Fact Sheet

Water Use Efficiency Rule

Goal Setting and Performance Reporting Requirements

July 2007
DOH PUB. #331-305
(Update)

Background

One of the three elements of the water use efficiency rule is water use efficiency goal setting and performance reporting. Municipal water suppliers must set water use efficiency goals through a public process and report annually on their performance to customers and the Department of Health (DOH), and also make this information available to the public.

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Getting Started
Water Use Efficiency Guidebook

Water Use Efficiency Goal Setting

All municipal water suppliers with 1,000 or more connections must set their initial water use efficiency goals by January 22, 2008, or by January 22, 2009 for water systems with fewer than 1,000 connections. These water use efficiency goals must be set through a public process and re-evaluated at least every six years. Municipal water suppliers may use their existing public processes as long as they meet the requirements of the rule.

All municipal water suppliers need to set water use efficiency goals and record these goals in planning documents and performance reports. When setting water use efficiency goals, the municipal water supplier must:

- Include a measurable outcome in terms of water production or consumption (for example: reduce peak production volumes by five percent, maintain current single family residential use, and reduce leakage from 30 percent to 10 percent).
- Address water supply and forecasted demand characteristics.
- Include an implementation schedule for meeting the goals.

Performance Report

All municipal water suppliers must report annually (by July 1) on their water use efficiency performance to customers and DOH, and also make this information available to the public. Municipal water suppliers may fulfill the reporting requirement to their customers and the public by including performance information in their consumer confidence report (an annual water quality report mailed to customers).

When reporting annually to DOH, municipal water suppliers must use the *Annual Water Use Efficiency Performance Report Form*, DOH Form #331-376.

Performance reports need to include the following elements:

- Annual water system production total.
- Annual distribution system leakage information. If a municipal water supplier is not fully metered, then it needs to report annually on its progress toward installing meters on all service connections (see Fact Sheet *Distribution Leakage Standard,* DOH Pub. #331-304 for more details).
- A description of the water system's water use efficiency goals and progress toward achieving those goals.

Performance Reporting Schedule

For municipal water suppliers with 1,000 or more connections, the initial performance report is due July 1, 2008.

For municipal water suppliers with fewer than 1,000 connections, the initial performance report is due July 1, 2009.

For More Information

If you have any questions about the water use efficiency rule, please contact:

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Additional information can be found on the Web at:
http://www.doh.wa.gov/ehp/dw/municipal_water/water_use_efficiency_rule.htm

It's Worth Saving
Drinking Water

Section 1
Description of Water System

The City of Port Townsend's municipal water is supplied by gravity from the Big and Little Quilcene Rivers. The existing surface water system has been in operation since 1928, making it one of the oldest water systems in Washington State. In addition to serving the residents of the City of Port Townsend, the system provides water to the Port Townsend Paper Company, the Glen Cove area to the south of the City, the unincorporated rural area just to the west of the City, and wholesale water to Public Utility District No. 1 of Jefferson County (PUD) for its use in supplying the South Hastings Loop. The City provides water for approximately 4,300 connections and has a service area that varies from the densely developed downtown to undeveloped open space. The City is designated as an Urban Growth Area and is expected to absorb much of the future development in eastern Jefferson County.

In 2002, the City of Port Townsend exchanged the Tri-Area ground water system and service area for the PUD's Glen Cove service area, which was served with surface water wholesaled from the City. The City now serves the Glen Cove area retail customers. In addition, as part of the exchange, the City acquired a small ground water system (Discovery Grove #1 System ID 036695) serving 12 lots adjacent to Glen Cove. Discovery Grove #1 is an independent group B system that has no connection to Port Townsend's surface water system.

1.1 Ownership and Management

The City of Port Townsend (City) owns and manages its water system for typical municipal purposes that include residential, commercial, industrial, and government uses. The Washington State Department of Health (WSDOH) water system identification number for the City's municipal system is 69000R.

The Water Operations Manager within the Public Works Department oversees the City's water system. The Water Operations Group is comprised of two sub-groups, one of which focuses on water quality and treatment issues (the Water Quality Group) and the other that focuses on distribution system related issues (Water Distribution Group). Day-to-day maintenance and operations are executed by the Water Distribution and Water Quality Groups. Water system planning, design, and other non-routine management of the water system are addressed by engineering staff within the Public Works Department. A copy of the City's Water Facilities Inventory (WFI), a document filed with WSDOH identifying major facilities and water rights, is presented in Appendix A.

Since it is a surface water system, a key component of the City's water system is the watershed. Most land in the municipal watershed is managed by the Forest Service. In order to ensure that the watershed continues to provide high quality source water to the City, the City and the Forest Service have entered into an agreement in which both parties

outline their responsibilities in the Watershed Protection Program. A copy of this agreement can be found in Appendix B and is further described in Section 5.

1.2 System Background

The City's isolation at the north end of the Quimper Peninsula, in the rain shadow of the Olympic Mountains, made it necessary early in the City's history for community and industry leaders to look further to the south for sufficient water supply. A summary of the history of the City's water system, its geographical and climatic setting, and its spatial relationship to nearby water systems are presented in the following subsections.

1.2.1 History of Water System Development and Growth

The Spring Valley Water Company (SVWC) supplied the City of Port Townsend with water in the late 1800s and the early 1900s. The SVWC's original water supplies were springs near the pond at F Street and San Juan Avenue near the existing Golf Course. The SVWC later began development of a diversion on Snow Creek, just west of Crocker Lake, as additional water was needed for growth. The City acquired the SVWC in 1904 and finished construction of a wood stave pipeline and diversion in 1906. Snow Creek served as the City's water supply until 1928 when construction of the Crown-Zellerbach Kraft paper mill (now Port Townsend Paper Company) created water demands that far exceeded the capacity of the Snow Creek supply system.

To accommodate the demands from the Mill, the City applied for and received water rights to the Big Quilcene and Little Quilcene Rivers, and the City and Crown-Zellerbach cooperatively undertook the Big Quilcene diversion project. Wood stave pipe ranging in diameter from 20 to 30 inches was constructed from a timber crib diversion structure on the Big Quilcene River to the City. In the 1950s, the wood stave pipe was replaced with steel pipe. The existing 28.5-mile pipeline from the Big Quilcene River diversion to the City is comprised mostly of 30-inch diameter steel pipe with some shorter sections of 24-, 28-, and 36-inch diameter steel pipe. This supply pipeline, which is known as the Olympic Gravity Water System (OGWS), is shown in Figure 1-1.

The City and the Mill developed the Little Quilcene River in 1956 as a supplemental supply to the Big Quilcene River supply. A timber crib diversion dam was constructed on the Little Quilcene River along with a 20-inch diameter steel pipeline to covey water by gravity to Lords Lake Reservoir, which was also constructed in 1956. A 20-inch diameter pipeline connects Lords Lake to the 30-inch diameter OGWS. The Little Quilcene River timber crib diversion was replaced in 1995 with a concrete diversion structure.

The City owns all of the diversion, reservoir, and transmission facilities associated with the OGWS as well as the water rights. A 1956 lease agreement, amended in 1983, between the Mill and the City permits the Mill to use the OGWS supply at no cost in exchange for payment of the debt service on the bond, which funded the 1950s improvements, and for operating and maintaining the pipeline and diversion structures. City staff operates the chlorine system at City Lake and the water system within the City.

1.2.2 Geography and Climate

Port Townsend is located approximately 50 miles northwest of Seattle at the tip of the Quimper Peninsula and covers approximately 4,652 acres. The city is bounded by Port Townsend Bay to the south, Admiralty Inlet to the east, and the Strait of Juan de Fuca to the north. Unincorporated Jefferson County lies to the west.

The City's service area lies within the Puget Sound lowlands on the Quimper Peninsula in eastern Jefferson County. The Quimper Peninsula is a smaller peninsula extending into Admiralty Inlet from the larger Olympic Peninsula. The Olympic Mountains are located to the west and southwest and are the source of numerous river systems.

Regional landforms have been shaped by historical glacial periods. The Puget Sound lowlands are essentially a glacial drift plain with underlain soils deposited by advancing and retreating glacial ice. At least four separate glaciers have invaded the Puget Sound lowlands, leaving behind a complex series of sediments up to 2,000 feet thick.

The Quimper Peninsula is generally characterized by wooded rolling hills that trend north-south. Ground surface elevations on the peninsula range from sea level to approximately 500 feet. Steep, wave-cut bluffs along Discovery Bay, the Strait of Juan de Fuca, and Puget Sound are common. Indian and Marrowstone Islands are consistent with the general topographic features of the adjacent peninsula.

The northern end of the Quimper Peninsula, in the rain shadow of the Olympic Mountains, does not typically receive the heavy precipitation common in other parts of the Olympic Peninsula and Puget Sound lowlands. The majority of the City's annual precipitation, mostly in the form of rain, occurs in the winter months, when most weather patterns pass over the City from the south. The City's average annual minimum and maximum precipitation are approximately 12 inches and 27 inches, respectively while average annual precipitation is about 18 inches. Average annual precipitation in the northern portion of the municipal watershed is less than 50 inches. Southward toward the Tunnel Creek drainage average precipitation increases to 75 inches in the vicinity of Mt. Constance. Annual rainfall at the Big Quilcene diversion, between 1950 and 1980, ranged from a low of 36.76" in 1976 to a high of 86.29" in 1966, averaging 68.28".

1.2.3 Neighboring/Adjacent Purveyors

The City's service area and those of nearby water systems are shown in Figure 1-2.

1.3 Inventory of Existing Facilities

The main facilities of the City's water system are summarized in Table 1-1 and shown in Figure 1-3. This section provides a brief description of the facilities.

The City water system is supplied from unfiltered surface water from the Big Quilcene and Little Quilcene Rivers. This supply is located approximately 30 miles south of the City. The

City has a close working relationship with the United States Forest Service, which manages most of the watershed land.

The Big Quilcene River is the primary water supply for the City. Water from the Little Quilcene River diversion is used to fill Lords Lake, which has a capacity of approximately

Table 1-1
Summary of Main Water System Facilities

Facility	Year Built	Description/Size	Elevation (feet)	Capacity	Construction Materials
Supply					
Big Quilcene River Diversion	1928	Timber crib diversion	1,023 (overflow)	19.4 mgd	Timber
Little Quilcene River Diversion	1956 Rebuilt 1995	Concrete diversion	1,050 (overflow)	6.2 mgd	Concrete
Lords Lake	1956	Earthen dam	920 (overflow)	500 mg	Natural
City Lake	1906	Earthen dam	610 (overflow)	120 mg	Natural
OGWS	1928 rebuilt 1950s	Steel pipeline from the Big Quilcene River to the City	Varies	Approx. 20 mgd	Steel
Treatment					
Chlorination at City Lake	1928	180 lbs per day feed capacity (150-lb Cylinders)		180 lb/day	--
Distribution System Storage					
5-mg Reservoir	1979	38 feet tall by 155 diameter	328 (overflow)	5 mg	Concrete
1-mg Standpipe	1994	84 feet tall by 47 feet diameter	375 (overflow)	1 mg	Steel
Morgan Hill Reservoir (not in use)	1910	2 in-ground, uncovered, concrete lined reservoirs	280 (overflow)	5 mg	Concrete
Distribution System Pumping					
Morgan Hill Booster Station	2004	2 domestic flow pumps (1 service, 1 standby), 3 high flow pumps (2 service, 1 standby), emergency power, serving closed distribution system with 2,000 gallons of storage		100 gpm each (domestic), 550 gpm each (high flow)	

500 million gallons. Lords Lake can also be filled from the Big Quilcene Diversion. The City's surface water supply is high in quality with generally very low turbidity. When the Big and Little Quilcene Rivers experience high-turbidity events, the City and PTPC use water stored in Lords Lake or City Lake. The entire system operates by gravity from both of the diversions, to Lords Lake, City Lake, and the City. City Lake functions as a raw-water-equalizing reservoir with approximately 120 million gallons of storage.

The OGWS pipeline is capable of transporting approximately 20 mgd to City customers and the Port Townsend Paper Company. An intertie at the southern City boundary divides the flow between the City and paper mill. Through a long-term contract between the Mill and the City, PTPC operates and maintains the OGWS pipeline and diversion in exchange for receiving use of the water. The City is allocated a maximum rate of 7.74 cfs (5 mgd). Of this, a maximum of up to 1 mgd is allowed to be allocated by contract to the Tri-Area. In the

event of a water shortage, the City is given first priority for the available water and the Mill must cut production or conserve water to deliver the contracted volumes of water to the City.

Water from City Lake flows through a mesh screen, which prevents large objects from entering the OGWS pipeline below City Lake. Chlorine gas is injected as a disinfectant into the OGWS pipeline just below City Lake. Chlorine is fed from 150-lb cylinders at a dosage up to 1.2 mg/L through a gas chlorinator/injector system. Automatic switchover and leak detection is provided for the feed system. The feed rate of the City's chlorine system at City Lake is controlled manually. Significant changes in flow rate in the OGWS must be accompanied by a manual change of the chlorine feed rate. Maintaining steady OGWS flows allows the Mill to operate a hydro-turbine generator and actual plant usage to fluctuate without impacting the total combined flow to the City and the Mill and ensures consistent chlorine residuals are maintained. During periods of low flow in the Big Quilcene River, PTPC shuts off the power generation, saving approximately 2.0 mgd, reducing the need to draft from Lords Lake, and preserves the instream fisheries. Chlorine residual monitoring is provided just downstream of the City Lake injection point, at Four Corners, and at the CT station by the City's reservoirs.

Chlorine residual, flow, pH, and temperature are monitored at the CT station. The chlorine feed rate is generally constant as flows to the Mill and City are normally maintained at a uniform rate.

The City operates two storage reservoirs: a 35-foot tall, 5-million gallon concrete reservoir that serves the City's low elevation zone and an 84-foot tall, 1-million gallon steel standpipe that serves the City's high elevation zone. Both reservoirs have baffles to increase the contact time in the reservoir to meet CT requirements.

The City has approximately 100 miles of distribution system pipelines and 4400 customer connections in its service area. Much of the distribution system, including nearly all of the larger-diameter pipelines, is constructed of asbestos cement. The majority of the remainder of the piping system is constructed of polyvinyl chloride (PVC). The Morgan Hill booster pump station, constructed in 2004, has 2 domestic flow pumps (1 service, 1 standby), 3 high flow pumps (2 service, 1 standby), emergency power, which serves closed distribution system with 2,000 gallons of storage.

The City has complied with water quality testing requirements for asbestos in the water system, demonstrating that concentrations are below the required standard. However, asbestos cement pipelines have been shown to be susceptible to deterioration in less time than other pipelines constructed of more durable materials. Thus, there is some concern that the City's aging asbestos cement pipelines may need replacement, particularly the smaller 4" lines.

The Tri-Area system, formerly owned and operated by the City of Port Townsend, is supplied by groundwater from the Sparling Wells and treatment facility. However, it is possible to supply the system with water from the OGWS through the Four Corners intertie connection in case of emergency (Figure 1-3). The capacity of this connection is approximately 0.8 mgd. The OGWS water does not have the required chlorine contact at

this location; thus, supplying the Tri-Area in this manner could only be implemented on an emergency basis with WSDOH approval.

1.4 Related Plans

The following sections inventory and summarize the major planning documents that impact the City's water system.

1.4.1 1996 City of Port Townsend GMA Comprehensive Plan

The City adopted its Comprehensive Plan by Ordinance No. 2539 in July 1996. The plan was prepared to comply with the GMA and includes policies and strategies for land use, housing, capital facilities, utilities, transportation, and economic development. As a result, other City plans, policies, and regulations must be consistent with the Comprehensive Plan. Future water system needs are based on the land use plan in this document. By Ordinance No. 2842, the City fully implemented the Revision 1.9 of the land use map through adoption of a zoning map and new zoning regulations.

The City's GMA Comprehensive Plan states that it will provide water service as prescribed by the plan. Utilities such as wastewater and stormwater will provide service as prescribed in their respective planning documents. The Water System Plan was developed in concert with the vision, policies, goals, and objectives of the GMA Comprehensive Plan.

1.4.2 1996 Jefferson County Coordinated Water System Plan Update

In 1983, the Jefferson County Board of Commissioners declared Jefferson County as a Critical Water Supply Service Area (CWSSA). The Water Utility Coordination Committee (WUCC) was formed to oversee the development of recommendations for individual utility plans and a countywide program for coordinated management of water supply within Jefferson County. The first Jefferson County CWSP was completed in 1986. The CWSP provides a framework for coordinating water service by the various providers in the County. Individual water system planning documents for each purveyor within the CWSSA must conform to the regional framework established by the adopted CWSP. The Public Water System Coordination Act (Chapter 246-293 WAC) requires a review and update of the CWSP every 5 years, or sooner if necessary. Jefferson County, the City, and the PUD have jointly funded the update of the 1986 CWSP.

In 1993 a draft CWSP was released for review. The WUCC was reorganized and officially designated by the Board of County Commissioners. The 1993 draft became the basis of the 1996 CWSP. The 1996 CWSP was approved by the WUCC on November 27, 1996, and by the DOH on May 12, 1997. The WUCC has met periodically to update the currently approved CWSP service areas and make several policy changes. Jefferson County has been the lead agency for WUCC planning since 2002.

1.4.3 1994 Dungeness/Quilcene Water Resources Management Plan

The Dungeness/Quilcene (D/Q) Plan, completed in June 1994 and approved by the Washington State Department of Ecology (Ecology) in September 1994, contains recommendations for water resources management for the region and specifically for Clallam and Jefferson Counties. The D/Q Plan was produced in accordance with the Chelan Agreement over the course of 3 years with caucuses representing agriculture, business, the environment, fisheries, recreation, and local, state, and tribal governments. The D/Q Plan recommendations are presented in Appendix C. Recommendations relating to conservation, instream flow, habitat restoration, and groundwater withdrawal could eventually become components of government policy.

1.4.4 Jefferson County Water Resources Council

The Jefferson County Water Resources Council was formed in recognition of the complexity of water issues in east Jefferson County, to build relationships, to set priorities, and to solve problems related to water resource issues. The purpose of the council was to provide a collaborative forum for coordination and cooperation among all interests, while avoiding duplication with other groups. The council was an advisory body to established decision-making bodies and communities of interest. As such, the council made recommendations concerning the use, protection, restoration, and enhancement of the water resources of east Jefferson County. The council's tasks included development of implementation strategies based on the recommendations of the Dungeness/Quilcene Water Resources Management Plan and supporting a balance of economic, cultural, and environmental interests in the management of the water resources in east Jefferson County.

The City was a charter member of the council and provided the sole source of funding for coordination and facilitation from 1995 to late 1996. In August 1996, the City entered into an MOU with the PUD to share coordination funding. Jefferson County itself became a participating member of the council in early 1998 . The council has not been active since the establishment of the WRIA-17 Planning Unit in 1998.

1.4.5 2005 Water Resource Inventory Area (WRIA)-17 Watershed Plan

The Washington State Legislature passed HB2514, the Watershed Management Act of 1998. The purpose of the Watershed Management Act was to provide a framework for addressing water quality, water quantity, and salmon habitat issues at the local level. The Act provided grant funding to Planning Units, which are councils of governmental and non-governmental entities, to determine the status of water resources in a watershed; and resolve the often-conflicting demands for that water, including ensuring that enough water is available for salmon. Each Planning Unit is responsible for a specific geographic area, called a Water Resource Inventory Area, or WRIA. The WRIA boundaries are established in the state's administrative code. The goal of the WRIA 17 Planning Unit was to create a watershed plan that addressed water quantity, water quality, instream flows, and habitat, using the Dungeness-Quilcene Plan as a foundation. A summary of the WRIA-17's Watershed Management Plan is provided in Appendix D.

To support development of the watershed plan, the Planning Unit commissioned a technical assessment of the watershed using grant funding from the Department of Ecology. The technical assessment, completed in 2000, summarized existing scientific information about the watershed, focusing on four topics of interest to the Planning Unit – water quantity, instream flows, water quality, and habitat. A number of additional studies were initiated to assist in the development of instream flow recommendations for streams in WRIA-17. A consensus of Planning Unit members forwarded minimum flow recommendations to the Department of Ecology in 2005.

1.4.6 1998 Comprehensive Water System Plan

The City's 1998 Comprehensive Water System Plan was prepared by CH2M HILL and approved by DOH. The plan provided a review of the existing water system, an analysis of its hydraulics, recommendations for system improvements, and a plan for meeting federal and state requirements.

1.4.7 2004 Jefferson County Comprehensive Plan and Unified Development Code

Jefferson County adopted its first post-GMA Comprehensive Plan in 1998, substantially updating and revising it in 2004. The Plan includes policies and strategies for land use, housing, capital facilities, utilities, transportation, economic development, and natural resources and environment. The Unified Development Code (UDC) came into effect in January 2001 as the set of regulations that implement the Comprehensive Plan. Policies, regulations, and maps were adopted for the Irondale and Port Hadlock Urban Growth Area (UGA) in 2004, which has since been contested before the GMA Hearings Board. To the extent the City has long-term excess capacity to serve out-of-city water demands, the City water service outside the city limits must not be inconsistent with the adopted land use ordinances, plans, and development regulations of Jefferson County.

1.5 Existing Service Area

The City's water service areas are shown in Figure 1-4. The City service area incorporates all areas within the City limits and adjacent lands west to and south of the City as described below. Area between the City limits and North Jacob Miller Rd. extending south, excepting property tax parcel numbers 001084020 and 001084021, continuing west along the County Landfill Rd incorporating parcel numbers 001083012, 001084025 and 001172002. The western boundary continues following along and including parcel numbers 992200401, 992200501, then shifting east to include parcels 001171011, 001171029, 001171028, 001171017, 001171012, 963303905, 963303904, 963303903, then extending west including the area bounded by parcel numbers 963600101, 963600601, 963600701, 963601201, 963601301, 963601801, 963601901, 963602401, 963602301, 001173011, 001173010, 001173009, 001173008, 001172007, 001172006, 001172003, 001173005, 001173018, 001173015, 001173011, 001174021, 001174016, 001174015, 001174017, 001174018, 963304301, 963303204, 963303202, 963303104, 963303102, then the western boundary extending south and including parcels 948600101, 948601401, 948601501, 948602084, 948602801, 948602906, 948602901, 948604203, 001212008,

001212009, 001212034, 001212001, 001212017, 001212002, 001212005. The southern boundary of the service area extends along Old Fort Townsend Rd. to and including parcel 001222002. . This area west of the city limits is currently zoned rural by the County and is not expected to be designated as an Urban Growth Area (UGA) in the near future. The area to the south, Glen Cove, is the unincorporated part of the City's UGA. See Appendix E for a copy of the Jefferson PUD Agreement.

An agreement and two resolutions related to the City's service area are presented in Appendix P. These documents, in some cases, describe actions that have already transpired such as transference of ownership of the Tri-Area system to Jefferson PUD and the Glen Cove system to the City. These documents, adopted in 1996, serve as the basis for establishing service area boundaries, provision of service, and related water service issues under which the City continues to operate. Resolution 93-072, referenced as Attachment B from the Agreement in Appendix P, is not included because it relates to Tri-Area service area boundary issues that no longer apply.

The City is not actively seeking to extend service beyond the City limits and the current areas outside the City limits it already serves. The City's main planning focus is ensuring that water system infrastructure is adequately sized to meet growth within the existing service areas.

1.6 Land Use Zoning

Current land use for the City consists of a mixture of residential, mixed use, commercial, industrial, public facilities, parks, and open space. A land use map is presented in Figure 1-5. Descriptions of the zoning categories are provided in the City's and County's GMA Comprehensive Plans. Copies of these descriptions are provided in Appendix F.

The City's historical land use pattern was established during the 1800s. During this period, plats were created with almost no regard to the topography or other natural physical limitations of the land. The result of this platting activity is a largely uniform series of approximately 11,100 parcels, typified by the 50-foot by 100-foot lot.

Land use and zoning for all other service areas outside of the city limits are within the jurisdiction of Jefferson County.

1.7 Future Service Area

The City's future service area is limited to infill within the existing service area. There are no plans for expansion of the City boundaries or its service area, other than possible minor corrections to include parcels already served outside the existing service area.

1.8 Service Area Agreements

Along with the City of Port Townsend and the PUD's exchange of water systems in 2001, both adopted revisions to their respective service areas. Appendix E and Figure 1-2 outline the current service areas.

1.9 Service Area Policies

The City manages its water utility in accordance with water system policies that govern various aspects of water utility operations. These policies are presented in Appendix G.

The City's water utility policies were prepared with guidance from the Water Advisory Committee and represent a consensus of a variety of opinions and perspectives. The policies provide the framework for the development of this plan, and provide guidance for directing the City's water service. Establishment of these policies was necessary to provide uniform treatment of all water utility customers and to document the basis for service for current water system customers and those considering service from the City. The City's water utility mission is: "The water utility is committed to providing a safe, reliable supply of high quality water, and responsive service to its customers."

1.10 Conditions of Service

It is a requirement of the City of Port Townsend that all new development within the City limits must connect to the city water system. Wells for domestic use are prohibited. In the out-of-city service area the city has the right of first refusal regarding water service. If the City elects not to provide water service, the applicant may seek service from another service provider in accordance with the adopted Coordinated Water System Plan (CWSP). City water service shall not be provided outside the city's currently adopted service area, unless a prior contractual obligation exists committing the city to provide service. Contractual obligations include service to the Port Townsend Paper Company and Jefferson County PUD for LUD #3 (see Appendix W).

1.10.1 City Responsibility

The city shall own all water mains, service connections and appurtenances in public streets or utility rights-of-way or easements to the property owner's side of the water meter. The person responsible for construction of such utility lines shall relinquish all interest in the ownership of such lines upon acceptance by the city.

1.10.2 Customer Responsibility.

The ownership and responsibility for the maintenance of individual service pipe extensions from the meter to the premises served shall be that of the owner of the premises served and the city shall not be liable for any part thereof. (Ord. 2579 § 1, 1997).

1.10.3 Connection fee schedule

Water system development charges are set forth in Port Townsend Municipal Code chapter 13.03.

1.10.4 Meter and materials specifications

Material specifications for meters, pipe, fittings, valves, hydrants and other miscellaneous water system materials is available in chapter 2-10 of the Port Townsend Engineering Design Standards.

1.10.5 Consent agreements for inspection, maintenance, and repair activities which may disrupt water service

All water system installations shall be inspected and approved by the City. All piping, pumping, storage, and other facilities shall be located on public rights-of-way or dedicated utility easements. Utility easements must be a minimum of 20 feet in width, and piping shall be installed no closer than 5 feet from the easement's edge unless approved by the city. Easements/rights-of-way for multiple utilities shall be a minimum of 25 feet wide.

Any person with an existing service connection or applying for a service connection to the city's water system shall be deemed to have freely and voluntarily consented to entry by authorized city employees with proper identification, at reasonable hours of the day and upon advance notice to the occupant, onto all parts of the premises or within buildings for the purpose of inspecting the water system construction and/or checking conformity to these regulations and the engineering design standards manual. All other right of entry by city employees shall be governed by the procedures of Chapter 20.10 PTMC. (Ord. 2579 § 1, 997).

1.10.6 Cross-connection control requirements

Cross connections to the City's water system are prohibited. Cross connection control shall be in accordance with WAC 246-290-490 et seq and the Accepted Procedure and Practice in Cross Connection Control Manual -- Pacific Northwest Section of the American Water Works Association, latest edition. Service connections shall conform to the standard detail drawings in this chapter and to WSDOT/APWA Standard Specifications Section 7-15.

1.10.6 Late-comer pay back provisions

Conditions for utility latecomer agreements are outline in the Port Townsend Municipal Code chapter 13.04.

1.10.7 Developer extension requirements, design standards, financing responsibilities, or professional engineer design required

Any extension of the Port Townsend Water System must be approved by the Public Works Department and all extensions must conform to these standards, the Port Townsend Water System Plan, the rules and regulations of the Department of Health (Chapter 246-290 WAC), the Port Townsend Fire Department requirements, and the Washington Surveying and Rating Bureau (ISO). In designing and planning for any development, it is the developer's responsibility to see that adequate water for both domestic and fire protection use is attainable. The design of a water system extension is the responsibility of the Developer proposing the construction and upgrading of the public water system.

All applicants for water system connections and improvements shall furnish drawings and specifications necessary to describe and illustrate the proposed water system improvements. If base maps prepared by a licensed land surveyor are available, the design and construction plans shall be submitted on such maps. If base maps are unavailable, the public works director may require a survey to avoid conflicts with existing facilities, to determine elevations and contours, and to determine the right-of-way for utility placement.

- All plans for main extensions and water system improvements shall be prepared, signed and stamped by a civil engineer licensed in the State of Washington.
- For main extensions and replacements of 260 feet (one city block) or less in Tier 1 which do not require engineered plans under another authority of the PTMC, the developer has the option of the city performing the engineering for the fee identified in Chapter 3.36 PTMC. Alternatively, the developer may pay for his or her own engineering with the full cost to be borne by the developer.
- All design and construction plans and specifications shall be prepared in accordance with current DOT/APWA standard specifications and the city's engineering design standards. If discrepancies exist in the standards and specifications, the city engineering design standards shall take precedence.
- The requirement for engineered plans may be waived in certain instances as defined by the PTMC and approved by the City Engineer for minor improvements to the water system that can be adequately inspected and certified by the City Engineer, and that will still assure the long-term integrity of the water system. As-builts must be submitted for the project.
- All plans must be reviewed and approved by the Director prior to proceeding with construction.

1.11 Complaints

The City has received 211 customer complaints regarding its water system over the last 6 years. The complaints were related to dirty water, taste and odor, low pressure, water leaks, and damage to the water system. Customer complaint response is discussed in Section 6.8 of this Plan.

1.12 SEPA

The City of Port Townsend prepared a SEPA checklist for this update to the Comprehensive Water System Plan (Appendix AG). The Plan was prepared to comply with the requirements of the Washington Department of Health (DOH) as set forth in the Washington Administrative Code (WAC) 246-290-100. Adoption of this document is a non-project action designed to improve and update the existing Plan that was published as an ordinance effective August 3, 1998. The plan applies throughout the incorporated limits of the City of Port Townsend, areas of unincorporated Jefferson County specified as the out-of-city service area and where applicable, to users of contractual water service or supply. This checklist covers the potential significant environmental impacts resulting from the adoption of the plan described above. Following adoption of this plan, other detailed regulations which implement the plan may be developed. Future SEPA reviews may be required for project actions undertaken to implement the adopted Plan (i.e., construction of capital facilities). The lead agency for this proposal, Port Townsend Development Services Department, determined that it does not have a probable significant adverse impact on the environment.

Section 2
Basic Planning Data and Water Demand Forecasting

This section defines the planning data, future land use, and future water demands for the City of Port Townsend. Planning data and water use forecasts are used for system planning purposes to assess the capability of the system to meet near-term and long-term demands. Because additional supply could take a long time to develop, it is common to project supply needs 20 years into the future. Water use forecasts are important for determining infrastructure needs such as transmission, storage, treatment, and distribution facilities at ultimate build-out conditions.

2.1 Current and Past Conditions

Data readily available for providing historical and current water use information was compiled and is presented in this section. This data includes information on population served, number of service connections, water consumption (as measured by individual service meters), and demand (as measured by master meters).

2.1.1 Population and Service Connections

Past growth trends are important in predicting future growth. Growth estimates for the City of Port Townsend were developed in light of historical trends. Current and past population and water service connection estimates for 1990 through 2004 are presented in Tables 2-1 and 2-2, respectively.

2.1.1.1 City Service Area

The population data presented herein for 1990 and 2000 is based on U.S. Census data, which was also used in developing the *Joint Population Forecast & Allocation* report prepared by Cascadia Community Planning Services in 2004 (Appendix H). Historical population for 1991 through 1999 was estimated by straight-line interpolation between the 1990 and 2000 census estimates. The estimates for 1991 through 1995 are slightly different from those provided in Port Townsend's 1998 Water System Plan. The estimates in the earlier Plan were based on the forecasts provided in the Watterson West Group report prepared in 1994 (Appendix H). In general, the new estimates presented herein are lower than the original estimates as growth was found to be slower within the City than was projected in the Watterson report.

Population data from 2000 through 2003 was estimated using the 2000 U.S. Census data and forecasts provided in the *Joint Population Forecast & Allocation* report (compound annual growth rate of 1.97 percent within the City). The Cascadia report was prepared for Growth Management Act (GMA) planning purposes and the results are being incorporated into the City's GMA Comprehensive Plan.

Table 2-1
Historical Population

Customer Classification	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
City of Port Townsend	7,188	7,304	7,419	7,535	7,650	7,766	7,882	7,997	8,113	8,228	8,344	8,508	8,676	8,847	9,021
Adjacent Service Areas															
West of City	119	142	169	170	170	190	201	204	208	200	203	208	219	253	260
Glen Cove	204	209	214	219	224	229	234	239	245	252	257	263	277	306	311
Total (not including Glen Cove)	7,307	7,445	7,588	7,705	7,820	7,956	8,083	8,201	8,320	8,428	8,547	8,717	8,895	9,099	9,281
Total (including Glen Cove)	7,511	7,654	7,802	7,924	8,045	8,211	8,337	8,459	8,583	8,681	8,804	8,980	9,172	9,405	9,592

Notes:

1. Populations from 1991 to 1995 are slightly low compared to those provided in the 1998 Water System Plan. Population estimates in the 1998 plan were based on projections from the 1994 Watterson report. Estimates provided here are based on a straight-line interpolation between actual census data from 1990 and 2000.
2. West of City population based on number of service connections multiplied by 2.36 persons-per-household.
3. Glen Cove population based on number of service connections multiplied by 2.36 persons-per-household multiplied by 72 percent (percent residential connections in Glen Cove).

Table 2-2
Historical Service Connections

Customer Classification	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
City of Port Townsend															
Residential	2,492	2,582	2,728	2,973	3,078	3,148	3,197	3,246	3,295	3,344	3,393	3,442	3,491	3,543	3,630
Commercial	220	235	277	348	357	369	370	371	371	372	373	374	375	376	384
Government	--	52	65	76	81	85	92	99	105	111	118	125	132	139	146
Subtotal In-City	--	2,869	3,070	3,397	3,516	3,602	3,659	3,716	3,771	3,827	3,884	3,941	3,998	4,058	4,160
Adjacent Service Areas															
West of City	51	60	72	72	72	80	83	86	90	93	97	100	103	107	110
Glen Cove	--	--	--	--	132	137	144	149	155	160	165	170	175	180	183
Subtotal Adjacent	--	--	--	--	204	217	227	235	245	253	262	270	278	287	293
Total (not including Glen Cove)	--	2,929	3,142	3,469	3,588	3,682	3,665	3,719	3,784	3,641	3,701	3,795	3,999	4,026	4,124
Total (including Glen Cove)	--	--	--	--	3,720	3,838	3,815	3,871	3,938	3,790	3,852	3,950	4,162	4,206	4,307

Notes:

1. Service connections between 1995 and 2003 are an interpolation of data to compensate for an a change in accounting.

City billing record information, where readily available, was used to identify the number of residential, commercial, and government service connections within the city limits. Information from 1990 through 1995 was extracted from the City's 1998 Water System Plan. After 1998, customer classification breakdown for the City system and the adjacent Glen Cove and West-of-City service areas were not readily available. Dashes are shown in Table 2-2 where data was not available or was not interpolated.

Complete connection data for the adjacent service areas (West-of-City and Glen Cove) was available only in 1994 and 2003. Therefore interpolation between 1994 and 2003 and these relative percentages were then used to determine estimated service connection totals and subtotals.

2.1.1.2 Adjacent Service Areas

No historical population data exists for the West-of-City area. Historical population presented for 1990 through 2004 for this area was estimated based on the estimated number of service connections and the 2.36 persons-per-household figure presented in the aforementioned Watterson report. All of the service connections in the West-of-City service area are residential.

Similarly, no historical population data exists for the Glen Cove service area. From data compiled in 1994, it was estimated that 72 percent of Glen Cove connections are residential and the remainder commercial/industrial. Population for the Glen Cove area was estimated by multiplying the 2.36 persons-per-household figure by the estimated number of residential connections.

The number of service connections for the West-of-City area was determined from City billing records for 1990 through 1995, which were presented in the 1998 Plan and are re-printed in this Plan. In 2003 and 2004, the number of service connections for the West-of-City and Glen Cove areas was determined from the City's billing records. Service connection information for Glen Cove and West-of-City service areas between 1994 and 2002 was determined as noted in the discussion of the City service area.

2.1.2 Water Use

The term demand refers to total water supplied, as measured by the City's master meters. Demand differs from consumption in that consumption refers only to the quantity of water actually purchased by customers. The difference in quantity between demand and consumption is referred to as "unaccounted water."

2.1.2.1 Demand

Current and past demand is presented in Table 2-3. The data presented in Table 2-3, based on the City's master meter readings, are presented in million gallons per day (mgd) and represent the average day demand (ADD) for the service area. The City's original master meter failed in 1996 and was replaced in 1998 with two separate meters to measure flow into the standpipe and 5 million gallon reservoir. Analysis of data since 1998 indicated demand was lower than the consumption in recent years. As a result, the City performed a series of

volume tests for both the 1 MG standpipe and 5MG reservoir meters to determine the current meter accuracies. Volume tests were performed over a range of flows that are typical of the City's actual operations. The testing concluded that both meters were undercounting the actual flow passing through the meters. Correction factors for both meters were developed and applied to the meter readings presented in this Plan. The City is currently in the process of calibrating the meters so that future meter data will be more accurate. Additional historical demand and consumption information is presented in Tables I-1 through I-15 of Appendix I.

Current or "base year" average water demand was estimated by averaging data from 2000 through 2004. These averages were computed for the purpose of establishing baseline values for projecting future growth in demand while minimizing the impact of recent, typical annual variations. These base year averages are assumed to represent 2005 demand.

Demand is characterized in this Plan as average day demand (ADD), maximum day demand (MDD), and peak hour demand (PHD). These variations are necessary for effective water system planning and infrastructure sizing. ADD represents the average water conveyed to the distribution system, including unaccounted uses, throughout the year, and is used to estimate the total annual amount of supply needed. MDD represents the day of the year during which the maximum amount of water is conveyed to the system. Supply, pumping, and treatment facilities are typically designed with a capacity equal to the projected future MDD. PHD represents the maximum amount of water supplied during a 1-hour period during the day when the MDD occurs. PHD is used for sizing distribution system piping and distribution system reservoir storage. More specifically, distribution system storage reservoir capacity is typically developed based on a combination of ADD, MDD, and PHD, and their relative differences.

ADD, MDD, and PHD are summarized in Table 2-4. Note that the base year ADD and MDD data, based on the two new master meters installed in 1999, includes meter correction factors as discussed above to account for apparent under-counting.

As is typical of most utilities, when data for MDD and PHD are unavailable, values for MDD and PHD are typically developed from standardized ratios to ADD, referred to as "peaking factors". However, both MDD and PHD data are available from master meter readings. The data for 2000 to 2004 were taken from master meter chart recordings. Similar to the ADD readings from the new master meters, these MDD and PHD readings include the meter correction factors to account for the apparent undercounting. The values for the five years were averaged to determine an overall ADD for the system for the base year. Averaging the data for past five years was used in order to account for any peak years that would not be representative of a normal year. The base year MDD and PHD are simply the maximum MDD and PHD identified during the five year period.

The ratios of MDD/ADD and PDH/MDD are often referred to as "demand ratios" or "peaking factors" and are computed for the purpose of characterizing demand in a given water system. The demand ratios determined from the base year ADD, MDD, and PHD data are:

Table 2-3
Master Meter Flow Data (mgd)

Service Meter	1974	1986	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Base Year
Old City Master Meter	1.440	1.260	1.290	1.447	1.438	1.410	1.392	1.357	--	--	--	--	--	--	--	--		--
New Standpipe Master Meter	--	--	--	--	--	--	--	--	--	--	--	0.252	0.245	0.241	0.241	0.245	0.236	0.242
New 5-MG Reservoir Master Meter	--	--	--	--	--	--	--	--	--	--	--	0.766	0.907	0.813	0.877	0.969	0.871	0.888
Subtotal New Master Meters	--	--	--	--	--	--	--	--	--	--	--	1.018	1.152	1.055	1.118	1.214	1.108	1.129
Total	**1.440**	**1.260**	**1.290**	**1.447**	**1.438**	**1.410**	**1.392**	**1.357**	**--**	**--**	**--**	**1.018**	**1.152**	**1.055**	**1.118**	**1.214**	**1.108**	**1.129**

Notes:
1. There are no master meter readings for 1996 through 1999. New meters were installed at end of 1999.
2. Master meter readings for 1999 through 2004 include meter correction factors to account for undercounting of meters.

Table 2-4
Variation in Demand (mgd)

Demand Type	1974	1986	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Base Year
ADD	--	--	1.290	1.465	1.461	1.436	1.420	1.377	--	--	--	1.018	1.152	1.055	1.118	1.214	1.108	1.129
MDD	--	--	--	--	--	--	--	--	--	--	--	--	2.520	2.665	2.310	2.583	2.609	2.665
PHD	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3.192	2.703	3.192

Notes:
1. ADD and MDD values for 1999 to 2003 include correction factors to the master meter readins demand based on the apparent undercounting of the new master meters.

MDD/ADD = 2.5

PHD/MDD = 1.2

2.1.2.2 Consumption

Consumption for customers within the City limits is measured at individual service meters. Customers are billed for water service every month. Current and past consumption along with per-capita consumption is presented in Table 2-5. Understanding per-capita water usage is important in identifying water use trends as well as how City water customer's usage compares with customers of other water utilities. Per-capita consumption was computed by dividing residential consumption by population.

2.1.2.3 Unaccounted Water

Unaccounted water is the difference between the volume of water entering the distribution system as measured by the supply meters (demand) and the volume actually measured and billed to customers (consumption). In most instances unaccounted water is a positive volume; the quantity which passes through the supply meter is larger than the sum of all consumption metered readings. The difference can typically be attributed to:

- Leakage from distribution system pipelines, reservoirs, valves, and hydrants;
- Water used during construction;
- Water used for street cleaning, firefighting, sewer and water main flushing, reservoir cleaning and other unmetered public uses; and
- Master meter and/or service metering inaccuracies

Typically, the volume of unaccounted water ranges between 10 to 15 percent of total water consumption.

Unaccounted water for the City, as presented in Table 2-6, represented approximately 30 percent of the total quantity of water passing through the City's master meter prior to 1996, as presented in the 1998 Plan. It was believed that the primary reason for the high percentage of unaccounted water was the result of service meter inaccuracies and water system leaks. While that may have been the case, data to confirm this assumption was not available.

Following installation of new master meters for the City's high and low pressure zones in 1999, unaccounted water for the City dropped to an annual average ranging from 9 to 16 percent of the total quantity of water passing through the City's master meters (these values were calculated with the appropriate correction factors applied to each meter).

The average amount of unaccounted water since the new meters were installed (2000 through 2004) is 10 percent of the total water consumed. This is within the typical range of unaccounted water for a system. With aggressive management of unaccounted for water, the City has reduced it to approximately 9 percent.

Table 2-5
Average Day Consumption (mgd)

Customer Classification	1974	1986	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Base Year
Consumption within City Limits																		
Residential	--	--	0.602	0.649	0.630	0.517	0.573	0.548	0.548	0.524	0.568	0.506	0.595	0.614	0.619	0.684	0.626	0.627
Commercial	--	--	0.232	0.234	0.252	0.255	0.278	0.274	0.262	0.255	0.271	0.381	0.328	0.337	0.350	0.361	0.333	0.342
Government	--	--	--	0.073	0.094	0.109	0.075	0.114	0.184	0.178	0.207	Commercial and Governement Accounts Combined						--
Subtotal of City	--	--	--	0.956	0.977	0.881	0.926	0.936	0.994	0.957	1.045	0.887	0.923	0.951	0.969	1.045	0.959	0.969
Consumption in Adjacent Areas Served																		
West of City	--	--	0.018	0.020	0.017	0.015	0.018	0.016	--	--	--	--	0.018	0.017	--	--	--	--
Glen Cove	--	--	--	0.018	0.023	0.027	0.028	0.020	0.048	0.045	0.049	0.045	0.024	0.024	--	--	--	--
Subtotal Adjacent Areas	--	--	--	0.038	0.039	0.041	0.045	0.035	--	--	--	--	0.041	0.041	0.047	0.056	0.047	0.047
Combined Total	--	--	--	**0.994**	**1.016**	**0.922**	**0.972**	**0.971**	--	--	--	--	**0.965**	**0.992**	**1.016**	**1.102**	**1.006**	**1.016**
Per-Capita Consumption (gpcd)																		
Per-Cap Ave Day Consumption	--	--	84	88	83	67	77	71	74	69	74	65	72	73	73	79	70	73

Notes:
1. Per-cap average day consumption for 1990 through 1993 was taken from the 1998 Water System Plan as no data was available on the population within Glen Cove during this period.
2. Per-cap average day consumption for 1996 through 1999 assumed an average consumption of 0.017 mgd for the West of City area based on the average consumption for the area in surrounding years.

Table 2-6
Unaccounted Water (mgd)

Water Use Category	1974	1986	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Base Year
Total City Demand	1.440	1.260	1.290	1.447	1.438	1.410	1.392	1.357	--	--	--	1.018	1.152	1.055	1.118	1.214	1.108	1.129
Total City Consumption	--	--	--	0.994	1.016	0.922	0.972	0.971	--	--	--	--	0.965	0.992	1.016	1.102	1.006	1.016
Unaccounted Water																		
Differential Flow	--	--	--	0.453	0.422	0.488	0.421	0.386	--	--	--	--	0.187	0.063	0.102	0.112	0.101	0.105
Percentage of Total Demand	--	--	--	31%	29%	35%	30%	28%	--	--	--	--	16%	6%	9%	9%	9%	9%

Notes:
1. Base Year unaccounted water was based on date from 2002, 2003, and 2004 to reflect the consistent 9% value of these recent years.

2.1.2.4 Equivalent Residential Units (ERUs)

An "equivalent residential unit" (ERU) is a unit of measure used to equate non-residential or multi-family residential water use to a specific number of single family residences. For example, if a system has a capacity to serve 100 ERUs, it has a capacity to serve 100 full-time single family residences. Similarly, it would be able to serve any combination of commercial, industrial, and residential customers provided that the quantity of water used is equivalent to the projected needs of 100 full-time single family homes (or 100 ERUs).

The consumption per single-family residence must first be determined by dividing the total single-family consumption by the number of single-family connections. Then the number of ERUs is computed for each customer category by dividing consumption per customer class by consumption per single-family residence. ERUs are a measure of system capacity in units of single-family residences.

Average day consumption data was used to develop the ERU data for residential and non-residential uses. The data was based on an average of 2000 to 2004 consumption to account for any peak years that would not be representative of a normal year. The current capacity of the City's water system, based on ERUs, is presented in Table 2-7. The ERU information is comprised of customers in the City and adjacent to the City. The conversion of unaccounted water to ERUs includes the meter correction factors for the base year ADD as discussed in Section 2.1.2.1.

Table 2-7
Base Year Equivalent Residential Units (ERUs)

Service	Number of Connections	Consumption (mgd)	Consumption per Single-Family Residence (gpd)	ERUs
Residential	3,630	0.627		
Single-Family	3,521	0.564	160	3,521
Multi-Family	109	0.063	160	394
Non-Residential	376	0.342	160	2,134
Unaccounted Water	--	0.105	160	656
Total	4,006	1.075	--	6,704

Notes:
1. ERUs were computed using "base year" data (average of 2000 through 2004)

2.2 Estimated Future Conditions

Estimated future population and land and water use is presented in this section. The estimated future conditions are important for planning purposes for the City to meet their long-term demands.

2.2.1 Land Use

Current land use for the City consists of a mixture of residential, mixed use, commercial, industrial, public facilities, parks, and open space. A map of current land uses is presented in Section 1 of this Plan. The land use map is used as the basis for future water system planning.

The City's historical land use pattern was established during the 1800s. During this period, plats were created with almost no regard to the topography or other natural physical limitations of the land. The result of this platting activity is a largely uniform series of approximately 11,100 parcels, typified by the 50-foot by 100-foot lot.

No changes in current land usage that would significantly impact estimated future water demand is predicted.

2.2.2 Population and Demand

Population and demand are presented together in this section because of their inter-relationship in estimating future demand. Estimated future population and demand for the 6-year and 20-year planning horizons are shown in Table 2-8 and are also depicted in Figure 2-1.

Table 2-8
Population and Demand Estimates (mgd)

Population and Demand	Base Year (2005)	2011	2025
Population	9,021	10,141	13,589
Total Demand			
ADD	1.13	1.24	1.62
MDD	2.67	3.04	3.99
PHD	3.19	3.60	4.73

Notes:

1. The U.S. Census data available on the web indicates that the actual population for 2000 was 8,334. A population of 8,344 (i.e., a difference of 10 people) was used in this document for consistency with the Cascadia report, which is being incorporated into the City's GMA Plan.

The 20-year population projection for the City was obtained from the Joint Population Forecast and Allocation report prepared by Cascadia Community Planning Systems (see Appendix H). It represents the "intermediate" population growth estimate. Projections for the current (2005), 6-year (2011) and 20-year (2025) forecasts were estimated using the 2000 U.S. Census data and a compounded annual growth rate of 1.97 percent. It is estimated between 2005 and 2025 Port Townsend will grow by 4,568, a 51% overall increase in population.

Water demand forecasts for the City service areas were developed using the base year demand for 2005. The projected ADDs, MDDs, and PHDs for the City were escalated at the same rate as the projected population estimates. Estimated future demand is presented in

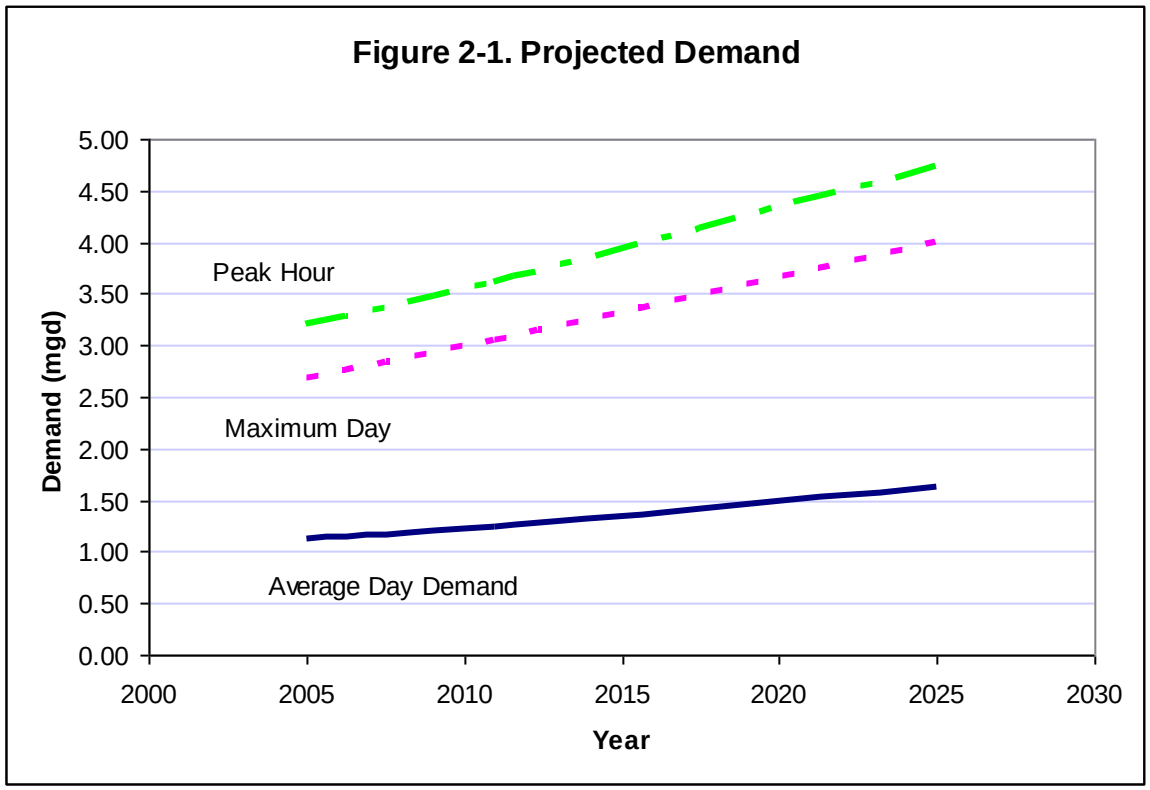


Figure 2-1. The projected average and maximum daily demands also include the appropriate meter correction factors to account for apparent under-counting, as discussed in Section 2.1.2.3.

Of particular interest with respect to the demand data presented in Table 2-8 and Figure 2-1 is the projected MDD. To meet customer needs, supply capacity must be equal to or greater than MDD. Demand in excess of MDD, such as PHD, is typically met by distribution system storage capacity. To meet estimated future demand the City must have supply capacity equal to or greater than the projected MDD. The year 2025 projected MDD is approximately 4 mgd. The City is bound by a lease agreement with the Port Townsend Paper Company that restricts the City's water usage to 5 mgd and allows the Mill to use all of the water supply flowing through the transmission system not expressly reserved for City use or obligations through the year 2020. Out of that 5 mgd, the City is contractually obligated to supply 0.28 mgd to PUD No. 1 of Jefferson County (Jefferson PUD) to meet the supply needs of LUD No. 3 until 2015. Average LUD daily demand during the peak month (meter is read once per month) since 2002 has been 0.19 mgd. The resulting supply available for the City's municipal uses is 4.72 mgd, which is still greater than the projected 4 mgd MDD. The PUD's daily contract quantity may be retrieved with four years of advanced notice to serve new residential, commercial or industrial customers within the City that cannot be met from the uncommitted City allocation from the OGWS. This supply-capacity-vs-demand comparison is also addressed in Section 4.2.3 in the context of establishing the adequacy of the City's water rights.

Section 4
Conservation Program, Water Right Analysis, System Reliability, and Interties

Like many other locations around Puget Sound and across the country, the City is experiencing increasing demands on its limited supply of water. At the same time, there is increased pressure to maintain instream flows for fisheries resources and wildlife habitat. The City recognizes its responsibility to protect, preserve, and enhance its water resources and to promote the efficient use of water through conservation. This section describes the City's Conservation Program, water rights analysis, system reliability, and interties.

4.1 Conservation Program Development

The City's conservation program, including conservation objectives, projected future demands with conservation, the specific measures selected for the conservation program, program management, and other related issues, is described in this section. A detailed evaluation of the appropriate conservation measures for the City's program and the measures selected for inclusion in the City's program are presented in Appendix Q.

4.1.1 Conservation Objectives

A first step in the preparation of a conservation plan is the establishment of objectives. Conservation objectives serve as the guide for the development of the conservation program. The City has selected the following objectives for its water conservation program:

- Reduce average daily per-capita use by 5 percent over a 10-year period starting in 2004 (i.e., by 2014).
- Target activities that result in the greatest water savings for the least effort and cost for initial implementation.
- Be consistent with the regional conservation program developed as part of the Jefferson County Coordinated Water System Plan (CWSP).
- Be balanced and equitable; don't unduly burden one customer class or industry.
- Prioritize youth education because it results in long-term changes in water-use habits.
- Reduce the current ratio of the MDD to ADD.
- The program must reflect the staff resources available to the City. The total program development and administration should require no more than one fourth of a full-time employee's time.

- Meet or exceed the minimum requirements established by Washington State Department of Health (WSDOH).
- Incorporate on-going conservation efforts on the part of the City's utilities, including the Parks, Water, Sewer, and Streets departments.
- Be primarily voluntary, assistance-oriented, and informational, rather than restrictive or forced.

4.1.2 Current and Past Conservation Activities

In 1992, the City of Port Townsend began implementation of conservation activities and improvements to data collection. The City's historical and ongoing conservation activities are summarized in Table 4-1 and the remainder of this section.

4.1.2.1 Public Education

During the drought of 2001, as with past abnormally dry summers, the City of Port Townsend requested voluntary conservation by its customers. The City devoted significant resources to providing the public with feedback on the effectiveness of the community's conservation efforts. Each week the City submitted a daily water use summary for the prior week for publication in the local newspaper.

Several articles and editorials relating to water supply issues and conservation were published by the City and concerned citizens.

The City has continued a proactive education program, including:

- Part time funding for a conservation program manager
- Submitting periodic newspaper articles
- Monthly newsletter included with utility bill
- Education coordination with Washington State University Cooperative Extension and Water Watchers

Public education measures are intended to inform citizens about the need for and the methods to achieve water conservation. Specific programs include the following:

- **School Outreach / Speakers Bureau:** School education programs include watershed tours, classroom presentations, and class participation in water quality monitoring.
- **Program Promotion:** Conservation brochures have been distributed to local businesses.
- **Public Outreach (Theme Shows and Fairs):** The City sponsors display booths at various public and professional gatherings.
- **Cooperative Extension:** The City is working in cooperation with the Washington State University Cooperative Extension of Jefferson County to develop additional education programs. A half-time water resources education specialist employed by cooperative extension leads these programs.

Table 4-1
Summary of Port Townsend Conservation Measures Implemented to Date

Measure	WSDOH Required or Recommended?	Description of Activities	Year Implemented
Public Education			
School Outreach	No	Watershed tours, classroom presentations, participation in water quality monitoring	Ongoing
Speakers Bureau	No	Presentations as requested for schools, professional organizations and public groups	1993
Cooperative Education	No	Development of education programs through Washington State University Cooperative Extension of Jefferson County	1992
Program Promotion	Required	Distribution of brochures, customer newsletter	Ongoing
Theme Shows and Fairs	No	Display booth at public and professional gatherings	1993
Technical Assistance			
None			
System Measures			
Source Meters	Required	Installation of source meters and master meters	Various
Service Meters	Recommended	Installation of service meters (over 99% of accounts currently metered)	1978
Unaccounted Water/Leak Detection	Recommended	Metering unmetered accounts, repairing broken meters, identifying and repairing leaks	1994
Incentives/Other Measures			
Single-Family/Multi-Family Kits	Recommended	Door-to-door distribution of conservation kits including brochures, faucet aerators, toilet leak detection tablets, and toilet flow splitters.	1994
Landscape Management / Playfields – Xeriscaping	Recommended	Xeriscaping of public spaces and parks	Ongoing
Conservation Pricing	Recommended	Implementing increasing block rate structure for residential customer class	1992-2000
Data Collection Improvements	No	Water and sewer billing based on usage, customer class usage	Ongoing
PTPC Conservation	No	Revise operation strategy to reduce water use	Ongoing

4.1.2.2 System Measures

System measures include those activities or improvements, such as metering that serves to monitor the flow of water through the system from its source to its delivery to customers so the utility can evaluate its performance in reaching its conservation goals.

- **Source Meters:** Two master meters are currently in place and operational on the CT pipeline that feeds the City's storage reservoirs. Data from the meters are used to

compare with service meter totals to evaluate for unaccounted water. Both the Big Quilcene River and Little Quilcene River source water diversions have installed meters as well as the inflow and outflow to City Lake reservoir.

- **Service Meters:** The City began installing water meters on all services in 1978. The difference in water usage rates from 1974 to 2004, as presented in Table 2-3 of Section 2 of this Plan, illustrates the significant impact this measure has had on reducing water usage. All municipal service connections are metered, and the City repairs or replaces meters that appear to be recording in error.
- **Unaccounted Water/Leak Detection:** Port Townsend currently has a program for identification and repair of leaks. The City monitors service meters to reduce the quantity of unaccounted water and better estimate the potential for unrecognized leaks in the system. The City has completed an extensive leak detection program conducted by an outside contractor in 1995 and completed another system wide leak assessment in 2005. The City also utilizes City staff in leak detection for routine monitoring and maintenance.

4.1.2.3 Incentives/Other Measures

Incentives and other measures are programs that encourage conservation from residential and commercial customers. The measures implemented as part of the City's program are described below. Note that the Single-Family/Multi-Family Kits and Xeriscaping measures are also included in Table 4-2 but are discussed in subsection 4.1.4.

- **Conservation Pricing:** Between 1992 and 2000 the City utilized a conservation rate structure. The rate structure included a base fixed charge for service, plus a per-gallon use rate with a surcharge for summer water use over 11,000 gallons per month. The surcharge was eliminated after determining there was no apparent conservation related to the rate structure and negative feedback from customers. Water rates have increased over 17% since 1998 and approximately 100% since 1992. Prior to 1998, wastewater utility rates were based on the average winter water use. Wastewater rates are now based on total water usage and include a surcharge if use is above 2,500 gallons per month. The increase of water and waste water rates has contributed to a conservation response by customers.
- The City is currently evaluating several options for a revised rate structure and how that may affect conservation. A new rate structure will be implemented in the near future.
- **PTPC Conservation:** Port Townsend Paper Company has responded to requests for conservation by modifying operating procedures that reduces their daily use from 14.5 mgd to between 10 and 11 mgd during low river flow conditions. The potential water savings from PTPC alone corresponds to more than the peak daily demand of the entire City water service area. Most of these savings at PTPC were achieved by eliminating hydropower generation and utilization of automatic level control for water inflow.

Data Collection Improvements: As water and sewer billings are now based on water usage, data collection procedures have been improved to more accurately identify customer classes and water use for each account type. Efforts will continue to improve data accessibility and

Table 4-2
Recommended Water Conservation Program for Public Water Systems

Measures	Public Water Systems by Size (1)			
	Large	Medium (2)	Small	Regional
Public Education				
School Outreach	X			X
Speakers Bureau	X			X
Program Promotion (required)	X	X	X	X
Theme Shows and Fairs	X			X
Technical Assistance				
Purveyor Assistance	X	X		X
Customer Assistance	X	X		X
Technical Studies	X			X
Bill Showing Consumption History	X	X		X
System Measures				
Source Meters (required)	X	X	X	X
Service Meters	X	X	X	X
Unaccounted Water / Leak Detection (3)	X	X		X
Incentives / Other Measures				
Single-Family / Multi-Family Kits	X	X		X
Nurseries / Agriculture	X	X		X
Landscape Management / Playfields – Xeriscaping	X	X		X
Conservation Pricing	X	X	X	X
Utility Financed Retrofit	X			X
Seasonal Demand Management	X			X
Recycling / Reuse	X			X

(1) Definitions of water system sizes:

Large system	25,001 or more services
Medium system	1,000 to 25,000 services
Small system	less than 1,000 services
Regional system	regional organizations

(2) Port Townsend is a medium system.

(3) Leak detection is required if unaccounted water is greater than 20%.

facilitate use of data for system evaluations, including evaluations of conservation program effectiveness.

4.1.2.4 Water Reuse and Largest Users

City evaluated opportunities for reuse of treated wastewater in the mid-1990s. The results of that evaluation were presented in the City's 1998 Water System Plan. That evaluation is re-printed, without change, and presented in Appendix R. At the time of its initial consideration, reuse was found to be not cost-effective for the City based on the City's evaluation and therefore was not selected for implementation by the City.

Re-examination of this earlier conclusion was undertaken as part of this planning effort. Potential reuse customers were identified by summarizing the current 20-Largest-Water-Users, which is also presented in Appendix R. The reason for identifying these customers was to assess whether or not any had substantial non-potable uses such as irrigation that could be replaced with treated wastewater. These largest water users were essentially the same as those identified in the 1998 Water System Plan. Only Fort Worden, Chetzemoka Park, and the Port Townsend Golf Course were identified as potential consumers because of their irrigation uses. However, their combined total is relatively small, only about 18 million gallons per year, or perhaps as much as 130,000 gallons per day during peak month usage (per Table R-1 in Appendix R).

Updating the previously developed capital costs (presented in Appendix R) to 2005 dollars results, in a capital cost in the range of $5.8 to $7.3 million. The high project cost, along with the continued limited opportunity to reduce demand for the City's surface water supply, have lead the City to defer pursuit of reuse at this time.

4.1.3 Evaluation of Conservation Measures

In March 1994 the Washington State Department of Health, the Department of Ecology, and the Washington Water Utilities Council established the Conservation Planning Requirements. These requirements went into effect on July 1, 1994. Water system plans submitted after this date must comply with these requirements. The Conservation Planning Requirements state that all water utilities must monitor water use and develop and implement water conservation programs. In accordance with the Conservation Planning Requirements, the three main aspects of a conservation plan are water use data collection, demand forecasting, and the selection of specific measures associated with conserving water.

The recommended water conservation measures from the Conservation Planning Requirements are shown in Table 4-2. New conservation requirements are in the process of being rolled out in Washington as part of the Municipal Water Law. The Municipal Water Law is discussed later in this Section. Port Townsend is a medium sized system in regards to conservation planning and therefore the requirements for medium sized systems are highlighted in the table. All recommended measures in the appropriate water system size category must be evaluated. This evaluation considered all of the medium sized system measures but also evaluated several measures outside the requirements for medium sized systems to enhance the conservation program for the City. The measures included in the City's conservation program are discussed in the following sub-sections of this Plan.

4.1.4 Selected Conservation Measures

The conservation program is based upon pursuing additional conservation measures that are expected to produce the greatest water savings for the least cost. In addition, the program includes public education activities designed to enhance public participation and overall conservation program effectiveness by increasing customer understanding of conservation benefits and encouraging water-conserving behavior and practices by the City's customers and utilities staff.

In consideration of its program objectives, the WSDOH Conservation Planning Requirements, and the qualitative benefit and cost analysis provided in Appendix Q, the City intends to pursue the conservation activities presented in Table 4-3. More detailed discussion of these proposed conservation measures is presented in Appendix Q.

The City's objective for reducing its projected demand will be attained through reductions attributable to specific conservation measures. The City estimates that the conservation measures included in its program can result in water savings up to the quantities described below:

- **PTPC Conservation Assistance.** The PTPC has the potential to save a significant amount of water throughout the year and especially during the late summer and early fall period when river flows are low. The City intends to work closely with PTPC to ensure that these water savings options are effected over the next several years.
- **Leak Detection and Reduction of Unaccounted Water.** Unaccounted water currently amounts to approximately 9 percent for the City water system as discussed in Section 2 of this Plan. The extent of potential savings with respect to unaccounted water is largely dependent on more accurate readings of meters. Other reductions in unaccounted water resulting from hydrant flushing, street cleaning, metering other unmetered uses, and service connection meter calibrations would generate more revenue for the City, but not change total demand.
- **Landscape Management/Playfield-Xeriscaping.** Research has shown that 10 percent or more of irrigation water use can be saved through irrigation system improvements and management. Total system savings will depend on the number of sites targeted.
- **Bill Showing Consumption History.** The current water billing software does not support printing a consumption history. Future upgrades to the software may include this feature.
- **Other Measures.** The savings from public education, customer assistance, conservation pricing, and municipal water use efficiency are difficult to estimate. Research suggests a saving of 3 to 5 percent is possible.

The conservation program may be revised as measures are implemented and monitored to continue to focus on the most cost-effective measures.

All measures recommended in the Conservation Planning Requirements for medium-sized utilities were evaluated for implementation in the City system. The following measures were either not selected or discontinued:

- **Single-Family/Multi-Family Kits.** The City conducted a retrofit kit program in 1993 and distributed kits to all residential customers. Kits were distributed door-to-door during summer meter reading. No additional kits are planned for distribution at this time.

Table 4-3
Selected Conservation Measures and Budgets

Selected Conservation	2005	2006	2007	2008	2009	2010
Public						
School Outreach (1)	$500	$500	$500	$500	$500	$500
Program Promotion (1)	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000
Technical (1)						
Purveyor and Customer (1)	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500
System						
Source Meter (2)	$0	$6,000	$0	$0	$0	$0
Service Meter (2)	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000
Water System Leak (2)	$5,000	$0	$0	$0	$0	$5,000
Incentives/Other						
Landscape Management	$0	$0	$0	$0	$0	$0
Conservation	$500	$500	$500	$500	$500	$500
Paper Mill Conservation (3)	N/A	N/A	N/A	N/A	N/A	N/A
Municipal Water Use	$500	$500	$500	$500	$500	$500
Annual Totals (3)	$25,000	$26,000	$20,000	$20,000	$20,000	$25,000

Notes

(1) Conservation coordinator staff time not included in measure budgets. An estimated 1/4 full-time equivalent (FTE) will be needed to manage and coordinate conservation activities.

(2) The budget for these measures is included in the system operation and maintenance budget.

(3) Port Townsend Paper Company conducts its own conservation program.

(4) Program costs have been estimated for the various conservation activities. These costs are approximate, based on available data and other utility experiences. Program water savings and cost should be carefully tracked as activities are initiated to verify these estimates and revise future conservation measures, as necessary.

- **Conservation Pricing.** Between 1992 and 2000 the City utilized a conservation rate structure. The rate structure included a base fixed charge for service, plus a per-gallon use rate with a surcharge for summer water use over 11,000 gallons per month. The surcharge was eliminated after determining there was no apparent conservation related to the rate structure and negative feedback from customers. Water rates have increased over 17% since 1998 and approximately 100% since 1992. Prior to 1998, wastewater utility rates were based on the average winter water use. Wastewater rates are now based on total water usage and include a surcharge if use is above 2,500 gallons per month. The increase of water and waste water rates contributes to a conservation response by customers.

- **Nurseries/Agriculture.** There is one nursery in the City and limited commercial agriculture utilizing municipal water; hence this measure does not address a viable target group. Water use by this sector will continue to be monitored to meet the requirements established in the Conservation Planning Requirements.

The success of these conservation measures will be monitored by per –capita use.

4.1.5 Conservation Program Management

The City has allocated 1/4 FTE as the conservation program manager for ongoing conservation program development and administration. The distribution system related tasks associated with conservation (leak detection, other unaccounted water reduction, meter installation, and maintenance) will be accomplished by water distribution crews.

The City allocates staff resources toward collecting data from billing records and the supply master meters to develop an updated comprehensive supply and consumption database. The conservation program manager will prepare an annual summary report of supply and consumption data to assess the effectiveness of the City's conservation activities. This annual report will include a discussion of the previous year's specific conservation activities, an evaluation of the success of those activities with respect to the usage data, and a summary and schedule of the next year's conservation activities.

4.1.6 Target Water Savings Projections

Data on water usage must be available to forecast water demand and to provide a basis for the evaluation of the effectiveness of a conservation program. The Conservation Planning Requirements establish minimum data collection criteria for water systems based on the size of the system. Port Townsend falls into the 1,000 to 10,000 service connection category and must collect data on water usage, as summarized in Table 4-4.

Demand forecasts showing the anticipated impact of conservation efforts are a requirement for conservation planning. As shown in Section 2, Table 2-5, per-capita consumption experienced an overall drop in the 1990's and has been relatively constant in the 2000's (with the exception of 2003, which was a very dry year). This initial reduction and continued reduced per-capita consumption is assumed to be the result of increased water rates, revised plumbing code, and a heightened awareness of the need to conserve water.

The projected conservation savings goal was developed in consideration of these recent conservation savings. The City's conservation goal is to reduce average gallons per day per connection by 5 percent over a 10-year period which began in 2004. The City is required to develop 6- and 20-year demand projections with conservation in accordance with the Conservation Planning Requirements.

Thus, based on the 5 percent savings goal by 2014, it is assumed that 3.5 percent savings would be attained by the year 2011. The total 5 percent savings attained by year 2014 would be maintained through the year 2025. Water demand projections for the City, with and without conservation, are presented in Table 4-5.

4.1.7 Regional Conservation Programs

The City is committed to participating in regional conservation activities. Participation will include involvement in program development by City staff and financial participation.

Table 4-4
Data Collection Requirements for Port Townsend
(Systems with 1,000 to 10,000 Service Connections) (1)

Type of Data	Collection Frequency	Current Practice by City
Source of supply meter readings	Read daily but report only monthly and annual totals	Yes
Emergency interties - amount imported (2)	Monthly	OGWS has emergency connection to Tri-Area water system for delivery only.
Wholesale - amount purchased (2)	Monthly	None purchased
Peak day / peak month (3)	Annually (peak day and peak month for each year)	Yes
Unaccounted-for water	Annually	Yes
Non-revenue accounted-for water	Annually	Yes
Service meter readings (4):		
Single-family	Monthly	Yes
Multi-family	Monthly	Yes
Commercial / government/ industrial	Monthly	Yes
Agriculture	Monthly	Yes
Emergency interties - amount exported (2)	Monthly	Yes
Wholesale - amount sold (2)	Monthly	Yes
Population served (5)	Annually	Yes
Economic data	Existing water rates for each customer class	Yes
Conservation data	Annually	Yes

(1) The number of system services is based on the number of direct retail services supplied by the water system reporting the data.

(2) Keep records for each buyer and seller and each intertie.

(3) Measured from supply sources.

(4) If the public water system has used different customer classes and/or definitions of classes, it may include those definitions and/or classes in its data reporting along with the corresponding data. If different classes of users are included, the system must include a timetable for when data will be collected for customer classes consistent with those in the table.

(5) Estimate the number of customers and connections serviced in the established customer classes: single-family, multi-family, commercial/government/industrial, and agriculture.

Table 4-5
Water Demand Projections With and Without Conservation (mgd)

Year	Without Conservation		With Conservation	
	ADD	MDD	ADD	MDD
Base Year (2005)	1.13	2.67	1.13	2.67
2011	1.24	3.04	1.20	2.93
2025	1.62	3.99	1.56	3.85

"Conservation Programs of major utilities should be monitored by the WUCC as part of a WUCC process to facilitate County-wide conservation implementation."

In addition to regional activities, the City will monitor the activities of the Conservation Coalition of Puget Sound, Washington State conservation initiatives, and the Pacific Northwest Section American Water Works Association (AWWA) Conservation Committee to keep informed of new developments in conservation activities.

4.1.8 Interim Trust Water Rights Dedication

The City sees value in conservation beyond the economic incentives that enable expensive supply development projects to be delayed and additional growth to be accommodated using the same volume of water. The environment can also benefit from conservation because some of the conserved water will remain in the Quilcene Rivers for the benefit of fisheries, wildlife, and other recreational uses. Depending on future water needs, the City may consider entrusting a portion of its conservation savings back to the Quilcene rivers as an Interim Trust Water Right, as allowed by recent Washington State legislation. The percentage to be dedicated as a trust right would depend on water use by PTPC. Any reallocation of supply would be undertaken in accordance with the City's Water System Policy 3.7, presented in Appendix G.

4.1.9 Municipal Water Law

The Municipal Water Supply – Efficiency Requirements Act is part of a multi-year process to reform the states water laws. The law produces changes that affect the WSDOH water system planning process. Interim requirements have been established for approval of water system plans while the law is being developed. Some of the major requirements include completion of the following:

- Water rights self assessment,
- System capacity analysis,
- Service area delineation,
- Description of water conservation program including conservation plan, discontinued conservation efforts, and program results,
- Demand forecasts based on water conservation efforts,
- Water reclamation checklist,
- Description of response to requests for new water service connections,
- Metering requirements,
- Water use efficiency goal setting performance reporting,
- Evaluation of distribution system leakage, and
- Annual performance reporting.

The City has fulfilled these interim requirements as outlined in the *Municipal Water Law: Interim Planning Guidance for Water System Plan/Small Water System Management Program Approvals* document. These requirements are fulfilled within this Plan. Documentation related to the interim Water Supply Law requirements is provided in Appendix S.

4.2 Water Rights Analysis

This section describes the City's water rights and issues related to water resources. The City has water rights for both the Big and Little Quilcene Rivers. In addition to its water rights to these surface water sources, the City also has storage water rights for two raw water reservoirs: City Lake and Lords Lake. Copies of the City's water rights are presented in Appendix T.

4.2.1 Existing Water Rights

This section describes the City's water rights for both its surface water sources and storage reservoirs. The City has applied for a 150 gpm irrigation ground water right for use by the Port Townsend Golf Course. This source could also serve an emergency supply for the City.

4.2.1.1 Surface Water Rights

The City has surface water rights on the Big Quilcene River and the Little Quilcene River. A summary of the existing and forecasted water rights status from the surface water sources are provided in Tables 4-6 and 4-7. Tables 4-6 and 4-7 show that the water rights are fully utilized to meet current and projected water uses for the City and PTPC. The data in the tables for maximum instantaneous flow rates are based on the flow rates used to fill Lords Lake during winter months as discussed in subsections 4.2.1.1 and 4.3.1.1. The maximum instantaneous flow rates are generally based on the MDD of a system. In this case, high withdrawal rates are used for filling the lake when demands are lower.

Both the City and PTPC are supplied from the Big and Little Quilcene Rivers through the Olympic Gravity Water System Pipeline (OGWS). PTPC leases all of the water supply that is not reserved by the City for its own purposes. The City has reserved 7.74 cfs (5 mgd) of the OGWS supply for meeting the needs of its retail and wholesale customers. The City's lease agreement with PTPC expires on March 15, 2020.

Permit #1021 documents a primary water right of 30 cfs of surface water (13,440 gpm) from the Big Quilcene River "to be used within corporate limits of the City of Port Townsend, Townships 30 and 31 North, Range 1 West, and nearby territory." Since 1997, the City and PTPC have voluntarily restricted usage of the Big Quilcene River to maintain at least 27 cfs in the river for the fishery downstream. At times, despite the complete suspension of diversions, natural stream flows below the Big Quilcene River diversion drop below 27 cfs. As a result of this in-stream flow commitment, the City and PTPC often reduce withdrawal of water from the Big Quilcene River between August and November. During these times, the difference is made up with water previously stored in Lords Lake.

The Little Quilcene River water right (Permit #9259) is allowed a withdrawal of up to 9.56 cfs, but is conditioned with the requirement to maintain a minimum 6.0 cfs instream flow

Table 4-6
Storage Reservoir Rights

Reservoir Name	Reservoir Permit Number	Priority Date	Storage Right		Primary Source	Secondary Source
			acre-feet	million gallons		
City Lake	R-118	2/20/1929	800	261	Big Quilcene	Little Quilcene
Lords Lake	R-62	2/9/1927	750	244	Little Quilcene	Big Quilcene
Lords Lake	R-181	2/9/1927	1,250	407	Little Quilcene	Big Quilcene

below the diversion, if naturally available. There is no specific seasonal restriction on the Little Quilcene water right. However, it is the City and PTPC's experience that Little Quilcene diversions are streamflow limited between July and October. Between January and July, Lords Lake Reservoir is typically full and only minimal diversions are necessary from the Little Quilcene River.

4.2.1.2 Storage Rights

The City has water rights for storage in two reservoirs, Lords Lake and City Lake. The rights are summarized in Table 4-6. The two Lords Lake reservoir storage permits were issued as part of the water right certificate for the Little Quilcene River. A separate certificate of water right was issued for City Lake storage.

Reservoir Permit R-118 (Certificate 2004) documents a total storage right of 800 acre-feet of surface water in the City Lake reservoir diverted from the Big Quilcene River pursuant to Certificate 322. The City currently owns all of the land within the watershed surrounding City Lake. The current storage capacity of City Lake is 120 MG (368 acre-feet).

Reservoir Permit 62 documents a storage right of 750 acre-feet of surface water in Lords Lake diverted from the Little Quilcene River pursuant to Certificate 7028. Reservoir Permit 181 documents a storage right of 1,250 acre-feet of surface water in Lords Lake diverted from the Little Quilcene River pursuant to Certificate 7028. Thus, the total storage right of water in Lords Lake is 2,000 acre-feet (652 MG). The current storage capacity of Lords Lake is 500 MG (1,535 acre-feet).

The City typically draws down Lords Lake during the later summer and early fall months when maintenance of in-stream flows limit withdrawals from the Big Quilcene and Little Quilcene Rivers. Lords Lake is filled from the Little Quilcene River when flows below the diversion are greater than the 6 cfs minimum in-stream flow requirement. Lords Lake can also be filled from the Big Quilcene River, as is often the case in the fall and winter, to speed refilling. Adding another inlet to Lords Lake from the transmission pipeline would provide additional flexibility in filling the reservoir from the Big Quilcene River. This would increase settling time for turbid water and allow filling of both Lords Lake and City Lake reservoirs at the same time. Moving or adding a second outlet would enable using water below the existing outlet gate without installing temporary pumping equipment. Incorporation of these modifications should be considered if Lords Lake reservoir undergoes major renovation or substantial works is required on the pipeline in the vicinity

of the reservoir. City Lake can be replenished from either source, but the Big Quilcene River is the primary supply for City Lake and the entire system in general.

The City has considered expanding Lords Lake to provide additional capacity to meet summertime water needs of the City and PTPC when low flows in the Big Quilcene and Little Quilcene Rivers limit diversions. An evaluation completed in 2001 by CDM examined increasing the size of Lords Lake by 50 and 100 percent. The analysis found that the ability to initially fill and refill the lake would be constrained for Big Quilcene River instream flow

Table 4-7
Existing Water Rights Status

Permit Certificate or Claim #	Name of Rightholder or Claimant	Priority Date	Source Name/ Number	Primary or Supplemental	Existing Water Rights		Existing Consumption[1]		Current Water Right Status (Excess/Deficiency)[1]	
					Maximum Instantaneous Flow Rate	Maximum Annual Average[1]	Maximum Instantaneous Flow Rate[3]	Maximum Annual Average[1]	Maximum Instantaneous Flow Rate	Maximum Annual Average[1]
Permits/ Certificates										
1021	City of Port Townsend	2/9/1927	Big Quilcene	Primary	30 cfs (19.4 mgd)	21,700 ac-ft/yr	30 cfs (19.4 mgd)	21,700 ac-ft/yr	0 cfs	0 ac-ft/yr
9259	City of Port Townsend	2/9/1927	Little Quilcene	Primary	9.56 cfs (6.2 mgd)	6,900 ac-ft/yr	9.56 cfs (6.2 mgd)	6,900 ac-ft/yr	0 cfs	0 ac-ft/yr
Claims										
None										
TOTAL	**********	**********	**********	**********	39.56 cfs (25.6 mgd)	28,600 ac-ft/yr	39.56 cfs (25.6 mgd)	28,600 ac-ft/yr	0 cfs	0 ac-ft/yr

Intertie Name/Identifier	Name of Purveyor Providing Water	Existing Limits on Intertie Water Use		Existing Consumption Through Intertie		Current Intertie Supply Status (Excess/Deficiency)	
		Maximum Instantaneous Flow Rate	Maximum Annual Average	Maximum Instantaneous Flow Rate	Maximum Annual Average	Maximum Instantaneous Flow Rate	Maximum Annual Average
None							

Pending Water Right Application	Name on Permit	Date Submitted	Primary or Supplemental	Pending Water Rights			
				Maximum Instantaneous Flow Rate Requested		Maximum Annual Volume Requested	
G2-30059	City of Port Townsend	6/13/2002	Well	Supplemental	150 gpm	34 ac-ft/yr	150 gpm	34 ac-ft/yr

Notes:

1. Maximum instantaneous flow rate is the amount of water which can be taken from the source during a period of peak operation. Typically this value is the MDD; however, in this case, the maximum instantaneous rate is the flow used to fill Lords Lake during winter months.

bypasses of 35 cfs or more. The study period of record was 20% wetter than long term average conditions and the analysis indicated that the current voluntary 27 cfs bypass release is likely close to the maximum release possible without causing significant adverse impact on reservoir initial fill and subsequent refill. Maintaining a 27 cfs bypass with a 50 percent reservoir expansion would only allow refilling a 50 percent or 100 percent expanded reservoir 4 out of 5 years during a wetter than normal cycle. Preliminary cost estimates were $2.3 to 3.0 million for a 50 percent storage expansion and $3.7 to 5.5 million to double the reservoir capacity.

4.2.2 Current and Projected Usage

The current and projected municipal usage for the City was presented in Section 2 of this Plan. PTPC utilizes the majority of the City's water rights as noted previously. Over time Port Townsend Paper Company has upgraded its equipment and improved operating processes so that today paper production has increased 50 percent from 20 years ago, while at the same time using less water. Average water use to produce a ton of paper has declined 41 percent between 1996 and 2003. Operation of the PTPC's hydro turbine generator requires a constant 14 mgd flow. When drafting from Lords Lake is necessary to maintain instream flows on the Big Quilcene River, PTPC shuts off the hydro turbine generator and changes its operations to save approximately 3 to 4 mgd. It is expected that PTPC will continue to implement additional conservation measures that will further reduce their water requirements, allowing the City to meet its future growth needs. For planning purposes, it is assumed that PTPC will continue to operate at a constant 14 mgd.

4.2.3 Adequacy of Water Rights

The comparison of existing water rights to projected demand is necessary to evaluate the long-term need for additional water rights. Water rights acquisition is typically a lengthy and controversial process. Thus, it is important to establish whether or not additional water rights will be needed to meet projected growth and when such rights would be needed.

Supply facilities are typically designed with a capacity equal to the projected total MDD of the customers they serve. Diurnal variations in demand in excess of the MDD are typically met by distribution system reservoir storage. Thus, the projected MDD for the City and PTPC's projected supply needs are compared in Table 4-7 and 4-8 with the instantaneous water right of the Big Quilcene River (19.4 mgd). The water right for the Little Quilcene River is not factored into this comparison because of restrictions on its use related to instream flow requirements limit its use during the late summer and early fall.

While the City has adequate water rights to meet current and projected water uses it is seeking an additional ground water right of 150 gpm for irrigation of the City owned golf course, which would reduce flows diverted from the Quilcene Rivers during periods of low stream flow and provide an emergency water source in the City. It is important to recognize that these water rights are fully utilized throughout the year. As the City voluntarily reduces its intake during summer months to maintain instream flows, water stored in Lords Lake is used to compensate for the difference between City demands and

Table 4-8
Forecasted Water Rights Status

Permit Certificate or Claim #	Name of Rightholder or Claimant	Priority Date	Source Name/ Number	Primary or Supplemental	Existing Water Rights		Forecasted Water Use from Sources (20 Year Demand)[1]		Forecasted Water Right Status (Excess/Deficiency - 20 Year Demand in Water Right)[1]	
					Maximum Instantaneous Flow	Maximum Annual Average[1]	Maximum Instantaneous Flow Rate[3]	Maximum Annual Average[1]	Maximum Instantaneous Flow	Maximum Annual Average[1]
Permits/Certificates										
1021	City of Port Townsend	2/9/1927	Big Quilcene	Primary	30 cfs (19.4 mgd)	21,700 ac-ft/yr	30 cfs (19.4 mgd)	21,700 ac-ft/yr	0 cfs	0 ac-ft/yr
9259	City of Port Townsend	2/9/1927	Little Quilcene	Primary	9.56 cfs (6.2 mgd)	6,900 ac-ft/yr	9.56 cfs (6.2 mgd)	6,900 ac-ft/yr	0 cfs	0 ac-ft/yr
Claims										
None										
TOTAL	**********	**********	**********	**********	39.56 cfs (25.6 mgd)	28,600 ac-ft/yr	39.56 cfs (25.6 mgd)	28,600 ac-ft/yr	0 cfs	0 ac-ft/yr

Intertie Name/Identifier	Name of Purveyor Providing Water	Existing Limits on Intertie Water Use		Existing Consumption Through Intertie		Current Intertie Supply Status (Excess/Deficiency)	
		Maximum Instantaneous Flow Rate	Maximum Annual Average	Maximum Instantaneous Flow Rate	Maximum Annual Average	Maximum Instantaneous Flow Rate	Maximum Annual Average
None							

Pending Water Right Application	Name on Permit	Date Submitted		Primary or Supplemental	Pending Water Rights			
					Maximum Instantaneous Flow Rate Requested		Maximum Annual Volume Requested	
G2-30059	City of Port Townsend	6/13/2002	Well	Supplemental	150 gpm	34 ac-ft/yr	150 gpm	34 ac-ft/yr

Notes:

1. Maximum instantaneous flow rate is the amount of water which can be taken from the source during a period of peak operation. Typically this value is the MDD; however, in this case, the maximum instantaneous rate is the flow used to fill Lords Lake during winter months.

withdrawal from the rivers. Reservoirs are refilled in the wet fall and winter months, during which the full water rights for both the Big Quilcene and Little Quilcene are utilized.

The City has identified the following alternatives to meet its long-term supply needs if City needs grow faster than projected:

- Reduce or eliminate its supply commitment to LUD#3
- Increase conservation efforts
- Continue to work with PTPC to develop ways to reduce consumption at the mill

Although adequate water rights are in place to meet the combined needs of the PTPC and the City, the City is limited to 5 mgd per its lease agreement with the PTPC. Out of that 5 mgd must come supply for the City as well as the 0.28 mgd commitment the City has to LUD#3. As a result, the City, itself (including areas currently served adjacent to the City), is limited in terms of supply to 4.72 mgd. Comparing that to the projected 2025 MDD of 3.99 mgd, as presented in Table 2-8, there appears to be adequate supply per the City's water rights and lease agreement with the PTPC for growth in demand.

Port Townsend is negotiating renewal of three special use permits with the US Forest Service (USFS) for the operation and maintenance of the Big and Little Quilcene River diversions and transmission pipelines. National Oceanic and Atmospheric Administration Fisheries department (NOAA Fisheries) review of the potential impact of the water diversions to threaten salmon species is likely to lead to minimum stream flow conditioning of the permits by the USFS. It is expected that the City's current 27 cfs voluntary minimum instream flow for the Big Quilcene River would be become a mandatory requirement. This would restrict withdrawals during low stream flows and necessitate increased reliance on water stored in Lords Lake. Nine years of operating the water system with a 27 cfs minimum instream flow restriction shows that storage capacity, combined with conservation efforts by City residents and Port Townsend Paper Company, is sufficient for community water needs.

4.2.4 Dosewallips Application

On February 20, 1956, the City filed Surface Water Application No. 13765 for the appropriation of 50 cfs continuously from the Dosewallips River for municipal supply. Development of this application was studied and discussed as Alternative 2 in the 1986 Coordinated Water System Plan for Jefferson County. This alternative, in combination with groundwater development, was selected by the WUCC as the alternative providing the "maximum net benefits."

In early 1998 the City sent a letter to Ecology reiterating its intention to continue forward with its water rights application on the Dosewallips River. Ecology responded in a letter recommending the City pursue an alternative water supply strategy because of the likelihood that instream flow requirements, not yet set, would close the river to diversions from July through mid-November. Ecology stated that despite the 1956 priority date of the City's application, any water right that might be granted would be subject to instream flow requirements that would necessarily be set as part of granting the water right.

The 1998 City of Port Townsend Water System Plan examined future water needs and the financial ability to develop water resources. Perfected supplies were determined to be adequate for planned population growth and the capital cost of developing and transporting water from the Dosewallips River was not justifiable. The expected listing of Puget Sound Fall Chinook salmon and Hood Canal Summer Chum salmon under the Endangered Species Act would also have had a significant adverse affect on the City's ability to obtain water rights. Based on the evaluation of existing water resources and environmental considerations, the Port Townsend City Council adopted a resolution in 1998 abandoning the City's Dosewallips River surface water application.

4.3 Water System Reliability Analysis

The City's efforts to ensure reliable water service and supply are presented in this section. These efforts are presented in the following categories: source, facility, and water shortage response planning.

4.3.1 Source Reliability

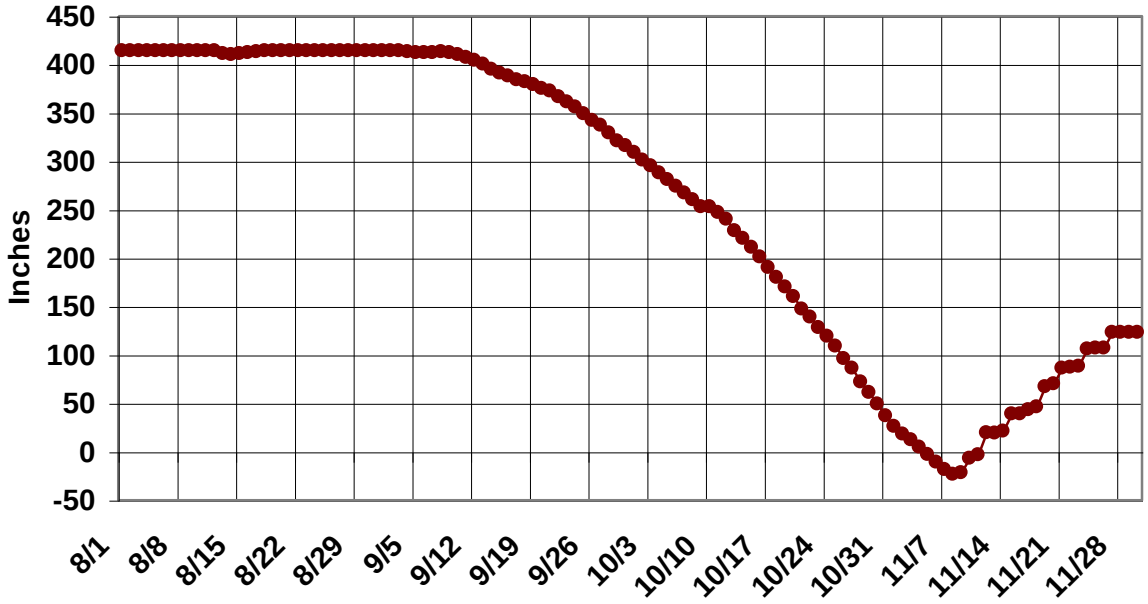
Both the Big Quilcene and the Little Quilcene Rivers provide the City's source water. These sources have historically been a reliable source for both quantity and quality of water for the City's municipal needs.

4.3.1.1 Capacity

Hydraulic Capacity of the OGWS: The hydraulic capacity of the OGWS between the Big Quilcene River diversion and City Lake is approximately 20 mgd, based on historical meter data collected at the meter into City Lake. The hydraulic capacity of the OGWS downstream of City Lake under the current facility conditions is shown from historical meter records to be approximately 25 mgd. With OGWS capacities exceeding the combined current and projected demand needs of the City and PTPC, and the Big Quilcene River water right, the hydraulic capacity of the transmission system is not a limiting factor in supplying the peak flow needs of the City and PTPC.

Critical Water Supply Period: The City has surface water rights equal to or in excess of projected demands. The main limiting factor in providing adequate future supply is the capacity of Lords Lake. Because of the voluntary maintenance of instream flow on the Big Quilcene River and the instream flow requirements for the Little Quilcene River, it is typically necessary to draft from Lords Lake to meet demands during the late summer dry weather season. The extent to which drafting of Lords Lake is necessary is dependent on the weather-related factors that affect the flows in the Big and Little Quilcene Rivers. In some years, very little drafting of Lords Lake is necessary; however, during 2002, the full capacity of Lords Lake was used and water was pumped 2 feet below the reservoir intake. The levels in Lords Lake for 2002 are depicted in Figure 4-1 showing a drawdown of approximately 520 MG. The year 2002 was unusually dry with limited rain between June and the beginning of November, whereas the average reservoir-draw-down for the past seven years has varied between 125 and 325 MG, averaging 175 MG.

Figure 4-1: 2002 Lords Lake Level



As seen in Figure 4-1, without appreciable rain during the summer and fall and maintaining a 27 cfs stream flow below the Big Quilcene River diversion, Lords Lake storage capacity allows for approximately two months of continued PTPC operations and supply to the City. As the City population grows, this storage depletion curve will steepen unless the City and PTPC are able to compensate with improved conservation measures.

The City is a cooperator with the National Resource Conservation Service (NRCS) in maintaining the nearby "SNOTEL" data- gathering site located on the south boundary of the Big Quilcene watershed at Mount Crag. The SNOTEL station documents snowpack and rainfall that can be used to predict streamflows. The SNOTEL site is operated and maintained by the U.S. Department of Agriculture's Natural Resources Conservation Service. The City and PTPC utilize the data collected since 1990 to estimate water availability; however summer rainfall patterns have a large influence on late summer streamflows.

Big Quilcene River and Little Quilcene River flow measurements below the diversions have been collected from a U.S. Geological Survey (USGS) gauge since 1994.

4.3.1.2 Quality

Water quality for the City's source waters is discussed in detail in Section 3. As discussed in Section 3, supply has been completely reliable in past operations. All applicable water quality requirements have been met.

4.3.2 Facility Reliability

An analysis of the City's water system facilities is presented in Section 3 of this Plan. The facility improvements summarized in Section 3 are included in the City's improvement program, presented in Section 8 of this Plan.

4.3.3 Water Shortage Response Planning

The City has a water shortage response plan, which is presented in Appendix U. This water shortage response plan addresses temporary short-term conditions where adequate supply is not available to meet customer needs.

4.4 Interties

The City has wholesale contracts for the delivery of water. To eliminate any potential argument that these wholesale customers are located outside of the boundaries of the City's water service area, as it exists now or at the time water rights were granted to the City, this notice is being provided to grandfather these interties according to state law. Pursuant to RCW 90.03.383, WSDOH and Ecology were notified that the interties were existing and in use as of January 1, 1991 (see intertie notice to Ecology and WSDOH in Appendix V). The wholesale customers to whom the City provides water through an intertie are as follows:

- PUD No. 1 of Jefferson County (LUD No. 3 - "South Hastings Loop") . Metering for the South Hastings Loop is at the Chevy Chase Golf Course on Cape George Road. The length of the pipeline between the intertie and first customer provides sufficient chlorine contact time. CT compliance for LUD No. 3 is calculated by the PUD but varies from greater than 2 to more than 15.
- PTPC. Metering for Mill usage is measured at the Mill and may be calculated by subtracting City and LUD No. 3 usage from City Lake outflow. Port Townsend Paper Company monitors CT for their potable water system.

Copies of these contracts are provided in Appendix W. There are no additional proposed interties for the City's water system.

Appendix Q
Conservation Measure Evaluation

The 2003 Municipal Water Law has changed State conservation program elements from voluntary measures to a regulated requirement. Water use efficiency rules are required to be adopted by December 2005. The new regulation will incorporate conservation planning, performance reporting, and a distribution leakage standard. Efficiency requirements will start with existing guidance.

Water systems are required to evaluate certain recommended conservation program measures for inclusion into their conservation program. Not all recommended conservation measures are required to be put in place. Some measures may not be suitable or feasible for a particular water system and may not represent the best use of the water systems financial resources. An effective conservation program is focused on the inclusion of measures that provide the greatest opportunity for water usage savings at a reasonable cost. A summary of that evaluation for the City of Port Townsend is presented in this appendix.

Q.1 Conservation Measure Evaluation

A qualitative summary of all potential program measures evaluated for inclusion in Port Townsend's Conservation Program is provided in Table Q-1, including measure description, cost (high to low), knowledge needed for implementation (high to low), and potential water savings (high to low). The list of measures for the City's program was narrowed based on this initial evaluation to include the program elements with the greatest benefit per cost in the City's initial program design. After successful implementation of the projects identified in the initial program and evaluation of initial program water savings, the City will reconsider other measures for inclusion in their conservation program.

It should be noted that water savings and costs directly and indirectly attributable to public education/information activities are often difficult to quantify because they occur as an integral part of administrating other technical programs within the overall conservation strategy. Utilities that have been pursuing conservation for some time indicate that, although the actual savings from these informational activities are difficult to quantify, these programs are necessary to ensure participation by customers in other program measures and increase community awareness of the importance of conservation.

TABLE Q-1
Port Townsend Conservation Program Potential Conservation Measures

Measure Description	DOH Recommend?	Implementation Cost Range	Implementation Difficulty	Water Savings Potential and/or Educational Value
Public Education				
School Outreach/ Teacher Conservation Education Workshops	No	Low	Moderate	Good long term change in water use attitude. Small initial savings.
Speaker's Bureau	No	Low to high depending on speaker	Moderate	Low to moderate
Program Promotion - Mailers/ Brochures/ Calendars	Required	Depends on materials used	Low	Low to moderate. Helps other programs succeed.
Theme Shows/ Exhibits	No	Low to moderate	Moderate	Low to moderate. Aids in program promotion.
Youth Education (scouts, 4-H, etc.)	No	Low	Low	Good long term change in water use attitude. Small initial savings.
Targeted Mailers/ New Customer Packets	No	Low to Moderate	Low	Low
Summer Water Use Monitor (direct observation of and suggestions for correcting wasteful water use practices)	No	Moderate to high	Moderate	Low to moderate. Probably most effective for short-term shortage savings.
Contests (poster, water saving landscapes, slogan/logo, exhibits)	No	Moderate	Moderate	Low.
Media Advertising (radio, newspaper, TV, bus signs, billboards, table tents, etc.)	No	Low if included as public service announcement.	Low	Low
Videotape Production	No	Low to High.	High	Will vary with delivery mechanism.
Technical Assistance				
Purveyor Assistance	Yes	Low	Low	Low to moderate.
Customer Assistance	Yes	Low	Low	Low to moderate.

TABLE Q-1
Port Townsend Conservation Program Potential Conservation Measures

Measure Description	DOH Recommend?	Implementation Cost Range	Implementation Difficulty	Water Savings Potential and/or Educational Value
Technical Study - Customer Water Use Survey	Yes	High	High	Moderate
Water Use History on Bill	Yes	High	High	Low
System Measures				
Source Meter - Installation, Calibration, and Repair	Required	Moderate	Low	Moderate
Service Meter - Installation, Calibration, and Repair	Yes	Moderate	Low	Moderate
Water System Leak Detection	Yes	Moderate	Moderate	Moderate to high
Multi-Family Submetering	Yes	High	Moderate	Moderate
Lower System Pressure	No	High	High	Low
Automatic Meter Reading	No	High	High	Low
Incentives/Other Measures				
Single-Family and Multi-Family Retrofit/Equipment Programs	Yes	Low to High.	High	Moderate
Nurseries/Agriculture	Yes	Moderate	Moderate	Low
Landscape Management/Playfields – Xeriscape	Yes	Moderate	Moderate	Moderate
Conservation Pricing	Yes	Low	Low	Low to moderate
Single Family Ultra Low Flush Toilet Rebates	No	Moderate to high	Moderate	Moderate
Residential/Commercial Water Use Audits	No	Moderate to high	High	Low to moderate
Paper Mill Conservation Assistance	No	Low	Low	High
Industrial/Commercial reuse/recycling (cooling systems, laundry, car washes)	No	Moderate to high	High	Moderate
Wastewater Reuse-Irrigation and Large Water Users	No	Moderate to high	High	Moderate

TABLE Q-1
Port Townsend Conservation Program Potential Conservation Measures

Measure Description	DOH Recommend?	Implementation Cost Range	Implementation Difficulty	Water Savings Potential and/or Educational Value
Demonstration Gardens	No	Moderate to High	High	Low
Municipal Water Use Efficiency	No	Low	Low	Low, but portrays positive community attitude.
Irrigation Technical Assistance (irrigation audits, irrigation system design assistance, promotion of efficient irrigation equipment, plant tags, workshops)	No	Moderate to high	High	Moderate
Gray Water Lines	No	High	High	Moderate
Landscape Conversion Incentives	No	Moderate	Low to moderate	Moderate
Pipe Insulation Program	No	High	High	Low
Policy/Ordinance				
Landscape Management/Landscape Ordinances	No	Low utility cost, potentially high customer cost.	Moderate	Moderate
Outdoor Water Use Restrictions/Alternative Day Watering	No	Low	Moderate	Moderate. More for short term use.
Irrigation System Approvals or Special Irrigation Design Requirements	No		High	Moderate
Wasted Water Ordinance	No	Low	Moderate	Low
Required Plumbing/Landscape Retrofit on Sale of Home	No	Low utility cost, high customer cost.	High	Moderate
Transferable Savings (paying a proportion of the city's avoided cost to the customer)	No	High	High	Low

Measures not selected are shaded.

Q.2 Selected Conservation Measures

The conservation measures presented herein fall into four main categories, as presented in WSDOH's current Conservation Planning Requirements, public education, technical assistance, system measures, and incentives/other measures. These measures were selected by the City for inclusion into its conservation program because of their potential effectiveness, historical success in Port Townsend and other municipalities, and relatively low cost of implementation. Brief summaries of these measures are also presented in Section 4.

Q.2.1 Public Education

The City recognizes the importance of educating its citizenry, especially its young people, about the importance of conserving water. The conservation measures presented in this section relate to education in the public schools as well as in other forums.

School Outreach

Description: Through presentations and facility tours the Water Conservation Program Manager will conduct outreach to community schools and other organizations. The goal is to help develop a conservation ethic within the community by educating staff and students.

Budget: $500 for supplies and $100/year thereafter. Staff time is not included as an expense.

Monitoring: Water savings from this type of program is difficult to measure. The success of this program will be monitored by the number of events, presentations, water system facilities tours, etc.

Program Promotion

Description: This measure is already in-place with mailings and brochures to customers regarding the need for conservation and the City's conservation efforts. This program includes a variety of conservation material including conservation brochures, literature and reference materials. The City will also periodically update brochures explaining their water rate structure.

The City will work with the local newspaper, The Leader, to establish a "Water Conservation Corner" section in the paper. The Conservation Program Manager will be responsible for coordinating public release of water supply and conservation information for the City. A series of conservation helpful hints, and a water supply and water use summary will be submitted regularly in the newspaper during the summer and on an occasional basis in the winter. Pertinent regional or statewide news (legislative, new programs, new conservation products, etc.) will also be tracked and submitted for publication in the newspaper.

Budget: $1,000 for brochures and literature

Monitoring: No monitoring plan has been established for this measure.

Q.2.2 Technical Assistance

The technical assistance measures presented in this section relate to assisting purveyors, including the Jefferson County PUD, and wholesale and retail customers.

Purveyor and Customer Assistance

Description: Provide assistance to wholesale water customers and purveyors as requested. Technical assistance will be provided by the Conservation Program Manager.

Budget: No material costs are associated with this program. Staff time is not included in the budget.

Monitoring: This program will be monitored through the number of calls received and documented assistance provided.

Q.2.3 System Measures

The measures presented in this section relate to actions that can be taken toward physical components of the distribution system.

Source Meter Monitoring and Calibration

Description: All of the City's water sources are currently metered. This measure will include meter calibration and repair. Calibration should occur every five years and meters will be repaired as needed.

Budget: The cost of this measure is included in the operations budget. The cost for the meter calibration program for 7 supply meters (Quilcene diversions (two), City Lake (two), Tri-Area master, and City meters) is estimated to be $7,500.

Monitoring: This measure will be monitored through annual calibration and comparison of annual master meter readings.

Service Meter Monitoring and Repair/Replacement

Description: Over 99 percent of the City's customers are currently metered. Efforts will continue to locate and meter remaining unmetered services and illegal system connections. Electronic data loggers are now being used during meter reading, which will decrease opportunities for errors in consumption records. Many of the City's customer meters are believed to be reading low because of their relatively old age, however there is a budget to replace 150

meters per year.

Budget: The cost of this measure is included in the operations budget. The estimated annual cost of the meter replacement program is $15,000 for touch-read meters plus approximately 75 hours of personnel time. Meter calibration for the wholesale customers (Port Townsend Paper Co., Jefferson County PUD's LUD#3 (two), Glen Cove, Ft. Flagler, Indian Island, and the Fish Lab) is estimated to cost an additional $7,500.

Monitoring: The success of the measure will be monitored by comparison of monthly data and amount of unaccounted-for water.

Leak Detection/Unaccounted Water

Description: The City has already begun efforts to locate and reduce sources of unaccounted water, including metering unmetered accounts, repairing broken meters, and identifying and repairing leaks. The City has contracted leak detection services and begun a routine program for leak detection and repair. The distribution system will be inspected on a 5-year rotating schedule, including meters, services, hydrants, and mains. At least two City water department staff will be trained in the use of the leak detection equipment. Reservoir leakage tests will also be conducted once every 5 years.

Budget: The cost of this program is included in the operations budget. The estimated costs are $8,500 per 25 miles + $300/leak for repairs.

Monitoring: Source-of supply volumes and volumes of unaccounted water will be estimated annually. These quantities will include water used for public uses (firefighting, street washing, sewer and water main flushing, non-metered irrigation at public facilities, etc.), and construction. If it is found that the volumes of water used for these purposes is significantly higher than for other similar sized communities, a program will be established to reduce public water uses and to meter construction water.

Q.2.4 Incentives and Other Measures

The conservation measures presented in this section include those that provide incentives for conservation and other miscellaneous measures.

Landscape Management/Playfield - Xeriscaping

Description: The Conservation Program Manager will collect and disseminate information to the public on efficient irrigation and landscaping practices, including the water savings potential and associated monetary savings that can be realized by using the techniques. Irrigation audit guidebooks will be made available to the public. Information on the availability of various irrigation/ landscaping products will also be made available. Depending on program cost and policy implications, the City may consider an economic incentive (coupon, rebate on water bill) for purchase of irrigation technology

and water conserving devices. The Conservation Corner of the newspaper (included in the Program Promotion measure) will be the primary vehicle for distribution of outdoor water use information. Irrigation education and self-auditing seminars will be held for interested groups such as gardening societies, environmental groups, and parent's associations.

Budget: $2,000/year for materials

Monitoring: Savings from this program will be monitored through reductions in peak demands and summer month demands. Success of the program will also be monitored through dispersal of literature and community interest in conservation incentives and devices.

Conservation Pricing

Description: The City has a base rate charge and a usage charge based on the actual water used. The current rate structure will be reviewed annually to determine whether it should be modified to include additional tiers, summer/winter rates, greater proportion of rates shifted to usage charges, or other additional conservation incentives.

Budget: The cost of evaluating, updating, and implementing periodic conservation rate adjustments is considered to be a necessary part of the City's financial administration; this cost has not been assessed as part of the City's conservation program.

Monitoring: This program will be monitored through monthly water use rates and per capita water use.

Paper Mill Conservation

Description: The Port Townsend Paper Company Mill (Mill) affords the greatest opportunity for large-scale water conservation of the City's Quilcene surface water supply. The Mill uses approximately 12.5 mgd for mill operations but diverts an average of approximately 14.5 mgd from the OGWS, which is used to generate electric power. The Mill has temporarily reduced water use during water shortages to 10 to 11 mgd through operational modifications. There is also a move toward equipment replacement at the Mill, which will result in water use reduction. These changes are being made to improve Mill performance and reduce use of natural resources.

Under the terms of the water service contract between the City and the Mill, the water supply system is operated and maintained by the Mill in exchange for water supply. The City has initiated discussions with the Mill regarding the potential for collaborative efforts to implement increased conservation by the Mill. These discussions will continue and may include revisions to the water supply contract between the City and the Mill to reallocate a percentage of the conserved water to the City's future requirements and/or to instream flow.

Budget: Current changes at the Mill are being implemented without cost to the City.

Monitoring: Water use will be monitored monthly on the master meter.

Municipal Water Use Efficiency

Description: In order to achieve active participation and support of conservation programs by the community, the following projects will be evaluated for implementation by City departments and at all City facilities.

- Flush and test hydrants during winter and spring months, except when an emergency arises
- Retrofit water efficient plumbing fixtures in City facilities.
- Use water efficient landscape and irrigation design principles on all new public and substantially remodeled facilities (schools, parks, reservoirs, community centers, libraries, other City buildings)

Budget: Replacement plumbing fixtures costs are estimated to be $1,000 and landscaping costs will depend on planting selection.

Monitoring: The success of this program will be monitored through monthly water use by the City.

Q.2.5 Measures to be Considered for Future Implementation

Several measures were evaluated but not included in the City's conservation program; however, some of these measures, though not included in the current program warrant further consideration in the short-term future. A description of these measures is presented in this section.

Residential Water Use Audits

Residential water audits would be performed at the request of the homeowner. This service would be advertised on the monthly water bill. Typically, these audits are performed free of charge and include installation of retrofit devices. The water use auditor checks for leaks, installs retrofit items, and provides detailed suggestions on areas where homeowners can save water. Water audits typically take one hour. To maintain savings from audits, the service probably needs to be periodically repeated (every 5 to 10 years). Audits typically cost about $70 per site.

Multi-Family/Commercial/Institutional Water Use Audits

The City would identify the largest water users in the system for participation in this program. Potential participants include: Ft. Worden, hotels/motels, Port Townsend hospital, car washes, laundries, Point Hudson, Port of Port Townsend, groceries, large apartments, and Kah Tai Care Center. The water audits would include and evaluation of indoor and outdoor water use as appropriate. Devices would not be included. Some

conservation incentives could be offered. Audits typically cost $1,000 for schools, care centers, apartment complexes, and motels/hotels and $4,000 for the larger customers such as Ft. Worden, Ft. Flagler, Point Hudson, and hospitals.

Single-Family Ultra Low Flush Toilet Rebates

This measure should target the large number of homes in Port Townsend with older, large volume toilets. The measure could include a $70 rebate for 1.6 gallon-per-flush toilets. This would result in a significant reduction in water use from a 5 to 7 gpf toilet. A budget of $4,000/year should be considered which would allow for about 60 rebates per year of about 1.5% of the residential customers. Rebates should be limited to one per household with new construction and major remodels excluded. Monthly water use for each customer receiving a rebate should be monitored and compared with usage for previous years. Customer follow-up should be conducted to determine customer satisfaction with the new toilet.

Conservation Education

The Water Conservation Program Manager along with the Washington State University Cooperative Extension coordinator would assist the schools with development of curricula on water conservation, which are applicable to grade school, middle school, and/or high school students. Similar programs within other Washington communities would be reviewed and customized to reflect the lifestyle and values of Port Townsend residents. As part of this educational effort, other City water department staff would speak to classes about water system operations and water supply issues. The curricula could include, but are not limited to, science or art projects/contests related to conservation, community involvement projects (design of a conservation poster display or flower garden for a community event), and field trips to water system facilities. Audio-visual materials may also be developed. The program could also be expanded to other community youth organizations.

Water Use History on Bill

The current utility billing software does not include the ability to print water consumption histogram on customer utility bills. This will be considered during future software upgrades.

Appendix R
Water Reuse and Largest Water Users

The narrative presented herein is excerpted, unchanged, from Section 8.8 of the City of Port Townsend 1998 Water System Plan. Backup cost information presented in the 1998 Plan as Appendix V is also included in this appendix – after the narrative.

As part of WSDOH's Conservation Planning Requirements, all public water systems are required to incorporate an inventory of major potential sources and uses for reclaimed water in their water system plan. Effluent from the City's municipal wastewater treatment plant is considered to be the only local supply available for reuse. However, other possible candidates for supplying reuse water are the effluent from the fish laboratory on Marrowstone Island and the effluent from the PTPC mill. The waste stream at Marrowstone Island is highly brackish and is very far from potential reuse customers in the City and Tri-Area systems. No studies have been conducted on the waste stream from the PTPC mill. Whether or not this waste stream represents a potential reuse supply source depends on many factors that would have to be evaluated.

Potential candidates for irrigation with wastewater treatment plant effluent include: Fort Worden State Park, the municipal golf course, the fairgrounds, cemeteries, two schools, and several other parks. Many of these potential candidates are not currently irrigated; thus, the potential for reducing demand by using reclaimed water is not great.

Only 3 acres of the 350-acre Fort Worden State Park are currently irrigated. Fort Worden contains approximately 80 acres of lawn area, of which 25 to 30 acres have been considered for installation of irrigation systems using City water. However, because of the cost of construction and recent increases in water rates, irrigation has not been pursued.

As previously stated, other potential reuse sites also do not currently use substantial amounts of irrigation water. The fairgrounds, some of the cemeteries, and other undeveloped parcels do not currently irrigate. The golf course only irrigates about 25 to 30 percent of 55 acres and typically does not irrigate at all for approximately 5 months during winter and early spring. A review of the City's billing records shows peak monthly consumption at the golf course to be as high as 3.4 MG. This 3.4 MG peak monthly consumption translates to an ADD during the peak month of 110,000 gallons per day. The annual ADD at the golf course is approximately 28,000 gallons per day based on the 1995 and 1996 billing records.

A summary of the City's 30 largest water customers is presented in Table 8-6. The users are presented in descending order based on the maximum month usage. These customers include wholesale and retail customers served from the City system and the Tri-Area system.

It is apparent from Table 8-6 that there is relatively little opportunity to reduce total customer demand by providing reclaimed water for some uses such as irrigation. However, another important benefit of developing a reclaimed water supply is the reduced volume of effluent discharge from the wastewater treatment plant. Reducing this volume can extend the useful life of the treatment plant outfall. This additional benefit should be considered when determining whether to implement a reuse project in the future.

An order-of-magnitude project cost estimate was prepared in 1993, including construction of filtration treatment for the sewage effluent, a pump station, storage reservoirs, and distribution network linking various irrigation sites. The project cost of a 0.75-mgd treatment facility, a distribution network, and other ancillary facilities was estimated at from $4 million to $5 million in 1993 dollars. If these costs are escalated to 1997 dollars at 5 percent per year, the total project cost would range from $4.9 million to $6.1 million. Backup information for these reuse system cost estimates is presented in Appendix V.

Table 8-6

Summary of Largest Water Users

(Based on 2003-2004 Billing Records)

Customer	2003-2004 1-Year **Total** (gallons)	**Average Annual Day** (gallons/day)	**Average Month** (gallons/month)		**Maximum Month** (gallons/month)	**Potential For Reuse?** (1)
FORT WORDEN	12,754,000	34,942	1,062,833	29,610	2,961,000	yes
P T GOLF COURSE	12,030,000	32,959	1,002,500	36,400	3,640,000	yes
JEFFERSON GENERAL HOSPITAL	5,024,000	13,764	418,667	6,060	606,000	no
PORT OF PORT TOWNSEND	5,004,300	13,710	417,025	2,528	711,000	no
MOUNTAIN VIEW SCHOOL	3,616,000	9,907	301,333	11,340	1,134,000	no
CHETZEMOKA PARK	3,537,700	9,692	294,808	7,754	775,400	yes
BLUE HERON SCHOOL	3,465,800	9,495	288,817	11,279	1,127,900	no
HARBORSIDE INN	2,769,700	7,588	230,808	3,714	371,400	no
JEFFERSON CO COURTHOUSE	2,685,600	7,358	223,800	4,232	423,200	no
SAFEWAY STORES INC	2,468,600	6,763	205,717	2,662	266,200	no
MANRESA INN,INC	1,989,000	5,449	165,750	3,860	386,000	no
LIFE CARE SERV OF AMERICA	1,847,300	5,061	153,942	2,357	235,700	no
P U D	1,645,400	4,508	137,117	3,357	335,700	no
ALC, INC/VICTORIA	1,561,600	4,278	130,133	2,522	252,200	no
CAROL'S LAUNDROMAT	1,387,400	3,801	115,617	1,747	174,700	no
MARINE PLAZA APTS	1,329,000	3,641	110,750	1,611	161,100	no
BPS INC	1,183,400	3,242	98,617	1,369	136,900	no
PT LAUNDROMAT AND CAR WASH	1,114,700	3,054	92,892	1,559	155,900	no
SEA BREEZE CENTER	975,100	2,672	81,258	1,458	145,800	no
FOREST PARK CONDO ASSOC.	814,300	2,231	67,858	1,939	193,900	no

Notes:

(1) Only those business and municipal customers in the City of Port Townsend (near the reuse water source of the wastewater treatment plant) that have significant irrigation usage are considered potential candidates for reuse.

Table 8-6

Summary of Largest Water Users

(Based on 1995 and 1996 Billing Records)

Customer	1995 and 1996 2-Year **Total** (gallons)	Average Annual **Total** (gallons/year)	Average Annual Day (gallons/day)	Average Month (gallons/month)	Maximum Month (gallons/month)	Potential For **Reuse?** (1)
Port Townsend Golf Course	20,267,000	10,133,500	27,763	844,458	3,395,000	yes
Indian Island Naval Station	37,046,700	18,523,350	50,749	1,543,613	2,984,000	no
Fort Worden State Park	23,785,700	11,892,850	32,583	991,071	2,480,800	yes
PUD (Glen Cove)	15,891,400	7,945,700	21,769	662,142	1,828,400	no
Port Townsend School District	6,972,100	3,486,050	9,551	290,504	1,422,800	yes
Chimacum School	6,424,400	3,212,200	8,801	267,683	1,260,600	no
PUD (LUD 3)	14,281,100	7,140,550	19,563	595,046	1,069,000	no
"Private Person"	5,612,100	2,806,050	7,688	233,838	1,000,400	no
Rowley Enterprises (Port of Port Townsend)	9,496,000	4,748,000	13,008	395,667	892,000	no
Fort Flagler State Park	6,536,900	3,268,450	8,955	272,371	495,300	no
General Hospital	7,880,600	3,940,300	10,795	328,358	452,300	no
Port of Port Townsend	4,708,500	2,354,250	6,450	196,188	363,300	no
"Private Person"	6,358,900	3,179,450	8,711	264,954	360,900	no
Quality Food Center	5,155,900	2,577,950	7,063	214,829	344,000	no
Harborside Inn	3,952,900	1,976,450	5,415	164,704	340,200	no
Manresa Inn	3,891,000	1,945,500	5,330	162,125	308,900	no
Marine Plaza Apartments	3,379,800	1,689,900	4,630	140,825	268,200	no
Service Activities Center	3,048,700	1,524,350	4,176	127,029	262,600	no
Sea Breeze Center	4,453,500	2,226,750	6,101	185,563	255,300	no
City of Port Townsend	2,693,000	1,346,500	3,689	112,208	249,500	no
Food COOP and Seed	1,992,500	996,250	2,729	83,021	241,700	no
Washington State Ferries	3,359,800	1,679,900	4,602	139,992	240,100	no
"Private Person"	3,911,700	1,955,850	5,358	162,988	205,900	no
Life Care Service of America	3,670,800	1,835,400	5,028	152,950	203,700	no
Safeway	3,620,500	1,810,250	4,960	150,854	201,200	no
County Jail	2,929,400	1,464,700	4,013	122,058	192,000	no
Admiralty Apartments	3,444,400	1,722,200	4,718	143,517	184,100	no
City of Port Townsend	2,167,800	1,083,900	2,970	90,325	165,600	no
Discovery View Retirement Home	1,756,600	878,300	2,406	73,192	120,700	no
Harmon-Mulligan	2,003,100	1,001,550	2,744	83,463	114,900	no

Notes:

(1) Only those business and municipal customers in the City of Port Townsend (near the reuse water source of the wastewater treatment plant) that have significant irrigation usage are considered potential candidates for reuse.

Table 6-8 5

City Of Port Townsend
Wastewater Reuse Evaluation
Actual and Potential Water Use

SITE NAME	EST. ACRES	EST. % IRRIG.	IRRIG. ACRES	ACTUAL IRRIGATION (MGD) 1992							POTENTIAL IRRIGATION (MGD)						
				MAY	JUNE	JULY	AUG	SEPT	OCT	SEASON	MAY	JUNE	JULY	AUG	SEPT	OCT	SEASON
Fort Worden State Park	350	20	70	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00118	0.00297	0.00385	0.00286	0.00188	0.00039	0.00219
CP#2 (Jackman & Umatilla)	4.1	20	0.82	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00001	0.00003	0.00005	0.00003	0.00002	0.00000	0.00003
New School Site (San Juan & Center)	5	30	1.5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00003	0.00006	0.00008	0.00006	0.00004	0.00001	0.00005
Levinski Property	38.5	20	7.7	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00013	0.00033	0.00042	0.00031	0.00021	0.00004	0.00024
Fair Grounds	32	50	16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00027	0.00068	0.00088	0.00065	0.00043	0.00009	0.00050
Catholic Cemetery	1	50	0.5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00001	0.00002	0.00003	0.00002	0.00001	0.00000	0.00002
Municipal Golf Course	55	75	41.25	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00069	0.00175	0.00227	0.00169	0.00111	0.00023	0.00129
Redmens Cemetery	4	50	2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00003	0.00008	0.00011	0.00008	0.00005	0.00001	0.00006
County Cemetery	3.4	50	1.7	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00003	0.00007	0.00009	0.00007	0.00005	0.00001	0.00005
Laurel Grove Cemetery	8	50	4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00007	0.00017	0.00022	0.00016	0.00011	0.00002	0.00012
School ('D' & Van Ness)	6.3	30	1.89	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00003	0.00008	0.00010	0.00008	0.00005	0.00001	0.00006
Sather Park	4.6	50	2.3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00004	0.00010	0.00013	0.00009	0.00006	0.00001	0.00007
Chetzemoka Park	20	50	10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00017	0.00042	0.00055	0.00041	0.00027	0.00006	0.00031
City Shops/Cherry Park	4.8	20	0.96	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00002	0.00004	0.00005	0.00004	0.00003	0.00001	0.00003
Morgan Hill Res. Site	2.1	20	0.42	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00001	0.00002	0.00002	0.00002	0.00001	0.00000	0.00001
Memorial Field	3.6	50	1.8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00003	0.00008	0.00010	0.00007	0.00005	0.00001	0.00006
Sims Way Industrial Site	50	50	25	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00042	0.00106	0.00138	0.00102	0.00067	0.00014	0.00078
Howard St. Res/SSF Site	17.6	30	5.28	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00009	0.00022	0.00029	0.00022	0.00014	0.00003	0.00016
TOTALS	610.00		193.12	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00325	0.00818	0.01062	0.00789	0.00520	0.00108	0.00603
TOTAL TO LAUREL GROVE	501.00		145.47	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00245	0.00616	0.00800	0.00595	0.00391	0.00082	0.00455

Notes:

1. Net Irrigation requirement by Month for Sequim, Wa

May	1.44	Aug	3.50
June	3.51	Sept	2.23
July	4.71	Oct	0.48
		Season	15.88

2. Irrigation efficiency assumed to be 75% for potential use computations.

Table 6-9

City of Port Tov

Wastewater Reuse System Costs

Site Description	From	To	Potential Irrigation MGD	Actual Irrigation MGD	Pipe Length (FT.)	Diameter (IN.)	Construction Cost	Project Cost
Fairgrounds	WWTP	Fairgrounds			1000	10	$50,000	$86,125
Fort Worden	Fairgrounds	Junction 1			1250	10	$62,500	$107,656
	Junction 1	Fort Worden			550	6	$16,500	$28,421
Levinski Property	Fairgrounds	Levinski			2900	6	$87,000	$149,858
Catholic Cemetery	Junction 1	C. Cemetery			1250	8	$50,000	$86,125
New School (Center and San Juan)	C. Cemetery	Junction 2			650	8	$26,000	$44,785
	Junction 2	New School			250	8	$10,000	$17,225
Jackman & Umatilla Prop.	New School	Junction 3			2100	8	$84,000	$144,690
	Junction 3	J & U Prop.			1000	4	$20,000	$34,450
Municipal Golf Course	Junction 3	Golf Course			300	8	$12,000	$20,670
Redmen's & Cnty Cemeteries	Golf Course	R. Cemetery			1500	6	$45,000	$77,513
	R. Cemetery	Cnty Cemetery			500	4	$10,000	$17,225
Laurel Grove Cemetery	R. Cemetery	L.G. Cemetery			650	6	$19,500	$33,589
City Shops/Cherry Park	Junction 2	City Shop/Cherry Pk			1700	4	$34,000	$58,565
Howard St. Res. Site	L.G. Cemetery	Junction 4			4900	6	$147,000	$253,208
	Junction 4	Res. Site			4400	4	$88,000	$151,580
Sims Way Industrial Site	Junction 4	SWIS			1500	4	$30,000	$51,675
School ("D" & Van Ness)	Golf Course	Junction 5			2700	6	$81,000	$139,523
	Junction 5	School			500	4	$10,000	$17,225
Sather Park	Junction 5	Junction 6			400	6	$12,000	$20,670
	Junction 6	Sather Park			700	4	$14,000	$24,115
Morgan Hill Reservoirs	Sather Park	Morgan Hill			750	4	$15,000	$25,838
Chetzemoka Park	Junction 6	Junction 7			2100	4	$42,000	$72,345
	Junction 7	Chetzemoka Park			300	4	$6,000	$10,335
Memorial Field	Junction 7	Memorial Field			2150	4	$43,000	$74,068
TOTALS (ENTIRE NETWORK)							$1,014,500	$1,747,476
TOTALS (TO LAUREL GROVE ONLY)							$492,500	$848,331
OTHER COSTS:								
Filtration Plant (0.75 MGD)							$1,016,000	$1,750,060
Storage Tank (1.5 MG)							$525,000	$904,313
Pump Station (1.8 MGD, 350 FT TDH)							$240,000	$413,400
Pressure Reducing Stations							$45,000	$76,500
Permits and Right-of-Way							$50,000	$50,000
Land (5 Acres)							$60,000	$60,000
TOTAL COST (LAUREL GROVE ONLY)							$2,428,500	$4,102,604
PIPE COST PER IN. DIAMETER =	$5.00							$848,331
CONTINGENCY =	25%							$4,042,604
TAX =	7.80%							
ENGR & MIN =	30%							