

Portland Water District Portland, Maine

Comprehensive Water System Strategic Plan Volume 4.3 - Water System Master Plan for Town of Falmouth

July 2003

Contents

Executive Summary

Section 1 - Demographics, Housing, and Economic Trends 1990-2020 for Seven Suburban Communities Served by PWD

1.1	Introduction and Summary.....	1-1
1.2	Population Growth.....	1-1
1.3	Housing Growth in the Region.....	1-5
1.4	Employment Growth in the Region.....	1-9

Section 2 - Population Projection and Water Use Trends for Town of Falmouth

2.1	Existing Water Service Area.....	2-1
2.2	Residential Development and Population Growth	2-1
2.2.1	Recent Residential Development Patterns	2-1
2.2.2	Population Trends	2-1
2.2.3	Planned Residential Growth Patterns	2-5
2.2.4	Implications of Residential Growth for the Water System.....	2-9
2.3	Nonresidential Development and Employment Growth	2-9
2.3.1	Employment Trends	2-9
2.3.2	Anticipated Nonresidential Growth Patterns	2-9
2.3.3	Implications for the Water Supply.....	2-10
2.4	Other Considerations Related to Water System.....	2-10

Section 3 - Existing and Proposed Future Water Distribution System

3.1	Configuration of PWD's Water Distribution System	3-1
3.2	Existing Water Distribution System in Falmouth	3-3
3.2.1	Service Zones	3-3
3.2.2	Distribution Mains and Hydrants.....	3-3
3.2.3	Storage Facilities	3-4
3.2.4	Pumping Facilities.....	3-4
3.3	Proposed Future Water Distribution System	3-5
3.3.1	Renewal and Replacement Plans	3-5
3.3.2	Capital Projects List	
3.3.2.1	Storage Improvements	3-7
3.3.2.2	Pumping Improvements.....	3-9
3.3.2.3	Piping Improvements.....	3-9

Appendices

- Appendix A* - Analysis and Forecasting Methods (Muskie/PDI)
- Appendix B* - Detailed Town Data (Muskie/PDI)
- Appendix C* - PWD Customer Satisfaction Goals

Figures

1-1	Population in PWD Service Area Urban and Suburban Communities	1-3
1-2	Population Forecasts for PWD Communities.....	1-4
1-3	New Housing Permits 1990-1999	1-6
1-4	Residential Permits Inside and Outside the PWD Service Area 1990-1999.....	1-7
1-5	1990-1999 Regional Residential Growth in Relation to the District’s Water Service Area.....	1-8
1-6	Employment and Population Growth Rates 1990-2000	1-10
2-1	Existing PWD Service Area	2-2
2-2	New Housing Units 1990-99	2-3
2-3	Falmouth Population Forecasts	2-6
2-4	Falmouth Population Forecast by Block Group	2-7
2-5	Future Land Use Plan	2-8
3-1	Existing and Proposed High Service Zones.....	3-2
3-2	Water Distribution System Improvements	3-6

Tables

1-1	Population Growth in the Portland Water District Communities: History and Forecast	1-2
1-2	Growth in Establishments and Employment 1990-2000	1-11
2-1	Distribution of New Dwelling Units.....	2-4
2-2	Population Growth 1990 - 2000.....	2-4
2-3	Employment Growth 1990 - 2000	2-10
3-1	Summary of Communities Served by Service Zone	3-1
3-2	Pipe Characterization in Zones 510 & 510 in Standish.....	3-3

Executive Summary

The Portland Water District (PWD), a quasi-municipal entity, has been providing drinking water to the citizens of Portland since 1869. Over the last 130 years, PWD's service area has expanded from the City of Portland to include Cape Elizabeth, Cumberland, Falmouth, Gorham, Raymond, Scarborough, South Portland, Standish, Windham, and Westbrook. Today, PWD provides an average of about 23 million gallons per day (mgd) to over 140,000 people.

Camp Dresser & McKee Inc. (CDM) was retained by PWD to conduct a water system evaluation to provide a comprehensive assessment of PWD's water system facilities and to develop a Capital Projects List that addresses current and future deficiencies. This evaluation, included as part of the Comprehensive Water System Strategic Plan (CWSSP) focused on the existing water system and ten of the eleven currently served communities (PWD extended a main to Raymond during the course of this project). The Muskie School of Public Service (MSPS) and Planning Decisions Inc. (PDI) were commissioned by PWD as subconsultants to CDM on the Master Planning task to analyze the growth in the region and provide projections to serve as the basis for water master planning analysis.

The assessment of the water system was guided by PWD's desire to meet its Customer Satisfaction Goals (included in Appendix C). These goals identify operational targets for hydraulic sufficiency, reliability, regulatory compliance, and system water quality. The results of the water system evaluation that pertain to the Town have been summarized in this document for use as a planning and coordination tool.

The improvements within the Town of Falmouth which are included on the District's Capital Projects List are presented graphically in Figure 3-3 of this report. They include the following:

- Upgrade the Winn Road Pump Station (Priority I, 2003-2010);
- Connect Gray Road at Eastern Avenue to Zone 340 (Priority I, 2003-2010);
- Determine if a hydraulic restriction can be located (i.e., a closed valve), otherwise install approximately 670 linear feet of 10-inch main on Rte. 88 Foreside Road between Casco Terrace and Town Landing Road to bypass restriction (Priority I, 2003-2010);
- Looping a new 8-inch diameter main from the existing 8-inch main on Nest Street to existing 8-inch mains on Brookside Drive. (Priority IV, 2021-2025); and
- Install a pressure reducing valve (PRV) in vicinity of Woodville Road and Birkdale Drive and install approximately 15,000 linear feet of 16-inch water main between Zone 340 and Zone 267 (Priority IV, 2021-2025).

In addition, the District undertakes water main renewals and replacements on an annual basis. Old unlined cast iron mains are among the most frequent targets of the

annual program. Figure 3-2 illustrates the location of unlined cast iron mains in the Town. Decisions on which mains are to be included in the annual water main renewal and rehabilitation program are made each year, and presented in a 5-Year Capital Improvements Program. The District plans to coordinate these programs with its serviced communities each year.

The report is organized into three sections. Sections 1 and 2, conducted by the subconsultants MSPS and PDI, were presented and discussed with the Town earlier in the project. These sections highlight the background on the demographic, housing and economic trends for the Portland suburban region in the last decade, and population projections and water use trends. A description of the existing water distribution system and the proposed future improvements in the Town resulting from the CWSSP analysis are presented in detail in Section 3.

Appendices A and B contain a discussion on the forecasting methodology and detailed statistics by community that served as the basis of results presented in Sections 1 and 2. Appendix C contains a summary of the PWD's Customer Satisfaction Goals that served as the foundation for the development of CWSSP.

Section 1

Demographics, Housing, and Economic Trends 1990-2020 for Seven Suburban Communities Served by PWD

1.1 Introduction and Summary

The Portland Water District (PWD) is undertaking a master plan for all its facilities over the next two decades. This section of the plan focuses on the suburban communities of Cape Elizabeth, Scarborough, Standish, Gorham, Windham, Falmouth, and Cumberland. The engineering firm of Camp Dresser & McKee (CDM) serves as the principal consultant to the District in this project, and as a part of the long term plan, CDM and PWD need information on both the extent of growth in population, housing, and employment and the location of that growth relative to the area in each community served by the District's water supply services. This plan was prepared by faculty and students of the Graduate Program in Community Planning and Development and the firm of Planning Decisions Inc. to provide the information needed for CDM and PWD to proceed with more detailed engineering studies of potential modifications to the water system in the region.

This section of the plan presents an analysis of trends over the past decade and presents forecasts of population growth in each town to 2020. Each town is covered in a separate document. This summary provides a comparative overview of the trends in the region. Descriptions of the methodologies used to analyze residential trends inside and outside of the PWD service area and of the forecasts prepared are contained in Appendix A. Appendix B contains detailed data tables.

1.2 Population Growth

Table 1-1 summarizes growth in each community from 1990-2000 and presents forecasts to 2010 and 2020. Four different forecasting methods are used for the seven "suburban fringe" towns examined in this study and two different methods are used for the "urban core." Table 1-1 presents the low, high, and mean forecasts of the methods used summarized at the town level. Discussion of the forecasting methods is presented in Appendix A. Tables showing the detailed results for each block group and town, along with maps showing how the different forecast methods affect each town are presented in Appendix B.

The seven towns examined in this study collectively comprise perhaps the fastest growing area in Maine. With about one third of the population of Cumberland County, the towns collectively accounted for two thirds of the population growth in the county over the decade, collectively growing by more than 14,400 (or 21.4%). This is the equivalent of adding a town the size of Windham or Gorham to the region over that decade. However, the growth was not equally distributed. Cape Elizabeth grew at just over 2%, while Falmouth and Scarborough both grew about 35%.

Town	1990 Population	2000 Population	2020 Forecast Population (Low)	2020 Forecast Population (Mean)	2020 Forecast Population (High)
Cape Elizabeth	8,870	9,068	9,027	9,551	10,096
Cumberland	5,867	7,159	9,775	10,564	11,519
Falmouth	7,610	10,310	15,021	18,653	24,923
Gorham	11,856	14,141	18,581	20,006	21,856
Scarborough	12,518	16,970	26,100	29,881	35,703
Standish	7,677	9,285	12,727	13,527	14,217
Windham	13,020	14,904	18,357	19,595	20,988
Suburban Fringe	67,418	81,837	109,588	121,777	139,302
Portland	63,106	64,249	65,393	65,995	66,597
South Portland	24,098	23,324	22,549	22,199	21,850
Westbrook	16,208	16,142	16,076	16,043	16,011
Urban Core	103,412	103,715	104,018	104,237	104,458
Total PWD Towns	170,830	185,552	213,606	226,014	243,760

**Table 1-1
Population Growth in the Portland Water District Communities:
History and Forecast**

The long-term population growth trends used here reveal some important potential changes in the Portland region over the next twenty years. If the decade of the 1990s is essentially repeated over the next two decades, then the population of the suburban fringe will exceed that of the urban core by 2020 (see Figure 1-1). This is the case even under the low forecast. As shown in Figure 1-2, Scarborough will become the second largest community in the Portland metro area by 2010, and, under the high growth scenario, it will become the third largest municipality in Maine by 2020. By 2020, Falmouth and Gorham will, under the high growth scenario, exceed the current (and projected) populations of South Portland. Windham will be about the same size as South Portland by 2020 under the high growth scenario. Standish will grow to a community larger than Falmouth today. Only Cape Elizabeth and Cumberland will see relatively slow growth under all scenarios.

Forecasting small geographic areas where population is measured only every 10 years is inherently difficult. Using multiple approaches to forecasting captures a range of possible futures, and permits planning based on different assumptions.

Section 1
 Demographics, Housing, and Economic Trends 1990-2020 for
 Seven Suburban Communities Served by PWD

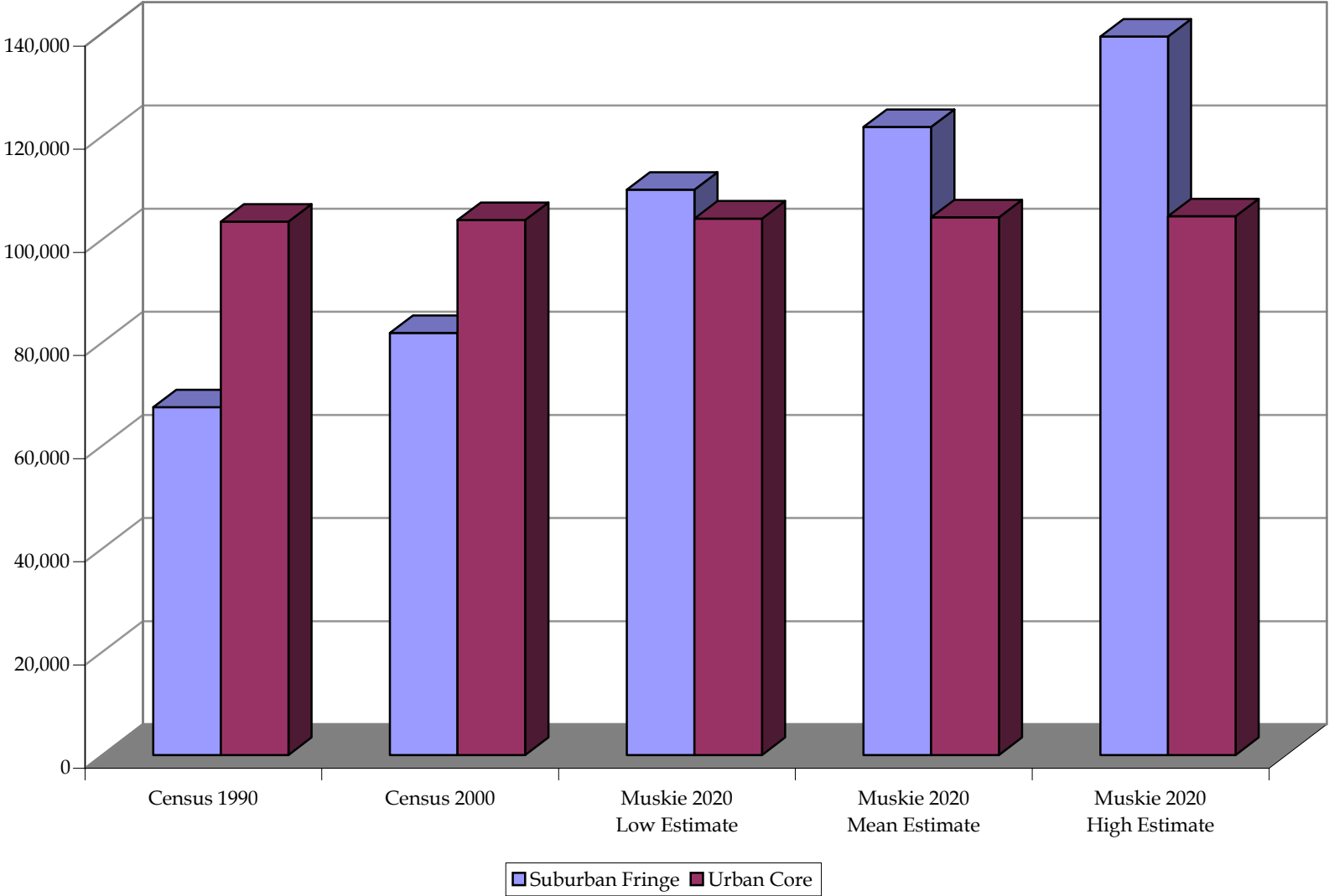


Figure 1-1

Population in PWD Service Area Urban and Suburban Communities

Section 1
 Demographics, Housing, and Economic Trends 1990-2020 for
 Seven Suburban Communities Served by PWD

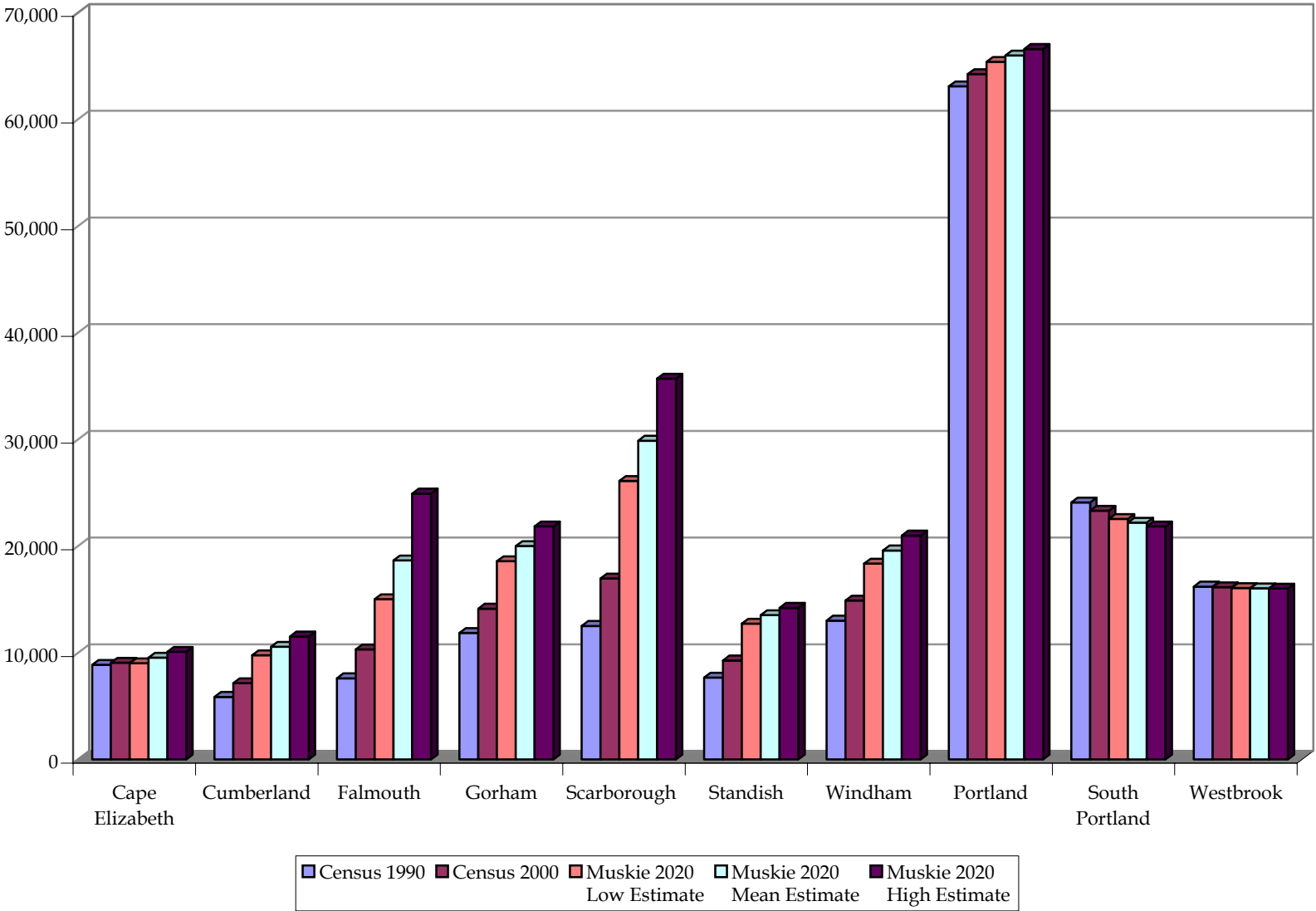


Figure 1-2
Population Forecasts for PWD Communities

However, past trends are at best an imperfect guide to the future. The forecasting methods used do not allow the normal tests of statistical reliability because of the lack of data, and there is always the possibility that significant changes in housing patterns (because of an aging population), transportation routes, or other public policies could alter the past trends. The forecasts at the block group level do not fully account for constraints in each region such as land form, although to the extent these constraints restricted growth in the past, they are also reflected in the future. However, the forecasts should provide a reasonable range of possible futures against which investment needs in the Portland Water District's system can be assessed.

1.3 Housing Growth in the Region

Housing growth in the region has been substantial. Using construction permits filed with each town as a measure of housing growth (and excluding permits for additions, renovations, etc), a total of 6296 permits were issued in the seven towns. As Figure 1-3 shows, Scarborough was the leader in housing permit growth, with more than 1700 permits issued over the period (28% of the town total). The fewest permits were issued in Cape Elizabeth with 340 permits (5.4% of the total).

Over 1990-1999, about two thirds of residential growth permits in the seven-town region were within the PWD service area (see Figure 1-4). All of Cape Elizabeth's growth and a high percentage of rapidly growing Scarborough's new permits (86%) are in the service area. Falmouth (79%) and Windham (78%) also saw a large percentage of their growth in the PWD service area. A smaller percentage of growth occurred inside the service area in Cumberland and Gorham (58% in each). Standish, with the smallest proportion of its area served by PWD, had only 4.6% within PWD service. Figure 1-5 shows the distribution of permits inside and outside the service area.

Block Group-level trends over 1990-99 modify this picture. With the exception of Cape Elizabeth, with nominally 100% service for current growth, every town has areas where significant growth concentrations have occurred outside water service. In the fastest growing towns of Scarborough and Falmouth, there is a high proportion of growth in the service area, but in each town there are also significant areas of development in their western districts which are outside of water service.

Cumberland and Gorham have experienced significant percentages of their 1990-99 growth (42% each) outside of the water service area, and also particularly in their western districts. The Town of Windham presents a slightly different pattern. Although a high percentage of Windham growth has been estimated to be within water service (78%+), an extensive pattern of development covers the areas directly east and south of the PWD service area that represents the north-south spine of the town.

Section 1
Demographics, Housing, and Economic Trends 1990-2020 for
Seven Suburban Communities Served by PWD

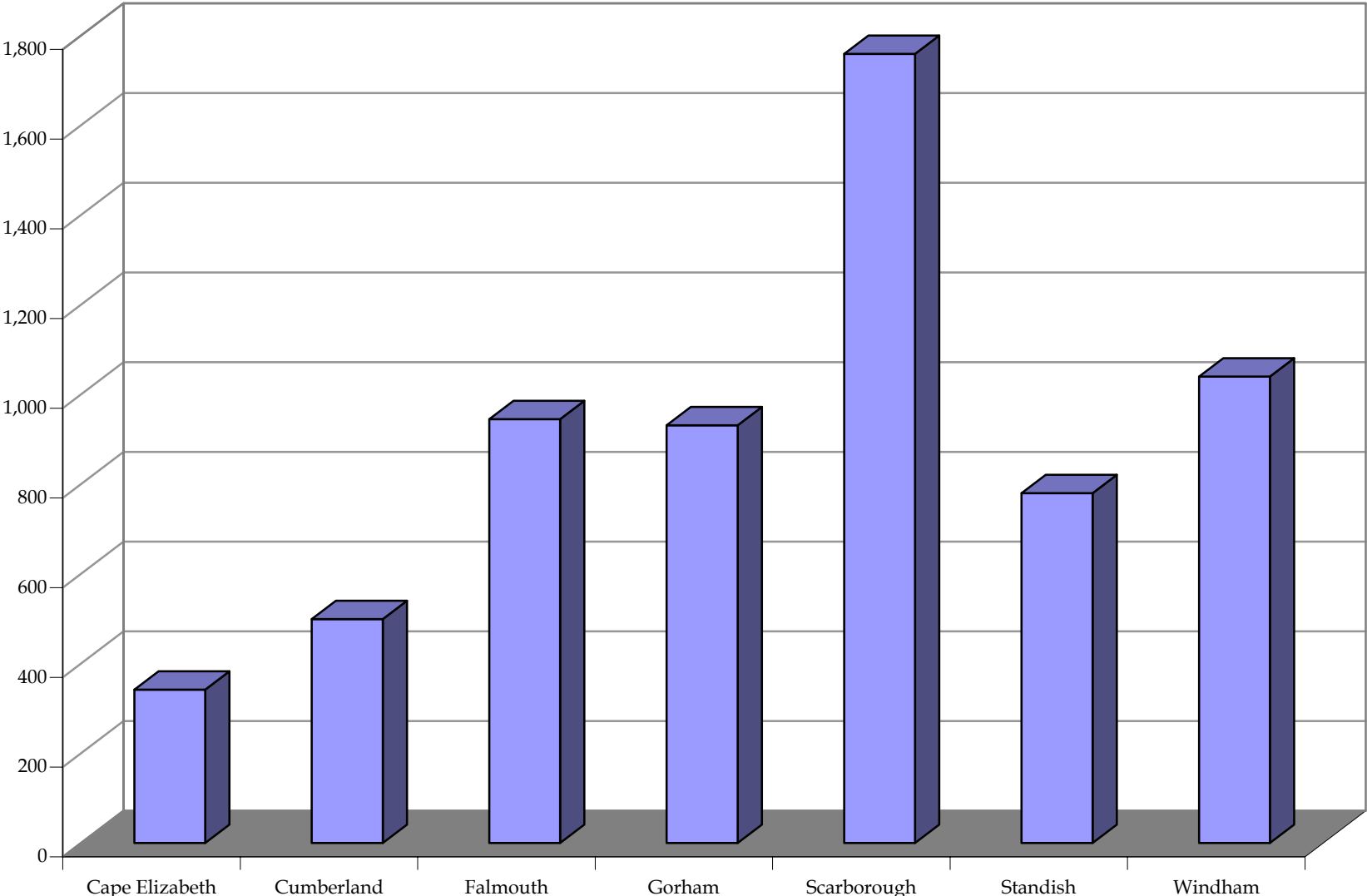


Figure 1-3
New Housing Permits 1990-1999

Section 1
 Demographics, Housing, and Economic Trends 1990-2020 for
 Seven Suburban Communities Served by PWD

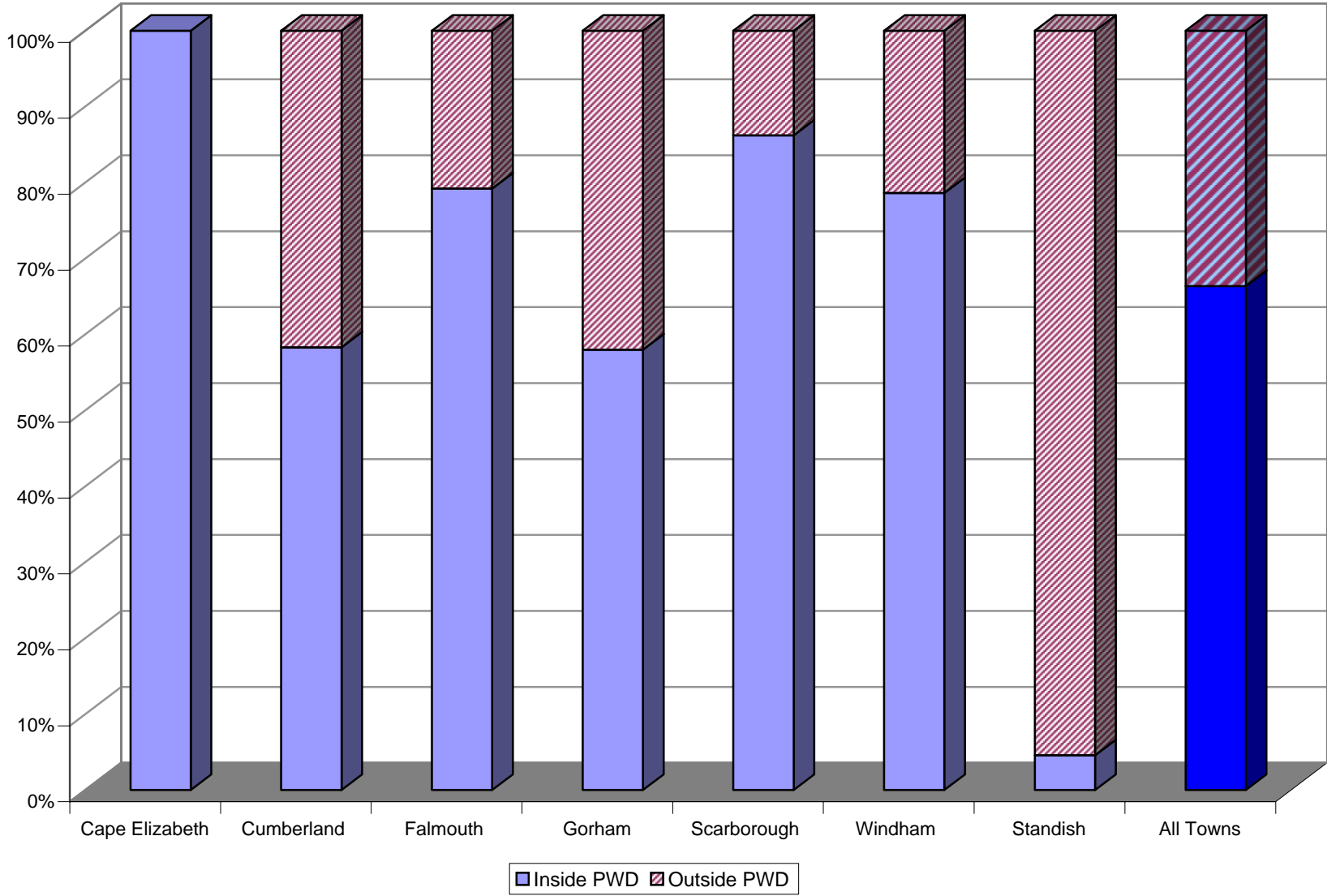
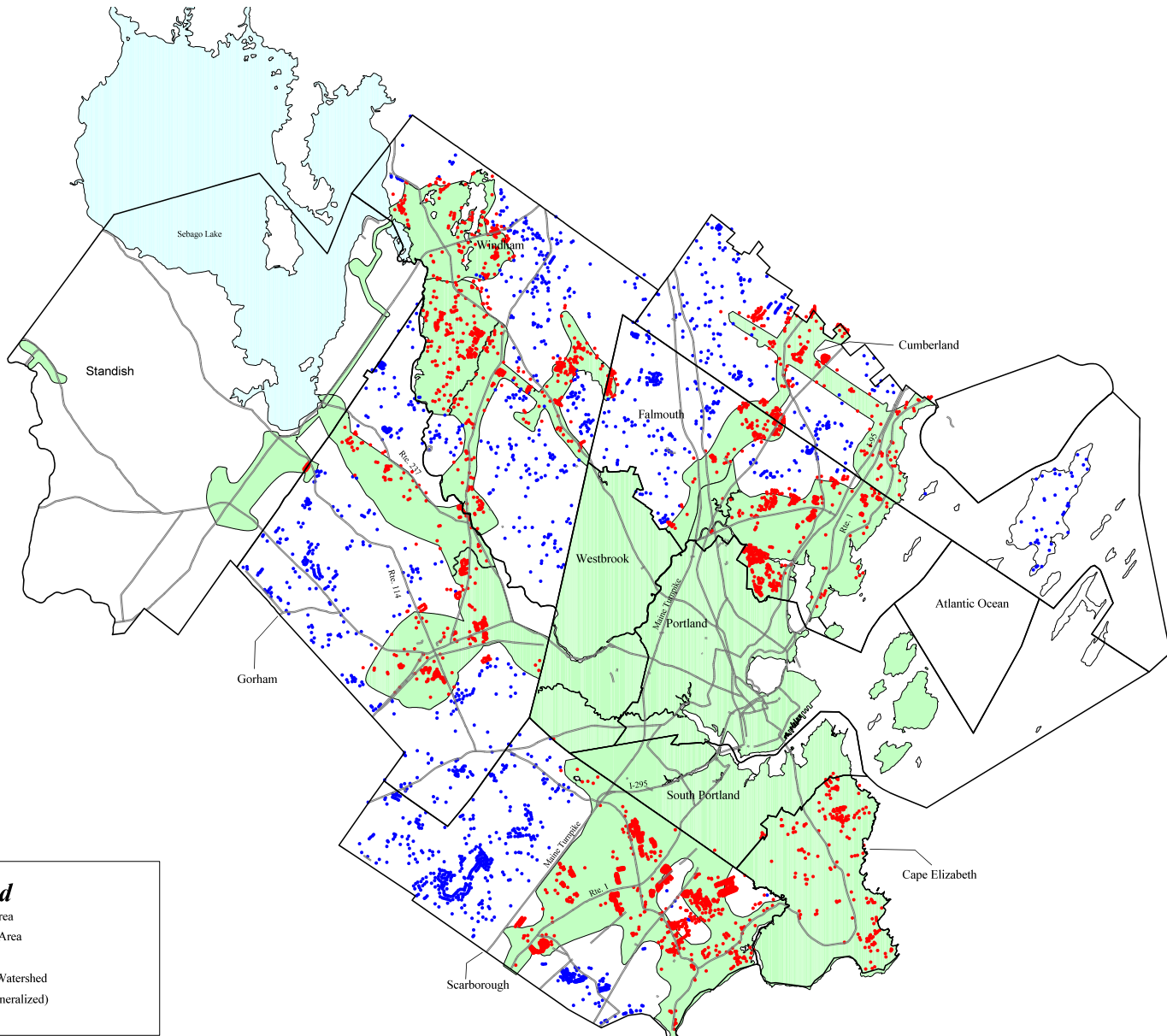


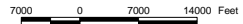
Figure 1-4

Residential Permits Inside and Outside the PWD Service Area 1990-1999



Legend

- Permits Inside PWD Service Area
- Permits Outside PWD Service Area
- ▭ Town Boundaries
- ▭ All Lakes and Small Ponds in Watershed
- ▭ PWD Water Service Areas (Generalized)



*1990-1999 Regional Residential Growth
In Relation to the District's Water Service Area*

The town-level and block group-level forecasts of how population growth and development location trends may interact is intended to simulate how much of a difference town sub-area trends may make in terms of future residential water demand patterns. The results show some potential volatility in the maximum forecasts. Of the 20,647 new persons expected under the Town-level MAX forecast, 79% are estimated to be within the existing water service area. However, of the 24,681 new persons forecast under the Block Group-level, unconstrained forecast, only 57% are estimated within the service area.

These results are somewhat modified when Standish is excluded. The highest percentage of growth within the service territory is estimated for the Town-level MAX forecast without Standish (87% of 18,452 new people or 16,161 people). The Block-Group-level MAX forecast without Standish produces a slightly attenuated estimate that 63% of 22,395 new people (14,092) will be within the service area.

1.4 Employment Growth in the Region

One of the most important features of the suburban communities around Portland is that employment has been growing in these communities faster than population during 1990-2000. While population was increasing by 21%, employment was growing by 40.4%. This rate of employment growth is remarkable, since it was measured at approximately the peak of employment in the business cycles of the 1980's and 1990's. As Figure 1-6 shows, five of the seven towns saw employment growth exceed population growth. Only in Gorham and Standish did population growth exceed employment growth.

Table 1-2 shows the distribution of growth in establishments and employment in each town. Establishments are locations of employment required to report to the Maine Department of Labor. The employment data reported is "covered" employment, that is, employment covered by the unemployment insurance laws.

It excludes farm and fisheries employment, along with most self-employment, so actual employment may be somewhat higher than that reported here, but the difference is not likely to be large enough to affect the Water District in any significant way.

Scarborough is the largest employment center in the seven town suburban region, with Windham, Falmouth, and Gorham following. Cumberland has the smallest employment in the seven-town region. Scarborough has the distinction of having more total employment than population in 2000. It also had the largest employment growth and the fastest growth rate over 1990-2000. Scarborough also accounted for nearly two thirds (64%) of the region's employment growth. Standish saw an increase in the number of employers but a slight decrease in employment.

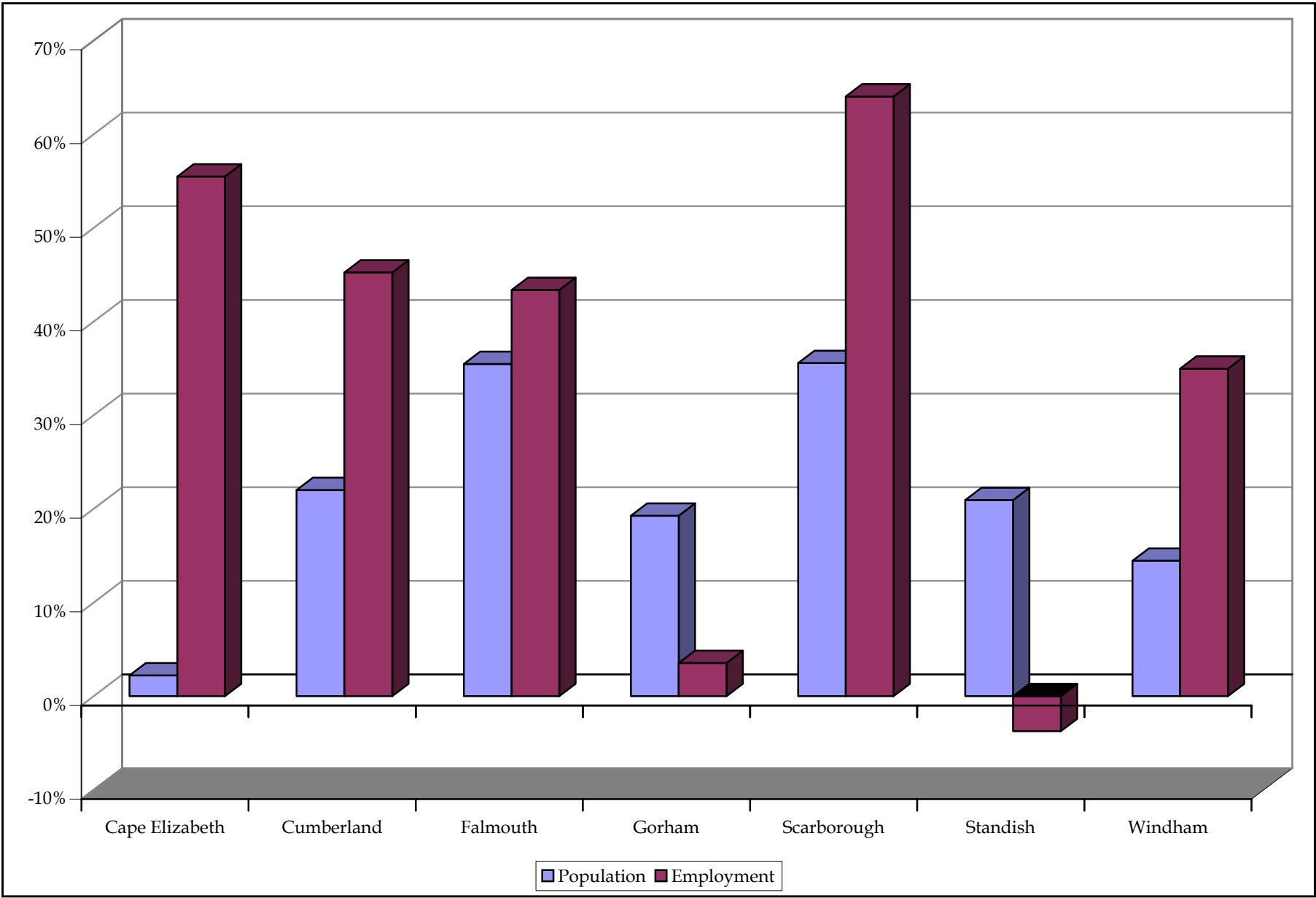


Figure 1-6
Employment and Population Growth Rates 1990-2000

Sources: Census and Maine Department of Labor

Town	Number of Establishments			
	1990	2000	Change	% Change
Cape Elizabeth	160	219	59	36.9%
Cumberland	137	210	73	53.3%
Falmouth	293	444	151	51.5%
Gorham	273	371	98	35.9%
Scarborough	512	735	223	43.6%
Standish	119	155	36	30.3%
Windham	416	492	76	18.3%
TOTAL	1,910	2,626	716	37.5%

Town	Employment			
	1990	2000	Change	% Change
Cape Elizabeth	1,237	1,924	687	55.5%
Cumberland	1,103	1,602	499	45.3%
Falmouth	3,632	5,208	1,575	43.4%
Gorham	4,543	4,704	161	3.6%
Scarborough	12,382	20,312	7,930	64.0%
Standish	2,967	2,856	(111)	-3.7%
Windham	4,563	6,159	1,596	35.0%
TOTAL	30,427	42,765	12,338	40.5%

Source: Maine Department of Labor

Table 1-2
Growth in Establishments and Employment 1990-2000

Because of the structure in the employer records maintained by the Department of Labor, it is not possible to precisely locate each establishment in the same way that the permit data can be located on specific land parcels or population data can be displayed in terms of Census geography. The data can only be geo-located by street address, and even this is often imperfect. Employment has been aggregated by street, and this data is discussed in Section 2.

Section 2

Population Projection and Water Use Trends for Falmouth

2.1 Existing Water Service Area

Much of the developed area of Falmouth, as well as some of the developing areas, are served by the Portland Water District's distribution system (*see Figure 2-1*). Almost the entire area east of Middle Road, including the Route One and Foreside Road (Route 88) corridors, is serviced by public water. The Pleasant Hill area as well as the Falmouth Road/High School/Woodlands area is also served. Public water is available in the Exit 10 - West Falmouth Corner areas of Route 100 (the Gray Road) and extends out the Winn Road to the Cumberland town line. PWD also services a small area adjacent to Highland Lake on the Windham town line through mains located in Windham.

2.2 Residential Development and Population Growth

2.2.1 Recent Residential Development Patterns

During the 1990's, the Town of Falmouth experienced significant residential development, primarily single-family homes. A review of building permit records identified 945 new housing units constructed between 1990 and 1999. Residential development occurred throughout the Town (*see Figure 2-2*), but was greatest in Census Tract 2502 especially Block Group 1 (the Pleasant Hill-Middle Road area) and Block Group 3, the Woodville-Woods Road area.

Of the new residential units built during the 1990's, approximately 750 or 79% were located within the PWD service area with the balance located in areas not served by public water. Table 2-1 shows the distribution of the units by Census block group.

2.2.2 Population Trends

During the 1990's, the year-round population of the Town of Falmouth grew from 7,610 in 1990 to 10,310 in 2000, or an increase of 2,700 residents or 35.5%. This population growth, like the residential development, occurred primarily in Census Tract 2502, especially in Block Groups 1 and 3, the areas west of the Middle Road. Table 2-2 shows the distribution of the population growth by Census block groups.

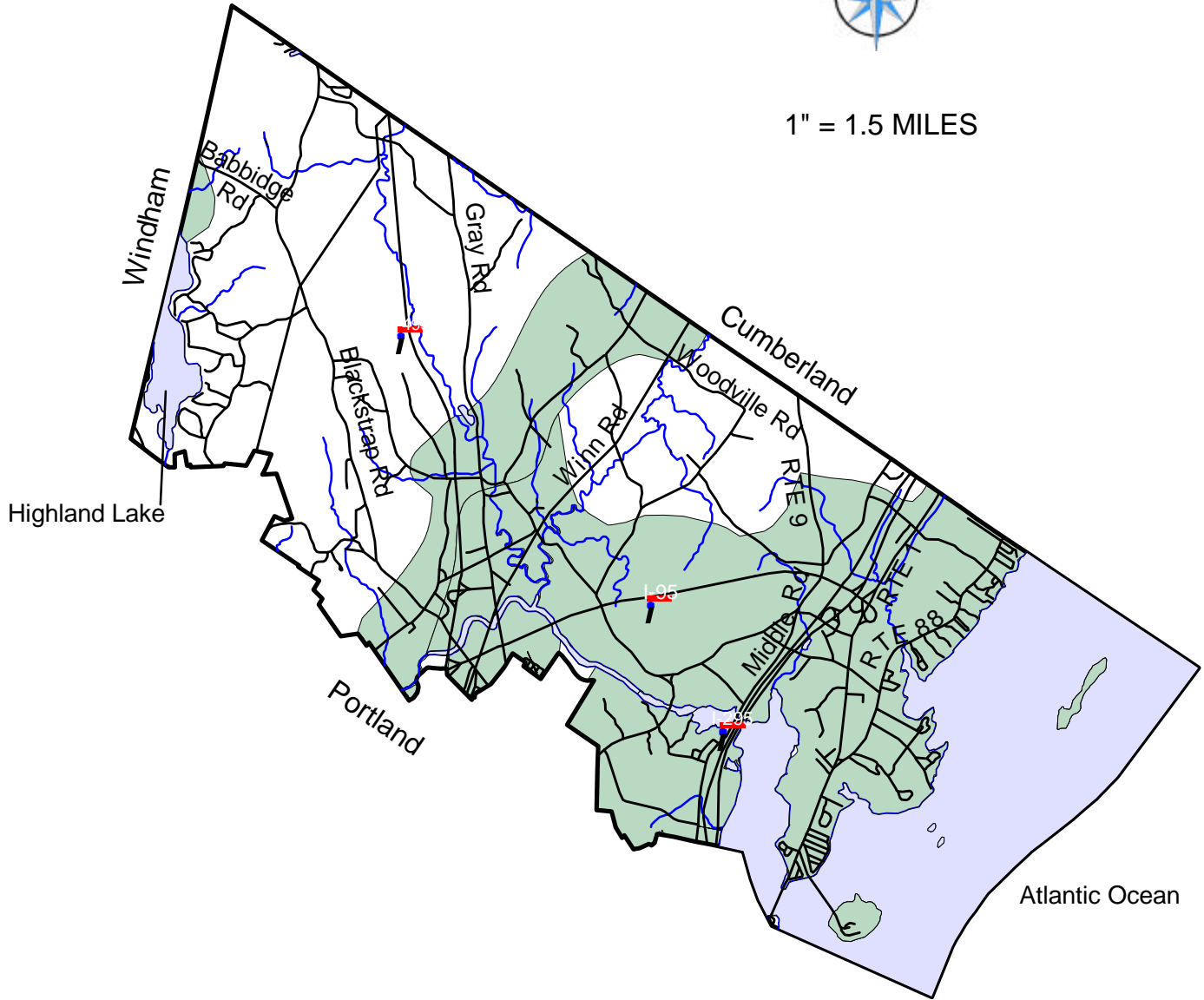


Portland
Water District




Town of Falmouth, Maine



1" = 1.5 MILES



Legend

-  Streams/Rivers
-  PWD Service Areas
-  Lakes/Ponds

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Fig. 2-1 Existing PWD
Service Area

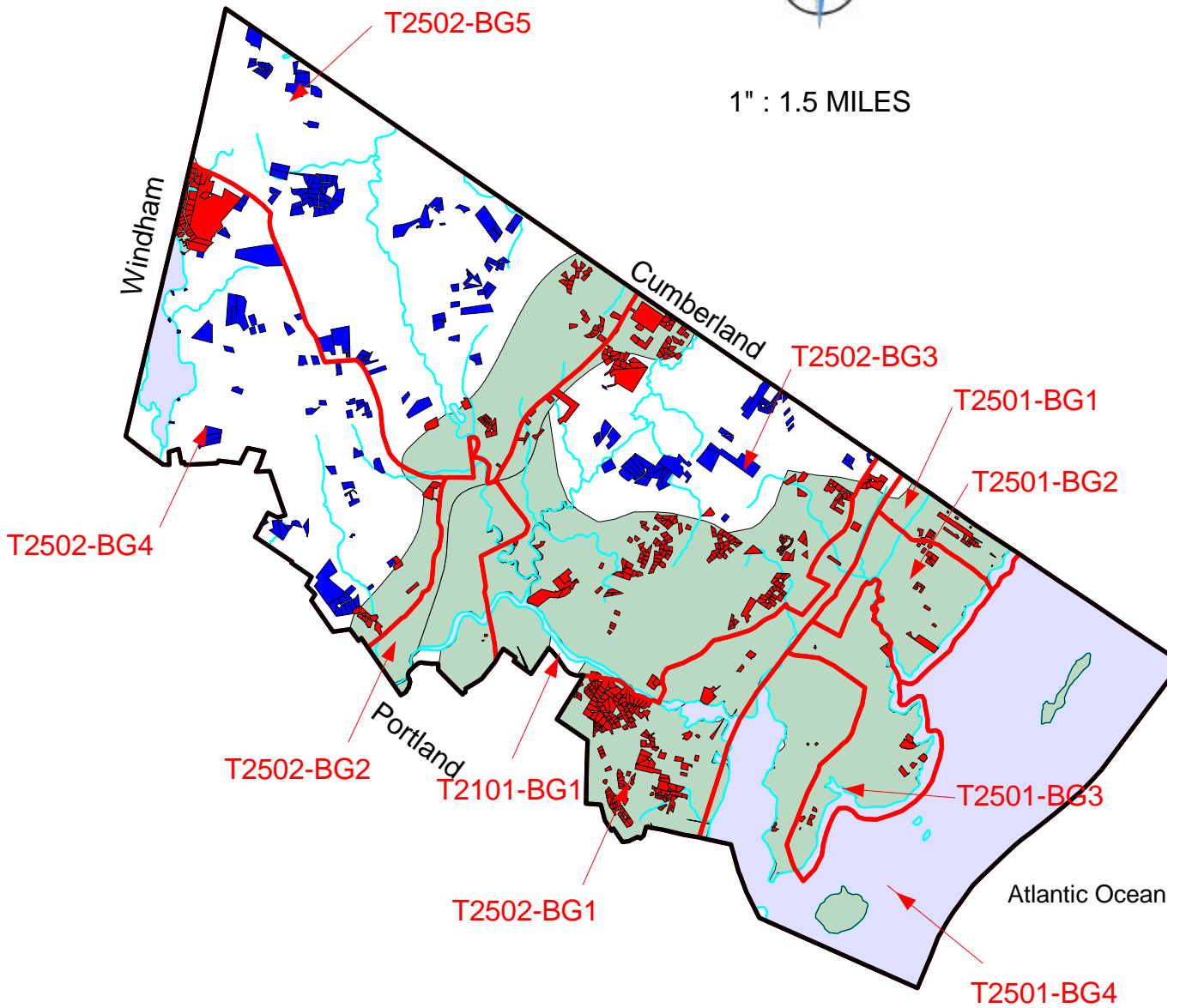


Portland
Water District

Town of Falmouth, Maine



1" : 1.5 MILES



Legend

- Permits Outside PWD Service Area
- Permits Inside PWD Service Area
- Census 2000 Block Groups
- PWD Service Area

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Fig. 2-2 New Housing
Units 1990-99

Tract and Block Group	Location	# of Units	% of Town Total	% with Water Service
T2501 BG1	North End of Route One, Route 88 Corridors	21	2.2	100
T2501 BG2	Johnson Road/Bucknam Road	132	14.0	100
T2501 BG3	Foreside/Lunt Road	12	1.3	100
T2501 BG4	Presumpscot Estuary	6	0.6	100
T2502 BG1	Pleasant Hill – Middle Road	251	26.6	100
T2502 BG2	Exit 10/West Falmouth Corridor	11	1.2	100
T2502 BG3	Woodville/Woods Roads	271	28.7	83
T2502 BG4	Blackstrap/Mast Road	110	11.6	43
T2502 BG5	Winn Road/Hurricane Road	131	13.9	31
Total Town		945	100.0%	79%

Source: Town of Falmouth Building Permit Records and PWD Service Area Maps

Table 2-1
Distribution of New Dwelling Units
Town of Falmouth 1990 - 1999

Tract and Block Group	1990 Population	2000 Population	Change 90 – 00	% Change 90 - 00
T2501 BG1	615	671	56	9.1
T2501 BG2	725	913	188	25.9
T2501 BG3	828	887	59	7.1
T2501 BG4	998	996	(2)	-0.2
T2502 BG1	987	1,765	778	78.8
T2502 BG2	605	588	(17)	-2.8
T2502 BG3	1,024	1,946	922	90.0
T2502 BG4	1,000	1,278	278	27.8
T2502 BG5	828	1,266	438	52.9
Total Town	7,610	10,310	2,700	35.5%

Table 2-2
Population Growth 1990 - 2000

Population projections prepared by the Muskie School of Public Service anticipate that the population of Falmouth will grow to approximately 18,650 residents by 2020 with a range of 15,021 to 24,923. The Town's 2000 Comprehensive Plan projected that the Town's population would continue to grow and projected the Town's population in 2009 based upon three growth scenarios, low (50 units/year), medium (100

units/year), high (150 units/years), resulting in projections of 10,700, 11,900, and 13,150 respectively.

As part of its update of the Regional Transportation Plan, the Portland Area Comprehensive Transportation Study (PACTS) prepared population projections for Falmouth. The PACTS projections forecast that Falmouth's year-round population will grow to 14,061 by 2025. This implies a 2020 estimate of 13,057, which is significantly less than the low estimate shown here. A comparison of the forecasts is shown in Figure 2-3.

Figure 2-4 shows the population of each Census block group in Falmouth from the 2000 Census and three forecasts of the population for each block group for the year 2020. These forecast figures show the lowest, highest, and mean forecasts from four different forecasting techniques. The details of the forecasting methods are presented in Appendix A.

2.2.3 Planned Residential Growth Patterns

The Town adopted an Update of its Comprehensive Plan in 2000. This document provides the best indication of the Town's desired pattern of future residential growth even though the Update does not identify specific residential growth areas for the community. The Plan divides the community into three categories; areas of infill growth, areas of master planned growth, and areas reserved for rural development (*see Figure 2-5*). As part of its recommendations, the Plan calls for the development of "Master Plans" for the developing areas of the community. The Town is currently beginning the process of developing the "Master Plans" for the areas designated for planned growth. This process will result in a better indication of where more intense residential development may occur in the future. The patterns of growth reflected in this document are not necessarily consistent with the population forecasts.

The 2000 Update of the Comprehensive Plan envisions the following types of residential growth for the three different categories of areas:

- The Infill Growth Areas are mostly developed and any future growth will fill in existing vacant land around existing neighborhoods with a similar development pattern.
- The Master Planned Growth Areas contain vast tracts of undeveloped land and have the most options for managing growth because of the availability of water and sewer.
- The Rural Development Areas include the most rural sections of the community where future development will occur on private wells and septic systems resulting in low-density development patterns.

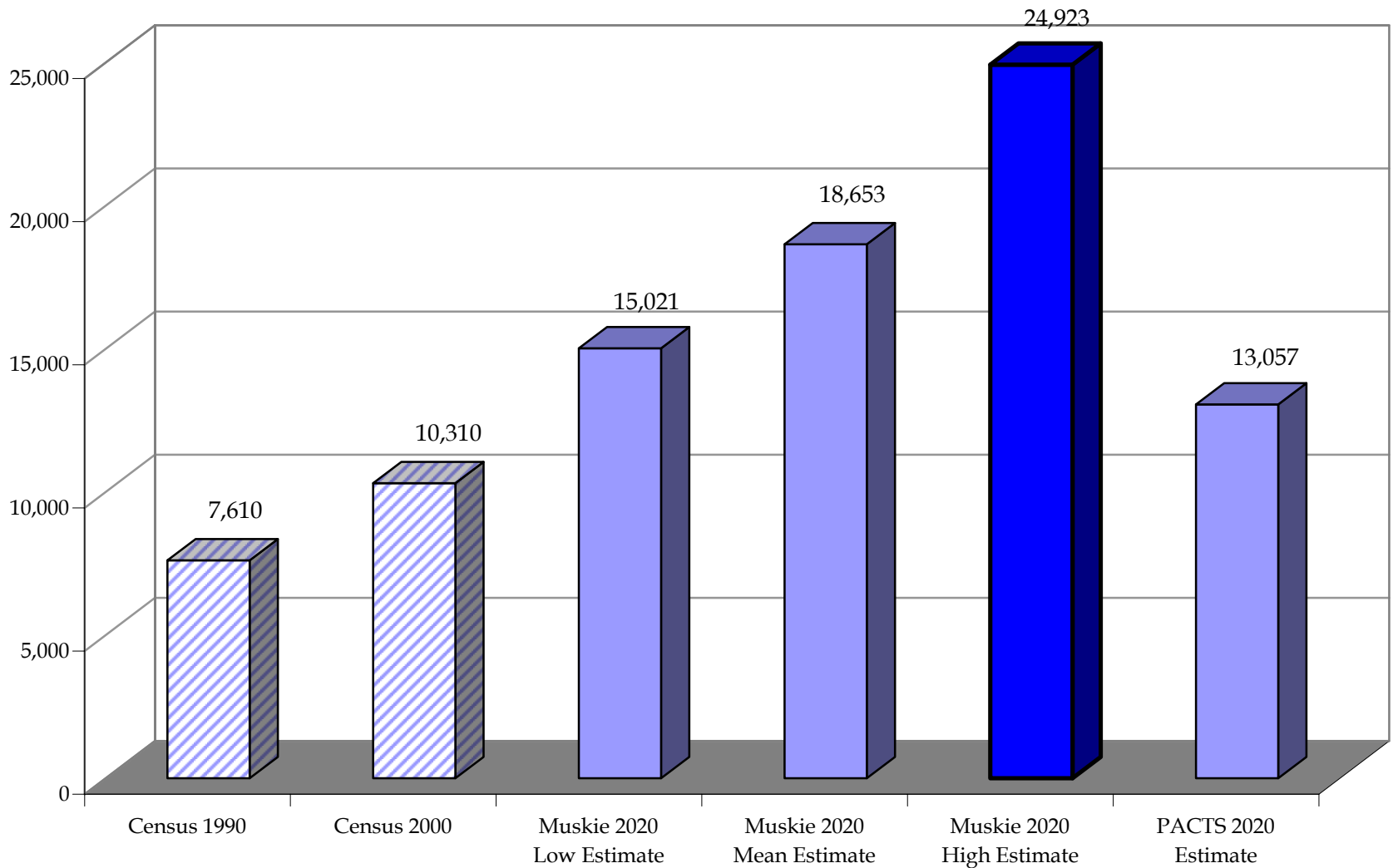


Figure 2-3
Falmouth Population Forecasts

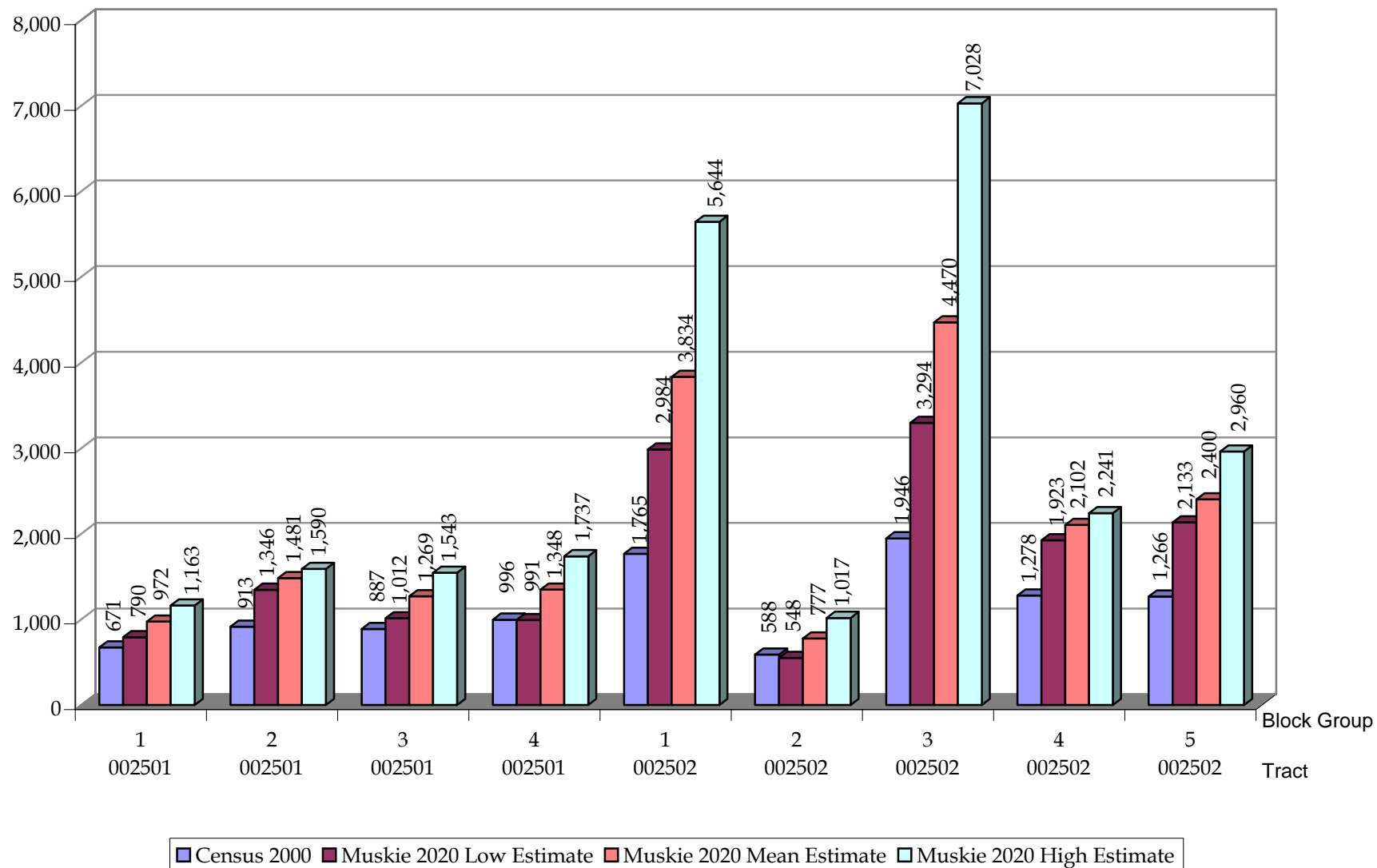


Figure 2-4
Falmouth Population Forecast by Block Group

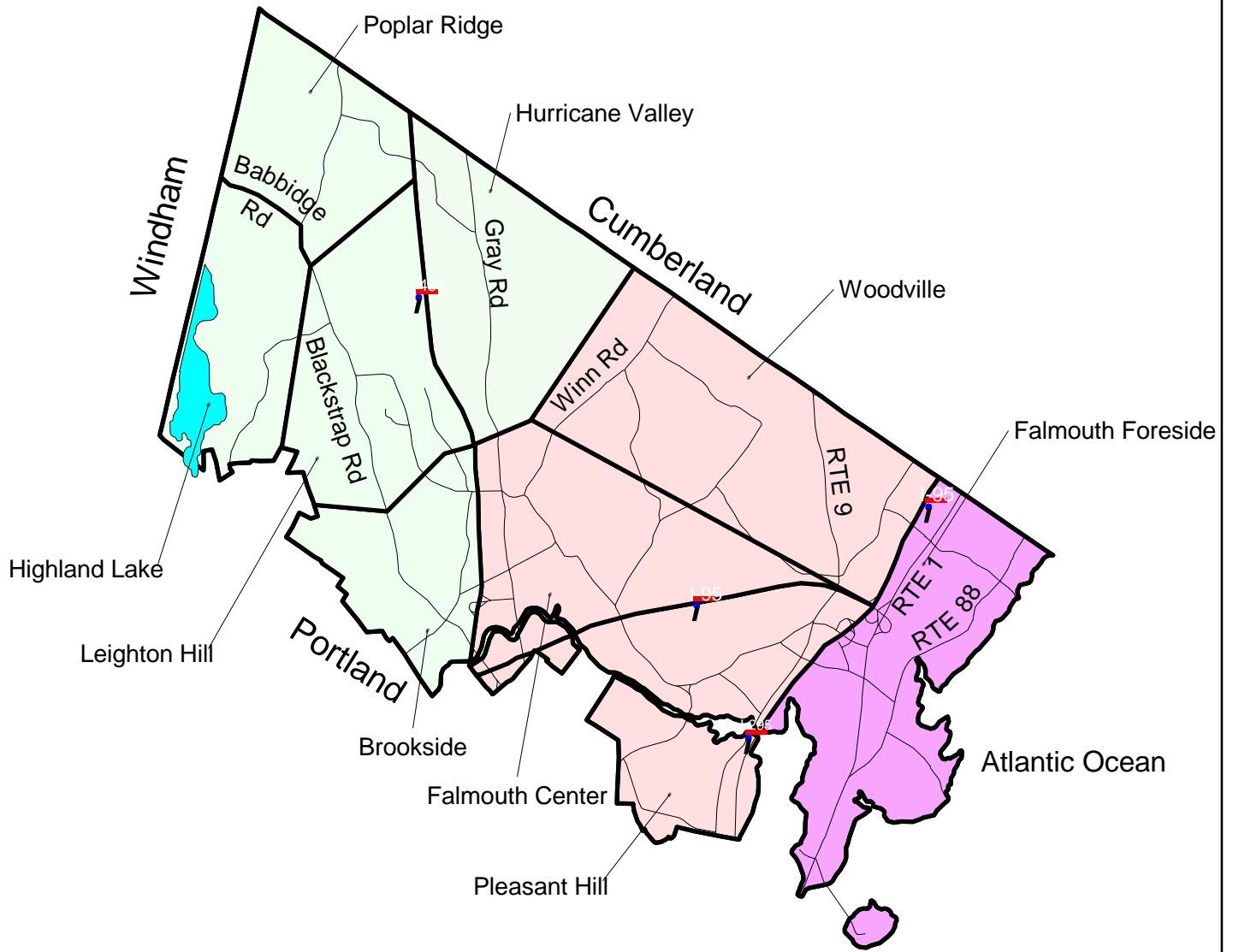


Portland Water District




Town of Falmouth, Maine



1" = 1.5 MILES



Legend

	Rural		Master Planned Growth		Areas of Infill Growth
	Leighton Hill		Falmouth Center		Falmouth Foreside
	Brookside		Falmouth Corners		
	Poplar Ridge		Woodville		
	Hurricane Valley		Pleasant Hill		
	Highland Lake				

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Figure 2-5 Future Land Use Plan



The Town's current zoning ordinance does not fully reflect this pattern of residential use, especially in the area designated for Master Planned Growth. The Town's zoning in this area may need to be adjusted depending on the outcome of the current master planning process.

2.2.4 Implications of Residential Growth for the Water System

Many of the areas designated for residential growth in the 2000 Update of the Comprehensive Plan are within the current PWD water service. The northern portion of the Planned Residential Growth area is currently not served by public water. If the Master Planning process results in this area being designated for more intense development, extension of the PWD water system may be required.

2.3 Nonresidential Development and Employment Growth

2.3.1 Employment Trends

Falmouth functions as a significant employment center. While employers are located throughout the community, the largest concentration of jobs is located in the Route One corridor and adjacent side streets. During the 1990's, Falmouth saw a significant increase in both total employment and the number of establishments.

Employment growth in Falmouth was generally concentrated in the Route One corridor and adjacent areas and in the Route 100 corridor including the Exit 10 area. Table 2-3 shows the employment growth in various areas of the Town based upon Maine Department of Labor data.

For a variety of reasons, the street-level data used in this analysis is imperfect, and should be used only to indicate the general location of a major employment centers. More detailed data from town or other officials should be gathered in order to fully assess the nonresidential patterns of growth in the town.

2.3.2 Anticipated Nonresidential Growth Patterns

The Town's Comprehensive Plan anticipates that nonresidential development will continue to occur in the existing commercial areas including the Route One area, the Exit 10 area, and the Route 100 corridor including West Falmouth Corner. Most of these areas are serviced with public water.

The Town's current zoning ordinance closely reflects the pattern of nonresidential growth set out in the Comprehensive Plan. Essentially all of the designated areas for commercial and industrial development are already zoned for nonresidential or mixed use.

Area	Establishments		Employment	
	1990	2000	1990	2000
Blackstrap Road	7	10	25	37
Falmouth Road	16	15	93	164
Foreside Road	12	16	327	365
Fundy Road	7	13	49	107
Gray Road	17	29	118	277
Middle Road	8	10	16	108
Northbrook Drive		6		184
Portland North Business Park	4	13	28	123
Us Route One	77	120	1512	2016
Woodville Road		11	D	528
Total Town	293	444	3632	5207

D = Disclosure not permitted

**Table 2-3
Employment Growth 1990-2000**

2.3.3 Implications for the Water Supply

Most of the areas designated for commercial and industrial growth and zoned for nonresidential uses are located within or adjacent to the current water service area. Therefore, nonresidential development as envisioned by the Town will have few, if any, implications for the geographic coverage of the water system.

2.4 Other Considerations Related To The Water System

During discussions with Town staff, other issues were identified that have potential implications for the water system:

Fire Protection Flows - The Falmouth Fire Chief identified concerns with the lack of fire protection water supplies in the Blackstrap, Babbidge Road, and Woodville Road areas.

Groundwater Quality - Staff also identified problems with the quality of the groundwater in the area of Longwoods Road near the town line and in the Indian Way area.

Section 3

Existing and Proposed Future Water Distribution System

3.1 Configuration of PWD’s Water Distribution System

The Portland Water District (PWD) currently supplies water from the Sebago Lake Water Treatment Facility (SLWTF) to eleven communities: Cape Elizabeth, Cumberland, Falmouth, Gorham, Portland, Raymond, Scarborough, South Portland, Standish, Westbrook, and Windham. Additionally, PWD operates a small groundwater system that serves a limited area in the Steep Falls section of Standish, which is not addressed in the CWSSP study.

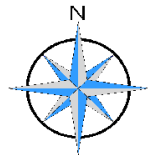
The SLWTF currently supplies water to six service zones. Each zone is designated by the overflow elevation of the primary storage tank in that system. It is important to note that the boundaries of each zone are dependent on several factors including topography, and the District’s service zones are not bound by the municipal boundaries. Figure 3-1 shows the geographic extent of the existing service zones and the proposed future service zones for most of the PWD service area. The zone boundaries identify the extents to which water mains can be extended while maintaining the PWD Customer Satisfaction goals defined as part of the CWSSP process (see Appendix C).

Under the current operating scheme, water is pumped directly from the SLWTF to serve Zone 540 and Zone 510. Water flows by gravity from the SLWTF, through a large diameter transmission system, into Zone 267, which is the largest service zone. From Zone 267, water is pumped (by three separate pump stations) to the three other high service zones: Zone 407N, Zone 407S, and Zone 340. Each service zone has associated facilities such as pump stations and storage tanks. Table 3-1 provides a summary of the communities served by each zone.

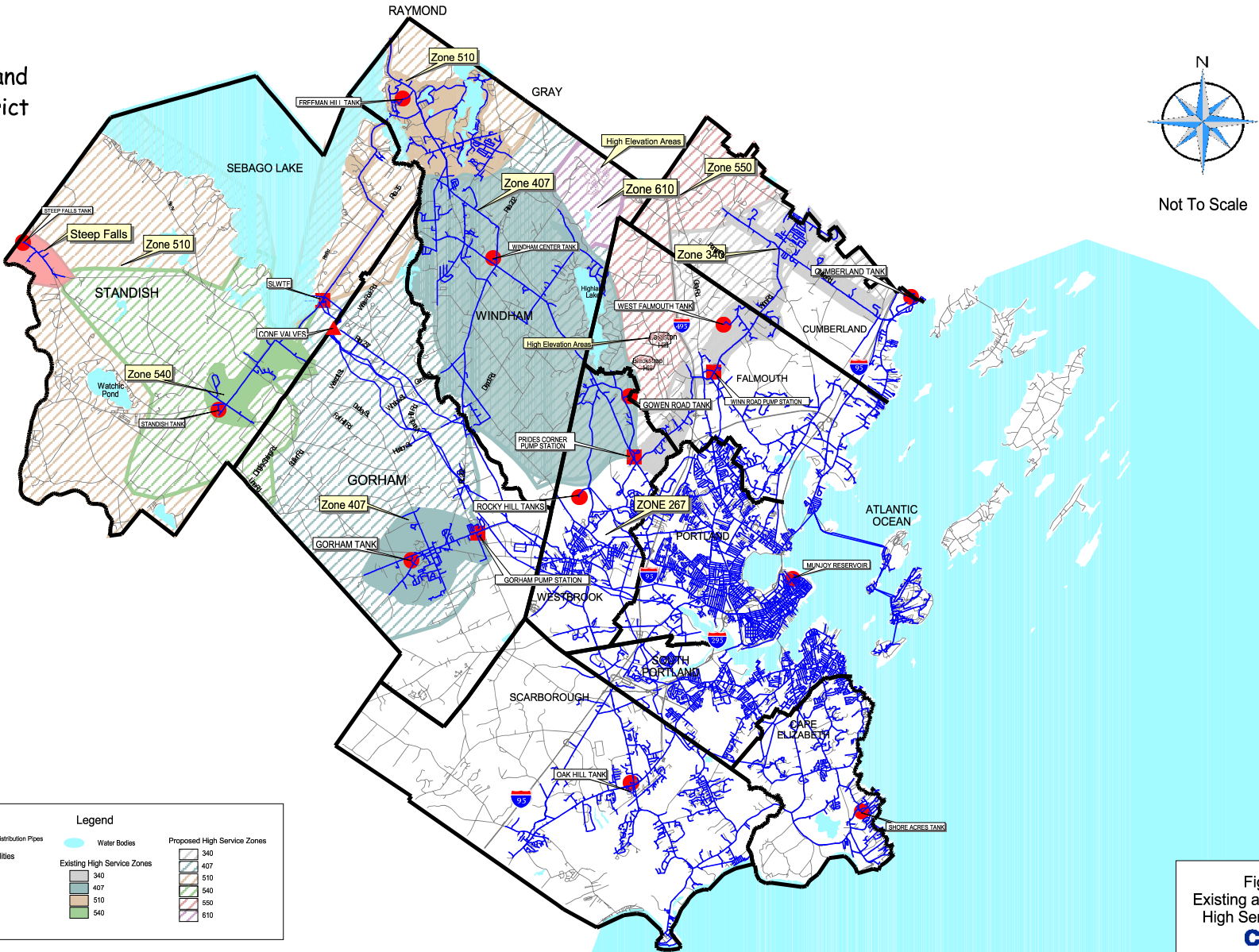
Zone	Communities Served
267	Cape Elizabeth, Cumberland, Falmouth, Gorham, Portland, South Portland, Scarborough, Westbrook
540	Standish
510	North Windham, Raymond, Standish
407N	Windham, Westbrook
407S	Gorham
340	Cumberland, Falmouth

Table 3-1

Summary of Communities Served by Service Zone



Not To Scale



Legend

Existing Water Distribution Pipes	Water Bodies	Proposed High Service Zones 340
Pump Station	Existing High Service Zones 407	Proposed High Service Zones 510
Tank	Existing High Service Zones 540	Proposed High Service Zones 550
Cone Valves	Existing High Service Zones 510	Proposed High Service Zones 610
Streets		
Towns		

Fig. 3-1
Existing and Proposed
High Service Zones
CDM

3.2 Existing Water Distribution System in Falmouth

The portion of the Town of Falmouth within the PWD service area receives water from two zones, Zone 267 and Zone 340. As mentioned previously, the service zones extend beyond the Town boundaries. As such, brief general description of each zone is presented first, and is followed by more detailed description of the facilities and system components in each zone that reside within the Town of Falmouth.

3.2.1 Service Zones

Zone 267

Zone 267 currently provides water to the communities of Portland, South Portland, Scarborough and Cape Elizabeth, in addition to portions of Westbrook, Falmouth, Cumberland, and Gorham. Zone 267 is the largest of the PWD service zones and supplies approximately 90 percent of the total system demand. Water for Zones 340, 407N and 407S is pumped directly from Zone 267. The towns of Yarmouth and North Yarmouth also purchase water from PWD system through interconnections within this zone.

The majority of Zone 267 is located more than 12 miles from Sebago Lake. Large diameter transmission pipes convey water by gravity from the SLWTF to the Zone 267 distribution piping system.

Zone 340

Zone 340 currently provides water service for portions of Cumberland and Falmouth. The Winn Road Pump Station, which draws water from Zone 267, currently serves Zone 340. Originally, areas within the current Zone 340 were served via Zone 267 or from two gravel packed wells located in Cumberland Center. In the early 1990s, PWD combined these separate service areas into a new Zone 340 with the construction of the Winn Road Pump Station and the West Falmouth Storage Tank.

Zone 340 is an elongated 'T'- shaped distribution system, with a single main conveying water north-south along Winn Road and a single main running east-west along Tuttle Road and Blanchard Road.

3.2.2 Distribution Mains and Hydrants

Distribution Mains

There are approximately 73 miles of water distribution mains in the Town of Falmouth. Sixty-two miles of water mains are contained within Zone 267 and the remaining eleven miles of water mains are contained within Zone 340. Table 3-2 provides a breakdown of the water mains by size and total length in each of the two zones in Falmouth.

ZONE 267	
Pipe Size (in.)	Approx. Length (lin. ft.)
1	3,192
2	15,971
4	4,358
6	19,956
8	142,181
10	28,788
12	60,017
14	10,621
20	19,058
24	8,610
30	1,317
36	12,278
42	1,112

ZONE 340	
Pipe Size (in.)	Approx. Length (lin. ft.)
2	1,509
6	718
8	36,665
12	7,724
16	5,040
20	7,898

Total Length = 59,554 lin. ft. (~11 mi.)

Total Length = 327,460 lin. ft. (~62 mi.)

Table 3-2
Pipe Characterization in Zones 267 & 340 in Falmouth

Hydrants

According to the PWD GIS database, there are approximately 338 hydrants located in the Town of Falmouth. Approximately 289 hydrants are located in Zone 267 and approximately 49 are located in Zone 340.

3.2.3 Storage Facilities

Zone 267

There are no storage facilities located within Zone 267 in the Town of Falmouth.

Zone 340

The West Falmouth Storage Tank is a 110-foot diameter, 42-foot high, concrete reservoir with a total capacity of about 3.0 million gallons and an overflow elevation of 340 feet. This tank is located in the central part of Zone 340. The West Falmouth Storage Tank water level generally fluctuates up to 12 feet during the day.

The tank was last inspected in 1997 and was found to be in good condition.

3.2.4 Pumping Facilities

Zone 267

All flow is conveyed by gravity from the SLWTF to Zone 267.

Zone 340

The Winn Road Pump Station supplies Zone 340. This is a relatively new pump station constructed in the late 1980s and is in good condition. The station has two 75-horsepower pumps with connections available for a third pump. The reported design capacity of the existing pumps is approximately 800 gallons per minute, however recent pumping records show that the pumps are able to produce about 975 gallons per minute. PWD reports that the pumps are not run together because of hydraulic restrictions in the distribution system.

The pump station is operated based on water levels in the West Falmouth Tank.

3.3 Proposed Future Water Distribution System

CDM developed a hydraulic model and evaluated PWD's water distribution system facilities (i.e., piping, pumps, and storage) to identify areas of deficiency under several different operating scenarios. Based on this evaluation, CDM and PWD have developed plans to address these deficiencies. This section presents the improvements that pertain to the Town of Falmouth. The discussion is in two sections: Renewal and Replacement Plans, and the Capital Projects List.

3.3.1 Renewal and Replacement Plans

PWD has pursued water main renewals and replacements on an annual basis for many years, and intends to increase these programs. Older unlined cast iron pipe, galvanized pipes and surface mains are among the most frequent targets of the renewal and replacement programs. The existing unlined cast iron pipes in the Town are presented in Figure 3-2. The designation of cast iron mains is based on data from the PWD GIS attribute files that are currently under review.

PWD will be annually evaluating the need for these and other improvements such as smaller looping projects, replacement of small mains, etc., and will annually provide this information in a 5-year Capital Improvements Plan for its planned improvements in the Town.



Portland Water District

Town of Falmouth, Maine



1" = 1 Mile



Legend

Pump Station	1969-1999
Tank	1900-1964
Water Mains	1925-1969
Town Lines	

Fig. 3-2
Unlined Cast Iron
Water Mains
CDM

3.3.2 Capital Projects Lists

Based on the results of the hydraulic analyses conducted as part of CWSSP, CDM and PWD developed a prioritized list of projects to mitigate existing and future deficiencies. The projects were prioritized based on the severity of the existing deficiency, overall benefit to the distribution system, and sequencing of implementation. The projects were categorized as follows:

- Priority I – highest priority improvements, to be scheduled within the next 7 years;
- Priority II – high priority improvements, scheduled for 2011-2015;
- Priority III – longer-term improvements, scheduled for 2016-2020;
- Priority IV – lower priority improvements, scheduled for 2021-2025; and
- Priority V – Low priority improvements due to the limited areas benefited from the recommendations, constructed after 2025.

The projects on PWD’s Capital Projects List that are located in the Town of Falmouth are presented in Figure 3-3. In addition, the fire flow locations, established by the Insurance Services Office (ISO), were modeled and are shown by a hydrant symbol, with red indicating a deficiency. The projects are broken down into three categories as follows:

- Storage Improvements,
- Pumping Improvements, and
- Piping Improvements.

Improvements in each of these categories are described in more detail for each service zone below.

3.3.2.1 Storage Improvements

Zone 267

There are currently no storage facilities planned for or needed in Zone 267 in the Town of Falmouth.

Zone 340

The highest elevation served by the West Falmouth Tank is 240 feet. Accordingly, the tank can fluctuate up to 8 feet and still maintain adequate water pressure at the highest elevations. This tank has adequate storage volume to provide current and future (2020) equalization and fire flow storage volume. No improvements are necessary during this planning period.



1" = 1 Mile



Legend

ISO Fire Flow Locations

- Adequate (Green square)
- Less than Adequate (Red square)

Distribution System Facilities

- Pump Station (Red circle)
- Tank (Red square)
- Water Mains (Blue line)

Capital Projects List - Prioritization of System Improvements

New Pipe	Schedule
Priority I (Red)	2003 - 2010
Priority II (Green)	2011 - 2015
Priority III (Blue)	2016 - 2020
Priority IV (Yellow)	2021 - 2025
Priority V (Orange)	2026 -

Fig. 3 - 3
Water Distribution System
Improvements
CDM

3.3.2.2 Pumping Improvements

Zone 267

This pressure zone is served by gravity and there are no pumping facilities within this zone.

Zone 340

The existing capacity of the Winn Road pump station is about equal to the current maximum day demand for the zone. Accordingly, additional pump capacity will be needed to meet future demands in this zone. To address these pump capacity deficiencies, the pump station needs to be upgraded.

3.3.2.3 Piping Improvements

Zone 267

There are two locations with system pressures during the fire flow simulations in Falmouth that do not meet the recommended goals. The fire flow location is referenced by the nearest intersection and a code in parentheses. Additionally, there were two locations with inadequate system pressure in neighboring communities of Cumberland and Westbrook where improvements are needed in Falmouth.

Gray Road at Eastern Avenue (FM 2)

A fire flow simulation of 2,000 gallons per minute at this location resulted in deficient system pressures in the vicinity of Gray Road, north of Mountain Road. This flow is located on a dead end 12-inch main that is fed exclusively via an unlined 8-inch pipe. This area could be connected to Zone 340. The higher hydraulic gradeline in this zone will meet minimum system pressure requirements under fire flow conditions with no additional piping improvements.

Alternatively, although a more expensive alternative, replacement of the 2,000 feet of existing 8-inch unlined main with a new 12-inch main on Gray Road would also address these pressure deficiencies and meet the fire flow requirements.

Woodlands Drive at Oakmont Drive (FM 8)

This 3,500 gallons per minute fire flow, located in a hydraulically remote and high elevation area of the system, will be deficient under future conditions. This location is currently served by a loop of 10- and 12-inch cement-lined mains.

One option to improve fire flow to this area is to make a connection to Zone 340, as shown on Figure 3-3. This system improvement involves the installation of a pressure reducing valve in the vicinity of Woodville Road and Birkdale Drive, along with approximately 15,000 feet of 16-inch main between Zone 340 and Zone 267. The proposed routing of this pipe is along Woodville Road from Winn Road to Woods Road (the proposed PRV would be located at Birkdale Drive), on Woods Road from Woodville Road to Woodlands Drive, and on Woodlands Drive from Woods Road to Oakmont Drive.

As an alternative (though not shown on Figure 3-3), new mains could be installed parallel to existing mains in this area to meet the fire flow and maintain minimum system pressures. Fifteen thousand (15,000) feet of parallel 16-inch main would be required from Falmouth Road to Middle Road through the side streets including Woodsville Road, Pinehurst Lane and Oakmont Drive to meet the fire flow criteria.

Both alternatives require approximately the same length of new main to improve fire protection at this location. However, the first alternative installs new water main along streets where there is currently no water service. Accordingly, this main would expand PWD's service area and customer base. In addition, the proposed inter-connection with Zone 340 provides the opportunity to improve circulation in Zone 340 when the interconnection is activated.

CDM suggests that PWD review the actual justification for the fire flow requirement at this location to determine if there are other methods to reduce the flow requirement (i.e., sprinklers, etc), in order to reduce the need for significant infrastructure improvements in the area.

Foreside Road (Route 88) at Lantern Lane (CU 9)

With a 1000 gallons per minute fire flow at this location in the Town of Cumberland, the distribution system model indicated pressures that do not meet the recommended goals in a number of areas along Foreside Road, north of the flow location. During model calibration, a significant system constraint was identified in the model, but not resolved in the field. This system constraint was simulated as a closed valve in the Town of Falmouth (on Foreside Road between Casco Terrace and Town Landing Road), which affects the system's ability to meet this fire flow. If this constriction remains, a new 10-inch pipe is required in this area to address the hydraulic restrictions. If the system constraint is identified and eliminated (i.e., local system valves opened), the proposed piping improvement would not be necessary. Accordingly, further field testing should be conducted at this location to identify the hydraulic restriction within the distribution system.

Lunt Drive at Brook Street (WB3)

During a 750 gallons per minute fire flow simulation on Lunt Drive at Brook Street in Westbrook, the model indicated residual pressures in the southern part of Zone 340 that do not meet the recommended goals. PWD has elected to install a new 8-inch diameter main from Nest Street to Brookside Drive to create a loop to address this deficiency.

Zone 340

The piping improvements necessary to address the deficiencies in Zone 340 are located in the Town of Cumberland.

Appendix A

Analysis and Forecasting Methods

1.0 Population Forecasts

Population data for each community was taken from the 1990 and 2000 Censuses. The 2000 Census data used was the redistricting data released in April, 2001. Data is shown for each block group and tract. In order to compute changes from 1990-2000, it was necessary to combine certain block groups into larger groups. All tables in the report show the 2000 block group numbers. Where block groups have been combined, the two groups are shown together.

In forecasting population growth, forecasts for each block group defined by the Census are prepared using four approaches under which the block group's growth rate for 2000-2010 is the same as:

- The block group's for 1990-2000.
- The *town's* growth rate for 1990 -2000
- The *block group's* share of Cumberland County growth in 1990-2000 applied to a forecast of Cumberland County population growth in 2000-2020.
- The *block group's* share of the town's 2000 population applied to the town's share of Cumberland County population growth.

Forecasting approaches 3 and 4 utilize a long term economic and demographic forecast of Cumberland county prepared by the USM Center for Business and Economic Research. The Cumberland county forecast used here is the same forecast used as the base forecast for the municipal traffic forecasts prepared by the Greater Portland Council of Governments for the Portland Area Comprehensive Transportation Study (PACTS). The PACTS forecasts are used for comparison purposes here, although they were prepared using slightly different methods of disaggregating from county to town-level forecasts. The forecasts used here also begin with actual 2000 population as a base year, compared with 1999 estimates for the PACTS forecasts.

The block group forecasts are summed to yield the forecasts for the town population, except in the case of the Portland, South Portland, and Westbrook forecasts shown below. In the case of these cities, forecasts of population were estimated at the city-level only using the rate of population growth 1990-2000 and the city's share of population growth in Cumberland County.

2.0 Residential Growth

The objective of the residential growth trends analysis is to show where residential growth is occurring in relation to the existing water supply network. Locating residential growth in terms of the Census geographic summary units, at the block group level, allows those growth trends to be used in conjunction with the Census data from 1990 and 2000.

Ideally, the most accurate method of determining growth in water service would be to link new building permits in the study period to customer records of active water service (to identify whether the new residential units or business establishment are “in-service area” or “out-of-service area”) and then to use address information in the customer record base to locate each new served structure within the desired geographic summary areas (e.g., Census Block Group). In practice, data to build this type of model does not yet exist.

An approach was developed to utilize existing data. The objective is to match town records of new occupied residential structures to the geographically-located records of the property ownership lots. The key to this methodology is the ability to use the Assessor’s “Map and Lot” identifiers as a matching field to join new building permit data to geo-located tax parcel information to locate each permit.

There are limitations to this approach. First, the match rate between building permit and map/lot locations is never 100% due to continuing updates of the map/lot records. The match rates for towns where appropriate map/lot data is available ranged from a low of 79% for Cape Elizabeth to 95% for both Cumberland and Falmouth, with most rates being in this higher range. We judge these rates to be adequate for estimating the trend in location patterns of growth. No GIS-compatible parcel maps were available for Standish. Suitable parcel maps for Windham had to be constructed from other records. This approach was not needed in Cape Elizabeth, which is entirely within the PWD service area.

The number of units associated with each permit was taken from records (e.g., Duplex, 2 units, Apartments, x units) and the final computation of the proportions of growth in- and out-of-service are based on numbers of **units**, not numbers of permits.

Second, we used a set of assumptions to assign tax lots with permits as being “in-PWD-water-service” or “out-of-PWD-water-service.” The digital location of permits within the District’s network of water service is itself a “proxy” for counting each customer by actual hookup or account. Working with PWD Technical Services, a parcel was considered “in-service” for this analysis if one of the following two conditions is met:

- The parcel is within, or intersects, the Water Service Area as defined by the PWD’s own geographic model of their network or
- The parcel is within 300 feet of a water main.

Updated water main data was added to this analysis during the project period. Not all of these assignments will be classified 100% correctly as with any proxy method. The bias in this approach is to over-classify new residential growth as having PWD water service, and thus it is a conservative estimate from a growth management standpoint.

Because Block Group boundaries are not congruent with tax parcels, the assignment of parcels to Block Groups resulted in a small number (10-40) of parcels split into two or more Block Groups. These records were manually edited so that the parcel was assigned to the Block Group that represented the dominant location for the property, e.g., the location of the street frontage and/or water main, or the larger part of the parcel when no significant “fragments” were created.

Finally, the analysis is limited to new residential growth from 1990-99. The cut-off in 1999 was in recognition of the need for year 2000 updates of digital parcel data in all of the towns (although some updates through April 2000 occurred for some towns). The 1999 cutoff assures more comparability and reliability of the data that was used, and indeed this was reflected in somewhat better match rates than when year 2000 permits are included.

Appendix B

Detailed Town Data

Table and Figure Legend

Table B-1	Cape Elizabeth Population Forecasts
Figure B-1	Comparison of Forecasting Methods of Cape Elizabeth Population
Table B-2	Cumberland Population Forecasts
Figure B-2	Comparison of Forecasting Methods of Cumberland Population
Table B-3	Falmouth Population Forecasts
Figure B-3	Comparison of Forecasting Methods of Falmouth Population
Table B-4	Gorham Population Forecasts
Figure B-4	Comparison of Forecasting Methods of Gorham Population
Table B-5	Scarborough Population Forecasts
Figure B-5	Comparison of Forecasting Methods of Scarborough Population
Table B-6	Standish Population Forecasts
Figure B-6	Comparison of Forecasting Methods of Standish Population
Table B-7	Windham Population Forecasts
Figure B-7	Comparison of Forecasting Methods of Windham Population
Table B-8	Housing Permits by Town 1990-1999 and Distribution Inside and Outside of the Portland Water District Service Area

Replace these pages with the color charts and plans.

**The original files reside with Portland Water District.
CDM received only a hard copy of this appendix.**

These pages are available upon request.

Appendix C

PWD Customer Satisfaction Goals

**Table One
Customer Satisfaction Goals**

Hydraulic Sufficiency	
Adequate domestic and fire flows at reasonable sustainable pressures and no negative system pressure under emergency conditions	
Fire flow:	Minimum ISO standard for flow and duration
Pressure:	<ul style="list-style-type: none"> • Design for 40 p.s.i. • Minimum allowable any where is 20 p.s.i. • Maximum fluctuation under normal operations is 10 P.S.I.
Head loss:	<ul style="list-style-type: none"> • Design for < 3'-5'/1000'. • Evaluate for sufficiency if >8'/1000'.
Storage:	<ul style="list-style-type: none"> • Meet ISO duration for fire flow. • Meet peak hour and day demand • Provide sufficient storage to meet operational emergencies.
SYSTEM RELIABILITY GOALS	
Domestic and fire flows meet regulatory requirements and are delivered at necessary pressure without interruption.	
Leaks	< 15/100 miles of main
Customer Outage Index	< 15 hr./1,000,000 hr.
Emergency Response Plan	reviewed annually
Regulatory Goals	
Compliance with all Safe Drinking Water Act requirements and proactively address all future regulations	
Rule	Requirements
Surface Water Treatment Rule	Maintain Filtration Waiver <ol style="list-style-type: none"> Maintain Source Water Quality - <20 fecal, <100 TC Maintain Watershed Protection Program Maintain CT Minimum 0.2 Cl₂ residual at entry point Detectable Cl₂ residual in system Turbidity <5.5 tu – no more than 2 exceedances in 12 months or 5 exceedances in 120 months. No waterborne disease outbreaks Pass annual sanitary survey
Total Coliform Rule	<ol style="list-style-type: none"> <5% positive samples per month No confirmed E.coli and +coliform upstream or downstream
Lead/Copper Rule	Optimized – <ul style="list-style-type: none"> • 90th percentile <15ppb • maintain water quality parameters • pH - >7.5 entering system - 6.5 in system • PO₄ - >2.75 entering system - >2 in system
Fluoride Rule	>1 mg/l - <2.0 mg/l
Microbial/Disinfectant-Disinfection By-products	THM – 0.08ppm HAA - 0.060ppm Bromate – 1ppm
Long term 1 Enhanced SWTR	Monitoring Cryptosporidium in Unfiltered System
Long term 2 Enhanced SWTR	May require watershed -based treatment

**Table Two
Water Quality Goals**

<p>The customer has every expectation that the water that they consume is free from microbiological and chemical contaminants. It must also be aesthetically pleasing and wholesome. The following goals will satisfy that expectation and result in a higher level of customer satisfaction.</p>		
Criteria	Long-term Goal	Target
1. Maximum water quality complaints (T&O, discolored water) per year	0	Reduce by 25% from previous year
2. Chlorine residual minimum at representative sampling sites	0.4 PPM	0.2 ¹
3. Maximum Total Coliform positive samples per year	2	5
4. Maximum detention time in distribution system	100 hours?	200 hours? ²
5. Comply with LCR	100% tier one sites <15 ppb	90 th percentile <15 ppb
6. Maintain active cross connection control program	No incidences of backflow	No incidences of backflow
7. Control nitrification and microbial re-growth in distribution system	1) NO ₂ -N < 25 ppb 2) HPC a) <200 on PC b) <2000 on R2A	

¹ Maintain trace levels at dead ends of distribution system

² Minimum time will be determined without detention in storage tanks.