Casco Bay Watershed
Land Use Inventory
1995

In Support of
The Casco Bay Estuary Project

Sponsored by the Soil and Water Conservation Districts of:

Androscoggin Valley
Oxford County
Cumberland County
York County

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COVER - The cover map shows a shaded relief model of the 985 square mile Casco Bay Watershed region. Topographic and hydrologic data are from the U.S. Geological Survey. The Casco Bay Watershed boundary was digitized by the Maine Geological Survey. The map was produced by Bill Duffy of the Maine Office of Geographic Information Systems using ARC/INFO software.

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* Natural Resources Conservation Service is formerly known as the Soil Conservation Service.

PREFACE

The USDA Natural Resources Conservation Service (NRCS) is a federal agency that works in cooperation with local Soil and Water Conservation Districts. The mission of NRCS is to provide leadership and to administer programs to help people conserve, improve, and sustain our natural resources and environment.

The Natural Resources Conservation Service has focused on a special project, a land use inventory of the Casco Bay Watershed. Initiated to support the Casco Bay Estuary Project's (CBEP) study of the bay, the inventory evaluates the complex pattern of land uses affecting the ecology of Casco Bay. The inventory features land use data from 44 towns, local, state and federal agencies, and hundreds of businesses and farms in the 985 square mile watershed. Watershed reports include actual acreage for developed, managed open, agricultural, and forest land.

The support and cooperation given by all contributing individuals, towns, and agencies demonstrates an awareness that watersheds both cross and unite political boundaries. This awareness is an essential first step toward establishing regional water quality conservation and protection. It also reflects positively on state and federal policy and education objectives as described by the Clean Water Act. To recognize this success, and to help assist communities with further targeting of water quality efforts, copies of this inventory are being distributed to all towns, resource conservation agencies, and special interest groups in the Casco Bay Watershed.

Inventory and Report Format

This inventory is intended to serve as a water quality education and planning tool. The land use data are organized into five subwatershed reports:

Coastal
Fore River
Presumpscot River
Royal River
Sebago Lake

Each report describes the cumulative town land use data for the watershed, presenting a written, numerical, and visual component. The narrative describes the watershed in terms of setting and land use definitions. Numerical data are collated by land use type, listed by town, and tabulated according to the towns inventoried in each subwatershed. Geographic Information System (GIS) maps, prepared by Thomas Burns of the Casco Bay Estuary Project, show watershed and political boundaries. Photographs are included to highlight conservation management practices in each subwatershed.

Appendices

Appendix A is an Alphabetical Town List with Watershed Acreages and Percentages, and includes a feature GIS map of the Casco Bay Watershed Political Boundaries. Appendix B is a Source List and Bibliography. Appendix C is a Source List of Water Quality Agencies for the Casco Bay Watershed. Appendix D is a current listing of DEP Water Quality Classifications and Status Definitions.

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The town managers, code enforcement officers, city and town planners, town clerks, planning boards, and other local municipal officials in the 44 communities that make up the Casco Bay Watershed, which include:

Auburn	Cumberland	Harrison	Otisfield	Standish
Albany Twp.	Denmark	Hiram	Phippsburg	Stoneham
Baldwin	Durham	Long Island	Poland	Sweden
Bethel	Falmouth	Lovell	Portland	Waterford
Bridgton	Freeport	Mason Twp.	Pownal	West Bath
Brunswick	Gorham	Naples	Raymond	Westbrook
Buxton	Gray	New Gloucester	Scarborough	Windham
Cape Elizabeth	Greenwood	North Yarmouth	Sebago	Yarmouth
Casco	Harpswell	Norway	South Portland	

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INTRODUCTION

A watershed is a drainage area from which water, sediments, and dissolved materials flow from a beginning point, through a ditch, stream, river, lake, or marsh to an outlet at a larger stream, lake, underlying aquifer, estuary, or ocean. Large watersheds are made up of smaller subwatersheds. Activity within an individual watershed affects downstream watersheds.

The Casco Bay Watershed covers a 985 square mile drainage area located in southwestern Maine. It encompasses land in 44 towns and is drained by 12 river and lake systems (hydrologic units). Table I-1 (p.1) identifies the five subwatersheds that are reported in this document: Coastal, Fore River, Presumpscot River, Royal River, and Sebago Lake.

Table I-1. NRCS 3-Digit Watershed Codes and Cumulative Town and Drainage Areas in the Casco Bay Watershed [1]

Watershed Report	Watershed Area (ac.)	Drainage System	NRCS Code
Coastal	91,397		
		Coastal Rivers	130
Fore River	32,675		
		Fore River	110
Presumpscot River	135,542		
		Pleasant River	080
		Little River	090
		Presumpscot River	100
Royal River	89,045		
		Chandler River	010
		Royal River	020
Sebago Lake	281,395		
		Stevens Brook	030
		Crooked River	040, 050
		Songo River	060
		Sebago Lake	070

[1] From U.S. Geological Survey, Hydrologic Unit Map published 1974, revised 1982 by the Soil Conservation Service to add 3-digit codes. Revised again in 8/88.

Inventory Methods

The approach for the Casco Bay Watershed Inventory was as follows:

1. Define the inventory unit as the municipal boundary.

2. Identify the towns according to the five major sub-watersheds of the Casco Bay Watershed (Table I-1, p.1).

3. Interview representatives from key agencies: Soil Conservation Service, Casco Bay Estuary Project, and the Maine Department of Environmental Protection - Water Bureau, to determine which land use types should be inventoried.

4. Collect existing data, look for coverage that is common to all 44 towns as well as data unique to each town.

5. Sort data by land use type, town, and watershed according to source definitions.

6. Show cumulative data in tabular form.

7. Provide definitions and narrative information to support each data table.

8. Distribute final drafts of each town's data for review by municipal officials.

Subwatershed Reports

The inventory reports data according to each municipal boundary. The decision to use the town unit rather than the watershed boundary was based on the availability of existing land use data. The inventory is meant to provide a link between the resource inventories found in current town comprehensive plans and a future Casco Bay Watershed management plan. It begins to describe the 985 square mile watershed composition.

As shown in Table I-1 (p.1), the town data are organized into five reports according to the five major sub-watersheds within the Casco Bay drainage system. The Coastal, Fore River, Presumpscot River, Royal River and Sebago Lake reports will enable communities to use the data for advancing local water quality efforts. This inventory will help towns and resource agencies to target specific land use types or areas and to extend water quality protection efforts throughout the watershed. Examples of local efforts within the Casco Bay Watershed include: water quality monitoring, riparian zone protection, streambank stabilization, and stormwater management.

Most towns are located within one watershed and information for those towns is contained within the appropriate watershed report. Some towns contain land area in more than one watershed. These towns are reported in multiple watershed reports. For example, all Portland land use data are included in both the Coastal and Fore River Reports, because 44% of Portland's land is in the Coastal Watershed and 35% is in the Fore River Watershed.

In each subwatershed report the data are collated by land use type, listed by town, and totaled in a table. Data were obtained from town comprehensive plans, government agencies, and the Maine Informational Display Analysis System (MIDAS), a natural resource management and planning database for the state which organizes data according to the municipal boundaries. The Sebago Lake report is an exception to this method; data are derived from an aerial study of the watershed.

Each subwatershed report includes a summary narrative identifying the watershed setting and listing the watershed boundary codes. Definitions for land use types occur in the same sequence as the data table. Source definitions are either paraphrased or directly referenced. Appendix B provides a source list and bibliography for this inventory.

Casco Bay Watershed Summary Table

Table I-2 (p.4) is a summary table for the Casco Bay Watershed which eliminates duplication of data between the individual subwatershed columns. For example, Portland data are included in the Coastal Watershed column, but are excluded from the Fore River Watershed column. Portland data are duplicated however in both subwatershed Table 1.4 (pp.11-12) and Table 2.4 (pp.21-22) Coastal Watershed Land Use and Fore River Watershed Land Use, respectively.

Geographic Information Systems Applications

A geographic information system (GIS) is a tool for storing and manipulating mapped information in a computer. Through the use of GIS mapping, users are able to view, compare, and analyze a wide variety of information. This information can include rivers, lakes, roads, tax parcels, forest types, and drainage patterns. GIS applications can provide the diversity and power to do multi-layer modeling to aid in targeting and planning land, water, and nonpoint source management practices.

Special Feature: GIS Maps

Each watershed report features three GIS maps, from Casco Bay Estuary Project's GIS database, which illustrate the watershed boundary and some specific land use information. Notes about these maps are found in each narrative. Appendix A data were partially derived from ARC-INFO's ability to calculate area from any given coverage.

Special Feature: Conservation Practice Photographs

Photographs complete each report by exhibiting resource conservation practices that are representative in each subwatershed. The photos demonstrate nonpoint source pollution management practices that provide water quality protection. The photos for each watershed report are as follows:

Coastal Watershed- Dune Stabilization and Conservation Cropping System

Fore River Watershed- Stormwater Management

Presumpscot River Watershed- Streambank and Shoreline Protection

Royal River Watershed- Fencing and Waste Storage Structure

Sebago Lake Watershed- Buffer Strip and Roadside Erosion Control

Table I-2. Summary of Land Use for the Casco Bay Watershed.

Watershed	Coastal	Fore River	Presumpscot River	Royal River	Sebago Lake	TOTAL
TOTAL LAND (ac.)	138,140	78,714	108,756	169,461	285,692*	776,376
DEVELOPED LAND (ac.)						
Commercial & Industrial	10,927	6,243	9,461	7,253	766	34,650
Residential	27,565	23,886	24,789	33,017	15,956	125,213
ROADS (mi.)	769	436	446	648	1,045	3,344
Roadside Erosion	35	23	22	29	--	109
MANAGED OPEN LAND (ac.) (Golf Courses, Parks, etc.)	6,279	1,518	20	5,147	3,671	16,635
FARM LAND (ac.)	13,723	21,248	17,773	16,259	5,096	74,099
Cropland	3,365	5,678	5,412	3,521	4,674	22,650
Hay & Pasture Land	1,688	2,148	1,710	1,710	~	
Livestock	--	--	--	--	89	89
Orchard	--	--	--	--	333	333
# Surveyed/# Farms	50/136	47/112	51/133	48/83	54/105	250/569
# Livestock Farms	28	38	50	34	36	163
FOREST LAND (ac.)	49,344	14,534	43,818	98,899	199,267	405,862
TIMBER OPERATIONS (ac.)	--	--	--	--	5,899	5,899
SAND & GRAVEL PITS (#)	49	59	91	84	--	283
Acres	--	--	--	--	964	964
SOLID WASTE SITES (#)	13	5	11	11	13	53
Landfill (ac.)	--	--	--	--	80	80
COASTLINE (mi.)	561	14	10	5	0	590
SHORELINE (mi.)	--	--	--	--	355	355
SURFACE WATER (ac.)						
Ponds & Lakes	868	350	4,624	6,735	37,109	49,686
Rivers & Streams	165	174	198	253	475	1,265
Wetlands	10,127	669	4,531	2,891	30,263	48,481
AQUIFERS (#)	17	21	19	16	102	175
POPULATION	117,153	53,162	33,579	49,978	50,398	304,270
WATER (people served)						
District	45,732	13,973	6,726	31,392	8,242	106,065
Community	500	1,048	0	970	2,033	4,551
Private	11,513	2,601	6,625	9,381	53,205	83,325
WASTEWATER (#)						
Municipal Accounts	26,284	11,606	2,962	8,454	66	49,372
Combined Sewer Overflow	47	24	0	9	0	80
Overboard Discharge	316	1	7	27	0	351

-- data not available

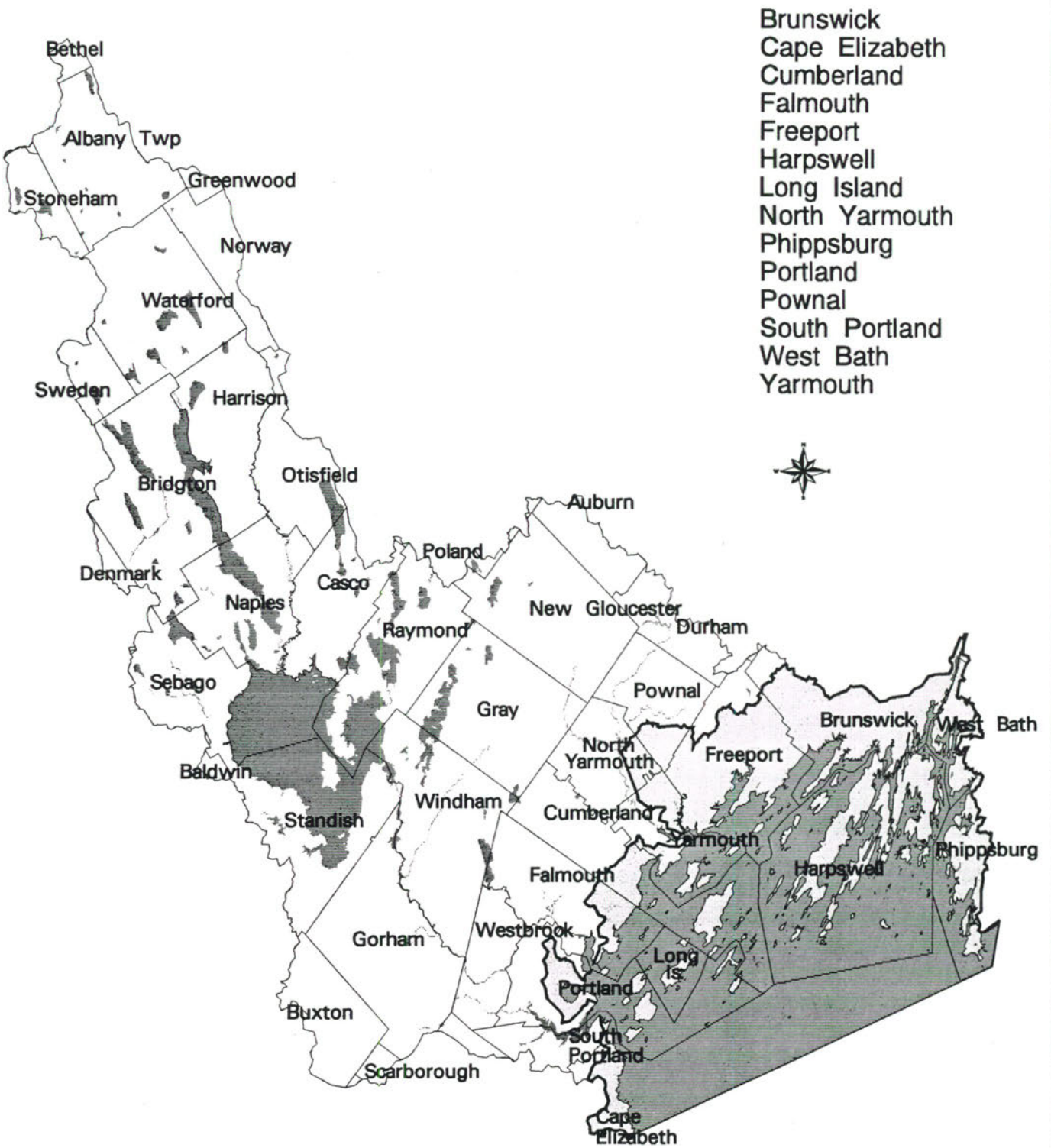
NOTE: Information inventoried from existing sources

~ Hay & Pasture Land acres are included in Cropland acres for the Sebago Lake Watershed.

Data for Portland is deducted from the Fore River column. Buxton, Falmouth, Gorham, and Westbrook are deducted from the Presumpscot River column and Gray is deducted from the Royal River column.

* This number adds the total 273,200 in-watershed acres from Table 5.7 to: 130 ac. (Gray); 23 ac. (Hiram); 254 ac. (Mason Township); 20 ac. (Lovell); 105 ac. Poland and 11,961 acres of Sebago Lake belonging to State of Maine.

Figure 1.1 - Coastal Watershed



COASTAL WATERSHED INVENTORY

Watershed Setting and Boundary

The Coastal Watershed is a stretch of land drained by the Cousins, Little, and Harraseeket Rivers into the tidewaters of Casco Bay. It is the most southeastern drainage region in the Casco Bay Watershed. The 143 square mile watershed is located in the towns of Brunswick, Cape Elizabeth, Cumberland, Falmouth, Freeport, Harpswell, Long Island, North Yarmouth, Portland, Pownal, South Portland, and Yarmouth in Cumberland County; and the towns of Phippsburg and West Bath in Sagadahoc County. About 10 percent of the State's 1.25 million people live in these towns.

This watershed is in the Coastal Lowlands region. This region has rolling hills with low relief (small changes in elevation). The topography ranges from nearly level to very steep (0 to 60% slopes). Stratified metamorphic rocks (rocks that have been greatly altered from their previous condition) are found in the southeastern parts of this region. The coastal zone consists of glacial till (unstratified glacial drift, such as sand and gravel, deposited directly by ice) and marine silts and clays.

The average annual precipitation is 43 inches, which is evenly distributed throughout the watershed. Snowfall averages 72 inches. Temperatures are warm in summer (69° F) and cold in winter (22° F), but more moderate at the coast.

The watershed boundary stretches from outer Casco Bay across Merriconeag and Luckse Sound, into Portland Harbor and Maquoit Bay, and upland to 11 coastal towns. Harpswell and Long Island are within this watershed.

Two code numbers identify the watershed boundary. The U.S. Water Resources Council (USWRC) code for the Presumpscot, Royal, and Coastal drainage region is 01060001- to which the Natural Resources Conservation Service code for Coastal Drainage, 130, is added. The corresponding Maine Department of Environmental Protection (DEP) and U.S. Environmental Protection Agency (EPA) waterbody numbers are: 601, 602, and 604. These identify the drainage basins of the Cousins, Little, and Harraseeket Rivers, as well as many brooks including: Frost Gully, Alewife, Mill Creek, Kelsey, Bunganuc, and Mare.

Table 1.1 **Percentage of land, by town[2], in the Coastal Watershed (Total watershed area is 91,397 acres (143 square miles)).**

Town	Percent Watershed Area
Brunswick	20.5
Cape Elizabeth	4.1
Cumberland	4.0
Falmouth	1.2
Freeport	19.9
Harpswell	16.6
North Yarmouth	2.2
Phippsburg	6.9
Portland	5.8
Pownal	5.1
South Portland	<1.0
West Bath	5.1
Yarmouth	7.7
Total	100

[2] Total town and watershed acreages calculated from Casco Bay Estuary Project GIS data.

Watershed Maps

The Casco Bay Estuary Project's Geographic Information System (CBEP-GIS) has provided a series of three maps which help the reader to visualize the Coastal Watershed boundary. Figure 1.1 (p.5) shows the Coastal Watershed in relation to the Casco Bay Watershed. Figure 1.2 (p.10) compares town and watershed areas by showing political and hydrologic boundaries. Figure 1.4 (p.14) features the clam flats, both open and closed flats within the Coastal Watershed.

Format and Definitions

Data for eight of the 14 towns in the watershed are presented in Table 1.4 (pp.11-12). The other towns are included in this report as follows: Long Island with Portland in the Fore River Report; Cumberland in the Presumpscot River report; North Yarmouth, Pownal, and Yarmouth in the Royal River report; and South Portland in the Fore River report.

Selected land use types, shown in **boldface and underlined**, and land use sub-types, shown in **TimesRoman font**, are defined below.

-- **Total land** includes terrain and surface water area and excludes marine water area. This is identified by either the town comprehensive plans or the CBEP-GIS.

-- **Developed land** is made up of two subsets: **commercial/industrial** and **residential.** Commercial/industrial and residential are primarily identified by town comprehensive plans and existing land use maps. Town plan types (business, commercial, industrial, mixed urban, etc.) are combined for this report as commercial/industrial. Town plan residential types (urban, suburban, rural, village, etc.) vary in population density and are combined for this report as residential.

-- **Managed open land** includes five land types defined below by their data sources:
Cemetery: counted from the U.S. Geological Survey (USGS) 7.5-minute quadrangle maps; and acres identified private business and town offices.
Golf course: acres identified by private businesses (golf courses) and town offices.
Land trust: acres identified by private non-profit agencies, and town offices.
Nursery/greenhouse: identified by the Maine Department of Agriculture, Food and Rural Resources.
Park/school: acres identified as Municipal, State (Maine Department of Conservation), Private, and University of Southern Maine property.

-- **Farm land** is identified by three combined sources: **farm tract** acreages calculated with a digital planimeter from 1:7,920 scale aerial photographs (Agricultural Stabilization and Conservation Service - ASCS), cooperator records (Cumberland and Androscoggin County Soil and Water Conservation Districts - SWCD), and a 1991-92 telephone farm survey/questionnaire (Soil Conservation Service). These sources identify **cropland**, **hay and pasture land**, and **farm woodlots** as subsets of the total farm land.

-- **Forest land** is identified by four sources: **town comprehensive plans** (forested plus undeveloped land), ASCS **farm tracts**, SWCD **farm woodlots**, and the state **Tree Growth Tax parcels**. The total forest area for the Coastal Watershed is identified on a town-by-town basis; the greatest acreage, identified by a single source, is computed into the total.

-- **Surface Water** includes **lakes and ponds**, existing and potential **wetlands**, and **river and stream** miles. The Maine Department of Inland Fisheries and Wildlife (IF&W) counts lakes larger than 10 acres in two ways: by the entire lake area or by town acre (the portion of the lake area within each town). For this report, town acres are totaled and added together to get the total lake area. The State of Maine defines a wetland as "....ten or less than ten contiguous acres and adjacent to a surface water body; inundated or saturated by surface or ground water which can or does support a prevalence of wetland vegetation typically adapted for life in saturated soils. Three typical features include: hydrophytic vegetation, hydric soils, and signs of wetland hydrology. The IF&W stream miles include the named brooks, streams, or rivers, as well as all unnamed tributaries in each town. (Wetlands are identified according to IF&W watershed codes: 0401, 0402, 0103, and 0104.)

Narrative

To facilitate the reading of this narrative with Table 1.4 (pp.11-12), all land use types are printed in **boldface and underlined**, while land use sub-types are shown in **TimesRoman font**. They are presented here in the same sequence as the table.

The **total land** area for the eight towns is 138,140 acres (216 sq.mi.). Of this area: 32% is developed, 10% is farmed, 36% is forested, 7% is wetlands, and 1% is ponds/lakes. The remaining 14% is identified as open or undeveloped acres. Though this area is significantly greater than the actual watershed, the various land uses within it can represent potential pollution problems. For example, evaluation of nonpoint source (NPS) pollution can be made from studying the proportions and types of developed, farmed, and forested land.

Of the **developed land**, roughly 65% is **residential**, 25% is **commercial/industrial**, and 10% is **managed open land**. This includes impervious and paved surface areas. There are 769 miles of **roads** in the watershed. According to the Cumberland County SWCD *Roadside Erosion Inventory*, in 1991 there were 35 severely **eroded ditches** in these eight towns.

Farm land area has remained relatively steady, although farm size has increased and farm numbers have declined. The farm land, 13,723 total acres, is diverse: 25% is **cropland**, 12% is **hay and pasture land**, 30% is **woodlot**, and the remaining 33% is uncultivated land. The principal crops of the Coastal Watershed are corn, fruit, hay, and market vegetables.

Livestock production is also a major farm industry in five of the eight towns. Fifty-three farms in these towns described their current farm practices in a 1991-92 telephone questionnaire. Twenty-eight of these farms are producing or boarding livestock (3 have two types of livestock) and 10 have implemented an agricultural waste management system (AWMS).

Table 1.2 **Livestock distribution of farms in the Coastal Watershed.**

Type	# Farms	# Head	# AWMS
Beef	9	352	5
Dairy	5	278	2
Horse	11	100	1
Pig	0	0	0
Poultry	0	0	0
Sheep&Goat	6	160	2

The total **forest land** acres are identified by the **town comprehensive plans** of Cape Elizabeth, Freeport, Harpswell, Portland, Phippsburg, and West Bath, and the **tree growth tax** data for Brunswick and Falmouth. Tree Growth Tax data indicate that these are mostly mixedwood and softwood stands for all eight towns.

Forty-nine **sand and gravel pits** (includes clay and rock sites) are identified from USGS 7.5-minute quadrangle maps (1957-1983). The range of distances from these sites to the nearest drainageway is from 0.1 to 0.5 miles.

The DEP reports 13 **solid waste sites** (landfill, brush-demo, and transfer stations). The total number of solid waste accounts reported in Table 1.4 (pp.11-12) is greater than the coastal population because separate accounts are required for each type of disposal.

Coastline miles do not include the coastlines of the Casco Bay islands.

The DEP *State of Maine Water Quality Assessment* classifies **river and stream** (riverine) and **pond and lake** (lacustrine) **surface waters** according to the Coastal Watershed boundary. Within this boundary, 498 riverine miles are attaining their water quality classifications. Those that are not achieving attainment include: Frost Gully Brook (3 mi.) and Alewife Brook (1 mi.). Of 113 lacustrine acres, 75 acres are attaining class GPA standards and 38 acres are classed as threatened. See Appendix D for DEP Water Quality Classifications and Status Definitions.

The coastal area is underlain by 17 significant sand and gravel aquifers. A significant sand and gravel **aquifer** "...yields 10 or more gallons per minute to a properly installed domestic well, and consists of glacial ice-contact and outwash deposits which occur primarily in the valleys of the major rivers and along their tributaries." Higher concentrations of sodium and chloride in the coastal region ground water are due to the precipitation of sea salt.

Appendix III of the DEP *State of Maine Nonpoint Source Pollution Management Plan*, November 1989, identifies 34 ground water sites that are not attaining water quality standards due to nonpoint source pollution. The nonpoint sources include hazardous substance sites, leaking underground storage tanks, solid waste land fill, uncovered pure salt piles, and uncovered sand and salt piles. DEP records identify all sites by town and map coordinates.

Population figures are obtained from towns and the 1990 U.S. Census.

Public **water** supplies are classified by the Maine Department of Human Services, *State of Maine Drinking Water Program* as Water Districts, Community, Non-Community (NC), and Non-Transient Non-Community (NTNC). NC and NTNC are grouped together in the table below. Individual water district records identify the number of people served from the eight towns. Approximately half of the Coastal Watershed residents receive treated surface water (SW) from Sebago Lake. The remaining half of the population, and an additional 1,960 seasonal residents, rely upon ground water (GW) from wells.

Table 1.3 **Public Water Sources of the Coastal Watershed.**

Type	GW Systems	SW Systems	People
Water District	8	4	45,732
Community	8	0	500
Non-Transient & Non-Community	86	0	11,513

Community **wastewater** disposal differs throughout the area. Municipal sewer systems process most of the wastewater in six towns. Septic suitability for communities without treatment plants is extremely variable. Combined Sewer Overflows (CSO's) occasionally discharge untreated sewage and stormwater in three towns. This discharge occurs when the treatment plant's capacity is overwhelmed by the stormwater runoff flows. The Coastal Watershed is also susceptible to malfunctioning overboard discharge units. These units treat waste from households and small commercial operators such as restaurants. When functioning properly, overboard discharge units use a mechanical or sand filter and chlorination to disinfect the water before it is released.

Figure 1.2 - Coastal Watershed
Town and Watershed Boundaries

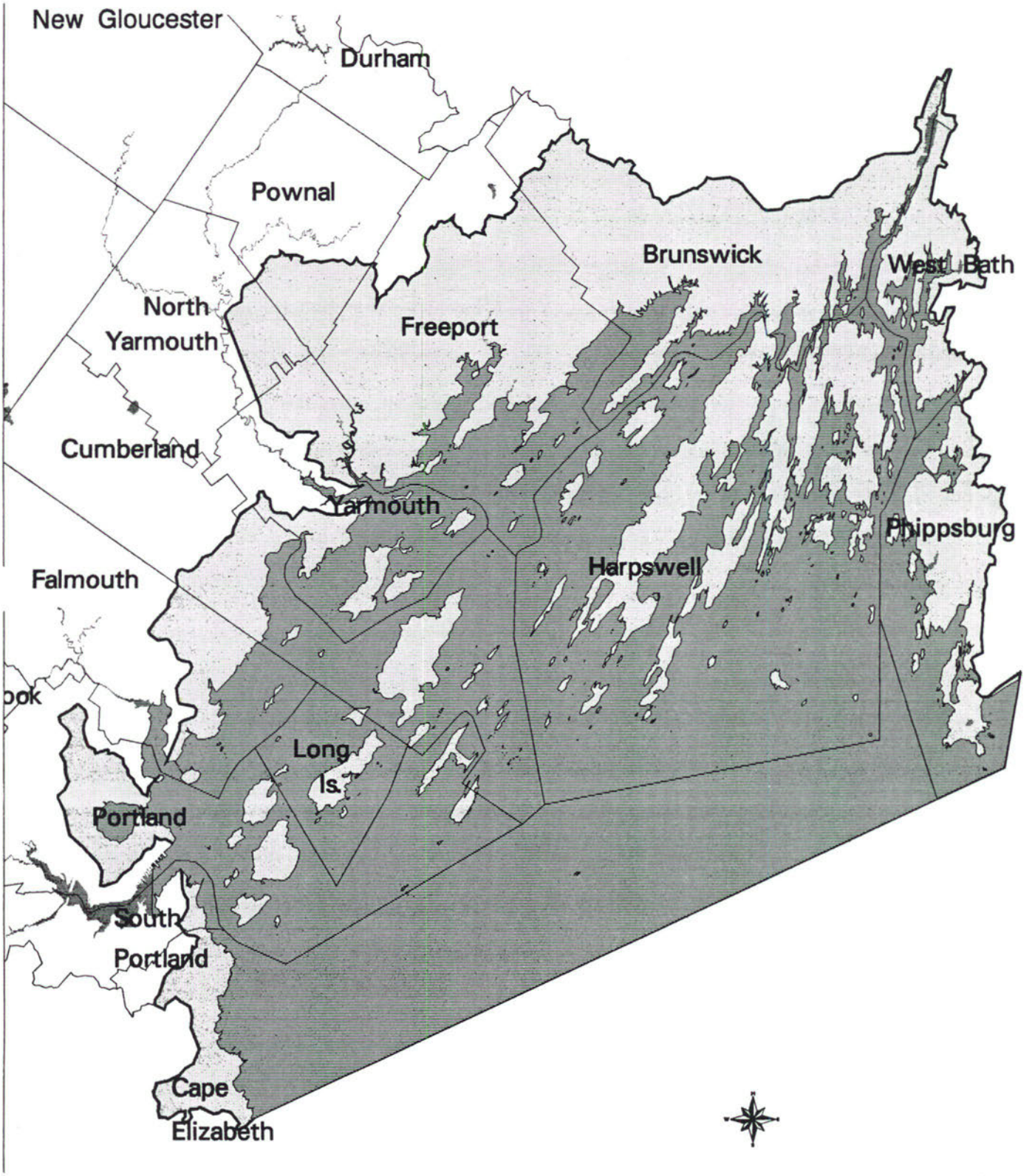


TABLE 1.4 COASTAL WATERSHED TOWN LAND USE

COMMUNITY	Brunswick	Cape Elizabeth	Falmouth	Freeport	Harpswell	Portland & Long Is.	Phipps-burg	West Bath	TOTAL
TOTAL LAND (ac.)	31,003	9,322	19,176	23,727	15,182	14,558	17,967	7,205	138,140
DEVELOPED LAND (ac.)									
Commercial & Industrial	552	27	2,328	321	100	7,353	92	154	10,927
Residential	5,120	1,843	8,016	4,023	2,530	4,412	1,110	511	27,565
ROADS (mi.)	148	58	92	96	58	242	49	26	769
Arterial	24	6	27	8	0	61	0	2	128
Collector	23	12	22	25	27	22	16	9	156
Local	101	40	43	63	30	159	33	15	484
Eroded Ditches (#)	4	5	5	13	4	4	--	--	35
MANAGED OPEN LAND (ac.)									
Cemeteries	--	29	5	--	--	537	35	42	648
Golf Course	0	188	100	100	0	44	0	0	432
Land Trust	241	220	160	--	605	0	880	--	2,106
Nursery/Greenhouse	4	47	4	30	1	1	0	0	87
Park/Schoolyard	610	338	143	513	50	708	594	50	3,006
FARM LAND (ac.)	2,720	3,854	1,438	5,133	483	95	0	--	13,723
Cropland	1,033	550	494	1,228	60	0	0	--	3,365
Hay & Pasture Land	618	319	222	339	190	0	0	--	1,688
# Surveyed/# Farms	13/47	16/16	7/15	12/50	2/8	0/0	0/0	--	50/136
LIVESTOCK FARMS (#)	7	6	4	9	2	0	0	--	28
Beef	2	1	0	6	0	0	0	--	9
Dairy	1	0	3	1	0	0	0	--	5
Horse	3	5	2	1	0	0	0	--	11
Pig	0	0	0	0	0	0	0	--	0
Poultry	0	0	0	0	0	0	0	--	0
Sheep & Goat	2	0	1	1	2	0	0	--	6
FOREST LAND (ac.)									
Town Comprehensive Plan	1,427	6,710	--	19,292	2,306	202	14,054	5,353	49,344
Farm Tract	229	921	141	343	0	158	0	0	1,792
Farm Woodlot	405	1550	293	1,334	257	0	0	0	2,289
Tree Growth Tax (total)				5,131					
Softwood	588	463	320	--	1,026	32	694	528	3,651
Mixed	1,010	675	755	--	879	29	661	362	4,371
Hardwood	59	289	320	--	144	2	137	80	1,031

NOTE: Information inventoried from existing sources

TABLE 1.4 (CON'T) COASTAL WATERSHED TOWN LAND USE

COMMUNITY	Brunswick	Cape Elizabeth	Falmouth	Freeport	Harpswell	Portland & Long Is.	Phipps-burg	West Bath	TOTAL
SAND & GRAVEL PIT (#)	16	9	2	10	2	5	5	0	49
Nearest Drainageway (mi.)	.2 - .75	.1 - .5	.25 - .5	.1 - .5	.25	.25 - .5	.25 - .5	0	.1 - .75
SOLID WASTE SITE (#)									
Landfill	1	0	1	1	0	2	1	0	6
Other	1	0	0	0	1	2	0	0	4
Transfer Station	0	1	1	0	0	0	0	1	3
People Served	35,892	7,865	6,733	6,117	3,914	175,693	1,608	3,400	241,222
COASTLINE (mi.)	66	20	5	55	230	80	100	5	561
SURFACE WATER									
Ponds & Lakes (ac.)	28	186	260	2	25	21	252	94	868
Rivers & Streams (mi.)	47	20	44	42	--	17	21	8	165
*Wetlands (ac.)	337	238	625	7,408	92	1,397	30	0	10,127
AQUIFER (#)	5	1	2	7	0	2	0	0	17
POPULATION	20,906	8,854	7,600	6,905	5,012	64,358	1,806	1,712	117,153
WATER (people served)									
District	16,728	3,069	2,202	3,024	0	17,309	0	3,400	45,732
Community	323	0	0	177	0	0	0	--	500
Private	1,467	25	75	1,741	2,669	236	5,300	--	11,513
WASTEWATER (#)									
Municipal Accts.	3,300	1,987	1,490	1,000	0	15,107	0	3,400	26,284
Combined Sewer Overflow	0	1	0	0	0	45	0	1	47
Overboard Discharge	36	6	4	5	139	55	20	52	316

-- indicates data unavailable.

* Wetland acres shown are within the watershed boundary. These figures do not represent each town's total wetland acres.

Figure 1.3

Coastal Watershed

DUNE STABILIZATION WITH AMERICAN BEACHGRASS

Managing our dunes for healthy vegetation reduces coastal erosion and provides wildlife habitat.

CONSERVATION CROPPING SYSTEM

Cropping practices that integrate a combination of proper cultural and management measures will reduce erosion, enhance the soil resource, and protect water quality.

Feature Photographs - Top: Long Island ME, Bottom: Cape Elizabeth ME

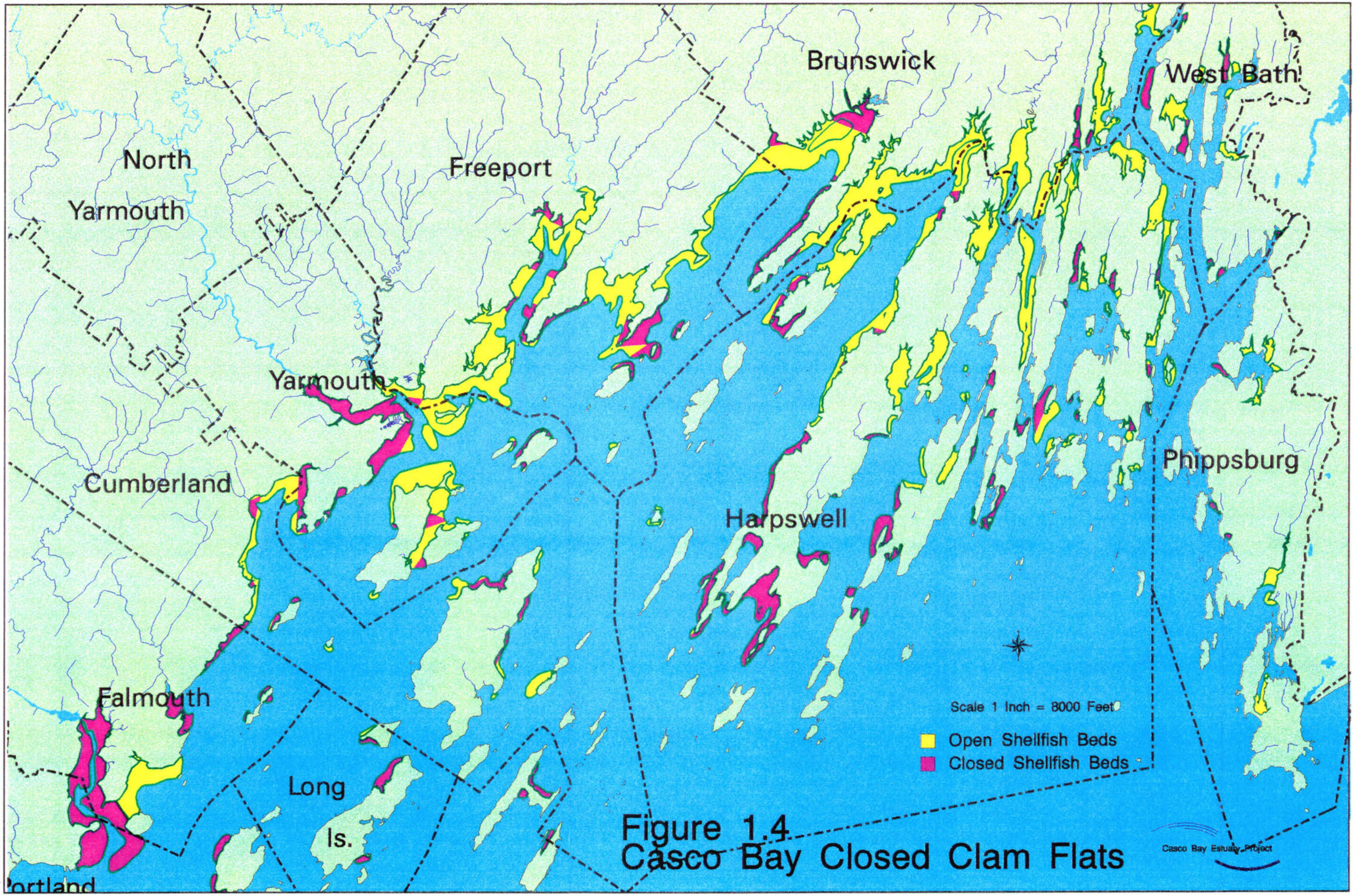
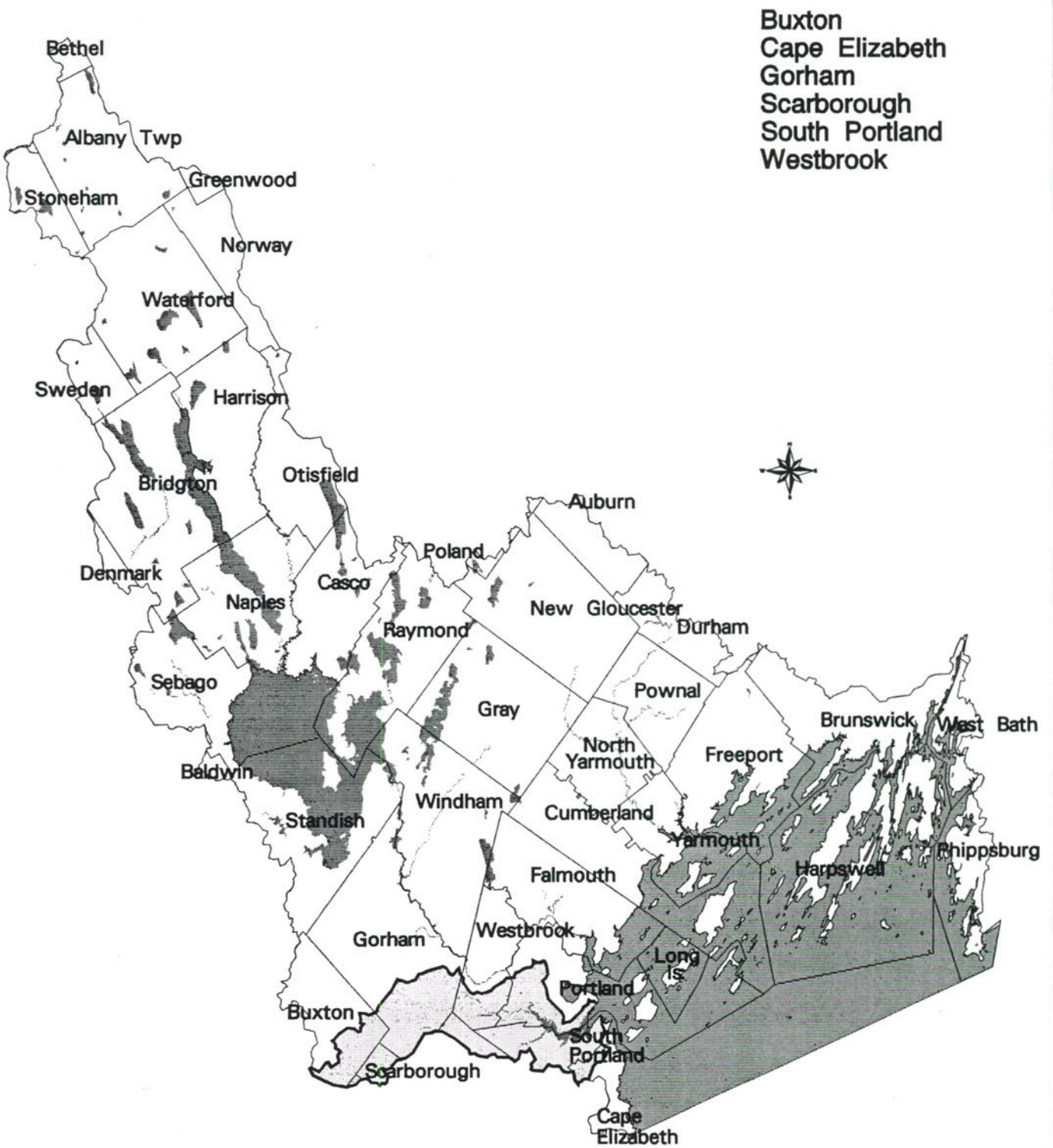


Figure 1.4
Casco Bay Closed Clam Flats

Figure 2.1 - Fore River Watershed



FORE RIVER WATERSHED INVENTORY

Watershed Setting and Boundary

The Fore River Watershed is a narrow corridor of lowland drained by the Stroudwater and Fore Rivers and Capisic Brook entering tidewaters in Portland Harbor. It is the most southern drainage region in the Casco Bay Watershed. The 51 square mile watershed area is located in the towns of Cape Elizabeth, Gorham, Portland, Scarborough, South Portland, and Westbrook in Cumberland County; and the town of Buxton in York County. About 10 percent of the State's 1.25 million people live in Portland and nearby communities.

This watershed is within the Coastal Lowlands region. This region has rolling hills with low relief (small changes in elevation). The topography ranges from nearly level to very steep (0 to 60% slopes). Glacial till soils (unstratified glacial drift, such as sand and gravel, deposited directly from ice) cover the uplands. The coastal zone consists of marine silts and clays, glacial outwash (soils that have been deposited by glacial meltwater) and ice-contact stratified drift which include kames, terraces, eskers, and deltas.

The average annual precipitation is 43 inches, which is evenly distributed throughout the watershed. Snowfall averages 72 inches. Temperatures are warm in summer (69° F) and cold in winter (22° F), but more moderate at the coast.

The watershed boundary encompasses Red Brook and Long Creek in South Portland and Cape Elizabeth, the Stroudwater River in Westbrook, Silver Brook in Scarborough, and the South Branch of Stroudwater River in Buxton. The tributaries of these rivers include Deering, Gully, Indian Camp, and Strout Brooks in Gorham, and Capisic Brook in Portland.

Two code numbers identify the watershed boundary. The U.S. Water Resources Council (USWRC) code for the Presumpscot, Royal, and Coastal drainage region is 01060001- to which the Natural Resources Conservation Service code for the Fore River, 110, is added. The corresponding Maine Department of Environmental Protection (DEP) and U.S. Environmental Protection Agency (EPA) waterbody number is 610. This number identifies the drainage basins of the Stroudwater and Fore Rivers.

Table 2.1 **Percentage of land, by town[3], in the Fore River Watershed (Total watershed area is 32,675 acres (51 square miles)).**

Town	Percent Watershed Area
Buxton	13.3
Cape Elizabeth	0.4
Gorham	25.5
Portland	15.7
Scarborough	11.2
South Portland	23.6
Westbrook	10.3
Total	100

[3] Total town data and watershed acreages calculated from Casco Bay Estuary Project GIS data.

Watershed Maps

The Casco Bay Estuary Project's Geographic Information System (CBEP-GIS) staff has developed a series of three maps to help the reader visualize the watershed boundary in context. Figure 2.1 (p.15) shows the Fore River Watershed in relation to the Casco Bay Watershed. Figure 2.2 (p.20) compares the town and watershed areas by showing the political and hydrologic boundaries. Figure 2.4 (p.24) is a color map showing the hydric, highly erodible, and aquifer potential soil types within the watershed. These soil types are identified in the NRCS publication *Soil Survey Data For Growth Management in Cumberland County, Maine*. Development on land having these soil types may potentially create erosion and sedimentation problems and degrade wetlands and aquifers.

Format and Definitions

Data for five of the seven watershed towns are presented in Table 2.4 (pp.21-22). Cape Elizabeth's data are recorded in the Coastal Watershed report and table. Scarborough is not included because most of the town drains into the Scarborough Estuary and Saco Bay.

Selected land use types, shown in **boldface and underlined**, and land use sub-types, shown in **TimesRoman font**, are defined below.

-- **Total land** includes terrain and surface water area and excludes marine water area. This is identified by either the town comprehensive plans or the CBEP-GIS.

-- **Developed land** is made up of two subsets: **commercial/industrial** and **residential.** Commercial/industrial and residential are primarily identified by town comprehensive plans and existing land use maps. Town plan types (business, commercial, industrial, mixed urban, etc.) are combined for this report as commercial/industrial. Town plan residential types (urban, suburban, rural, village, etc.) vary in population density and are combined for this report as residential.

-- **Managed open land** includes five land types defined below by their data sources:
Cemetery: counted from the U.S. Geological Survey (USGS) 7.5-minute quadrangle maps; and acres from private business and town offices.
Golf course: acres identified private businesses (golf courses) and town offices.
Land trust: acres identified by private non-profit agencies, and town offices.
Nursery/greenhouse: identified by the Maine Department of Agriculture, Food and Rural Resources.
Park/school: acres identified as Municipal, State (Maine Department of Conservation), Private, and University of Southern Maine property.

-- **Farm land** is identified by three combined sources: **farm tract** acreages calculated with a digital planimeter from 1:7,920 scale aerial photographs (Agricultural Stabilization and Conservation Service - ASCS), cooperator records (Cumberland and Androscoggin County Soil and Water Conservation Districts - SWCD), and a 1991-92 telephone farm survey/questionnaire (Soil Conservation Service). These sources identify **cropland, hay and pasture land**, and **farm woodlots** as subsets of the total farm land.

-- **Forest land** is identified by four sources: **town comprehensive plans** (forested plus undeveloped land), ASCS **farm tracts**, SWCD **farm woodlots**, and the state **Tree Growth Tax parcels.** The total forest area for the Fore River Watershed is identified on a town-by-town basis; the greatest acreage, identified by a single source, is computed into the total.

-- **Surface Water** includes **lakes and ponds**, existing and potential **wetlands**, and **river and stream** miles. The Maine Department of Inland Fisheries and Wildlife (IF&W) counts lakes larger than 10 acres in two ways: by the entire lake area or by town acre (the portion of the lake area within each town). For this report, town acres are totaled and added together to get total lake area. The State of Maine defines a wetland as "....ten or less than ten contiguous acres and adjacent to a surface water body; inundated or saturated by surface or ground water which can or does support a prevalence of wetland vegetation typically adapted for life in saturated soils.

Three features include: hydrophytic vegetation, hydric soils, and signs of wetland hydrology. The IF&W stream miles include the named brooks, streams, or rivers, as well as all unnamed tributaries in each town. Wetlands are identified according to IF&W watershed codes: 0401, 0402, 0103, and 0104.

Narrative

To facilitate the reading of this narrative with Table 2.4 (pp.21-22), all land use types are printed in **boldface and underlined**, while land use sub-types are shown in **TimesRoman font**. They are presented here in the same sequence as the table.

The **total land** area for the five towns is 93,272 acres (146 square miles). Of this area: 48% is developed, 23% is farmed, and 10% is forested, 2% is wetlands, and less than 1% is ponds/lakes. The remaining 16% is identified as open undeveloped lands. Though this area is significantly greater than the actual watershed, the various land uses within it can represent potential pollution problems. For example, evaluation of nonpoint source (NPS) pollution can be made, from studying the proportions and types of developed, farmed, and forested land.

Of the **developed land**: 63% is **residential**, 30% is **commercial/industrial**, and 7% is **managed open land**. This includes impervious and paved surface areas. There are 678 miles of **roads** in the watershed. According to the Cumberland County SWCD *Roadside Erosion Inventory*, in 1991 there were 27 severely **eroded ditches** in these towns.

The **farm land** area has remained relatively steady, although the farm size has increased and the farm numbers have declined. The farm land, 21,343 total acres, is diverse: 27% is **crop**, 10% is **hay and pasture**, 18% is **woodlot**, and the remaining 45% is uncultivated. The principal crops of the Fore River watershed are corn, fruit, hay, market vegetable, ornamental nursery, and potatoes.

Livestock production is also a major industry in 2 of the 5 towns. Fifty-seven farms in these towns described their current farm practices in a 1991-92 telephone questionnaire. Thirty-eight of these farms are producing or boarding livestock and 10 of these farms have implemented an agricultural waste management system (AWMS).

Table 2.2 **Livestock distribution of farms in the Fore River Watershed.**

Type	# Sites	# Head	# AWMS
Beef	5	164	3
Dairy	21	1,316	4
Horse	5	60	2
Pig	2	51	0
Poultry	0	0	0
Sheep&Goat	5	420	1

The total **forest land** acres are identified by the **town comprehensive plans** of Buxton and Portland, **tree growth tax** data for Gorham and Westbrook; and the **farm tract** data for South Portland. Tree Growth Tax data indicate that these are mostly mixedwood and softwood stands for all five towns.

Fifty **sand and gravel pits** (includes clay and rock sites) are identified from USGS 7.5-minute quad maps (1957-1983). The range of distances from these sites to the nearest drainageway is from 0 to 0.5 miles.

The DEP reports nine **solid waste sites** (landfill, brush-demo, and transfer stations). The total number of solid waste accounts reported in Table 2.4 is greater than the total population because separate accounts are required for each type of disposal.

Coastline miles do not include the coastlines of the Casco Bay islands.

The DEP *State of Maine Water Quality Assessment* classifies the **river and stream** (riverine) and **pond and lake** (lacustrine) **surface waters** according to the Fore River Watershed boundary. Within this boundary 61 riverine miles are attaining their water quality classifications. Those that are not achieving attainment include: Capisic Brook (3 mi.), Clark Brook (1 mi.), Long Creek (3 mi.), and Stroudwater River (4 mi.). All of the 60 lacustrine acres are attaining their Class GPA standards. See Appendix D for DEP Water Quality Classifications and Status Definitions.

The Fore River drainage area is underlain by 23 significant sand and gravel aquifers. According to the U.S. Geological Survey definition, a significant sand and gravel **aquifer** "...yields 10 or more gallons per minute to a properly installed domestic well, and consists of glacial ice-contact and outwash deposits which occur primarily in the valleys of the major rivers and along their tributaries."

Appendix III of the DEP *State of Maine Nonpoint Source Pollution Management Plan*, November 1989, identifies 32 ground water sites that are not attaining water quality standards due to nonpoint source pollution. These nonpoint sources include hazardous substance sites, leaking underground storage tanks, solid waste land fill, uncovered pure salt piles, and uncovered sand and salt piles. DEP records identify all sites by town and map coordinates.

Population figures are obtained from towns and the 1990 U.S. Census.

Public **water** supplies are classified by the Maine Department of Human Services, *State of Maine Drinking Water Program* as Water Districts, Community, Non-Community (NC), and Non-Transient Non-Community (NTNC). NC and NTNC are grouped together in the table below. Individual water district records identify the number of people served from the five towns. Most of the Fore Watershed residents receive treated surface water (SW) from Sebago Lake. The remaining segment of the population relies upon ground water (GW).

Table 2.3 **Public Water Sources for the Fore River Watershed.**

Type	GW Systems	SW Systems	People
Water District	0	2	29,697
Community	3	0	4,048
Non-Transient & Non-Community	26	0	2,837

Community **wastewater** disposal differs for the area. Municipal sewer systems process most of the wastewater in four towns. Septic suitability for communities without treatment plants is moderate-to-high in small pockets and low for large areas. Combined Sewer Overflows (CSO's) occasionally discharge untreated sewage and stormwater in three towns. This discharge occurs when the treatment plant's capacity is overwhelmed by the stormwater runoff flows. The Fore Watershed is also susceptible to malfunctioning overboard discharge units. These units treat wastes from households and small commercial operators such as restaurants. When functioning properly, overboard discharge units use a mechanical or sand filter and chlorination to disinfect the water before it is released.

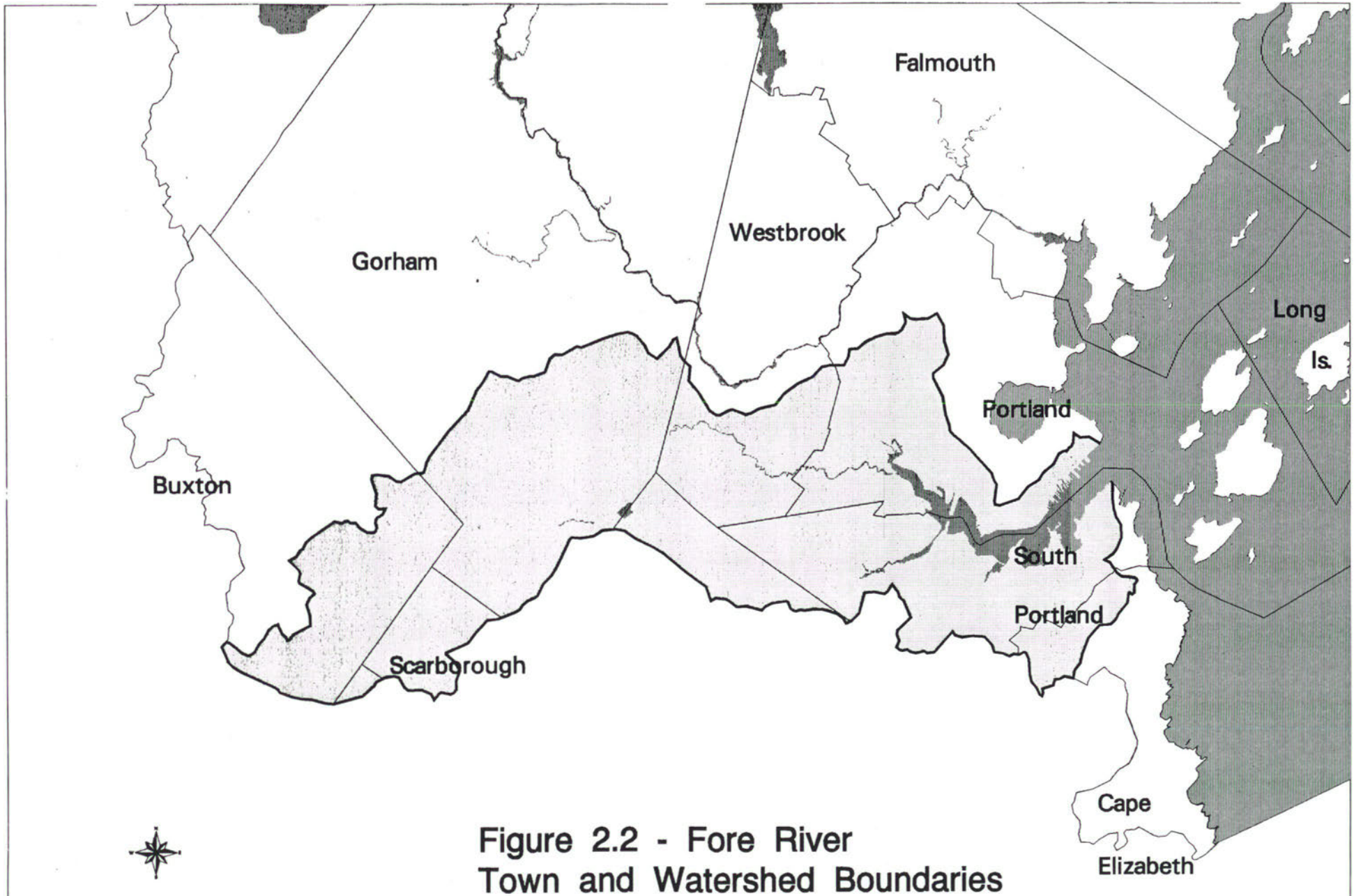


Figure 2.2 - Fore River
Town and Watershed Boundaries

TABLE 2.4 FORE RIVER WATERSHED TOWN LAND USE

COMMUNITY	Buxton	Gorham	Portland	South Portland	West-brook				TOTAL
TOTAL LAND (ac.)	26,579	32,224	14,558	8,800	11,111				93,272
DEVELOPED LAND ac.)									
Commercial & Industrial	1,841	1,682	7,353	2,315	405				13,596
Residential	9,465	8,773	4,412	2,528	3,120				28,298
ROADS (mi.)	107	134	242	114	81				678
Arterial	6	20	61	26	19				132
Collector	0	18	22	14	12				66
Local	101	96	159	73	49				478
Eroded Ditches (#)	--	14	4	1	8				27
MANAGED OPEN LAND (ac.)									
Cemeteries	56	28	537	193	56				870
Golf Course	0	355	44	140	115				654
Land Trust	0	3	0	31	--				34
Nursery/Greenhouse	--	55	1	1	2				59
Park/Schoolyard	103	100	708	250	30				1,191
FARM LAND (ac.)	5,050	13,271	95	287	2,640				21,343
Cropland	--	4,843	0	218	617				5,678
Hay & Pasture Land	--	1,698	0	0	450				2,148
# Surveyed/# Farms	0/10	38/93	0	3/3	6/16				47/122
LIVESTOCK FARMS (#)	5	25	0	1	7				38
Beef	--	5	0	0	2				7
Dairy	5	12	0	0	4				21
Horse	--	3	0	1	1				5
Pig	--	1	0	0	1				2
Poultry	0	0	0	0	0				0
Sheep & Goat	--	4	0	0	1				5
FOREST LAND (ac.)	13,479	--	202	169	886				14,736
Town Comprehensive Plan	13,479		202		--				
Farm Tract	1,344	719	158	169	51				2,441
Farm Woodlot	--	2,376	0	0	94				2,470
Tree Growth Tax	1,344								
Softwood	--	980	32	11	244				1,267
Mixed	--	2,595	29	4	501				3,129
Hardwood	--	78	2	7	141				228

NOTE: Information inventoried from existing sources

TABLE 2.4 (CON'T) FORE RIVER WATERSHED TOWN LAND USE

COMMUNITY	Buxton	Gorham	Portland	South Portland	West-brook				TOTAL
SAND & GRAVEL PITS (#)	23	23	5	2	11				64
Nearest Drainageway (mi.)	.1 - .25	.1 - .3	.25 - .5	.0 - .2	.25 - .5				.0 - .5
Active (ac.)	--	307	--	50	--				357
SOLID WASTE SITES (#)									
Landfill	0	0	2	1	1				4
Other	0	0	2	0	0				2
Transfer Station	1	1	0	0	1				3
People Served	6,465	10,336	175,692	22,747	14,947				230,187
COASTLINE (mi.)	0	0	80	14	0				94
SURFACE WATER									
Ponds & Lakes (ac.)	125	176	21	16	33				371
Rivers & Streams (mi.)	47	76	17	20	31				191
*Wetlands (ac.)	346	228	1,397	85	10				2,066
AQUIFERS (#)	12	5	1	2	2				22
POPULATION	6,495	11,856	64,358	23,690	11,121				117,520
WATER (people served)									
District	0	1,585	17,309	7,672	4,716				31,282
Community	0	1,048	0	0	0				1,048
Private	1,881	620	236	50	50				2,837
WASTEWATER (#)									
Municipal Accounts	0	964	15,107	6,883	3,759				26,713
Combined Sewer Overflow	0	0	45	17	7				69
Overboard Discharge	0	0	55	1	0				56

-- indicates data unavailable

* Wetland acres shown are within watershed boundary. These figures do not represent each town's total wetland acres.

Figure 2.3

Fore River Watershed

Stormwater Management

PERFORATED INLET

A significant part of stormwater management is controlling volume and velocity of water. This perforated concrete riser controls and slows runoff water by restricting inflow and allowing sediment to settle out.

HYDRO-BRAKE

This is a hydro-brake (vortex valve) that regulates the rate of stormwater inflow. Part of nonpoint source control is stormwater runoff management from urban as well as rural areas.

Feature Photographs - Portland ME