

NATURAL ENVIRONMENT

Inventory and Analysis

NATURAL ENVIRONMENT¹

PORTLAND'S LANDSCAPE

Participants in community forums held in 2001 were asked, "What makes Portland distinctive?" Portland's natural setting was the number one response. The geographic diversity of Portland as a coastal community with rivers, estuaries, streams, islands, and hills is highly valued by citizens. The natural beauty, scenic views, and accessibility of natural resources are cited as significant attributes of the city.² For this inventory, Portland's environment is divided into three basic categories: I) Physical Elements; II) Wildlife and Critical Resource Elements; and III) Natural Resource Elements. The final section (IV) is a summary of conservation efforts, including environmental regulations and issues.

I. PHYSICAL ELEMENTS

A. Regional Context

According to Bennett's Maine's Natural History, Portland is located within the Coastal Region, and more specifically, within the Transitional Coastal Sub-region. A highly convoluted, irregular and rocky coastline characterizes this sub-region, extending from Scarborough to Penobscot Bay. These coastal waters, with their varied temperature, salinity, and complex currents support a tremendous assortment of marine and terrestrial animals and plants. This Sub-region marks the changeover from the white pine and hardwoods forests typical of central eastern United States to the northern boreal forests characterized by red and white spruce and balsam fir. Portland is more closely aligned to the more temperate forests with hardwood species comprising a significant portion in the native forest.

B. Geologic and Glacial History

Portland's underlying bedrock began as sediment laid down under the ancient Iapetus Ocean. The tectonic plate collision of Avalonia and North America caused the characteristic folding of the bedrock seen in the geologic band called the Casco Bay Group. The bedrock's parallel folds are in a distinctive southwest-northeast orientation, which are revealed in the shape and position of the Casco Bay Islands and the Portland peninsula.

The Wisconsin Age glacier extended out onto the continental shelf. It depressed bedrock, as much as 2,000 feet into the earth's fluid mantle and tied up so much water that sea level was 300 feet below its current level. As global temperatures rose, the glacier began

¹ Excerpt from Green Spaces, Blue Edges: An Open space and Recreation Plan for the City of Portland, Chapter Three, Portland's Natural Environment. Edited in 2002.

² Edited and updated 2002 for Comprehensive Plan Certification.

to melt and recede. The sea followed the glacier landward to a point at least 15 miles inland of the current coastline. Glacial sediments and marine deposits became Portland's soils.

C. Topography

Portland is the first step of a gradual rise in the land's contour that culminates in the White Mountains, approximately 50 miles to the northwest. The city with its islands extends 12 miles, north to south, and 15 miles, west to east. Portland's total area is approximately 46,100 acres (72 square miles); however, the land area is only 14,100 acres (22 square miles) and the remainder is water, primarily Casco Bay and Back Cove. The mainland portion of the city extends over 4.9 miles, north to south, and stretches over 6 miles, east to west with approximately 11,150 acres. The 17 islands or parts of islands within Portland's city limits add approximately another 2,950 acres of land area.

The Portland Peninsula is dominated by a 1-mile by 3-mile southwest-northeast oriented double-topped ridge. At the eastern end of the peninsula is Munjoy Hill with an elevation of 161 feet; on the west is the 175-foot Bramhall Hill that ends abruptly in a vegetated sharp-faced cliff. The remainder of the mainland is relatively level, with an average elevation of 100 feet, except for a few low hills and ridges. These highpoints include Summit Hill (180), Rocky Hill (150 feet), outer Washington Avenue (168 feet), Graves Hill (174 feet), and Deering Highlands (126 feet). A shaded relief map of Portland's watersheds depicts the topography on Portland's mainland (Environmental Map #2). Several of the City's Islands, most notably Cliff, Cushing, Great Diamond and Little Diamond, exhibit significant hills and rises, with elevations as high as 80 feet.

Another significant aspect of Portland's topography is the tendency toward steep slopes along some of the City's shores and inland waterways. This is particularly evident along the Fore River west of Thompson's Point, the Stroudwater River west of UNUM, the Presumpscot River, and Nason's Brook. Cliff Island derives its name from the cliff found on that island. The 80-foot whitehead Cliffs on Cushing Island and the lower steep slopes on Great Diamond and Little Diamond Islands are other notable examples of the precipitous edges where land meets water.

D. Bedrock and Soils

Portland is underlain by mid-Paleozoic volcanic rocks and sediments metamorphosed into schists and phyllites. During and after metamorphism the rocks were strongly folded, as described previously, and some bodies of granite were emplaced. Also during this period, the Nonesuch River Fault was created, which extends from Stroudwater through the USM campus to Martins Point. There are no indications that this fault has been active in modern times.

The Cumberland County Soil Survey (U.S. Department of Agriculture, Soil Conservation Service) divides soils in Portland into two general classes or associations.³ The peninsula and areas near and south of Brighton Avenue are generally classified in the

³ Refer to appendix for brief description of soil characteristics and for the specific descriptions of the soil types found in Portland.

Hollis-Windsor-Au Gres Association. The off-peninsula areas and areas north of Brighton Avenue are generally classified in the Suffield-Buxton-Hollis association.

These associations frequently overlap and elements of each association are found throughout the City. Although the characteristics of these soils vary, they generally exhibit high water tables. They tend to be highly subject to erosion, particularly along slopes and they exhibit relatively low water absorbency, primarily because of the presence of marine clays and the shallow depth to bedrock.

The peninsula has been subject to extensive filling. A swath of filled land up to 200 feet in width was created along the waterfront (the Fore River), which supports the entire length of Commercial Street. Similarly, the existing northern bank of the Fore River, from the Casco Bay Bridge to Thompson's Point, was created with fill. Much of what we know as Bayside today was previously part of Back Cove. The east-west diameter of Back Cove was approximately 1.5 miles in the early 19th century- the present east-west diameter is approximately 0.8 miles. The perimeter of Back cove area was filled with soil and demolition debris (including debris from the Great Portland Fire of 1866) from the 18th to the 20th centuries. The filling of the southeastern bank facilitated the construction of Marginal Way and I-295. Because of the variability of material used for fill, it is not possible to characterize the soil and its limitations without on-site investigation.

E. Surface Waters and Wetlands

1) Overview

Casco Bay, Back Cove, and the Fore, Stroudwater, and Presumpscot Rivers surround over 80 percent of Portland's mainland. The City's total area includes the water between the mainland and the islands, thus Portland has more acreage of water (32,000 acres) than land (14,100 acres).

2) Principal Surface Waters (refer to Surface Water Map)

Casco Bay covers 229 square miles from Two Lights in Cape Elizabeth to Cape Small in Phippsburg with more than 200 islands. The Bay has 578 miles of irregular shoreline with an 18-mile wide entrance and an average width of 12 miles. Closer to Portland, the Hussey and Luckse Sounds offer sheltered, deep, and spacious anchorages for ocean-going vessels.

Portland occupies a prominent location within the Casco Bay Watershed.⁴ The watershed includes four major rivers: the Fore; Stroudwater; Royal; and Presumpscot Rivers. All of these rivers, except the Royal, pass through or abut Portland and empty into Casco Bay here. The watershed, covering 985 square miles, extends approximately 60

⁴ The watershed is defined as the entire land area that drains by overland flow and through streams and rivers into a given body of water, in this case, Casco Bay.

miles to the north, and reaches its terminus in Bethel at the Crooked River's northern-most extent. The watershed includes forty municipalities, and several major water bodies, including Sebago, Little Sebago, Long and Highland Lakes. Sebago is Maine's second largest lake and serves as the principal water supply for Portland. Due to the hydrological relationship of this watershed, activities such as industry, agriculture, development and wastewater treatment in communities as far away as Bethel can impact the quality and character of resources in Portland and Casco Bay.

Portland Harbor, the westernmost portion of Casco Bay, is a deep-water, year-round, sheltered harbor, only 3 ½ miles from open ocean. Its main channel entrance is 1,100 feet wide with a depth of 45 feet at mean low tide. Within the inner harbor, the channel is 35 feet deep.

Back Cove is a semi-enclosed tidal cove covering approximately 660 acres. Its narrow, bottleneck opening empties into Portland Harbor. Today its use is primarily recreational, such as windsurfing, and its shoreline is ringed with a walking/jogging/biking path.

The Fore River serves as the inner portion of Portland Harbor, running from the Stroudwater River into Casco Bay. While the Fore River has an important water transportation function, it is also a highly productive estuary with its associated tidal marshes.⁵ West of Thompson's Point, there is an extensive area of salt marsh cord grass and salt marsh hay, including the Fore River Sanctuary, which contributes to the productivity of the estuary. In 2000 and 2001, the Resource Protection Zone for the Fore River Estuary was enlarged to incorporate and protect over 112 acres of additional land held by Maine Audubon Society, Portland Trails, the City of Portland and Union Water and Power Company.

The Stroudwater River empties into the Fore River in the Stroudwater neighborhood of Portland. This river's watershed includes sections of seven communities: Buxton, Cape Elizabeth, Gorham, Portland, Scarborough, South Portland and Westbrook.

The Presumpscot River is the longest river traversing Portland and it has the largest watershed. The watershed comprises the northern reaches of the Casco Bay watershed, beginning with the Crooked River in Bethel, through Standish, Windham, Gorham, Westbrook, Falmouth and Portland. The river is also an estuary at its outlet in Falmouth. In 2003, The Smelt Hill Dam is scheduled to be removed from the lower reaches of the Presumpscot River in Falmouth. The removal of the dam will result in a significant environmental shift for the river and open it up to fisheries that have long been excluded from the Presumpscot.

⁵ Estuary is an aquatic region where fresh and salt-water mix, characterized by fluctuations in salinity, tidal action, and typically, high biological diversity and productivity.

3) Four Major Streams

Capisic Brook begins with two branches. One originates north of Morrills Corner and runs west just north of Evergreen Cemetery. The second branch begins near Westbrook/Portland border, just north of Exit 8 of the Maine Turnpike (heavily developed area), and runs under the Turnpike to connect with the other branch just north of the Hall School. From there, it flows south, crossing Brighton Avenue to Capisic Pond, then under Capisic Street into the Fore River Sanctuary and empties into the Fore River.

Fall Brook starts in North Deering near Lyseth-Lyman Moore School and runs parallel to Washington Avenue. It passes under that avenue near Andover College and flows in a southerly direction, emptying into Back Cove. A portion of the brook between Allen and Maine Avenues flows within an underground culvert.

Nason's Brook begins in Westbrook, runs under the Maine Turnpike near the Pine Tree Industrial Park, under Rowe and Rand Avenues, and flows over Jewell Falls. It also enters the Fore River Sanctuary and empties into the Fore River. Jewell Falls was recently rezoned to Resource Protection Zone (RPZ) as part of the environmental conservation efforts for the Fore River Estuary.

The fourth, unnamed stream runs in a south-north orientation through Riverside Golf course, emptying into the Presumpscot River.

4) Inland Wetlands (refer to Wetland Map)

In addition to the saltwater wetlands associated with the Fore River estuary, there are a number of freshwater wetlands scattered on the mainland. Most of Portland's freshwater wetlands have been altered and encroached upon by development, but many small pockets still exist. Typically, they are found in low-lying areas of the city that are frequently inundated with water or other land that has remained vacant because of poor soils or other factors. There is only one freshwater wetland on the mainland of Portland of sufficient size to be designated for protection under shoreland zoning regulations (refer to Sec IV) on Allen Avenue near Northfield Green. There also are several wetlands on Peaks Island that are afforded this protected status.

5) Groundwater Resources

Drinking water for the mainland is piped from Sebago Lake by the Portland Water District, which serves nine other area communities. The Portland Water District maintains large reserves, so the city has not been impacted by any water shortages during the 2001-2002 drought. The islands are served by a combination of well water and Sebago Lake water piped from the mainland. Cliff Island is totally dependent on well water.

Great Diamond and Little Diamond have public water, but some of the lines are seasonal. Peaks Island has year-round and seasonal water lines and there are also a number of private wells.

Groundwater on the islands and the mainland originates from rain and snow that falls on the land surface. The water then filters into the underground aquifers through aquifer recharge zones. On the mainland, the two principal aquifer recharge zones are located in fairly broad swaths along the Presumpscot River (roughly from Rankin Street to the Maine Turnpike) and along St. John Street (roughly from Danforth Street to Congress Street).

The City of Portland had Robert G. Gerber, Inc. prepare a ground water management study for the islands.⁶ The islands studied included Peaks, Cliff, Great Diamond and Little Diamond. The consultants assembled data on the island ground water resources, undertook reconnaissance-level investigations and developed simulation modes to describe the way in which ground water originates and moves on the islands, located known and potential sources of ground water contamination, and proposed ground water management goals, objectives and implementation measures. There are two types of aquifers on the islands:

1. “**Surficial**” **deposits** or those in the soil. It is determined that as little as 5% of the precipitation and snow melt will infiltrate clay soils and almost all of the water will infiltrate in gravel soils, although almost half of annual precipitation is lost to plants and evaporation.
2. **Bedrock aquifers** absorb water into cracks or fractures. On the average, about 8% of the precipitation falling on the Portland islands moves through the fractures to become ground water flow in the bedrock aquifer. The water moves through narrow openings, through planes of sedimentary rock (which may now be vertical), or larger cracks from rock breakage. The groundwater entering the rock at the highest point of the island flows nearly straight down, deep into the earth, before turning sideways, then upwards to discharge at the saltwater interface. Groundwater entering the rock near the edge of an island stays shallow and will discharge just above or below the high tide line.

Saltwater intrusion is a particular concern on the islands. Freshwater has a lower density and will float on top of salt water. A thick zone of brackish ground water occurs near the saltwater interface, due to mixing caused by tidal fluctuations and by ground water moving along the saltwater interface. The saltwater interface is located about 40 times the depth below Mean Sea Level, with ground water elevated above Mean

⁶ City of Portland Island Groundwater Management Study, prepared by Robert G. Gerber, nc. , Consulting Civil Engineers and Geologists, adopted 1989, financially supported by a grant from Maine’s Coastal Program through funding provided by the U.S. Dept. of Commerce, Office of Coastal Zone Management, under the Coastal Zone Management Act.

Sea Level. Therefore, the saltwater interface is very deep under the center of an island where the ground water may be close to 80 feet above Mean Sea Level. The closer to the shoreline, the shallower the saltwater interface becomes. When a well is being pumped and draws down the ground water surface, salt water is displaced upward toward the well.

The principal soils on the islands include: a) thick silty, stony soil called “glacial till”; b) thin stony, sandy soil developed by water washing through glacial till; c) stratified sand or gravelly sand deposited by glacial meltwater streams; and d) interbedded fine sand, silt, and clay. The stratified sands and gravels make the best surficial aquifers, the tills are intermediate in favorability; and clay-silts are least productive. Dug wells are only reliable where soils are relative thick (10 ft or more). Soils are typically less than 5 ft thick in large areas on the west shore of Peaks Island and relatively thin soils cover most of the islands. Surficial aquifers are only of minor importance to the islands as a water source. The study includes a map locating site of surficial deposits with above-average thickness and coarse texture, which favor developing wells.

Bedrock geology is complex on the islands. The bedrock aquifers are divided according to different bedrock types. The rock type, called Cape Elizabeth Formation, produces more water when pumped than other rock types. On Cliff Island the rock types naturally produce more iron and manganese (which stains laundry and smells like sulfur). Cliff Island wells produce above average yields and the ground water quality did not show much human-generated contamination. Typical bedrock well depth on the island is about 100 feet, whereas 175 feet is average depth for the coast as a whole. The study identifies where subsurface sewage disposal systems and other potential sources are suspected of contaminating wells. There were very few cases of reported saltwater intrusion in the island wells. It was found that contaminants could spread rapidly in the bedrock.

The Ground Water Management Study recommended measures to preserve the quantity of groundwater by preserving the recharge rate, so the ground water table is not lowered and saltwater intrusion does not occur. The study also provided recommendations to preserve the quality of water, so that it meets or exceeds the State of Maine Primary Drinking Water Standards. The measures adopted to preserve the ground water resources on the islands are found in section IV, Conservation Issues and Efforts.

II. WILDLIFE AND CRITICAL NATURAL RESOURCE ELEMENTS

A. Wildlife Habitats

1) “Beginning with Habitat” Inventory

Portland is part of a larger regional coastal habitat. Many of the shoreland resources on the mainland and the islands are significant components of this larger coastal habitat, extending from Cape Elizabeth to Harpswell. It has been characterized as follows:

The abundance and quality of the intertidal habitat make the marine and estuarine environment of this region important. The presence of many large shallow bays with inter-tidal flats, mussel reefs, and eelgrass beds provide large acreages of many habitats. Similarly, the occurrence of many near shore islands (approx. 400) provides additional intertidal areas, as well as habitats for nesting waterbirds and rocky ledges for seals. (An Ecological Characterization of Coastal Maine, vol. 1 Department of the Interior, US Fish and Wildlife Service.)

In 2001, a cooperative effort of environmental organizations and government agencies⁷ introduced a program call “Beginning with Habitat, An Approach to Conserving Open Space.” Maps and data identifying valued habitats and rare species locations are being provided to municipalities. The significant habitats for Portland are shown on Wildlife Habitat Map, which is an excerpt of the “High Value Plants and Animal Habitat Map for the Towns of Gorham, Windham, Falmouth, Portland, and Westbrook.” A summary of the map information regarding Portland is as follows:

1. **Maine Natural Areas Program -MNAP Rare or Exemplary Natural Communities⁸:** Portland does not have any rare species or natural communities, except that a spotted turtle habitat in Falmouth touches the municipal boundary (northerly boundary line) in the vicinity of the Presumpscot River.
2. **U.S. Fish and Wildlife Service – High Value Habitat for USFWS Priority Trust Species (> 5 acres)⁹:**
 - a. **Grass, shrub, and bare ground:** On the mainland, areas of this habitat are found along the Stroudwater

⁷ Cooperative effort with Maine Department of Inland Fisheries and Wildlife, Maine Natural Areas Program, Maine Audubon Society, Maine State Planning Office, United States Fish and Wildlife Service, Maine Cooperative Fish and Wildlife Research Unit, Southern Maine Regional Planning Commission and Wells National Estuarine Research Reserve. Maps prepared by Maine Natural Areas Program.

⁸ The Maine Natural Areas Program tracks natural communities that are either rare types or outstanding examples of more common types. In addition, they track rare plant species.

⁹ Priority Trust Species: Trust species of the USFWS include all migratory birds, anadromous/catadromous and certain coastal fishes, and federally listed endangered and threatened species. The map identifies important habitat for 64 trust species that regularly occur in the gulf of Maine watershed and are considered a priority for protection because they: are listed as federally endangered or threatened, and or are exhibiting significant declining population trends nationwide, and or have been identified as endangered or threatened by two or more of the three states in the Gulf of Maine Watershed.

River, within Evergreen Cemetery and Payson Park, along the Presumpscot River, within the Riverside Golf Course, and two undeveloped locations in the vicinity of the Maine Turnpike.

- b. **Forest (Includes Forested Wetlands):** There are only two identified high value forested areas in Portland. One is off Ocean Avenue near the Falmouth line and the other is on Peaks Island.
 - c. **Marine/Estuarine Intertidal Wetland:** The high value Marine/Estuarine Intertidal wetlands are identified along the Fore River, Back Cove, Portland Harbor, Presumpscot Estuary and surrounding all of the Islands. In 2001, the Resource Protection Zone (RPZ) for the Fore River Sanctuary was expanded to encompass a much larger land area in order to conserve this resource and the adjoining wildlife corridors.
 - d. **Freshwater Wetlands (non-forested) and lakes and rivers:** There are no freshwater wetlands exceeding 5 acres noted on the map. Portland has the following freshwater rivers and streams: Fore River, Stroudwater River, Presumpscot River, Fall Brook, Capisic Brook and Capisic Pond, Nason's Brook, and a fourth unnamed brook.
3. **Maine Department of Inland Fisheries and Wildlife – MDIFW Mapped Habitats and Confirmed Species Locations¹⁰:** There are no essential wildlife habitats in Portland; however, the Significant Wildlife Habitats are as follows:
- a. **Deer Wintering Area¹¹:** There is a deer wintering area that is west of the Turnpike and encompasses both sides of the Stroudwater River. This area extends into Westbrook.

¹⁰ Maine's Endangered Species Act protects Essential Wildlife Habitats, which are areas currently or historically providing physical or biological features essential to the conservation of an Endangered or Threatened Species and which may require special management. Maine's Natural Resources Protection Act (NRPA), which became effective on August 4, 1988, was intended to prevent further degradation or destruction of certain natural resources of state significance. Within the Act are certain provisions for protecting significant wildlife habitats.

¹¹ A deer wintering area (DWA) is defined as a forested area used by deer when snow depth in the open/hardwoods exceeds 12 inches, deer sinking depth in the open/hardwoods exceeds 8 inches, and mean daily temperatures are below 32 degrees Fahrenheit. Non-forested wetlands, non-stocked clearcuts, hardwood types, and stands predominated by Eastern larch are included within the DWA only if they are less than 10 acres in size. Agricultural and development areas within DWA are excluded regardless of size. This coverage has not been officially adopted as a regulated NRPA habitat.

- b. **Shorebird Habitat¹²:** Shorebird habitat is noted on the State habitat map along the Fore River west of the Million Dollar Bridge, in back cove, within the Presumpscot Estuary east of I-296, several small locations along the Eastern Promenade, and on Ram Island (conserved under State ownership).
- c. **Tidal Waterfowl/Wading Bird Habitat¹³:** According to the State map tidal waterfowl and wading bird habitats are found around each of the islands, at several points off the Eastern Promenade, within the Fore River and its estuary starting at the westerly tip of the peninsula, in Back Cove, and in the Presumpscot Estuary including shore frontage between B&M Baked Beans factory and Martin's Point.
- d. **Seabird Nesting Islands¹⁴:** There are three islands in Portland identified as seabird nesting sites: House Island, Ram Island, and Outer Green Island. The latter two islands are conserved under State ownership.

B. Local Wildlife Assessments¹⁵

An environmental report by Woodlot Alternatives on Capisic Pond entitled Natural and Cultural Resources of Capisic Pond and conducted in 1989, identified 20 mammalian species confirmed or suspected of breeding within the 18-acre park. A total of 36 species of birds were also observed in the area. Specifically, these birds include several species of ducks, cardinals, and a green-back heron. Resident or visiting mammals included moose, deer, river otters and mice.

The Capisic Brook Greenbelt/Stormwater Abatement Study recommended employing an integrated approach to address stormwater management, which includes habitat and

¹² The shore bird data layer from the State specifically addresses migratory shorebird coastal staging areas. Staging habitat is defined as areas that meet shorebird feeding and roosting requirements, during migration. Shorebird staging habitat consists of coastal areas, which provide both tidal mud flats rich in invertebrates for feeding, and areas such as gravel bars and sand spits for roosting. This coverage has not been officially adopted as a regulated NRPA habitat.

¹³ Waterfowl habitats characterized both seasonally and behaviorally as: breeding habitat, migration and staging habitat, and wintering habitat. Wading bird habitats consist of breeding, feeding, roosting, loafing, and migration area. Habitats can include: seaweed communities, reefs, aquatic beds, emergent wetlands, mudflats, and eelgrass beds. Any area around a seabird nesting island (with at least 25 nesting pairs of Common Eiders) and areas documented as wading bird rookeries are also included. This coverage has not been officially adopted as a regulated NRPA habitat.

¹⁴ Seabird nesting islands are an island, ledge, or portion thereof in tidal waters that has documentation of (a) 25 or more: nests, adult seabirds associated with nests or combination thereof (single species or aggregate of different species) in any nesting season during, or since 1976; or (b) one or more nests of a seabird that is a Maine endangered or threatened species in any year during or since 1976, provided that the island, ledge or portion thereof, continues to have suitable nesting habitat. This coverage has been officially adopted as a regulated NRPA habitat.

recreation improvements. The inventory for this study described the brook's habitat. The Capisic Brook Greenway Master Plan and the Fall Brook Greenway Master Plan are more detailed studies of using the integrated approach for storm water management in both stream watersheds. First, the natural conditions (watershed, flood zones, slopes, and soils) of each brook were identified. Then, the consultants analyzed the vegetation, stream, and wildlife habitats along each segment of the streams. From this information base, recommendations are presented that combine the required engineering improvements for stormwater management and flood mitigation with opportunities for habitat enhancements.

The removal of the Smelt Hill Dam in Falmouth (scheduled for 2003) should improve the Presumpscot River's fisheries habitat and allow a broader range of species access to the river. The Presumpscot River Task Force, a subcommittee of the Casco Bay Estuary Project, is currently studying the potential environmental impacts, habitat improvements, public access demands, and water quality considerations that will result from the removal of this and other dams along this corridor. Their work will be important in understanding this large watershed and enhancing the Presumpscot, which flows through seven communities. The Land for Maine's Future and the City of Portland are partners in the purchase of 48 acres along the Presumpscot River (northerly tip of Portland), which will provide public access (trail and canoe launch) and conserve wildlife habitats.

III. NATURAL RESOURCE ELEMENTS

A. Forestry Activities

Portland is known as the "Forest City". The city's native old growth tree stands included red and white oak, beach, hickory, hemlock, spruce, pine fir and American chestnut. Lumber was an early export product that helped establish Portland as a major trading area in the 1700's. Portland's native forest was largely intact until the early 1800's when settlers cleared the land for farming and pastures. Currently, the only timber harvesting in Portland is taking place on Cliff Island, on one of the two properties listed under the Maine Tree Growth Law for managed wood lots. The 31-acre parcel on Cliff Island contains mostly Spruce and 55 acres near the Stroudwater River has seen forestry related activity in the past five years.

Deering Oaks and Baxter Woods Parks represent the best examples of Portland's original forest. The City purchased Deering Woods (now known as Deering Oaks) in 1879 as a park with the "crowning glory" being its ecologically significant stand of white oaks. Baxter Woods was purchased by then Governor Percival Baxter and given to the City as a nature preserve in 1946. Another old-growth stand is a small pocket of pine and hemlocks (among the tallest in the city) on Davis Farm Road at the Verizon facility (formerly New England Telephone site).

A variety of trees may be found along the Presumpscot and Stroudwater Rivers, including Red Oak, Red Maple, White Pine, Black Willow, Alders, Shadblow or Anelanchier. Vegetation along stream corridors includes large Black Willows, which help slow floodwaters and minimize erosion. The Islands are more rural and have more substantial tree cover than the mainland. In Peaks Island's Pond Cove Cemetery, remnants of the original forest persist. Little Diamond has a 350 to 400-year-old stand of hickory, maple and oak trees.

The first documented tree planting in the city took place in 1793 on Washington Avenue. More substantive tree planting was initiated on the peninsula as early as the 1850's and expanded to off-peninsula neighborhoods in the 1900's. Tree planting along Baxter Boulevard was initiated in 1921. Four hundred lindens were planted and remain an essential element of one of Portland's most enduring designed landscapes, which is a designated historic landscape district. The factors contributing to the decline of the Lindens are documented in the Baxter Boulevard Master Plan along with recommendations to preserve the trees. These factors include cultural impacts, root collar disorders, and environmental impacts.

Dutch Elm disease devastated Portland, like the rest of the Northeast in the 1960's, and 20,000 Elm trees were lost on the peninsula. Only about 100 elm trees are left today. During the 1970's, a massive tree-planting program was initiated (up to 2,000 trees a year planted) to diversify the tree stock by using a mix of species. Today, it is estimated that there are 20,000 street trees in the city.

Portland's park spaces preserve important forestry resources that have dwindled over time as development has occurred in the community. A summary of the most significant forestry resources follows and park resources are shown on Recreation Map #1 in that the chapter on recreation resources:

- **Deering Oaks** –There are 1,000 trees including old growth White and Red Oaks. Deering Oaks is a designated Historic Landscape District.
- **Evergreen Cemetery** – It features the largest stand of Sugar Maples in Greater Portland, with ages of approximately 100 to 150 years. The cemetery has over 1,000 trees.
- **Baxter Woods** – This Park has 32 acres of forest. It is the largest undisturbed forest in the city and contains valuable stands of White Oak and groves of Hemlock. An important section of this “old growth” forest is on land owned by the Sisters of Mercy (Catherine McAuley High School) and the Deering Pavilion. This part of the forest was likely cut at one point over 150 years ago. Governor Baxter planted a plantation of Red Pines in 1947.
- **Baxter Boulevard** – The Boulevard was planted with 400 Linden trees that were **dedicated** in 1921 as a memorial to World War I Veterans. They remain an essential element of one of Portland's most enduring designed landscapes. The boulevard demonstrates the landscaped arborway proposed by the Olmsted Brothers Landscape firm in the 1905 plan for Portland's park system. They proposed a tree-lined green belt, connecting the Eastern Prom with Deering Oaks, Baxter Boulevard and the Eastern Prom. Baxter Boulevard is a designated Historic Landscape District
- **Riverton Park** – Former Trolley Park contains mature stands of White Pine, Red Maple, Oak, **and** Beech. The stand has been colonized by invasive Norway Maples once planted near View Street, which have now become the dominant tree in some areas.
- **Capisic Pond Park** – This area includes fields and some woods with alders, Elms and White Pines.

- **Pine Grove Park** – located between Ray and Virginia Streets near Allen Avenue. This 6.5-acre park contains a mature stand of White Pine. Set aside in 1926, Pine Grove Park also contains related natural groundcover of woodland wildflowers.
- **Fore River Sanctuary** – located in the Stroudwater area this 85 acre preserve owned by Maine Audubon contains stands of mature White Pine and Hemlock.
- **Oaknuts Park** – located on Summit Street in North Deering this area connects to the Presumpscot Preserve and contains stands of Red Maple, Beech, Red Oak, White Pine and Hemlock.
- **Presumpscot Preserve** – Portland and Land for Maine’s Future recently purchased this tract located along the Presumpscot River at the end of Overset and Cutis Roads. The 50-acre preserve contains stands of primary White Pine, Hemlock, Red Maple, along with more rare Shagbark Hickory (the northern fringe of the range for this species) and Moose Maple, *Acer Pensylvanicum*.
- **Cushing Island** – The area conserved by the Cushing Island Conservation Corp. (private **holding**) has White Spruce trees and native shoreland vegetation including large specimens of American Mountain Ash *Sorbus americana*.
- **Peaks Island** – The forested areas owned by the State of Maine near Brackett Avenue along with Peaks Island Land Trust property contains forest of mature Red Oak and Shagbark Hickory.

The Forestry Division of Parks & Recreation was formed in 1889 to care for municipal street and park trees. Portland became a Tree City USA in 1978 and has continued to meet or exceed standards set forth by the National Arborday Foundation. In 1993 the Forestry Division along with Oakhurst Dairy developed a strong public/private partnership initiative to plant trees in our gateways, parks and public grounds known as the ‘Oakhurst Tree Challenge’. The City of Portland has over 12,000 street trees along with 5,000 park and public grounds trees. In addition, to trees on the city’s mainland, the Forestry Division also cares for municipal trees on Peaks, Little Diamond, Great Diamond, and Cliff Islands.

B. Agricultural and Resource Extraction Activities

Agriculture had a significant presence in Portland up until the first half of the twentieth century and the islands were used extensively for grazing. The 1914 Richards Atlas indicated vast tracts of open land in North Deering, Riverton, and Stroudwater that presumably were used for farming. As late as 1921, there were 80 registered dairy farms in the City. However, with the off-peninsula housing boom after World War II, the few remaining farms gradually disappeared and the last farm closed in the 1980’s. While there are no working farms in Portland, approximately 265 acres of land are listed under Maine’s Farm and Open Space Law taxation program. Below is a chart of the conservation groups and property owners, along with the acreage designated as open space under the State program. Today, Portland’s commercial agricultural endeavors include several nurseries scattered throughout the city, the Farmers Market held twice a week, and the Portland Public Market.

Portland Properties Participating in Maine's Farm and Open Space Law Taxation Program				
<u>Location</u>	<u>Owners</u>	<u>Open Space Land</u>		<u>First</u>
		<u>Square Feet</u>	<u>Acres</u>	<u>Year Listed</u>
Cliff Island	Cliff I Corp	700,282	16.08	1984 & 2002
Cliff Island	Land Assoc. of Cliff Island	1,009,542	23.18	1994
Cliff Island	Belknapp	1,263,240	29.00	1990
Cushing Island	Cushing I Conserv Corp	6,058,025	139.07	1979 & 1997
Diamond Island	Diamond Island Assoc.	125,316	2.88	1992 & 1993
Peaks Island	Clark	158,500	3.64	1996
Along Stroudwater R.	Rogers	1,702,164	39.08	1990
Along Stroudwater R.	Barris	512,546	11.77	1992
Total		11,529,615	264.7	

Source: Portland Tax Assessor Record as of 4/1/01

Resource extraction is still practiced in Portland. Past quarrying at Rocky Hill is readily apparent from the scarred and angular appearance of that bedrock formation today. Blue Rock Industries processes crushed rock on the Portland/Westbrook line. Dragon Products no longer mines rock for concrete on outer Ocean Avenue. There are no other active mining activities in the city although previously there were a number of brickyards and gravel pits.

C. Scenic View and Vistas

Being virtually encircled by water, Portland owes much of its beauty to the surrounding water bodies, including freshwater rivers, the ocean, a working harbor and an enclosed cove. Portland's waters were recognized early in the city's history as scenic resources. The Eastern Promenade and the Western Promenade were acquired in the 19th century to provide open space on these promontories and to protect the majestic views. Baxter Boulevard was planned as a parkway because of the unique view of Back Cove. Evergreen Cemetery, Baxter Woods and Fore River Sanctuary are prime examples of individual open spaces that have outstanding visual attributes.

a) Gateways

The basic visual identity of the city as a unit is represented through the concept of Gateways. Gateways to the City – the avenues of access, whether physical or visual – are zones of transition, from one environment to another. The most obvious gateways are the major transportation routes into Portland, from the water or along major roadways from the north or south. Of comparable importance, however, are the smaller gateways into the city along the roads from surrounding towns and from one neighborhood to the next.

Portland has a number of scenic roadways and boulevards. Baxter Boulevard, and the Eastern and Western Promenades have been recognized on national and local levels for their scenic qualities (all are designated historic landscapes). Interstate 295 and the Franklin Arterial are scenic roads with their landscaped medians and dramatic water and city skyline views. Other major streets, including portions of Park Avenue, State Street, Forest Avenue, Capisic Street and Stevens Avenue, offer scenic views of adjacent parks and woodlands. Minor residential streets often provide scenic resources of high quality because of adjacent open space or their heavily tree-lined borders.

b) Vistas from Promenades and High Points

The topography of the city plays an important part in shaping views and the bluffs of the Western and Eastern Promenades are the high points of the peninsula. City parks were established at these locations precisely because of the scenic views they afforded of Casco Bay, the Fore River, the surrounding countryside and the White Mountains. These bluffs also serve as defining elements of the City. The Western Prom, in particular, rising abruptly from the low riverside, delineates and accentuates the sense of Portland as a unit, a city of stature, for any traveler approaching from the south. Off the peninsula, the topography of the city includes several high points that provide scenic vistas or are appealing objects for viewing themselves. For example, Graves Hill offers a majestic view of the Presumpscot River Sanctuary and the islands. Rocky Hill (near Canco Road), Deering Highlands and Summit Hill (North Deering) also provide pleasant vista opportunities.

c) River Corridors

River corridors offer picturesque views of the City and its natural features. Many of the areas directly adjacent to these river corridors have retained their natural features and vegetation. The upper reaches of the Fore River include freshwater and salt-water marshes, nestled in the dense surrounding transitional vegetation. The Fore River Sanctuary, owned by Maine Audubon Society, has a trail system that offers scenic views of this sensitive environment and visual access into the estuary is possible from several public streets, such as Congress, Frost and several residential streets. The Fore River corridor along the central waterfront area offers views from Commercial Street that are urban in character, though still of high scenic value. Large stretches of the Presumpscot River and Stroudwater River are heavily wooded with dramatic steep slopes and ravines. These features can be seen at the site of the former Riverton Trolley Park where “one can experience drastic drops of topography, breathtaking view of the river and the Westbrook landscape beyond, and pastoral, peaceful open fields.” In addition, the City and Land for Maine’s Future have purchased 48 acres of river frontage along the northerly tip of Portland adjoining Falmouth. This area is designated as a scenic location in the Shoreway Access Plan. The acquisition will preserve the natural environment and extend public access along this beautiful stretch of the river.

d) Portland Waterfront¹⁶

The Portland Waterfront Public Access Design Study identified major visual corridors and viewing points, suggested measures to protect and enhance these resources, identified opportunities for recreation and suggested waterfront linkages. The inventory of views are classified as follows:

- A View – Foreground or mid-ground view of Portland’s waterfront or the water’s edge, plus background views of Casco Bay or South Portland (shown with wide dashed lines).
- B View – Mid-ground or background view of Casco Bay or the Fore River and the opposite shore, with the Portland Waterfront obstructed by grade changes or buildings. (shown with narrower dashed line).
- C Views – Water is not visible, but the observer has a sense of being near the water. (shown with open squares in a line).
- Panorama – Panorama viewpoints are noted with an arrow, the larger the arrow the greater the significance of the panorama in terms of angle of view, position of observer, and degree of obstructions. A panorama is generally assumed to be a point or area offering the street level observer the opportunity to view water and waterfront activities in a cone of vision greater than 45 degrees.

The view corridors identified for Eastern Prom, Commercial Street Waterfront Core, Western Prom and the Fore River are included as figures #.

The accomplishments of the Portland Waterfront Public Access Design Project include the following:

- Waterfront Trail: Public access along the waterfront is achieved by a marked trail that runs along the edge of some piers and provides open space along Commercial Street.
- Maine State Pier: The pier is part of the trail system and offers a large public open space at the end of the pier where views of Casco Bay and Portland Harbor are unparalleled.
- The Eastern Prom Trail: It connects with the Waterfront Trail.
- Portland Maine Downtown Height Study: The study is an outgrowth of the Waterfront Public Access Plan. The Study incorporated the public access inventory and developed building height regulations to preserve view corridors in the downtown.

¹⁶ Portland Waterfront, Public Access Design Project, Terrien Architects and Mitchell-Dewan Assoc., 1983

e) Downtown

The graduated topography of the peninsula maximizes opportunities for scenic views. The sloping public streets that traverse the peninsula offer numerous public views of the harbor, Back Cove and the Fore River. Further, the elevated peninsula with the double ridge provides a virtual stage for the most urban portions of the city. The City conducted a downtown height study¹⁷ (as a follow-up to the Portland Waterfront Study and as part of Downtown Vision) and established building height limits in the zoning ordinance that are intended to preserve the views and unique topography of the peninsula. In preparing the recommendations, the study examined the contextual relationship, the skyline, view corridors, architectural massing, pedestrian environment, and open space. Included is a map identifying the views and landmarks in Downtown Portland. The consultants used computer modeling to envision Portland's skyline and view corridors using several development scenarios. Height limits were incorporated into the City's zoning ordinance, which support the study's recommendations.

f) Waterlinks Concept¹⁸

In 1987, Portland studied existing and potential open spaces and pedestrian access opportunities on Portland's waterfront along the Stroudwater, Fore and Presumpscot Rivers, as well as on the islands. The Portland Shoreway Access Plan identifies public access opportunities throughout the city, while respecting the integrity of existing neighborhoods. Refer to the recreation section of this report for more information.

¹⁷ Portland Maine Downtown Height Study, by Carr, Lynch, Hack and Sandell, February 1989.

¹⁸ Portland Shoreway Access Plan, Mitchell-Dewan Associates for City of Portland, financial assistance from Maine's Coastal Program. 1987. Updates 2002

IV. CONSERVATION ISSUES AND EFFORTS

The previous three sections of this chapter describe Portland's environment, addressing the basic building blocks of the city's landscape. Within that context, there are many specific areas of environmental concerns that warrant a focused discussion. Generally, these areas and issues of conservation interest are concerned with the protection or preservation of natural resources. Addressing these areas and issues of conservation interest provides yet another level of context and information.

A. Shoreland Zones

Portland first created shoreland zones in the 1970's and then updated these provisions in the zoning code in 1991 to comply with State regulations. Shoreland Zones are designated in the zoning ordinance as areas 250 feet inland from the normal high water line of rivers and Casco Bay. Shoreland areas are vegetated buffers, which protect water quality by filtering out toxins and excess nutrients from stormwater run-off. Land development activity is not prohibited within the shoreland zone, but stricter development standards must be met. For example, all new structures must be set back a minimum 75 feet from the high-water line; piers and docks are regulated, and tree clearance is limited. Environmental Map #4 shows the Shoreland Zones, Resource Protection Zones, and Flood Plains.

In 1991, the State rules required that the Resource Protection Zone (RPZ) be expanded to incorporate the 100 year flood plain along rivers and saltwater. To comply with the 1991 regulations, Portland rezoned the floodplains to RPZ along the Presumpscot, Stroudwater and Fore Rivers, except those areas that are intensely developed, such as the working waterfront, or are protected under Recreation and Open Space, such as the Riverside Golf Course. In 2000 and 2001, the City rezoned over 100 acres of property to RPZ allowing only low impact uses, as recommended in an adopted neighborhood plan.. This rezoning encompassed all of the Fore River Estuary (a portion was already RPZ and included a shoreland zone), Jewell Falls, and adjoining wildlife corridors. Maine Audubon Society, Portland Trails, City of Portland, Union Water Power, and CMP own the rezoned property.

The Capisic, Fall, and Nasons Brooks are subject to a Stream Protection Zone, which extends 75 feet from the normal high water mark on each of the waterways. The zone parallels many of the shoreland zoning requirements. These areas were largely developed prior to the enactment of this ordinance although most existing houses do meet the 75-foot setback.

Under the state shoreland zoning program, only non-forested freshwater wetlands of 10 acres or greater in size are protected under its provision. Few wetlands in Portland meet these criteria. Only a wetland located off Allen Avenue near Northfield Green is designated for shoreland zoning protection on the mainland. On Peaks Island, there are two wetlands that require protection under the law. One is located near the intersection of Brackett Avenue and Whaleback Road and the second one is in the Trout Pond area. In addition, five smaller wetlands on Peaks Island have been afforded shoreland zoning protection exceeding the state's minimum protection requirements.

Portland maintains a strong Shoreland Zoning Program. The Zoning Administrator provides all applicants a summary of the shoreland regulations and reviews each application. For 2000 and 2001, there were a total of 39 applications received and permits approved. There were no variances granted by the Zoning Board of Appeals and enforcement actions were conducted for three complaints.

B. Floodplain Zones

Portland's river corridors, coastal areas, Fall Brook, and Capisic Brook are subject to periodic flooding, and thus have been designated as flood plain areas (see Environmental Map #5). A flood plain area is defined as the region periodically inundated with floodwaters during the largest flood event that can be expected within a span of 100 years (such storms can occur more than once a century). Flooding during this type of storm swells the banks of these waterways as well as the lower elevation of surrounding areas. Flood plain areas help store excess water during major floods so that other areas are not inundated with water.

C. Surface Water Quality

Over the last two decades there have been dramatic improvements in water quality of our nation's and Maine's waters due to the implementation of Public Law 92-500, known as the Clean Water Act. Development of water quality standards, construction of secondary, and in some cases, advanced wastewater treatment facilities, management of wastewater sludge, and investment in wastewater conveyance systems have gone a long way toward restoring the beneficial uses of our water resources.¹⁹ The surface water classifications established by the Maine Department of Environmental Protection are listed below for Portland's waters. Following the classifications is a section on Combined Sewer Overflows and Storm Water Management.

1) Surface Water Classification

The Maine Department of Environmental Protection (DEP) classifies surface water bodies under State law (Title 38 Water and Navigation, Chapter 3 Protection and Improvement of Waters) to establish water quality goals for the State. The intent is to improve and protect water quality in Maine. As stated on DEP's web page, "The classification system is used to direct the State in the management of its surface waters, protect the quality of those waters for their intended management purposes, and where standards are not achieved, direct the State to enhance the quality to achieve those purposes." Marine and freshwater bodies have separate classifications and the Portland classifications are as follows:

Portland Harbor: Portland Harbor is divided into two classification zones. The outer portion of the harbor, outside the waters of Cushing, Peaks, Little Diamond and Great Diamond Islands, is classified as SA, the highest rating for marine waters. This classification is applied to

¹⁹ Combined Sewer Overflow Abatement Study, Master Plan, 1993.

waters “which are outstanding natural resources and which should be preserved because of their ecological, social, economic or recreational importance.”

The inner harbor area is classified SC, a lower classification. This area includes the waters near the islands mentioned above, westward to the mainland and the Fore River. SC waters are “of such quality that they are suitable for recreation in and on the water fishing, aquaculture, propagation and restrictive harvesting of shellfish, industrial process and cooling water supply, hydroelectric power generation and navigation and as a habitat for fish and other estuarine and marine life.”

Presumpscot River: The Presumpscot River starts at Sebago Lake with a Class A designation. The classification drops to Class B between the confluence of the Pleasant River and Sacarappa Falls. From the Falls, the classification drops further to Class C (the lowest classification). The river carries this classification through Westbrook and into Portland to tidewater. Class C waters are defined as having “such quality that they are suitable for the designated uses of drinking water supply after treatment; fishing, recreation in and on the water, industrial process and cooling water supply; hydroelectric power generation and as a habitat for fish and other aquatic life.”

Stroudwater River: Stroudwater River is classified as B, “suitable for the designated uses of drinking water supply after treatment; fishing; recreation in and on the water; industrial process and cooling water supply; hydroelectric power generation .. and as habitat for fish and other aquatic life.” Discharges to such waters “ shall not cause adverse impact to aquatic life in that the receiving waters shall be of sufficient quality to support all aquatic species indigenous to the receiving water without detrimental change in the biological community.”

2) Combined Sewer Overflows and Stormwater Management

Portland operates and maintains the combined sewer collections system, while the Portland Water District is responsible for the combined sewer interceptors and the WWTF. The Portland sewerage system consists of over 200 miles of sewer, 25 pump stations, and the Portland WWTF.

N-19

CSO’s are permitted by the State of Maine under the National Pollutant Discharge Elimination System (NPDES). The Portland Water District has permit responsibility for 25 CSO’s and the City maintains responsibility for the remaining 17 CSO’s. As a result of the Abatement Study and the city’s efforts to eliminate CSO’s, the original 42 CSO’s identified in the city reduced to 34 with the elimination of 8 CSO’s.

In January 1991, the City and the Portland Water District (PWD) entered into an Administrative Consent Agreement with the State of Maine Department of Environmental Protection (DEP).²⁰ This agreement

²⁰ Combined Sewer Overflow Abatement Study, Master Plan, 1993.

required the City and PWD to begin a prioritized, long-term program (15 years) to abate combined sewer overflows (CSO's)²¹ in Portland. During dry weather, the combined sewer system transports a combination of sanitary flow and groundwater infiltration to the Portland Wastewater Treatment Facility (WWTF). During wet weather, storm water runoff flows to the combined sewer system, resulting in overflows of combined sewage at one or more of 34 locations (refer to Environmental map #6). CSO's degrade the quality of the riverine and coastal waters by carrying pathogens, bacteria, sanitary sewage "floatables," and elevated nutrient levels (phosphorous and nitrogen) that contaminate and limit use of the receiving waters.

Today, Portland system serves 14,965 residential users, 1419 commercial/industrial users, and 214 governmental users. The average residential user is charged \$48.80/month for sewer use, which is approximately 1.9% of the median household income. The City has an on-going implementation program to reduce CSO's. The first steps to system-wide improvements were implemented in 1995 by PWD by increasing the treatment and pumping capacity of the WWTF, the Northeast Pump Station and the India Street Pump Station. Since the start of the abatement study, the City has eliminated 6 of the 39 CSO's (a 15.4% reduction) and separated sewers so the combined sewer system is reduced from 75% to 54.7% of the total system. Portland has achieved these results through a series of sewer separation projects, removal of catch basin connections, installation of hydrobrakes in catch basins to allow first flush to be treated with the remainder separated from the system, and sewer lining installations to reduce infiltration. Portland conducts a thorough maintenance program, which includes frequent catch basin, sewer, and pump station cleaning. The City also worked with private property owners in 1992 and 93 to remove roof leaders and basement sump pump connections to the combined system. Other pollution prevention programs include public information campaigns, do not dump logos on catch basins, additional trash receptacles in the downtown, an active street sweeping program, and instituting a recycling and trash bag program that has reduced curbside litter.

Portland is nearing the end of its first phase to complete designated improvements under the DEP Consent Decree. The City is developing its second phase implementation plan for review and approval by DEP. The City allocates roughly \$5.7 million per year in the Capital Improvement Budget for on-going improvements for the CSO program. The City has expended \$38 million and has \$52 million planned for the next tier of projects. In addition, the sewer user fees support upgrades in the system to complete required improvements.

²¹ Combined Sewer Overflow (CSO) means a discharge of excess wastewater from a municipal or quasi-municipal sewerage system that conveys both sanitary wastes and storm water in a single pipe system and that is in direct response to a storm event or snowmelt. Combined sewer overflow discharges do not include dry weather discharges that occur as a result of nonstorm events or are caused solely by groundwater infiltration. [Maine State Statutes, Title 38, Chapter 3, Sec 466]

In addition to the efforts listed above, Portland has also focused on cost effective infrastructure improvements for the Capisic and Fall Brook watersheds, in order to reduce two of the City’s largest CSO’s in sensitive watercourses. Work has been completed on the dam at Capisic Pond, sewer separation projects have progressed in the Capisic Brook area, and culvert expansions have occurred in both watersheds. Sewer separation work is scheduled to occur in the Fall Brook Watershed between 2002-2012. In addition, the City conducted the Greenway Studies for each watershed.²² The studies examine the integration of additional stormwater into the natural system with flood mitigation, habitat enhancements, and opportunities for recreation. This planning process included an extensive public participation process to discuss improvements for water quality, habitat, and recreation opportunities. Required storm water improvements in these watersheds will be designed to reflect the recommendations of the greenway studies.

Portland has invested in its infrastructure in order to improve surface water quality. The above measures have improved the quality of surface water in Portland, as evidenced by the fact that in 2001 the East End Beach was available for swimming and recreation use all summer. However, none of the shellfish areas in or near Portland were open for harvesting in 2001.

The development review process in Portland uses best management practices for storm water management and the city is designated by DEP to conduct the State’s Site Location reviews. Development proposals undergoing either minor or major review under Portland’s site plan and subdivision ordinances must meet the review criteria and technical standards that comply with best management practices.

The Maine DEP is currently developing a stormwater program with standards to implement the Stormwater Phase II rules under the National Pollutant Discharge Elimination System (NPDES), which will apply to small construction sites, urbanized areas (MS4’s²³), and industrial activities. Portland is one of the designated “urbanized areas”, which is defined as an area having a population of at least 100,000 and a population density of 1,000 people per square mile. A regulated MS4 must develop, implement and enforce a program to reduce the discharge of pollutants to the “maximum extent practicable.” The program must include six elements:

- Public education and outreach
- Public involvement and participation

²² Capisic Brook Greenway Master Plan and Fall Brook Greenway Master Plan, consultants Carol R. Johnson Associates, Inc., CH2M Hill, and Eco Analysts.

²³ MS4 is a Municipal Separate Storm Sewer System, which is a conveyance or system of conveyances owned or operated by a state, city, town or other public entity that discharges to waters of the U.S. and is: 1) designed or used for collecting or conveying stormwater; 2) not a combined sewer, 3) not part of a Publicly Owned Treatment works; and 4) located in an “urbanized area” (“automatic nationwide designation”).

- Illicit discharge detection and elimination
- Construction site runoff control
- Post-Construction stormwater managements
- Pollution prevention measures for municipal operations.

Portland is working with DEP in the development of program standards and is required to submit an application (Phase II Notice of Intent) no later than March 10, 2003. The application must include a five-year program that defines the actions Portland will take to meet the terms of the general permit requirements.

3) Oil Spills

Portland remains a major port for oil tankers and the potential for spills is another major concern. In September of 1996, the *Julie N* struck the “Million Dollar” bridge and spilled 93,000 gallons of intermediate fuel oil and 86,000 gallons of #2 heating oil.²⁴ This major spill impacted 14 miles of shoreline, which included 8 miles of salt marsh. The area around the bridge and Thompson’s Point was most heavily impacted and oil did enter the upper Fore River and Stroudwater Marsh. The 700 personnel and volunteers from 60 organizations quickly responded to the spill. A total of 140,994 gallons of oil was recovered, which is a 78% recovery rate. Typically there is a 10 to 15% recovery rate for spills. The two types of oil that entered the environment posed different threats to the environment. The #2 diesel fuel evaporates quickly but also disperses rapidly in the water column and the heavier oil creates a black oil ring on everything it touches.²⁵ Studies of the sediments and benthic community (bottom dwellers) still find evidence of the spill, but the marshes are recovering naturally.

One million dollars in compensation has supported the following restoration efforts in Casco Bay:

- Restored 130 acres of saltwater marsh in the Scarborough Marsh that would provide habitat for seabirds that frequent the Fore River marshes;
- Supported the construction of the Fore River Nature Trail;
- Purchased oil and grease separators for the Portland storm sewer collection system; and
- Contributed to the purchase a seabird-nesting island in Casco Bay.

²⁴ “A Review of the *Julie N* Oil Spill, A Report by the Oil Spill Advisory Committee, prepared by Gro Flatebo, 1998.

²⁵ “*Julie N* Spill Five Years Later”, The Casco Bay Bulletin, Autumn 2001, page 4.

4) Groundwater Quality

In 1989, the Portland Island Groundwater Management Study was adopted as part of the City's comprehensive plan. Groundwater recharge and discharge areas were identified on all of the islands. This report recommended careful stewardship of the islands' groundwater resources.

The plan recognized the availability of Sebago's water on several of the islands but nonetheless recommended that land use policies should be balanced to preserve groundwater resources. One of the land use policies subsequently adopted by the city was the following:

The goal of island use policy shall be the protection of groundwater aquifer resources from degradation or depletion as a result of the cumulative impact of development. Ground water resources shall be managed so that the islands can be self sufficient in reliance upon natural systems for water supply and sewage disposal.

To protect both the quantity and quality of groundwater on the islands, residential density provisions were adjusted to support a safetyfield of groundwater. A finding of the groundwater management study was that the bedrock aquifers on the islands would supply only enough water to support an average overall island density of about 1 dwelling per acre. To achieve this sustainable density balance, revisions to the zoning code were adopted regarding the grandfathered lot size provision, densities for the island business zone and the IR-3 Residential Zone (with projects lacking public water). Not all of these provisions were enacted for Peaks Island. On Peaks Island, residents have been collecting well data for long term monitoring.

5) Land Bank Commission

The Land Bank commission was established in 1999 to ensure the conservation and preservation of open space in Portland. Refer to the Recreation Resources and Implementation Initiatives sections, which outline the purpose and recent work of the Commission.