

**RESOLUTION NO. 1239**

**A RESOLUTION ACCEPTING A WATER MANAGEMENT AND CONSERVATION PLAN**

**WHEREAS**, the City obtained water rights for Well #8 from the State Water Resources Department; and

**WHEREAS**, the approval document (Permit #G-11761) required the City to prepare a Water Management and Conservation Plan in accordance with OAR 690-86; and

**WHEREAS**, the City engaged the services of a consultant, Economic and Engineering Services, Inc. to prepare the Plan; and

**WHEREAS**, the Plan has been prepared, reviewed by staff and found to be acceptable.

**NOW THEREFORE BE IT RESOLVED BY THE COUNCIL OF THE CITY OF TROUTDALE**

That the "City of Troutdale Water Management and Conservation Plan, February, 1996" which is attached hereto and made a part hereof, is accepted.

**YEAS:** 6  
**NAYS:** 0  
**ABSTAINED:** 0

  
Paul Thalhofer, Mayor

Dated: 4-16-96

  
George Martinez, City Recorder

Adopted: 4-9-96



**CITY OF TROUTDALE  
WATER MANAGEMENT AND  
CONSERVATION PLAN**

**February 1996**

**ECONOMIC AND ENGINEERING  
SERVICES, INC.**

**CITY OF TROUTDALE**  
**WATER MANAGEMENT AND**  
**CONSERVATION PLAN**

**February 1996**

**Economic and Engineering Services, Inc.**

**4380 SW Macadam, Suite 365**  
**Portland, OR 97201**  
**503-223-3033**

**OLYMPIA, WA \* BELLEVUE, WA \* PORTLAND, OR \* VANCOUVER B.C. \* WASHINGTON, DC**

# Contents

<b>Section 1 - The Troutdale Water System and Water Use Characteristics</b>	<b>1-1</b>
1.1 Water Sources .....	1-1
1.2 Water Supply Facilities .....	1-2
1.3 Water Storage Facilities .....	1-4
1.4 Water Distribution Facilities .....	1-4
1.5 Water Usage.....	1-5
1.6 Water Demand Forecasts .....	1-8
1.7 Future Demand.....	1-9
<b>Section 2 - Conservation Plan.....</b>	<b>2-1</b>
2.1 Introduction.....	2-1
2.2 The Interim Water Conservation Plan .....	2-2
2.2.1 Level 1 Program .....	2-3
System Water Audit.....	2-3
Leak Detection and Meter Replacement Program.....	2-3
Water Audit of the Utility and Municipality Use Patterns ....	2-4
Public Education Program .....	2-4
2.2.2 Level 2 Program .....	2-5
Customer Incentive Programs .....	2-5
Public Outreach Program .....	2-6
2.2.3 Level 3 Program .....	2-8
Rate Structures that Support and Encourage Conservation ..	2-8
Inclusion of Bill Messages and Increased Billing Information	2-8
Development of Regulatory Standards and Ordinances .....	2-9
<b>Section 3- Curtailment Plan.....</b>	<b>3-1</b>
<b>Section 4 - Long Range Water Supply .....</b>	<b>4-1</b>
4.1 Introduction.....	4-1
4.2 Existing Water Supply.....	4-1
4.3 Water Storage .....	4-1
4.4 Water Distribution System.....	4-1
4.5 Forecasts.....	4-2
4.6 Water Wells.....	4-2
4.7 Conclusions .....	4-4

**Section 5 - Savings, Implementation, and Program Evaluation Strategy 5-1**

5.1 Total Projected Program Savings..... 5-1

5.2 Implementation Considerations..... 5-2

5.2.1 Program Goals and Objectives ..... 5-2

5.2.2 Long-Term Reliability of a Program ..... 5-3

5.2.3 Rate and Revenue Impacts ..... 5-3

5.2.4 Public Education/Outreach..... 5-4

5.2.5 Integration With On-Going Efforts ..... 5-4

5.3 Implementation Program Management ..... 5-6

5.3.1 Program Management ..... 5-5

5.3.2 Pilot Studies ..... 5-5

5.3.3 Conservation Program Refinements and Implementation..... 5-6

5.4 Schedule ..... 5-6

# Section 1

## The Troutdale Water System and Water Use Characteristics

---

The City of Troutdale (City) is responsible for the prudent management of its water resources and to provide safe, reliable and sustained water supplies to its current and future customers. The City strives to deliver this supply in the most efficient and cost-effective manner possible. To do this, the City is developing a water management and conservation plan in accordance with OAR 690-86.

The City serves approximately 11,000 people currently with strong growth occurring for a number of years in the area. By the year 2015 the City population is expected to grow to 21,200 with an ultimate population of nearly 25,000 people within the existing City limits.

### 1.1 Water Sources

The City's water supply is from wells which extract water from the Sandy River Mudstone and the Troutdale formations that underlie the City. These formations are further divided into specific units. Well #4 is completed into the lower unit of the Sandy River Mudstone. Wells #2, #3, #6 and #7 are completed into the Upper Troutdale formation and Wells #6 and #7 are further completed into the upper and lower units of the Sandy River Mudstone. Well #8 will be completed in 1995 in the Upper Troutdale and Sandy River Mudstone.

Recharge of the aquifers serving Troutdale is into the Beaver Creek drainage basin and recharge is estimated to average 13 mgd (million gallons per day). This is more than 4 times the ultimate average demand for water forecast for a city of 25,000 persons. No water from the Columbia River enters the City's wells. The City holds water rights equal to 7.2 mgd as shown in Table 1-1.

**Table 1-1  
City of Troutdale  
Ground Water Rights**

Certif. #	Permit #	Well Location	Owner Name	Priority Date	CFS	Remarks
	G-2320	1N/3E-36N	Troutdale Well 1A (from FUJII)	12/26/62	0.81	MU, Appl. #T3119 Supersedes 34708
	G-6881	1N/3E-36N	Troutdale Well 1B (Drinker)	08/19/74	1.60	MU, Appl. #G-6627
50525	G-7035	1N/3E-35N	Troutdale Well 2	11/22/76	1.00	MU, Appl. #G-7589
	G-8655	1N/3E-35G	Troutdale Well 3	06/26/79	1.10	MU, Appl. #G-9291
	G-9866	1N/3E-25M	Troutdale Well 4	07/17/81	1.11	MU, Appl. #G-9583
				09/20/82	1.11	
	G-9867	1S/3E-01B	Troutdale Well 6	05/01/80	2.20	MU, Appl. #G-9714
		1N/3E-36R	Troutdale Well 7	12/16/81	2.20	
	G-11761	1N/3E-36R	Troutdale Well 8	11/26/93	2.23	MU, Appl. #G-13565

Certif. # - Oregon Water Resource Department water right certificate number

Permit # - Oregon WRD water right permit number

Well Location - Township, range, section and 1/4 1/4 designate

Owner Name - Owner name given on Oregon WRD report

Priority - Date of priority, date water right application was filed with WRD

CFS - Authorized rate of withdrawal in cubic feet per second

Remarks - Application number,

Uses

MU - Municipal

## 1.2 Water Supply Facilities

There are seven wells connected into the City water distribution system. The locations of the wells are shown on accompanying Exhibit 1-1, and the table below indicates the yield in mgd. One of these, Well No. 1-B, is out of service because of a decline in its yield. Its pump capacity greatly exceeds the well's yield, and therefore, the pump cannot perform properly.





**Table 1-2  
City of Troutdale  
Production Well Yields**

Well No.	Yield (mgd)
1B	0
2	0.7
3	0.8
4	1.4
6	0.8
7	1.0
8	1.4
Total	6.1

Note: A pending water rights transfer will allow the City to utilize the full 1.7 mgd capacity of Well #8.

EXHIBIT 1-1  
 CITY OF TROUTDALE  
 WELL AND RESERVOIR SITES

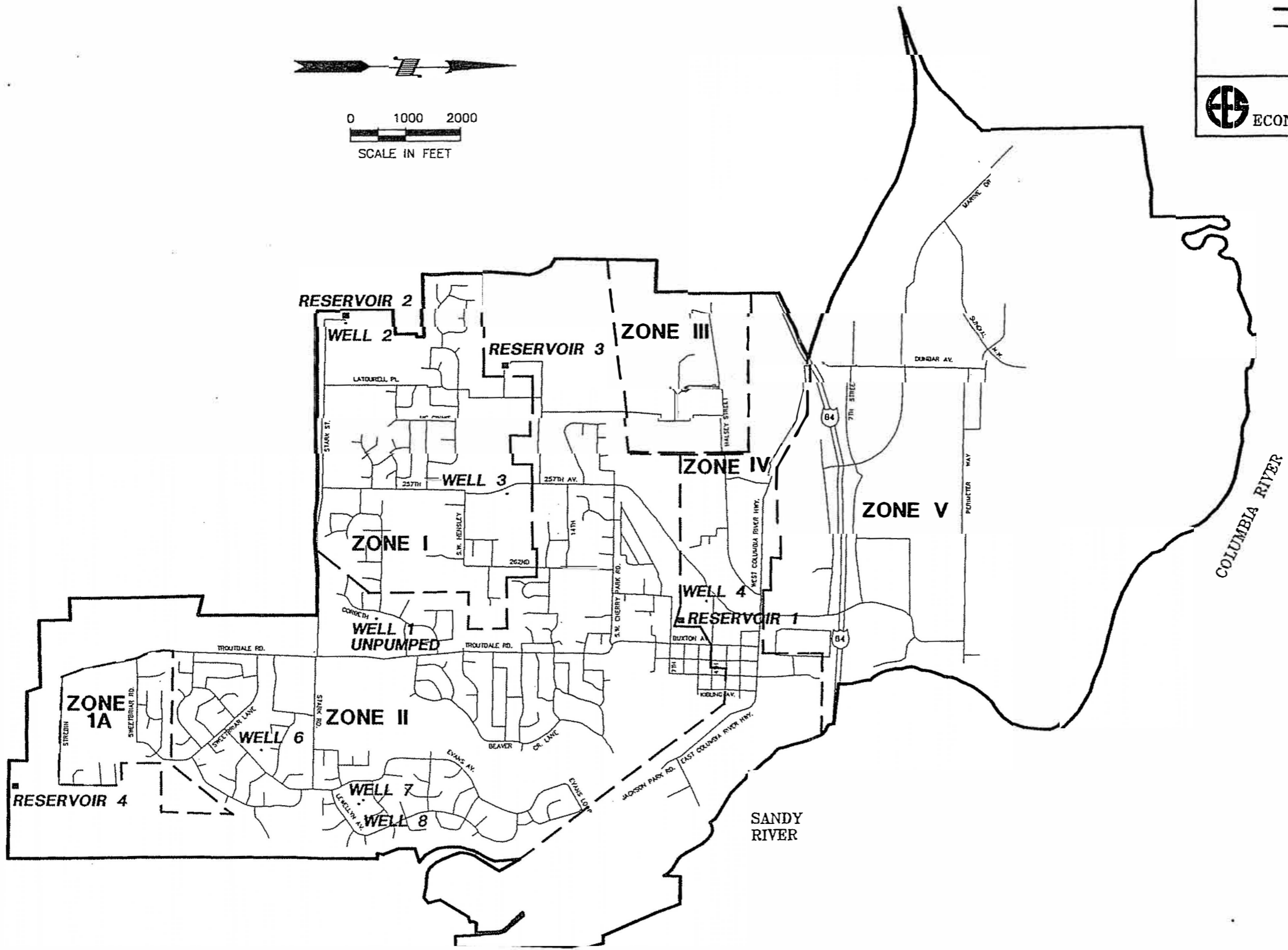
LEGEND

-  SERVICE AREA BOUNDARY
-  PRESSURE ZONE BOUNDARY
-  WELL SITES
-  RESERVOIR SITE

 ECONOMIC AND ENGINEERING SERVICES, INC.



0 1000 2000  
 SCALE IN FEET



Well No. 1-B is adjacent to "Drinker's Well". The Drinker's Well facility is housed in a wooden building and the pump which was installed in Drinker's Well has been moved to Well No. 1-B. The pump is a vertical line shaft turbine type, but its condition is not well known as the yield of the well is so much less than the pump capacity that the pump itself is not operated.

Well No. 2 is housed in a concrete block building with a wooden roof. The well is fitted with a line shaft turbine pump and control of the pump comes from the water level of Reservoir No. 2, which is adjacent to this well. The well is fitted with an electric outlet for connection to a portable generator that could be used in the event of a power outage. The pumphouse includes equipment to pump from Reservoir No. 2 when it is less than 65% full, but the equipment has only been used when the reservoir is intentionally drained.

Well No. 3 is housed in an underground vault. The well is fitted with a submersible pump. The pump was repaired in 1991 in the course of an investigation of lost pumping capacity. The capacity loss was attributed to mechanical damage to the pump column check valve. This station also includes a sodium hypochlorite feeder that is used for taste control necessitated by an elevated level of dissolved manganese. This well is controlled by the water level in Reservoir No. 2.

Well No. 4 was constructed in 1981. It is housed within a composite structure consisting of a concrete wall with a wood superstructure and roof. The well is fitted with a submersible pump. The station is fitted with a chlorine solution feeder that was installed to overcome water odors associated with hydrogen sulfide. The well pump is controlled by water levels from Reservoir No. 1.

Well No. 6 is located within an underground vault in a city park. The well is fitted with a submersible pump. The installation includes a hypochlorite feeder for control of odors associated with hydrogen sulfide. The water level in Reservoir No. 4 controls the operation of this well and Well No. 7.

Well No. 7 is housed in a concrete block building with a tile roof. The well itself is fitted with a submersible pump. Chlorination is provided at this well. This well is controlled by Reservoir No. 4 water level, and the sequencing is such that Well No. 7 is started before Well No. 6.

Well No. 8 is currently under construction. It will be housed in an underground vault adjacent to Well No. 7. The chlorination equipment for Well No. 7 will also be used to treat water from Well No. 8. This well will pump into Reservoir No. 4 as do wells No. 6 and No. 7.

### 1.3 Water Storage Facilities

Four covered reservoirs are in place throughout the City. Exhibit 1-1 indicated their location. The overflow elevation and the maximum storage volume in mg (millions of gallons) of each reservoir is indicated in the table below.

Table 1-3  
City of Troutdale  
Water Storage Data

Reservoir No.	Elevation (Feet above sea level)	Capacity (mg)
1	262	1.0
2	454	1.0
3	400	2.0
4	400	2.0
	Total	6.0

Reservoir No. 1 is a buried tank constructed of reinforced concrete. Reservoir No. 2 is a welded steel tank with an ornamental exterior paint coating. This tank can be filled with water available from the City of Gresham as a standby source and this supply can be used if the tank or wells in Zone I are out of service. Reservoir No. 3 is a welded steel tank. A standby interconnection is available to the Wood Village system here as well as on Halsey Street. Reservoir No. 4 is also a welded steel water tank.

### 1.4 Water Distribution Facilities

The distribution system conducting water from the reservoirs and water wells to the customers is divided into six pressure zones. This has been deemed necessary on account of the topographic setting of the City which varies from an elevation of about 340 feet above sea level in the vicinity of Strebin Road to approximately 20 feet in the vicinity of the Troutdale Airport. Each pressure zone is interconnected to the next lower pressure zone through pressure reducing valves located within the distribution system. Reservoir No. 2 controls the pressures within Pressure Zone I which serves the highest ground in the City. Reservoirs No. 3 and No. 4 control the pressures with Pressure Zone II. Finally, Reservoir No. 1 controls the pressure in Zone IV. There are no reservoirs within Zones III or V, with Pressure Zone III receiving its water from Zone II and lying between Zones II and IV, and Pressure Zone V receiving its water from Zone IV and being the farthest north and lowest and generally serving the areas from Interstate 84 north to the area on the north side of Troutdale Airport. Zone IA pressure zone is controlled by a booster pump located just south of Strebin Road.

Most of the water distribution system is of comparatively recent construction as the majority of it has been installed to accompany residential development that has occurred since the mid-70's. Water main materials are cast iron, ductile iron, or in some cases, polyvinylchloride. Approximately 63% of the mains are larger than 6-inch. The system appears to be in good condition as attested by the unaccounted-for water statistics (which includes leakage, meter error and unmetered usage such as from hydrants or for public purposes) of 7% to 13%. This percentage of loss is low for the Portland region and is indicative of a new, well constructed and maintained system. The extent of the existing water system is indicated by the data below:

**Table 1-4  
City of Troutdale  
Installed Water Mains**

Pipe Size	Total Footage (feet)
4"	10,523
6"	74,034
8"	52,143
10"	25,900
12"	65,114
Total Footage	227,714 (43.13 miles)

## 1.5 Water Usage

The City currently classifies water users under three general classifications; Residential, Commercial and "Other". "Other" includes agricultural accounts, sewer only, availability accounts, fire service accounts and unactivated new services.

The primary and predominant use of water within Troutdale is residential, and it is expected to remain so. This conclusion is supported by the Comprehensive Plan and the comparatively low per capita use that Troutdale has experienced, and the fact that 97% of the installed meters are 3/4-inch and 1-inch sizes.

Table 1-5 shows the number of accounts and the water usage by class for the 12 months from July 1994 through June 1995. Based on this data the average 1994-1995 residential water use is 78 gallons per capita per day (gpcd). The City does not maintain records for peak day usage but keeps weekly production records. The high weekly production period was May 24 through May 31, 1995, when total production was 18,575,700 gallons or an average of 2,653,671 gallons per day. Assuming residential usage at 73% of the total usage; peak usage is 176 gpcd, discounting unaccounted for water.

**Table 1-5**  
**City of Troutdale**  
**Water Use Data - July 1994 - June 1995**

Month	Residential		Commercial/Industrial		Other		Total	
	Account	Gallons	Account	Gallons	Account	Gallons	Account	Gallons
July	3,007	41,388,000	105	11,533,000	229	447,000	3,341	53,368,000
Aug.	3,023	45,662,000	105	14,781,000	213	495,000	3,341	60,938,000
Sept.	3,304	27,602,000	105	10,970,000	202	259,000	3,341	38,831,000
Oct.	3,045	21,159,000	110	9,427,000	231	123,000	3,386	30,709,000
Nov.	3,059	20,371,000	111	6,870,000	212	0	3,382	27,241,000
Dec.	3,107	23,104,000	111	7,529,000	231	0	3,449	30,633,000
Jan.	3,124	18,152,000	111	6,504,000	217	0	3,452	24,656,000
Feb.	3,134	19,693,000	112	7,463,000	209	0	3,455	27,156,000
March	3,152	20,530,000	112	8,069,000	196	2,000	3,460	28,601,000
April	3,161	19,058,000	112	8,009,000	266	0	3,539	27,067,000
May	3,169	24,682,000	112	10,276,000	258	22,000	3,539	34,980,000
June	3,187	31,632,000	112	13,091,000	240	86,000	3,539	44,809,000
<b>Total</b>		<b>313,033,000</b>		<b>114,522,000</b>		<b>1,434,000</b>		<b>428,989,000</b>

Table 1-6 shows monthly water production and usage for the 12 month period from July 1994 through June 1995. The difference between water production and usage on a monthly basis is due to hydrant use, city use, miscellaneous use, new stand pipe use, new main installation and flushing.

Table 1-7 shows the estimated water loss for the previous 12 month period. Water loss for that period is estimated at 13.8%. A previous study completed in 1992 showed 7% water loss.

Commercial users represent a diverse group of usage types. The top 20 water users are shown in Table 1-8. The 17 largest commercial users comprise 67% of the total commercial use for the City.

**Table 1-6**  
**City of Troutdale**  
**Average Water System Production and Usage**  
**June 1994 - June 1995**

Month	Production	Usage
July, 1994	2.134 mgd	1.722 mgd
August, 1994	2.217 mgd	1.966 mgd
September 1994	1.524 mgd	1.294 mgd
October, 1994	1.132 mgd	.991 mgd
November, 1994	.973 mgd	.908 mgd
December, 1994	.929 mgd	.998 mgd
January, 1995	.978 mgd	.795 mgd
February, 1995	1.014 mgd	.970 mgd
March, 1995	1.040 mgd	.923 mgd
April, 1995	1.338 mgd	.902 mgd
May, 1995	1.830 mgd	1.128 mgd
June, 1995	2.070 mgd	1.494 mgd

**Table 1-7**  
**City of Troutdale**  
**Estimated Water Loss**  
**July 1994 - June 1995**

Total Production	<u>561,940,000 gallons</u>
Consumption	428,989,000 gallons
Hydrant meter usage	15,283,000 gallons
City meters	14,753,000 gallons
Miscellaneous use	2,027,554 gallons
Estimated standpipe use	4,000,000 gallons
Estimated water used for new main chlorinating and flushing	7,100,000 gallons
Estimated City water line flushing	12,000,000 gallons
Total Usage =	484,152,554 gallons
Estimated loss = Production - Usage =	77,787,446 gallons
Estimated water loss =	13.8%

**Table 1-8**  
**City of Troutdale**  
**Highest Water Users (in thousands of gallons)**  
**July 1994 - June 1995**

<b>User</b>	<b>Total</b>	<b>% of Commercial Use</b>	<b>Type</b>
Burns Bros.	16,511	14%	Truck Stop
Mt. Meadows Apts.	10,511	N/A	Multi Family
Sewage Treatment System	10,380	N/A	Wastewater Plant
Toyo Tanso	9,593	8%	Manufacturer
McMenamin's	8,103	7%	Restaurant
Motel 6	6,578	6%	Hotel
Corr Facility	6,309	6%	Institution
Flying J	5,654	5%	Truck Stop
Phoenix Inn	3,985	3%	Hotel
MML Diagnostic	3,054	3%	Manufacturing
Factory Stores	2,222	2%	Retail
C.G. RV Park	2,110	2%	RV Park
Reynolds H.S.	2,048	2%	Public
Shari's	2,033	1.9%	Restaurant
Corps of Engineers	1,960	1.7%	Public
Cascade Apartments	1,936	N/A	Multi Family
Taco Bell	1,522	1.4%	Restaurant
Edgefield C.C.	1,363	1.2%	Child Service
Animal Control	1,289	1.1%	Animal
<b>Total</b>	<b>98,964</b>		

N/A - Not a commercial class user

## 1.6 Water Demand Forecasts

Water demand forecasts within the planning area have been made for the purposes of determining the adequacy of the present distribution, supply, and reservoir installations and the location and size of additional such facilities in the near and long term. The forecasts are based on water delivered into the system, and therefore they include unaccounted-for water, which is that volume of water that is unaccounted because of leakage, meter error, public use, fire fighting water and water used in flushing the mains.

The planning period extends to the year 2010. The planning area is restricted to those lands within the City at present and to those additional lands that are within the urban growth boundary but not currently within the city limits. A forecast of water demand at "ultimate" development of the City is also made.

The forecasts of water demand are based on present usage as derived from actual production records, populations served in respect to those records, and population forecasts made throughout the planning period.

Population for analysis and forecasting are based on the current Metropolitan Service District for Population, Households and Dwelling Units.

For the planning period, the following forecasts have been developed.

---

**Table 1-9**  
**City of Troutdale**  
**Population Forecast**

---

Year	Population
1990	7,852
1995	11,400
2000	13,300
2005	15,800
2010	18,400
2015	21,200

---

Based on the City's Comprehensive Plan, it appears that the population holding capacity for the City including the unannexed urban growth boundary will be 26,500. EES was asked to include a forecast of water usage as required by a population of 25,000, which is 5.7% less than the holding capacity and which seems to be a reasonable forecast for ultimate population inasmuch as all possible land for dwelling units will probably not be fully developed or occupied.

### **1.7 Future Demand**

The forecast of future demand as based on population, per capita use, and peak day ratios is presented below. In order to arrive at future system usage, per capita usage will be applied to forecasts of population. Per capita water usage is determined by dividing the total water production by the served population. Since the planning period for this study is 20 years, a longer term water use history was required for the demand forecast.

For the years between 1983 and 1992, the per capita use ranged from a low of 99 gpcd (gallons per capita per day) to a high of 125 gpcd (in 1987). This figure is affected primarily by the nature of the consumption as well as the influence of weather upon consumption. Usage such as this is typical of communities where the basic demand for water arises from residential use. Over the period from 1983 to the present, the average usage has been 114 gpcd. For purposes of planning, the quantity of 125 gpcd is used. This is 10% larger than the average over the years and provides a contingency that is needed when planning for future water usage.

Industrial and commercial usage is small, and the primary impact these and other non-domestic customers have on distribution facilities is derived from their need for

fire protection flows. Fire protection flows are significant in analyzing the hydraulic capacity of the distribution system and the amount of water stored to supplement water production. For residential areas, fire flows have been specified by the City as 1,000 gpm (gallons per minute) or 1.43 mgd. For areas zoned commercial or industrial, the City has set a standard of 3,000 gpm or 4.29 mgd.

For this study, the peak daily demand has been estimated based on a peak daily factor of 2.5 times annual average daily usage. For other larger water utilities located in the Portland region, the peak daily factor is up to 2.4 times the average daily usage. It is reasonable to assume that the peak day for a smaller utility will have a larger peaking factor because of a larger diversity in usage. Based on the foregoing, the following table indicates the water demand forecast. Demands are rounded-off to the nearest 0.1 mgd.

Table 1-10  
City of Troutdale  
Water Demand Forecast

Year	Population	Average Demand (mgd)	Peak Daily Demand (mgd)
1995	11,400	1.4	3.6
2000	13,300	1.7	4.2
2005	15,800	2.0	5.0
2010	18,400	2.3	5.8
2015	21,200	2.7	6.8
Ultimate	25,000	3.1	7.8

# Section 2

## Conservation Plan

---

### 2.1 Introduction

This section describes an interim water conservation plan for the City of Troutdale. This plan is being prepared in accordance with OAR 690-86 as a condition of the City's water rights permit and to promote efficient use of the City's resources. Its purpose is to fully address water conservation as both a future water supply resource and as an integral part of the City's water resource management program. Because of the difficulty associated with making supply and demand projections, many northwest utilities are adopting a phased approach to conservation planning, with multi-level programs. An advantage of this type of program is that it has the flexibility to be adapted as data becomes available on the relative success of the program and advancing technologies, and on the changing regulatory picture concerning conservation.

The interim conservation plan is based on a mixture of supply and demand management activities. Supply management activities are those actions which the City will undertake to increase the availability of water by making more efficient use of the existing supply. Examples of supply management measures include leak detection programs, meter replacement programs, and water reuse facilities installed in the decorative fountains and irrigation systems in public places. These types of measures are controlled by the utility, and their effectiveness does not depend upon customer participation.

Demand management measures are actions taken and programs implemented which are aimed at reducing the level of customer demand for water, rather than increasing the available supply. Examples of demand management measures include public education materials, specific calendar day water programs, distribution of rebates or credits for installation of low flow or timed irrigation devices, plumbing fixture modifications, and rate incentives. The demand management measures described here will be targeted at reducing both total annual consumption and peak period consumption. Peak period consumption is related to seasonal demand and is typically measured in daily consumption. Both of these measures, as described herein, are responsive to the Oregon State Water Resources Department (WRD) implementation rules.

## 2.2 The Water Conservation Plan

The Water Conservation Plan incorporates three distinct phases, or levels, of water conservation, and a curtailment plan. This approach can allow phasing in of the program as other water utilities are doing while maintaining the flexibility to address the growth needs of the City. The first level of conservation measures are primarily oriented to supply management, and are intended to address areas where the utility can achieve significant use reductions, set positive examples, and ensure that the water system is being operated in the most efficient manner possible. Level 1 also contains the first phase of a public education program to inform customers of the need to conserve and to encourage them to do so on a voluntary basis. A documented Level 1 program will meet some of the WRD conservation plan requirements. As of this date, the City has completed the majority of the requirements identified in the Level 1 program.

The second level of the conservation plan shifts from emphasis on supply management to emphasis on demand management activities. It includes measures which continue the customer education process and providing some customer incentives. This level introduces specific measures for customers, such as making landscaping changes by converting to "zeriscape" practices and installing efficient plumbing fixtures and irrigation systems. The Level 2 program addresses still more of WRD's requirements.

The third level of the conservation plan focuses on conservation-based rate structures and their savings potential. The City recently implemented a conservation based rate structure by removing a declining block rate and instigating a flat rate. These types of rate changes are most effective when consumers are provided with clear and prompt feedback on price-consumption impacts. Level 3 also addresses water reuse opportunities. By covering rate and reuse questions, Level 3 addresses the remaining WRD requirements.

All combined, the Conservation Plan provides the potential to achieve from 10% to 15% or more in savings to the City. Although the region is well known for the satisfactory water supply which is received through rainfall during the late autumn, winter and early spring months, there is a clear recognition in the region that the seasonal droughts can not be overcome through existing storage capacities. Given these considerations, actions are necessary to ensure that the combined efforts of effective supply and demand management are achieved through a comprehensive conservation program.

The Plan could contain items outlined as follows:

**LEVEL 1 PROGRAM (Target up to 5% Savings)**

- System Water Audit
- Leak Detection and Meter Replacement Program
- Water Audit of the Utility and Municipality Use Patterns
- Public Education Program

**LEVEL 2 PROGRAM (Target up to 6% Savings)**

- Customer Incentive Programs
- Public Outreach Programs

**LEVEL 3 PROGRAM (Target up to 5% Savings)**

- Inclusion of Bill Messages and Increased Billing Information
- Rate Structures that Support and Encourage Water Conservation
- Development of Regulatory Standards and Ordinances
- Water Reuse Opportunities

A complete description of the activities that may be included in the conservation program and curtailment plan is presented below.

**2.2.1 Level 1 Program**

***System Water Audit***

1. The City should conduct a thorough annual accounting of all water that flows into and out of the system. Determination should be made of the quantity and causes for unaccounted-for water that does not ultimately pass through a customer's meter. This will include but not be limited to losses from reservoirs, as well as transmission, distribution, and meter losses.
2. The City should continue to insure all connections to their water system are metered.

***Leak Detection and Meter Replacement Program***

1. The City should implement a comprehensive leak detection program, involving a survey and field examination of the reservoirs, tanks, and transmission system, as well as a survey of all 20 year old or older distribution mains up to the customer meters. Sources of system leakage should be identified, and where significant leakage is found a schedule should

be developed to address and reduce leakage through such measures as reservoir repair and defective pipe replacement as a first policy.

2. The City should implement a meter repair/replacement program to replace, clean and test suspect meters to ensure accurate readings.

### ***Water Audit of the Utility and Municipality Use Patterns***

The City should promote conservation activities within its own water (and sewer) operations, as well as within any municipal agencies that use water. The usage pattern changes listed below are oriented at reducing seasonal peak demand.

1. The use of water for parks or public building grounds irrigation should be evaluated for efficiency. Irrigation should occur primarily during the evening or early morning hours to reduce evaporation. Irrigation systems on timers should also be used to avoid evaporation losses and to reduce wasteful over-watering.

2. When washing line trucks, fire trucks or any vehicles, care should be taken to ensure that hoses are equipped with self-closing nozzles. Fire training and hydrant testing should take place during off-peak demand periods.

3. Public decorative fountains should be of re-circulating design or should be shut off during conservation campaigns and/or low water availability periods to send a positive message to the public.

### ***Public Education Program***

1. The City should coordinate the development of timely informational brochures regarding conservation matters, concentrating efforts on practices that will lower peak usage to be distributed among all customers. Potential topics include:

#### **Seasonal Use Reductions:**

- The Need to Conserve - When and Why
- Residential Lawn Watering Practices & Calendars
- General Outdoor Water-Saving Measures
- Irrigation Systems and Practices for Large Users

#### **Annual Use Reductions:**

- Low-Water Use Appliances and Fixtures
- General Indoor Water-Saving Measures

- Economic Incentives for Commercial/Industrial Users
- Commercial/Industrial Audits and Program Suggestions

These brochures should be made available at the City's offices, with the eventual goal of distribution by mail to all customers.

2. Conservation-message signs should be erected wherever water conservation measures are in place. For example, if the utility puts timers on a park irrigation system, a sign explaining that it was done to conserve water should be placed near the park entrance. If decorative fountains are recirculating, they should be labeled as such.

### 2.2.2 Level 2 Program

#### *Customer Incentive Programs*

1. Free residential water audits should be offered to help customers understand ways in which they could use water more efficiently. The audits should include recommendations for water-saving devices such as:

<u>Device</u>	<u>Average Water Saved (gallons per capita per day or %)</u>
• Ultra-low-flush toilets	13.6
• Toilet dams or dual-flush toilet devices	10.5
• Low flow shower heads	9.0
• Toilet leak detection kit	3.4
• Pressure Reducing Valves	3.0
• Hot water line insulation	2.0
• Tankless hot water heaters	2.0
• Low flow faucet aerators	0.5
• Self-closing hose nozzles	5.0%
• Soaker hoses	2.0%
• Irrigation timers	2.0%
• Moisture sensors	2.0%

2. Device distribution kits could be assembled to provide a selected group of the water-saving devices listed above to customers free of charge. The City has participated in efforts by PGE including mass mailings to all customers of devices, such as toilet dams and toilet leak detection kits. Some devices, such as low flow shower heads and faucet aerators, as well as self-closing hose nozzles and outdoor faucet timers can be purchased in large lots at a wholesale price. These devices can then be assembled into single-family unit or multi-family unit kits, which could either be mailed to customers or made

available at the utility office. As the savings figures listed above illustrate, the potential reduced demand with some of these devices is significant. The difficulty is in reaching customers.

3. Commercial and large user water audits should be performed on those customers with the highest potential for savings, such as those shown in Table 1-8. The City may also wish to assist targeted customers with payback calculations and extend rebate or credit offers for device installations.

### ***Public Outreach Program***

Public involvement is considered the most critical key to the success of any conservation program. The public education program included in Level 1 was the first step toward public involvement, including passive measures such as making informational brochures available. The public outreach program is more comprehensive and active, and includes a higher level of effort by City staff. The City should be continually looking for opportunities to promote the conservation message - to eliminate wasteful water use. All of the following public outreach suggestions can easily be oriented towards reducing peak period and overall annual usage.

#### **1. Brochures/Handouts**

Brochures and handouts should be developed to explain and promote conservation measures. In addition to the suggested brochure topics in Level 1, handouts should be developed or acquired to provide information on the following:

- Low Flow Showerhead Installation
- Toilet Retrofit Devices
- Leak Detection
- Effective Irrigation
- High Water Bill Impacts
- Water Use by Appliance or Activity
- Comparison Data on Average and Peak per Capita Usage

These brochures and handouts should not only be made available in the customer service center (as suggested in Level 1), but should be mailed to customers and distributed at public events. Local merchants may be willing to display informational handouts next to their displays of irrigation and plumbing supplies.

## 2. Community Events

Home and garden shows, community fairs, parades and other civic celebrations should be investigated as opportunities for the City to spread the conservation message. A mobile poster/display could be developed so that the utility can move quickly to take advantage of these opportunities when they arise. During the summer months, in particular, a "cold-water booth" at fairs and street markets is always appreciated. The utility could distribute conservation literature, buttons, and/or water-saving devices such as flow restrictors with every cup of water.

## 3. School Programs

Coordination with the School Districts is essential for this element. Teachers and districts must be involved in development of programs aimed at students to strengthen understanding and commitment to the project. Videos, teaching aids, and classroom projects (the AWWA has a variety of water education tools available, especially suitable for ages K-9), field trips to City well sites, and stage productions can all be effective means of teaching the community's youth the value of water.

## 4. Advice Phone Line

This type of service should be advertised in brochures, handouts, displays or other program materials. The City's employees should be trained to respond to conservation-oriented questions, and should be able to provide customers with helpful "tips" on saving water. This type of service is another means of making people aware of any device distribution and/or rebate programs the City may implement.

## 5. Local News Media

The local media can provide valuable assistance in achieving a conservation goal, particularly in terms of reducing peak usage. Television and radio public service announcements can be especially effective tools to provide timely reminders. Peak water use days can be announced (in the same manner as air pollution alerts), and customers asked to avoid lawn watering during certain hours or on certain days. Well-crafted commercial spots or newspaper ads can also increase public awareness. A Public Information Handbook which contains guidelines for building a successful public information/community relations program is available through the AWWA.

### **2.2.3 Level 3 Program**

The Level 3 Program, while still dependent on customer involvement to achieve water savings, differs from the Level 2 program in that it attempts to achieve usage reductions through rate increases and billing messages. The advantage to this approach is that the customer's receptivity to the conservation message is not critical to success. Every customer is reached and affected through rates. In this program the disincentive of high bills is added to the incentive of behaving responsibly and avoiding waste.

A comprehensive study should be conducted to determine the effects on demand of implementing a conservation-based structure. The percent water savings that conservation rates would yield is dependent upon the price response, or price elasticity, of the demand for water by the utility's customers.

#### ***Rate Structures that Support and Encourage Conservation***

The choice of a rate structure is determined in part by the specific circumstances of the utility. The following rate structures most commonly considered to encourage conservation should be evaluated by the utilities:

- Uniform Volume Rates
- Inverted Block Rates
- Seasonal Rates
- Excess Use Rates
- Goal-Based Rates

In 1992 the City evaluated these options and in 1994 selected a uniform commodity rate of \$2.15 per thousand gallons, as shown in Appendix B. This rate charge went into effect in 1995. This change is expected to have an impact on residents' peak water usage.

#### ***Inclusion of Bill Messages and Increased Billing Information***

1. Billing inserts can be the most cost-effective way to ensure that customers should get the conservation message. Such inserts should be kept simple and interesting, and should concentrate on a single message each time. Attempting to put too much information on an insert will lessen the likelihood that the customer will read it. Bill messages need to be timely to be effective. Customers should be given advance notice, for example, if rates will be going up in the summer in an attempt to reduce usage. If the notification arrives after the usage has occurred, an opportunity for savings is lost and a possibility of customer dissatisfaction has been created.

2. In addition to billing inserts, the City should evaluate the possibility of providing customers with increased information about their own usage patterns printed on the bill itself. The example often given is that electricity and natural gas bills usually show a comparison of how much fuel was used in comparison to the same period of the prior year. Northwest Natural Gas and Portland General Electric Companies also note the temperature and rainfall amounts/month differential between years on their bills. This practice lets the customer relate the increase/decrease in usage to changes in the weather, thus providing more complete information.

### ***Development of Regulatory Standards and Guidelines***

Several opportunities exist to get in on the ground floor of development to ensure that every consideration is given to **minimizing** the demand side of customer usage. Many of the measures require the local, regional or state jurisdictions to provide the regulatory oversight.

#### **1. New Construction Plan Review**

This measure would require the City to participate in the review of interior and exterior proposed water uses before project approval or issuance of building permits. The permitting jurisdiction would then have the option to require new users to install advanced water-efficient devices and/or use water-efficient processes which go beyond **minimum** State building code requirements. Laws would need to change to provide the jurisdictions with the proper direction in determining the basis and need for potential conditions to approve a permit application.

#### **2. Landscape Guidelines**

The City should work with local jurisdictions to develop landscape design standards, turf limitations, and irrigation regulations that will be tied to the issuance of a building permit to promote and require water conservation practices which are outside the City's jurisdiction. Existing customers may have to be offered some form of incentive to participate. Major modifications or remodels would participate along with new construction. If enacted for commercial and industrial sites this program can effectively reduce the size and operation demands of irrigation systems. As an incentive, a reduction in water meter size will result in a reduction in system development charges.

### 3. Development Guidelines

This measure involves revising current local government codes to require water-efficient landscaping and irrigation practices at commercial and industrial development sites. The City should develop a model policy that could be adopted.

#### ***Reuse Opportunities***

The most promising reuse opportunities that can affect water use are irrigation uses and process uses at the wastewater treatment plant and facilities nearby. The plant currently provides secondary treatment for the City's wastewater. The Unified Sewerage Agency is currently using secondary effluent at the Jackson Bottoms area for wetlands enhancement. Other area plants have installed irrigating and reuse plant water systems to use treated effluent to replace drinking water in and around their sites.

By replacing drinking water with treated effluent, these reuse opportunities reduce demand on the water system, reduce discharge to the receiving streams and minimize capital costs. A reuse intake system can be retrofitted into the chlorine contact basin. A typical reuse system would require a fine-screen, pump, storage/pressure tank and distribution system.

For reuse of secondary effluent, uses should be limited to areas or times where direct human contact will not occur.

# Section 3

## Curtailment Plan

---

This section describes the interim curtailment plan to be implemented in times of a water shortage. No shortages have occurred in the past 10 years as a result of the reliable water supply the City has developed. However, if such a shortage would occur in the future the interim plan, once adopted by the City Council, would be put into effect.

The plan uses a phased approach. In a prolonged shortage, outdoor water use could be curtailed and a request for conservation of indoor water use would be made to all classes of customers. In a critical situation, the City could use its emergency powers to mandate a reduction in water use, with appropriate enforcement powers. In an extremely critical situation, the last resort would be rationing.

Before implementing any of the "curtailment type" conservation measures, there are several decision criteria for selection. The decision criteria are:

- (1) Consistency with a phased drought response that increases with the severity of the drought.
- (2) Suitability for being applied in a fair/equitable manner in the best interests of the public.
- (3) Capacity for communication to the public.
- (4) Ability to implement to have only a temporary impact on water demand.
- (5) Ability to implement with minimum impact on the City.
- (6) Consistency with the water sales contracts to outside purveyors.
- (7) Consistency with a policy of coordinated application of responses with other public agencies.

It is important to develop a system which effectively restricts consumption during the critically low supply/peak demand period and while reducing restrictions during high supply periods when excess water is beneficial to the system. This will protect the City from unduly forcing rates up and creating additional penalties for the conservation. The measures should be performed in sequenced steps, responding to the severity of the supply emergency starting with:

1. **Enhanced wise use messages through various media**

Media messages should include frequent updates on the extent and severity of the water shortage, the expected length of the shortage and steps being taken by the City to resolve the situation.

2. **Larger user interruptions**

For any large customers on a wholesale, or contract, basis, the City should determine whether these customers could potentially be served on an interruptible basis. If large customers have other sources of supply available to them (or if they have sufficient supply to carry them through one or more peak day periods) the City should attempt to negotiate an agreement to divert their use to off-peak times. This type of negotiation is potentially possible with large volume commercial, agricultural or industrial customers, who may be willing to defer non-essential usage to off-peak times in return for a discounted rate schedule.

3. **Extreme mandatory measures:**

a) **Mandatory Metered Watering**

Mandatory metered watering (i.e., every 3-4 days or once a week for designated time periods) provides a way for the utility to control usage by customers who do not have automatic irrigation systems and should be part of the supply side of conservation. Mandatory ordinances for implementation during severe water shortage periods should be passed by the City, establishing a system of warnings and fines for violators.

b) **Water Waste Ordinance**

The City should develop a model ordinance that requires use of shut-off nozzles on hoses, and prohibits wasteful practices such as gutter-flushing or outdoor non-essential washing. Enforcement methods should include but not be limited to warning citations, fines and shutoff of water service.

c) **Penalties for Audit Non-Compliance**

In this measure those customers who were targeted in the level 2 program to receive water audits should be penalized if they have failed to participate. The penalty would take the form of a surcharge, or use restrictions for commercial/industrial customers, or direct intervention by the utility to retrofit the non-compliant and bill them for the costs of design and installation. This represents a severe measure and is hard to implement.

# Section 4

## Long Range Water Supply

---

### 4.1 Introduction

This section describes plans by the City to provide water to its customers over the next 10 to 20 years.

As evidenced by population statistics kept by the City and forecast by the Metropolitan Service District (Metro), the City of Troutdale has been in a period of growth and its growth is expected to continue. For instance, the current population is 11,560, the population in 1992 was estimated at 9,008, while the population in 1983 was 6,640. Metro forecasts that by the year 2010 the City's population could reach 18,400. Accompanying this growth is the need to correct any existing deficiencies in the City's water system as well as to plan for future additions to the water supply, storage installations, and the water distribution system.

Increased water usage has paralleled population growth. For the most recent 12 months, the average daily demand was 1,540,000 gallons per day, an increase of 56% since 1992, when the average demand was 984,000 gallons per day. All water is produced by City-owned wells.

### 4.2 Existing Water Supply

The total yield of the five wells now in production is 4.7 mgd. By 1996 the installed capacity will be about 6.1 mgd. The well pumping stations and associated equipment and machinery have been and are maintained to a high standard.

### 4.3 Water Storage

The City presently stores water in four water tanks with a total capacity of 6.0 mg (million gallons). All reservoirs and associated sites are maintained to a high standard of preservation and cleanliness.

### 4.4 Water Distribution System

The water distribution system is divided into six zones on account of the sloping topography from the area near the airport to the area near Strebin Road. The total increase of elevation is approximately 320 feet. The system is comprised of approximately 43 miles of 4-inch to 12-inch pipe, much are less than 15 years old. Unaccounted for water amounts between 7% and 15%, which is below average

experienced by similar water systems in the Portland Metropolitan region. For the foregoing reasons of length and size of water mains and good condition as relates to age and leakage, the existing water system is considered to be a strong network.

#### 4.5 Forecasts

The Metropolitan Service District forecast for the year 2010 has been adopted for planning purposes in this study. The population of the City is now approximately 11,560 persons; by the year 2010 Metro expects 18,400 to dwell within the urban growth boundary of Troutdale. EES has made an estimate of the ultimate population to be served. This estimate is based on the City's comprehensive plan and it appears that the City could contain as many as 25,000 people when the land is "built-out". The predominant usage of water will be for residential purposes.

Water demands estimated to occur in the future are as follows:

Year	Average Demand		Peak Day Demand	
	W/O Conservation	With Conservation	W/O Conservation	With Conservation
1995	1.4 mgd	1.4 mgd	3.6 mgd	3.6 mgd
2000	1.7 mgd	1.4 mgd	4.2 mgd	3.5 mgd
2005	2.0 mgd	1.7 mgd	5.0 mgd	4.1 mgd
2010	2.3 mgd	1.9 mgd	5.8 mgd	4.8 mgd
2015	2.6 mgd	2.2 mgd	6.8 mgd	5.6 mgd
"Ultimate"	3.1 mgd	2.6 mgd	7.8 mgd	6.6 mgd

Conservation savings are estimated at 16% for Levels 1, 2 and 3.

#### 4.6 Water Wells

Comparing forecasted peak day demands with the installed capacity of 4.7 mgd (6.1 mgd after 1996) results in the following forecast of surplus or shortage in supply.

**Table 4-1**  
**City of Troutdale**  
**Well Capacity Compared to Forecasted Peak Demand**

Year	Surplus (Shortage)	
	Without Conservation	With Conservation**
1995	1.2 mgd	1.2 mgd
2000*	1.9 mgd	2.6 mgd
2005*	1.1 mgd	2.0 mgd
2010*	0.3 mgd	1.3 mgd
2015*	(0.7) mgd	0.5 mgd

\* Includes Well No. 8 capacity of 1.4 mgd.

\*\*Includes Levels 1, 2 and 3 for a total of 16% demand reduction

The foregoing table, however, does not entirely describe the need for additional water. In the first place, it assumes that the present facilities will be capable of continued production at their present output. This may or may not be the case because yields may decline in the future or aquifer contamination may occur and require abandonment of one or more wells. This is not to say that these events will occur, it is intended to mean that they could occur. Further, the location of the system demand with respect to the pressure zones needs to be considered.

When demand is allocated to Zone I, it can be demonstrated that there is a surplus of supply within Zone I throughout the planning period. However, Zone I can feed Zone II which in turn can feed Zone III all through pressure reducing valves. Therefore, it is convenient to consider the demands within Zones I, II, and III, as indicated by Table 4-2. This indicates that there is a surplus of supply at the present time, but that by the year 2010, additional supply will be needed because of forecasted growth within Zones I, II and III. Conservation can significantly reduce the need for Zone II supply by reducing the demand and delaying the need for an additional well.

For Zones IV and V, which are served by a well in Zone IV, the allocation of load in comparison with supply indicates that throughout the planning period there will be a surplus within these two zones.

**Table 4-2**  
**City of Troutdale**  
**Zonal Peak Day Demands vs. Zonal Supply Capacities**

Zones	Year	Peak Day Demand (mgd)		Supply (mgd)	Surplus (Deficiency)	
		Without Conservation	With Conservation		Without Conservation	With Conservation
IV&V	1995	0.3	0.3	1.4	1.1	1.1
	2000	0.4	0.3	1.4	1.0	1.1
	2005	0.5	0.4	1.4	0.9	1.0
	2010	0.6	0.5	1.4	0.8	0.9
	2015	0.6	0.6	1.4	0.7	0.8
I, II, III	1995	3.2	3.2	3.3	0.1	0.1
	2000	3.8	3.2	4.7	0.9	1.5
	2005	4.6	3.7	4.7	0.1	1.0
	2010	5.2	4.3	4.7	(0.5)	0.4
	2015	6.2	5.0	4.7	(1.5)	(1.3)

The surplus provided by the well in Zone IV could be pumped into Zone III if hydrogeologic conditions are unfavorable for the prospect of a good producing well within Zone III. It is also possible to pump out of Zone IV into Zone II. However, the quality of water produced by the well in Zone IV is not considered as good as the quality of water produced from within Zones I and II. So from this point of view, it

is thought best to develop new sources within Zone II or Zone I for purposes of making up the forecasted deficiency. With the addition of Well No. 8 capacity of 1.4 mgd, then no further additions to the water supply will be needed until approximately the end of the planning period. This assumption is only true if the forecast is reasonably correct and if there is no decline in the capacity of the wells located in Zones I and II.

As shown in Table 4-3, the supply deficiency in Zones I, II and III will also be combined with a projected storage deficit beginning in the year 2005. The combined storage and supply deficiencies are a further reason why conservation is needed to help delay capital expenditures. For example, storage requirements can be reduced to some degree if conservation impacts the average and peak day demands.

**Table 4-3**  
**City of Troutdale**  
**Zonal Storage Requirements**

Zones	Year	Existing Storage	Required Storage (mg)	Deficiency (mg)
I, II, III	1995	5 mg	3.9	0
	2000	5 mg	4.5	0
	2005	5 mg	5.5	0.5
	2010	5 mg	6.3	1.3
	Ultimate	5 mg	8.5	3.5
IV & V	1995	1 mg	0.4	0
	2000	1 mg	0.4	0
	2005	1 mg	0.5	0
	2010	1 mg	0.6	0
	Ultimate	1 mg	0.8	0

#### 4.7 Conclusions

The City has adequate source of supply for the next 10 years with the addition of Well No. 8 (1996). A new source of supply will need to be developed in the next 20 years however. Implementing the conservation plan in Section 2 can have a significant impact on the timing.

# Section 5

## Savings, Implementation, and Program Evaluation Strategy

---

Water conservation planning and implementation should be a dynamic process incorporating refinements and new techniques to enhance conservation activities. After a water conservation program is implemented, it will be important for the City to evaluate how the program is working. As the effectiveness of various water conservation measures is determined, and as water demands increase, modifications to water conservation efforts should be anticipated. Both economic and non-economic evaluations need to be made with respect to the various programs and conservation activities. Results from pilot studies and information from water conservation programs conducted by other utilities can assist the City in making informed decisions.

This section provides a discussion of savings estimates and activities important for successful program implementation and evaluation.

### 5.1 Total Projected Program Savings

Water savings as a result of the combination of supply- and demand-side programs were estimated from 1995 to the year 2000. The results are shown on Table 5-1.

	1995	2000	2005	2010	2015
Demand Side Savings	0	0.1	0.1	0.1	0.2
Supply Side Savings	0	0.2	0.2	0.3	0.3
Total	0	0.3	0.3	0.4	0.5

The process involved in projecting savings for the supply-side efforts involved an estimate of the overall effectiveness of the combined efforts and a translation of that to a million gallons/year savings figure. The first year, savings were added to other major conservation program elements in that year to get an overall program savings estimate. For the supply-side activity, an average of 0.75 percent savings/year was utilized over the 20 year planning period.

For the demand-side, estimates of savings per device or activity were taken from the data in Appendix A, and applied to an estimated target population per year. An estimated savings was calculated for each device or activity per year. These were totaled to derive the total demand-side savings expected. It was assumed that the savings the first year would "carry over" in the second and subsequent years.

Consequently, when each year's savings were tallied, they were accumulated and an estimate was made of the percent savings. This figure was compared to that year's projected average daily demand without conservation.

## **5.2 Implementation Considerations**

Water conservation programs vary by region and utility. The City must assess its own resources and goals. Most successful water conservation programs include the following features:

- A least cost planning program which compares conservation program cost with the marginal costs of incremental supply alternatives. This process enables conservation measures to compete on the same level with new water supply options. The measure with the lowest unit cost is implemented based on this process.
- Coordination between key stakeholder groups, such as other water and wastewater utilities, County government, regulatory agencies, larger water users, environmental and energy interests.
- A balanced program with a mix of both supply and demand management measures, designed to reduce risk and attain the target level of water savings.

Peak use reduction is an important City goal since peak water use occurs in the summer months when the Region's water supplies are at a minimum. This will become increasingly more important as the population in the region continues to grow and the City's supply responsibilities escalate.

Key issues the City should consider when implementing a program are: program goals and objectives; long-term reliability of the program; impacts on bills and revenues; public education/outreach; integration and coordination with on-going efforts; and implementation sequence. A discussion of each issue follows.

### **5.2.1 Program Goals and Objectives**

It is important for the City to evaluate the method and success of implementing its conservation program in comparison to the goals and objectives cited in Section 2.

## **5.2.2 Long-Term Reliability of a Program**

It is important to distinguish between long-term versus short-term water savings. Programs that only temporarily change people's awareness or habits are not reliable for long-term savings. The promotion of water saving activities must be an ongoing effort to achieve long-term savings. Furthermore, some technologies such as toilet dams and outdoor soaker hoses actively conserve water, but do not provide long-term savings, due to short service life and retention rates.

As discussed in Appendix A, the expected service life and retention rate need to be taken into account when selecting program measures. For instance, an ultra-low flush toilet has been shown to provide reliable long-term indoor water savings, whereas a toilet dam may be removed or fail after several years. The anticipated water savings estimated for each of the program measures described in Appendix A reflect this issue.

## **5.2.3 Rate and Revenue Impacts**

Consumers may decide not to individually invest in cost-effective water conservation technologies because of poor information, limited capital, or some perceived risk or hassle. Therefore, the City, rather than its consumers, must invest in water conservation measures to ensure that prudent water resource and source augmentation occurs. To do this, the City needs to evaluate the best options, and allocate funds towards the best combination of measures.

A decision to fund conservation efforts generally increases the utility's overall revenue requirements which, in turn, may result in a water rate increase. For those customers participating in conservation activities, their overall bill may go down. However, non-participants' bills would increase.

Conservation may extend or delay new resource development, and as a result, water rates could be lower in comparison to rates that would have been set in order to recoup the costs of the new resource. The overall system benefits from conservation are passed to all customers in reduced supply expenses, delayed supply development costs, etc. However, it should be anticipated that some customer bills will increase, especially in the early years of a conservation program. This bill impact needs to be evaluated carefully as the City decides how to prioritize the customer classes and socioeconomic areas to serve as participants in the program.

#### **5.2.4 Public Education/Outreach**

Not all conservation activities can be solely based on cost-effectiveness. Costs and benefits may not be easy to estimate or separate out from total program savings. A combination of demand management activities may promote a conservation ethic and create good public relations. These benefits, in the long run, will reinforce or add to the probability of success of other conservation measures.

The most effective use of public information time and budget is to concentrate the effort into discrete "digestible" messages and discrete blocks of time. A message heard three times within a week is more effective than the same message heard ten times within a year.

#### **5.2.5 Integration With On-going Efforts**

Integration and coordination is needed between water conservation and supply management programs region-wide. In coordinating a regional effort, the City and other purveyors should seek guidance from key stakeholders i.e. customers, special interest groups, and other agencies. Water conservation will be one integral part of the City's individual and regional Water Supply planning process. Finances, water quality, demand, supply, and new facilities are other major components of the process.

Coordinated regional planning and conservation efforts will benefit the City and other utilities, because activities can be better promoted, delivered, and cost-shared effectively at the regional level. Furthermore, the implemented programs and measures will influence beneficial water use beyond the City's retail water service area boundaries. For instance, the Portland Water Bureau's public information media programs have affected water users in adjacent service areas without active conservation programs.

The City shares a media market with several other cities (e.g., Portland and Vancouver) and towns and the City is currently participating in Regional Water Resource planning efforts. Therefore, it makes good sense to consolidate resources and coordinate efforts to inform and involve the public.

Also, opportunities for increasing water conservation exist in other utilities operating in the region. For example, wastewater and energy utilities also benefit from programs that encourage the installation of water-efficient fixtures. Coordination with these other utilities will provide joint benefits and economics of scale through opportunities for joint device distribution programs and cost sharing.

Regular ongoing exchanges of ideas, problems, successes, and program results should be pursued. However, schedules, budgets, and programs may

be affected greatly by coordination with other utilities. Therefore, joint projects need to be selected and planned carefully. The City should consider if there are activities which may be unique to its retail customers or service territory, or if there are schedules which cannot be adjusted.

## **5.3 Implementation Plan**

Water conservation improvements, especially demand management measures, do not always result in immediate savings. Water savings are realized over a period as customers begin to change their usage patterns and participate in conservation activities.

Given the program goals and objectives presented in this Plan, it will be important to develop a program which is consistent with the values and public policies of the community. Based on experience with other conservation program efforts, the following activities should be implemented in the sequence outlined below to allow time to effectively develop public awareness, values, and policies necessary to support and implement conservation.

### **5.3.1 Program Management**

A management plan can be used to monitor the effectiveness of the City's conservation programs by tracking budgets, following manpower expenditures, and updating program activities, thereby helping the City determine the success of each program activity beyond measured water savings.

Actual program costs, manpower requirements, administrative efforts, and other factors should be evaluated annually at a minimum. This information can be summarized by the City in an annual report at the end of each fiscal year. The review will be useful for establishing annual budgets and for refining the City's program.

To facilitate management efforts, the City should develop a calendar of events and an annual fiscal budget.

### **5.3.2 Pilot Studies**

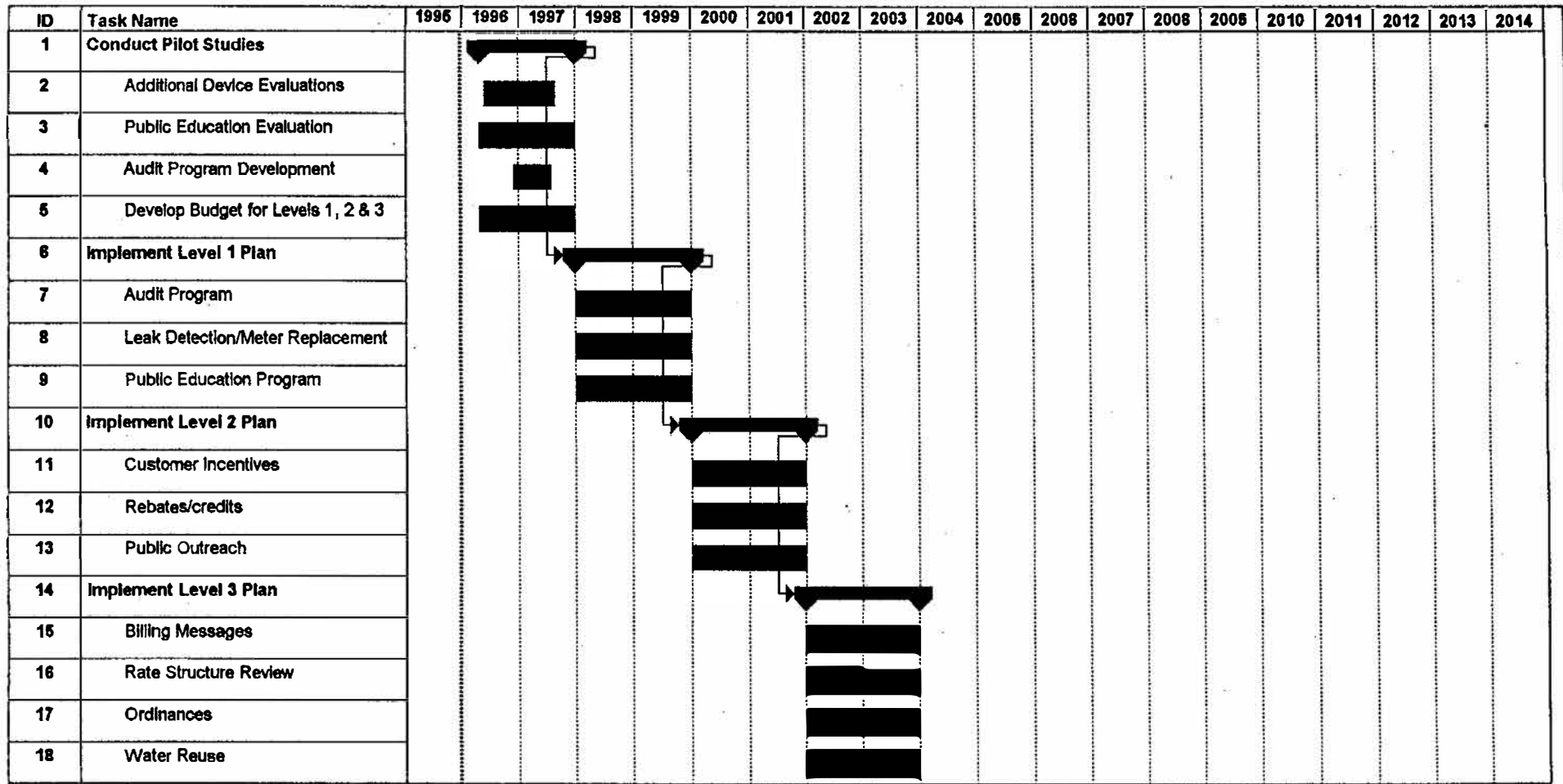
Concurrent with ongoing public education and rate incentive efforts, the City could conduct various pilot studies to examine the effectiveness of alternative conservation devices, evaluate public education alternatives and develop audit program activities. An implementation budget should be developed for the Level 1, 2 and 3 Plans. At the end of the two year pilot phase the City should be ready to implement the first level of the plan.

### **5.3.3 Conservation Program Refinements and Implementation**

The Level 1 plan should be implemented within a two year time frame after the pilot phase is completed. After the City has implemented the first level plan, the schedule and makeup of activities for levels 2 and 3 should be revisited.

## **5.4 Schedule**

A proposed implementation schedule for the Conservation Plan is shown in Exhibit 5-1.



Project: Troutdale Conservation Plan Date: 12/17/95	Task	█	Summary	█	Rolled Up Progress	█
	Progress	█	Rolled Up Task	█		
	Milestone	◆	Rolled Up Milestone	◇		

# Appendix A

## VOLUNTARY DEMAND MANAGEMENT MEASURES

The devices and measures included in the evaluation and discussed below are based on a review of current technology and cost. The data used is from other utility programs and device distribution/installation programs, such as by the East Bay Municipal Utility District (EBMUD) in California, Denver Water Department in Colorado, cities of Tucson and Scottsdale in Arizona, as well as data collected and summarized by the Arizona Department of Water Resources, the Texas Water Development Board, the American Water Works Association, the American Public Works Association, and from the "Conserv 90," a National Conference and Exposition held in Phoenix, Arizona in August, 1990.

Devices and measures were included based on inclusion in a utility program and do not represent an exhaustive list of alternatives available to individual customers. In addition, since the water conservation industry is dynamic and new devices are apt to become available as improvements or upgrades are made, the City should continue to update alternatives as appropriate.

### A. RESIDENTIAL WATER AUDITS

#### Description:

Water audits are performed by trained staff or consulting services to go to residences to examine water use practices, detect leaks, and make recommendations for improved efficiency. Single-family audits are usually the least cost effective due to the time spent in arranging appointment and travel cost and therefore are not done as frequently. Single family audits have been performed by East Bay Municipal Utility District (EBMUD). Multi-family audits are more cost effective than single-family audits, because auditors can make pre-arranged visits with managers of apartment complexes, and preparation time and travel cost is shared among more residences. Indoor audits could include installing retrofit device. Outdoor audits could include providing advice on more efficient lawn watering practices, drip irrigation systems, improving water retaining capacity of soils and low water using plants, as well as the possibility of distribution of some devices.

#### Savings:

The evaluation described in Section 4 aided in the determination of what types of devices should be installed along with audits. EBMUD has estimated a complete audit saves between 20 and 24 gallons per capita per day (gpcd) which includes savings from installed devices. With no devices installed, this evaluation assumed only a 2 percent annual savings in single-family water use and a 1 percent annual savings for multi-family residences. Total savings will depend on acceptability of water conservation measures by customers and retrofit devices provided or installed.

#### Cost:

Costs for water audits without device installation are estimated at \$40 for single-family homes and \$25 for multi-family homes.

#### Service Life:

5 years

## B. PRESSURE REDUCING VALVES (PRV)

### Description:

A PRV is a valve that automatically regulates incoming pressure to desired pounds per square inch (psi). A PRV is usually installed on the customer side of the delivery meter.

Pressure reduction may be feasible where pressure is considered excessive (that is, greater than 80 psi). In plumbing systems, high water pressure may increase the likelihood and the magnitude of leaking water heaters, water hammer, dripping faucets, dishwasher and clothes washer noise and breakdown, and leaking water pipes.

For many water-using fixtures (such as toilets) and appliances (such as washing machines), use is based on volume, so a change in pressure will have no effect. Nor will it affect the usage of people who do not use showers at the maximum capacity or those who take baths. Reducing water pressure may cause less wear on plumbing systems, fixtures, and appliances, but it is not expected to reduce indoor use significantly. Pressure reductions are likely to have more of an impact through reduced outdoor use (mainly irrigation) and reduced likelihood and magnitude of leaks.

Most water systems, as well as plumbing and irrigation systems, were designed to operate with a specified pressure level. Some uncertainty exists regarding the impact on existing appliances, sprinkler systems, etc., when operating at lower levels. Increasing pressure after a low-pressure period may create a stress on pipes and loosen potential contaminants lining pipes.

Pressure reduction also may violate State and local codes, threaten fire protection capabilities, and cause customer complaints. Minimum pressures are required to overcome: the head losses from valves required in the buildings by code, backflow prevention devices, detector check metering valves, a minimum 7 psi required at the sprinkler, and the losses in the height of the building. Any drop in pressure in some areas of the City service area could cause malfunction to automatic sprinkler systems.

### Cost:

Any pressure reduction strategy must consider topographical elevations, the reliability of pressure regulators, maintenance of regulators, and replacement costs. Pressure reduction valves for individual residences cost approximately \$50 for new construction and \$90 for retrofit installation. Valves for water mains often cost several hundred dollars, not including installation costs. Reducing water pressure can save money due to less power use from the lower water system pumping head requirement. It may be more effective to impose pressure limitations on new customers through local code requirements. This would provide for adequate design of new facilities at lower pressure and mitigate many of the anticipated retrofit problems.

It does not appear practical to reduce water pressure in existing developed areas due to limited savings in water use. System-wide reduction, likewise, does not appear justified at this time. Further consideration for this measure should focus on new customers only.

### Savings:

Studies of pressure reduction indicate that potential savings may be on the order of 3 to 6 percent. However, AWWA and others have reported 3 gpcd which was the value used herein. In addition, it can reduce leakage amounts and maintenance requirements on faucet and toilet valves.

Service life:

25 years

**C. LOW FLOW SHOWERHEADS**

Description:

Low flow showerheads are designed to deliver less water per unit time. It is designed to replace the old showerhead with flows ranging upwards from 4 to 5 gallons per minute (gpm). Typical flows range between 2 and 3 gpm. They should not be confused with showerhead flow restrictors, the older remedy used in the past which consisted of plastic, rubber or steel inserts that restricted the flow from the pipe to the showerhead. Although showerhead restrictors are very inexpensive and easy to install, they often produce unsatisfactory flow and are removed by customers. Low flow showerheads have been designed to provide a better flow pattern, and several studies have been performed to evaluate the performances of different types and brands.

Savings:

Actual savings will depend on original showerhead flow rate and new flow rate, average length of shower, and number of showers per week. For purpose of the evaluation, a 2.25 gpm savings was assumed for a total savings of 9 gpcd assuming an average shower length of 4 minutes. However, lesser savings have been reported by the AWWA, which assumes 1.5 gpm savings.

Cost:

\$4.00 per device.

Service Life:

15 years

**D. LOW FLOW FAUCET AERATORS**

Description:

Aerators are basically a fine mesh screen which breaks up the water into small droplets. They are designed to concentrate the flow and reduce splashing. Aerators mix air with water and produce a reduction in flow depending upon water pressure and flow rate. They can be installed on kitchen and bathroom faucets. Non-flow dependent tap water use is not effected, and additional time to obtain desired quantity is insignificant.

Savings:

Most studies, including those by the American Water Works Association (AWWA), estimate a saving of 0.5 gpcd. However, water savings as high as 2-8 percent of interior use has been reported. For purposes of this evaluation, we based our calculations on the more conservative figure of 0.5 gpcd. Water savings depends on the behavior of the individual and whether or not they tend to leave the faucet running for non-consumptive purposes.

Cost:

The devices are relatively inexpensive and easy to install. Cost effectiveness is marginal because of small water savings. Devices cost about \$1.00 up to \$7.00.

Service Life:

15 years

**E. DUAL FLUSH TOILETS**

Description:

Dual flush toilets can be purchased new, or existing toilets can be retrofitted with dual flush devices. Dual flush toilets are designed to use two separate flush cycles, depending on whether waste is liquid or solid. In the last few years a number of different types of flushing devices have been developed. The devices use between 1.0 and 5.0 gallons per flush, depending on tank and device. The down-side of the device is it requires a change in the users habits, because the method of flushing is different depending on the desired volume of flush. In addition, operation of the units can be confusing for visitors and guests.

Savings:

Savings as much as 10 to 20 percent of interior water use has been reported. AWWA has reported savings of 15.7 gpcd. For purposes of this evaluation, 10.5 gpcd was assumed.

Cost:

Retrofit devices cost between \$15 and \$30. A figure of \$20 was used for the analysis. As with any of the other devices, the device is cheaper if purchased wholesale and in bulk quantities.

Service Life:

A service life expectancy of 15 years has also been reported. However, after evaluating several of the devices available, for this evaluation, it was reduced to 10 years.

**F. EARLY CLOSURE TOILET FLAPPERS**

Description:

Early closure toilet flappers are new devices designed to reduce water consumption in existing toilets. This device works in a similar fashion as the dual flush toilets, but does not incorporate a new handle. There is no confusion in the method of flushing; however, the water is reduced for every flush, as with the toilet dam.

Savings:

Product literature provided by manufacturers showed reductions from 5 to 3 gallons per flush. Assuming 4 flushes per day, the water amounts to 8 gpcd.

Cost:

Cost for the device has been estimated at above \$5 per unit.

Service Life:

A service life of 5 years is expected, similar to toilet dams.

## **G. TOILET DAMS**

### Description:

Toilet dams have been included in number of other utility water conservation packets. Past studies have shown that it is more likely to be installed and left in place than other devices. It is a simple device usually composed of plastic and/or steel that dams off a portion of the water in the toilet tank. In addition, the longer life expectancy, which may even be greater than the 5 years assumed for this evaluation, and less need for routine adjustments appears to make it more acceptable to users.

### Savings:

Toilet dams reduce the amount of water released during the flush cycle by about 0.5 to 2 gallons, depending on the type of dam. Water savings of 8 to 18 percent of interior water have been reported. For purpose of this evaluation, 0.8 gallons per flush and 4 flushes per day, or 3.2 gpcd, was assumed.

### Cost:

More expensive than water displacement bags and bottles, toilet dams cost less than \$1 to as high as \$4. However, dams save more water and interfere less with flushing mechanisms than other displacement devices. This evaluation used \$2.00.

### Service Life:

5 years

## **H. TOILET LEAK DETECTION WITH REPAIR**

### Description:

Widely distributed by utilities and used in retrofit program kits, non-toxic dye tablets are put in the toilet tank to color tank water. Dyed water will appear in the lower bowl if flapper is leaking.

### Savings:

A 1984 study by US Department of Housing and Urban Development (HUD) showed an average toilet leak accounted for 5 to 13 percent of the total interior water use. It has also been estimated about 20 percent of all toilets leak. A savings of 3.4 gpcd was assumed for this evaluation.

### Cost:

Tablets cost less than \$0.50 per package of two. Repair cost vary. Repairs can range from minor adjustment, toilet flapper replacement to all internal tank replacement. This evaluation assumes only the flapper is replaced in about 1 out of 6 of the tanks inspected for leaks. Flappers cost about \$2. The average toilet leak detection and repair cost to the City would be about \$1 per toilet.

### Service Life:

5 years

## **I. ULTRA-LOW FLUSH (ULF) TOILETS AND REBATES**

### **Description:**

Rebates which encourage homeowners to replace existing toilets with new ultra-low flush toilets (1.6 gallons per flush or less) have been recently offered by a number of utilities, particularly in drought stricken areas or areas with wastewater treatment capacity problems.

### **Savings:**

Assuming an original 5 gallon toilet tank and 4 flushes per day, 13.6 gpcd could be saved.

### **Cost:**

Rebates of \$25, \$50, and \$100 were examined for this evaluation. These fixtures have been used extensively in Europe for many years with much success. Actual ULF toilets cost from as little as \$100 on up. Additional cost may be incurred because the base of the toilet may not correspond with existing toilet base, and hence new flooring material would need to be replaced. The \$200 cost shown for utility includes installation cost without floor replacement.

### **Service Life:**

25 years

## **J. TANKLESS HOT WATER UNITS**

### **Description:**

Rather than having a hot water tank to heat and store hot water, hot water is heated by coils adjacent to the hot water outlets. Water wasted while waiting for hot water to travel from a tank to point of use is eliminated.

### **Savings:**

Estimated savings is less than 2 gpcd.

### **Cost:**

The devices are more cost effective for new construction. The cost for new construction is estimated to be about \$250. Cost for retrofitting existing single-family residences is approximately \$600.

### **Service Life:**

25 years

## **K. HOT WATER LINE INSULATION**

### **Description:**

Insulating materials such as fiberglass and polyurethane foam are used to cover hot water lines to help maintain the temperature level of water. Water is saved by reducing the waiting time between when the tap is turned on and when the water arrives. Insulation is most easily installed at the time of construction.

Savings:

Estimated water savings of 2 to 8 gpcd have been reported. The AWWA has reported savings of 4.7 gallons per day per household. Hence, 2 gpcd water savings was used herein as a conservative estimate.

Cost:

Average cost is about \$0.50 per foot of pipe or \$25.00 - \$100.00 over the cost of uninsulated hot water lines. \$50.00 was used for this evaluation.

Service Life:

25 years

L. SELF-CLOSING HOSE NOZZLE

Description:

Self-closing hose nozzles keep hoses from freely discharging when not needed by the user.

Savings:

It particularly saves water from reducing amount used for home car washing practices. Because better data is not available at this time, a savings of about 5 percent of total outdoor water use was assumed.

Cost:

Nozzles are relatively inexpensive. The cost to a utility has been estimated to be about \$2 per nozzle.

Service Life:

5 years

M. IRRIGATION TIMERS AND AUTOMATIC SHUTOFF DEVICES

Description:

Over watering of lawns frequently occurs when sprinklers are not turned off in a timely manner. Timers in combination with automatic shutoff devices save water. It does not reduce the amount of water due to misconceptions about how much water is really needed for thriving, healthy plants and lawns.

Savings:

Potential combined savings is estimated at 2 percent of total outdoor water use.

Cost:

Combined cost of both devices is estimated to be \$5.

Service Life:

5 years

**N. IRRIGATION TENSIOMETERS**

Description:

An irrigation tensiometer is a gauge for measuring soil moisture levels so that the water needs of plants can be determined. A liquid tensiometer consists of a closed tube filled with water and connected to a vacuum gauge. It is placed in the ground with the stopper and gauge remaining above ground. The dryer the soil, the greater the vacuum. Electronic tensiometers measure soil tension using the heat diffusion principle.

Savings:

Savings have been reported from about 2 to 10 gpcd. Lacking sufficient information, only 2 percent of outdoor water use was assumed for this evaluation.

Cost:

Individual tensiometers are about \$10 to \$20 apiece.

Service Life:

5 years

**O. IRRIGATION SOAKER HOSES**

Description:

Irrigation soaker hoses cut down on the amount of water lost through evaporation and less water is likely to be sprayed on non-permeable surfaces such as sidewalks, driveways and roads.

Savings:

Saving was assumed to be 2 percent of outdoor use. Again, additional information is needed on potential outdoor water savings.

Cost:

Soaker hoses have been estimated to cost about \$10 per hose.

Service Life:

5 years

**P. DRIP IRRIGATION SYSTEMS**

Description:

Drip irrigation systems consist of the use of pipes or tubes with small holes or emitters which allow delivery of a limited quantity of water to each plant, shrub, or tree to be irrigated. Drip irrigation is not practical for lawns or large areas. It is better in landscaped or garden areas.

Water is directed at the root system and therefore is more efficiently applied, with less evaporation.

Savings:

Depending on percent of landscape or garden area, as much as 20 to 30 percent of exterior water use has been reported as potential savings in more arid areas. Additional information on percentage of lawn and water use pattern specific to the Northwest is needed before an estimate of the potential savings achievable with installation of drip irrigation systems. Only 5 percent of outdoor water use was used for this evaluation.

Cost:

Average cost for drip irrigation equipment has been estimated at \$200 for single-family residences and \$400 for multi-family residences.

Service Life:

10 years

**Q. GREYWATER USE WITHOUT TREATMENT**

Description:

Greywater is water that has already been used for other purposes such as clothes washers, bathtubs, showers, and bathroom sinks. The cleanest greywater does not include the kitchen sink or dishwasher, due to the presence of grease and food particles. This water should not be included in a greywater system.

Greywater can be used to irrigate fruit trees, groundcovers and ornamental trees and shrubs. It should not be used for vegetable gardens, to sprinkle lawns, or wash off hard surfaces. It could also be used to flush toilets.

Santa Barbara County recently became the first county to allow plumbing that would divert greywater for irrigation. Other jurisdictions ban such hook-ups because of potential health hazards. As far as anyone has been able to determine, there is not a single recorded instance of anyone in the United States becoming ill from exposure to greywater. Currently, only six states have any regulations concerning the use of greywater. The remaining states consider it blackwater and thus outlaw its use, usually under health department regulations. Recently, improved understanding of greywater quality and its potential beneficial use has led to increased interest and expanded utilization.

Greywater can be relatively safe if an approved system is installed and maintained properly. Greywater may contain some infectious bacteria and viruses. For maximum safety, there should be no human or animal contact with greywater. Greywater should be distributed to subsurface irrigation points as soon as it is produced. The health standards of states with greywater approval generally do not allow greywater to be: stored; pool on the surface of the ground; used for sprinkling lawns; used on vegetable gardens; or, used to wash off driveways or sidewalks. Greywater should not include laundry water from soiled diapers or water used by any person who has an infectious disease--especially diarrheal infections, infectious hepatitis or intestinal parasites.

It is important to develop a regular maintenance procedure and regularly inspect the system for leaks or blockages and verify that plants receive the correct amount of water.

Most hand and dish soaps and shampoos that are introduced to home vegetation through greywater systems will not damage plants at low residential concentrations and the phosphates may act as a mild fertilizer. A greywater system consists of piping to bring the greywater to a surge tank (45-55 gallons) to temporarily hold large drain flows from washing machines or bathtubs, and an irrigation distribution system. The number of plumbing fixtures which can be easily used in a greywater system will depend on the building's foundation, and the quantity of water required to irrigate.

Because greywater systems require modifications to the wastewater pipes in the home, regulatory codes, ordinances, and permits should be required. The City will need to set up guidelines for approved use of greywater. In addition, amendments to State regulations and local building codes and ordinances would be required.

Greywater use would reduce summer water use. The City should work cooperatively with the local and State Health Departments in developing guidelines, etc. However, because of the expense associated with installing a system, it is not cost-effective for homeowners at this time.

#### Savings:

Greywater reuse for this evaluation was based on outdoor water usage. An average of 20-30 gallons per capita per day (gpcd) of greywater is generated from a home. This represents 50-60 percent of the total domestic wastewater production, and shows the potential savings in potable water use for irrigation. Actual savings will depend on amount of landscape or garden area. Estimated savings for this evaluation was 10 percent of annual outdoor water use.

#### Cost:

The components of a greywater system, along with estimated costs for the homeowner to install a system, are provided below as taken from the Santa Barbara Guidelines for the Approved Use of Greywater.

All systems require (prices will vary):

1. A permit (\$30 for Santa Barbara building permit).
2. A 3-way manual diverter valve to direct greywater to either the sewer or to vegetation (\$25 manual, \$200 electronic).
3. A 45-55 gallon surge tank to hold high volume flows from a bathtub or washer until the water can drain to the vegetation (\$125).
4. A swing check valve so that a clogged sewer line can't back up into the greywater system (\$25-\$30).
5. Inexpensive polyethylene irrigation hose (\$40 for 500 ft.).
6. Pipes, fittings and hose (\$50-\$70).
7. Gravel and clay pots - 10 trees (\$60).

Some systems will require (prices will vary):

1. A sump pump (\$100+) and check valve (\$25).
2. A washing machine 'Y' valve (\$30).
3. Manual (\$2) or electronic (\$175-\$200) irrigation valves.
4. Electronic irrigation clock (\$50 to \$250).

Total cost estimated to range from \$400 to over \$1,000 for a single-family residence based on Santa Barbara's guidelines.

It is an extremely expensive endeavor even without treatment in comparison with the other alternative measures. For this evaluation, it was estimated to cost about \$500 per single-family residence and \$2,000 on the average for multi-family apartment complexes.

## **R. NON-RESIDENTIAL WATER AUDITS AND COST/BENEFIT ANALYSIS**

### Description:

For commercial and industrial, public authority and large turf customers, only water audits, or water audits and cost/benefit analyses were considered at this time. For a more complete description of a water audit, see previous discussion on residential water audits. Retrofitting of public authority facilities or some other additional arrangements could be made with these other customers at a later time, including low interest loans for retrofit programs. Again, in order to assess the potential success of the program, more information on water use characteristics, percent of customers willing to participate in audit, and water use changes acceptable to customers needs to be obtained.

### Savings:

Potential water savings of about 15 percent of annual water use was assumed.

### Cost:

The estimated cost of an audit was about \$150.

### Service Life:

Expected service life of non-residential water audits was estimated by Denver, Colorado to be about 10 years. Not having proven reliable data, only a 5 year service life was assumed for this evaluation.

---

**APPENDIX B**

---

**APPENDIX B  
WATER USER FEE SCHEDULE**

**EFFECTIVE JANUARY 1, 1995**

**A. Commodity Charge:** The commodity charge shall be \$2.15 per thousand gallons.

**B. Other charges:**

	3/4"	1"	1-1/2"	2"	3"	4"	6"	8"	10"
<b>STANDBY (1)</b>			\$ 6.00	\$ 9.64	\$ 18.19	\$ 30.36	\$ 61.45	\$ 96.91	\$ 136.00
<b>INSTALLATION (2)</b>	\$ 235.00	\$ 285.00	--- Equipment + Materials + Labor + Overhead ---						
<b>STAND PIPE (3)</b>	\$ 50.00	Not Applicable							
<b>HYDRANT METER (4)</b>	\$100 DEPOSIT + \$25.00 / MONTH + WATER USAGE								

**NOTES:**

- Standby Fire Service requires new construction to include a "detector check" with a meter. Existing installations without these standard configurations will be billed at a rate twice that listed for standby fire service. Any consumption through detector check meters will be billed at twice the commodity charge. Rate is per month.
- The installation rates shown are one-time charges. Installation charges for services 1 1/2" and over are billed at the cost of equipment and materials plus direct labor and applicable City overhead. All installations requiring excessive costs, pavement cuts, or special conditions may be billed for additional costs.
- A stand pipe is for single family (one unit) construction use only. Rate is per 90 days or any fraction thereof.
- Hydrant meters are to be used only for construction, agriculture or other approved short term applications. Water usage shall be charged according to the commodity charge/1000 gallon schedule.