depressions; bristly dewberry is a dominant species here, in addition to cinnamon fern, sensitive fern, and skunk cabbage. Netted chain fern is also noted in the southern part of Wetland 1. Canada mayflower is abundant on the

hummocks, which average eight feet across and 1.5 feet in height. The vegetation on two small upland islands consists of a mixed hardwood forest with beech and red oak, sweet pepperbush, and ground cover dominated by princess pine. The western upland island occurs on a bedrock outcrop, and surface rocks are moderately common. Snaps and treefalls are present but less common than in the northern part of Wetland 1.

The wildlife value for deer needing browsing space and for resident or fall migrant birds requiring fruiting shrubs and dense shrub cover should be high in Wetland 1, based on vegetation characteristics. The wetland should also be well suited to birds that forage for invertebrates in moist organic-rich soils, such as the American woodcock. Because this wetland is seasonally flooded, it should, in addition, provide breeding habitat for amphibians. However, the wetland has not lived up to its potential as a bird and wildlife habitat due to environmental pressures exerted by surrounding developments and activities. With appropriate controls, these pressures can be reduced, thereby increasing the wetland's functional values.

OTHER WATERBODIES

Ponds

Lily Pond: Located in the northern part of Milford between the Connecticut Turnpike and Plains Road, Lily Pond is about 5 ¾ acres in size. The pond, which is privately owned, is bounded on two sides by single-family residences; a corporate center surrounds the other two sides. Almost half of the pond is surrounded by upland forested areas.

As recently as 20 years ago, the pond was drying up and becoming a swamp. However, when Milford Place Corporate Center was under construction in the 1980s, the pond was dredged and approximately 60,000 cubic yards of bottom spoil were removed, opening clogged subterranean springs that raised the water level appreciably. In addition, most of the lily pads were destroyed, eliminating their adverse effect on the water supply. The corporate center restocked the pond with several different species of fish. As a consequence, the pond has become an amenity not only for the corporate center but also for the residents who live next to the water.

Over the years, the pond has become somewhat isolated from the nearby swamps along the Turnpike and from the Beaver Brook watershed, of which the pond was once a part. There is an overflow pipe running underground across Plains Road and emptying into MI-7 Water Authority property. A catch basin from Plains Road empties into Lily Pond, occasionally contributing contaminants from runoff water.

As attested to by the number of shorebirds and waterfowl that frequent the pond during the spring, summer, and fall, there is an abundance of fish inhabiting the pond. Among these fish are sunnys, bluegills, wide-mouth bass, and carp. Shorebirds that fish on the pond include great blue heron, black-crowned night heron, greater egret, osprey, and kingfisher. Waterfowl include Canada geese and mallard and wood ducks. A variety of turtles and frogs are also found in and around the pond.

Walker Pond:

Quirk's Pond:

AGRICULTURAL LAND

When Milford was founded in 1639, all of the founders and their families engaged in farming, which was the main form of subsistence. By 1939—three centuries later, according to *The History of Milford Connecticut*— more than one-third of the total land area of Milford, 6,106 acres out of 16,290, was still devoted to agriculture. The crops produced for local markets at that time were green vegetables, small fruits, poultry products, and milk; the individual farms were small, with a relatively high proportion of tillable land. In 2002, however, the agricultural picture is quite different. At the present time, based on the updated *Plan of Conservation and Development,* only 27 parcels comprising 278 acres, or not quite 2%, of Milford's total land area are devoted to agriculture. Although many of these agricultural parcels are little more than orchards and vegetable farms, there are several functioning farms still remaining.

Much of our rural origins is wrapped up in our collective memories of farms and farm life. Nevertheless, agriculture has all but disappeared from Milford's landscape. This process has been going on for some time across New England. Better soils, the possibility of larger operations and farm subsidies, and rampant development, among other factors, have influenced the migration of farming to points westward.

The recommendations portion of this report provides an overview of possible ways to support agriculture locally.

OPEN SPACES

The Mayor's Open Space Advisory Committee was established in 1997 in response to increased development pressures on environmentally sensitive lands and increased public pressure to control the undesirable consequences of apparently rampant growth. Aside from acquiring numerous parcels that are worthy of protection since its inception, the Committee has had an important hand in writing the 2002 Open Space component of the *Plan of Conservation and Development*.

The significance of Open Space lands

Open Space lands are lands deemed worthy of protection from development or its adverse impacts. The purposes of Open Space lands include conservation, recreation, environmental education, and preservation, protection, and maintenance and enhancement of community character. The functions of Open Space lands include natural resource protection, preservation of forests, woodlands, wetlands, and fisheries, outdoor recreation, protection of public health and safety, maintenance and enhancement of community character, and protection of historic and archeological sites. Outcomes of the preservation of Open Space lands include: l) the maintenance and enhancement of natural or scenic resources and creation of new opportunities for natural resource protection; 2) protection of natural streams or water supplies; 3) promotion of the conservation of soils, wetlands, beaches, mudflats, or tidal marshes; 4) enhancement of the value to the public of neighborhood parks, forests, wildlife preserves, nature sanctuaries, or other Open Spaces worthy of preservation; 5) promotion of the development of greenway corridors by providing linkages between existing Open Spaces; 6) enhancing passive recreational opportunities for the public with access to all citizens on lands adjacent to major waterways; 7) enhancing active recreational opportunities for the public in organized sporting activities for youth and adults; 8) preserving significant historic sites and important archeological sites; and 9) providing opportunities for environmental education for children and adults.

The 1972 *Milford Connecticut City Development Plan* provided guidance for the present plan by calling attention to the major Open Space systems of Milford, including the Housatonic River, the Beaver Brook, the Wepawaug River, and the Indian River corridors. In addition, the 1972 Plan delineated the shoreline beaches and the Calf Pen Meadow and Oyster River corridor. We believe one of the primary concerns of Milford's residents is maintaining our quality of life. Therefore, a major objective of the current *Plan of Conservation and Development* is to conserve significant Open Space while allowing development that is in harmony with the environment; in other words, to build on developable land and to protect lands worthy of preservation. For this reason, we urge Open Space conservation while promoting thoughtful, well-planned residential, commercial, and industrial development that will ensure an economically viable and diverse community. These steps will, in turn, preserve and enhance our quality of life.

Two Open Space maps are included in this report: Open Space I is comprised of lands designated by conservation easements, deed restrictions, or other demonstrable protective measures, as permanently protected while Open Space II contains properties, both public and private, that are not permanently protected.

Open Space I-Permanently protected parcels:

- State park: Silver Sands State Park, including Charles Island
- The Beaver Brook Marsh and Trail (conservation restriction)
- The Mondo Ponds and Trail
- Milford Point and the McKinney National Wildlife Refuge
- D'Amato property (state grant funded)
- Eisenhower Park (state and city owned)
- Milford Land Conservation Trust (currently 114 acres scattered throughout city)
- Wilcox Park (deeded to city)
- Duck Pond (deeded to city)
- City-owned beaches, including Walnut and Gulf Beaches

Open Space II-Unprotected parcels currently considered as Open Space:

- Outdoor recreation areas and playing fields
  (Washington Field, Wassam Field, Fowler Field, -------Field)
- Cemeteries
  (Milford Cemetery)
- Golf courses
  (Great River Golf Course, Orchards Golf Course)
- Subdivision Open Space set-asides (uncatalogued acreage)

- Open Space properties purchased by city
  (Alter property, Solomon property, Milford Academy)

- Water Authority property (for sale but still unsold)

- Pocket neighborhood parks

OTHER SIGNIFICANT FEATURES

Eel's Hill

Notable Trees

RECOMMENDATIONS

Based on an *Outline of Environmental Elements to be Addressed in an Updated Plan of Conservation and Development* by Jim Gibbons, the following is a comprehensive list of environmental elements that a Planning and Zoning Commission should use to address preservation issues in an updated Plan of Conservation and Development.

1. *Topography*, including scenic vistas worthy of preservation and steep slope areas with limitations for development.

2. *Bedrock geology*, including implications for carrying water, susceptibility to erosion, and unique geological formations worthy of preservation.

3. *Surficial geology*, including suitability for development, water holding capacities, and drainage characteristics.

4. *Soils* that are shallow to bedrock, have a high water table, a steep slope, are poorly drained, are excessively well drained, and have a low potential for septic systems.

5. *Groundwater*, using state standards as a planning goal.

6. *Surface water*, including drainage patterns, storm water management, erosion, presence and quality of streams, rivers, and ponds, state standards, public access, stream belts, and non-point sources of pollution.

7. *Inland wetlands*, with consideration of type and function, priorities, buffer zones, and state and local inland wetland statutes and regulations.

8. *Flood prone areas*, considering restrictions on development and natural water absorbing functions.

9. *Aquifers*, considering state law, recharge areas, prioritization, and future water supply.

10. *Prime farmlands*, including state PDR program, prime soils vs. actual use, and land banking for the future.

11. *Drainage basins and watersheds*, including use as a basis for land use planning and site plan review, and storm water management.

12. *Rivers, brooks, and ponds*, including quality, direction of flow, role in drainage, setbacks, public access, need for coordinated planning, and management plans based on characteristics of the resource.

13. *Forests*, including public vs. private ownership and economic value.

14. *Recreation areas*, considering active vs. passive facilities, school, town, private facilities, projected needs based on population and recreation standards, and aging population implications.

We will now consider recommendations on a selected number of these environmental elements important to Milford, including geology; ridgelines; slopes; rivers, brooks, and ponds; wetlands; farmland and woodland; wildlife habitat; archeological, historical, and

architectural resources; Open Space; and recreational land.

Geology

1. Strictly control development within rock outcrop zones to preserve scenic character and minimize the possibility of land disturbance and impacts to neighboring properties.

Ridgelines

1. Require the use of vegetation to minimize clearing and a requirement to plant trees, shrubs, and hedges.

2. Acquire ridgeline areas as part of the city's Open Space holdings.

3. Encourage the use of conservation easements on ridgeline lands.

Slopes

1. Encourage the avoidance of development on slopes in excess of 25%.

2. Require detailed erosion control plans for development in upland review areas possessing slopes in excess of 15%, along with periodic environmental monitoring and frequent reports on the results to the appropriate city boards and commissions.

3. Require applicants to address feasible and prudent alternatives to building on steep slopes as part of the zoning/subdivision permit process.

Rivers, Brooks, and Ponds

1. Explore alternative technologies such as created wetlands for treatment of stormwater runoff, where feasible.

2. Encourage vegetated and appropriately wide buffer zones along rivers and streams to preserve water quality and habitat value, based on the recommendations of the Inland Wetlands and Watercourses Agency.

3. Discourage or minimize maintained landscapes adjacent to rivers, brooks, and ponds.

4. Strictly control fertilizer, herbicide, and pesticide use adjacent to any waterbody.

5. Promote the use of land adjacent to major watercourses that is consistent with water dependent activities.

Wetlands

1. The upland review area for the significant natural resources listed in this report should be 150 feet, rather than the usual 100-foot review area used by the Milford Inland Wetland and Watercourses Agency.

2. Minimize or avoid wetland disturbance or filling.

3. Adhere to best management practices for erosion and sedimentation control.

4. Require/encourage native buffer plantings where proposed development will occur near wetlands.

5. Strictly regulate commercial uses near wetlands.

6. Require/encourage ground water recharge of storm water runoff.

7. Require that new developments yield a "zero increase" in stormwater peak runoff rates, based on 100-year storm events.

8. Require stormwater biofiltration where large-scale residential or commercial development is to occur near wetlands.

9. Consider the use of mitigation measures such as wetland enhancement and wetland restoration to offset *unavoidable* wetland disturbance.

10. Encourage alternatives to traditional road salting practices near major wetland systems.

11. Encourage the management/eradication of non-native invasive plant species in or adjacent to wetlands and watercourses.

12. Encourage native plantings and drought-tolerant plantings to minimize the need for widespread domestic irrigation.

13. Strictly control fertilizer, herbicide, and pesticide use adjacent to any wetland.

14. Protect valuable or unique wetland systems through Open Space acquisition.

<u>Farmland and Woodland</u>

1. Utilize and support Connecticut's Farmland Protection Program.

2. Explore the adoption of local tax support to farmers and tax assessments aimed at farm preservation.

3. Support initiatives to control non-native insects such as the Asian long-horned beetle and the wooly Adelgid beetle.

4. Encourage and manage for habitat diversity.

5. Prohibit the indiscriminate clearing or thinning of tree canopy and shrub understory within residential properties.

6. Encourage forest stewardship programs that include provisions for control of non-native invasive shrubs and encourage the preservation of native forest understory plants and shrubs.

7. Encourage Open Space acquisitions that provide connectivity between large forested or wooded areas.

<u>Wildlife Habitat</u>

1. Develop a strong upland review policy for impact on natural resource areas included in this report.

2. Require land-use applicants to prove that an intended project will not cause long-term negative impacts, because decisions should be based on scientific facts.

3. Require thorough biological inventories for large development proposals to properly assess what is at risk.

4. Institute a non-native invasive plant management policy.

5. Require wetland and forest management violators to restore damaged and disturbed areas by replanting with vegetation local to the area and/or allowing native vegetation to become reestablished.

6. Prohibit activities that fragment or isolate habitats, such as clearing of the forest understory and creation of vast expanses of unnecessary lawn.

7. Implement a sound forestry policy that protects and enhances biodiversity.

8. Educate the public on such issues as the value of protected lands and their role in moderating taxes, why natural systems and biodiversity are economically important, and the myriad other ways they enhance our Quality of Life.

9. Promote Open Space acquisition for areas possessing valuable wildlife habitat.

10. Define minimum acreage for preservation of native species and minimum widths for wildlife corridors in greenways.

<u>Archeological, Historic, and Architectural Resources</u>

1. Use existing land protection tools and the sale of development rights to protect these resources.

2. Concentrate, where feasible, suitable new development in existing centers through infill development.

3. Protect old stone walls and trees that contribute to the character of the landscape.

4. Promote Open Space acquisition that acts as a buffer to the Historic District and preserves architectural sites, where feasible.

<u>Open Space</u>

1. Appoint one or more environmental experts to represent the city of Milford and the Kingdom Life Christian Church who would review controversial but permitted activities based on the present Declaration of Conservation Restriction to determine, prior to their implementation, to what extent these activities may adversely impact the Beaver Brook Marsh and surrounding uplands.

2. Determine the appropriate techniques for Open Space protection such as conservation easements, donations, charitable remainder trusts, etc, when outright purchase is not

feasible.

3. Identify dedicated Open Space by deed restriction and work to dedicate important uncommitted Open Space by deed restriction.

4. Carefully consider and act on the acquisition recommendations of the Open Space Steering Committee.

5. Enable the Open Space Steering Committee to act in a semi-autonomous way in its efforts to acquire significant Open Space properties, in order to eliminate the red tape that leads to a delay and subsequent failure to protect through preservation.

6. Encourage linkages of existing Open Spaces, where feasible, through zoning regulations and Planning and Zoning Board deliberations.

7. Educate the public about the economic benefits of Open Space preservation by compiling and disseminating existing information and by creating a community model based on the economic repercussions of Open Space preservation.

8. Evaluate and revise, as appropriate, the current "Fee in Lieu of Open Space" regulation, to ensure that these funds are used solely for Open Space acquisition and related expenses.

9. Actively promote the New England and Connecticut Greenways Initiatives both locally and regionally.

10. Appoint a full-time Open Space land manager with the expertise to oversee all of, and determine the direction of maintenance for, the City's Open Space lands.

<u>Recreational Land</u>

1. Preserve and enhance our system of walking trails by connecting as many of them as possible, maintaining them, and protecting any that are threatened by development.

2. The city should secure Open Space linkages for walking trails and greenway connections by accepting donations of land, obtaining easements from individual landowners, requiring Open Space set-asides in subdivisions, or purchasing land outright.

3. Establish regular maintenance schedules and a maintenance budget for existing recreational facilities.

CONCLUSIONS

For the first time ever, we can stand back and take a long view of our evolving landscape. Painstaking mapping has been reduced and updates of information made less labor intensive with the use of Geographical Information System (GIS) mapping. We can now share our own information with others, compare historic maps and photos, and map our own assessments using computer technology available to and recognizable by everyone.

Each map contains geographic information regarding individually mapped resources. These resources can be individually or collectively compared against proposed developments. **Where convergence of multiple valuable resources conflict with proposed development, efforts should be made to revise development plans to preserve important zones worthy of conservation and protection.** Better yet, ***the maps can be studied to determine guidelines for protecting important natural resources before development proposals are initiated.***

These maps are now available for use by all Planning and Zoning Board staff and board members, and by the public. The information can be easily updated or expanded, thus maintaining accuracy or enhancing the level of detail. Natural resource information is a critical and powerful tool in assessing possible development impacts. Accurately mapped and quantified information is one of the most powerful and objective planning tools available.

The Milford Open Space Steering Committee and the Milford Conservation Commission advocate collaboration among the public and private sectors in the preservation of Milford's irreplaceable natural resources. We must provide for balanced growth that sustains what is left of the small town character and, at the same time, maintain the economic viability of our city. Through unified natural resource-based land use management and a prevailing spirit of cooperation, we believe a proper balance between conservation and development can be achieved.

If there is one thing we have learned from the application of the principles of environmental science, it is that our entire city and region are interconnected and interdependent. Although we cherish the rights of property ownership, we must accept the fact that our properties are part of larger environmental systems, and that what can be done on one property may affect all others. The development of land and its use should alway be considered in the context of the greater whole. It is incumbent on all land use management agencies to assess the pressures on these systems and to craft plans and regulatory innovations that protect and preserve the natural resources and Quality of Life in the community they serve.

This report will provide our Planning and Zoning Board with the information it needs to make carefully considered decisions and to better inform the public about what is at risk, if proper planning is not undertaken.

We have a wonderful opportunity to work together on the conservation of places we know and love and to build better communities for ourselves, our families, and our neighbors.

We hope you will find this documentation of Milford's natural resources informative. We will appreciate any additional information or corrections you may wish to offer.

Please contact: (1) Milford Conservation Commission, Parson's Complex, Milford, CT 06460
(2) Open Space Steering Committee, c/o Mayor's Office, City Hall, Milford, CT 06460

MAPS

GLOSSARY

Alluviation: A gradual increase of land on a shore or a river bank by the action of water, whether from natural or artificial causes.

Anadromous: Refers to fish that typically inhabit seas of lakes but swim upstream to spawn.

Aquaculture: Cultivation of fish and other aquatic organisms in freshwater ponds, lakes, irrigation ditches, and other bodies of water.

Aquifer: A permeable layer of sand, gravel, or rock that stores and conveys subterranean water.

Artesian spring: The result of a pressurized aquifer intersecting the surface or being penetrated by a pipe or conduit, from which water gushes without being pumped; also called a well.

Bedrock: Unweathered rock underlying the soil layer; parent material.

Benthic: The biogeographic region that includes the bottom of a lake, sea, or ocean, and the littoral and sublittoral zones of the shore.

Berm: Any level strip of ground at the summit or sides, or along the base, of the slope.

Biodiversity: The diversity of life in terms of total number of different species in a defined area.

Biofiltration: The use of plants and soils to filter contaminants from water.

Catadromous: Refers to fish that feed and grow in fresh water, but return to the sea to spawn.

Community: The populations of plants, animals, and microorganisms living and interacting in a certain area at a given time.

Demersal: Submersed.

Diameter at breast height (dbh): Diameter of tree measured 4 feet, 6 inches from ground level.

Dissolved oxygen (DO) content: Amount of oxygen dissolved in a given volume of water at a given temperature and atmospheric pressure; usually expressed in parts per million (ppm).

Diversity: A measure of the number of different species in an ecosystem.

Downdrift: The immediate area on the same side of a groin as the direction of the wave currents.

Drumlin: A glacially-formed, elongated hill composed of glacial till, oriented parallel to the glacier's path.

Ecosystem: A specific biological community and its physical environment interacting in an exchange of matter and energy.

Elver: A young or immature eel.

Endangered species: A plant, animal, or microorganism that is in immediate danger of biological extinction.

Environment: A combination of external biological and nonbiological factors that influence the life of a cell or organism.

Epifaunal: Benthic organisms that live on or move across the surface of a substrate.

Estuary: Enclosed or semi-enclosed body of water that forms where a river enters the ocean and creates an area of mixed fresh water and ocean or salt water.

Eutrophic: Rivers and lakes rich in organisms and organic material.

Extirpation: A localized extinction caused by direct human action such as hunting or fishing.

Fauna: All of the animals present in a given region.

Floodplain: Low-lying region along a river or stream, periodically subject to natural flooding; common site for human habitation and farming.

Flora: All of the plants present in a given region.

GIS: Geographic Information System, a computerized system that manages spatial information and its associated database.

Glaciation: The occurrence and actions of glaciers.

Gneiss: A type of rock; a banded, metamorphosed granite.

Greenstones: Any of various altered basaltic rocks having a dark green color caused by the presence of chlorite, epidote, etc.

Greenway: A stretch of interconnected lands, usually bordering a major watercourse, that provides habitat and breeding grounds for wildlife and associated plants and other forms of life.

Groin: A short jetty extending from the shore to prevent beach erosion.

Groundwater: Water held in gravel deposits or porous rock below Earth's surface; does not include water or crystallization held by chemical bonds in rocks or moisture in upper soil layers.

Habitat: An area where an animal or plant species lives

Hydrology: The study of the storage and flow of water.

Infill: The planned conversion of empty lots, underused or rundown buildings, and other available space in densely built-up urban and suburban areas for use as sites for commercial buildings and housing, frequently as an alternative to overdevelopment.

Infiltration: The process of water percolation into the soil and pores and hollows of permeable rocks.

Intertidal: Of, or pertaining to, the littoral region that is above the low-water mark and below the high-water mark.

Landfill: Land disposal site for solid waste; operators compact refuse and cover it with a layer of dirt to minimize rodent and insect infestation, wind-blown debris, and leaching by rain

Littoral: Shallow water of a lake in which light penetrates to the bottom, permitting submerged, floating, and emergent vegetative growth; also shore zone of tidal water between high-water and low-water marks.

Marsh: A tract of low wet land, often treeless and periodically inundated, generally characterized by a growth of grasses, sedges, cattails, and rushes.

Mesic: Of, pertaining to, or adapted to, an environment having a balanced supply of moisture or a moderately moist habitat.

Midden: A refuse heap.

Natural Resources: Goods and services supplied by the environment.

Nitrogen cycle: The circulation and reutilization of the element nitrogen in both the nonliving and living worlds.

Nocturnal: Of, or pertaining to, or occurring in the night.

Palustrine: Swampy or marshy.

Phragmites: Any of several tall grasses of the genus *Phragmites* having plumed heads and growing in marshy areas, especially the common reed.

Phylites: A slate-like rock, the cleavage planes of which have a luster imparted by minute scales of mica.

Ppt: Abbreviation for parts per trillion.

Recharge: The percolation or infiltration of water into and through the soil that replenishes groundwater.

Reservoir: A natural or artificial place where water is collected and stored for use, especially water for supplying a community, irrigating land, furnishing power, etc.

Riparian: The area immediately adjacent to a river, lake, or pond.

Riprap: Loose rocks used to protect against erosion.

Riverine: Pertaining to or resembling a river.

Runoff: Precipitation that is transported from the area on which it falls. Runoff is directly related to the amount of impervious surfaces in the drainage area.

Salinity: Amount of dissolved salts (especially sodium chloride) in a given volume of water.

Scavenger: An animal that feeds on dead or decaying matter.

Schist: A type of rock; medium- to coarse-grained, flaky metamorphic rock typically containing mica.

Sewage treatment plant: Facility where human solid and liquid wastes from homes, hospitals, and industries are treated, primarily to remove organic matter, nitrates, and phosphates.

Sediment: Soil particles, sand, and other mineral matter eroded from land and carried in surface waters.

Soil: A complex mixture of weathered mineral materials from rocks, partially decomposed organic molecules, and a host of living organisms.

Species: A population of morphologically similar organisms that can reproduce sexually among themselves but that cannot produce fertile offspring when mated with other organisms.

Successional: The progressive replacement of one community by another until a climax community is established.

Surficial: Of, or pertaining to, a surface, especially a land surface.

Swamp: A tract of wet, spongy land, often having a growth of certain types of trees and other vegetation, but unfit for cultivation.

Threatened species: While still abundant in parts of its territorial range, this type of species has declined significantly in total numbers and may be on the verge of extinction in certain regions or localities.

Tidal flats: Tideland that is flat or nearly flat and often muddy or marshy.

Tombolo: A sandbar connecting an island to the mainland or to another island.

Updrift: The immediate area on one side of a groin where sand and gravel accumulate opposite the direction of the wave currents. .

Watershed: The entire surface drainage area that contributes runoff (from precipitation, snowmelt, and springs) to a common outlet.

Wetlands: Ecosystems of several types in which rooted vegetation is surrounded by standing water during at least part of the year.

Wildlife: Plants, animals, and microbes that live independently of humans or are not domesticated.

Woodland: A forest where tree crowns cover less than 20% of the ground.

REFERENCES

Ad Hoc Conservation Committee. 2000. *Washington, Connecticut. Natural Resource Inventory. Report and Recommendations.*

Anonymous. 1972. *Milford, Connecticut City Development Plan*. Raymond, Parish & Pine, Inc. Prepared for The Milford Planning and Zoning Board.

Anonymous. 1981. *State of Connecticut Department of Environmental Protection Water Resources Unit Study of Shore Erosion and Shore Protection Milford, Connecticut.* Vol I. Nathan L. Jacobson & Associates, Consulting Engineers, Chester, Connecticut.

Anonymous. 1984. *Environmental Impact Evaluation: Great Creek Flood Control Project. Milford, Connecticut.* State of Connecticut Department of Environmental Protection.

Anonymous. 1993. *Environmental Impact Evaluation: Silver Sands State Park Master Plan, Milford, Connecticut*. Prepared by Diversified Technologies Corporation for the State of Connecticut Department of Environmental Protection.

Anonymous. 1998. *Open Space Land on the Housatonic River*. Open Space and Watershed Land Acquisition Grant Application, Department of Environmental Protection, Division of Land Acquisition and Management, State of Connecticut.

Anonymous. 1998. *Stewart B. McKinney National Wildlife Refuge*. U.S. Fish & Wildlife Service.

Anonymous. 1998. *Draft Biological Assessment: Impacts to Piping Plover (Charadrius melodus) Associated with Runway Safety Improvements: Sikorsky Memorial Airport, Stratford, Connecticut.* Prepared for the City of Bridgeport and the Federal Aviation Administration, Fitzgerald & Halliday, Inc, Hartford, CT.

Anonymous. 1999. *Sikorsky Memorial Airport, Stratford, Connecticut. Volume I. Final Environmental Impact Statement/Environmental Impact Evaluation for the Proposed Improvements to Runway 6-24.* Department of Transportation, Federal Aviation Administration *and* the Connecticut Department of Transportation, Bureau of Aviation and Ports.

Anonymous. 2001. Declaration of Conservation Restriction. Kingdom Life Christian Church, Inc. in favor of the City of Milford, Connecticut.

Anonymous. *Milford Point/Wheeler Marsh/Mouth of the Housatonic River.* Bent of the River Sanctuary.

Anonymous. 2001. *Harbor Management Plan, City of Milford*.

Anonymous. 2002. *City of Milford, CT, Plan of Conservation & Development.* Planning & Zoning Board, City of Milford, Connecticut. Harrall-Michalowski, Associates, Inc. in association with Westcott and Mapes, Inc.

Bakker, Jane. Editor and Designer. *A Guide to the Housatonic River Estuary: Its Wildlife, History, Activities, Water Quality.* Housatonic Valley Association, Cornwall Bridge, Connecticut.

Bell, Michael. *The Face of Connecticut People, Geology, and Land.* http://g3.tmsc.org/face_of_ct/index.html

Ellum David S. 1999. *The Solomon Property. A Site Description with Considerations for Open Space Conservation.* The Milford Open Space Steering Committee.

Ellum, David S. 1999 *Site Description and Biological Inventory for the Alter Property*. The Milford Open Space Steering Committee.

Federal Writers' Project. 1939. *History of Milford Connecticut 1639-1939*. Work Projects Administration for the state of Connecticut.

Gibbons, Jim. 1995. *Outline of Environmental Elements to be Addressed in an Updated Plan of Conservation and Development*. In: Open Space Packet. Cooperative Extension Center, University of Connecticut.

Karl, Dorie. 1979. *Eisenhower Park; Existing Resources and Prospects for Future Use.* The Milford Conservation Commission.

Proctor, Noble S. 1978. *25 Birding Areas in Connecticut*. The Pequot Press, Chester, Connecticut.

Rogers, Lee 1982. *The Beaver Brook Property, Milford, Connecticut*. South Central Connecticut Regional Water Authority.

Rotman, H.D. 1994. *Open Space Use of MI-4*. Report to the Conservation Commission.

Rema Ecological Services, LLC. 2001. *Environmental Assessment*. Submitted to the City of Milford Inland Wetlands Agency with an application for a permit to conduct regulated activities addressing wetlands, wildlife, & water quality for the proposed Avalon at Milford, Wolf Harbor Road & Wheelers Farms Road, Milford, Connecticut.

Sharp, Penelope C. 1999. *Ecological Evaluation of D'Amato Property, Herbert Street, Milford, Connecticut.* The City of Milford.

Smith, DeForest W., ed. 1989. *Only In Milford: An Illustrated History*. Vol. 1, George J. Smith & Son Realtors, Milford, Connecticut.

Victoria, Julie. 2002. Letter to Judy Weyant re: shorebirds nesting on Charles Island. DEP, Franklin Wildlife Management Area.