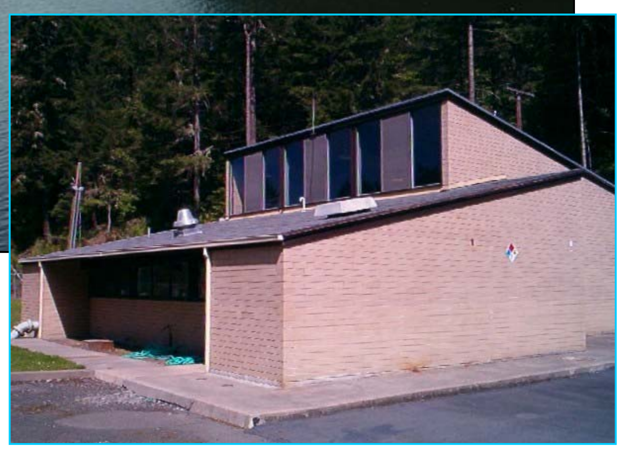
City of Sutherlin
Douglas County, Oregon

WATER MASTER PLAN

MAY 2006



The Dyer Partnership
Engineers & Planners, Inc.

1330 Teakwood Avenue
Coos Bay, Oregon 97420
(541) 269-0732 ◘ Fax (541) 269-2044
www.dyerpart.com

Project 146.01/146.03

City of Sutherlin

Douglas County, Oregon

Water Master Plan

May 2006

Project No. 146.01/146.03

REGISTERED PROFESSIONAL ENGINEER
11,809
OREGON
JULY 16, 1982
STEVE B. MAJOR
EXPIRES: 12-31-06

REGISTERED PROFESSIONAL ENGINEER
16357
OREGON
DAVID T. JEPSEN
EXPIRES: 6/30/07

The Dyer Partnership
Engineers & Planners, Inc.

1330 Teakwood Avenue
Coos Bay, Oregon 97420
(541) 269-0732 Fax (541) 269-2044
www.dyerpart.com

Table of Contents

SECTION 4 – REGULATORY ENVIRONMENT, continued

SECTION 5 – EXISTING WATER SYSTEM

SECTION 6 – WATER USE and PROJECTED DEMANDS

SECTION 9 – WATER CONSERVATION PLAN, continued

SECTION 10 – WATER CURTAILMENT PLAN

LIST OF TABLES

LIST OF TABLES, continued

LIST OF TABLES, continued

LIST OF FIGURES

REFERENCES

APPENDICES

Section

1

Summary

Since the early 1900s, potable water has been supplied to the residents of Sutherlin. As demands to the community's water system have increased, improvements have been made to satisfy the demand and maintain excellent water quality. This Water Master Plan was compiled to address the demands on the City's water system created by recent growth within the City and provide guidance to address the City's future water needs. This Plan also contains all the necessary elements for a Water Management and Conservation Plan in accordance with OAR 690-086-100 to 170.

The City's water system consists of facilities for diversion, treatment, transmission, storage and distribution of water. Raw water is currently diverted from two sources and treated at two separate facilities: Calapooya Creek at the Nonpareil Water Treatment Plant (WTP) and Cooper Creek Reservoir at the Cooper Creek WTP. The City has water rights for diversion of 4.0 cfs from Calapooya Creek and 5.0 cfs from Cooper Creek. In addition to water rights and permits from these sources, the City has a water right permit for diversion of 2.0 cfs from the North Umpqua River. The City holds water right certificates for 3.0 cfs on Calapooya Creek; the rest of the water rights are permits. Two of the water rights (1.0 cfs on Calapooya Creek and 2.0 cfs on North Umpqua River) are junior to instream water rights.

The Nonpareil WTP is utilized year-round while the Cooper Creek WTP is used only in the high demand months of summer (June through September). Booster pumps at each WTP convey water to the City's distribution system that consists of approximately 51 miles of piping ranging from 2-inch to 14-inch diameter mains. The City has four service areas with different pressures. These service areas include five booster pump stations and nine potable water storage tanks ranging in capacity from 0.024 to 1.25 million gallons (MG).

The City provides water to City residents, the Union Gap Water District, and 17 low-pressure users located along the Nonpareil water main. The population currently being served by the City's water system is 8,088. System water demand was compiled for both the amount of water pumped to the City, produced at the WTPs, and diverted from the raw water sources. Current water demand production is calculated to be 1.58 million gallons per day (MGD) on an annual average with a maximum month and daily demand of 2.76 MGD and 3.38 MGD, respectively. The combined capacity of the City's WTPs is 3.3 MGD. Additional WTP capacity is needed for future water demand. The average of nonaccount (water sold less water produced) in the City's system is approximately 29 percent, which is comparable to calculation presented in previous City water planning documents.

Future water demand was primarily based on current water production/consumption parameters, projected growth within the City, and anticipated nonaccount water (10 to 15%). Population growth was projected using the County's adopted 2.7 percent annual growth for the City over a 20-year period. In addition, two 3,000 population increments above the 20-year projection were also examined. In consideration of users outside the City (approximately 728) and the two population increments, the anticipated potable water use populations for the Years 2025, 2034 and 2046 are 13,606, 16,606, and 19,606, respectively. The projected water demand production in the Year 2025 (assuming 15% nonaccount water) in terms of maximum month and daily demand are 4.0 and 4.9 MGD, respectively. The values for maximum month and daily demand are projected to increase to 5.8 MGD and 7.1 MGD, respectively, by the Year 2046.

Based on the projected maximum daily demand (MDD), the City's existing water rights on Calapooya Creek and Cooper Creek should be sufficient to meet the City's demand until approximately the Year 2025 to the Year 2029 depending on the percentage of unaccounted for water. This conclusion is based on the City fully developing the Cooper Creek water right of 5.0 cfs (3.2 MGD).

After the Years 2025 to 2029, the City will need to utilize its water right on the North Umpqua River or find another source of water in order to meet the projected MDD demand. If the City develops its water right on the North Umpqua River, the projected MDD is anticipated to exceed all of the City's existing water rights (minus its junior Calapooya Creek water right) between the Years 2046 and 2050. To satisfy long-term demand (beyond the Years 2046), the City will need to pursue conservation of its existing diverted water and/or explore long-range acquisition of future sources of raw water.

A number of alternatives were evaluated for the full development of the North Umpqua River and Cooper Creek water rights. A total of seven different alternatives were initially evaluated for the development of the City's water right on the North Umpqua River. Three of these alternatives were selected for further analysis. The most cost-effective alternative consisted of water diversion, treatment, and pumping by Umpqua Basin Water Association. A booster pump between Umpqua Basin's distribution system and the City's system would provide the conveyance to the City. To fully develop this water right and handle the raw water quality of Cooper Creek Reservoir, new WTP facilities are needed at Cooper Creek. Three WTP alternatives were examined in addition to a number of on-site improvements. The most cost-effective WTP alternative was the Adsorption Clarifier Followed by Filtration Process.

The City's water distribution system was evaluated using a hydraulic computer model, with emphasis on selected vital or high fire flow areas within the City. Based on the results of this model, the following vital areas were shown to have less than required fire flow: High School, Middle School, Umpqua Regency Inn, Orenco industrial site, and Central Avenue. Proposed projects to improve fire flows within the City's distribution includes looping and installation of larger diameter mains along Central Avenue, 4th Avenue, 6th Avenue, South Comstock Road, and Airway Avenue among others.

Storage capacity of the treated water tanks within the City was evaluated and found to be currently deficient by almost 1.3 MG. By the Year 2025, the City would be approximately 3.3 MG deficient in reservoir storage unless new storage tanks are constructed. A number of new storage tanks were recommended to handle the City's current and future storage requirements. Improvements, such as cathodic protection and tank reconditioning, to several of the existing storage tanks were also recommended. Filling of the Oak Hills Tank to its overflow elevation has been a continuing problem and is attributed to a hydraulic bottleneck between this tank and the WTPs and other reservoirs. Proposed distribution system projects to improve fire flow will reduce this bottleneck and improve the filling of the Oak Hills Tank.

A water management and conservation plan was compiled as this Water Master Plan and subdivided into different sections of the report. A water conservation plan was compiled in accordance with the requirements of OAR 690-086-150 and plan details a total of 35 separate conservation measures or benchmarks that the City plans to implement during the Years 2005 to 2010. As the City has not been required to address water conservation in the past, City resources and commitment will be needed for successful implementation of this Water Conservation Plan and develop a "water conservation mindset" within the community.

A water curtailment plan was compiled for the City based on four levels or stages of alert. Recommended indicators for determination of water shortage and need for curtailment include the use of Palmer and Surface Water Supply Indices, delivery disruption, curtailment of diversions by County, State or Federal agencies, declaration of drought conditions by the Governor, and staff assessment. Curtailment actions recommended include public information measures, non-essential restrictions and bans, rationing, pricing, and enforcement measures. Measures within this Plan have been implemented by the City to conserve water within the system during an emergency.

A water supply plan was developed which evaluated projected water demand and a comparison of the demand with available supplies and alternate supplies. Proposed water supply for the City includes full development of the Cooper Creek and North Umpqua River water rights. Full utilization of the Cooper Creek water right will require construction of a new WTP at the Cooper Creek facility. The proposed method of utilizing the North Umpqua River water right is for diversion and treatment by Umpqua Basin Water Association, and pumping the treated water to the City.

A total of 26 improvements were recommended in the Capital Improvement Plan. Total estimated cost for installation and construction of these improvements is $27,129,800. These improvements were prioritized into three phases with Phase I Improvements as the most critical projects. Recommended Phase I Improvements include construction of a new water treatment plant and related improvements at the Cooper Creek WTP site, new raw water intake improvements at Umpqua Basin Water Treatment Plant to handle the City's additional flow, construction of a supervisory control and data acquisition (SCADA) system, distribution system improvements to improve fire flow and storage, and individual booster pump stations for customers on the Nonpareil water main. Total estimated cost for the Phase I Improvements is $12,073,900.

Recommended Phase II and III Improvements include additional SCADA system improvements, new reservoir tanks, upgrade of the Nonpareil WTP, installation of a multi-level intake and hypolimnetic aeration system at the Cooper Creek Reservoir, improvements at Umpqua Basin Water Association's WTP for treatment of North Umpqua River water from City's water right, distribution system projects to improve fire flow, and an inter-tie connection with the City of Oakland's water system. Total cost for Phase II and III Improvements is $3,555,100 and $11,500,800, respectively.

Various funding programs were evaluated for financing the Phase I Improvements through the use of either low-interest loans or a combination of low-interest loans and grants. Projected monthly debt service ($/EDU) from viable funding programs ranged from $13.67 to $14.77. Projected monthly user rates, including debt reserve and system O&M costs, ranged from $41.31 to $44.13 per EDU, depending on whether or not Murphy Plywood was on the City's water system.

Recommendations for implementing the elements of this Water Master Plan include the following.

- Commence with new water management and conservation measures and programs per the recommended benchmarks.
- Initiate study of user rates and revise system development charges (SDCs) for water system and implement proposed changes.
- No new individual residential water connections outside the urban growth boundary.
- Enter into an agreement for the City to withdrawal of water from the North Umpqua River at Umpqua Basin Water Association's raw water intake.
- Submit request to Department of Water Resources for an additional point of diversion for the North Umpqua River water right at Umpqua Basin Water Association's intake location.
- Schedule and attend "One-Stop" Meeting to discuss financing options for the proposed Phase I Improvements.
- Submit system information and necessary applications to private funding sources and public funding agencies for financing the Phase I Improvements.
- Following favorable review by the selected financing sources, secure the authority to issue revenue or general obligation bonds in the amount needed to finance the Phase I Improvements.
- Authorize detailed design of recommended improvements, and preparation of plans and specifications for the Phase I improvements. Secure the necessary special use permits for construction.

- North Umpqua River Water Right - Submit request to Department of Water Resources for extension of compliance date for construction and full utilization to Year 2050.
- Cooper Creek Water Right - Submit request to Department of Water Resources for extension of compliance date for construction and full utilization to Year 2025.
- Calapooya Creek Water Right – Reassess full utilization of this permit and submit request to Department of Water Resources for extension of compliance date for construction and full utilization.
- Receive construction bids and award contracts for Phase I Improvements.
- Submit revised Water Management & Conservation Plan (Year 2011-2016) to Department of Water Resources.

The following is a tentative schedule identifying key activities and approximate implementation date for the Water Master Plan.

- Initiate Water Conservation Plan Tasks Per Benchmarks — July 2006
- Initiate Rate Study and SDC Revisions — July 2006
- Enter into Agreement with Umpqua Basin Water Association for the withdrawal of water From their Raw Water Intake — July 2006
- Submit Request to Department of Water Resources (DWR) for An Additional Point of Diversion at Umpqua Basin Water Association's Raw Water Intake Location — July 2006
- City Attend One-Stop Meeting for Financing Options — October 2006
- Obtain Financing for Phase I Improvements — October 2007
- Design of Phase I Improvements — November 2007 – November 2008
- Health Division Approval of Phase I Improvements — December 2008
- Advertise for and Receive Construction Bids for Phase I Improvements — January - February 2009
- Submit Request to DWR for Extension of Compliance Date for Construction and Full Utilization of North Umpqua River Water Right — January 2009
- Construction of Phase I Improvements — April 2009 – April 2010
- Submit Requests to DWR for Extension of Compliance Dates for Construction and Full Utilization of Cooper Creek and Calapooya Creek Water Rights — January 2010
- Submit Revised Water Management & Conservation Plan to DWR — March 2011

Section 2

Introduction

2.1 Background and Objective

The original water system for the City of Sutherlin was constructed in 1913 and consisted of an intake on Sutherlin Creek with wood stave pipe for transmission and distribution. Water from the Luce Land Company Irrigation Ditch and Calapooya Creek augmented the Sutherlin Creek source. In 1925, a diversion line from Sutherlin Creek to Calapooya Creek was completed to the present site of the present day Nonpareil WTP. New intakes were built in the late 1940s and distribution lines were replaced with steel pipe during the late 1940s to the mid 1950s. The Cooper Creek WTP, along with the earth impoundment dam, was constructed in 1971, and upgrades to the plant were made to increase the plant capacity from 0.8 to 2.0 MGD in the years that followed. In 1983, the new Nonpareil WTP was completed to provide the City with another 2.5 MGD capacity. Today, the Nonpareil WTP remains as the City's primary supply of potable water. The Cooper Creek WTP serves as a secondary source of water when Nonpareil WTP is not in service and supplements potable water production during the peak water demand in summer.

Recent population growth has added a number of new users of the City's utilities. With the added growth and increased potable water demand, there are a number of concerns with respect to the capability of the City's present water infrastructure to address present and future water needs of the City. A water master plan will provide an evaluation of the City's current water system facilities, project future water needs and recommend improvements to satisfy the anticipated water demand. In looking at future water demand, the City is continuing to pursue its development of its 3.0 cfs water right on the North Umpqua River. The City recently renewed its permit for this water right with the Oregon Department of Water Resources. One of the stipulations of the permit renewal of this water right is that a water management and conservation plan would be completed within two years of the permit renewal (May 7, 2004). Per OAR 690-086-100 to 170, a water management and conservation plan can be a part of a water master plan. To address the above concerns, the City initiated the compilation of a water management and conservation plan and a water master plan in 2004.

2.2 Study Objective

The purpose of the Plan is to provide the City of Sutherlin with a comprehensive planning document that provides engineering assessment and planning guidance for the successful management of its water system over the next 20 years and beyond. This plan will also provide guidance and assist the City in evaluating the infrastructure needs of new developments. This document satisfies the Oregon Health Division requirement for communities with 300 or more service connections to have a current master plan (OAR 333-061-0060). The principal objectives include:

- Evaluation of the existing water system components
- Prediction of future water demands
- Evaluation of the capability of the existing system to meet future needs

- Recommendations for improvements needed to meet future needs and/or address deficiencies

- Development of a municipal Water Management and Conservation Plan per OAR 690-086-0010

The Plan outlines water system improvements necessary to comply with State and Federal standards and to provide for anticipated growth. The capital improvements are presented as projects with estimated costs to allow the City to plan and budget as needed. Supporting technical documentation is included to aid in grant and loan funding applications and meets the requirements of the Oregon Economic and Community Development Department (OECDD), the Oregon Department of Water Resources, Rural Development, as well as the Oregon Health Division.

2.3 Scope of Study

The overall scope of this Plan consists of 1) an examination of the City's existing water supply sources and system, 2) review existing and recommend a new water conservation plan, 3) review existing and recommend a new water curtailment plan, and 4) determine the adequacy of existing water sources and need to development new water sources for future potable water service in the City.

Planning Period

The planning period for this Plan is 20 years, ending in the Year 2025. The period is short enough for current users to benefit from system improvements, yet long enough to provide reserve capacity for future growth and increased demand. In addition to this time period, the impact of two 3,000 population increments was also examined. If the current projected population increase continues at the anticipated annual rate of 2.7 percent, the population increments would extend to the Year 2046.

Planning Area

The city's Urban Growth Boundary (UGB) plus the additional limits of the system defined by raw water sources and transmission is considered the Study Area in this Plan.

Work Tasks

In compliance with Oregon Health Division and Water Resource Department (WRD) plan elements and standards, this study provides descriptions, analysis, projections, and recommendations for the City's water system over the next 20 years. The following elements are included:

- **Executive Summary** – Provide a summary of the conclusions and recommendations from this study.

- **Study Area Characteristics** – Identify applicable study area characteristics, land use, population trends and projections.

- **Regulatory Requirements** – Identify current and future regulatory requirements/regulations that affect the planning, operation and maintenance of community water systems.

- **Existing Facilities** – Description and evaluation of the existing water system including supply, treatment, storage, and distribution.

- **Water Use and Projected Demand** – Determine the City's future water demand based on current use, projected population and economic growth.

- **Water Management and Conservation Plan** – Evaluate existing water system, sources, demand, and water rights. Develop and describe plans for water conservation and curtailment, and long-range sources. Identify recommended measures and plan update.

- **Alternatives/Capital Improvement Plan** – Identify and evaluate various alternatives for the City's water system. Select the most cost-effective program that will meet the City's water needs within the planning periods. Identify and describe a capital improvement plan for the water system with recommended implementation schedule.

- **Improvement Phasing and Financing -** Identify various local financing mechanisms and the most applicable funding programs. Develop a financing program for proposed improvements. Financing program will include propose monthly rate structure, implementation schedule, and system development charges.

2.4 Authorization

The City of Sutherlin contracted with The Dyer Partnership, Engineers & Planners, Inc. on April 27, 2004 to prepare the Water Management and Conservation Plan and December 27, 2004 to prepare the Water Master Plan. The scope of this Plan was based on a Scope of Engineering Services that was included in the contract with the City.

2.5 Past Studies and Reports

Documents that discuss the City's water system and facilities have been used in the preparation of and analyses in this Plan. A list of these studies and reports, with a brief summary of their conclusions, is listed below.

Douglas County Water & Sewerage Comprehensive Plan, Harlan, Gessford & Erichsen Architects Engineers, May 1970.

In this comprehensive plan, the following recommendations were made with respect to the City.

- Proposed regional water source from the North Umpqua River should be utilized to meet the future water demands from Winchester area (north of the river) to the City of Oakland.

- Sutherlin should continue the development of the Cooper Creek Reservoir source and increase distribution sizing in the high value district.

- Storage capacity should be provided to more adequately serve potential high level development in the area.

- An interconnection should be provided to serve the City of Oakland and the Union Gap area with an adequate water supply.

Capital Improvement Program for Water System, Storm Drainage, and Street Improvements by HGE Engineers & Planners, Inc. for the City of Sutherlin, February 1975.

The following is a summary of conclusions and recommendations made in this report with respect to the City's water system.

- Cooper Creek Reservoir was selected as the long range water source for future development. Regional water system with the City of Oakland is recommended with Cooper Creek as its source.
- Two-phase improvement project recommended; estimated total project cost for Phase I and II improvements was approximately $4.1 million.
- Phase I improvements include an expansion of the Cooper Creek Treatment Plant to 3.8 MGD, two 1.0 MG storage reservoirs (one in northwest Sutherlin, the other in northeast Sutherlin), and major transmission and distribution piping improvements.
- Phase II improvements include a 1.0 MG storage reservoir (south Sutherlin) and additional transmission and distribution piping improvements.

Oakland-Sutherlin Water Study by Robert E. Meyer Consultants, Inc. for Douglas County, December 1979.

The following is a summary of conclusions presented in this report with respect to the City's water system.

- City should investigate a suitable location for a small dam site above one of their existing intakes. Usable storage should be approximately 600 acre-feet.
- City should start a testing program for the best treatment process to remove excess manganese from source water removed from Cooper Creek Reservoir.
- If a suitable small dam site is not found, the City should consider the proposed Pollock Creek Dam as a source of stored water.
- City should proceed with plans to expand its water treatment facilities and water system in general.
- A method of providing a reliable source of water to the community of Union Gap should be found, with or without an intertie between the Cities of Oakland and Sutherlin.

Gassy-Norris Creek Damsite Reconnaissance Report, International Engineering Company, Inc., August 1982.

The following is a summary of conclusions presented in this report with respect to the proposed dam site.

- The identified Gassy-Norris Creek site was considered the best water storage site that would 1) provide gravity flow to the City's municipal intake at Nonpareil, 2) have sufficient storage capacity for a major portion of the projected water needs of the area, and 3) minimize adverse effects to salmonid populations.
- Proposed earthfill dam would have a storage volume of 6,700 acre-feet.

- Proposed 500 acre-feet per year for municipal and industrial use, and 620 acre-feet for stream flow augmentation.

Water, Wastewater, and Stormwater Engineering Study, Part II – Water, HGE Engineers and Planners, Inc., 1997

The following is a summary of conclusions and recommendations made in this report with respect to the City's water system.

Water Supply
- Request and secure an additional 500 acre-feet of storage from Cooper Creek Reservoir (application pending).
- Initiate Phase I Feasibility Study of Gassy-Norris Creek Impoundment. If results of this study are encouraging, proceed with detailed field investigations.
- Complete a predesign report for installing a hypolimnetic aeration system in Cooper Creek.
- If additional storage at Cooper Creek cannot be secured and construction of the Gassy-Norris Creek appears unfeasible, then develop the City's existing water rights on the North Umpqua River.

Water Treatment
- A new 3.2 MGD treatment facility be constructed at the Cooper Creek site.
- Upgrade of Nonpareil Water Treatment Plant (WTP) primarily centered on updated electrical controls and automated systems.

Water Storage
- Construct a 2.0 million gallon (MG) concrete reservoir south of Plat M Road (Priority I)
- Construct a 1.0 MG steel reservoir north of St. John's Street, and a 70,000 gallon reservoir north of 6th Avenue as part of the extended Upper Umpqua pressure zone (Priority II).
- Construct a 0.5 MG reservoir north of Highway 138 (Priority III).

Water Transmission & Distribution
- A total of 23 distribution improvements to improve flow capacity, and correct existing system deficiencies.

Capital Improvement Plan
- Plan consisted of three priorities with the following estimated costs (rounded):

- Priority I	$9.6 million
- Priority II	$3.0 million
- Priority III	$3.3 million
Total	$15.9 million

Modeling and Analysis of Cooper Creek Reservoir Water Quality, Wells, S.A.; Annear, R.L.; Berger, C.; Systma, M; March 2000 (Wells' Report).

A summary of this report is given below.

- Cooper Creek Reservoir is strongly stratified during the summer months.
- Oxygen depletion in the hypolimnion layer begins in late winter and is anoxic by summer.
- Reservoir water quality is thought to be negatively impacted by septic tank leachate from the recreational areas and urea applications to fertilize surrounding forestland.

- Aeration of the hypoliminion layer will reduce internal loading of nutrients and may reduce phytoplankton productivity in the epilimnion layer in the summer. Increased water clarity may be offset by increase in aquatic plant growth.

- Suggestions for improving water quality include sewer the two recreational areas, restrict fertilizer application to forestlands, capture inflow particles from upstream watershed, and limit clear-cutting in the watershed basin.

***Letter Report on Cooper Creek Hypolimnetic Aeration Project*, B. Bogus of Kennedy/Jenks Consultants to D. Philippi, BTS Engineering & Surveying, August 14, 2003; & *Cooper Creek Reservoir Hypolimnetic Aeration Considerations and Calculations*, Tetra Tech Inc., July 30, 2003.**

A summary of these reports is given below.

- Hypolimnetic aeration in the reservoir would meet the hypolimnetic oxygen demand, reduce soluble iron, manganese, and hydrogen sulfide levels in the water supply, reduce concentrations of phosphorus in the hypolimnion, and provide an oxygenated bottom water habitat for aquatic organisms.

- Recommend acquisition of a sole-source hypolimnetic aeration system with micro-bubble diffusers.

- Estimated cost for a hypolimnetic aeration system ranged from approximately $376,000 to $576,000 depending on whether it was a custom system or sole source system.

2.6 Acknowledgements

The development of the Sutherlin Water Master Plan is the result of the combined efforts of a number of individuals and agencies. The participation of these parties in collecting data, answering questions, reviewing drafts, and providing guidance for this Plan is greatly appreciated.

We particularly wish to acknowledge the efforts of Bud Schmidt, City Manager; Mike Grey, Public Works Director; Randy Harris, Water Division Supervisor; Patty Cook, Utility Billing; and the rest of the City staff who assisted us in many ways. Mayor Mongiovi and the rest of the City Council were instrumental in the development of this Plan by providing guidance and support through the planning process.

The assistance and cooperation of the Oregon Department of Human Services, Drinking Water Program and to the Oregon Department of Water Resources in the development of the Plan is appreciated, especially the participation of Mr. Scott Curry of the Drinking Water Program and Mr. Bill Fujii of the Department of Water Resources.

2.7 May 2006 Revisions

The original draft of this report was published in August 2005. Project cost estimates presented in this report were primarily compiled in July 2005. Revisions to this report were made in April - May 2006 in response primarily to comments from City staff and the Department of Water Resources.

Section 3

Study Area Characteristics

3.1 Study Area

As with some of the other communities in Douglas County, Sutherlin and the surrounding area were initially settled for agricultural endeavors. Fendel Sutherlin established the community in 1851 after traveling west to join the California gold rush. The timber industry eventually overtook agriculture as the area's primary activity and continues to be a prominent economic activity in the area.

The City of Sutherlin is located next to Interstate 5 (I-5) in the north-central portion of Douglas County, approximately 55 miles south of Eugene and 12 miles north of Roseburg (Figure 3.1.1). Sutherlin is surrounded on the north and south by forested hills and to the west and east by Sutherlin Valley that consists of spotted timber, open agricultural use, and minor rural development. The area has a number of nearby water bodies including Sutherlin Creek, Calapooya Creek, Cooper Creek, Umpqua River, Cooper Creek Reservoir, Plat I Reservoir, and Fords Pond.

The area encompassed within the City Limits is approximately 3,259 acres or over 5 square miles. The study area for this Master Plan includes the City Limits and the Urban Growth Boundary (UGB), and the City's existing and potential future water sources as shown on Figure 3.1.2.

3.2 Physical Environment

The following provides information about the physical environment in and around the City of Sutherlin.

Climate

Sutherlin is located in a climatic zone that has greater temperature extremes than many of the other parts of Oregon. Like others in the region, Sutherlin experiences the most precipitation from November through April. Even though partially protected by Coastal mountains from maritime weather patterns, Sutherlin experiences a significant amount of rainfall (approximately 40 inches per year). Rainfall amounts for November, December and January average approximately 18.4 inches per month. The wettest month is December with a historic average of approximately 6.5 inches of rainfall. The driest month is July with a historic average of approximately 0.57 inch of rainfall. Records show that the maximum 24-hour rainfall is 2.5-inches.

Sutherlin is in a transition climate area between the climate zones of the Williamette Valley and the drier Rogue Basin. However based on its extended dry periods and vegetation types, it more closely resembles the Mediterranean-like patters of the Rogue Basin. Temperatures average 41° F in January and 68° F in August. The yearly mean temperature is approximately 54°F. The average low temperature is 34° F, while the average high temperature is 84° F. Extreme temperatures range from 5 to 106°F. Sutherlin experiences prevailing winds of approximately 7 miles per hour all year long.

Figure 3.1.1 – Location Map

Figure 3.1.2 – Study Area

Soils

There are many general classifications of surficial geologic formations found in the local Sutherlin area. A map showing these formations (Natural Resource Conservation Service 2005) is included in Appendix A. The formations are described as follows.

- **Nonpareil Series -** The Nonpareil series consists of shallow, well drained soils that formed in colluvium and residuum weathered from sandstone and siltstone. Nonpareil soils are on ridge tops, hill slopes and convex foot slopes and have slopes ranging from 3 to 90 percent.
- **Conser Series** - The Conser series consists of very deep, poorly drained soils that formed in silty and clayey mixed alluvium from sedimentary and basic igneous materials. Conser soils are in depressions on low alluvial stream terraces. Slopes are 0 to 3 percent.
- **Chapman Series** - The Chapman series consists of very deep, well drained soils that formed in mixed alluvium. These soils are on low stream terraces and flood plains. Slopes are 0 to 3 percent.
- **Chehalis Series** - The Chehalis series consists of very deep, well drained soils that formed in mixed alluvium. Chehalis soils are nearly level to undulating flood plains.
- **Sutherlin Series** - The Sutherlin series consists of very deep, moderately well drained soils that formed in mixed alluvium and colluvium over residuum weathered from sandstone and siltstone. Sutherlin soils are on foot slopes, hill slopes and drainageways and have slopes of 3 to 60 percent.
- **Oakland Series** - The Oakland series consists of moderately deep, well drained soils that formed in colluvium and residuum weathered from sedimentary rocks. Oakland soils are on hillsides and broadly convex footslopes and ridges and have slopes of 3 to 60 percent.
- **Waldo Series -** The Waldo series consists of very deep, poorly drained soils that formed in alluvium from mixed, but dominantly basic igneous materials. These soils are on narrow flood plains and fans. Slopes are 0 to 3 percent.
- **Coburg Series** - The Coburg series consists of very deep, moderately well drained soils that formed in mixed alluvium. Coburg soils are on stream terraces and have slopes of 0 to 7 percent.
- **Speaker Series -** The Speaker series consists of moderately deep, well drained soils that formed in colluvium weathered from sedimentary and metamorphic rocks. Speaker soils are on low rolling foot slopes and side slopes and have gradients of 2 to 75 percent.
- **Pengra Series** - The Pengra series consists of very deep, somewhat poorly drained soils that formed in clayey alluvium. These soils are on foot slopes, toe slopes or alluvial fans of foothills. Slopes are 1 to 30 percent.
- **Rosehaven Series -** The Rosehaven series consists of very deep, well drained soils that formed in colluvium and residuum weathered from sandstone, conglomerate sandstones, and siltstone. Rosehaven soils are on uplands and have slopes ranging from 3 to 90 percent.
- **Atring Series -** The Atring series consists of moderately deep, well drained soils that formed in colluvium and residuum weathered from sandstone, siltstone and metasedimentary rocks. Atring soils are on ridges and side slopes of mountains. Slopes are 12 to 90 percent.

- **Larmine Series -** The Larmine series consists of shallow, well drained soils that formed in colluvium weathered from sandstone and siltstone. Larmine soils are on mountainsides and ridgetops and have slopes of 12 to 90 percent.

- **Bateman Series** - The Bateman series consists of very deep, well drained soils that formed in colluvium weathered from sandstone and siltstone. Bateman soils are on foothills and mountains. Slopes are 3 to 60 percent.

- **Stockel Series -** The Stockel series consists of very deep, somewhat poorly drained soils that formed in mixed alluvium and colluvium. Stockel soils are on footslopes and in swales and narrow drainageways dissecting old alluvial terraces and have slopes of 3 to 12 percent.

- **Dickerson Series -** The Dickerson series consists of very shallow, well drained soils that formed in material weathered from sandstone and siltstone. Dickerson soils are on rounded ridgetops, foothills and mountains. Slopes are 3 to 90 percent.

- **Sibold Series -** The Sibold series consists of very deep, somewhat poorly drained soils that formed in mixed alluvium. Sibold soils are on high flood plains and have slopes of 0 to 5 percent.

- **Malabon Series -** The Malabon series consists of very deep, well drained soils formed in mixed alluvium. Malabon soils are on stream terraces. Slopes are 0 to 3 percent.

- **Veneta Series -** The Veneta series consists of very deep, moderately well drained soils that formed from old mixed alluvium. Veneta soils are on old alluvial terraces and have slopes of 0 to 20 percent.

- **Packard Series -** The Packard series consists of very deep, well drained soils that formed in alluvium. They are on low stream terraces and flood plains and have slopes of 0 to 5 percent.

Geologic Hazards

There are several areas within Sutherlin that are susceptible to geologic hazards. These hazards include river flooding, earthquakes, high groundwater and erosion. A discussion of each hazard and expected locations are discussed below.

- **River Flooding.** The Federal Emergency Management Agency (FEMA) has declared the City of Sutherlin a 'No Special Flood Hazard Area.' All areas within the UGB have been designated Zone C, areas of minimal flood hazard (FEMA Map Specialist 2005).

- **Earthquakes.** Earthquakes are the products of deep-seated geologic faulting and the subsequent release of large amounts of energy. The relative earthquake hazard includes factors such as earthquake induced landslides, liquefaction and shaking amplification. Based on earthquake hazard maps developed by Oregon Department of Geology and Mineral Industries (Madin and Wang 2000), there are no liquefaction or amplification hazards within the area examined in and around Sutherlin. With respect to landslides, there exists medium to high hazard risks on the hills surrounding Sutherlin. The high landslide hazard areas are found on some of the slopes southwest of the City, southwest of Cooper Creek on the upper ridge, and northeast of town on the Union Gap side of the ridge.

  As summarized in these maps, areas of relatively steep slope that reside directly north, south and southeast of town present the greatest relative hazard.

- **High Groundwater.** High groundwater is apparent in specific areas within the Sutherlin UGB. This water may be due to land contours, springs, hillside seepage, or saturated soil conditions following periods of wet weather.

- **Erosion.** Erosion within the UGB of Sutherlin does not present a significant geologic hazard.

Water Resources

Water resources within the Study Area include both surface waters and groundwater. The majority of the resources utilized within the Study Area are surface waters.

Surface Waters

Sutherlin is located in the North Umpqua Drainage Basin. Major water courses in the Study Area include Sutherlin Creek, Cooper Creek, Calapooya Creek, and North Umpqua River. Major water bodies include Plat I Reservoir, Cooper Creek Reservoir, Fords Pond, and the log ponds along Calapooya Avenue. The City's municipal water supply comes from upper Calapooya Creek at Nonpareil and from impounded water from Cooper Creek Reservoir. The City also has a water right permit for withdrawal of water from the North Umpqua River. The City's water rights and withdrawals are discussed later in the report (e.g. Sections 5.1).

Sutherlin Creek, where it flows through Sutherlin's City Limits, is not within its natural channel. The creek was excavated and diverted to its present course by the Luse Land and Development Company in 1906 to drain the Sutherlin Valley for orchard cultivation. Later in 1966, the Soil Conservation Service modified the creek bed further and a water control district was established to maintain the watercourse. Overtime, the creek channel has become overgrown and natural features as wetlands and riparian areas have become established.

Calapooya Creek and its tributaries stretch a maximum of 13 miles north to south, and 27 miles east to west, encompassing approximately 157,300 acres. Calapooya Creek flows through the town of Oakland before joining the Main Umpqua River near the community of Umpqua approximately six miles west of Sutherlin. The northwestern section of Sutherlin is also within the Calapooya Creek Watershed.

North Umpqua River originates on the west slope of the central Cascade Range in southwest Oregon and drains approximately 1,350 square miles before it joins the South Umpqua River just west of Roseburg. There are eight dams on the upper North Umpqua River and two major tributaries that are part of the North Umpqua Hydroelectric Project. During the summer months, all of the North Umpqua River's flow passes through PacificCorp's Soda Springs powerhouse, which is located approximately 60 miles east of Roseburg near Toketee. On the lower North Umpqua River, the Winchester Dam is located approximately one mile upstream from the mouth of the North Umpqua River and provides water to the Winchester Water Control District and for recreational use. The origins of this dam date back to the 1890s. Winchester Dam has a fish ladder that permits adult fish passage, but may be an obstacle to juvenile fish.

Although Plat I and Cooper Creek Reservoirs are small in size they have had a significant impact on the Sutherlin area by completely eliminating the nearly annual flooding of the City and surrounding agricultural lands (Douglas County 1997). The Plat I Reservoir was built in 1967 and has 2,050 acre feet of active storage, of which 880 acre-feet is used for irrigation and 1,170 acre-feet are used for flood control. The dam for this reservoir has a fish ladder that operates from mid-October through mid-February. This fish ladder is considered a barrier to juvenile fish. The Cooper Creek Reservoir was built in 1970 and has 4,385 acre-feet of active storage. Of that total, approximately 3,400 acre-feet are used for recreation, 500 acre-feet provides additional water supply to Sutherlin for municipal and industrial water use and 485 acre-feet are for flood control. The dam for this reservoir blocks fish passage in Cooper Creek. The Oregon Department of Fish and Wildlife stocks rainbow trout in both Plat I and Cooper Creek Reservoirs.

One potential water resource is a proposed impoundment on Gassy Creek, which is a tributary of Calapooya Creek. The potential impoundment would have 9,200 acre-feet of storage at normal pool elevation of 928 feet, and have a surface area at normal pool elevation of approximately 194 acres (Douglas County 1997).

Water quality within the North Umpqua Drainage Basin is generally good. However, all of the surface water resources within the Study Area are considered water quality limited to some extent and are on the DEQ's 303(d). A summary of the water quality limited water bodies and water quality limited parameters within the Study Area is given in Table 3.2.1.

TABLE 3.2.1
SUMMARY OF WATER QUALITY LIMITED WATERBODIES IN THE STUDY AREA

Parameter	River Mile (RM)	Season
Sutherlin Creek		
Lead, Iron. Manganese, Arsenic	0 – 16	Year Around
Copper	4.6 – 10	Year Around
Cooper Creek \ Cooper Creek Reservoir		
Iron	0 – 5.9	Year Around
Mercury, water column	0 – 5.9	Year Around
Mercury, fish tissue	0 – 5.9	Year Around
Calapooya Creek		
Temperature, Fecal Coliform, pH	0 – 18.7	Summer
Fecal Coliform	0 – 18.7	Winter/Fall/Spring
Dissolved Oxygen	0 – 18.7	Winter/Fall/Spring
North Umpqua River(1)		
Temperature	0 – 47.7	Summer
Plat I Reservoir		
Mercury, fish tissue	0 - 0	Year Around

(1) – N. Umpqua River has other water quality limited segments upstream RM 35 to 78.

Oregon DEQ and US Environmental Protection Agency (EPA) have completed a number of investigations on the extent and arsenic and mercury contamination in the Calapooya and Sutherlin Creek watersheds. The following is a summary of the preliminary findings of these agencies (DEQ unknown date). The sources of arsenic and mercury in these watersheds appear to be from natural deposits of cinnabar and other mineral-rich rocks related to geothermal and volcanic activity and from past mining activities. Past mining activities from ore at the Bonanza and Nonpariel Mines appear to be contributing to the arsenic and mercury contamination of the watersheds. The Bonanza Mine operated until 1960 and had a total production of approximately 1,500 tons. In 1940, this mine was considered the second largest producer of mercury in the United States. The Nonpareil Mine closed in 1932 and produced approximately 13 tons of mercury over the course of its operation. It has been reported that tailings from the Bonanza Mine were used to construct the railroad grade by Weyerhauser, which is now a dirt road, known as Red Rock Road. It also appears that the dam for Plat I Reservoir was also constructed with tailings from the Bonanza mine.

In addition to the above surface water resources, the City of Sutherlin pumps treated effluent from its wastewater treatment plant to a holding pond at the Oak Hills Golf Course for irrigation of the golf course during the summer months. For the remainder of the year, the City discharges its wastewater effluent to the Calapooya Creek at the Rochester Covered Bridge under the requirements of its NPDES discharge permit.

Groundwater

Withdrawal of groundwater is highly dependent upon the underlying geology. Information on groundwater resources within the Study Area was obtained from a USGS report on groundwater availability in the Sutherlin area (Robison 1975).

Within the Study Area, there are three basic geologic units: Alluvium, Tyee Formation, and Umpqua Formation (Robison 1975). Alluvium consists of sand gravel, and silt deposited by rivers and streams including Sutherlin, and Calapooya Creeks, and the Umpqua River. Thickness of this geologic layer is generally less than 30 feet and permeable in nature. However, the saturated thickness generally is small except in a few places, such as adjacent to the Umpqua River in the Cleveland Rapids area. In this area, the Alluvium is sufficient to yield at least 10 gpm to most wells. However, this area is the only location where Alluvium can ordinarily be anticipated to serve as an aquifier.

The Tyee Formation consists of thin-bedded and massive sandstone and siltstone. The rocks are marine in nature with a thickness of 2,000 feet in the areas. This formation underlines the area northwest of the Study Area. Wells are less than 300 feet deep and yields range from less than one gpm to as much as 20 gpm.

The Umpqua Formation is the most prevalent geologic unit within the Study Area. This formation contains diverse rock types but consists predominantly of thin-bedded siltstone and sandstone within the Study Area, with some sandstone containing pebbles. In the southern and southeastern part of the Study Area, the major rock type is basalt. The Umpqua Formation is deformed into a series of parallel northeast-trending anticlines and synclines. Average dip of this formation is 25 to 30 degrees. Consequently, wells drilled only short distances apart may penetrate completely different beds of the formation and, therefore, may differ substantially in quantities of water yield. Well yields range from less than one gpm to more than 15 gpm. Siltstone beds generally have a lower yield and a higher incidence of unsuccessful wells than do other well types.

Groundwater quality in the Study Area is diverse in chemical nature with no recognizable areal pattern. The only exception to this observation is that waters with high concentration of dissolved mineral matter are most of the sodium chloride type. Iron and manganese are slightly excessive in some groundwater that is otherwise of good quality and are significantly excessive in some waters with other constituents in excess. Excessive sulfate and chloride have been observed in some waters. Arsenic has also been detected in some wells.

Overall, groundwater is present within the Study Area. However, as is the case in much of Douglas County, it is difficult to accurately predict and obtain a well of sufficient yield and water quality for large water consumption. Many wells within the Study Area may be adequate for rural domestic usage but have too low a yield and power consumption too high for practical use of well water for commercial irrigation or as a significant municipal supply.

Flora and Fauna

The majority of the Study Area is in what is considered as the Umpqua Interior Foothills Ecoregion. In this Ecoregion, valley bottoms have been converted from native prairie and savanna to urban and rural residential areas, grazing lands and agricultural lands. With favorable soil and sufficient moisture, the uplands support Douglas fir, madrone, bigleaf maple, California black oak, incense cedar, and Oregon white oak. In drier soils, madrone and oaks are the dominant species with some

Douglas fir, ponderosa pine, and incense cedar. Invasive species such as the Himalayan blackberry and Scotch broom are common.

The following fish are viable, reproducing populations or with annual runs in the Calapooya Creek and Lower North Umpqua River watersheds: summer and winter steelhead (*Oncorhynchus mykiss*), fall and spring chinook (*O. tshawytscha*), coho (*O. kisutch*), cutthroat trout (*O. clarkii*), Umpqua chub (*Oregonichthys kalawatseti*), Western brook lamprey (*Lampetra richardsoni*), Pacific lamprey (*L. tridentate*), Umpqua dace (*Rhinicthus cataractae*), sculpin (*Cottus sp.*), redside shiner (*Richardsonius balteatus*), speckled dace (*Rhinicthys osculus*), Umpqua pike minnow (*Ptychocheilus oregonensis*), and largescale sucker (*Catostomus marcocheilus*). Warm water fish, including largemouth bass (*Micropterus salmoides*), smallmouth bass (*Microptterus dolomieu*), yellow perch (*Perca flavescens*), bluegill (*Lepomis macrochirus*) and brown bullhead (*Ameiurus nebulosus*) have been reported in the watershed. These fish were introduced into the river systems from private ponds or enter the water shed from Umpqua River during summer months. Stream temperatures in the area prevent these species from establishing reproducing populations.

Wetlands and floodplains provide habitat for many water fowl: mallard, pintail, widgeon, coot, ruddy duck, canvasback, green-winged teal, gadwall, redhead, ring-necked duck, scaup, and merganser. Other animals found in the study area include beaver, muskrat, river otter, raccoon, mink, skunk, squirrel, deer, elk and bear.

The riparian communities act as important buffers for water users and urban development. They are important to wildlife for shelter, food, and ecosystem diversity. The clearing of vegetation causes considerable effect on the diversity and stability of the ecosystem of an area. Removal can also bring about the loss of a significant ecotone (transition between water related environments and upland areas).

Environmentally Sensitive Areas

Sutherlin not only lies near sensitive environmental areas, but also affects those downstream. The combination of forests, rangeland, pasture and other wetlands provide a unique surrounding for the City and within the Study Area that should be considered and protected in facilities planning. A discussion of environmentally sensitive areas and environmental topics pertinent to public facilities planning is presented below:

Wetlands

There are a number of significant wetland areas within the City. These areas are shown in Appendix A. Other areas within the Study Area that are considered significant wetlands include along Sutherlin Creek to the south of town, between Exit 135 and Wilbur area (10 acres); the upper end of Copper Creek Reservoir at its inlet (10 acres); Fords Pond located on the west end of Sutherlin (2 acres); and Plat I Reservoir (40 acres, Douglas County 1997). All of these wetlands are considered to be good to excellent quality. To ensure that significant wetlands are adequately protected, the County will apply a 50-foot setback standard around these wetlands.

Riparian Zones. The transition zone between creeks and uplands are also sensitive. They should be protected for erosion control, cover for animals, and shading for reducing water temperatures. In addition to exceeding the physical tolerance levels of fish, high temperatures lower the oxygen concentration, increase disease potential for aquatic life, and produce conditions for competing fish.

Douglas County has adopted a Riparian Vegetation Corridor Overlay Zone that applies to lands located 50 feet from the bank of all identified perennial and intermittent water courses. This Overlay Zone requires all structural development to have a 50-foot setback from the streambank unless

Oregon Department of Fish and Wildlife staff agree that this setback is unnecessary or a reduction in the setback would not jeopardize streambank, stability, water quality, etc. (Douglas County 1997).

Special Bird Habitats

The natural surroundings in Douglas County supports a wide range of bird habitats; four of which the County (1997) has designate as requiring special consideration: eagle nesting sites, great blue heron rookeries, osprey nest sites, and pigeon mineral springs. Within the Study Area, osprey nest sites have been identified adjacent to Cooper Creek Reservoir and just north of Cooper Creek. To assist in the protection of osprey special bird habitats for activities not regulated by the Forests Practice Act (FPA), Douglas County will apply a Special Bird Habitat Overlay Zone (BH). Within these overlay zones, the County will manage the osprey special bird habitats through consultation with ODFW.

Scenic Views and Sites

Douglas County (1997) has identified and inventoried a number of outstanding scenic views and sites. Within the Study Area, one scenic view/site was identified; Cooper Creek Reservoir. The County has a day use park on northwest end of the reservoir.

Natural Areas

Within its Comprehensive Plan, Douglas County (1997) has also identified Natural Areas to assist in protecting ecologically distinct ecosystems, habitats, and organisms. One such site has been identified within the Study Area: Wilbur-Rodgers Road White Camas Site. This site, which is approximately 21 acres in area, is located east of Interstate 5 between the Interstate and Old Highway 99. This site, being adjacent to Sutherlin Creek, provides excellent habitat for growing the white camas variety endemic to the Roseburg area (Leichtlin's white camas, or *Camassia Leichtlinii* var. *Lechtlinii*). The County has employed a Natural Area Overlay designation to protect this white camas site. This overlay zone shall permit only uses which would not permanently destroy the white camas habitat. The overlay zone may allow conditionally use for such temporary uses as gravel stockpiling or grazing provided that these uses do not occur between February and June 1st, the growing season for the white camas.

Air Quality and Noise

Air quality within the Sutherlin area is generally good. Being located in a valley, the Sutherlin's airshed is prone to frequent temperature inversions accompanied by air stagnation. The Study Area experiences blue haze problems as a consequence of its proximity to Interstate 5 freeway and particulate pollution from industrial sources and regional slash burning.

The City of Sutherlin has received few complaints of excessive noise. Major sources of noise within the City include Interstate 5 freeway, other traffic concentrations, railroad traffic, and wood products processing plants. Noise is also not a nuisance.

Energy Production and Consumption

No major energy resources have been identified in the Study Area. Energy consumption is expected to increase within the Study Area due to population growth during the planning period. Pacific Power and Douglas Electric Cooperative serves the Study Area with electrical energy.

Rare, Threatened and Endangered Species

A number of rare, threatened and endangered species are known to reside near or within the Study Area. A list of these species within the Study Area is provided in Table 3.2.2. This list is based on information obtained from the Oregon Natural Heritage Information Center (March 2005).

TABLE 3.2.2
LIST OF THREATENED AND ENDANGERED SPECIES IN THE STUDY AREA

Common Name	Scientific Name	Status (Federal/State)[1]
Foothill Yellow-Legged Frog	*Rana boylii*	SOC/SV
Purple Martin	*Progne subis*	SOC/SC
Pacific Lamprey	*Lampetra tridentata*	SOC/SV
Coho Salmon (Oregon Coast ESU)	*Oncorhynchus kistuch*	LT/SC
Steelhead (Oregon Coast ESU winter run)	*Oncorhynchus mykiss*	C/SV
Umpqua Chub	*Oregonichthys kalawatsei*	SOC/SV
Columbian White-tailed Deer	*Odocoileus virginianus leucurus*	PS:LE
Northwestern Pond Turtle	*Emys marmorata marmorata*	SOC/SC
Red-root Yampah	*Perideridia erythrorhiza*	SOC/C
Rough Popcorn Flower	*Plagiobothrys hirtus*	LE/LE
Oregon Timwort	*Cicendia quadrangularis*	-
Hairy Sedge	*Carex gynodynama*	-

[1] – Federal: LE – listed threatened, LT – listed endangered, C – candidate, SOC – species of concern; State: LE – listed threatened, SC - sensitive-critical, SV – sensitive vulnerable, SU or U – sensitive-undetermined status, C-Candidate

Foothill Yellow-Legged Frog (*Rana boylii*) lives in an aquatic environment preferably consisting gravelly or sandy streams with sunny banks and open woodlands nearby. This frog is present from sea level to an elevation of approximately 6,000 feet. Breeding occurs from March to May, when streams have slowed after winter runoff. Egg clusters are attached to downstream submerged rocks.

Purple Martin (*Progne subis*) can be found in most of the United States. This martin prefers open areas near marsh, open woodlands, or water where it will feed on ants, grasshoppers, wasps, bees, beetles, flies, moths, and butterflies. Between the months of August and December, the purple martin migrates to South America to winter. This martin uses natural tree cavities or bird houses built specifically for nesting habitat. Breeding typically starts between April and July. After the birds have hatched, they are fed by both parents for about a month, and congregate at a pre-migratory roost with the parents before flying south for the winter.

Pacific Lamprey (*Lampetra tridentate*) is a long parasitic fish found in coastal and Columbia River drainages. With its circular toothed mouth, this lamprey feeds on salmonids and whales. This species migrates upstream to spawn between July and September and stay in freshwater streams till March of the following year to spawn. Spawning habitat is similar to salmonids including, cool, flowing water and clean gravel, while rearing areas are slow-moving backwaters with fine sediment. Larvae spend several years in freshwater before transforming and migrating to the ocean. Based on counts at Winchester Dam on the North Umpqua River, the Pacific Lamprey population is showing a clear declining trend.

Coho Salmon, Oregon Coast Evolutionary Significant Unit (ESU, *Oncorhynchus kistuch*) is an anadromous fish found along the Pacific Coast from Alaska to Monterey Bay, California, and in freshwater streams and rivers. Adult and juvenile Oregon Coast coho salmon are found in the Calapooya Creek and Umpqua River watersheds. Coho salmon utilizes the tributaries of Calapooya Creek and the North Umpqua River for spawing and rearing.

Steelhead, Oregon Coast ESU, winter run (*Oncorhynchus mykiss)* occupies streams along coastal Oregon and in the lower Columbia Basin. Adult and juvenile Oregon Coast Steelhead are found in the Calapooya Creek and Umpqua River watersheds. Winter Steelhead spend one or two years in the Pacific Ocean before returning to spawn. Most returning adults enter the river system in November through February and move quickly upstream. Most spawning takes place from March through April with fry hatching in April and May. Juveniles generally spend two years in freshwater before smolting and migrating to the ocean. Winter steelhead and Coho salmon use many of the same stream reaches (0 to 4% gradient) but at different times of the year.

Umpqua Chub (*Oregonichthys kalawatsei*) is a small minnow endemic to the Umpqua River basin. Based on characteristics of its sibling Oregon Chub, these minnows typically occupy off-channel habitats such as beaver ponds, oxbows, side channels, backwater sloughs, low gradient tributaries, and flooded marshes. The habitat usually has little or no water flow, silty and organic substrate, and considerable aquatic vegetation as cover for hiding and spawning.

Columbia White-tailed Deer (*Odocoileus virginianus leucurus*) is the westernmost representative of 30 subspecies of white-tailed deer in North and Central America. This species has a partial status in Oregon. Only the population along the lower Columbia River has the listed Endangered status – the Douglas County population was introduced so the Environmental Species Act (ESA) was removed. Columbia White-tailed Deer in Douglas County are most often associated with riparian habitats. However, they have been found to reside in the following habitats: grassland, grass shrub, oak savannah, oak hardwood type, conifer and urban/suburban yards. Within the Study Area, the habitat of the Columbia White-tailed Deer is in the wooded hills surrounding Sutherlin.

Northwestern Pond Turtle (*Emys marmorata marmorata*) is found in quiet water and are found near a wide variety of wetland, including pools, marshes, lakes, streams, irrigation ditches, and vernal pools. Habitats are usually aquatic with adequate vegetative cover and exposed basking sites. The pond turtle prefers habitats with large areas for cover (logs, algae, vegetation) and basking (logs, boulders).

Red-root Yampah (*Perideridia erythrorhiza*) is found on both sides of the Cascade Range in southwestern Oregon. The population on the west side of the Cascades, which includes the Study Area, is more threatened, even though it is more numerous. They are highly fragmented and many populations are small. The Red-root Yampah is found growing in low swales, moist prairies, valleys, and pastureland at lower elevations. It is often found in heavy, poorly drained soils.

Rough Popcorn Flower (*Plagiobothrys hirtus*) was listed as endangered on January 25, 2000 and is found only in the Umpqua River drainage in Douglas County at sites ranging from 330 to 750 feet in elevation (Federal Register 2003). Naturally occurring populations of this species occur along the Sutherlin Creek drainage from Sutherlin to Wilbur, adjacent to Calapooya Creek west of Sutherlin, and in roadside ditches near Yoncalla Creek, just north of Rice Hill. Until 1998, all known sites were east of Interstate 5 but at that time a site was discovered 0.5 miles west of the Interstate at the junction of Stearns Lane and Highway 138. The easternmost extent of the Rough Popcorn Flower population is just east of Plat K Road outside of Sutherlin. Historic populations have been observed east near Nonpareil but not seen in recent surveys (Ibid 2003).

The Rough Popcorn Flower is a perennial herbaceous plant, but can be annual depending on environmental conditions. The species occurs in seasonal wetlands. The majority of sites occur on the Conser-type soil series that is characterized as poorly drained flood plain soils. Urban and agriculture development, invasion of non-native species, habitat fragmentation and degradation, and other human-caused losses have contributed to substantial losses of seasonal wetland habitat throughout the species' historic range (Ibid 2003).

Oregon Timwort (*Cicendia quadrangularis*) is a tiny yellow flowering plant that resides in prairies of the Williamette Valley and the valleys of the Umpqua River basin. This flower may be found as scattered plants or in patches of 10s to 100s, often on drying mud or open soil in grasslands and around vernal pools. This species is not listed as a threatened or endangered species but is considered a sensitive species in the State by the Oregon Natural Heritage Information Center.

Hairy Sedge (*Carex gynodynama*) is a perennial herb that is native and confined to western North America. This species is typically found in moist meadows and open forests. This species is not listed as a threatened or endangered species but is considered a sensitive species in the State by the Oregon Natural Heritage Information Center.

Wild and Scenic River System

There are no Wild and Scenic Rivers within the Study Area.

Historic Sites

Within Sutherlin's City Limits, there is only one structure listed in the National Register of Historic Places: the Sutherlin Bank Building on Central Avenue. This building was constructed in 1910 of rock-cut stone in an area not even incorporated in the City at the time. The building played a key role in Sutherlin's commercial development.

Douglas County has applied a Historic Resources Overlay for one historic bridge in the Study Area: Rochester Bridge that crosses Calapooya Creek west of town.

3.3 Socioeconomic Environment

The future need for water service and facilities within Sutherlin depends upon, in large part, to the socioeconomic conditions within the City and surrounding area. In this section, the local economic conditions, trends, population, land use, and public facilities will be discussed.

Economic Conditions and Trends

Regional economic conditions and trends will likely affect population growth and future water consumption in the City of Sutherlin. Major industrial or commercial development can create a large, immediate demand for water and sewer services. On the other hand, depressed economic conditions can affect employment opportunity and the number of families moving into a community.

The economy of Sutherlin tied to a very large extent to the regional economy. Lumber and wood products, agriculture, trade and service industries are considered the primary industries in and around Sutherlin. The most dominant economic sector in Douglas County is the lumber and wood products industry. Nearly 70 percent of the County's economy is dependent upon this industry. Future growth in this sector will be challenged by reductions in the available timber supply both from public and private industry lands. Agriculture in the Sutherlin Valley will continue to contribute to the local economy. However, growth in this sector is limited to the existing soils and availability of water. Trade and services industries will likely increase in importance since the demand for goods and services is increasing rapidly with the rise in the standard of living. Continued development of the City's industrial zones lands will also contribute to employment opportunities for City residents. The largest employers within the City include Murphy Plywood, wood products industry; and Orenco Systems, Inc, manufacturer of on-site sewage systems and equipment.

Based on the Year 2000 Census, median household income level in Sutherlin was slightly less than that of Douglas County ($29,068 vs. $33,223).

Population

The current population (Year 2004) within the City of Sutherlin is 7,360 based on Portland State University's (PSU) Population Research Center's estimate.

Historic Population

Since 1990 Sutherlin has experienced a growth rate higher than most other communities in Oregon. Economic conditions were difficult in the early 1980's due to the decline of the forest products industry, and some uncertainty remains over the availability of timber and lumber. Sutherlin's livability characteristics, however, especially for retired persons and those enjoying outdoor recreation, have attracted a long term growing populace regardless of the local economic climate.

Based on United States Census data, the City of Sutherlin's population increased from 5,020 to 6,669 between 1990 and 2000. This increase equates to an average annual growth rate of 2.9%. During this same period, the average County growth rate was only 0.6%.

Future Population

Growth is expected to continue at or exceed a rate similar to that experienced in the community during the last decade. The coordinated population projection of 2.7% per year has been selected by Douglas County in its Comprehensive Plan (1997) for the next 25 years (to the Year 2029). Table 3.3.1 summarizes the population projections over the next 20 years, using the Year 2004 PSU estimate of the City population (7,360) as the base figure.

TABLE 3.3.1
CURRENT POPULATION ESTIMATE AND POPULATION PROJECTIONS

Year	2000	2004	2005	2010	2015	2020	2025
Residential Population	6,669	7,360	7,559	8,636	9,866	11,272	12,878

City staff has expressed concern that the County's adopted 2.7 percent annual growth for the City may be too conservative. This concern is based on a number of observations including recent growth within the City, developers expressing interest in developing residential, commercial, and industrial properties within the City Limits and Urban Growth Boundary (UGB), and property owners outside the City's UGB expressing an interest in annexing into the City. If higher than anticipated growth were to occur, a water master plan based on the 2.7 percent annual growth would be underestimate the required potable water infrastructure to support future users. On the other hand if growth were not to occur as fast as anticipated, then the plan may recommend improvements that may not be needed within the Study Period (next 20 years). To address both of these concerns, this master plan was compiled to examine the City's potable water infrastructure needs not only for the anticipated 20-year City population of 12,878, but also for two 3,000 population increments leading up to and exceeding this projected population. With these two increments of 3,000 capita beyond the anticipated population of 12,878, future populations of 15,878 and 18,878 were also evaluated in this plan.

Potable Water Use Population

For the calendar Year 2004, there were 2,039 residential potable water connections within the City. The number of equivalent dwelling units (EDUs) for these connections is 3,179 (see Section 6.2 for more details). With a current City population of 7,360, the number of capita per equivalent dwelling unit is 2.32 (7,360 capita/ 3,179 EDUs, rounded).

In addition to the City's residents, there are a total of 260 residential water connections outside the City limits. Assuming each residential connection is a single-family dwelling, there are a total of 260 EDUs outside the City. Based on representative Year 2000 Census data for Census Tract 500.01, the average of number of persons per household ranges from approximately 2.8 to 3.0 (Blocks 3071 & 3072, Block Group3; Blocks 4007, 4008, 4009, 4010, & 4016, Block Group 4). Assuming 2.8 persons per EDU and 260 EDUs with water service outside the City, the estimated population of potable water users outside the City limits is 728. City staff considers future growth of potable water users in these currently served areas to be minimal or non-existent.

The current and future total number of potable water users on the City's system is summarized in Table 3.3.2. With the two 3,000 population increments above the 20-year projection, the anticipated Years when these populations would be achieved, at 2.7 percent annual growth is 2034 and 2046, respectively.

TABLE 3.3.2
CURRENT AND FUTURE POTABLE WATER USE POPULATION

Year	Population		
	Exist. & Future City Users	Exist Outside Users	Total
2004	7,360	728	8,088
2005	7,559	728	8,287
2010	8,636	728	9,364
2015	9,866	728	10,594
2020	11,272	728	12,000
2025	12,878	728	13,606
2034	15,878	728	16,606
2046	18,878	728	19,606

Land Use

Land use within Sutherlin is categorized into five general categories: residential, commercial, industrial, public facilities and special district and other lands. There is an estimated 3,259 acres within the current UGB. The Sutherlin zoning map is shown resides in Appendix A. The five land use categories are briefly discussed below:

Residential Lands. Sutherlin residential lands are throughout the community and on each side of Interstate-5. Residential lands also occupy the elevated surrounding hills on the north side of the UGB and new subdivisions are being constructed in the areas surrounding town. Residential land use ranges from single-family dwellings to multi-family dwellings to bed and breakfast and motel land uses. Detailed descriptions of each residential land use zone are described below.

- **RH – Residential Hillside District**
  The goal of this district is to preserve the visual and physical identity of the hills and the native geologic conditions, while permitting controlled residential development. (Ord. 798 § 3.060, 1992).

- **R-1 – Low Density Residential District**
  This district is a low-density area, where it is the goal to protect residential quality, value and identity. Environmental privacy, air and outdoor space are considered that are meant to support the residential quality of the area. (Ord. 798 § 3.130, 1992).

- **R-2 – Medium Density Residential District**
  This district is a medium-density area, where it is the goal to protect residential quality, value and identity. Environmental privacy, air and outdoor space are considered that are meant to support the residential quality of the area (Ord. 798 § 3.210, 1992).

- **R-3 – High Density Residential District**
  This district is a high density area meant to serve as a general residential district, allow a large variety of housing and densities without conflict together with certain nonresidential uses. (Ord. 798 § 3.290, 1992).

Commercial Lands. The commercial properties are clustered around Interstate-5 and Highway 138 (Central Avenue). Commercial activities generally include retail and tourist related services. Small shops and restaurants catering to the tourist market make up the majority of the commercial properties in the City.

- **C-1 – Commercial Downtown District**
  This district is intended to serve as a downtown retail and service center providing the more common everyday goods and services for both potential and existing city and adjacent area needs and to concentrate uses for the walking public. All commercial uses shall be conducted wholly within an enclosed building. (Ord. 798 § 3.370, 1992).

- **C-3 – Commercial Community District**
  This district is intended to be a general commercial zone, providing a large goods and services to the area residents and traveling public. Off-street parking and required as well as design curtailments of adverse effects. (Ord. 798 § 3.440, 1992)

- **CG – General Commercial District**
  This zone is intended to provide for a broad mixing of commercial uses and for wholesale and heavier commercial uses in older, close-in sections of the community.

Industrial Lands. The industrial properties are dispersed throughout the City, but specifically around Interstate-5 and Highway 138 (Central Avenue). Commercial activities generally include retail and tourist related services. Small shops and restaurants catering to the tourist market make up the majority of the commercial properties in the City.

- **M-1 – Industrial Light District**
  This district is intended for the location of non-noxious industry. Such industries that do not produce noise, odor, smoke, fumes or other nuisances will be permitted to locate in this area.. Should there be any doubt concerning the creation of a nuisance by a particular building or use, the planning commission shall determine whether a specific use or structure shall be permitted. (Ord. 798 § 3.510, 1992).

- **M-2 – Industrial Heavy District**
  This district is intended for the location of heavier industry but in no case shall an industry which would create any noise, odor, smoke or other nuisances having an effect on nearby nonindustrial areas, be allowed to locate in this district. (Ord. 798 § 3.600, 1992).

Public Facilities Lands. Public lands consist of those required for government offices, schools, hospital, transportation facilities, parks, and recreation areas. The wastewater treatment plant and city shops are included within the public facilities lands.

Special District and Other Lands. The City has adopted special district and other zoning land use types. Summary of these zoning types are below.

- **FR – Forest Resource District**
  The forestry classification is intended to preserve lands with high forest resource potential. The resource zone is applied to rural areas where urbanization is untimely and services cannot be provided in the immediate future. (Ord. 798 § 3.000, 1992).

- **CS – General Community Services Special District**
  This district is intended to provide for the review and location of public facilities and related uses which by necessity, character or effect will be compatible with surrounding uses. (Ord. 798 § 3.760, 1992).

- **CSA – Airport Community Services Special District**
  The purpose of this district is two-fold: (1) (A1 district) to provide for the development of the airport and related lands to stimulate jobs and the economic sector and to enhance the airport with compatible support activities; and (2) (A2/A3 district) protect primary surface approach and departure patterns from intrusion by unsafe or hazardous uses. (Ord. 798 § 3.730, 1992).

- **MHO – Low Density Manufactured Home Overlay Special District**
  The purpose of this district is to allow needed manufactured housing on single lots in low-density (R-1) residential zones. (Ord. 798 § 3.800, 1992).

Section 4

Regulatory Environment

4.1 Municipal Water Management Plans

The Oregon Water Resources Department has developed rules that govern water management planning (Water Management and Conservation Plans; OAR Chapter 690, Division 86). Included in the rules are groundwater management, hydroelectric power development, instream flow protection, interstate cooperation, water resources protection on public riparian lands, conservation and efficient water use, water allocation, and water storage. The Water Resources Commission has adopted a statewide policy on Conservation and Efficient Water Use (Statewide Water Resource Management; OAR 690-410). The policy requires major water users and suppliers to prepare water management plans. Municipal water suppliers are encouraged to prepare water management plans, and are required to do so if a plan is prescribed by a condition of a water use permit. The following elements are to be included in the plan: description of the water system, a water conservation element, a water curtailment element, and a long-range water supply element.

A Water System Master Plan prepared under the requirements of the Oregon Health Division and that substantially meets the requirements of OAR 690-086-0125 to 0150 may be submitted to meet the requirements of this rule. It is the intent of this Plan to meet all of the requirements of this rule.

The elements required in a Water Management and Conservation Plan are briefly described below. A more detailed discussion of the elements required for Water Conservation and Curtailment Plans, and a long-range water supply element is presented in Sections 9, 10 and 11 of this Master Plan.

Description of the Water System

The water system description shall include sources of water, storage and regulation facilities, transfer and exchange agreements, and intergovernmental cooperation agreements. System capacity, limitations and opportunities for expansion under existing water rights are to be included. Water use shall be discussed including current average annual water use, peak seasonal demand, average and peak day demands, and quantities of water used from a source. Customer information is required such as estimated numbers and general water use characteristics of residences, commercial, industrial, and other users. Also required is a schematic of the system which shows the sources of water, storage facilities, treatment facilities, major transmission and distribution lines, pump stations, interconnections with other municipal supply systems, and the service area. All of the applicable information required for a description of Sutherlin's water system is included in this Master Plan.

Water Conservation Plan

A water conservation plan is a long-term program intended to reduce average water use and the resulting demand on the water system. Conservation means eliminating waste or otherwise improving the efficiency of water use while satisfying beneficial uses. Conservation can be achieved by modifying the technology or method for diverting, transporting, applying or recovering water, by changing the management of water use, or by implementing other measures. The plan shall describe the City's existing and proposed water conservation elements, conform to OAR 690-086-150 and include the following.

- An annual water audit that includes a systematic and documented methodology for estimating any unmetered authorized and unauthorized uses.
- A program to install meters on all un-metered water service connections.
- A meter testing and maintenance program.
- A rate structure under which customers' bills are based on the quantity of water metered at the service connections.
- For systems with annual losses greater than 10 percent, a regularly scheduled and systematic program to detect leaks in the transmission and distribution system.
- A public education program to encourage efficient water use and the use of low water use landscaping.
- A description of specific activities required under OAR 690-086-0150 (5) and (6), if expansion or initiation of diversion of water under an extended permit for which resource issues identified under OAR 690-086-0140(5)(i).

Water Curtailment Plan

A water curtailment plan is defined as a short-term mandatory conservation plan usually brought on by an emergency or extreme water shortage. The goal of a water curtailment plan is to drastically reduce water consumption in order to protect existing resources and system components. Once the water shortage or emergency has passed, the curtailment activities can be discontinued. The water curtailment element shall include at least the following.

- A description of the frequency and magnitude of supply deficiencies within the past ten years and current capacity limitation. The description shall include an assessment of the ability of the water supplier to maintain delivery during long-term drought or other source shortages;
- A list of three or more alert stages for potential shortage or water service difficulties. The stages shall range from a potential or mild alert, increasing through a serious situation to a critical emergency;
- A description of predetermined levels of severity of shortage or water service difficulties which will trigger the curtailment actions under each stage of alert to provide the greatest assurance of maintaining potable supplies for human consumption; and
- A list of specific standby water use curtailment actions for each stage of alert ranging from notice to the public of a potential alert, increasing through limiting nonessential water use, to rationing and/or loss of service at the critical alert stage.

Water Supply Element

Under this task, the adequacy of the existing water sources and need for development or acquisition of new sources is explored in detail. This task will include the following elements primarily based on OAR 690-086-0170.

- A delineation of the current and future service areas consistent with state land use laws that includes available data on population projections and anticipated water-intensive development consistent with relevant acknowledged comprehensive land use plans and urban service agreements or other relevant growth projections.

- A description of how the City intends to exercise all the water rights and water use permits currently held.

- Based on the service area information provided above, an estimate of water demand projections for 10 and 20 years will be compiled.

- A comparison of the projected water needs and the sources of water currently available to the City considering the reliability of existing sources. If acquisition of new water rights will be necessary within the next 20 years based on this comparison, then an anticipated schedule for development of new sources of water will be compiled.

- Analysis of alternative water sources that considers availability, quantity (max. rate & monthly volume diverted), reliability, feasibility, likely environmental impacts, proposed mitigation measures, if any, and cost effectiveness. Summary of analysis will be compiled as a matrix evaluation table. Alternatives sources includes the following:

  - Additional storage in Cooper Creek Reservoir.
  - New storage of and diversion from Gassy-Norris Creek
  - Diversion of water from the North Umpqua River (an undeveloped municipal water right).
  - Analysis of the possibility of wells or well field as an additional source of water.
  - Investigate recycling of backwash water from the treatment plant per EPA's Filter Backwash Rules.
  - Consideration of conservation measures identified under OAR 690-086-0150.
  - Any other conservation or cooperative regional measures that would provide water at a cost that is equal to or lower than the cost of other identified sources.

4.2 Public Water System Regulations

Drinking water regulations were established in 1974 with the signing of the Safe Drinking Water Act (SDWA). This act and subsequent regulations were the first to apply to all public water systems in the United States. The Environmental Protection Agency (EPA) was authorized to set standards and implement the Act. With the enactment of the Oregon Drinking Water Quality Act in 1981, the State of Oregon accepted primary enforcement responsibility for all drinking water regulations within the State. Requirements are detailed in OAR Chapter 333, Division 61. Since its inception, the SDWA and associated regulations have been amended a number of times, with the most recent amendments in August 1996.

One of the main elements of these drinking water regulations is the establishment of maximum contaminant levels (MCLs) for inorganic, organic, microbiological, and radionuclide contaminants and turbidity. An MCL is the maximum allowable level of a contaminant in water delivered to the users of a public water system. Concentrations above the MCL for a contaminant are considered violations and require the water supplier to perform immediate corrective action and notify the public of such violations.

Surface Water Treatment Rule (SWTR)

The Surface Water Treatment Rule (SWTR) is one amendment to the SDWA. This rule affects all public water systems using surface water sources and established, among other requirements, that water must be treated through filtration and disinfection. This rule is required for all water providers using a surface water source unless certain water quality criteria and site-specific requirements are met. Treatment requirements, performance standards and MCLs are generally summarized as follows (excluding MCLs for inorganic materials, radioactive substances, and secondary contaminants) for a water system:

- The turbidity level of representative samples of filtered water must at no time exceed 1.0 NTU, measured as specified in OAR 333-061-0036(4)(b). That is to say, 0 percent of the turbidity measurements can exceed 1.0 NTU. Turbidity monitored continuously with results reported every four hours.

- The turbidity level of representative samples of filtered water must be less than or equal to 0.3 NTU in at least 95 percent of the measurement taken each month, measured as specified in OAR 333-061-0036(4)(b). That is to say, the turbidity levels can rise above 0.3 NTU no more than 5 percent of the time.

- Total coliform-positive (coliform present) samples shall not exceed more than one sample collected during a month. Nine monthly samples are required for the City of Sutherlin. A set of at least three repeat samples is required for each positive sample. Repeat sampling continues until the MCL is exceeded or a set of repeat samples with negative results (coliform absent) is obtained. Confirmed presence of fecal coliform or *E. coli* requires immediate notification of the public.

- At least 99.9 percent (3-log) inactivation and/or removal of *Giardia lamblia* cysts at a point downstream at or before the first customer.

- At least 99.99 percent (4-log) inactivation and/or removal of viruses at a point downstream at or before the first customer.

- A free chlorine residual of 0.2 mg/L after 30 minutes of contact time shall be achieved under all flow conditions before the first customer.

- The residual disinfectant concentration in the distribution system, measured as total chlorine, combined chlorine, or chlorine dioxide, as specified in OAR 333-061-0036(4)(b)(C) cannot be undetectable in more than 5 percent of the samples each month, for any two consecutive months.

The adoption of the 1989 Surface Water Treatment Rule (SWTR) has improved the quality of drinking water and greatly reduced the number of infections caused by water borne pathogens. The SWTR set standards to reduce water concentration of *Giardia* and viruses, with a goal to reduce the risk of infection to less than one in 10,000 people per year. However, some water sources have a high concentration of pathogens that, even when treated to the levels required by the rule, do not meet the health goal. Specifically, the rule does not specifically control the protozoan *Cryptosporidium*, which has been linked to at least 50 deaths of *Cryptosporidium*-caused illness outbreaks in Milwaukee, Nevada, Oregon, and Georgia. Although the public health benefits of disinfection are significant and well recognized, it has been found that the disinfection byproducts also pose health risks at certain levels. The Safe Drinking Water Act (SDWA) Amendments, signed by President Clinton in August 1996, mandated the establishment of a series of new drinking water regulations in response to these and other concerns. Since the enactment of the amendments, EPA has been busy developing, proposing, and finalizing regulatory actions. Some of the recent regulatory actions are summarized below.

Long Term 1 Enhanced Surface Water Treatment Rule

One of the first rules developed by EPA under the SDWA amendments was the Interim Enhanced Surface Water Treatment Rule (IESWTR). The IESWTR was promulgated to address health risks from microbial contaminants without significantly increasing the potential risks from chemical contaminants. This rule applies to public water systems that use surface water or ground water under the direct influence of surface water (GWUDI) and serve at least 10,000 people. For water systems with a population of less than 10,000, the Long Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR) was adopted. This rule was adopted in January 2002 and includes the following provisions:

- Maximum contaminant level goal (MCLG) is set at zero.
- Filtered systems must physically remove 99% (2-log) of Cryptosporidium
- Specific combined filter effluent (CFE) turbidity requirements depend on the type of filtration. For conventional and direct filtration, the CFE shall be less than 0.3 NTU 95 percent of the time, and at no time higher than 1 NTU.
- Perform CFE turbidity monitoring at least every four hours; record continuous individual turbidity effluent (IFE) measurements (at least every 15 minutes).
- Disinfection profiling and benchmarking provisions to ensure continued microbial protection.
- Requirements for covers on new finished water reservoirs.

Stage 1 Disinfectants/Disinfection Byproducts Rule (Stage 1 DBPR)

Stage 1 DBPR was published along with the IESWTR to control disinfectants and formation of their harmful byproducts. This rule establishes maximum residual disinfectant level goals (MRDLGs) and maximum residual disinfectant levels (MRDLs) for three disinfectants: chlorine (4.0 mg/l), chloramines (4.0 mg/l), and chlorine dioxide (0.8 mg/l). The rule also establishes maximum contaminant level goals (MCLGs) and maximum contaminant levels (MCLs) for specific disinfection byproducts as given in Table 4.4.1.

TABLE 4.4.1
MCLGs AND MCLs FOR STAGE 1 DISINFECTANTS

Disinfection By-Product	MCLG (mg/l)	MCL (mg/l)	Time Period
Total trihalomethanes (TTHM)	-	0.080	Annual Average
Bromodichloromethane	0	-	-
Dibromochloromethane	0.06	-	-
Bromoform	0	-	-
Haloacectic acids (HAA5)	-	0.06	Annual Average
Dichloroacetic acid	0	-	-
Trichloroacetic acid	0.3	-	-
Chlorite	0.8	1.0	Monthly Average
Bromate	0	0.010	Annual Average

Water system providers must monitor and control the use of disinfectants and meet the requirements for total trihalomethanes (TTHM) and the sum of five haloacetic acids (HAA5). In addition, water systems that use surface water or GWUDI and use conventional filtration treatment are required to also remove a specified percentage of organic materials, measured as total organic carbon (TOC), that may react with disinfectants to form disinfection byproducts.

Filter Backwash Recycle Rule

EPA is required to regulate the recycling of filter backwash within the treatment process of a public water system. The final filter backwash recycle rule has recently been issued for comment. The proposed provisions would impact all conventional and direct filtration systems, which recycle filter backwash and use of surface water or GWUDI. Under the final rule, the following provisions will be required.

- Recycle water from filter backwash, supernatant from sludge thickening, and liquids from sludge dewatering must pass through all filtration processes for treatment.

- By December 8, 2003, all systems that utilize recycle water must notify the Health Division in writing the following.

  1. A plant schematic showing the origin of all recycle flows, how they are conveyed, and at what point they are returned to the treatment process.
  2. Descriptions of typical recycle flows in gallons per minute, highest observed flows in the last year, design flow for the plant, and state approved operating capacity (if such approval has been given).

- All system compile certain additional recycle information and maintain it for possible future review by the Health Division. Specifically, the following information must be collected and retained.

  1. A copy of the recycle notification and information submitted to the Health Division by December 8, 2003.
  2. A list of all recycle flows and their return frequency.
  3. Average and maximum filter backwash flowrate through the filters and the average and maximum duration of the filter backwash process, in minutes.
  4. Typical filter run length and a written summary of how the run length was determined.
  5. Type of treatment provided for recycle flows.
  6. Physical dimensions of the recycle equalization and/or treatment units, typical and maximum hydraulic loading rates, type of treatment chemicals used, average dose and frequency of chemical use, and frequency at which solids are removed, if applicable.

- All systems comply with treatment technique (pass through all filtration processes) by June 8, 2006.

Specific information on the regulations concerning public water systems may be found in the Oregon Administrative Rules (OAR), Chapter 333, Division 61. The rules can be found on the Internet at www.ohd.hr.state.or.us/cehs/dwp/pwsrules.htm.

Arsenic and Clarifications to Compliance and New Source Monitoring Rule

In January 2001, the Arsenic and Clarifications to Compliance and New Source Monitoring Rule was enacted. The major features of this rule included the following.

- Include health effects statements in Consumer Confidence Reports for arsenic levels from 5 to 50 ug/l and when systems are in violation of the arsenic MCL of 10 ug/l.
- All new systems/sources must collect initial monitoring samples for all IOCs, SOCs, and VOCs.
- The new arsenic MCL of 10 ug/l becomes effective on January 23, 2006.
- One sample must be taken and analyzed after effective date of MCL. Surface water systems must take annual samples.
- A system with a sampling point result above the MCL must collect quarterly samples at that sampling point, until the system is reliably and consistently below the MCL.

4.3 Responsibilities as a Water Supplier

Per OAR 333-061-0025, water suppliers are responsible for taking all reasonable precautions to assure that the water delivered to water users does not exceed maximum contaminant levels, to make certain that water system facilities are free of public health hazards, and to verify that water system operation and maintenance are performed as required by these rules. This includes, but is not limited to, the following:

- Routinely collect and submit water samples for laboratory analyses at the frequencies prescribed by OAR 333-061-0036.
- Take immediate corrective action when the results of analyses or measurements indicate that maximum contaminant levels have been exceeded and report the results of these analyses as prescribed by OAR 333-061-0040.
- Continue to report as prescribed by OAR 333-061-0040, the results of analyses or measurements, which indicate that maximum contaminant levels have not been exceeded.
- Notify all customers of the system, as well as the general public in the service area, when the maximum contaminant levels have been exceeded.
- Notify all customers served by the system when the reporting requirements are not being met, or when public health hazards are found to exist in the system, or when the operation of the system is subject to a permit or a variance.
- Maintain monitoring and operating records and make these records available for review when the system is inspected.
- Maintain a pressure of at least 20 pounds per square inch (psi) at all service connections at all times.
- Follow-up on complaints relating to water quality from users and maintain records and reports on actions undertaken.
- Conduct an active program for systematically identifying and controlling cross connections.
- Submit, to the Division, plans prepared by a professional engineer registered in Oregon for review and approval before undertaking the construction of new water systems or major modifications to existing water systems, unless exempted from this requirement.
- Assure that the water system is in compliance with OAR 333-061-0205 relating to certification of water system operators.
- Verify that Non-Community water systems utilizing surface water sources or sources under the influence of surface water are in compliance with OAR 333-061-0065(2)(c) relating to required special training.

4.4 Future Water System Regulations

In addition to the existing water system regulations, EPA is proposing additional regulations for water systems. A few of the proposed regulations are discussed below.

Stage 2 Disinfection Byproduct Rule (Stage 2 DBPR), Proposed

The Stage 2 DBPR is designed to reduce disinfection byproducts occurrence peaks in the distribution system based on changes to compliance monitoring provisions. The requirements of this rule will apply to all community water systems and non-transient non-community water systems that add a disinfectant other than UV or deliver water that has been disinfected. The Stage 2 rules would be implemented in two phases.

- **Phase 1.** All systems must comply with a 120 mg/l TTHM/ 100 mg/l HAA locational running annual average based on Stage 1 monitoring sites and also continue to comply with the Stage 1 annual average requirements. The end of Phase 1 is three years after rule promulgation with an additional two-year extension for available for systems requiring capital improvements.

- **Phase 2.** For small systems required to do *Cryptosporidium* monitoring, compliance with a 80 mg/l TTHM / 60 mg/l HAA locational running annual average will begin 8.5 years after rule promulgation with an additional two-year extension for systems requiring capital improvements. For all other small systems, compliance with the 80/60 locational running annual averages would begin 7.5 years after rule promulgation with potential two-year capital improvement extension.

An initial distribution system evaluation (IDSE) would be conducted by the water provider and is intended to select new compliance monitoring sites that reflect locations with system high TTHM and HAA5 concentrations. Water providers would recommend new or revised monitoring sites based on their IDSE study. The results from the IDSE study would not be used for compliance purposes. For surface water systems with less than 10,000 people, water providers must monitor either quarterly (population from 500-9,999) or semi-annually (population <500) for one year at two distribution system sites per plant. These sites must be in addition to the Stage 1 DBPR compliance monitoring sites. Water providers that certify to the State that all samples taken in the last two years were below 40 mg/l TTHM / 30 mg/l HAA5 are not required to conduct the IDSE.

For long term compliance monitoring, the principles of reduced compliance monitoring strategy (for very low DBP levels) utilized in Stage 1 DBPR would continue in the Stage 2 DBPR. Water providers would collect paired samples (TTHM and HAA5) at the site representing the highest TTHM and the highest HAA5 locations in the distribution system as identified under the IDSE. If the highest levels of TTHM and HAA5 are observed at the same location, then only one sample would be needed. Monitoring would be either quarterly (population from 500 – 9,999) or annually (population <500). The Federal Advisory Committee also recommended that EPA propose that all wholesale and consecutive systems comply with the provisions of the Stage 2 DBPR on the same schedule of the system serving the largest population in the combined distribution system.

Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR), Proposed

The Long Term 2 Enhances Surface Water Treatment Rule (LT2ESWTR) was proposed and reviewed by a Federal Advisory Committee at the same time as the Stage 2 DBPR rules. The requirements of this rule would pertain to all public water systems that use surface waters or GWUDI. The rule would incorporate system specific treatment requirements for one of four categories or “bins” depending upon the results of source water *Cryptosporidium* monitoring. Treatment requirements for each system would depend on system’s existing treatment equipment and removal capabilities. To comply with additional treatment requirements, water providers would choose technologies from a “toolbox” of options. Proposed treatment requirements for average *Cryptosporidium* are presented in Table 4.4.2.

For small systems monitoring requirements, it is anticipated that source water *E. coli* concentrations would be utilized for *Cryptosporidium* monitoring. Observed *E. coli* concentrations above certain levels would trigger *Cryptosporidium* monitoring. The recommended *E. coli* monitoring for small systems would begin 2.5 years after rule promulgation and would include 24 samples over one year. After six years of the system characterization, a second round of monitoring is proposed.

TABLE 4.4.2
PROPOSED TREATMENT REQUIREMENTS FOR AVERAGE *Cryptosporidium* CONCENTRATIONS

Bin No.	Ave. *Cryptosporidium* Concentration	Additional Treatment Requirements[1]
1	< 0.075/ liter	No action
2	0.075/ liter < x < 1.0/ liter	1-log treatment (any technology or technologies)
3	1.0/ liter < x < 3.0/ liter	2.0 log treatment (must achieve at least 1-log of treatment using specific technology [2]
4	> 3.0/ liter	2.5 log treatment (must achieve at least 1-log treatment using specific technology [2]

[1] - For systems with conventional treatment that are in full compliance with IESWTR.
[2] - Acceptable technologies include ozone, chlorine dioxide, ultraviolet (UV), membranes, bag/cartridge filters, or in-bank filtration.

In summary, the rules are getting tougher with increased treatment standards, lower MCLs, and more regulated substances. Water suppliers must stay informed of upcoming standards and requirements to ensure that their system will stay in compliance. Proper preparation is critical. When upcoming MCLs are established, a supplier should begin to test for these materials to determine if compliance will be a problem. Advanced planning will allow a utility more time to make necessary modifications to treatment techniques. Additional information on recent and pending regulations can be found at www.epa.gov/safewater/standards.htmlT.

Section

5

Existing Water System

The City of Sutherlin's existing water system consists of sources of raw water supply and facilities, treatment plant facilities, treated water storage, and treated water transmission main and distribution system. These components are discussed in detail below.

5.1 Water Rights and Raw Water Supply

The nature and status of existing raw water supplies and water rights is crucial to the formulation of a successful long-range plan for the City. The following is a discussion of the sources, availability, and reliability of the City's raw water sources.

Raw Water Sources

Presently, the City of Sutherlin has three available sources of raw water: Calapooya Creek, Cooper Creek Reservoir, and the North Umpqua River. An overall map of the Study Area showing the major components of the City's water system, including its raw water sources, is displayed in Figure 3.1.2.

Calapooya Creek. The first and primary source is the Calapooya Creek at Nonpareil, approximately 8 miles east of the City. The Calapooya Creek source is generally of excellent water quality and is used throughout the year although the creek turbidity can be high (> 500 NTUs) for short periods of time during winter storms.

Cooper Creek Reservoir. During the dry season months, the City withdraws and treats water from Cooper Creek Reservoir to keep up with water demand. Cooper Creek Reservoir is located southeast of Sutherlin on Cooper Creek, which is a tributary of Sutherlin Creek. Water quality in Cooper Creek Reservoir is generally poorer than in Calapooya Creek. Raw water at the City's water treatment plant (WTP) often has zero dissolved oxygen (DO), elevated concentrations of iron and manganese, and noticeable levels of hydrogen sulfide. The reservoir is eutrophic with high concentrations of algae and growth of an evasive weed, *Egeria densa*.

North Umpqua River. The City has an undeveloped municipal water right on the North Umpqua River of 3.0 cfs. The point of diversion is located downstream of Whistlers Bend. Water quality from the North Umpqua River is considered excellent and flows are generally reliable even in summer.

Water Rights

All water in Oregon is publicly owned. Because of this public ownership, a water right is generally required for anyone to use water— whether it originates from surface or underground sources. Oregon's water laws are based on the principal of prior application. That is, if a person obtains a water right on a particular source before someone else, the person would then posses a "senior" water right that would permit them first use of the water during times of lower flows or droughts. A "junior" water right is one that is obtained after other water rights for a particular source have been assigned. A water right may be both senior to some and junior to others. During periods of low water availability, a water right holder may use as much water as their water right allows as long as the use is truly beneficial and all senior water rights are satisfied. This method of resource appropriation governs all water used until the water is exhausted.

The City currently holds surface water right certificates and permits on the Calapooya Creek, Cooper Creek (as part of Sutherlin Water Control Board) and Umpqua River totaling 12.0 cfs or approximately 7.76 million gallons (MG) per day. In addition, the Sutherlin Water Control Board holds a water right to store 500 Ac-Ft of water at the Cooper Creek Reservoir. Copies of the City's water rights certificates and permits are provided in Appendix B.

TABLE 5.1.1
WATER RIGHTS DOCUMENTATION SUMMARY

Location	Application	Permit	Certificate	Magnitude, cfs	Priority Date
Calapooya Creek	S9945	S6610	6344	0.75	07/01/1926
Calapooya Creek	S19502	S15016	19629	2.25	09/05/1941
Calapooya Creek	S58288	S44066	-	1.00	01/29/1979
Cooper Creek (1)	S44016	S32426	-	5.00	08/29/1967
North Umpqua River	S59416	S44926	-	3.00	10/15/1979

(1) – From Cooper Creek and from 500.0 acre-feet of stored water in Cooper Creek Reservoir constructed under Application No. R-33574 and appropriated under Permit No. R-4965.

Calapooya Creek

A total of approximately 37 cfs of water rights are allocated on Calapooya Creek. Six cfs are municipal rights split between the City of Oakland (2.0 cfs) and Sutherlin (4.0 cfs). The City of Oakland's water right has the most senior water right on Calapooya Creek. The majority of the remaining water rights (approximately 75%) are for irrigation. Minimum instream flows for Calapooya Creek were established by the State in 1958, and increased in 1974 to reflect seasonal requirements, as an attempt to maintain minimum flows necessary to sustain aquatic life. Of the City's water rights, the 1.0 cfs water right obtained in 1979 is junior to these minimum instream flows. Consequently if the streamflow in Calapooya Creek drops below minimum instream flows, the City may not be able to utilize this 1.0 cfs right until streamflows are restored above the minimum instream levels.

A comparison of long-term flow statistics for Calapooya Creek downstream of Oakland, with the 1974 minimum instream flows, is presented in Table 5.1.2 as compiled by HGE (1997).

TABLE 5.1.2
HISTORICAL PROBABILITY OF FLOW AND MINIMUM INSTREAM FLOWS
CALAPOOYA CREEK

Month	Flow (cfs) / Probability of Exceedance					1974 minimum Instream Flow
	95%	90%	80%	50%	40%	
May	53	71	95	181	217	70
June	22	29	41	71	83	40
July	6.1	7.5	10	20	25	12
August	1.9	2.8	4.3	8.5	10	12
September	1.7	2.9	4.2	9.4	12	12
October	5.7	7.2	11	24	30	20 (10/1-15) / 50 (10/15-31)
November	21	28	48	150	235	100
December	54	97	203	613	850	100

Based on this historical streamflow data, there is less than a 40 percent probability of the streamflow in the Calapooya (downstream of Oakland) exceeding the minimum instream flow in August. In other words, over six out of 10 years in the month of August, the County Watermaster would have the authority to enforce minimum instream flow requirements and restrict any water rights junior to the instream requirements. To date, there are only two known instances in which the County Watermaster has requested the City to restrict their diversion of water from Calapooya Creek: July 16, 1985 and August 15, 1990. The lowest streamflow on record for this location is zero (no) flow in September 1966.

As mentioned above, Sutherlin's most recent water right (1.0 cfs, 1978) is junior to the minimum instream flows and will likely (>90% probability) be available between the months of December through April. During the remaining months (May through November), the City may be requested to restrict its diversion using this water right during drought conditions. For planning purposes, it will be assumed in this report that this junior right of 1.0 cfs will not be available for the City's diversion during the summer and late fall months. The City's other water rights on Calapooya Creek (3.0 cfs) predate the minimum instream flows and are only impacted by other more senior water rights.

Cooper Creek

Sutherlin has 5.0 cfs of water rights on Cooper Creek plus 500 acre-feet (ac-ft) storage on Cooper Creek Reservoir. In HGE's 1997 report, there are a number of references in regards to the City's pending application for another 500 acre-feet of storage from Cooper Creek. However, there has not been found any documentation for this application. The initial allocation of storage on Cooper Creek Reservoir included 500 ac-ft for municipal use and 3,400 ac-ft for recreational use.

North Umpqua River

Sutherlin has a permit dated October 15, 1979 for diversion of water (3.0 cfs) from the North Umpqua River. The point of diversion is located between the Winchester Dam and Whistlers Bend. For the Lower North Umpqua River watershed, municipal use is the largest user at approximately 35 percent, followed by irrigation (32 percent). The City's water right is junior to the minimum instream water rights. A comparison of long-term flow statistics for the North Umpqua River near Glide, with the 1974 minimum instream flows, is presented in Table 5.1.3.

TABLE 5.1.3
HISTORICAL PROBABILITY OF FLOW AND MINIMUM INSTREAM FLOWS
NORTH UMPQUA RIVER

Month	Flow (cfs) / Probability of Exceedance					1974 Minimum Instream Flow
	95%	90%	80%	50%	40%	
June	1020	1230	1470	2140	2390	600
July	776	860	975	1270	1350	600
August	688	722	788	970	1116	600
September	688	714	775	928	975	750
October	733	777	842	1080	1150	800
November	885	1010	1170	2110	2680	800

Stream flow in the North Umpqua River historically exceeds the minimum instream flows during the low flow months with the exception of during the months of September and October. During these months, the streamflow has historically been below minimum instream flows from 10 to 20 percent of the time. Consequently every one to two years out of 10 years in the months of September and October, the County Watermaster would have the authority to enforce minimum instream flow requirements and restrict the City's water right which is junior to the instream requirements.

Diverted Water

As mentioned above, the City primarily utilizes Calapooya Creek as its primary source for a majority of the year and supplements use from the Cooper Creek source during the dry season months (June through October). While the City has flowmeters on both raw water sources, there is concern about the accuracy of these meters. Based on a cursory comparison of the calculated flows, the sum of the water pumped to the City and backwash is typically greater than the reported water diverted from the raw water source. In the case of the Nonpareil WTP, City staff reports that debris occasionally becomes lodged in the meter (typically in the winter) requiring removal, which distorts the flow readings. For both WTPs, the raw water meters have been in service for a number of years without calibration and consequently, are thought to be reading low. For these reasons, the amount of diverted water from each source was calculated based on the sum of the amount of water pumped to the City, and backwash water. This sum is equal to the WTP water production.

The estimated amount of water diverted from this source and the estimated amount from the City sources for the Water Years 2000 to 2004 is presented in Table 5.1.4.

TABLE 5.1.4
HISTORICAL WATER DIVERSION (2001 – 2004)

Parameter/Year	2000	2001	2002	2003	2004
Nonpareil WTP – Calapooya Creek					
Total Gallons, MG	513.47	482.79	490.57	509.87	510.82
Ave. Daily cfs	2.18	2.05	2.08	2.16	2.17
Max. Month, cfs	2.75	2.72	2.82	2.81	2.81
Peak Week, cfs	3.25	3.03	2.89	3.18	2.95
Max. Daily, cfs	3.78	3.35	3.43	3.48	3.41
Total Water Rights, cfs	4.0				
Pre-1974 Water Rights, cfs	3.0				
Cooper Creek WTP – Cooper Creek Reservoir					
Total Gallons, MG	43.39	38.22	48.07	67.27	49.86
Ave. Daily(1), cfs	0.92	0.75	0.78	1.02	0.89
Max. Month, cfs	0.92	0.79	0.96	1.32	1.12
Peak Week, cfs	1.26	0.99	1.24	1.50	1.44
Max. Daily, cfs	1.81	1.35	1.52	1.92	1.75
Total Water Rights, cfs	5.0				

(1) – Average GPD/cfs based on the number of days that water was diverted from Cooper Creek Reservoir.

Based on the historical water diversion, water withdrawals from Calapooya Creek have exceeded 3.0 cfs (sum of the City's most senior water rights) on a daily basis and, in some years, during a week of peak flow demand. With respect to Cooper Creek Reservoir, all water withdrawals have been considerably less than the City's water right of 5.0 cfs.

Watershed for Raw Water Sources

The City currently withdraws water from two watersheds: Calapooya Creek and Cooper Creek. The City also has a permit to withdraw water from a third watershed, the North Umpqua River. Information on these watersheds was obtained from the Source Water Assessment Summary Brochure developed by the Oregon Department of Environmental Quality (DEQ) and Oregon Department of Health Services (DHS). For the Calapooya Creek and Cooper Creek watersheds, information was obtained from the City of Sutherlin's report (PWS #4100847). For the North Umpqua River, information was acquired from the City of Roseburg's report (PWS #4100720), as the Roseburg's intake is downstream of Sutherlin's permitted water withdrawal from the river. The Roseburg assessment addresses the geographic area providing water to Roseburg's intake at Winchester between its intake and upstream intake for Glide and USFS Wolf Creek Job Corps. This source water information may be found at DEQ's website at http://www.deq.state.or.us/wq/dwp/SWACompleteSW.asp. The boundaries for each watershed are presented in Appendix A.

The City's Calapooya Creek watershed extends approximately upstream approximately 71 miles in an easterly direction and includes approximately 85.4 square miles. The area within the watershed includes Calapooya Creek and the following tributaries: Long Valley, Pelland, Cantell, Gassy, Hinkle, Jeffers, Timothy, Corn and White Creeks. The dominant land used within Calapooya Creek watershed consists of agricultural land uses and privately owned managed forestlands. Potential contamination sources identified in this watershed include rural homesteads, Red Rock Road (potential runoff from mine tailings), grazing animals, clear cuts, road density, stream crossings, areas of slope instability, and managed forestlands.

The Cooper Creek Reservoir portion of the watershed extends upstream approximately three to four miles in a southeasterly direction and includes a total of 4.5 square miles. The watershed includes the reservoir and its tributaries, including Cooper Creek. The Cooper Creek watershed is primarily dominated by recreation and forest land uses with interspersed residential land use. Potential contaminant sources within this watershed include grazing animals, clear cuts, areas of slope instability, managed forestlands, recreation areas (parks), large capacity septic systems, a stormwater outfall and retention basin, and a rural residential area.

The North Umpqua River watershed extends upstream approximately 190 miles in an easterly direction and encompasses a total area of approximately 200 square miles. Tributaries to the main stem include Cooper, Huntley, Dixon, Clover, Oak, Buckhorn Creeks, and the Little River and its tributaries. Activities and impacts in the Roseburg, Glide, Toketee Village, and Wolf Creek Job Corps drinking water protection areas have the potential to impact downstream users. The North Umpqua River watershed is dominated by commercial, residential/municipal, agricultural, and forestland uses. Potential contaminant sources within the watershed include a number of commercial land uses, six schools, a wastewater treatment plant, two water treatment plants, a transfer station, a fire station, parks, three transportation corridors, a ranger station, grazing, irrigated crops, and clear-cuts.

5.2 Raw Water Facilities

The raw water facilities consist of diversion structures and impoundments, and raw water transmission mains. These facilities are discussed in detail below.

Nonpareil WTP

The intake structure for the Nonpareil WTP is located behind a small concrete dam on Calapooya Creek. The raw water intake consists of a fine-slotted screen that is oriented parallel with the creek flow. This screen is used to reduce the amount of solids entering the raw water main. An air compressor and storage tank located in an adjacent concrete block building is used to provide air scour to clear the screen of solids. During wet weather events when the turibidity of the creek water is high (up to 200 NTUs and greater), air scours are needed every 45 to 60 minutes. As it takes 45 minutes for the air compressor to fill the air storage tank, larger or dual compressors are needed to provide timely cleaning of the intake screens.

From the intake screens, water flows by gravity through a concrete channel to the raw water wetwell. The wetwell itself is an approximately eight foot square concrete vault with a metal lid. Submersible pumps, with large solids clearance (as for sewer service) are utilized to pump the water to the treatment plant via 14-inch diameter pipe. A turbine meter is located in a concrete vault on the west side of the

WTP building is used to measure the raw water flow. City staff reports that this water meter is occasionally plugged with small sticks that have cleared the raw water intake screens and raw water submersible pumps. The summertime water right is for 3 cfs (1.94 MGD) and the wintertime water right is for 4 cfs (2.59 MGD).

Copper Creek WTP

The raw water intake for the Cooper Creek WTP lies at an elevation of 630 feet mean sea level (MSL) approximately 38 feet below the permanent pool elevation of 668 feet MSL. The intake consists of a concrete riser with a 12-inch sluice gate on the top. Reservoir water enters through the gate and drops into a 24-inch diameter reinforced concrete pipe that is connected upstream to a sediment drain riser. The sediment drain riser is used to clear sediment from the bottom of the reservoir; this riser is located at 613 feet MSL. The 24-inch diameter pipe penetrates the dam and terminates downstream with an outlet to Cooper Creek. For the municipal feed, water is diverted from the 24-inch main at a tee with 18-inch diameter main. The size of this main pipe reduces to 14-inch diameter and thence to 10-inch diameter. The transition from 14-inch to 10-inch diameter pipe occurs approximately 750 lineal feet from the WTP. The location of the 18-inch to 14-inch diameter main transition is not known.

The elevation head between the reservoir (approx. 668 ft) and the treatment plant (approx. 610 ft) is adequate to supply raw water flow rates required to deliver the maximum daily water supply equal to the City's water right of 5 cfs (3.23 MGD). However, the limiting factor is the size of the intake and raw water piping. At 3.2 MGD, the velocity within the 10-inch main is approximately 9 feet per second (fps), which is too high. To minimize pipe velocity, the 10-inch water main should be replaced with at least a 14-inch diameter main.

5.3 Water Treatment Facility

The City of Sutherlin has two potable water treatment plants (WTPs): Nonpareil WTP and Cooper Creek WTP. The City utilizes the Nonpareil WTP year-round while the Cooper Creek WTP is used to supplement water production during the high water demand months in the summer. Water availability and treatment capability from the City's two water sources (Calapooya Creek and Cooper Creek Reservoir) provides the City with redundancy and backup reliability in the event of an emergency. A discussion of each of these water treatment facilities is presented below.

Nonpariel WTP

The Nonpareil WTP was rebuilt in 1982 with a net design capacity of 2.3 MGD, including backwash. This plant utilizes chemical coagulation and polymer addition, a solids contact clarifier for flocculation and clarification, multimedia filtration with surface wash, and disinfection with chlorine gas. A site plan of the Nonpareil WTP site is presented in Figure 5.3.1. Photographs of the Nonpareil WTP are presented in Figures 5.3.2 and 5.3.3.

Design data for the water treatment unit is provided in Table 5.3.1.

Figure 5.3.1 – Nonpareil WTP Existing Site Plan

FIGURE 5.3.2 NONPAREIL WTP BUILDING

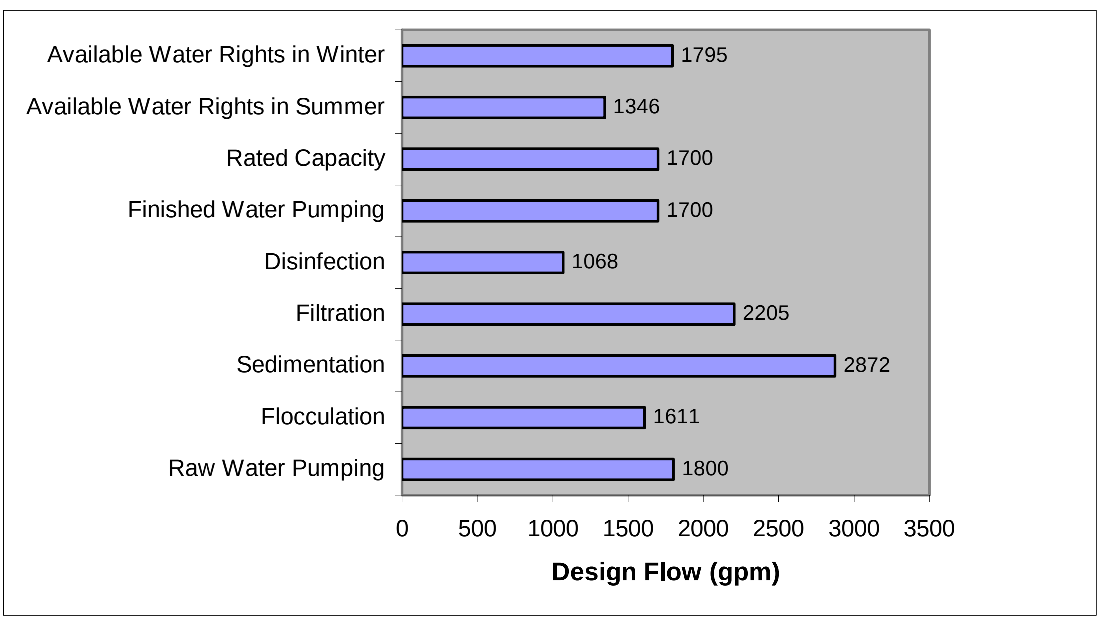
FIGURE 5.3.3 NONPAREIL WTP TREATED WATER PUMPS

TABLE 5.3.1
EXISTING DESIGN DATA – NONPAREIL WTP

Parameter	Value/Description
General Design Data	
Year Constructed	1982
Demand Flow / Design Plant Capacity (w/backwash)	1,450 gpm (2.1 MGD) / 1,600 gpm (2.3 MGD)
Health Division Performance Rating	2.0 log for treatment, 1.0 log for disinfection
Raw Water Pumps (only one runs at a time)	2 submersible, 1,800 gpm @ 18.5 TDH
Raw Water Chemical Feed	
Coagulant	Polyaluminum chloride (PAC)
Polymer	Anionic Polymer, 1986 N
Solids Contact Clarifier	
Flocculation Chamber Volume/Detention Time	16,000 gallons / 10 minutes
Sedimentation Area	1,390 sq. ft. w/ settling tubes
Upflow Rate	1.2 gpm/sq. ft.
Filters	
Number of Units	4
Depth & Type of Media	18" Anthraciite, 14" Sand, 13" Gravel
Surface Area	110 sq. ft. each; 440 sq. ft. total
Filtration Rate	4 gpm / sq. ft.
Backwash Rate (one filter)	17 gpm/ sq. ft.
Treated Water Pumps	3 vertical turbine, 75 Hp, 850 gpm @ 255 TDH
Clearwell Volume	50,000 gallons
Backwash	
Pumps	1 vertical turbine, 30 Hp, 1,875 gpm @ 41 TDH
Ponds - Number/Approx. Surface Area	3 / 14,000 sq.ft. (estimated)
Disinfection	Gaseous Chlorine
Treated Water Chemical Feed	Polyphosphate for corrosion control

A summary of the design capacity of the selected hydraulic and process equipment for the Nonpareil WTP is shown in Figure 5.3.4.

FIGURE 5.3.4
DESIGN CAPACITY OF NONPAREIL WTP



Based on this comparison of design capacities of individual components, the disinfection capability is considered the primary limitation of the Nonpareil WTP. Disinfection is limited because of the available contact time in the WTP clearwell. Additional clearwell storage or finished water storage before the first user would provide additional needed contact time for disinfection.

Plant Operation

Raw water is delivered to the WTP via the raw water pumps located on the south side of Calapooya Creek and a 14-inch diameter AC water main. Polyaluminum chloride (PAC) is added to the raw water prior to an in-line, static mixer by chemical metering pump. The amount of PAC introduced into the raw water adjusted based on readings from a streaming current monitor on the raw water line. After the static mixer, the raw water travels to the solids contact clarifier. This unit is a circular concrete basin with a inner metal circular well. Raw water flows into the inner circular well for flocculation and then to the outer well for sedimentation. Inside the outer well there are tube settlers to aid in sedimentation. Clarified water travels through effluent launders to the filters. There are four filter units, each of which is designed to have anthracite, sand and gravel as media. The clarified water travels through the filters and is injected with chlorine prior to entering the clearwell. The clearwell serves three purposes: 1) temporary storage, 2) contact time for disinfection, and 3) source of backwash water for the treatment unit. Water is then pumped into the City's treated water transmission main and distribution system via the treated water pumps located over the WTP clearwell. Turbidity of the filtered water is measured off the effluent from each filter and from a composite of the effluent.

Ultimately, treated water production is controlled by the water level in the Umpqua or Calapooya Reservoir Tanks in town and radio telemetry. When the water level in these tanks drops to a predetermined level, the treated water pumps located above the Nonpareil WTP's clearwell start and pump water to town. When water level in the clearwell reaches a predetermined level, the filter effluent valves will open and place the filters into operation. As the level falls in the filter bays and inlet flume, a level probe in the filter flume will start the raw water pump and chemical feed system. Treated water from the solids contact clarifier will flow to the filters and the plant will operate until shutdown by 1) high level switch from the clearwell, 2) automatic call for backwash, 3) manual shutdown by the operator, or high level in the filter flume.

The backwash operation of the filters is automatically initiated by the pressure switch at the filter outlet, after a preset loss of head is registered for several minutes. Once the cycle is started, a programmed timer controls all functions in the following sequence: 1) surface wash system is initiated, 2) backwash valve opens slowly and the backwash pump starts, and 3) after a preset time (4-6 minutes) the surface wash and backwash valves and pumps are shutdown and the filter plant is returned to normal service. The WTP has no filter to waste capabilities. Backwash water is directed to one to three ponds adjacent to the WTP. These ponds are operated in series with the overflow from the southern-most pond discharging to a nearby creek that discharges to Calapooya Creek. City staff periodically takes the primary pond out of service during the summer to dry and removal of accumulated solids.

Metering

The raw and treated water streams are measured with turbine water meters. The raw water meter periodically requires removal of accumulated debris during the months of high creek flows. Because of the accumulated debris, accuracy of this flow meter is in question. There are no water measurements made on the backwash water, surface wash water, or general water usage (sanitation, pump seals, chemical make-up, water quality measurements, etc.) at the WTP. Water used for backwash and surface wash is estimated from the product of the pump capacity (backwash and surface wash) and number of pump operating hours.

Water Production & Backwash

A summary of historical water pumped to the City, amount of backwash, amount of water produced, and percentage of backwash (based on total water production) is given in Table 5.3.2. More detailed information on these parameters for the Nonpareil WTP is provided in Appendix C.

TABLE 5.3.2
HISTORICAL WATER PRODUCTION & BACKWASH FOR THE NONPAREIL WTP

Parameter	Year					Average
	2000	2001	2002	2003	2004	
Water Pumped, MG	488.16	455.94	467.18	483.81	487.22	476.46
WTP Backwash, MG	24.99	26.86	23.39	26.46	23.60	25.06
Total WTP Production, MG	513.15	482.80	490.57	510.27	510.82	501.52
WTP Backwash, %	4.9	5.6	4.8	5.2	4.6	5.0

Operation & Maintenance Issues

A number of operational issues were identified during site visits and discussions with City staff. These operational issues are discussed below.

- **Solids Contact Clarifier** – The metal components on the Clarifier are showing wear and need to be recoated. Refurbishment of the flocculator components may be needed. A number of cracks and weeping is evident on the outside concrete wall of the clarifier. These cracks should be pressure grouted. Staff indicates that solids periodically boil up on the north side of the clarifier in the afternoon during the summer months. Staff recently installed new tube settlers in the sedimentation part of the clarifier.

- **Filters** – The filters appear to be in satisfactory condition and operating well. Flow to the filters does not appear to be evenly distributed between the filter bays. The filter bays (No. 1 & No. 3) closest to the Solids Contract Clarifier appear to be getting more flow than the other bays as these units need to be backwashed more often. Anthracite was replaced in 1998.

  There is no filter-to-waste capability at this plant. Consequently when the filter backwash is completed, the filter is immediately placed into service. Filter-to-waste piping and controls would allow diversion of the first water treated through the filter after backwash to the backwash pond, and eliminate any solids carryover to the clearwell.

  The backwash cycle utilizes a surface wash to assist in cleaning the filters. The use of air scour may be a more effective means of fluidizing and cleaning the filter bed and would reduce the amount of potable water use during backwash. Backwash is dependent on a single backwash pump, which appears to be difficult to replace because of the height of the existing ceiling and location of the stairwell. Installation of a skylight over the backwash pump would ease the removal of this pump. A standby backwash pump is needed in case the existing pump goes down. Operation of the filters is also dependent on the operation of the potable water pump.

- **Disinfection** – Staff indicates that the chlorine injector needs replacement. Chlorine gas, injected into water, is utilized for disinfection. Chlorine gas is a hazardous substance requiring a number of operating precautions and equipment to monitor for chlorine gas. Additional clearwell capacity and/or installation of baffling in the clearwell is needed to gain additional contact time for disinfection.

- **Backwash Ponds** – It is difficult for staff to remove solids from the Backwash Ponds. When primary pond is out of service to let the solids dry out, the secondary ponds become overloaded. The northern-most Backwash Pond does not have a fence around it.

- **Potable Water Pump** - WTP Operation is dependent upon a single Potable Water Pump, which is a submersible pump located in the Clearwell. If this pump fails, the WTP cannot operate and no water is available to nearby residents. A redundant pump is needed.

- **Combination Air Valve/Treated Water Main** – During the site inspection of the WTP facilities, it was noted that the pressure on the downstream side of the treated water pumps was at zero immediately and that a vacuum was observed off the fire hydrant outside the WTP immediately after the pumps turned off. Further investigation is needed on the reason for this low pressure condition.

- **Electrical Equipment** - Electrical Equipment is old & should be upgraded. Installation of a supervisory control and data acquisition (SCADA) system would allow City staff to remotely access WTP data and control WTP operations.

- **Chemical Feed Storage** – Concrete surfaces in this area are corroded and should be resurfaced.

Cooper Creek WTP

The Cooper Creek WTP was built in 1970 with an original design capacity of 2.0 MGD. This plant utilizes chemical coagulation and polymer addition, a hydraulic mixing tank for flocculation, multimedia filtration with surface wash, and disinfection with chlorine gas. Design data for the water treatment unit is provided in Table 5.3.3. A site plan of the Cooper Creek WTP site is presented in Figure 5.3.5. Selected photographs of the Cooper Creek WTP facility are provided in Figures 5.3.6 and 5.3.7.

TABLE 5.3.3
EXISTING DESIGN DATA – COOPER CREEK WTP

Parameter	Value/Description
General Design Data	
Year Constructed	1970
Demand Flow / Design Plant Capacity (w/backwash)	1,250 gpm (1.8 MGD) / 1,400 gpm (2.0 MGD)
Health Division Performance Rating	2.0 log for treatment, 1.0 log for disinfection
Raw Water Feed	Gravity, 58 feet head difference, normal pool elev.
Raw Water Chemical Feed	
Oxidant	Potassium Permanganate
Coagulant	Polyaluminum chloride (PAC)
Polymer	Anionic Polymer, 1986 N
Mixing Chamber Volume/Detention Time	8,000 gallons / 6 minutes
Filters	
Number of Units	4
Type of Media	Anthracite, Sand, Gravel
Surface Area	72 sq. ft. each; 288 sq. ft. total
Filtration Rate	5 gpm / sq. ft.
Backwash Rate (one filter)	17 gpm/ sq. ft.
Treated Water Pumps	3 vertical turbine, 40 Hp, 1,000 gpm @ 50 TDH
Clearwell Volume	50,000 gallons
Backwash	
Pumps	1 vertical turbine, 15 Hp, 1,200 gpm @ 45 TDH
Ponds - Number/Approx. Surface Area	3 / 9,750 sq. ft. (approx.)
Disinfection	Gaseous Chlorine
Treated Water Chemical Feed	Polyphosphate for corrosion control, Soda ash for pH

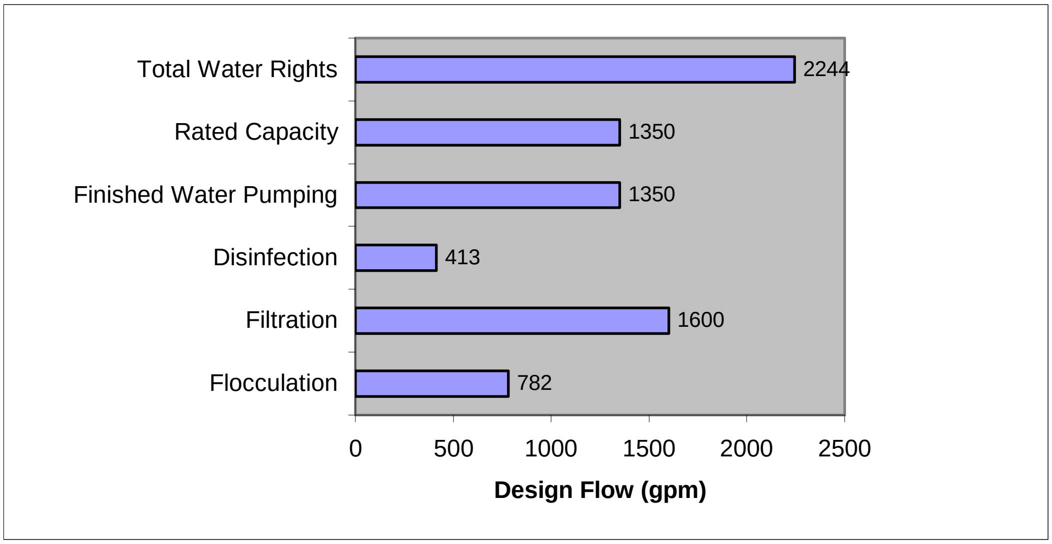
Figure 5.3.5 - Cooper Creek WTP Existing Site Plan

FIGURE 5.3.6 COOPER CREEK WTP BUILDING

FIGURE 5.3.7 COOPER CREEK WTP FILTER UNIT & PIPING

A summary of the design capacity of the selected hydraulic and process equipment for the Cooper Creek WTP is shown in Figure 5.3.8.

FIGURE 5.3.8
DESIGN CAPACITY OF COOPER CREEK WTP



Based on the WTP design parameters, the disinfection capability is considered a significant limitation of the Cooper Creek WTP. Disinfection is limited because of the available contact time in the WTP clearwell. Additional clearwell storage or finished water storage before the first user would provide additional needed contact time for disinfection. While disinfection is a limiting factor in the WTP's design, the primary limiting factor is the oxidation and removal of iron and manganese from the raw water. The lack of sedimentation facilities requires the WTP to be operated at a much lower rate (approximately 1.0 MGD) than its original design finished water capacity of 1.8 MGD.

Plant Operation

Raw water is delivered to the WTP by gravity via a combination of 10-inch and 14-inch diameter AC water main. Potassium permanganate and polyaluminum chloride (PAC) is added to the raw water prior to an in-line, static mixer by chemical metering pump. Potassium permanganate is added to oxidize soluble iron and manganese in the raw water to insoluble precipitates. The amount of PAC introduced into the raw water is adjusted manually based upon periodic jar testing of the raw water. After the static mixer, the raw water travels to the hydraulic mixing chamber for flocculation. Flocculated water travels via a filter flume to the filters. There are four filter units, each of which is designed to have anthracite, sand and gravel as media. The clarified water travels through the filters and is injected with chlorine prior to entering the clearwell. The clearwell serves three purposes: 1) temporary storage, 2) contact time for disinfection, and 3) source of backwash water for the treatment unit. Water is then pumped into the City's treated water transmission main and distribution system via the treated water pumps located over the WTP clearwell. Submersible pumps for the Ridgewater Pump Station are also located within the clearwell. These pumps convey water to the Ridgewater Reservoirs and area users. Turbidity of the filtered water is measured off the effluent from each filter and from a composite of the effluent.

As with the Nonpareil WTP, treated water production is controlled by the water level in the Umpqua or Calapooya Reservoir Tanks in town and radio telemetry. When the water level in these tanks drops to a predetermined level, the treated water pumps located above the Cooper Creek WTP's clearwell start and pump water to town. When water level in the clearwell reaches a predetermined level, the filter effluent valves will open and place the filters into operation.

The pressure switch at the filter outlet automatically initiates the backwash operation of the filters, after a preset loss of head is registered for several minutes. Once the cycle is started, a programmed timer controls all functions in the following sequence: 1) surface wash system is initiated, 2) backwash valve opens slowly and the backwash pump starts, and 3) after a preset time (4-6 minutes) the surface wash and backwash valves and pumps are shutdown and the filter plant is returned to normal service. The WTP has no filter to waste capabilities. Backwash water is directed to the two ponds adjacent to the WTP. These ponds are operated in series with the overflow discharging to Cooper Creek. City staff periodically pumps sludge out of these ponds for removal of accumulated solids.

When the WTP is not in operation, a valve on the treated water is left partially open to allow water from the distribution system back into the clearwell to provide water to the Ridgewater Pump Station.

Metering

The raw and treated water streams are measured with turbine water meters. There are no water measurements made on the backwash water, surface wash water, or general water usage (sanitation, pump seals, chemical make-up, water quality measurements, etc.) at the WTP. Water used for backwash and surface wash is estimated from the product of the pump capacity (backwash and surface wash) and number of pump operating hours.

Water Production & Backwash

A summary of historical water pumped to the City, amount of backwash, amount of water produced, and percentage of backwash (based on total water production) is given in Table 5.3.4. More detailed information on these parameters for the Cooper Creek WTP is provided in Appendix C.

TABLE 5.3.4
HISTORICAL WATER PRODUCTION & BACKWASH FOR THE COOPER CREEK WTP

Parameter	Year					Average
	2000	2001	2002	2003	2004	
Water Pumped, MG	31.82	26.76	35.23	50.11	39.82	36.75
WTP Backwash, MG	11.57	11.45	12.75	17.02	10.04	12.57
Total WTP Production, MG	43.39	38.22	47.98	67.13	49.86	49.32
WTP Backwash, %	27	30	27	25	20	25

From 2000 to 2004, the Cooper Creek WTP operated on average of 87 days, ranging from 73 days to 102 days.

Operation & Maintenance Issues

A number of operational issues were identified during site visits and discussions with City staff. These operational issues are discussed below.

- **WTP Flocculation & Filters** – WTP equipment is old and in need of refurbishment or replacement with new equipment. Anthracite was replaced in 1998. The WTP is not capable of its design treatment capacity because of having to oxidize and remove iron and manganese in the influent raw water. The addition of sedimentation would allow removal of solids that are not deposited on the filters and thus greatly reduce the amount of backwashing on these filters. It will be difficult to install any new equipment of substantial size due to the lack of sufficiently size opening in the WTP building. Removal of the backwash pump would appear to be a difficult intertaking. Treated water piping and valves also need replacement.

- **Disinfection** – Chlorine gas, injected into water, is utilized for disinfection. Chlorine gas is a hazardous substance requiring a number of operating precautions and equipment to monitor for chlorine gas. Additional clearwell capacity and/or installation of baffling in the clearwell is needed to gain additional contact time for disinfection. Clearwell also needs additional venting.

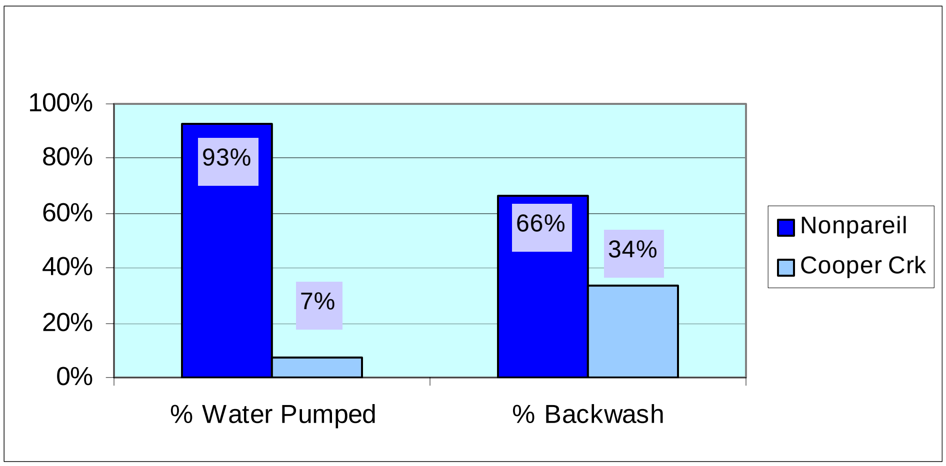
- **Backwash Ponds** – It is difficult for staff to remove solids from the Backwash Ponds.

- **Electrical Equipment** - Electrical Equipment is old & should be upgraded. Installation of a supervisory control and data acquisition (SCADA) system would allow City staff to remotely access WTP data and control WTP operations.

Overview of WTPs

A comparison of the WTP operation is presented in Figure 5.3.9.

FIGURE 5.3.9
COMPARISON OF WTP OPERATION



The Nonpareil WTP is the City's primary source of potable water; approximately 93 percent of the City's water is produced at this facility. Overall, this WTP is in good operation. However, the Nonpareil WTP is in need of an overhaul to maintain and enhance its continued operation. The Cooper Creek WTP is used to handle peak water consumption during the summer months. This plant is operable but is in need of major improvements and most likely needs to be replaced.

5.4 Treated Water Storage

The purpose of treated water storage reservoirs or tanks is to provide 1) a sufficient amount of water to average or equalize the system's daily demand, 2) adequate pressures throughout the system, 3) sufficient storage for fire flows demand and 4) reserve storage for periods when the City is without a water supply. The City's water system has a total of nine storage tanks providing a nominal capacity of 3,519,000 gallons of storage. A summary of relevant reservoir data is provided in Table 5.4.1. A brief description of each tank is provided below.

TABLE 5.4.1
TREATED WATER RESERVOIRS

Tank Name	Service Area	Material	Year Constructed	Nominal Volume, gal	Base/Overflow Elevation, ft
Umpqua	Low Level	Welded Steel	1956	1,250,000	653 / 693
Calapooya	Low Level	Prestressed/ Precast Concrete	1981	1,000,000	653 / 693
Oak Hills	Low Level	Glass-Fused-to Steel Bolted	2002	1,025,000	660 / 693
Schoon Mt. (2 tanks)	Mid Level	Welded Steel	1997	24,000	847 / 855
Tanglewood	Mid Level	Welded Steel	1974	75,000	841 / 861.5
Upper Umpqua	Mid Level	Welded Steel	1970	75,000	846.5 / 861.5
Ridgewater No. 1	High Level	Welded Steel	1974	35,000	952 / 974
Ridgewater No. 2	High Level	Welded Steel	2003	35,000	952 / 974

A brief site inspection of the City's reservoir tanks was made on April 12, 2005 (Ridgewater Tanks) and May 5, 2005 (remaining tanks), which primarily consisted of a review of the outside of the tanks and associated appurtenances. No observations were made of inside of the tank or tank roof. The following is a summary of the site observations and comments from City staff.

Low Level Tanks

The low level tanks, consisting of Umpqua, Calapooya, and Oak Hills, provide a total of 3,275,000 gallons of storage for the majority of the City's service area. Elevations within this service area range from approximately 400 feet to 600 feet. Water levels within the Umpqua or Calapooya Tanks are utilized to call for the operation of the City's WTPs (Nonpareil and Cooper Creek). The finished water pumps at each WTP feed these reservoir tanks.

A brief site inspection of the reservoirs was made on May 5, 2005, which primarily consisted of a review of the outside of the tanks and associated appurtenances. No observations were made of inside of the tank or tank roof. The following is a summary of the site observations and comments from City staff.

- **Oak Hills Tank** – The tank is new and in good condition. City staff indicates that the tank will fill only up to approximately 26 feet instead to its maximum water level of approximately 33 feet. Staff also indicates that there has been some difficulty in maintaining a chlorine residual in the tank and that the tank only drops six to ten inches during the day as compared to the other low-level tank levels dropping two to three feet. Fire flow tests at a hydrant between the tank and Highway 138 shows similar flow rates whether the valve to the main line on Highway 138 is open or not. No cathodic protection was observed at the tank. Sutherlin Fire Chief, Barry Hutchings, has indicated that it is critical that this tank remains full, or nearly full, for fire flow protection.

- **Calapooya Tank** – This tank appears to be in good condition. Access to this tank site is on a steep, narrow road above the City's Public Works Shop. Cracks were observed in the asphalt driveway on the downhill side of the tank. Survey markers have been placed on the downhill side of the tank to monitor any movement of the ground surface. Due to accumulated material on the southern fence line of the tank site, one may be able to scale the existing chain link fence at this location.

- **Umpqua Tank** – This tank was recoated on the external surface approximately 2½ years ago. The previous outside coating had a lead-based coating that had to be removed. Tank appeared to be in excellent condition. No cathodic protection was observed at the tank.

Mid Level Tanks

The mid level tanks, consisting of Schoon Mountain, Tanglewood, and Upper Umpqua, provide a total of 174,000 gallons of storage for pressure zones above the City's low level service area. Elevations within this service area range from approximately 560 feet to 700 feet for Schoon Mountain area, and approximately 600 to 760 feet for Tanglewood and Upper Umpqua area. Individual booster pump stations (Schoon Mountain, 6^{th} and Oak, and Umpqua) maintain the water levels within these tanks.

- **Schoon Mountain Tanks** – These tanks (12,000 gallons each) were originally pressure filters utilized by the City of Roseburg. These tanks were rehabilitated and put into operation around 1997. The lengths of these tanks lay horizontally which only gives approximately eight feet of vertical head in the tanks. The Schoon Mountain Pump Station fills this reservoir tank based readings from pressure transducers in the tanks, which transmit the data by radio telemetry.

- **Tanglewood Tank** – This 75,000 gallon welded tank serves an area generally encompassed by Sixth Street to the south, the railroad tracks to the east, and Comstock Road to the west. With the exception of some recently placed graffiti, the tank appeared to be in good condition. The 6^{th} and Oak Pump Station fills this reservoir tank based on pressure at the pump station. With the tank off-line, the pump station continues to operate based on pressure with a pressure reducing valve, on the mainline near the tank, preventing excessive pressures from building up in the system. This arrangement results in frequent pump starts that over a long period of time would be detrimental to the pumps. However for one to two day outages, this arrangement has proven to be satisfactory.

- **Upper Umpqua Tank** – This 75,000 gallon welded steel tank serves an area generally encompassed by Sixth Street to the south, and the railroad tracks to the west. This tank appeared to be in good condition except for numerous bullet marks on the tank. These marks are showing signs of rust and the outside should be recoated. The Umpqua Pump Station fills this reservoir tank based on pressure at the pump station. With the tank off-line, this pump station operates in a fashion similar to the 6^{th} and Oak Pump Station with a pressure relief valve located next to the Upper Umpqua Tank.

High Level Tanks

There are two high level tanks (35,000 gallons each); both of which serve the Ridgewater Estates. Elevations within the high level service area served by these tanks range from approximately 760 feet to 870 feet. A booster pump station located at the Cooper Creek WTP maintains the water levels within these tanks. These tanks also act as reservoir storage for the Upper Ridgewater Pump Station which services customers at elevations from 860 to 950 feet.

- **Ridgewater Tank No. 1** – This tank has been in service for a number of years. The outside coating of this tank needs refurbishment and the inside probably does too. The tank level gauge is broken and needs repair or replacement. Being the older of the two tanks (built in 1974), there are no seismic foundation chairs/bolts. The tank also has a single inlet/outlet which does not promote mixing within the tank. There is no cathodic protection on this tank.

- **Ridgewater Tank No. 2** – This tank is the most recently constructed tank in the City's water system (Year 2003). This tank appears to be in excellent condition. The tank has separate inlet/outlet lines and has seismic foundation chairs/bolts. Some of the seismic bolts at the foundation need a coating for corrosion protection. This tank does not have cathodic protection and should some additional security measures (e.g. gate covering the ladder cage, and/or ladder shield) installed at the ladder to prevent access to the top of the tank.

Summary

Overall, the City's water storage tanks appear to be in good condition. The most discerning tank items are the inability to fill and the lack of turnover at the Oak Hills Tank and lack of cathodic protection of the steel tanks. Some tanks, such as the Upper Umpqua and Ridgewater No. 1, are in need of maintenance.

5.5 Water Distribution System

An overview of the City's water distribution system is presented in Figures 5.5.1a-e. Sutherlin's water distribution system is a combination of pipe materials and sizes. The distribution system consists of 14-inch main lines from the City's Water Treatment Plants (WTPs), 2 to 12-inch diameter lateral pipe with service lines consisting of ¾ and 1-inch diameter pipe. The most prevalent pipe within the distribution system (47 percent) consists of 8-inch diameter pipe.

In addition to varying by diameter, the water distribution system is also composed of a variety of pipeline materials. The material that was used to construct water lines over the years depended primarily on the accepted and available materials of the time. In the 1940's and 1950s, cast iron, steel, and galvanized piping was commonly used. In 1951, concrete cylinder pipe was installed for the Nonpareil water main. Later, asbestos cement (AC) piping was utilized for water main construction in the 1970s. Today ductile iron, PVC and polyethylene (PE) pipe materials are used almost exclusively in the construction of new water lines. The City's piping consists primarily of AC and PVC pipe for lateral pipes, and copper and polyethylene pipe for service lines. A summary of the distribution system pipe size and material inventory (not including service lines) is given in Table 5.5.2. Current materials of choice for replacement are PVC pipe for lateral mains and PE pipe for service lines. An inventory of the service lines was not compiled due to insufficient information.

TABLE 5.5.2
DISTRIBUTION SYSTEM SIZE AND MATERIAL INVENTORY

Pipe Diameter, in.	Materials of Construction							
	PVC	Cast Iron	Ductile Iron	Asbestos-Cement	Concrete Cylinder	Steel/Copper	Total	% of Total
2	3,105	-	-	-	-	2,340	5,445	2
4	2,625	1,610	-	6,180	-	-	10,415	4
6	6,818	5,030	-	21,110	-	-	32,958	12
8	57,610	20,540	2,925	44,300	-	870	126,245	47
10	2,025	-	510	3,440	-	-	5,975	2
12	10,740	-	5,545		-	-	16,285	6
14	610	-	4,705	13,205	54,145	-	72,665	27
Total	83,533	27,180	13,685	88,235	54,145	3,210	269,988	100
% of Total	31	10	5	33	20	1	100	-

The existing condition of the distribution system depends greatly on the materials that were used to construct the system as well as the level of workmanship at the time of construction. Although a historical log of distribution system repairs has not be maintained, City staff believe that the majority of recent leaks in the distribution system have been observed with 6-inch diameter cast iron pipe on East Dean between Willamette and Umatilla, and East Everett between Willamette and South State.

Figure 5.5.1a – Existing Water System

Figure 5.5.1b – Existing Water System

Figure 5.5.1c – Existing Water System

Figure 5.5.1d – Existing Water System

Figure 5.5.1e – Existing Water System

In addition to the leakage observed in the above areas for cast iron pipe, the most susceptible pipe and areas for corrosion and leakage within the City's distribution system are 1) copper and steel water mains between Oak Terrace and Tanglewood Drive, on Ceder near West 6th Street, off South Comstock Road, near 1st Street between Umpqua and Calapooya Streets, and 2) other areas where cast iron pipe has been installed. The 2-inch steel water mains along Lane Street were replaced in the summer of 2005. These pipelines should be investigated to determine whether these lines leak. If they are found to be leaking, these mains should be removed and replaced.

Another area of potential concern with regard to leakage is the 14-inch diameter concrete cylinder main, which has a number of corporation stops embedded in the pipe along its length. This pipe is primarily located on the water main connecting the City's system with the Nonpareil WTP. These corporation stops should have no impact on future water flow.

As mentioned in Section 5.3, low pressure was observed downstream of the treated water pumps located at the Nonpareil WTP. Observations made by City staff of various services show that the pressure at most of these services dropped below 20 psi when the treated water pumps are off. Under these conditions, there is a potential for backflow into the water main. Consequently, these services are not in conformance to Health Division rules in regards to maintaining 20 psi at all times.

The inability of the Oak Hills Tank to fill to its overflow elevation is likely due to 8-inch diameter water main located on Central Avenue between this tank and the WTPs and other tanks. This water main is too small for serving the west side of town and the Oak Hills Tank. A larger diameter water main will reduce the friction losses and increase fire flow availability in this section of the City's distribution system.

Computer modeling was conducted to analyze the performance of the existing City of Sutherlin water system. Hydraulic analysis software called WaterCad® by Haestad Methods was used to perform the complex calculations necessary to analyze the water system. The diameter and materials of each pipeline section was input to the computer model. A discussion on the computer modeling results of the distribution system is presented in Section 8.

Service Areas

The City's distribution system is currently divided into four service zones to keep pressures within commonly accepted pressure ranges. These service zones are referred to the following designations (HGE 1997): 1) low-level, 2) mid-level, 3) first high-level, and 4) second high-level. A summary of each service zone with approximately elevations served, estimated static pressures, and associated reservoir tanks and booster pump stations is provided in Table 5.5.3.

TABLE 5.5.3
SUMMARY OF SERVICE AREAS(1)

Service Zone	Service Area	Approx. Service Elevation Range, ft	Approx. Static Pressure Range, psi	Associated Reservoirs	Associated Pump Stations
Low Level	Sutherlin	400 – 600	40 - 130	Umpqua Calapooya Oak Hills	Nonpareil WTP Cooper Crk WTP
Mid-Level	Schoon Mt	560 - 700	40 - 110	Schoon Mt	Schoon Mt
	Tanglewood	600 - 760	40 - 115	Tanglewood	Tanglewood
	Upper Umpqua	600 - 760	40 - 115	Upper Umpqua	Umpqua
1st High Level	Ridgewater	760 - 870	40 - 90	Ridgewater No. 1 & No. 2	Ridgewater located at Cooper Crk WTP
2nd High Level	Upper Ridgewater	860 - 950	40 - 80	Hydropneumatic Tanks – 2	Upper Ridgewater

(1) – Based on information from HGE (1997)

Booster Pump Stations

Booster pump stations are utilized to pump water to reservoir tanks and boost pressures from lower level service areas to higher service areas. A summary of the booster pump stations within the City to pump water from the Low-Level Service Area to Mid-Level and High Level Service Areas is given in Table 5.5.4.

TABLE 5.5.4
EXISTING BOOSTER PUMP STATIONS(1)

Station	No. of Pumps	Hp	Flow (gpm)(2)	TDH (feet)(2)
Ridgewater – 1st High-Level	2	30	250	250
Ridgewater – 2nd High-Level	2	1	50	95
Schoon Mt.	2	30	125	220
6th & Oak	1	30	400	300
Umpqua	1	25	300	200

(1) – Based on information from HGE (1997)
(2) – Design Capacity

5.6 Financial Management

The financial management of the City's water system was reviewed by examining the current system charges, revenue, and operations and maintenance budget.

System Charges and Revenue

The City collects water system charges to retire debt and finance the operation and maintenance of the water system. A summary of the current system charges is given below in Table 5.6.1.

TABLE 5.6.1
MONTHLY WATER SYSTEM CHARGES(1)

Service	Base Rate	Variable Rate $/1,000 gals.
Residential		
¾- Inch	$17.25	$1.35
1- Inch	$23.00	$1.35
1½ -Inch	$30.50	$1.35
2- Inch	$39.00	$1.35
Commercial		
¾ - Inch	$20.00	$1.35
¾ - Inch D	$31.00	$1.35
1- Inch	$23.00	$1.35
1½ - Inch	$30.50	$1.35
2- to 3- Inch	$39.00 - $50.50	$1.35
4- to 10- Inch	$72.50 – 249.00	$1.35
County		
¾- Inch	$29.50	$2.70
1- Inch	$41.00	$2.70
1½ -Inch	$59.00	$2.70
2- Inch	$73.00	$2.70
4- to 6-Inch Commercial	$140.00 - $253.00	$2.70

(1) – Charges shown in this table do not show for of the individualized accounts.

The City collects other revenue for the water system operation from user deposit refunds, service fees, new connections and other miscellaneous sources. A summary of the revenue budget for the fiscal year 2005-2006 is presented in Table 5.6.2

TABLE 5.6.2
WATER OPERATIONS REVENUE: FUND 32 (2005-2006 BUDGET)

Item	Amount ($)
Collection Charges	1,138,560
Connection Charges	10,000
Turn On Fees	11,500
Special West Side SDCs	10,000
Interest Earned	18,500
Beginning Fund Balance	193,725
Total	1,382,285

Operation and Maintenance Budget

Each fiscal year, the City proposes, approves and adopts an operation and maintenance (O&M) budget for the water system. The Public Works Operations Fund is an internal service fund, which acts as a cost center for personnel, equipment and materials to the other internal Divisions. A portion of the O&M budget is directed to the Water Reserve Fund, which was created for the distribution of funds required by the Division's Capital Improvement Plan. Additional funds are distributed to the Water Debt Service Fund for the purpose of timely payments of long-term financing of water system improvements. Some monies must also be appropriated to the General Fund. The City has an additional Water Construction Fund created to account for the receipt and distribution of funds for major replacement or additions to the water system infrastructure.

TABLE 5.6.3
WATER OPERATIONS REQUIREMENTS: FUND 32 (2005-2006 BUDGET)

Item	Amount ($)
Public Works Operations	686,121
Materials & Services	240,905
Water Reserve Fund	6,000
Debt Service Fund	225,000
General Fund	147,998
Water Construction Fund	0
Unappropriated Funds	76,261
Total	1,382,285

Water Use and Projected Demands

Section

6

6.1 Description and Definitions

Water demand can be defined as the quantity of water delivered to the system over a period of time to meet the needs of consumers, provide filter backwashing water, and to supply the needs of fire fighting and system flushing. In addition, virtually all systems have an amount of leakage or loss that cannot be feasibly or economically reduced or eliminated. Total demand, therefore, includes all consumption and lost water. Demand varies seasonally with the lowest usage in winter months and the highest usage during summer months. Variations in demand also occur with respect to time of day (diurnal) with higher usage occurring during the morning and early evening periods and lowest usage during nighttime hours.

The objective of this section is to determine the current water demand characteristics and to project future demand requirements that will establish system component adequacy and sizing needs. Water demand is described in the following terms:

Average Annual Demand (AAD) - The total volume of water delivered to the system in a full year expressed in gallons. When demand fluctuates up and down over several years, an average is used.

Average Daily Demand (ADD) - The total volume of water delivered to the system over a year divided by 365 days. The average use in a single day expressed in gallons per day.

Dry Season Daily Demand (DDD) – The gallons per day average during the months of June through October.

Maximum Monthly Demand (MMD) - The gallons per day average during the month with the highest water demand. The highest monthly usage typically occurs during a summer month.

Peak Weekly Demand (PWD) - The greatest seven day average demand that occurs in a year. Expressed in gallons per day.

Maximum Day Demand (MDD) - The largest volume of water delivered to the system in a single day expressed in gallons per day. The MDD is commonly used to size facilities to provide capacity for periods of high demand. The MDD is usually occurs during the warmest part of the year when agriculture, irrigation, and recreational uses of potable water are at their greatest and, commonly, associated with a holiday, such as Fourth of July, or during a event, such as a County Fair.

Peak Hourly Demand (PHD) - The maximum volume of water delivered to the system in a single hour expressed in gallons per day. Distribution systems should be designed to adequately handle the peak hourly demand. During this peak usage, storage reservoirs supply the demand in excess of the maximum day demand. Peak hour demand is commonly experienced during the early morning hours when many water users are bathing, cooking, and engaging in other activities that require widespread water use.

Demands described above, expressed in gallons per day (gpd), can be divided by the population served to come up with a demand per person or a per capita demand which is expressed in gallons per capita per day (gpcd). Per capita demands can be multiplied by future population projections to determine future water demands.

In addition to water demand parameters, various terms are used and values calculated that are related to water conservation. These water conservation terms are described below (EPA 1998).

Loss/Lost Water - Metered source water less revenue producing water and authorized unmetered water uses.

Nonaccount Water - Metered source water less metered water sources.

Unaccounted-For Water -The amount of nonaccount water less known or estimated losses and leaks.

For most communities, the known or estimated losses and leaks within a water system are not known. Rather the amount of system lost or leakage is estimated based on an audit of water usage within the system. To the extent possible, we will utilize the above water conservation terms in this report.

6.2 Current Water Demand

For the purposes of this study, current water demand was evaluated from three different perspectives: water consumption, water treated, and water diverted. These different water demands are discussed in detail below.

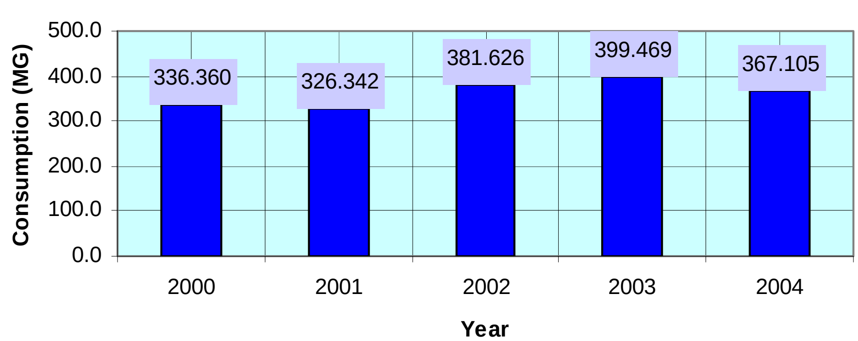
Water Consumption

Water consumption or sales records allow for determination of actual water consumption by the City's water users, calculation of an Equivalent Dwelling Unit (EDU) and provide measurement of nonaccount water when compared with plant production records.

Water Sales

For this study, water consumption is based on the City's water consumption records for the Years 2000 to 2005. A graph of the total annual amount of water sold to customers, including bulk water sales, is presented in Figure 6.2.1.

FIGURE 6.2.1 TOTAL ANNUAL WATER CONSUMPTION, YEAR 2000 - 2005



The largest amount of water consumed was in the Year 2003. The amount of water consumed by different users (residential, commercial, etc.) within the distribution system is discussed below under Equivalent Dwelling Units.

Equivalent Dwelling Units

The number of equivalent dwelling units (EDUs) or residential housing units within a system is determined to calculate the average cost for water services to a typical residence. The average cost per residential connection is not only used to inform the system users but is also used by regulatory and funding agencies for comparing costs with other communities. Since a water system typically consists of commercial, institutional, and industrial users, the most common method of calculating the average residential user cost is to evaluate each source on the basis of water consumption relative to the typical residential account or equivalent dwelling unit (EDU).

Total water consumption data for users within the City is compiled over a period of time (typically a year). Residential usage is determined by subtracting commercial and industrial contributions from the total water usage. The average water usage per EDU is calculated by dividing the residential water usage by the total number of dwelling units within the City. The total number of EDUs is determined by dividing the total water usage by the average water usage per EDU.

For the EDU calculation, the different sources or sectors within the City were divided into the following categories.

- Residential (single family dwellings, mobile home parks, multi-family, and assisted living).
- Commercial/Industrial (e.g. supermarkets, motels, etc.)
- Schools (Grade, Middle and High Schools).
- Public/non-profit (e.g. post office, BLM, Douglas County, churches, etc.).

While the high school and grade schools are public, these schools were separated from the public/non-profit sources because of their significant water consumption within the City. In addition to these categories, the EDU calculation was also subdivided into inside and outside the City Limits to document the amount of water consumed outside the City.

The estimated number of EDUs within the City is summarized in Table 6.2.1. The estimated annual residential water consumption per EDU, based calendar year 2004, is 79,900 gallons per EDU per year. Based on an estimated service population of 7,360, the average per capita consumption is approximately 136.5 gallons per capita per day. The total number of EDUs within the City's service area was calculated from the quotient of the total annual water consumption for each source by the annual residential usage (79,900 gallons/EDU-year). The total number of EDUs for each source was rounded to the nearest EDU.

TABLE 6.2.1
ESTIMATED NUMBER OF EDUs BASED ON WATER CONSUMED (Year 2004)[1]

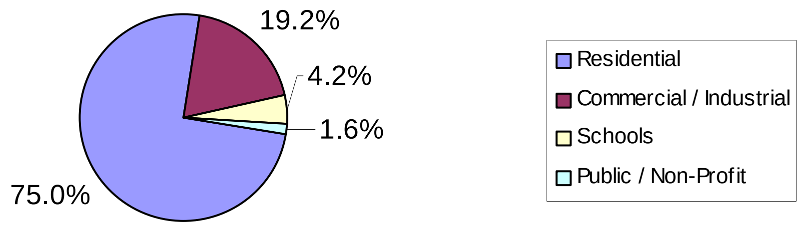
Source	Number of Connections	Est. Water Usage		EDU's	% of Usage
		Annual, gpy	ADD, gpd		
Residential (Inside City)					
Single Family	1,957	183,342,630	502,309	1,957	42.6
Mobile Home Parks	11	48,092,924	131,761	814	17.7
Multi-Family	69	18,925,454	51,851	333	7.3
Assisted Living	2	2,732,090	7,485	75	1.6
Subtotal	2,039	253,093,098	693,406	3,179	69.2
Residential (Outside City)					
Single Family	260	21,683,122	59,406	260	5.7
Total Residential	**2,299**	**274,776,220**	**752,812**	**3,439**	**74.9**
Commercial / Industrial					
Inside City	215	69,669,536	190,875	872	19.0
Outside City	3	535,950	1,468	7	0.2
Bulk Water	**3**	497,403	1,363	6	0.1
Total Commercial	**218**	**70,702,889**	**193,706**	**885**	**19.3**
Schools					
Grade / Middle / High	**13**	**15,582,976**	**42,693**	**195**	**4.2**
Public / Non-Profit					
Inside City	39	5,903,877	16,175	74	1.6
Outside City	4	138,910	381	2	0.04
Total Public / Non-Profit	**43**	**6,042,787**	**16,556**	**76**	**1.6**
TOTAL	**2,574**	**367,104,872**	**1,136,946**	**4,595**	**100.0**

[1] - Number of EDUs based on 79,900 gallons per EDU per year, does not include City Services.

It should be reiterated that Table 6.2.2 shows the average consumption levels within the system. All losses, nonaccount water, and other water uses are not accounted for within the consumption data. Water system planning requires that all water diverted from the source be analyzed and considered as total water system consumption.

Residential sources account for approximately 75 percent of all water consumed within the City. The remaining system users (i.e. commercial/industrial, schools, public/non-profit) utilize 25 percent of the City metered water. Users within the City account for approximately 94 percent of the water consumed; approximately 6 percent of the water users are outside the City Limits. The distribution of water consumed within the City is summarized in Figure 6.2.2.

FIGURE 6.2.2. WATER CONSUMED BY SOURCE



Water Treated

For planning purposes, demand projections and unit design factors for water consumption should be based on the City's yearly water production data rather than historical customer water consumption records (meter readings) since leaking water mains its water system. This methodology incorporates all system losses and unmetered usage in the projected water requirements developed later in this Master Plan. The amounts of treated water produced, pumped to the City for consumption, and utilized for backwash are discussed below.

Water Treatment Plant Production

The amount of water produced at the water treatment plant and sent to the City for consumption is based on daily records maintained by the City staff. The amount of treated water produced at a WTP is typically equal to the sum of the amount of water sent to the City for consumption plus the amount of water used for backwash, and miscellaneous water usage at the WTP (e.g. for pump seals, sanitary usage, etc.). As the City does not currently record miscellaneous water usage at the WTP, this miscellaneous usage at the WTP is not known. Consequently for this study, water treatment plant production will be based on the sum of water pumped to the City for consumption and the amount of water used for backwash.

Water production rates were derived from the plant data for average annual demand (AAD), average daily demand (ADD), maximum monthly demand (MMD), peak weekly demand (PWD), and maximum daily demand (MDD). A definition of each of these water demand parameters was previously given in Section 6.1. A summary of the compiled water demand parameters for the Years 2000 to 2004 is presented in Table 6.2.2. The maximum water production for the time periods reviewed was observed in the Year 2003.

TABLE 6.2.2
ANNUAL, MONTHLY, WEEKLY & DAILY WATER PRODUCTION W/BACKWASH

Time Period	AAD, gpy	ADD, gpd	DDD, gpd	MMD, gpd	PWD, gpd	MDD, gpd
2004	560,682,360	1,536,116	1,923,212	2,545,401	2,833,107	3,163,250
2003	577,142,000	1,581,211	2,162,209	2,764,377	2,931,464	3,382,250
2002	538,655,320	1,475,768	1,950,647	2,399,088	2,731,929	3,196,750
2001	520,276,314	1,425,415	1,803,256	2,158,272	2,403,714	2,498,750
2000	556,539,840	1,524,767	1,951,198	2,354,863	2,776,250	3,252,750
Average	550,659,167	1,508,655	1,958,104	2,444,400	2,735,293	3,098,750

AAD/ADD. Over the past five years, the overall annual average water production has ranged from 520 to 577 million gallons (MG) per year or approximately 1.42 to 1.58 MGD. The average water production over this period was 1.5 MGD or approximately 550 MG per year. The highest water production was observed in the Year 2003.

DDD. The DDD value represents the daily water production during the dry season months (June through October), which includes the highest water demand months (usually July or August). Although this value is not typically calculated for water systems, it is presented in this report to allow a comparison of dry season production with available water to be diverted from the City's raw water sources. The DDD over the time period reviewed averaged approximately 1.96 MGD with a flow of 2.16 MGD observed in Year 2003.

MMD. The MMD represents the highest flow produced over a month. For the City of Sutherlin, the MMD typically occurs in the months of July or August. From the Year 2000 to 2005, the MDD ranged from approximately 2.16 to 2.76 MGD. The average MMD flow for this period was 2.44 MGD.

PWD. The PWD is the peak water production over a week. This flow usually occurs during the month of the highest water production (i.e. July or August). The PWD over the last five years has ranged from 2.40 to 2.93 MGD.

MDD. The MDD values given in Table 6.2.3 are the highest daily water production rates for the given time periods. The MDD typically occurs the month and peak week of maximum water production. Over the last five years, the MDD has ranged from approximately 2.5 to 3.38 MGD. The average MDD over this time period was approximately 3.1 MGD.

Peaking factors are commonly used to develop relationships between the ADD and the other planning criteria. These factors are used primarily for calculating future water demand. Peaking factors tend to be consistent from one water system to another. Typically, MMD is approximately 1.5 times the ADD while the PWD is generally between 1.5 and 2.0 times the ADD. Peaking factors between 2 and 2.5 are commonly used for MDD. As the DDD is a unique value for this study, there are no typical peaking values for comparison. A summary of the calculated flow peaking factors is presented in Table 6.2.3.

TABLE 6.2.3
SUMMARY OF TREATED WATER FLOW PEAKING FACTORS (w/BACKWASH)

Time Period	DDD/ADD	MMD/ADD	PWD/ADD	MDD/ADD
2004	1.25	1.66	1.84	2.06
2003	1.37	1.75	1.85	2.14
2002	1.32	1.63	1.85	2.17
2001	1.27	1.51	1.69	1.75
2000	1.28	1.54	1.82	2.13
Average	1.30	1.62	1.81	2.03

Water Pumped to the City for Consumption

The water pumped to the City for consumption represents the amount of water leaving the WTP and conveyed to the City. This value does not take into account water utilized at the WTP (e.g. backwash and miscellaneous water usage).

The amount of water pumped to the City was derived from the plant data for average annual demand (AAD), average daily demand (ADD), maximum monthly demand (MMD), peak weekly demand (PWD), and maximum daily demand (MDD). A summary of the compiled water demand parameters for water pumped to the City (Years 2000 to 2004) is presented in Table 6.2.4.

TABLE 6.2.4
ANNUAL, MONTHLY, WEEKLY & DAILY WATER PUMPED TO THE CITY

Time Period	AAD, gpy	ADD, gpd	DDD, gpd	MMD, gpd	PWD, gpd	MDD, gpd
2004	527,037,000	1,443,937	1,799,386	2,339,032	2,603,286	2,927,000
2003	533,924,000	1,462,805	1,981,889	2,463,548	2,679,143	2,966,000
2002	502,411,000	1,376,468	1,822,209	2,201,065	2,478,000	2,893,000
2001	482,698,400	1,322,461	1,666,908	1,980,355	2,225,286	2,388,000
2000	519,978,000	1,424,597	1,802,392	2,145,839	2,514,286	2,994,000
Average	513,209,680	1,406,054	1,814,557	2,225,968	2,500,000	2,833,600

The peak hourly demand (PHD) is often used in the computer modeling process to ensure that the storage and distribution system will continue to function during short, peak demand situations. This value may be calculated by plotting the probability of occurrence of demand versus the various water demand values. From this logarithmic plot, the PHD value can be extrapolated.

The PHD was estimated by means of an extrapolation based on probability. Such a projection is based on the principle that an average monthly flow is likely to occur 6/12 of the time or 50%, and a peak monthly flow occurs 1/12 of the time or 8.3%. Likewise, peak weekly flow will take place 1/52 of the time or 1.9%; peak daily flow occurs once in 365 days or 0.27%, a peak hour flow happens once in 8,760 hours or .011%. Using this method and the flow data for the Year 2003 (MDD = 2.966 MGD; PWD = 2.679 MGD; MMD = 2.463 MGD; ADD = 1.462 MGD), the PHD for Sutherlin was estimated to be 4.1 MGD. The calculated peaking factor (PHD/ADD) is 2.80, which is slightly less than the range of peak factors of 3 to 5 commonly used for PHD.

A summary of the calculated flow peaking factors is presented in Table 6.2.5.

TABLE 6.2.5
SUMMARY OF TREATED WATER PUMPED TO CITY FLOW PEAKING FACTORS

Time Period	DDD/ADD	MMD/ADD	PWD/ADD	MDD/ADD
2004	1.25	1.62	1.80	2.03
2003	1.35	1.68	1.83	2.03
2002	1.32	1.60	1.80	2.10
2001	1.26	1.50	1.68	1.81
2000	1.27	1.51	1.76	2.10
Average	1.29	1.58	1.78	2.01

Nonaccount Water

Water sold is typically less than the amount of water produced at the plant due to system leaks, unmetered use at the WTP (backwash water, turbidimeter water, wash down, etc.), unmetered use within the distribution system, inaccuracies in customer meters, and other unmetered use such as fire flows and system flushing. A comparison of the amount of water treated (sum of water pumped to the City and backwash), and the amount of water consumed is given in Table 6.2.6.

TABLE 6.2.6. COMPARISON OF WATER PRODUCED, BACKWASH, PUMPED & CONSUMED

Time Period	Water Produced	Backwash	Water Pumped	Water Consumed	% Nonaccount[1]
2004	559,214,000	32,177,000	527,037,000	367,105,000	30
2003	575,254,000	41,330,000	533,924,000	399,469,000	25
2002	537,071,000	34,660,000	502,411,000	381,626,000	24
2001	518,594,650	35,896,250	482,698,400	326,342,000	32
2000	554,948,000	34,970,000	519,978,000	336,360,000	35
Average	549,016,330	35,806,650	513,209,680	362,180,400	29

(1) - % Unaccounted is based on the quotient of the water consumed and water pumped to the City.

Over the last five years, the average amount of nonaccount water pumped to the City is approximately 29 percent. Previously, the percent of nonaccount water within the City has been reported as 27.5 percent in 1995-96, and 39 percent in 1974 (HGE 1997). Potential sources of lost treated water include the following.

- Leakage within the City's water distribution system.
- Inaccurate water meters
- Unauthorized use or connections without meters
- Unmetered water for fire-fighting and operations such as street cleaning, water main flushing and testing.
- Other approved, but non-metered, water uses.

The Oregon Administrative Rules (OAR) Section 690-86, states that all water systems should work to reduce system leakage levels to 15 percent. If the reduction of system leakage to 15 percent is found to be feasible, the water provider should work to reduce system leakage to ten percent. With the amount of nonaccount water within its system, the City should strive to account and reduce the nonaccount water, and increase system efficiency. Reductions in lost water can result in increased revenues, reduced expenses, and improved water system performance. Measures and programs to account for and reduce water losses are discussed in Section 9.

Water Diverted

As part of the auditing process, the City must account for all water diverted from each source. This is typically accomplished through a metering device at or near the point of diversion. OAR 690-085-0015 requires that, "Where practical, water use shall be measured at each point of diversion." However, the rule also states that:

> "...measurements may be taken at a reasonable distance from the point of diversion if the following conditions are met:
>
> a) The measured flow shall be corrected to reflect the flow at the point of diversion. The correction will be based on periodic flow measurements at the point of diversion taken in conjunction with flow measurements at the usual measuring point;
>
> b) If the measured flow includes flow contributions from more than one point of diversion, the measured flow shall be proportioned to reflect the flow at each point of diversion using the method prescribed subsection (a) of this section;
>
> c) A description of the correction method shall be submitted with the annual report the first time it is used and any time it is changed, or once every five years, whichever is shorter."

If the point of diversion is relatively close to the water treatment plant, it is common for many communities to use a single influent meter at the water plant to measure the amount of water that is diverted.

As mentioned in Section 5.1, there is concern about the accuracy of the raw water flow meters. For this, the amount of diverted water from each source was calculated based on the sum of the amount of water pumped to the City, and backwash water, which is the WTP water production.

Summary

The current water demand parameters for water production and water pumped to the City were compiled and are provided in Tables 6.2.7 and 6.2.8. These parameters were primarily based on the water demand data for the year of the highest demand (Year 2003) within the Study Period. These water demand criteria will serve as the basis for the planning criteria of this Master Plan.

TABLE 6.2.7
SUMMARY OF CURRENT DEMAND OF WATER PRODUCED

Demand Parameter	Total, gpd	Peaking Factor	Per Capita Demand, gpcd (1)
Average Daily Demand, ADD	1,581,200	1.0	215
Dry Season Daily Demand, DDD	2,162,000	1.37	294
Maximum Month Demand, MMD	2,764,000	1.75	375
Peak Weekly Demand, PWD	2,931,000	1.85	398
Maximum Daily Demand, MDD	3,382,000	2.14	460

(1) – Based on population of 7,360 in Year 2004; value rounded.

TABLE 6.2.8
SUMMARY OF CURRENT DEMAND OF WATER PUMPED TO THE CITY

Demand Parameter	Total, gpd	Peaking Factor	Per Capita Demand, gpcd (1)
Average Daily Demand, ADD	1,462,800	1.0	199
Dry Season Daily Demand, DDD	1,982,000	1.35	269
Maximum Month Demand, MMD	2,465,000	1.68	335
Peak Weekly Demand, PWD	2,679,000	1.83	364
Maximum Daily Demand, MDD	2,966,000	2.03	403
Peak Hourly Demand, PHD (2)	4,100,000	2.80	557

(1) – Based on population of 7,360 in Year 2004; value rounded.

6.3 Projected Water Demand

Water demands are projected into the future using the past records of water produced and water sold along with projected population estimates and anticipated additional water demand (i.e. industry). The goal of projecting future water demand is not to build larger facilities to accommodate excessive water consumption, but rather to evaluate the capability of existing components and to size new facilities for reasonable demand rates. Large amounts of leakage and excessive water consumption should not be projected into the future estimates. Rather, efforts should be made to reduce leakage and lost water to a reasonable level and utilize lower, more acceptable demand rates for planning efforts. Water demand projections should be based on acceptable water loss quantities, reasonable conservation measures, and the community's expected water use characteristics.

There is a degree of uncertainty associated with future water demand projections for any community. Uncertainties in projections exist because of the estimates used to define the community's current water use and the built-in assumptions made with respect to anticipated growth in a community. The impact of water conservation measures on a community's future water consumption also is difficult to predict.

Future Per Capita Water Usage and Growth

The U.S. Department of the Interior documented the per capita water use for Oregon in the 1995 U.S. Geological Survey - Circular 1200. According to the study, the average per capita water use for Oregon is 235 gallons per capita day (gpcd) including domestic, commercial, industrial, and public use and loss. Of the total 235 gpcd, 53 percent is domestic use, 14 percent is commercial, 17 percent is industrial, and 16 percent is public use and loss. An interagency team made up of personnel from the DEQ, Oregon Economic and Community Development Department (OECDD), Oregon Health Division (OHD), the Oregon Department of Water Resources (WRD), the USDA-Rural Utilities Service, Rural Community Assistance Corporation, and the Department of Land Conservation and Development has developed target design numbers based on the USGS study and their experience with Oregon communities. The team has adopted a maximum ADD of 235 gpcd, a MDD of 588 gpcd (2.5 times the ADD), and a PHD of 1,175 gpcd (5 times the ADD).

Based on water production records, the average per capita use in Sutherlin is 215 gpcd, which is slightly lower than the interagency team maximum ADD design value of 235 gpcd. Likewise, the calculated MDD and PHD for Sutherlin are also lower than the interagency design values. For this study, future water demand for water pumped to the City will be based on the current water pumped parameters (per capita usage), projected growth within the City (see Section 3.3), and anticipated unaccounted water. This methodology assumes that water demand characteristics within the City will basically remain the same as the existing per capita basis with allowances for changes in anticipated nonaccount water. The future water demand for water production was calculated in a similar manner as that for water pumped to the City with the exception that per the water production capita values were reduced assuming that the amount of backwash water resulting from a new Cooper Creek WTP will be at least one-half (based on percentage) of its current amount. The future anticipated nonaccount water is discussed below.

Anticipated Lost Water

Responsible water planning should not include the propagation of high lost water levels into water demand projections. According to OAR 690-86-140, a water system should endeavor to reduce system leakage to 15 percent or less of the total water diverted from their raw water sources. As developed previously in this section, the nonaccount water within the City is on the order of 29 percent. In order to be in compliance with OAR, Division 86 and to improve system efficiency, the City must work to reduce this level to 15 percent and, once obtained, thence strive for 10 percent.

In order to project the water demand values into the future with reasonable levels of nonaccount water, two separate scenarios were developed and evaluated. The first scenario (Scenario No. 1) is based on the nonaccount water within the City being reduced to 20 percent by the Year 2010, 15 percent by the Year 2015, 12 percent by the Year 2020, and 10 percent for the Years 2025 to 2046. For Scenario No. 2, it is anticipated that the amount of nonaccount water within the City will be reduced to 25 percent by the Year 2010, 20 percent by the Year 2015, and to 15 percent by the Year 2025 through the Year 2046. The future projected water demand for each scenario was calculated assuming these anticipated levels of unaccounted/loss water.

The City will hopefully be able to reduce the percentage of nonaccount water more quickly and to lower levels (ultimately to 10 percent and less). However without knowing the source of the nonaccount water, it is difficult to determine the exact magnitude and timing of these reductions. Consequently, the above percentages of nonaccount water were utilized to be conservative in assessing the City's future water needs. If the City is not capable of reducing lost water to these levels, future demands will likely be greater than those developed within this section.

Summary of Future Water Demand

A summary of the water production demand projections using Scenario No. 1 and Scenario No. 2 is presented in Tables 6.3.1 and 6.3.2, respectively. The water production demand projections presented in Table 6.3.2 (Ultimate nonaccount water at 15%, the more conservative value) will be used in this Master Plan to evaluate the City's water sources and size its raw water and WTP facilities for future demand.

TABLE 6.3.1
FUTURE WATER PRODUCTION DEMAND – SCENARIO NO. 1,
ULTIMATE NONACCOUNT WATER 10%

Parameter/Year	2010	2015	2020	2025	2034	2046
Total Population	9,364	10,594	12,000	13,606	16,606	19,606
% Nonaccount Water	20	15	12	10	10	10
Water Demand						
ADD, gpd	1,761,800	1,876,000	2,052,500	2,275,500	2,777,300	3,279,000
DDD, gpd	2,376,800	2,530,800	2,769,000	3,069,800	3,746,700	4,423,500
MMD, gpd	2,950,200	3,141,400	3,437,000	3,810,400	4,650,600	5,490,800
PWD, gpd	3,141,400	3,345,000	3,659,700	4,057,300	4,951,900	5,846,500
MDD, gpd	3,615,100	3,849,400	4,211,600	4,669,100	5,698,600	6,728,100

TABLE 6.3.2
FUTURE WATER PRODUCTION DEMAND – SCENARIO NO. 2,
ULTIMATE NONACCOUNT WATER 15%

Parameter/Year	2010	2015	2020	2025	2034	2046
Total Population	9,364	10,594	12,000	13,606	16,606	19,606
% Nonaccount Water	25	20	17	15	15	15
Water Demand						
ADD, gpd	1,879,300	1,993,300	2,176,200	2,409,400	2,940,600	3,471,900
DDD, gpd	2,535,300	2,689,000	2,935,800	3,250,400	3,967,100	4,683,800
MMD, gpd	3,146,900	3,337,800	3,644,100	4,034,600	4,924,200	5,813,800
PWD, gpd	3,350,800	3,554,000	3,880,200	4,296,000	5,243,200	6,190,400
MDD, gpd	3,856,100	4,089,900	4,465,300	4,943,800	6,033,800	7,123,900

Summaries of the future water pumped to the City demands with Scenarios No. 1 and No. 2 are provided in Tables 6.3.3 and 6.3.4, respectively. The projections in Table 6.3.4 (Ultimate nonaccount water at 15%, the more conservative value) will be utilized to size the City's water distribution facilities.

TABLE 6.3.3
FUTURE WATER PUMPED TO CITY DEMAND – SCENARIO NO. 1
ULTIMATE NONACCOUNT WATER 10%

Parameter/Year	2010	2015	2020	2025	2036	2046
Total Population	9,364	10,594	12,000	13,606	16,606	19,606
% Nonaccount Water	20	15	12	10	10	10
Water Demand						
ADD, gpd	1,651,700	1,756,800	1,924,300	2,133,300	2,603,700	3,074,100
DDD, gpd	2,237,900	2,382,900	2,607,100	2,890,300	3,527,600	4,164,900
MMD, gpd	2,781,700	2,961,900	3,240,600	3,592,700	4,384,900	5,177,000
PWD, gpd	3,025,100	3,221,100	3,524,300	3,907,100	4,766,600	5,630,100
MDD, gpd	3,349,100	3,566,100	3,901,700	4,325,500	5,279,300	6,233,000
PHD, gpd	4,629,500	4,929,500	5,393,400	5,979,300	7,297,700	8,616,100

TABLE 6.3.4
FUTURE WATER PUMPED TO CITY DEMAND – SCENARIO NO. 2
ULTIMATE NONACCOUNT WATER 15%

Parameter/Year	2010	2015	2020	2025	2036	2040
Total Population	9,364	10,594	12,000	13,606	16,606	19,606
% Nonaccount Water	25	20	17	15	15	15
Water Demand						
ADD, gpd	1,761,800	1,868,700	2,040,200	2,258,800	2,756,900	3,254,900
DDD, gpd	2,387,000	2,531,800	2,764,200	3,060,400	3,735,100	4,409,900
MMD, gpd	2,967,100	3,147,000	3,435,900	3,804,000	4,642,800	5,481,600
PWD, gpd	3,226,800	3,422,500	3,736,600	4,137,000	5,049,100	5,961,300
MDD, gpd	3,572,300	3,789,000	4,136,700	4,580,000	5,590,000	6,559,700
PHD, gpd	3,818,800	5,237,600	5,718,300	6,332,000	7,727,000	9,122,900

Design Criteria and Cost Basis

Section 7

7.1 Design Life of Improvements

The design life of a water system component is sometimes referred to as its useful life or service life. The selection of a design life is a matter of judgment based on such factors as the type and intensity of use, type and quality of materials used in construction, and the quality of workmanship during installation. The estimated and actual design life for any particular component may vary depending on the above factors. The establishment of a design life provides a realistic projection of service upon which to base an economic analysis of new capital improvements.

As discussed in Section 2, the base planning period for this Master Plan is 20 years, ending in the year 2025. With the additional two 3,000 population increments, the planning period would extend to the Year 2046 based on an annual growth of 2.7 percent. The planning period is the time frame during which the recommended water system is expected to provide sufficient capacity to meet the needs of all anticipated users. The required system capacity is based on population, water demand projections, and land use considerations. The planning period for a water system and the design life for its components may not be identical. For example, a properly maintained steel storage tank may have a design life of 60 years, but the projected fire flow and consumptive water demand for a planning period of 20 years determine its size. At the end of the initial 20-year planning period, water demand may be such that an additional storage tank is required; however, the existing tank with a design life of 60 years would still be useful and remain in service for another 40 years. The typical design life for system components are discussed below.

Raw Water Intakes and Transmission

Intake structures including concrete impoundments should have design lives of 50 to 100 years when properly constructed and maintained. Water transmission piping should easily have a design life of 40 to 60 years if quality materials and workmanship are incorporated into the construction. Modern PVC and cement mortar-lined ductile iron piping can last up to 100 years when properly designed and installed.

The lives of wells and well heads vary widely depending on the magnitude of the well, the draw-down of the aquifer by other consumers, the recharging of the well by main sources, the type and quality of the well water, and many other quantities. Though it is not uncommon to obtain more than 50 years of service from a single high production well, a well life of 20 years is often used due to the uncertainties associated with these groundwater sources.

Water Treatment Facility

Major structures and buildings should have a design life of approximately 50 years. Pumps and equipment usually have a useful life of about 20 years. The useful life of treatment equipment can be extended when properly maintained if additional treatment capacity is not required. Filter media normally has a design life of ten to 15 years. Flow meters typically have a design life of ten to 15 years. Valves usually need to be replaced after 15 to 20 years of use.

Treated Water Transmission and Distribution Piping

Water transmission and distribution piping should easily have a design life of 40 to 60 years if quality materials and workmanship are incorporated into the construction. Modern PVC and cement mortar lined ductile iron piping can last up to 100 years when properly designed and installed.

Treated Water Storage

Distribution storage tanks should have a design life of 50 to 60 years (glass-fused-to-steel construction) to 70 to 80 years (concrete and welded steel construction). Steel tanks with a glass-fused coating can have a design life similar to concrete construction. Actual design life will depend on the quality of materials, the workmanship during installation, and the timely administration of maintenance activities. Several practices, such as the use of cathodic protection, regular cleaning and frequent painting can extend or assure the service life of steel reservoirs.

7.2 Sizing and Capacity Criteria

Demand projections presented in Section 6.3 are based on population projections offered in Section 3.3. The projections assume an average 2.7 percent annual growth rate until the Year 2025. As discussed in Section 3.3, two additional population increments of 3,000 people were also examined in addition to the 2.7 percent annual increase. With these increments and based on a 2.7 percent annual growth for the entire period, the study period would extend to the Year 2046.

Accurately predicting growth is difficult, especially beyond 20 years into the future. As time progresses, all of the projections should be updated to reflect actual population and demand. The analysis and presentation of recommended improvement alternatives can be found in Section 8.

Raw Water Source

The water sources and reservoirs must be capable of meeting maximum daily demand of the system over a period of many years. The selection of a source is a long-term commitment that cannot be easily changed. Water rights are becoming more critical as the State's population and water demand increases and the number of viable water sources remains constant. Typically, water sources and reservoirs are evaluated to ensure enough water to meet the MDD 50 years into the future. In Sutherlin’s case, the water sources need to be sufficient to handle the water demand during the dry season months (June through October). The appropriate design parameter for this dry season evaluation would be the Maximum Daily Demand (DDD).

Intake and Pumping Facilities

Intake piping and wetwells are not easily expanded and should be sized to meet the anticipated maximum day demand well into the future. A design life of 50 years is common for such facilities.

Pumps and other mechanical equipment can be expected to last no more than 20 years under normal conditions before extensive maintenance or replacement is necessary. Commonly, two pumps are installed in a pumping station, each having capacity equal to the capacity of a water treatment plant or the MDD predicted within a planning period. Duplex pumping systems can be designed to alternate after each cycle to extend the life of the equipment. If future demands increase beyond the ability of a single pump, the second pump can serve as a lag pump in parallel to sustain higher flow rates during peak demand times.

Transmission Piping

The long distances and high replacement cost of the transmission lines warrant an analysis for demand beyond the normal 20-year period. The existing transmission lines must have the ability to handle at least the 20-year MDD. The capacity of the raw water and treated water transmission piping will be evaluated against the 20-year MDD and the 50-year MDD.

Water Treatment Facility

Water treatment plants are typically designed to handle the 20-year MDD flow since these facilities can be expanded and typically have an overall design life of around 20 years. The existing treatment plant components will be evaluated against the 20-year MDD flow.

Treated Water Storage

Total storage capacity must include reserve storage for equalization storage, and emergency storage and fire reserve. The interagency team (see Section 5.3) of various Oregon agencies has adopted a target storage capacity of 2.5 times the ADD plus 180,000 gallons for residential fire flow. An alternative method to analyzing the treated water storage requirements suggests itemizing the potential requirements for treated water within the system. A discussion of these various needs follows.

Equalization storage is utilized to meet fluctuations of the supply capacity of the treatment plant and peak demand of the distribution system. Equalizing storage is typically set at 25 percent of the MDD of the water system.

Emergency storage is required to protect against a total loss of water supply such as would occur with a broken transmission main, a prolonged electrical outage, treatment plant breakdown, or source contamination. The emergency storage reserve is set at one MDD or three ADD. With one MDD storage criteria, it is assumed that supply disruption will occur on a day of maximum demand and be corrected within 24 hours. The basis for the three ADD criteria is that the supply disruption could occur at anytime and would be repaired within three days.

Fire reserve storage is needed to provide sufficient water for fire suppression in the water system. The amount of fire reserve is based on the maximum flow and duration of flow needed to confine a major fire. Guidelines for determining the required fire flow and duration are generally determined using the “Fire Suppression Rating Schedule” by the Insurance Services Office (ISO) and/or the Uniform Fire Code adopted by the State of Oregon. International Fire Code (IFC) recommends fire flows of 1,000 gpm for a minimum of two hours is recommended for one or two family dwellings not exceeding two stories in height. Commercial, industrial, and institutional buildings typically require higher fire flows with longer durations. Determination of these flows are unique to each building under consideration and will depend upon such factors as the square footage of the floor area, and the type of construction based on the International Building Code (IBC).

Ideal storage capacity should be the sum of equalizing, emergency and fire reserve storage.

Another important design parameter for reservoirs is elevation. Ideally, reservoirs should be located at similar elevations to allow hydraulic balance within the distribution system. Within a given service area, the need for altitude valves, check valves, pressure reducing valves (PRVs), booster pumps, pumper trucks for extracting fire flows, and other control devices is reduced when a consistent water surface in maintained in all reservoirs. Distribution reservoirs should also be located at an elevation that maintains adequate water pressure throughout the system; sufficient water pressures at high elevations and reasonable pressures at lower elevations. The pressure range in the system should stay within the range of 25 to 100 psi.

All of the above criteria will be used to evaluate the adequacy of existing storage and the need, if any, for future additional storage in Section 8.5.

Distribution System

Distribution mains are typically sized for fire flow and 20-year population demand, or fire flow and saturation development demand. The mains should be at least 6-inch diameter to provide minimum fire flow capacity. All pipelines should be large enough to sustain a minimum line pressure of approximately 25 psi. The State of Oregon requires a water distribution system be designed and installed to maintain a pressure of at least 20 psi at all service connections at all times. The distribution system must be sized to handle the peak hourly flows and to provide fire flows while maintaining minimum pressures.

In addition to the above design criteria, the following general guidelines are recommended for the design of water distribution systems.

- 6-inch diameter lines - minimum sized lateral water main for gridiron (looped) system and dead-end mains.

- 8-inch diameter lines - minimum size for permanently dead-ended mains supplying fire hydrants and for minor trunk mains.

- 10-inch and larger diameter - as required for trunk (feeder) mains.

The distribution system lateral mains should be looped whenever possible. A lateral main is defined as a main not exceeding 8-inch diameter, which is installed to provide water service and fire protection for a local area including the immediately adjacent property. The normal size of lateral mains for single-family residential areas is 6-inch diameter. However, 8-inch diameter or greater lateral mains may be required to meet both the domestic and fire protection needs of an area.

The installation of permanent dead-end mains and dependence of relatively large areas on a single main should be avoided. For the placement of a fire hydrant on a permanently dead-ended main, the minimum size of such laterals should be 8-inch diameter. However, 6-inch diameter mains may be used for a stub out not exceeding 500 feet in length supplying a single fire hydrant not on a public street and for internal fire protection. On new construction, the minimum size lateral main for supplying fire hydrants within public ways should be 6-inch diameter provided 6-inch diameter mains are looped.

A computer model of the distribution system was developed as part of this Master Plan. The model utilized actual pipe sizes, system configuration, and materials as well as system pipe junction elevations and storage tank elevations. A computer model of the City's distribution system was checked to determine the maximum flow rate available at various locations within the system. The model was developed using a software program called WaterCAD® (version 3.1) offered by Haestad Methods.

The requirements for fire fighting within the City were developed by consulting with the City's Fire Chief. The buildings within the City that could potentially require high fire flows include the old Murphy Plywood site, High School, Middle School, Orenco, Umpqua Regency Inn and Sutherlin Plaza. For the old Murphy Plywood site fire flows were agreed to be 4,500 gpm for 2 hours. The fire flow requirements for the Mill Site may change depending upon what improvements are made to the site and the mill operation. For the High and Middle Schools, the Fire Chief recommended a minimum fire flow capability of 2,900 gpm and 3,100 gpm for 2 hours, respectively. Orenco, Umpqua Regency Inn and Sutherlin Plaza have fireflow requirements of 4,400 gpm, 6,000 gpm and 3,000 gpm, respectively. For a detailed discussion of the distribution system performance and fire flow analysis, see Section 8.6.

7.3 Basis for Cost Estimates

The cost estimates presented in this Plan will typically include four components: construction cost, engineering cost, contingency, and legal and administrative costs. Each of the cost components are discussed in this section. The estimates presented herein are preliminary and are based on the level and detail of planning presented in this Study. As projects proceed and as site-specific information becomes available, the estimates may require updating. System improvements that are recommended in the City of Sutherlin are detailed in this section along with associated costs.

Construction Costs

The estimated construction costs in this Plan are based on actual construction bidding results from similar work, published cost guides, other construction cost experience, and material prices. Reference was made to the as-built drawings, and system maps of the existing facilities to determine construction quantities, elevations of the reservoirs and major components, and locations of distribution lines. Where required, estimates will be based on preliminary layouts of the proposed improvements. Cost estimates for this Plan were primarily based on costs compiled in July 2005.

Future changes in the cost of labor, equipment, and materials may justify comparable changes in the cost estimates presented herein. For this reason, common engineering practices usually tie the cost estimates to a particular index that varies in proportion to long-term changes in the national economy. The Engineering News Record (ENR) construction cost index is most commonly used. This index is based on the value of 100 for the year 1913. Average yearly values for the past ten years are summarized in Table 7.3.1.

TABLE 7.3.1
ENR CONSTRUCTION COST INDEX – 1995 TO 2005 [(1)]

Year	Index	% Change
1995	5484	1.39
1996	5617	2.43
1997	5863	4.38
1998	5921	0.99
1999	6076	2.62
2000	6225	2.45
2001	6404	2.88
2002	6605	3.14
2003	6695	1.36
2004	7126	6.44
2005	7398	3.82
	Average Annual Change =	3.19%

[(1)] – Index based on July of each year at 20-city average labor rates and material prices.

Cost estimates presented in this Plan for construction performed should be projected with a minimum increase of three percent per year. Future yearly ENR indices can be used to calculate the cost of projects for their construction year based on the annual growth in the ENR index.

It is also recommended that in the event other public works projects are being performed in the same location, (i.e., sewer, street, storm, etc.), planning priority be given to combining these water projects with the projects at hand. In proceeding in this manner, the City will save money by eliminating repetitive mobilization, demolition, and road patching in the same locations.

Contingencies

A planning level contingency factor equal to approximately 15 percent of the estimated construction cost has been added. In recognition that the cost estimates presented are based on conceptual planning, allowances must be made for variations in final quantities, bidding market conditions, adverse construction conditions, unanticipated specialized investigation and studies, and other difficulties which cannot be foreseen at this time but may tend to increase final costs.

Engineering

The cost of engineering services for major projects typically includes special investigations, a predesign report, surveying, foundation exploration, preparation of contract drawings and specifications, bidding services, construction management, inspection, construction staking, start-up services, and the preparation of operation and maintenance manuals. Depending on the size and type of project, engineering costs may range from 15 to 25 percent of the contract cost when all of the above services are provided. The lower percentage applies to large projects without complicated mechanical systems. The higher percentage applies to small, complicated projects.

Additional engineering services may be required for specialized projects. This could include geotechnical evaluations, structural evaluations, and other specialized consulting activities.

Legal and Administrative

An allowance of seven percent of construction cost has been added for legal and administrative services. This allowance is intended to include internal project planning and budgeting, grant administration, liaison, interest on interim loan financing, legal services, review fees, legal advertising, and other related expenses associated with the project.

Land Acquisition

Some projects may require the acquisition of additional right-of-way or property for construction of a specific improvement. The need and cost for such expenditures is difficult to predict and must be reviewed as a project is developed. Effort was made to include costs for land acquisition, where expected, within the cost estimates included in this Plan.

Environmental Review

In order for a project to be eligible for Federal and/or State grants and loans, a review of anticipated environmental impacts of the proposed improvements is required. The primary goal of the environmental review is to help public officials make decisions that are based on the understanding and consideration of the environmental consequences of their actions, and to take actions that protect, restore, and enhance the environment. To accomplish these tasks, the National Environmental Policy Act (NEPA) was promulgated. NEPA requires Federal agencies or monies originating from Federal programs to either prepare or have prepared written assessments or statements that describe the 1) affected environment and environmental consequences of a proposed project, 2) reasonable or practicable alternatives to the proposed project, and 3) any mitigation measures necessary to avoid or minimize adverse environmental effects.

The environmental review will include one of the following four levels in the order of increasing complexity.

- Determination of categorical exclusion without an environmental impact or assessment report.
- Determination of categorical exclusion with an environmental impact or assessment report.
- Preparation of an environmental impact or assessment report.
- Preparation of an environmental impact statement.

Within this plan, the cost for performing the anticipated environmental review was estimated for the projects to be financed with publicly financed grants and loans. The cost for the environmental review will be based on previous experience in preparing the required documents. If funding is obtained from a public funding agency, then the City will likely be required to submit some form of environmental report that examines the potential impact of the proposed improvements on local habitat and species.

Analysis and Improvement Alternatives

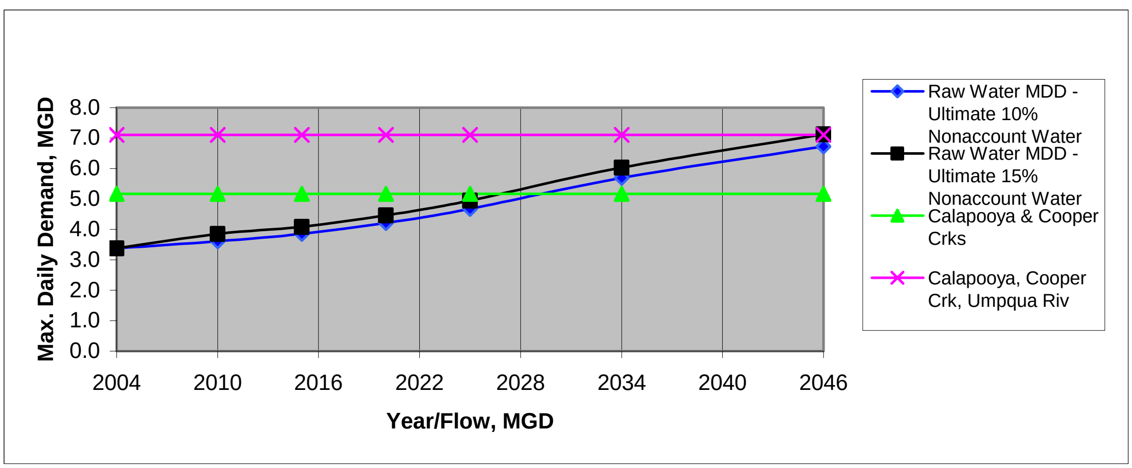
Section 8

This section of the Master Plan presents detailed analyses of each component within the system and, where appropriate, provides an evaluation of proposed alternatives and recommended option(s). For the most part, the analysis and alternatives for water conservation measures, and associated cost, are discussed and addressed in Section 9; the exception is non-potable water reuse which is evaluated in Section 8.1. Preliminary cost estimates are presented in this section for some of the alternatives. Cost estimates for the recommended improvements are given in the Capital Improvement Plan (see Section 12). Improvement phasing and potential impacts to ratepayers are discussed in Section 13.

8.1 Raw Water Sources and Water Rights

As presented in Section 5.1, the City has water rights for 4.0 cfs on Calapooya Creek, 5.0 cfs on Cooper Creek with 500 acre-feet of storage in Cooper Creek Reservoir, and 3.0 cfs on the North Umpqua River. The need to develop additional raw water sources will depend on whether the current City sources and reservoir are sufficient to handle the anticipated water demand. Based on the present and projected water demands discussed in Sections 6.2 and 6.3, the City has not had any difficulty in meeting its water requirements during the wet season months (November through April) because demand is low and the raw water supply is sufficient. The City is not anticipated to have any future difficulty in meeting projected water demands in the wet season months for the same reason. The most critical time for the City to obtain water is during the dry season months (June through October) when demand is high and the supply of raw water is limited. A plot of projected maximum daily demand versus time is presented in Figure 8.1.1.

FIGURE 8.1.1
RAW WATER MAX. DAILY DEMAND (MDD) & CITY WATER RIGHTS[(1)] VS. YEAR



(1) Water rights for Calapooya Creek do not include its junior right (1.0 cfs) due to instream rights.

Based on the projected maximum daily demand (MDD), the City's existing water rights on Calapooya Creek and Cooper Creek should be sufficient to meet the City's demand until approximately the Year

2025 to the Year 2029 depending on the percentage of non-accounted for water. This projection is based on the following assumptions:

- Full withdrawal can be made from Cooper Creek,
- City's junior water right on Calapooya Creek is not restricted due to low stream flows, and
- Ultimate non-accounted water within the City is reduced to 10 or 15 percent.

After the Year 2025, the City will need to utilize its water right on the North Umpqua River or find another source of water in order to meet the projected MDD demand. Between the Years 2046 and 2050, the projected MDD demand is anticipated to exceed all of the City's water rights (minus its junior Calapooya Creek water right) even with the non-accounted water ranging from 10 to 15 percent. To satisfy long-term demand (beyond the Years 2046), the City will need to pursue conservation of its existing diverted water and/or explore long-range acquisition of future sources of raw water. Source water in the state is becoming increasingly scarce and developing viable water supplies is becoming more difficult as environmental concerns are considered in the renewal or acquisition of water rights. Many communities are finding it necessary to develop and even purchase source water now that will not be needed for more than 20 years. A number of potential raw and drinking water sources are discussed below.

Groundwater Sources

Overall, the groundwater resources within the Study Area are not considered to have sufficient yield to adequately meet the full needs of the City. While an attempt could be made to develop a number of wells to supplement the amount of water diverted during the dry season months, there are few wells in Douglas County that can consistently produce double-digit yields. Consequently, groundwater wells are not considered a feasible alternative for addressing the City's future water demand needs.

Surface Water Sources

Historically, a number of different surface water sources have been identified and evaluated as a possible supply of potable water treatment for the City. Potential surface water sources for the City include impoundments within Calapooya Creek Watershed, City of Oakland (Calapooya Creek), North Umpqua River and Cooper Creek. These potential sources are discussed below.

Impoundments Within Calapooya Creek Watershed

In previous studies (HGE 1975, Robert E. Meyer 1979, HGE 1997), development of additional impoundments on tributaries of Calapooya Creek has been recommended. A sufficiently sized reservoir would provide water to supplement flow in Calapooya Creek, during low flow periods and allow full utilization of the City's water rights at its Nonpareil WTP site. Proposed sites for a multi-use impoundment include Hawthrone Creek, Hinkle Creek, Gassy Creek, Rock Quarry, Pollock Creek and the Banks Creek sites. Of these sites, the Gassy or Gassy-Norris Creek site has been the location of most recent interest and investigation (HGE 1997). International Engineering Company, Inc. prepared a reconnaissance level study of the suitability of a storage impoundment at the Gassy-Norris site in 1982. Based on this study, a reservoir with 6,700 acre-feet and a dam with maximum height of 150 feet and crest length of approximately 900 feet were recommended. The main limitations with the construction of a dam and reservoir at the Gassy-Norris site (or any other site) are cost for the dam construction and environmental documentation and permitting requirements. While cost estimates for the construction of this reservoir have never been published, it is anticipated that the cost of this reservoir would be substantial. Efforts to compile environmental and permit documentation are also anticipated to be substantial. Construction of the reservoir will require an Environmental Impact Statement and Report and would likely face serious opposition from environmental groups. For this reservoir (or any other in the County) to become reality, the political climate and environmental attitude towards constructed dams will have to change. It is unclear whether or when such change would occur.

City of Oakland

The possibility of the City leasing or purchasing water rights from the City of Oakland has been proposed and discussed in the past for a number of reasons. These reasons include the proximity of the two Cities, Oakland's senior water right on Calapooya Creek, and available water under Oakland's water right. An intertie between the City's two water systems appears feasible with the installation of a water main between the City of Oakland's system and the Union Gap Water District's system.

As the holder of the senior water right on Calapooya Creek, the City of Oakland has the ability to fulfill its 2.0 cfs diversion at the expense of other water rights during low flow conditions. In the mid-1990s, the City of Oakland was using approximately 0.7 cfs of the 2.0 cfs water right, and thus, currently has excess water source capacity at this time (HGE 1997). However as development occurs, the water demand within the City of Oakland is anticipated to eventually match or exceed its water right. The projected 25-year and ultimate water demand in Oakland is 1.7 cfs and 3.2 cfs, respectively. In the short term, the City could benefit by having access to more senior water rights then their own on the Calapooya Creek. However in the long run, there is no net benefit for the City to lease Oakland's water rights as Oakland will eventually need these rights.

North Umpqua River

As discussed in Section 5.1, the City has an undeveloped municipal water right on the North Umpqua River for 3.0 cfs with a seniority date of 10/15/1979. Point of diversion is located between the Interstate 5 bridge at Winchester (downstream) and Whistlers Bend (upstream). The main reasons that this water right had not been previously developed include the distance and elevation change between the diversion point and the City's water system, and overall anticipated cost for construction for developing and operation/maintenance of utilizing this water source.

The original intentions of this water right were to divert water from the North Umpqua River and pump this water to replenish the Cooper Creek Reservoir during the dry season. Two means were identified in the Oakland Sutherlin Water Study (Robert E. Meyer 1979): 1) construction of a 510 acre-feet dam above the existing Cooper Creek Reservoir and 2) pump North Umpqua River water over the ridge and let it flow down into the Cooper Creek Reservoir through existing drainage. With either alternative, the estimated loss of water in the existing drainage through percolation and evaporation was estimated to be 30 percent. HGE (1997) estimated the cost for Alternative No. 2, a pumping system including intake, 2-250 Hp pumps, station, and 16,100 L.F. of 16-inch main, to be $1.791 million.

Drawbacks to these alternatives include high electrical costs for pumping the water, limited or "fixed" amount of storage in available in the Cooper Creek Reservoir for municipal use, anticipated water loss, and mixing of the high quality water from the North Umpqua with the Cooper Creek waters in the Reservoir. The high electrical costs (250 Hp pump) are due the long distance and elevation difference needed to pump water from the river to the Cooper Creek drainage basin. A water loss of 30 percent is substantial, especially in light of the City possibly needing additional source water by the Year 2040. Storage in Cooper Creek Reservoir presents a problem (Robert E. Meyer 1979), as pumping water into the reservoir will have to done so as to replace water used from their storage allotment of 500 acre-feet. The pumping into and retrieval of water from the reservoir would have to be managed so as not to overfill the reservoir. Obtaining additional water right of 500 acre-feet from the reservoir storage could mitigate this issue. The final drawback identified includes mixing of the excellent water quality of the North Umpqua water with that of the poorer water quality of Cooper Creek Reservoir. While the introduction of water from North Umpqua River would be beneficial to the reservoir water quality, it is not known how much of an effect this water source would have on the raw water quality to the Cooper Creek WTP. In summary, the drawbacks of the previous alternatives for development of the City's North Umpqua River are significant.

Several alternatives were examined to develop the City's water right on the North Umpqua River that would minimize (if possible) electrical costs, pipeline distances, and treatment costs. A total of seven alternative routes and systems were identified. A map showing the routes of each alternative is shown in Figure 8.1.2. The following is a brief description of these alternatives.

Alternative No. 1 – Umpqua Basin Water Association. With this alternative, water would be diverted at the Umpqua Basin Water Association's raw water intake, treated and pumped into the Umpqua Basin's distribution system. A new treated water pipeline would be constructed from the intersection of Oak Hill Road and Old Highway 99 (just north of Wilbur) to the South Sutherlin exit (Exit 135). The proposed water system improvements would include improvements to Umpqua Basin's raw water intake piping and water treatment facilities, and the construction of a booster pump station, and approximately 3.5 miles of pipeline. Maximum elevation change over the pipeline alignment is approximately 67 feet. The main advantage of this alternative is the low elevation change and pipeline distance. The main disadvantage is loss of treatment oversight and control.

Alternative No. 2 – North Umpqua To Cooper Creek WTP. For this alternative, the point of diversion would be from the original diversion point on the North Umpqua River. The proposed water system would include the construction of a raw water intake, pump station, water treatment plant, and approximately 6.8 miles of pipeline. The proposed pipeline route is along existing gravel roads between the North Umpqua River and the Cooper Creek Reservoir and thence along Cooper Creek Road to the Cooper Creek WTP. Maximum elevation change over the pipeline alignment is approximately 450 feet. The main advantage of this alternative is the alignment along an existing gravel road and delivery of the river water to the Cooper Creek WTP site. The main disadvantage is the relatively high elevation change and pipeline distance.

Alternative No. 3 – North Umpqua to South Sutherlin. This alternative includes a diversion from North Umpqua River near the confluence of the River and Sutherlin Creek. The proposed water system would include the construction of a raw water intake, pump station, water treatment plant, and approximately 6.1 miles of pipeline. The proposed pipeline route is along Wilbur Road and along Old Highway from Wilbur to the South Sutherlin exit (Exit 135). Maximum elevation change over the pipeline alignment is 134 feet. The main advantage of this alternative is the relatively low elevation change over the pipeline alignment. The main disadvantage is the pipeline alignment is the pipeline distance.

Alternative No. 4 – North Umpqua to East Sutherlin. For this alternative, the point of diversion would be from the original diversion point on the North Umpqua River. The proposed water system would include the construction of a raw water intake, pump station, water treatment plant, and approximately 7.0 miles of pipeline. The proposed pipeline route is along existing gravel roads between the North Umpqua River and the Cooper Creek Reservoir and thence along Plat I Road to Nonpareil Road. Maximum elevation change over the pipeline alignment is 470 feet. The main advantage of this alternative is the alignment along an existing gravel road. The main disadvantage is the relatively high elevation change and pipeline distance.

Alternative No. 5 – Winchester to South Sutherlin. This alternative includes a diversion from North Umpqua River just east of the Interstate 5 bridge. The proposed water system would include the construction of a raw water intake, pump station, water treatment plant, and approximately 6.1 miles of pipeline. The proposed pipeline route is along Old Highway 99 from just north of Winchester to the South Sutherlin exit (Exit 135). Maximum elevation change over the pipeline alignment is 160 feet. The main advantage of this alternative is the relatively low elevation change over the pipeline alignment. The main disadvantage is the pipeline alignment on a rather congested portion of Old Highway 99 (from north of Winchester through Wilbur).

Figure 8.1.2 – North Umpqua Water Right Development Alternatives

Alternative No. 6 – East of Winchester to South Sutherlin. This alternative includes a diversion of North Umpqua River at approximately river mile 10, east of Winchester. The proposed water system would include the construction of a raw water intake, pump station, water treatment plant, and approximately 6.3 miles of pipeline. The proposed pipeline route is along Old Highway 99 from just north of Winchester to the South Sutherlin exit (Exit 135). Maximum elevation change over the pipeline alignment is 300 feet. The main advantage of this alternative is avoidance of a portion of the pipeline alignment on a rather congested portion of Old Highway 99. The main disadvantage is the relatively high elevation change in the pipeline alignment.

Alternative No. 7 – Main Umpqua to West Sutherlin. For this alternative, the point of diversion would be from the main stem of the Umpqua River near the confluence of Calapooya Creek and the river. This alternative would include the construction of a raw water intake, pump station, water treatment plant, and approximately 5.9 miles of pipeline. The proposed pipeline route is the Sutherlin-Umpqua Road. Maximum elevation change over the pipeline alignment is 300 feet. The main advantage of this alternative is the delivery of water to the west end of town. The main disadvantage of this alternative is withdrawing water from the main stem of the Umpqua River, which has poorer water quality than the North Umpqua River.

In reviewing the above seven alternatives for developing the North Umpqua River water right, Alternative No. 1, No. 2 and No. 3 were selected for further analysis, including compilation of capital and operation/maintenance costs (over a 20-year period). The following is a summary of assumptions that were made in regards to evaluating these alternatives.

Alternative No. 1 – Umpqua Water Basin Association

- 20-inch O.D. HDPE pipe (16-inch I.D.) for transmission main between the Umpqua Basin connection and South Sutherlin located in the roadway with controlled density backfill.
- Duplex pump station, with 75 Hp pumps, located in a CMU building
- $3.835 million for treatment plant upgrades at Umpqua Basin Water Association (Black & Veatch 2005a, 2005b – in Appendix D). A number of improvements have been proposed to upgrade the capacity of Umpqua Basin's water treatment facilities to 6 MGD. The cost for the treatment plant upgrades to handle Sutherlin's 3 cfs water right is for upgrading Umpqua Basin's WTP capacity from 6 MGD to 8 MGD. These upgrades include an additional 2 MGD membrane system with chemical clean-in-place equipment, a higher capacity on-site chlorine generation system, additional site piping, new pumps for finished water pump station, new intake screens, pumps and larger diameter pipe for raw water intake and pump station, larger concrete clearwell, and larger standby generator.
- Estimated cost for treated water is based on the sum of Umpqua Basin's current rate of $14 per month plus $2.39 per 1,000 gallons, and the cost for pumping the water to Sutherlin. Staff at Umpqua Water Basin anticipates the cost per 1,000 gallons to the City to be less than the above value (Groshong 2005). The actual cost for treated and delivered water will have to be decided upon through negotiations between Umpqua Basin Water Association and the City.

Alternative No. 2 – North Umpqua to Cooper Creek WTP

- Raw water intake located at original water right location.
- 20-inch O.D. HDPE pipe for transmission main from raw water intake to high point of main alignment, 14-inch O.D. HDPE pipe for transmission main from high point of main to Cooper Creek WTP, 22-inch O.D. HDPE pipe from Cooper Creek WTP to City's distribution system.
- Duplex pump station, with 250 Hp pumps located in a CMU building.
- Packaged treatment plant (2.0 MGD capacity), dual train, located either at Cooper Creek WTP site or on the east end of Cooper Creek Reservoir.
- Estimated cost for treated water is based on current average cost for treating City water plus pumping costs.

Alternative No. 3 – North Umpqua to South Sutherlin

- Raw water intake located near the confluence of the North Umpqua River and Sutherlin Creek.
- 20-inch O.D. HDPE pipe for transmission main from raw water intake to the City's existing distribution system (near South Sutherlin off-ramp, exit 135), located in roadway with controlled density backfill.
- Duplex pump station, with 150 Hp pumps located in a CMU building.
- Packaged treatment plant (2.0 MGD capacity), dual train, located near the raw water intake.
- Estimated cost for treated water is based on current average cost for treating City water plus pumping costs.

The estimated capital costs, O&M costs, and salvage value for Alternatives No. 1 through No. 3 are summarized in Table 8.1.1. Detailed cost estimates for these alternatives are provided in Appendix D.

TABLE 8.1.1
SUMMARY OF PRESENT WORTH COSTS FOR NORTH UMPQUA RIVER ALTERNATIVES

Item	Alternative No. 1 – Umpqua Basin Water Assoc	Alternative No. 2 – North Umpqua to Copper Crk	Alternative No. 3 – North Umpqua to South Sutherlin
Capital	$7,957,900	$10,358,800	$10,689,500
O&M	$3,776,200	$1,746,600	$1,672,400
Salvage Value	($136,800)	($337,800)	($349,900)
Total	$11,597,300	$11,766,800	$12,012,000

Based on these compiled costs, Alternative No. 1 – obtaining North Umpqua River water from Umpqua Basin Water Association is considered the most cost-effective alternative. Although Alternative No. 1 is the most cost-effective alternative, Alternative No. 2 is only slightly more expensive. Cost savings may not necessarily be the deciding factor in which alternative the City will choose.

Cooper Creek

Cooper Creek is a surface water source that the City has utilized but not fully benefited from its water right. Over the past five years, the City has only exercised up to approximately 40 percent of its 5.0 cfs water right from Cooper Creek and Cooper Creek Reservoir (Section 5.1). The main limitations to the City fully utilizing this water right are the iron and manganese concentrations in the raw water and the lack of treatment capacity at the Cooper Creek WTP. Currently, the Cooper Creek WTP can produce approximately half of its design capacity (2.0 MGD) primarily due to the age of the treatment equipment and lack of sedimentation facilities. Even if the WTP could process potable water at its design rate, this production rate would still be short of its full water right of 3.2 MGD (5 cfs). As shown in Figure 8.1.1, the City will need additional surface water assuming that all of its current water rights on Calapooya Creek and Cooper Creek are being utilized. Since the Nonpareil WTP is withdrawing and producing water at a rate equal to or greater than the sum of the City's most senior water rights on Calapooya Creek, the next logical step is for the City to fully develop their water rights on Cooper Creek.

Three options have been identified for fully developing the City's water right on Cooper Creek: 1) construct a new WTP that can process the anticipated reservoir water quality, 2) modify the existing raw water intake structure to allow the withdrawal from different water levels within the reservoir, and 3) installation of a hypolimnetic aerator system within the reservoir. The objective of the first option is to treat the raw water from the reservoir while the other options attempt to obtain better quality water or improve water quality within the reservoir. While the installation of a multi-level raw water intake and/or the hypolimnetic aerator system will most likely improve the reservoir raw water quality, neither of these options improves the capacity or treatment effectiveness of the Cooper Creek WTP. Without a properly sized or designed WTP, the City will not able to fully develop its water right on Cooper Creek. Thus, construction of a new Cooper Creek WTP is the City's first step to develop its Cooper Creek water right.

Alternatives for a new Cooper Creek WTP are discussed immediately below. Improvements such as a multi-level raw water intake and hypolimnetic aerator system are discussed below in Section 8.2.

As mentioned above, the main limitations to the existing Cooper Creek WTP is its inability to treat the existing iron and manganese concentrations in the raw water at design rates with the existing treatment equipment. Currently, the iron and manganese concentrations in the reservoir raw water have been observed up to 1.7 mg Fe/l and 0.7 mg Mn/l, respectively. As raw water reservoirs grow older or age, the water quality within the reservoir tends to further degrade unless the environmental conditions of the reservoir is modified with such measures as the introduction of a new water supply, installation of hypolimnetic aeration, or multi-level withdrawal. Assuming that there are no changes to the reservoir's environmental conditions, the future iron and manganese conditions within the reservoir raw water could increase to approximately 4 mg Fe/l and 2 mg Mn/l. The future treatment process at the Cooper Creek WTP must have the capability of significantly removing the above anticipated iron and manganese concentrations within the reservoir raw water.

Iron and manganese can be effectively removed from water using a number of treatment processes depending both on the form and concentration of these metals. Potential treatment processes include water softening (ion exchange), polyphosphate addition, manganese greensand filtration, and oxidation followed by filtration. Water softening and polyphosphate addition are usually employed for water treatment at homes and not at the flow rates contemplated at Cooper Creek. Manganese greensand filters combine oxidation and filtration in one unit and can be very successful in removing iron and manganese within certain operating parameters. However, the manganese greensand filtration process is not considered a economic solution for Cooper Creek due to the raw water quality and desired flow rate.

The most promising technology for Cooper Creek is oxidation followed by filtration. The City currently utilizes oxidation with potassium permanganate, an oxidant, followed by filtration. The major drawback with potassium permanganate is that it is a toxic substance that is difficult to handle. Other potential oxidants include chlorine, hydrogen peroxide, oxygen (aeration), and ozone. Chlorine is not considered viable option as the introduction of chlorine into the raw water will likely result in an increase in the following regulated contaminants: trihalomethanes (THM) and haloacetic acids (HAA). Hydrogen peroxide and ozone are considered some of the more capital intensive and expensive oxidants for iron and manganese removal. Aeration may work by cascading, bubbling, or stripping gas from water. The advantage of aeration is it does not add chemicals to the water. Aeration has the disadvantage of slow kinetics or reaction time, particularly in waters with a significant amount of organic complexing agents.

In consulting the available literature, and with various treatment process manufacturer representatives, it appears the use of potassium permanganate and/or aeration followed by sedimentation and filtration is the most appropriate treatment processes for the Cooper Creek WTP. City staff advocated the use of aeration in order to avoid their handling and exposure of potassium permanganate. However, aeration does not typically remove manganese as well as iron from raw water due to the different reaction times of these metals. This fact was observed in the laboratory aeration of a raw water sample from Cooper Creek conducted by Tetra Tech (2003). After 24 hours of aeration, the iron concentrations reduced from 0.075 mg/l to 0.017 mg/l (77% reduction) while manganese in the water only changed from 0.007 mg/l to 0.006 mg/l (14% reduction). For the new Cooper Creek WTP, a combination of both aeration and permanganate addition was incorporated into the proposed design to reduce the amount of potassium permanganate for iron and manganese treatment.

Three different treatment process trains were evaluated for use at the Cooper Creek WTP. These proposed processes include additional improvements to the Cooper Creek WTP that are needed to treat up to 3.2 MGD. These additional improvement include the installation of new 14-inch diameter PVC raw water main, demolition of the treatment equipment and installation of a large doorway in the existing WTP building, new sewer drain field, back-up generator, on-site hypochlorite system, new concrete backwash ponds, new 100,000 gallon concrete clearwell, new treated water pumps and new WTP building. A brief description of the three proposed treatment alternatives is given below.

- **Alternative No. 1 – Conventional Flocculation/Sedimentation Basins Followed by Filtration** – This proposed process consists of two trains with an aeration basin (1-hour detention), oxidant/coagulation addition, flocculation basin, sedimentation basin with settling tubes, and dual media filtration.

- **Alterative No. 2 – Adsorption Clarifier Followed by Filtration** – The proposed process consists of a two train packaged system with aeration basin, oxidant/coagulation addition, adsorption clarifier, and mixed media filtration.

- **Alternative No. 3 – Dissolved Air Flotation Followed by Filtration** – This process consists of two train packaged system with aeration basin, oxidant/coagulation addition, flocculation basin, dissolved air flotation, and dual media filtration.

The estimated capital costs, O&M costs, and salvage value for Alternatives No. 1 through No. 3 are summarized in Table 8.1.2. Detailed cost estimates for these alternatives are provided in Appendix D.

TABLE 8.1.2
SUMMARY OF PRESENT WORTH COSTS FOR COOPER CREEK WTP ALTERNATIVES

Item	Alternative No. 1 – Conventional/Filtration	Alternative No. 2 – Adsorption Clarifier/Filtration	Alternative No. 3 – Dissolved Air Flotation/Filtration
Capital	$4,388,300	$3,800,300	$4,963,500
O&M	$1,964,500	$1,773,800	$3,143,700
Salvage Value	($143,700)	($124,300)	($163,500)
Total	$6,209,100	$5,449,800	$7,943,700

Based on these compiled costs, Alternative No. 2 – Adsorption Clarifier Followed by Filtration is considered the most cost-effective alternative for the Cooper Creek WTP.

Water Rights Purchases

Another option for obtaining water rights is to purchase them from water rights holders in the Study Area, ideally upstream of their existing water rights. The City could research water rights held within the Study Area to determine the location of existing diversions and holders of existing water rights. It could then identify appropriate and available water rights, and approach the holders of those rights to discuss the potential purchase.

Once the City reaches an agreement to purchase water rights, the appropriate paperwork should be prepared to transfer the water right to the City and change, if necessary, the point of diversion (POD) and service area. Some communities have chosen to purchase entire pieces of property for the sole purpose of obtaining a water right allotted to the property. Once the water provider owns the property, they are able to transfer the water right to the City, change the POD to the City intake, and resell the property.

The City can acquire and utilize a water right that is intended for irrigation purposes. For this type of water right, the City would only be able to make withdrawals during the irrigation season that were similar to irrigation patterns utilized over the growing season.

The City should consult with the Watermaster for assistance in obtaining any new water source. Lost time and unnecessary expenses can be avoided by including the Watermaster in all water acquisition plans.

Non-Potable Water Reuse

There are several potential sources of non-potable water within the Study Area including the City's water treatment plant (WTP) backwash water, and City's wastewater treatment plant (WWTP) effluent. Potential non-potable water reuse from these sources is discussed below.

WTP Backwash Water Reuse

Backwash water is currently discharged into the Backwash Ponds at both the Nonpareil and Cooper Creek WTPs. Supernatant from these ponds overflows into a creek adjoining the Nonpareil WTP site and into Cooper Creek at the Cooper Creek WTP. During peak water usage (June through August), the amount of backwash water that could be recycled averaged from June through October 9.6 million gallons per year (gpy) from the Nonpareil WTP and 12.6 million gpy from the Cooper Creek WTP. The percentage of backwash produced should be reduced with the installation of new treatment facilities that are better equipped to treat iron and manganese in the raw water. However, the production from the plant will also increase. For the purposes of this study, it will be anticipated that the amount of backwash produced from Cooper Creek WTP will be approximately the same amount as is produced now.

City staff has expressed concerns about recycling the backwash water into the treatment system. One concern is the introduction of the filter wash water, with viruses, other microbiological agents and any accumulated algae in the ponds, back into the system. While the treatment processes at the City's WTPs are capable of handling a wide variety of different raw water conditions, the effect of the backwash water on the WTP operation is not known at this time. Another concern is how much of the backwash water would be available for recycling. During the dry season, water may be "lost" in the backwash ponds due to evaporation and seepage. The exact amount of water being discharged from the backwash ponds is not currently known. Water quality and flow data from the backwash pond should be collected to further evaluate whether recycling of the backwash water at the WTPs is feasible and appropriate.

If a backwash recycle system was to be utilized, installation of a pump station and 4-inch diameter pipeline would be needed. To meet EPA's Filter Backwash Recycle Rule, the backwash water would have to undergo all the WTP's treatment processes and require introduction at the head of the WTP treatment processes. Operation of the pump station would be initiated with the WTP's call for raw water. At the Nonpareil WTP, the backwash pump station operation would coincide with the raw water pump station. For Cooper Creek WTP, the design and operation of the pump station will be more complicated due to the amount of head available in the raw water main from Cooper Creek. The pump would require sufficient head to overcome the existing raw water head and its operation would coincide with the opening of an electric actuated valve. With this conceptual design, backwash supernatant would be introduced upstream of the introduction of treatment chemicals (alum, potassium permanganate).

Assuming that the WTP backwash water was primarily used during the dry season months (June through October) and that 30 percent of the backwash water is lost to evaporation and seepage, the amount of water recycled during a dry season is estimated to be 6.7 MG per year at Nonpareil WTP and 8.8 MG per year at Cooper Creek WTP (average of both WTPs, 7.7 MG/yr). The estimated cost for installing a recycle pump system at these WTPs is approximately $70,000 each. Taking into account estimated O&M costs and assuming six percent interest over 20 years, the estimated average present worth cost for these pump stations is $130,000. With an average of 23.6 acre-feet per year (7.7 MG/yr), the total amount of potential water available for recycle over 20 years is 472 acre-feet per WTP. The overall average cost for backwash water recycle at the WTPs is approximately $275/acre-feet.

WWTP Water Reuse

The City currently pumps Class II reclaimed water to the Oak Hills Golf Course between the months of June through October. This 18-hole golf course reuses the effluent for irrigation of the fairways and greens. Presently, there is approximately 95 acres of greens and fairways under irrigation, with the potential to irrigate an additional 105 acres of rough. Water from the City's WWTP is pumped to an irrigation pond located at the golf course. From this pond, a pump station at the course conveys reclaimed water to the course's irrigation system. Overflow from the irrigation pond travels to additional ponds on the course. Ultimately, reclaimed water overflowing from these ponds can be discharge to a Cook Creek, which is a tributary of Calapooya Creek.

The City's original contract with Oak Hills mandates that the City send 100 percent of the wastewater effluent to the golf course. This original contract was amended to limit the maximum amount of reclaimed water conveyed to the golf course to be 193 million gallons. Up to the summer of 2004, the City sent all of its effluent to the golf course. However, it has been found that the golf course was not utilizing all of the reclaimed water that was sent, especially in the months of September and October. The City has installed a level monitor at the irrigation pond that controls the amount of reclaimed water that is sent to the golf course. Reclaimed water that is not used at the golf course is diverted to the wastewater treatment plant's effluent outfall pipe and discharged into the Calapooya Creek, which is in violation of its NPDES permit. The City will be entering into a Mutual Agreement of Order with DEQ to deal with this discharge.

With the surplus reclaimed water, the City is considering other uses for this water. One application that the City is considering is the use of reclaimed water at its WWTP for process use and landscape irrigation. Unfortunately, the water usage at the WWTP is not currently being metered and therefore the amount of potable water that could be conserved is difficult to estimate. Even though the amount of potable water conserved by using non-potable water is not known, the use of non-potable water at the WWTP is recommended.

The other alternative for surplus reclaimed water is for the irrigation of the City's parks and possibly the fields of the School District, and for process water by local industry, most notably Murphy Plywood. Available Year 2004 flow data for the High School's athletic and soccer fields, and Murphy's Plywood (large services only, prior to the mill fire) is summarized below.

TABLE 8.1.3
YEAR 2004 WATER USAGE FOR HIGH SCHOOL FIELDS & MURPHY PLYWOOD

User	Account No.	Usage, gpy
Sutherlin High School		
Soccer Field No. 1	2144	148,250
Soccer Field No. 2	2145	67,386
Athletic Field	2134	681,890
Athletic Field – Meter No. 2	2135	2,705,000
	Subtotal	3,602,526
Murphy Plywood		
10-inch Commercial	1878	15,904,300
Meter 2/3	1879	7,371,000
	Subtotal	23,275,300

The ability of the City to provide these quantities to these users will depend on how much reclaimed water is available. Data is currently being collected for the Year 2005 irrigation season (June to October) to determine how much reclaimed water is being used by the golf course and how much is available for other uses. This water usage data will be compiled and analyzed as part of the City's Wastewater Facilities Plan that is to be completed in the Year 2006.

Production and conveyance of non-potable or reclaimed water to the High School, the City Parks, or Murphy Plywood will require additional treatment at the WWTP, a pump station, and a force main to deliver the water. Level IV water is required for reclaimed water use on parks, playgrounds and school yards. Level IV water requires wastewater to receive biological treatment, clarification, coagulation, filtration and disinfection. A new treatment process unit at the City's WWTP would be needed to perform these processes. A pump station and conveyance main will also be required. The cost and layout for a reclaimed water treatment process, pump station, and transmission main will be evaluated in the City's Wastewater Facilities Plan.

Summary

Several different raw water sources were evaluated as potential resources for the future City use. These alternatives included groundwater sources, surface water sources (Impoundments within Calapooya Creek watershed, City of Oakland, North Umpqua River and Cooper Creek), water rights purchases, and non-potable water reuse (WTP backwash water reuse and WWTP water reuse). The most promising alternatives are 1) withdrawal and treatment of North Umpqua River by Umpqua Basin Water Association, 2) construction of a new Cooper Creek WTP, 3) WTP backwash water reuse, and 4) WWTP water reuse. With the exception of the WWTP water reuse, the estimated present worth cost and amount of water available from each of these alternatives are summarized in Table 8.1.4.

TABLE 8.1.4
PRESENT WORTH COSTS & AVAILABLE WATER FOR RAW WATER ALTERNATIVES

Alternative	Present Worth Cost, $(1)	Available Water, Ac-ft(2)	Cost for Water, $/Ac-ft
North Umpqua – Umpqua Basin Water Assoc.	11,597,300	55,096	210
New Cooper Creek WTP	5,449,800	110,193	50
WTP Backwash Water Recycle (per WTP)	130,000	472	275

(1) – Cost based on 6% interest rate over 20 years
(2) – Total available water over a 20-year period.

The most cost-effective alternative is construction of the new Cooper Creek WTP followed by the development of the North Umpqua River water right and WTP Backwash Water Recycle. Although WWTP effluent reuse was not evaluated with respect to cost, this alternative may be viable for the City due to the amount of reclaimed water that is available and need for the City to utilize this source for beneficial uses. At a minimum, the use of reclaimed water for non-potable uses at the WWTP is recommended. Further evaluation and analysis on the raw water sources is discussed in Section 11, Water Supply Plan.

8.2 Raw Water Improvements – Cooper Creek Reservoir

Hypolimnetic aeration has previously been proposed to add oxygen to the hypolimnetic layer within the Cooper Creek Reservoir to improve water quality within this reservoir (HGE 1997, Wells et. al. 2000, Bogus 2003, Tetra Tech 2003). This technology and a multi-level reservoir intake are considered as viable means for the City to obtain improved water quality for this raw water source. Both of these improvements are considered below.

Multi-Level Reservoir Intake Structure

Currently, the raw water intake from Cooper Creek Reservoir is located approximately 38 feet below the permanent pool elevation. With this fixed location, the City is only able to remove water from the reservoir at this depth. The proposed improvements would be to construct a multi-level intake structure that would allow the City to withdraw water from two other depths above the current intake elevation. For planning purposes, the target depths for these additional intakes were approximately 28 and 18 feet below the permanent pool elevation. Further evaluation is needed to verify the most optimum depths for these intakes.

Based on a preliminary evaluation, the main components of these intakes would be 16-inch diameter ductile iron piping and appurtenances (elbows and tees), sluice gates, stainless steel stems encased in Schedule 80 casing pipe, and concrete supports for the piping. The new intakes would be aligned in a similar manner as the existing intake with the new stems and stem guides offset approximately 10 and 15 feet from the existing stems (to the north) and along the inside face of the dam. The majority of the installation would be installed with the use of underwater divers. Total estimated cost for these improvements is $172,600.

With the additional intakes, the City would still withdraw from the lower intake and should do so as long as until iron and/or manganese concentrations increase to unacceptable levels. This practice is considered as hypolimnetic withdrawal and is a technique that shortens the detention time of hypolimnion. Once water quality became unacceptable from the lower intake, the water could be withdrawn from the higher intake structures.

The advantage of this multi-level intake would be the ability to obtain better quality water from the reservoir. The disadvantage of this improvement is that it does nothing to improve the water quality within the reservoir itself.

Hypolimnetic Aeration System

The hypolimnion layer of a water body is a region of relatively constant temperature below the thermoclime (metalimnion or middle layer) and extending to the bottom in a thermally stratified body of water. The Cooper Creek Reservoir strongly stratified in the summer months with almost no summer inflow. Because there is no mixing in a stratified hypolimnion, the dissolved oxygen depletes resulting in anoxic conditions, which is a chemical reducing environment. In this environment, iron and manganese, along with nutrients are reduced to soluble forms causing rapidly increasing amounts of iron, manganese and nutrients in the hypolimnion and in the City's raw water intake.

The purpose of hypolimnetic aeration is to introduce a sufficient amount of oxygen into the hypolimnion to avoid anoxic conditions. Successful hypolimnetic aeration will reduce taste and odor problems in the water supply associated with iron, manganese and sulfur. With increased oxgenation (min. 2 mg/l, preferably greater than 4 mg/l) in the hypolimnion, soluble forms of iron and manganese will form precipitates and settle out of the water column, and hydrogen sulfide will be oxidized to sulfate (Tetra Tech 2003). Aeration of the hypolimnion of the reservoir may also reduce the phytoplankton productivity in the epilimnion in the summer (Wells et.al. 2000). The resulting improvement in water clarity with the reduction of phytoplankton productivity may be offset in an increase of the noxious weed *E. densa* (Ibid 2000).

A number of investigations and proposals have been made and evaluated with respect to the use of hypolimnetic aeration in Cooper Creek Reservoir. Kennedy/Jenks Consultants (Bogus 2003) with assistance of Tetra Tech (2003) made the most recent hypolimnetic aeration treatment proposal. This proposal suggested that the aeration system with micro-bubble diffusers should be designed to provide 327 kg per day of oxygen to the hypolimnion at an estimated oxygen transfer rate of 21 percent. Kennedy/Jenks provided two preliminary engineer's estimate of probable cost: 1) sole source hypolimnetic aeration system and 2) custom hypolimnetic aeration system (Bogus 2003). The estimated cost for these systems ranged from $376,000 to $516,000 (Ibid 2003).

The advantage of the hypolimnetic aeration system would be that it would benefit not only the WTP raw water feed but also the reservoir water quality. However, the extent and potential benefits on water quality cannot be determined with existing data (Wells et.al. 2000). The main drawback is the capital and O&M costs associated with the construction and operation of this system.

8.3 Water Treatment Facilities

A number of operational issues with the both of the City's water treatment plant (WTP) facilities were presented in Section 5. Proposed improvements to these WTPs are described below.

Nonpareil WTP

Nonpareil water treatment plant supplies the majority of the City's water. The plant continues to function well considering its age. In order to ensure that the treatment plant continues to operate and deliver high-quality water to the City's customers, improvements must be made to the plant. These improvements are discussed in detail in the Section 12 – Capital Improvement Plan of this Water Master Plan. The improvements include a new backwash pond, onsite hypochlorite generation, equipment refurbishment and other upgrades that will improve the function of the plant.

Cooper Creek WTP

As discussed in Section 5 and Section 8.1, the existing Cooper Creek WTP is incapable of treating the full extent of the City's existing water rights from Cooper Creek because of the age of the treatment equipment and inability of the treatment process to effectively handle the influent iron and manganese concentrations at design flow rates. A new treatment plant is needed here. Based on an evaluation of three treatment process alternatives, Alternative No. 2 - Adsorption Clarifier Followed by Filtration is considered the most cost-effective alternative for the Cooper Creek WTP (see Section 8.1).

8.4 Treated Water Storage

The City currently has a total treated water storage capacity of 3,519,000 gallons provided by nine storage tanks, not counting a total of 100,000 gallons stored in the clearwells at the WTPs. Regular inspection and maintenance of each tank is required to extend the useful life of the infrastructure. The interior of each tank should be inspected every three to five years and deficiencies repaired as required.

Lower Level Tanks. The lower level tanks represent the bulk of the City's treated water storage. The tanks in this pressure zone include Oak Hills, Calapooya, and Umpqua. The Oak Hills Tank is the newest tank in this pressure zone. The main issues with this tank are the inability to completely fill the tank and difficulty in maintaining chlorine residuals within this tank. The inability to fill this tank appears to be related to this tank being located furthest from the other Lower Level Tanks and the WTPs, and having a hydraulic bottleneck resulting from smaller diameter water mains between it and the other tanks and WTPs. As a result, it takes more hydraulic head to fill this tank. Installation of larger diameter water mains should reduce the friction loss in the main lines and allow this tank to fill more completely and at a faster rate. The maintenance of a chlorine residual within this tank is a function of the residence time of water within the tank. With removal of the hydraulic bottleneck between the Oak Hills tank and the WTPs and other tanks, there should be more turnover in the Oak Hills tank and higher chlorine residuals in the tank. If maintenance of chlorine residuals in this tank are still an issue after the hydraulic bottleneck is removed, then tank mixing improvements or chlorine addition at the tank should be evaluated.

The only issues with the Calapooya Tank were cracks observed in the pavement on the downhill side of the tank and accumulated material against the fence. The cracks in the pavement need to be monitored and the accumulated material against the fence should be removed.

The Umpqua Tank appeared to be in excellent condition. Only recommended improvement is the installation of cathodic protection for this tank.

Mid Level Tanks. The tanks in this pressure zone include Schoon Mountain, Tanglewood, and Upper Umpqua. All of these tanks are constructed of steel and lack of cathodic protection. Installation of cathodic protection is recommended, especially at the Tanglewood and Upper Umpqua Tanks. With the exception of graffiti at the Tanglewood Tank and bullet marks on the Upper Umpqua Tank, these tanks appear to be in good condition. Recoating of the Upper Umpqua Tank is recommended. The reliance of a pressure relief valve for temporary outage of the Tanglewood Tank and Upper Umpqua Tank is acceptable but does result in unaccounted for water loss. For longer outages (as in the case of recoating a tank), the City will need to either install a smaller tank next to the existing tank or bring in a temporary storage tank to serve as the reservoir for this pressure zone.

High Level Tanks. Ridgewater No. 1 and No. 2 tanks comprise the High Level Tanks. Ridgewater No. 1 has been in service a number of years and is in need of maintenance. The inside and outside of the tank should be recoated, the level gauge should be repaired or replaced, and cathodic protection of the tank should be added. To increase the reliability of this tank during a seismic event, the City may wish to consider installing seismic foundation chairs and bolts to this tank. The suitability of the installation of these seismic restraints would need to be reviewed by a registered structural engineer.

Ridgewater No. 2 tank is new and in excellent condition. Improvements to this tank include additional coating of some of the seismic bolts around the foundation, installation of cathodic protection, and installation of additional security measures to prevent access to the top of the tank.

Design Storage Capacity

As discussed in Section 7, there are a number of ways to determine the treated water storage requirements of a given water system. Two different methods were utilized to determine the treated water reserve requirements for the City of Sutherlin. Each method is briefly summarized below:

State Agency Recommended Method – Method 1

An interagency team made up of personnel from the a number of different regulatory and financing agencies developed recommended sizing strategies based on state and community consumption averages and their experiences with Oregon communities (see Sections 6.3 and 7.2). Part of these recommendations included sizing parameters for treated water reserve components.

The interagency team suggests that reserves in the system be sized for a volume that is equal to 3.0 times the ADD plus fire flow reserves (Bryan 2000). Based on this methodology, the required reserve for the City of Sutherlin is summarized in Table 8.4.1. It should be noted that the sizing analysis was performed using demand figures that have been adjusted for the non-account water to range from 25 percent in the Year 2010, 20 percent in the Year 2015, 17 percent in the Year 2020, and 15 percent from the Year 2025 on. Current average demands are actually higher and would result in increased reserve requirements. If the City is unsuccessful in reducing lost water levels, additional storage may be required in the future.

TABLE 8.4.1
DESIGN TREATED WATER STORAGE – METHOD 1

Parameter/Year	2004	2010	2015	2020	2025	2034	2046
Water Demand, Mgpd							
ADD	1.4628	1.7618	1.869	2.040	2.259	2.757	3.255
Storage Capacity, gal.							
Existing Storage	3.519	3.519	3.519	3.519	3.519	3.519	3.519
Emergency	4.388	5.286	5.606	6.121	6.776	8.271	9.765
Equalization	0	0	0	0	0	0	0
Fire Reserve	0.180	0.180	0.180	0.180	0.180	0.180	0.180
Total Design	4.568	5.466	5.786	6.301	6.956	8.451	9.945
Difference	(1.049)	(1.947)	(2.267)	(2.782)	(3.437)	(4.932)	(6.246)

Based on the State Agency methodology (Method 1), the City's existing storage is insufficient to meet current and future water storage requirements.

Standard Methodology – Method 2

The second method used to analyze the reserve requirements for the City of Sutherlin is based on methodology commonly used for determining optimum municipal reservoir storage. This methodology also typically includes input from the local fire chief as to the fire flow requirements for the City, and for emergency storage reserve utilizes either one MDD or three ADD. Since the City has two WTPs and a number of reservoirs, emergency storage based on one MDD should be adequate. For optimum storage, the City should have enough capacity to satisfy the following demands.

Emergency Storage = MDD.
Equalization = 0.25*MDD.
Fire Reserve = 4,500 gpm for 4 hours.

The optimum storage methodology is based on a planning scenario that includes sufficient storage for three days of average consumption and suppressing a major fire. As with the first methodology, the sizing analysis was performed using demand figures that have been adjusted for non-account water to range from to range from 25 percent in the Year 2010, 20 percent in the Year 2015, 17 percent in the Year 2020, and 15 percent from the Year 2025 on. Based on this second methodology, the required storage capacity for the City of Sutherlin is summarized in Table 8.4.2.

TABLE 8.4.2
DESIGN TREATED WATER STORAGE – METHOD 2

Parameter/Year	2004	2010	2015	2020	2025	2034	2046
Water Demand, Mgpd							
ADD	1.4628	1.7618	1.869	2.040	2.259	2.757	3.255
MDD	2.966	3.572	3.789	4.137	4.580	5.590	6.600
Storage Capacity, gal.							
Existing Storage	3.519	3.519	3.519	3.519	3.519	3.519	3.519
Emergency	2.966	3.572	3.789	4.137	4.580	5.590	6.600
Equalization	0.741	0.893	0.947	1.034	1.145	1.397	1.650
Fire Reserve	1.08	1.08	1.08	1.08	1.08	1.08	1.08
Total Design	4.788	5.545	5.816	6.251	6.805	8.067	9.330
Difference	(1.268)	(2.026)	(2.297)	(2.732)	(3.286)	(4.548)	(5.811)

Using the Standard Methodology (Method 2), the City's existing storage is insufficient to meet current and future water storage requirements.

Recommended Storage Capacity

A number of issues should be considered when sizing new treated water reserve components. The above analyses can be used to develop the requirements for treated water reserve system both now and at the end of the planning period based on current and predicted system demands. The above methodologies do not, however, take into consideration the remaining life of the existing reserve facilities or the expected life of new components.

Depending on the methodology used, different reserve requirements are developed for the Sutherlin water system. With either method, the existing storage capacity in Sutherlin is considered insufficient with a greater shortfall from Method 2 in comparison to Method 1. The difference between the two methods is primarily due to the fire flow reserves (180,000 gallons vs. 1,080,000 gallons) and emergency/equalization reserves. Ideally, the City's reservoir capacity would have the optimum capacity, which is the sum of emergency, equalizing, and fire flow storage. Realistically, the existing and/or design storage is often less than optimal for a number of reasons including cost to construct, long residence time for water within the tanks, and inability of the distribution system to deliver desired fire flow.

Due to the fire flow requirements requested by the City's Fire Chief, the recommended storage capacity within the City shall be based on Method 2. A summary of the recommended and existing storage capacity within the City is given in Table 8.4.3.

TABLE 8.4.3
RECOMMENDED STORAGE CAPACITY IN SUTHERLIN

Parameter/Year	2004	2010	2015	2020	2025	2034	2046
Storage Capacity, million gallons							
Existing Storage	3.519	3.519	3.519	3.519	3.519	3.519	3.519
Emergency	2.966	3.572	3.789	4.137	4.580	5.590	6.600
Equalization	0.741	0.893	0.947	1.034	1.145	1.397	1.650
Fire Reserve	1.08	1.08	1.08	1.08	1.08	1.08	1.08
Total Design	4.788	5.545	5.816	6.251	6.805	8.067	9.330
Difference	(1.268)	(2.026)	(2.297)	(2.732)	(3.286)	(4.548)	(5.811)

New Treated Water Tanks

Based on the above recommended storage capacity, the City of Sutherlin is deficient in the treated water storage within all the planning periods examined in this study. Approximately 3 million gallons of additional storage is needed in the next 20 years to obtain the recommended capacity within the City. Ultimately an additional 5.8 million gallons of reservoir storage is anticipated within the City. Alternatives as to the tank construction and location are addressed below.

Tank Construction

Tanks for storage of treated water are usually constructed with one of the following materials: wood, concrete, or steel. Each type of tank material has its advantages and disadvantages.

Wood tanks have historically been associated with smaller water systems such as campgrounds, parks and small communities. These tanks are usually constructed of redwood, less expensive than concrete or steel, and typically found in sizes of 100,000 gallons or less. Wood tanks usually have a concrete base, circular steel hoops for perimeter support, and use the natural swelling of wet wood to provide a near watertight seal. Leakage and the tendency of wood reservoirs to encourage the growth of bacteria, especially *Klebsiella*, are some of the disadvantages of this type of tank. The Health Division rules require that redwood tanks by provided with separate inlet/outlet and continuously chlorinated.

There are a number of different designs and methods of constructing a concrete tank. Some tanks use reinforced concrete while others use a prestressed, post-tensioned design. Tanks can also be constructed with poured-in-place concrete or utilize precast concrete. The advantages of concrete tank include ability to withstand seismic forces, ability to fully or partially backfill against the tank, and less maintenance. The disadvantages of concrete tank are the greater load this type of tank applies to the underlying soil and its cost.

Steel tanks are constructed with structural steel that is either welded or bolted together. Typically, the steel is manufactured off-site, and then delivered and assembled on-site. To protect against corrosion, a coating is applied to both the exterior and interior of the tank. Interiors of steel tanks are typically coated with an epoxy or enamel type finish that have a typical life expectancy of approximately 20 years with proper care and maintenance. One type of tank that has been popular in recent years is glass-fused-to-steel bolted tanks. With this type of tank, a 10-14 mil glass coating is applied to steel to provide a protective coating. Life expectancy of this type of tank has been estimated to be over 50+ years. The main advantage is that steel tanks typically have lower construction and installation costs than concrete. The primary disadvantage of steel tanks is the associated maintenance. Cathodic protection and periodic refurbishing of the steel tank surfaces are required to maintain the tank. While the glass-fused-to-steel bolted tanks do not need periodic refurbishing of the tank walls, these types of tanks are generally cost more than epoxy coated bolted tanks. For smaller size tanks (<60,000 gallons), stainless steel tanks may be a viable option.

Tank Location

Site selection for treated water tanks is based on a number of factors, the most important of which are as follows.

Elevation. There generally exists an optimum preferred elevation for a reservoir, which will provide acceptable pressure to customers located within the widest range of elevations. In Sutherlin's case, the optimum tank height for the majority of the City would be to match the overflow elevation of the reservoir tanks that service the low level service area (693 feet).

Topography. The optimum site is flat or gently sloping. Steep topography or areas susceptible to landslides are not desirable since such sites require extensive earthwork and associated cost. Locating tanks on cut/fill sections will require additional geotechnical investigations and sitework to avoid differential settlement. Generally, the site should accommodate the tank (plus room for another tank), a perimeter access road (minimum 15 feet width), and space to store the materials to build the tank.

Proximity to Other Land Uses. Locating a tank in close proximity to other types of land use, including residential areas is considered acceptable. Paint color, reservoir height, and landscaping are all considerations for sites within residential areas.

Location Relative to Service Areas/Other Tanks. Tank sites located long distances from the primary demand centers are not favored. Generally, system hydraulics and water main costs can be minimized by the utilization of a site close to the areas of maximum water demand. In addition, the relative location of the existing treated water tanks should also be considered. While it is typically more cost-effective to construct a new tank adjacent to an existing one, a separate location may be more recommended to provide system redundancy at another location and improve the hydraulics of the distribution system (see Section 8.5).

Recommended Tank Locations

Using the above site selection criteria, several general areas for a new treated water tank were identified. These potential tank locations include the following:

- **Plat M Road Reservoir Site.** This tank would be located in the southwest portion of the City off Plat M Road. The Oak Hills Tank currently serves this area. A tank at this location would provide redundant tank storage for the west side of the City. Ideally, the tank site would accommodate two tanks ranging from 1.0 to 2.0 MG. An evaluation of any proposed sites for geologic hazards is recommended especially in this portion of the City has identified some areas in the foothills in this region to be susceptible to landslides during a seismic event (Madin & Wang 2000).

- **Oak Hills Tank Site.** The present location for the Oak Hills Tank site has room for another 1.0 MG reservoir. The main advantage of this site is that it is already developed and has the existing infrastructure (i.e. 12-inch diameter water main) for providing reservoir service.

- **Umpqua Tank Site.** The present location of the Umpqua Tank site has room for another reservoir tank. As with the Oak Hills site, this tank site is already developed and served by an existing water main (14-inch diameter).

- **Sherwood Street Site.** The location of this proposed tank site is north of Sherwood Street in the foothills northeast of town. This tank would primarily serve the central and eastern portion of the City.

Of the above potential tank sites identified, the Plat M Road Reservoir Tank site is considered as the preferred site for construction of the City's next reservoir tank. This site would provide reservoir storage to the southwest portion of the City thus, providing additional storage to the west of Interstate 5. In conjunction with the construction of the Plat M Road Reservoir Tank, additional large diameter water mains would have to be installed to gain maximum benefit of the storage and fire flow capabilities provided by a tank at this location. The larger diameter water mains should be installed to connect the tank with the water main along Central Avenue and to connect with a large water main along Duke Road. See Section 12 for a development of the costs for and phasing of the recommended reservoir options.

8.5 Distribution System

The distribution system in the City of Sutherlin is comprised of a variety of pipe materials and sizes. The majority of the system consists of 8-inch diameter pipe, which is generally adequate for a well-looped system. A hydraulic model was utilized to assist in evaluating the capability of the City's existing water system in providing proper water flows (primarily fire flow) to selected areas in town. The basis for and results from the hydraulic model along with proposed water distribution system improvements are discussed below.

Hydraulic Modeling

With the advent of computer hydraulic models, an entire municipal water system can be mathematically analyzed with respect to existing hydraulic characteristics and "what if" scenarios. The mapping, calibration, and analysis of the City's water distribution system using a computer hydraulic model are discussed below.

Mapping

The City provided a map of the existing distribution system in an AutoCAD 2002 format and elevation data of the City in the form of 8½-inch by 11-inch drawings with no scale. These drawings were scanned, scaled, transferred into AutoCAD format, and overlaid on the existing distribution system piping map. In addition to the City's existing maps, plans for the City's Water Treatment Plants (WTP), Nonpareil water main, and Oak Hills Reservoir were also consulted and utilized in developing an overall base map.

Calibration of Computer Model

The existing distribution piping network was evaluated with a computer model; specifically, Water CAD® software by Haestad Methods. Water CAD® is a state-of-the art software tool primarily used in the analysis and modeling of water distribution systems. This program employs mathematical algorithms based on hydraulic principles to predict system pressures and flow rates within a water system. Fire flows are of particular interest since the magnitude of these flows dictates the necessary hydraulic capacity of the water system.

Information on the current operating parameters was entered into the computer model. Input parameters included daily system flows, pump flow rates or and/or flow curves, and operating pressures at pump stations and water treatment plants. User demand was more or less allocated evenly to each node of the existing system. A more refined allocation of the demand is not necessary as the projected user demand, even at peak flows, is substantially less than fire flow requirements.

A model is a representation of an existing system used to predict the behavior of the system upon real changes. A model is only useful if it can be calibrated and validated. The accuracy of the model output with existing conditions was checked or calibrated using water pressures and flows observed and collected in the field by the City's fire department. The hydraulic model solves for pressures and flows available in the main lines and not from hydrants. Pressures were calibrated for the system first by adjusting friction factors until the pressures in the model closely approximated measured pressures in the real system. In general, calibration is within approximately ±10 percent, which is considered a reasonable level of accuracy given the uncertainties in the model data.

Hydraulic Analysis of the Existing System

The existing distribution system was modeled using a hydraulic computer modeling software. This model included current piping, pump stations, reservoirs, and water treatment plants. The model contained 466 pipe elements and 366 nodes or junctions. Due to adequate system pressures and a relatively well-looped distribution network, hydraulic performance of the system is adequate in most areas. Residual pressures of 20 psi were used as a constraint on the system. This is a requirement of the Health Division. Greater fire flows may be attained due to the lack of this constraint in the physical system. It cannot be guaranteed that residual pressures will be maintained or that backflow conditions will not be encountered.

Performance of the distribution system with respect to maximum available fire flow capabilities was specifically examined at selected vital areas within the City that were identified with the assistance of the City's Fire Department staff. The locations examined were chosen for a number of reasons including potential fire suppression (e.g. Murphy Mill, schools), representation of a portion of the City, and identification of potentially undersized lines. The actual fire flow requirements for each of these vital areas and use were determined with input from the City's Fire Department. A summary of the specific fire flow requirements under State Fire Code at vital locations within the City is presented in Table 8.5.1.

TABLE 8.5.1
FLOW REQUIREMENTS FOR VITAL AREAS

Occupant, Location	Flow Req. per State Fire Code (GPM)[1]			
	100%	75%	50%	25%
High School, 400 Block East 4th Ave.				
Gym Area[2]	5,800	4,400	2,900	1,500
Upper Wing	3,400	2,600	1,700	900
Middle School, 649 East 4th Ave.				
Gym Area	3100	2,300	1,500	800
Upper Wing	800	600	400	200
West School, 531 North Comstock St.				
Gym Area	1,900	1,400	1,000	500
Upper Wing	400	300	200	100
East School, 301 East 3rd Ave.				
Gym Area	1,000	800	500	300
Lower Wing[2]	500	400	300	200
Sutherlin Plaza[2], Myrtle St. & Central Ave.	3,000	2,300	1,500	800
Sutherlin Inn, 1400 Hospitality Way	3,400	2,600	1,700	900
Umpqua Regency Inn, 150 Myrtle St.	6,000	4,500	3,000	1,500
Orenco[2], 814 Airway Ave.	8,700	6,500	4,400	2,200
Murphy Plywood[2], 144 West Central Ave.	41,000	31,000	12,000	10,000

(1) - Shaded areas indicated actual fire flow requirement
(2) – Building with sprinklers, which allows for 50% reduction in fire flow requirements.

The fire flow model was run with the requirement of maintaining minimum residual pressures of 20 psi throughout the system during a fire flow event. A summary of the available fire flows at various locations within the City is provided in Table 8.5.2.

TABLE 8.5.2
SUMMARY OF CURRENTLY AVAILABLE FIRE FLOWS

Location	Available Fire Flow (GPM)	Required Fire Flow (GPM)	Fire Flow Requirement Met?	Amount Deficient (GPM)
High School	2,500	3,400	No	900
Middle School	2,200	3,100	No	900
West School	2,700	1,900	Yes	-
East School	1,120	1,000	Yes	-
Sutherlin Plaza	3,000	1,500	Yes	-
Sutherlin Inn	1,800	1,700	Yes	-
Umpqua Regency Inn	2,300	6,000	No	3,700
Orenco	3,600	4,400	No	800
Murphy Plywood	3,000	12,000	No	9,000

The available fire flow at a number of the identified vital areas was significantly less than the required fire flow for these areas. The vital areas with less than required fire flow include the High School, Middle School, Umpqua Regency Inn, Orenco, and Murphy Plywood. In addition to these deficient areas, it was noted that the west side of town (west of Interstate 5) does not have adequate storage volume or flow capacity to delivery fire flow during a major fire event.

Fire at Murphy Plywood Plant, July 5, 2005

The major components of a water distribution system are typically designed to handle high flows as in the case of fighting a major fire. When a water system is put to the test when a major fire occurs, it is helpful to review how the water distribution system responded to the emergency. On July 5, 2005, the City's water distribution system was put to the test when a fire broke out at and eventually consumed the Murphy Plywood Plant. The City's fire department and 13 other regional agencies responded to the fire. In total, there were 15 engine companies, three ladder trucks, one tender, and eight brush units fighting the mill fire and related brush fires. Despite the efforts of the Plant's employees and the City, the Mill was considered a total loss. The following is a summary of observations made on the water system during the fire.

- The fire started at the mill approximately 12:30 pm, on Tuesday after the July 4th weekend.
- Both of the City's water treatment plants were in service and producing potable water, and the City's reservoir tanks were at levels typical for summer operation.
- During a 24 hour period (8:00 am July 5th to 8:00 am July 6th), an estimated 3.3 million gallons (MG) of potable water from the City's water system was utilized in fighting the fire. Total water produced and used for the day (including normal domestic usage) was 5.1 MG. Average flow over the 24-hour time period is 2,290 gpm.
- At approximately 6:15 pm, the City requested the Fire Department to reduce the amount of water used to fight the fire, if possible, due to low water levels in the reservoir tanks. As a result of this request, the valve to the 10-inch diameter water main supplying the mill was closed and some of the fire units reduced their fire flow. The City also imposed water curtailment measures to conserve water until the tank levels had reach normal levels.
- Over the course of the fire, there was a power outage (approximately 30 minutes) at Cooper Creek WTP, which resulted in some loss in water production. This power outage is attributed to the power to the mill being turned off.
- Oak Hills Reservoir was the last tank to drain and the last to fill up once the fire was over. Since the fire, the water level in the tank has not reached its pre-fire level.

Over a 24-hour period, the City's water system was able to deliver an average of 2,290 gpm. During the course of the fire, the system undoubtedly delivered more than the 2,290 gpm and the 3,000 gpm predicted by the hydraulic model. The higher than predicted flow rate is due to the conservative nature of the model simulation in that it was assumed that 1) a residual pressure of 20 psi was maintained throughout the distribution system at all times, and 2) the WTPs were not in operation. It is not known if a residual pressure of 20 psi was present throughout the City's water distribution system during the fire. Residual pressures for some of the higher elevation systems may be been adversely affected by the fire fighting. However, the City has not received any reports of such incidents.

With the exception of a short power outage at Cooper Creek WTP, both WTPs were in fact operating on July 5th. Although the pumps at the WTPs have a combined capacity of roughly 2,550 gpm, the treatment capacity dictates the amount of long-term water that can be delivered. The combined capacity of the WTPs is approximately 3.0 MGD or approximately 2,100 gpm. With both WTPs in operation, it is estimated that the City's system could deliver up to approximately 5,100 gpm to the Murphy Mill site while maintaining a 20 psi residual.

Proposed Improvements

Based on the results from the computer hydraulic model, observations made during the Murphy Mill fire, and discussions with City staff, several proposed improvements were identified for the City's distribution system. These proposed improvements are discussed below.

West Side Main Improvement

The water main in the City of Sutherlin must be upsized in order to deliver required fire flows and accommodate future growth on the west side of town. This new 18 diameter line will begin at the existing 14" water main located at the intersection of North Umpqua Street and East 6th Avenue. The line will continue west on East 6th Avenue, north on North State Street and southwest on West 6th Avenue to its intersection with Sherman Street, where it will turn south to the intersection with West Central Avenue. The line will continue west along West Central Avenue, which crosses Interstate-5 and changes into Highway 138, and terminates where the 12-inch diameter line from the Oak Hills development intersects with Highway 138. The total improvement length is approximately 10,850 feet.

High School / Middle School Improvement

Fire flow requirements for Sutherlin High School and Sutherlin Middle School will be met if a 14-inch diameter line size upgrade loop is installed. This line will begin at the intersection of North Umpqua Street and East 4th Avenue, where it will tap the existing 14-inch diameter reinforced concrete line. The line will continue east on East 4th Avenue and turn south on Mardonna Street. The line will tap the existing 14-inch diameter concrete waterline at the intersection of Mardonna Street and East Central Avenue. The total length of the improvement is approximately 3,900 feet.

Central Avenue Improvement

The main extending along West Central Avenue is undersized and must be upsized if fire flow and future demand requirements are to be met. The recent unfortunate fire that resulted in the destruction of Murphy Plywood changed the fire flow requirements for the area. The requirement is no longer for 12,000 GPM. An 18-inch diameter pipe will be installed beginning at the intersection of North Umpqua Street and East Central Avenue, where it will connect with the existing 14-inch diameter reinforced concrete water main. The line will continue south to the alleyway between East Central Avenue and East Everett Avenue, where is will continue west to Front Street. The line will continue north on Front Street and then west on West Central Avenue where it will terminate at the intersection with Sherman Street. The total length of the improvement is approximately 3,800 feet.

Orenco Improvement

Fire flows available to Orenco are short of those required and may be remedied by line size upgrades. A new 12-inch diameter main would begin at the intersection of East Duke Avenue and South Comstock Road. The line will continue south and then east on Airway Avenue at the end of which it will terminate. The total length of the improvement is approximately 1,000 feet.

Foster Avenue Loop Improvement

In order to increase the available flow on Foster Avenue the existing line will be looped. The total length of the improvement is approximately 1,600 feet. Further modeling investigation may be required in order to verify that the line does not require upsizing.

TABLE 8.5.3
SUMMARY OF AVAILABLE FIRE FLOWS AFTER PROPOSED IMPROVEMENTS

Occupant	Available Fire Flow (GPM)	Required Fire Flow (GPM)	Fire Flow Requirement Met?
High School	3,400	3,400	Yes
Middle School	3,400	3,100	Yes
West School	2,700	1,900	Yes
East School	1,120	1,000	Yes
Sutherlin Plaza	3,000	1,500	Yes
Sutherlin Inn	1,800	1,700	Yes
Umpqua Regency Inn	6,000	6,000	Yes
Orenco	4,400	4,400	Yes
Murphy Plywood	4,500	12,000(1)	No

(1) – based on the previous Murphy Mill site

Fire flow from treated water tanks is also dependent upon elevation and geographic location of the tanks within the distribution system. Elevation is important as it provides the static head or pressure to move the water. In Sutherlin's case, all of the treated water tanks have approximately the same overflow elevation and thus, provide the same static pressure. Geographical location of the treated water tanks is of importance for the distribution of fire flow with the water mains. If there is only one pipe between the reservoir and a hydrant providing access for fire suppression then all the water must travel through this pipe.

Depending upon the desired flow capacity, this pipe may need significantly larger than what is required to handle normal water distribution. To reduce the pipe size required to convey fire flows, multiple pathways or pipes are provided. Ideally, water from treated water tanks is conveyed from different pipe mains for flow redundancy. For example if two separate pipelines are used to convey 4,000 gpm of water, then each pipe would be required to convey 2,000 gpm instead of 4,000 gpm. By virtue of its locations, the treated water tanks in Sutherlin provide some flow redundancy.

Section

9

Water Conservation Plan

(OAR 690-086-140, 150)

9.1 Water Management and Conservation Plan

Water conservation consists of any beneficial reduction in water losses, waste, or consumption. As water providers face growing demands of them and their limited resources, conservation planning is playing an increasingly important role in their management practices. Water that is conserved, in effect, becomes a new and relatively inexpensive source of water for the utility.

Conservation can have the effect of helping water providers avoid, downsize, or postpone water and wastewater expansion projects. Capital, maintenance, and financing costs, and many other expenses may be reduced by effectively practicing conservation within the water system. Additional benefits for the environment include restoring stream flows to support aquatic life, providing recreational opportunities, and maintaining water quality. Investments in conservation planning yield savings that can be measured in terms of reclaimed water, resources and related operating dollars.

A water conservation plan is long-term program intended to reduce average per capita water consumption, thus diminishing the overall demand placed on a water system and its resources. The Oregon Department of Water Resources reviews municipal water management and conservation plans based on the requirements found in the Oregon Administrative Rules (OAR) Division 86 (OAR 690-086-100 to 170). Much of what is required in a conservation plan is provided in a standard water master plan. However, the conservation and curtailment elements of a conservation plan are typically not part of a water system master plan. Sections 9, 10 and 11 of this Master Plan have been specifically prepared to satisfy the requirements outlined in OAR 690-086-100 to 170. The entire Master Plan should be submitted to the Oregon Department of Water Resources as well as the Oregon Health Division for review and acceptance.

As outlined in OAR 690-086-125, a water management and conservation plan shall include the following:

- Water supplier description,
- Water conservation element,
- Water curtailment element,
- Water supply element,
- A list of affected local governments to whom the draft plan was made available pursuant to OAR 690-086-120(6), and a copy of any comments on the plan provided by the local governments,
- A proposed date for submittal of an updated plan with no more than 10 years based on proposed schedule for implementation of conservation measures, any relevant schedules for other community planning activities, and the rate of growth or other changes expected by the water supplier or an explanation of why submittal of an updated plan is unnecessary and should not be required, and
- If the municipal water supplier is requesting additional time to implement metering as required under OAR 690-086-0150(4)(b) or a benchmark established in a previously approved plan, documentation showing additional time is necessary to avoid unreasonable and excessive costs.

Much of this Master Plan is summarized in this section including information on the existing system, service population, system demand, and long-range supply. The municipal water supplier description and conservation elements of the City's Water Management and Conservation Plan are addressed in this section. The water curtailment element is discussed in Section 10 and the water supply element is presented in Section 11.

9.2 Municipal Water Supplier Description (OAR 690-86-140)

The City of Sutherlin is located next to Interstate 5 (I-5) in the north-central portion of Douglas County, approximately 55 miles south of Eugene and 14 miles north of Roseburg (Figure 3.1.1). Sutherlin is surrounded on the north and south by forested hills and to the west and east by Sutherlin Valley that consists of spotted timber, open agricultural use, and minor rural development. The City provides potable water service to its residents, commercial/industrial users, schools, and public/non-profit customers. In addition, the City also serves a number of residential, commercial/industrial and public/non-profit users outside the City.

A comprehensive description of the City's water supply and usage is given below in accordance with OAR 690-086-140.

Supply Sources & Supply/Delivery Contracts (OAR 690-86-140 (1))

The primary water sources for the City of Sutherlin are Calapooya Creek, Cooper Creek Reservoir, and North Umpqua River. The Calapooya Creek source is the City's primary diversion that is used year-round due to its good water quality. The Cooper Creek Reservoir source is utilized to satisfy demand during the dry season months (June to October) and in the case of water supply emergencies. The City's withdrawal from Cooper Creek Reservoir is based on the City's water right of 5 cfs from Cooper Creek and the Sutherlin Water Control District's water right for stored water in the reservoir (500 Ac-Ft for municipal diversion). The City has obtained a water right permit for the diversion of water from the North Umpqua River between Winchester and Whistler's Bend. The City has not yet developed or diverted water from this source.

The City currently supplies potable water to the Union Gap Water District. The City does not have any other interconnections with other municipal or community water systems.

Current Service Area & Population (OAR 690-086-140(2))

The City's water service area includes users within the City Limits, the Union Gap Water District located between the City and the City of Oakland, and outside users located between the City and its Nonpareil Water Treatment Plant (WTP) located approximately eight miles east of town. The City's service area is shown in Figure 9.2.1.

The current population (Year 2004) within the City of Sutherlin is 7,360 based on Portland State University's (PSU) Population Research Center's estimate. Since 1990 Sutherlin has experienced a growth rate higher than most other communities in Oregon. Based on United States Census data, the City of Sutherlin's population increased from 5,020 to 6,669 between 1990 and 2000. This increase equates to an average annual growth rate of 2.9%. During this same period, the average growth rate in Douglas County was only 0.6%.

Sutherlin's livability characteristics, especially for retired persons and those enjoying outdoor recreation, have attracted a long term growing populace regardless of the local economic climate. Growth is expected to continue at or exceed a rate similar to that experienced in the community during the last decade. The coordinated population projection of 2.7% per year has been selected by Douglas County in its Comprehensive Plan (1997) for the next 25 years (to the Year 2029). Table 9.2.1 summarizes the population projections over the next 20 years, using the Year 2004 PSU estimate of the City population (7,360) as the base figure.

FIGURE 9.2.1 – WATER SERVICE AREA

TABLE 9.2.1
CURRENT POPULATION ESTIMATE AND POPULATION PROJECTIONS

Year	2000	2004	2005	2010	2015	2020	2025
Residential Population	6,669	7,360	7,559	8,636	9,866	11,272	12,878

City staff has expressed concern that the County's adopted 2.7 percent annual growth for the City may be too conservative. This concern is based on a number of observations including recent growth within the City, developers expressing interest in developing residential, commercial, and industrial properties within the City Limits and Urban Growth Boundary (UGB), and property owners outside the City's UGB expressing an interest in annexing into the City. If higher than anticipated growth were to occur, a water master plan based on the 2.7 percent annual growth would be underestimate the required potable water infrastructure to support future users. On the other hand if growth were not to occur as fast as anticipated, then the plan may recommend improvements that may not be needed within the Study Period (next 20 years). To address both of these concerns, this master plan was compiled to examine the City's potable water infrastructure needs not only for the anticipated 20-year City population of 12,878, but also for population increments leading up to and exceeding this projected population. The population increments leading up to 12,878 are based on a rational, phased approach that is discussed in further in Section 3.3. Two increments of 3,000 capita beyond the anticipated population of 12,878 were examined (15,878 and 18,878) in this plan.

For the calendar Year 2004, there were 2,039 residential potable water connections within the City. The number of equivalent dwelling units (EDUs) for these connections is 3,179 (see Section 6.2 for more details). With a current City population of 7,360, the number of capita per equivalent dwelling unit is 2.32 (7,360 capita/ 3,179 EDUs, rounded).

In addition to the City's residents, there are a total of 260 residential water connections outside the City limits. Assuming each residential connection is a single-family dwelling, there are a total of 260 EDUs outside the City. Based on representative Year 2000 Census data for Census Tract 500.01, the average of number of persons per household ranges from approximately 2.8 to 3.0 (Blocks 3071 & 3072, Block Group3; Blocks 4007, 4008, 4009, 4010, & 4016, Block Group 4). Assuming 2.8 persons per EDU and 260 EDUs with water service outside the City, the estimated population of potable water users outside the City limits is 728. City staff considers future growth of potable water users in these currently served areas to be minimal or non-existent.

The current and future total number of potable water users on the City's system is summarized in Table 9.2.2. With the two 3,000 population increments above the 20-year projection, the anticipated Years when these populations would be achieved, at 2.7 percent annual growth, is 2034 and 2046, respectively.

TABLE 9.2.2
CURRENT AND FUTURE POTABLE WATER USE POPULATION

Year	Population		
	Exist. & Future City Users	Exist Outside Users	Total
2004	7,360	728	8,088
2005	7,559	728	8,287
2010	8,636	728	9,364
2015	9,866	728	10,594
2020	11,272	728	12,000
2025	12,878	728	13,606
2034	15,878	728	16,606
2046	18,878	728	19,606

Assessment on the Adequacy & Reliability of Existing Water Supplies (OAR 690-086-140(3))

The City currently diverts water from Calapooya Creek and Cooper Creek. To date, these supplies have been adequate to satisfy the City's potable water demand. The main limitation has been the City's ability to treat raw water from Cooper Creek. Due to eutrophic conditions within the Cooper Creek Reservoir, raw water treated by the City's Cooper Creek WTP often has zero dissolved oxygen (DO), elevated concentrations of iron and manganese, and noticeable levels of hydrogen sulfide. To treat this quality of water, the City utilizes potassium permanganate as a oxidation agent prior to filtration. However, the WTP does not have a sedimentation basin prior to filtration that results in all of the precipitated solids being removed at the filters. As a result, the filters require frequent backwashes that reduce WTP capacity. Current maximum day production (approximately 1.0 MGD) is roughly half of the WTP's design flow of 2.0 MGD. As the Cooper Creek Reservoir has aged, the water quality has declined. A continued decline in the reservoir water quality is anticipated.

Both the Calapooya and Cooper Creek sources have historically been reliable. The Calapooya Creek is utilized throughout the year even when the creek turbidity occasionally exceeds 500 NTU for short periods of time during winter storms. Based on an analysis of historic streamflows of the Calapooya Creek and Sutherlin's water rights, the following conclusions were made concerning the ability of the City to withdraw water from Calapooya Creek during the summer months (see Section 5.2).

- The City's most recent water right (1.0 cfs, obtained in 1978) is affected by minimum instream flows, and will likely only be available during the months of December through June.

- The City has on two occasions (July 16, 1985 and August 15, 1990) been notified by the County Watermaster to limit its water diversion at its Nonpareil WTP because streamflows in Calapooya Creek had dropped below minimum instream flow requirements of 12 cfs (July – Sept). On both occasions, the City was asked to limit their withdrawal from 4.0. cfs to 3.0 cfs. The City's most recent water right on Calapooya Creek (1979) is junior to the instream water right and therefore, subject to restrictions at lower stream flows.

- The cumulative total of all water rights issued for Calapooya Creek from 1909 (first right) to 1941 (Sutherlin's 1941 right) is 7.473 cfs. The probability of obtaining this stream flow (downstream of Oakland) in the months of July through October is as follows: July - 90%; August, September - 50 to 80%, October 80 to 90%.

Under severe drought conditions and low stream flows, the City's senior water rights could be restricted as the City does not have the most senior water rights on Calapooya Creek. Based on historical stream flow data, the lowest stream flows and thus, the most likelihood for water diversion restrictions is in the months of August and September, which happens to be the months of largest water consumption within the City.

The City's other water source, Cooper Creek Reservoir, has never presented any water supply issues since the City's diversion is well below the normal reservoir water surface. In consulting with the Sutherlin Water Control District, restrictions from diverting water from Cooper Creek Reservoir are not anticipated (Bing 2005).

The adequacy and reliability of the City's existing water supplies to satisfy projected future water demand is addressed in Sections 8.1 and 11.4. A plot of projected maximum daily demand (MDD) versus time is presented in Figures 8.1.1 and 11.4.1.

Quantification of Water Delivered by Supplier (OAR 690-086-140(4))

As mentioned in Section 5.1, there is concern about the accuracy of the raw water flow meters due to debris occasionally becoming lodged in the meter. For this, the amount of diverted water from each source was calculated based on the sum of the amount of water pumped to the City, and backwash water, which is the WTP water production.

The amount of water produced at the water treatment plant and sent to the City for consumption is based on daily records maintained by the City staff. The amount of treated water produced at a WTP is typically equal to the sum of the amount of water sent to the City for consumption plus the amount of water used for backwash, and miscellaneous water usage at the WTP (e.g. for pump seals, sanitary usage, etc.). As the City does not currently record miscellaneous water usage at the WTP, this miscellaneous usage at the WTP is not known. Consequently for this study, water treatment plant production will be based on the sum of water pumped to the City for consumption and the amount of water used for backwash.

Water production rates were derived from the plant data for average annual demand (AAD), average daily demand (ADD), maximum monthly demand (MMD), peak weekly demand (PWD), and maximum daily demand (MDD). A definition of each of these water demand parameters was previously given in Section 6.1. A summary of the compiled water demand parameters for the Years 2000 to 2004 is presented in Table 9.2.3. The maximum water production for the time periods reviewed was observed in the Year 2003.

TABLE 9.2.3
ANNUAL, MONTHLY, WEEKLY & DAILY WATER PRODUCTION W/BACKWASH

Time Period	AAD, gpy	ADD, gpd	DDD, gpd	MMD, gpd	PWD, gpd	MDD, gpd
2004	560,682,360	1,536,116	1,923,212	2,545,401	2,833,107	3,163,250
2003	577,142,000	1,581,211	2,162,209	2,764,377	2,931,464	3,382,250
2002	538,655,320	1,475,768	1,950,647	2,399,088	2,731,929	3,196,750
2001	520,276,314	1,425,415	1,803,256	2,158,272	2,403,714	2,498,750
2000	556,539,840	1,524,767	1,951,198	2,354,863	2,776,250	3,252,750
Average	550,659,167	1,508,655	1,958,104	2,444,400	2,735,293	3,098,750

Tabular List of Water Rights (OAR 690-086-140(5))

A tabular list summarizing information on the City's water rights and sources is presented in Table 9.2.4. A summary of monthly and daily diversions from Calapooya Creek and Cooper Creek is presented in Appendix C.

Table 9.2.4

Existing Service Population (OAR 690-086-140(6))

The City of Sutherlin provides users inside and outside the City limits. A summary of the City's water user accounts for the Year 2004 is provided in Table 9.2.5.

TABLE 9.2.5
SUMMARY OF WATER USERS

Source	Number of Connections	Est. Water Usage		EDU's	% of Usage
		Annual, gpy	ADD, gpd		
Residential (Inside City)					
Single Family	1,957	183,342,630	502,309	1,957	42.6
Mobile Home Parks	11	48,092,924	131,761	814	17.7
Multi-Family	69	18,925,454	51,851	333	7.3
Assisted Living	2	2,732,090	7,485	75	1.6
Subtotal	2,039	253,093,098	693,406	3,179	69.2
Residential (Outside City)					
Single Family	260	21,683,122	59,406	260	5.7
Total Residential	**2,299**	**274,776,220**	**752,812**	**3,439**	**74.9**
Commercial / Industrial					
Inside City	215	69,669,536	190,875	872	19.0
Outside City	3	535,950	1,468	7	0.2
Bulk Water	**3**	497,403	1,363	6	0.1
Commercial / Industrial	**218**	**70,702,889**	**193,706**	**885**	**19.3**
Schools					
Grade / Middle / High	**13**	**15,582,976**	**42,693**	**195**	**4.2**
Public / Non-Profit					
Inside City	39	5,903,877	16,175	74	1.6
Outside City	4	138,910	381	2	0.04
Total Public / Non-Profit	**43**	**6,042,787**	**16,556**	**76**	**1.6**
TOTAL	**2,574**	**367,104,872**	**1,136,946**	**4,595**	**100.0**

(1) - Number of EDUs based on 79,900 gallons per EDU per year, does not include City Services.

It should be reiterated that Table 9.2.5 shows the average consumption levels within the system. All losses, nonaccount water, and other water uses are not accounted for within the consumption data. Residential sources account for approximately 75 percent of all water consumed within the City. The remaining system users (i.e. commercial/industrial, schools, public/non-profit) utilize 25 percent of the City metered water. Users within the City account for approximately 94 percent of the water consumed; approximately 6 percent of the water users are outside the City Limits.

Interconnections with Other Systems (OAR 690-86-140(7))

The City has an interconnection with and supplies potable water to the Union Gap Water District. The City is currently negotiating an agreement with the Umpqua Basin Water Association for payment of site improvements completed by the Association in January – April 2006. These improvements were made in conjunction with other improvements being performed by the Association to accommodate the City's future diversion of raw water from the North Umpqua River. Total cost of these completed improvements was $595,000.

System Schematic (OAR 690-86-140(8))

A schematic of the City of Sutherlin's existing water system is displayed in Figure 9.2.2. This schematic shows the raw water diversions, water treatment plants (WTP), treated water mains from WTPs, and treated water reservoir tanks. The actual location of these facilities is shown in Figures 3.1.2 and 5.5.1.

Quantification & Description of System Losses (OAR 690-086-140(9))

Water sold is typically less than the amount of water produced at the plant due to system leaks, unmetered use at the WTP (backwash water, turbidimeter water, wash down, etc.), unmetered use within the distribution system, inaccuracies in customer meters, and other unmetered use such as fire flows and system flushing. A comparison of the amount of water treated (sum of water pumped to the City and backwash), and the amount of water consumed is given in Table 9.2.6.

TABLE 9.2.6. COMPARISON OF WATER PRODUCED, BACKWASH, PUMPED & CONSUMED

Time Period	Water Produced	Backwash	Water Pumped	Water Consumed	% Nonaccount[1]
2004	559,214,000	32,177,000	527,037,000	367,105,000	30
2003	575,254,000	41,330,000	533,924,000	399,469,000	25
2002	537,071,000	34,660,000	502,411,000	381,626,000	24
2001	518,594,650	35,896,250	482,698,400	326,342,000	32
2000	554,948,000	34,970,000	519,978,000	336,360,000	35
Average	549,016,330	35,806,650	513,209,680	362,180,400	29

[1] - % Unaccounted is based on the quotient of the water consumed and water pumped to the City.

Over the last five years, the average amount of nonaccount water pumped to the City is approximately 29 percent. Previously, the percent of nonaccount water within the City has been reported as 27.5 percent in 1995-96, and 39 percent in 1974 (HGE 1997). Potential sources of lost treated water include the following.

- Leakage within the City's water distribution system.
- Inaccurate water meters
- Unauthorized use or connections without meters
- Unmetered water for fire-fighting and operations such as street cleaning, water main flushing and testing.
- Other approved, but non-metered, water uses.

The City does not currently monitor system losses on a periodic basis and a number of services that are not metered. Consequently, the City must rely on occasional nonaccount water calculations as a measure of system losses. Proposed elements of the water conservation plan include an annual water audit, metering of unmetered uses, and leak detection. These items are discussed below; see Table 9.4.1 for a summary of conservation benchmarks.

Figure 9.2.2 – Water System Schematic

9.3 Water Conservation Element (OAR 690-086-150)

Municipal water providers are in the service of providing potable drinking water to its patrons. The sale of that water allows the utility to pay expenses, retire debts for system development loans, and plan for future water production facilities. Some providers may view conservation as an activity that may jeopardize the financial survival of their water system. However, practically every water system is capable of making changes in their operation that will result in reducing "lost water" and lower production costs. Conservation often results in an increase of operating revenues and a decrease in unnecessary and wasteful expenses. Responsible water management also includes educating the public about wasteful water usage practices. The section addresses current and proposed water conservation measures for the City to implement.

Water Conservation Progress Report (OAR 690-86-150 (1))

As the City does not have a previously approved plan, a progress report for previously implemented conservation measures is not required. However, existing conservation measures are described later in this section.

Water Use Measurement and Reporting Program (OAR 690-86-150(2))

Both of the City's water diversions are measured with flowmeters with flow totalizers on the influent line to the water treatment plants. City believes that the installed flow measurement system complies with the measurement standards in OAR 690-085.

Current Conservation Practices (OAR 690-86-150(3))

The current conservation practices employed by the City of Sutherlin are metering, rate structure, and production and delivery of reclaimed water for irrigation of a golf course in the summer. The vast majority of the existing water system is metered enabling the City to charge its users according consumption. The meters are read on fixed intervals and can be used for audits and accounting practices. The City replaced all of the ¾-inch and 2-inch meters approximately 3 years ago with the installation of automated meter reading (AMR) system. Flow usage at larger meters is gathered manually. The large meters are calibrated annually.

The City currently utilizes a base rate with uniform charges for consumption. This water rate structure provides excellent revenue stability, is a good conservation tool, provides good equity, and is simple to administer and explain.

The City currently produces and pumps Class II reclaimed water from its wastewater treatment plant (WWTP) to the Oak Hills Golf Course for irrigation of the greens and fairways during the months of June through October. Presently, there is approximately 95 acres of greens and fairways under irrigation at the golf course.

Planned Conservation Program Activities (OAR 690-86-150(4,6))

This section described the City of Sutherlin's planned water conservation program activities for the Years 2006 to 2010. A table of conservation benchmarks, as required in the Division 86 rules, is at the end of each section. These conservation benchmarks are specific commitments that the City will implement according to the schedule in each table. The Year 2006 to 2009 time period is the focus of the conservation benchmarks as the proposed submission of a revised Water Management and Conservation Plan for the City is the Year 2011.

The planned conservation program activities listed below are the City's first organized effort in implementing a water conservation plan. One underlying goal of this plan is for the City, including staff, elected officials, and the public, to develop a sustainable "water conservation mindset". It takes time to change existing attitudes, habits and work practices, and develop new ones. As such, this program emphasizes the basic elements needed in a water conservation plan: periodic auditing, metering of sources and uses, leak detection, public education, basic technical and financial resources, rate structures that encourage conservation, and recycling opportunities. In some cases, the recommended benchmarks include conducting surveys and collecting additional information. While these activities may not appear to be pressing forward with the water conservation message and activities, these small steps are needed to develop support for and encourage water conservation. As the City gains experience and knowledge of their system, and as the public becomes more aware for the need of water conservation, the City can branch out in new water conservation activities.

Annual Water Audit (OAR 690-086-150(4a))

The purpose for a water audit is to track the efficiency of the system, monitor water consumption levels, determine effectiveness of conservation measures, and gather system performance data. The OAR requires determination of the level of water loss as communities seek to reach efficiency goals of 90 percent or greater.

Historically, the City has not performed periodic water audits on a regular basis. Previous audits were performed consulting engineers in conjunction with water master planning. At a minimum, the City needs to perform annual water audits.

Installation of water meters is recommended for those services not currently metered. A list of services that need water meter reading is given below under heading "Metering". A spreadsheet and method for incorporation this data into the spreadsheet will need to be developed to incorporate the various water measurement data and perform the necessary calculations in a reasonable time frame.

To better track and respond to changes in system losses, the City needs to implement a monthly water audit within its raw and treated water systems. This monthly audit will prove to be helpful in detecting irregular water use patterns that may be attributable to leaks, malfunctions, and other system problems. Performance of monthly audits will provide the City with relatively "fast" feedback on the performance of its system and the response of specific repairs or improvements that have been developed.

As part of the auditing system, the City needs to develop estimates of known uses and losses on a monthly basis and maintain records of this water use. Known uses and losses will include estimating quantities of water used for flushing mains, lost due to major leaks or water main replacement, and utilized through hydrant meters. In addition, the City will need to implement a system to track water used for fire suppression and training through its hydrants. This auditing needs to be implemented as soon as possible even though all of the components may not be in place. Conservation benchmarks for annual water audit are listed in Table 9.3.1.

TABLE 9.3.1
ANNUAL WATER AUDIT BENCHMARKS – YEAR 2006-2010

Benchmark	Start Date	Frequency or Completion
Install new meters & read existing water meters as described under Metering Benchmarks (Table 9.3.2)	2006	Nov. 2006 - 2011
Develop electronic spreadsheets & procedure for implementing audits	2006	Aug. 2006
Collect & record monthly meter readings, complete monthly audits	2006	Monthly
Perform annual water audit	2008 (using 2007 data)	Annual

Metering (OAR 690-086-150(4b))

Not all of the water services within the City are metered. Installation of water meters is recommended at the following locations.

- Central Park
- City's Wastewater Treatment Plant (WWTP)
- Nonpareil WTP
- Triangle Park
- City Library
- Community Building
- Public Works Shop

In addition, there are some services (e.g.) that have had a meter installed but are not currently being read. The City should begin to collect water usage data from these meters as soon as possible. The locations where meters have been installed without water usage retrieved include the following.

- City Hall
- Calapooya Fire Department
- Fire Department on State Street
- Everett Pump Station
- Church Street Pump Station
- Cooper Creek WTP

Backwash water utilized at each of the City's WTPs is not metered. Currently, the quantity of water used for backwash is estimated using the design pump capacity and number of pump run hours. These streams should be directly metered. Installation of these water meters is recommended with the proposed upgrades to each WTP. Conservation benchmarks for metering are identified in Table 9.3.2

TABLE 9.3.2
METERING BENCHMARKS – YEAR 2006-2010

Benchmark	Start Date	Frequency or Completion
Install new meters at the following locations:		
Central Park & Community Building	2006	Nov. 2006
City's WWTP & Triangle Park	2006	Jun. 2007
Public Works	2007	Jan. 2008
Nonpareil WTP & City Library	2008	June 2008
Collect water usage data from existing meters not currently being read	2006	July 2006
Install water meter on Cooper Creek WTP backwash stream	2007 est.	2009 est.
Install water meter on Nonpareil WTP backwash stream	2010 est.	2011 est.

Metering Testing & Maintenance Program (OAR 690-086-150(4c))

Water meters are a water provider's cash register used to equitably charge for provided water. Yet many providers rely on old, poorly maintained meters that can be inaccurate, commonly on the order of 10 to more than 50 percent of the actual water flowing through the meters. Inaccurate water meters usually are providing flow readings in favor of the customer. The water that is able to "slip" through the meter undetected becomes not only loss revenue, but also lost water.

As mentioned in Section 9.2, the City replaced all of the ¾-inch and 2-inch meters are relatively new as they were replaced approximately 3 years ago with the installation of automated meter reading (AMR) system. Typically the meter testing schedule for these size meters ranges from 5 years (for 2-inch) to 8 years (for ¾-inch). Thus, the 2-inch meters should be tested in Year 2007 and the ¾-inch meters beginning in the Year 2008. However due to the number of meters to be tested, it is recommended that meter testing on one-quarter of the system metes every year for four years.

The large meters (2-inch and larger) are calibrated annually. This program will continue.

The City has not had a formal, scheduled testing of its source meters to the WTPs. The City proposes to verify the WTP source meters at least every 2 years, or as needed, by using the drawdown or fill up method. With this method, a known or calculated amount of water flows through the meter and then a comparison is done between the calculated and metered amounts. For the Nonpareil WTP, source meter verification can be accomplished by drawing down the Raw Water Wetwell (with no inputs), which is upstream of the meter. At Cooper Creek WTP, the source meter can be verified by calculating the amount of water that is filling up the Mixing Chamber (with no outputs). For both methods, at least two to three drawdowns or fill ups should be conducted and the results averaged to verify the source meter accuracy.

Meter testing and maintenance program conservation benchmarks are shown in Table 9.3.3.

TABLE 9.3.3
METER TESTING & MAINTENANCE PROGRAM BENCHMARKS – YEAR 2005-2010

Benchmark	Start Date	Frequency or Completion
Verify 2-inch Meters within system	2007	Every 5 years
Verify ¾-inch Meters	2008	¼ of total meters, Annually from 2008-2012
Verify Large Meters (>2-inch)	Ongoing	Annually
Source Meters	2005	Every 2 years or as needed

Rate Structure (OAR 690-086-150(4d))

The City of Sutherlin currently charges customers for their water based upon a standard base rate plus a uniform consumption rate. The customer is billed the base rate regardless of whether or not the water is used. Thereafter, the customer is billed in direct proportion to the amount of water consumed, either based on $1.35 per 1,000 gallons or $2.70 per 1,000 gallons depending on whether the customer is inside or outside the City. This rate structure is in conformance to the requirements of OAR 690-086-150(4d).

Leak Detection Program (OAR 690-086-150(4e))

The annual water audits that have been compiled thus far have not been able to determine the amount of leakage in the City's system due to the large number of unmetered services. Consequently, the City is not able to determine at this time if system leakage exceeds 10 percent. However, the City's percent of non-account water losses discussed in Section 9.2 are at a level that suggests implementation of a leak detection program would be prudent. As part of its conservation plan, the City will perform monthly and annual audits of its water usage and production and install meters on those uses that are correctly unmetered. Once the audit and additional meter reading information are available, the City will be able to assess their system losses. A leak detection program makes use of planned strategy and various techniques and technologies to efficiently and effectively locate leaks in the system and identify pipelines requiring repair or replacement.

Leak Detection Measures

Leak detection measures may include regular on-site testing using computer-assisted leak detection equipment, sonic leak detection surveys, or another acceptable method for detecting leaks along water distribution mains, valves, services, and meters. The inspections can also include the internal inspection of water tanks and reservoirs. The City staff or an outside consultant can perform leak detection of the City's water system.

A number of different methods are available for locating leaks in a water system. The simplest method of leak detection is to search for and locate wet spots or green areas that might indicate the presence of a leak. This technique would be especially suited for water mains that are not under buildings or paved surfaces.

The next level of leak detection is to use listening devices that amplify vibrations caused by a leak. The simplest device is a steel bar held against a pipe or valve. To detect leaks, listening devices (such as geophones) should be placed on fire hydrants, valves, meters, mains and services. If a leak sound is detected, a detailed investigation should be initiated by listening to each meter in the area of the leak sound. Listening on the meter allows one to check the meter coupling and curb stop for leakage and may indicate whether the leak is on the service or main.

For more sophisticated detection techniques, the City may wish to bring in leak-detection consultants to scan the water system for leakage. These detection techniques include the use of electronic leak detectors and leak noise correlators. A typical leak detection survey costs anywhere from $100 to $400 per mile of main surveyed, depending on the size of the system, the material of mains to be surveyed, and the distance traveled (Fenney 1999). Leaks from PVC and PE pipes, and appurtenances are difficult to detect because sound does not travel very far through these materials. Special listening equipment may be needed for these pipes. General surveying equipment costs from $2,000 to $5,000, while leak noise correlators can cost from $35,000 to $60,000 (Ibid 1999).

Another method that the City may employ to detect leaks is the isolation method. This method includes the isolation of short piping sections utilizing existing and newly installed mainline valves. The mainline is isolated under "line" pressure and all services are turned off at the meters with prior notice to customers. A pressure gauge is attached to one service and the pressure is monitored over a period of time. If the pressure falls off relatively quickly, it is likely that a major leak is located within that section of piping. Pressurizing the isolated main to a higher pressure than normal can increase the sensitivity of this method. Once a pipe segment has been identified to be leaking, listening or electronic devices can be used to pinpoint the location of the leak.

Leak Detection Strategy

The recommended strategy for leak detection within the City of Sutherlin is to focus on the portions of the water system that are the most likely, or have been observed, to leak. This strategy will rely primarily on the age and material of water mains within the system. For example, older piping made of steel and cast iron is anticipated to be more susceptible to leak problems than newer, PVC pipe. With respect to service lines, galvanized pipe is considered more prone to leakage than poly or copper pipe. Consequently, leak detection efforts should concentrate on the most susceptible portions of the City's water system.

A list of the City's distribution piping, prioritized in terms of anticipated leakage, and associated location within the City is presented in Table 9.3.4. Priority 1 is considered to require the highest priority for leak detection while Priority 3 is the lowest.

TABLE 9.3.4
PRIORITY AREAS FOR LEAK DETECTION

Pipe Size & Material	Length (LF)[1]	Location
Priority 1		
2-inch Steel/Copper	2,340	Lane St., off Comstock, between Tanglewood, Cedar off 6th Ave., & 2 lines between Calapooya & Umpqua off 1st Street.
High Priority Cast Iron Mains	1,670	East Dean between Willamette & Umatilla; East Everett between Willamette & State
Priority 2		
4-inch, Cast Iron	1,610	1st, 2nd, 3rd, & 4th Streets, at Sherwood St.
6-inch, Cast Iron	3,420	Various, primarily north of Central Ave.; east of I-5
Priority 3		
8-Inch Cast Iron	12,840	Various, excluding proposed upgrade sections, West 6th Ave.

(1) – Approximate lengths

It should be noted that portions of the 8-inch diameter cast iron pipe on Central Avenue (west of the railroad tracks) and 6th Street was excluded for consideration as a new larger water main is proposed for this alignment (see Section 12.2). Until this pipe segment is replaced, these mains need to be monitored and repaired as necessary to keep water losses to a minimum.

The City should develop a map that will allow them to graphically document and track their progress and findings. Items recommended on this map include: 1) areas monitored or tested for leaks, 2) location of service lines that are galvanized, and 3) areas where water mains and/or service lines have been repaired or replaced.

The recommended schedule for leak detection program for initiation and completion of the systematic leak detection is dependent upon the results of the comprehensive Annual Water Audit to be completed in January 2007. If the system leakage is greater than 10 percent based on this Annual Water Audit, then the leak detection program of Priority No. 1 areas should be initiated. Once Priority No. 1 areas have been completed, then leak detection should be initiated on Priority No. 2 areas, and thence to Priority No. 3 areas once Priority No. 2 is completed. This time frame for implementation of the leak detection program is considered both feasible and appropriate since the City will be seeking to simultaneously implement this leak detection program and other water conservation measures, make necessary pipe repairs, and proceed with recommended measures and capital improvements presented in this Master Plan. If a substantial number of the Priority 1 mains are replaced, then the City should move to suspect leak detection of Priority 2 and 3 mains unless system leakage still remains above 10 percent.

A summary of leak detection program benchmarks is presented in Table 9.3.5.

TABLE 9.3.5
LEAK DETECTION PROGRAM BENCHMARKS – YEAR 2005-2010

Benchmark	Start Date	Frequency or Completion
If System Leakage is shown to be >10%, perform leak detection of Priority 1 Areas	2007	Jan. 2008
If System Leakage is shown to be >10% in Annual Audit & leak detection has been completed on Priority No. 1 Areas, then perform leak detection of Priority 2 Areas	2008	Mar. 2009
If System Leakage is shown to be >10% in Annual Audit & leak detection has been completed on Priorities No. 1 & 2, then start on Priority 3 areas.	2009 (dependent on No. 2)	Mar. 2010 (dependent on No. 2)
Leak Occurrence Map of City's Water Distribution System	2006	Ongoing

Public Education Program (OAR 690-086-150(4f))

The goal of a public information program on water use efficiency is to develop a conservation ethic among water users. A public information and education program on water conservation is recommended as a means of influencing water consumptive practices and patterns within the system. An informed public will also be more likely to support changes in the rate structure and management practices if they feel they are part of the conservation effort. Public education may take on the form of mailers, workshops, school programs, and individual conservation reviews.

Public information programs can educate consumers on a wide variety of conservation issues including the following.

- Toilet flushing and fixture efficiency.
- Detecting and fixing leaks.
- Efficient use of water when washing cars or other outdoor use.
- Landscape efficiency and irrigation practices.
- Low water use landscaping (Xeriscape™)
- Rebates and other incentives promoting conservation practices.
- Potential curtailment activities.
- General conservation awareness.

A significant amount of education materials have been developed at little or no cost to the water provider from such organizations as American Water Works Association (AWWA; www.awwa.org) and OSU Extension Service (http://extension.oregonstate.edu/). AWWA has a number of consumer and youth education materials on water conservation including consumer guides, manuals, and DVD/VHS videos. OSU Extension Service has a number of publications about water conservation on such topics as Water-Efficient Landscape Plants, Strategies for Reducing Irrigation Use, and Conserving Water in the Garden. Another good source of information is from other municipalities and utilities that have already have developed water conservation measures for their constituents. Some examples of utilities with water conservation programs include Southern Nevada Water Authority (www.snwa.comT), San Antonio Water System (www.saws.org), and the City of Ashland, Conservation Division (www.ashland.or.us). Pamphlets, videos, CD-ROM computer programs, and other materials are available to assist the water provider in their public education efforts. Information is available on a variety of topics and materials can be obtained for practically any age group, demographic, or purpose.

The effectiveness of public education programs, in terms of conservation, is difficult to predict. During periods of drought, public awareness is high and public education may result in significant water consumption reductions. During other periods, the effectiveness will depend greatly on the program itself. Studies have suggested that a four to five percent reduction in water consumption could be expected from a comprehensive public education program.

The City should implement an ongoing public education program on water conservation. During the fall and winter months, it is recommended that the educational efforts target indoor water use. The educational focus in the spring and summer months should shift and emphasize conservation in outdoor uses. Of the focus areas, the City should place most of its efforts to outdoor water use, as it is the highest and most critical time period. Increase in water consumption during the summer months is attributed to outdoor recreation, gardening, and landscaping water use brought on by mild or warm summer weather. Outdoor water usage drives maximum-day demand, which in turn drives system capacity requirements for water system components. Reduction of landscape water demand can play a positive role in a water conservation program by reducing the overall water demand in the dry season months.

Specific tasks recommended include the following.

- Creation of a water conservation web page on the City's web site. This page should contain information about how to conserve water, any technical and financial assistance available to customers, and a link to American Water Works Association's (AWWA) Waterwiser site.

- Publish water conservation articles in the City's quarterly newsletter. The topics of these articles should include tips on reducing seasonal peak usage (outdoor measures), suggestions to reduce base demand (indoor measures), introduction of water conservation information on the City's web page, any technical and financial assistance available to customers, and any other pertinent conservation information.

- Provide water conservation brochures at City Hall and the Library. Copies of or ideas for brochures can be obtained from AWWA or other municipalities with an existing water conservation program (e.g. Cities of Ashland and Bend). In keeping with the recommended focus of reducing outdoor water usage, recommended brochure topic include lawn-watering guide, low water landscaping (i.e. Xeriscaping™), and drip irrigation.

TABLE 9.3.6
PUBLIC EDUCATION PROGRAM BENCHMARKS – YEAR 2005-2010

Benchmark	Start Date	Frequency or Completion
Creation of a water conservation web page on City's web site	2006	Sept. 2006
Publish water conservation articles in City's quarterly newsletter	2006	Ongoing
Provide water conservation brochures at City Hall & Library	2006	Ongoing

Leak Repair or Line Replacement Program (OAR 690-086-150(6a))

The intent of a leak detection and repair program is to reduce the amount of water that leaves mains, tanks, or other system components through cracks, openings, and defects. The goal of this program should be to reduce leakage to 15 percent of the total diverted water. If the reduction to 15 percent is found to be feasible and appropriate, additional measures should be implemented to reduce leakage to 10 percent or less.

The impact of water leakage can be measured in terms of water volumes as well as the associated costs required to treat, store, and distribute water to the consumers—"lost" water produces no revenue for the utility. Repairing leaks can result in significant savings and additional revenues for the water system.

The City currently makes repairs to its water system when leaks have been found or reported. However, there is not a formal program to systematically detect and repair leaks. A leak detection program has been proposed and is discussed above. Results from this leak detection will assist the City in determining which pipe segments should be replaced. Pipe segments with leaks should be repaired as soon as practical. Mains that are determined to be impractical to repair will be temporarily patched and slated for replacement.

Much of the distribution system consists of cast iron and AC piping. The Capital Improvement Plan presented in Section 11 includes a number of improvements that will replace a number of existing mains with larger diameter pipe. Pipe segments that are recommended for replacement include the 8-inch diameter cast iron main on Central Avenue and 6th Avenue. With the replacement of these water mains, the services off these mains will also be replaced from the water main to the meter. For additional detail on these improvements, please refer to Section 12.

TABLE 9.3.7
LEAK REPAIR & LINE REPLACEMENT PROGRAM BENCHMARKS – YEAR 2005-2009

Benchmark	Start Date	Frequency or Completion
Design & construct proposed water line replacement presented in the Capital Improvement Plan	2007est	2009est
Repair leaky pipe segments determined from Leak Detection Program and observed or reported.	Ongoing	Ongoing

Technical & Financial Assistance Programs (OAR 690-086-150(6b))

One of the keys to a successful water conservation program is participation of the water users. Conservation is achieved at the customer level by changing consumption habits via the knowledge of water usage and means to implement conservation measures. Technical and financial assistance water conservation programs can play a significant role in encouraging water users in implementing conservation ideas into action and making conservation measures a reality. Examples of technical and financial assistance measures include the following:

- Providing technical water conservation information and educational materials to interested customers, such as the water savings with the installation of a new ultra-low-flow toilet or retrofit devices, location of the nearest agrimet station, and tips on saving water on indoor and outdoor activities.
- Financing or conducting irrigation audits,
- Partnering with large water users in evaluating current usage and options to reduce consumption,
- Rebates for replacement of lawns with alternative landscaping,
- Rebates for installation of drip irrigation systems, and
- Rebates for the purchase and installation of such items as ultra-low-flow toilets, front-loading washing machines, and water conserving dishwashers.
- Reward for homeowner repair of a leak on the house side of the meter within one billing cycle.

For the City's first Water Conservation Plan, the planned technical and financial assistance measures include conducting water audits of and partnering with large water users and implementing financial assistance programs. Technical assistance will be in the form of providing technical and educational water conservation information (see Public Education Program), instructions on installation of retrofit kits (see next subsection), and the hiring of consultants to perform the water audits. Financial assistance programs will be in the form of rebates.

Audits/Partnerships

As the City's water conservation program is in its infancy, it is recommended that the City first concentrate on auditing and/or entering into partnerships with existing large commercial and industrial water users. Depending on the experience and success of these initial partnerships, the City may wish to enlarge their approach to include other commercial and industrial users, and even residential customers. Some of the area's largest water users include the Sutherlin School District, Murphy Plywood (prior to the mill fire), and the area's motels. The School District for one has already expressed an interest in receiving assistance from the City in reducing its water usage. With respect to the School District, the City should assist the District in financing a water audit of its usage, and explore the feasibility of supplying non-potable water for irrigation of the school fields. It is anticipated that an irrigation audit of the High School's fields and current irrigation protocol would cost from $3,500 to $7,500.

If Murphy Plywood chooses to rebuild in Sutherlin, the City has asked to be involved in the design of the water supply and transmission mains for the new facility. The City believes that there may be an opportunity for a large commercial or industrial user within town to utilize surplus reclaimed water from its wastewater treatment plant (WWTP) for process water, landscape irrigation, or even fire flow.

As with the School District, the City should assist local motels in financing a water audit of their usage and explore feasibility of installing water saving devices at their businesses.

Rebates

One of the greatest conservation incentives a water provider can offer to its customers is to save money on their water bill. Some savings may be direct and from the provider while others are indirect and originate from such sources as reduced electrical costs for low-flow showerheads and reduced maintenance costs from low-water-use landscaping. Savings may also be realized from rebates programs sponsored by the provider or other agencies.

In order to accelerate the replacement of older, less efficient fixtures and appliances, some water and electrical utilities offer rebates to customers who purchase approved, efficient appliances, such as front-loading washing machines and highly efficient dishwashers. Some of the municipalities that offer rebates for clothes washers and/or dishwashers include the Cities of Ashland and Corvallis, Eugene Water & Electric Board, and Springfield Utility Board. Rebates offered by these utilities range from $50 to $125 for clothes washers and $30 to $60 for dishwashers. In addition to appliances, some utilities are giving rebates to customers who replace their old, inefficient toilets with ultra low flow toilets using 1.6 gallons per flush. The City of Corvallis currently offers a $25 per toilet rebate for City residents. The City of Ashland offers $45 for the first toilet, $35 for the second toilet, and $25 for the third toilet replaced in the same house or business.

In addition to utility rebates, the Oregon Residential Energy Tax Credit Program provides a tax credit for clothes washers, dishwashers and other major household appliances certified energy-efficient by the Oregon Office of Energy. Tax credits will vary from $160 to $230 for clothes washers and $50 to $70 for dishwashers.

The City may wish to offer incentives to customers who purchase these appliances for use in their homes or provide forms and information to facilitate the reception of rebates available from such sources as the Department of Energy. For more information on rebates available from the Oregon Department of Energy, see their website at *http://www.energy.state.or.us/res/tax/taxcdt.htm* .

For the City's first Water Management and Conservation Plan, we recommend that the City consider rebate programs for the ultra-low-flow toilets and front-loading clothes washer. The feasibility of these programs is addressed below. As the City gains experience and interest in water conservation from the community, other rebate programs, such as ones for dishwashers, water-saving landscape, and drip irrigation systems, could be implemented in the future.

Rebate for Ultra-low Flow Toilets. Non-conserving toilets commonly used before 1980 used about five to seven gallons per flush. In the 1980s, low flush toilets (3.5 gallons per flush) were manufactured and installed. In 1993, the State of Oregon adopted the plumbing standards that included the ultra-low flush toilets (1.6 gallons per flush). According to the 2000 Census, the City of Sutherlin had a total of 2,907 housing units. Of these housing units, 1,511 were constructed prior to 1980 and 760 were built between 1980 and 1994. Consequently, the City potentially has a considerable number of non-conserving toilets being currently utilized.

The potential cost and water savings for the City implementing a $150 per toilet rebate was compiled for water conservation over a 5-year rebate period. The proposed rebate of $150 was selected as a new toilet itself starts around $100 without installation. With this program, a customer could apply for a $150 rebate toward the replacement of each and every high-flow and low flow toilet at each household built prior to 1992. The City would require a certificate from the installing plumber or property owner that the existing toilets had been replaced with new ultra-flow units. Renters would be required to complete a Landlord Consent form for replacement of toilets in a rented household. Annual audit of some of the installations would be required to determine compliance.

For this potential program, it was assumed that participation consisted of 5 percent of the pre-1994 residences. The anticipated cost for implementing this rebated program included administration, advertisement, and actual rebate expenses. For dry season (June – September) savings, the cost per acre-feet for this rebate is calculated to be $5,477 per acre-feet of water conserved over a 10-year period. For annual savings, the anticipated cost is $1,816 per acre-feet of water conserved over a 10-year period. Detailed calculations are provided in the Appendix E.

Rebate for Clothes Washer. The potential cost and water savings for the City to initiate a $150 rebate clothes washer rebate was completed in a manner similar to the above rebated proposed for ultra-low flow toilets. A typical household in Sutherlin is anticipated to do approximately 310 loads of laundry per year, using about 40 gallons of water per full load with a conventional washer. With a full-sized Energy Star qualified clothes washer, the water usage is approximately 18 to 25 gallons per load.

For this potential program, it was assumed that participation consisted of 5 percent of the total number of housing units (based on 2000 Census). The cost for implementing this rebated program includes administration, advertisement, and actual rebate expenses. For dry season (June – September) savings, the cost per acre-feet for this rebate is calculated to be $6,474 per acre-feet of water conserved over a 10-year period. For annual savings, the anticipated cost is $2,146 per acre-feet of water conserved over a 10-year period. Detailed calculations with estimated costs and assumptions are provided in the Appendix E.

A summary of the ultra-low-flow toilet and clothes washer rebate programs is given in Table 9.3.8.

TABLE 9.3.8
SUMMARY OF ESTIMATED WATER SAVINGS & COST FOR PROPOSED REBATE PROGRAMS

Rebate	Est. 5-Year Water Savings (Dry/Annual), acre-feet	Est. Cost/ Water Conserved, $/acre-feet (Dry/Annual)
Ultra-Low-Flow Toilet	7.73/23.33	$5,477/$1,816
Clothes Washer	4.81/14.51	$6,474/$2,146

Of the two rebate programs, the ultra-low-flow toilet program is anticipated to be considerably more cost-effective than the proposed clothes washer rebate.

In summary, the use of rebates for installation of ultra-low-flow toilets and/or front loading clothes washers in Sutherlin would result in savings of approximately 2,000 gallons per day or equivalent to 9 EDUs (6,658 gallons per EDU-month) over a month's time period. While this savings is significant, these rebate programs in itself will not meet the projected future demand in the City (see Section 11.4.1). It is recommended that the City send out a survey or set-up a survey on its web site or at the front desk of City Hall to ask users if there was interest in rebates for installation of ultra-low-flow toilets and front loading clothes washers. Based on this public response, the City could tailor a program suitable for its users.

A summary of proposed technical and financial assistance program benchmarks is presented in Table 9.3.9.

TABLE 9.3.9
TECHNICAL & FINANCIAL ASSISTANCE PROGRAM BENCHMARKS – YEAR 2006-2010

Benchmark	Start Date	Frequency or Completion
Finance a portion of the cost for a water audit of the Sutherlin School District's water usage (focused on outdoor usage)	2007	Aug. 2007
Investigate the feasibility of providing non-potable water to the School District for irrigation purposes in the City's Wastewater Facilities Plan	2006	Dec. 2006
Provide technical assistance to Murphy Plywood for the design of a water supply to its new facility.	2006e	Ongoing
Finance a portion of the cost for a water audit of the motels within the City (focused on indoor usage)	2007	Oct. 2007
Conduct survey of users on the potential participation in a rebate program for the installation of ultra-low-flow toilets and/or front loading clothes washer. If sufficient interest is observed, then adopt a program for implementation by July 2007.	2006	Oct. 2006 (Survey) July 2007 (Potential Rebate Program)

Retrofit/Replacement Program of Inefficient Fixtures (OAR 690-086-150(6c))

One incentive to encourage users to conserve water is to provide retrofit kits to increase the efficiency of their existing plumbing fixtures. The proposed plan would be for the City to give away retrofit kits or packages to City water users. Retrofit kits usually consist of toilet tank inserts, low-flow showerheads, faucet flow restriction devices, toilet leak detection dye tablets, and an informational guide. The cost of a retrofit kit varies from $10.00 to $16.00, depending upon the number and specific items included. Only showerheads and faucet restrictions should be needed for new residences. One limitation of retrofits is that the long-term effectiveness is questionable because 1) the resident may not install them, 2) installed retrofits can easily be removed, and 3) some devices (e.g. toilet tank displacement devices) have a limited life, some three to five years.

The potential cost and water savings for the City procuring and distributing retrofit kits was compiled in a similar manner as described above for the proposed ultra-low toilet rebate. For the retrofit kit, it was assumed that each kit would cost $30 each and included of one toilet tank displacement device, an adjustable toilet flapper, two low-flow showerheads, two faucet flow restriction devices, toilet leak detection dye tablets, and an informational guide. Detailed calculations with estimated costs and assumptions are provided in the Appendix E. A summary of the estimated water savings and cost with the proposed retrofit/replacement program is presented in Table 9.3.10.

TABLE 9.3.10
SUMMARY OF ESTIMATED WATER SAVINGS & COST FOR RETROFIT/REPLACEMENT PROGRAM

Incentive	Est. 5-Year Water Savings (Dry/Annual), acre-feet	Est. Cost/ Water Conserved, $/acre-feet (Dry/Annual)
Retrofit/Replacement	1.52/4.58	$5,912/$1,960

The relative water savings and cost of proposed retrofit/replacement program is comparable to the rebate programs for the ultra-low-flow toilets and front loading clothes washer. Although the water savings are significantly less than the other rebates, so are the material costs associated with this rebate. The City should conduct a survey on its web site or at the front desk of City Hall to ask users if what type of items they would utilize to retrofit or replace inefficient water fixtures in their residence. Depending on public response, the City could tailor the retrofit kits suitable for its users. For example if there was significant interest in utilizing the rebate for the ultra-low-flow toilets, then the City may wish to modify the retrofit package by reducing the number of toilet retrofit devices included in the retrofit kits. A summary of proposed retrofit/replacement of inefficient fixtures is presented in Table 9.3.11.

TABLE 9.3.11
RETROFIT/REPLACEMENT OF INEFFICIENT FIXTURES PROGRAM – YEAR 2005-2010

Benchmark	Start Date	Frequency or Completion
Conduct survey of users on the potential participation and type of desired kit items in a retrofit/replacement program. Adopt a program for implementation by July 2007.	2006	Oct. 2006 (Survey) July 2007 (Adopt Program)

Adoption of Rate Structures, Schedules, Programs That Support & Encourage Water Conservation (OAR 690-086-150(6d))

A proper water rate structure can support and encourage water conservation. Water rates can take many forms. Five basic types include blanket, uniform, declining block, inclining block, and seasonal rate structures. A number of different factors are generally considered in selecting a rate structure. These factors can include revenue stability, water conservation, equity to customers, and simplicity in terms of implementation and customer understanding. A comparison of the five basic types of rate structures with respect to these factors is given in Table 9.3.12 (NRWA 1990, AWWA 2000).

TABLE 9.3.12
COMPARISON OF WATER RATE STRUCTURES

Type of Structure	Revenue Stability	Conservation	Equity	Simplicity
Blanket	Poor	Poor	Poor	Excellent
Uniform	Excellent	Good	Good	Excellent
Declining Block	Fair	Poor	Fair	Fair
Inclining Block	Fair	Excellent	Fair	Fair
Seasonal	Fair	Excellent	Fair	Fair

The ideal conservation rate structure would be one that encourages maximum participation in the conservation efforts while providing revenue stability, user equality, and easy implementation and administration.

The City currently utilizes a base rate with uniform charges for consumption. This water rate structure provides excellent revenue stability, is a good conservation tool, provides good equity, and is simple to administer and explain. In reviewing potential rate structures, we recommend that the City review its current rate structure and consider the possibility of implementing an inclining block or seasonal water rate structure. As the City must bring both of its water treatment plants into production during the summer months to handle the increase in water demand, the City is incurring additional expenses for handling seasonal demand that are now incorporated into a water rate structure that is uniformly applied year-round.

The inclining block rate structure most effectively encourages efficient water use as it is set up to charge higher unit prices to customers who place a higher demand or strain on the water supply system, and to charge lower unit prices to customers who use average or below-average amounts of water. The seasonal rate structure provides a conservation price signal when moving from winter to summer and can be made more effective for water conservation if the seasonal rate incorporates inclining block rates. Both the inclining block and seasonal rate structures are both excellent water conservation tools while being fair in providing revenue stability, equity among customers and in administration.

The rate structure program benchmarks are provided in Table 9.3.13.

TABLE 9.3.13
RATE STRUCTURE PROGRAM BENCHMARKS – YEAR 2005-2010

Benchmark	Start Date	Frequency or Completion
Evaluate Inclining Block and Seasonal Rate Structures	2006	Jan. 2007
Adoption of Alternate Rate Structure, if accepted	2007	Apr. 2007

Reuse, Recycling, & Non-Potable Water Opportunities (OAR 690-086-150(6e))

The City currently pumps Class II reclaimed water from its wastewater treatment plant (WWTP) to the Oak Hills Golf Course for irrigation of the greens and fairways during the months of June through October. Presently, there is approximately 95 acres of greens and fairways under irrigation, with the potential to irrigate an additional 105 acres of rough. The City's original contract with Oak Hills mandates that the City send 100 percent of the wastewater effluent to the golf course. This original contract was amended to limit the maximum amount of reclaimed water conveyed to the golf course to be 193 million gallons.

Up to the summer of 2004, the City sent all of its effluent to the golf course. However, it has been found that the golf course was not utilizing all of the reclaimed water that was sent, especially in the months of September and October. Based on a water balance performed by Brown & Caldwell (2004), an estimated 352.6 acre-feet or 114.7 million gallons were sent to the golf course. Of this amount, approximately only half was actually needed based on typical soil areas on the course. A portion of the remaining reclaimed water is thought to have been eventually discharged to Cook Creek, a tributary of Calapooya Creek. DEQ has indicated that this discharge is not acceptable and has required the City to install a level monitor at the irrigation pond that controls the amount of reclaimed water that is sent to the golf course. Reclaimed water that is not used at the golf course is diverted to the WWTP's effluent outfall pipe and discharged into the Calapooya Creek, which is in violation of its NPDES permit. The City will be entering into a Mutual Agreement of Order with DEQ to deal with this discharge.

As discussed in Section 8.1, other potential uses for the WWTP reclaimed water include process water at the WWTP, irrigation water for the fields at the High School and at City Parks, and process water for a future Murphy Mill facility. Of these potential uses, the use of reclaimed water at the WWTP for process water appears to be appropriate and feasible since the source and application of this water is at the same place. The main limitation in evaluating the remaining potential uses is the lack of data on the amount and when surplus reclaimed water is available. The amount of surplus reclaimed water available for other uses is not known at this time due to the lack of data on the amount of water being used by the golf course for irrigation. Water usage and effluent discharge data collected from the Year 2005 irrigation season should provide a basis for estimating the amount of available surplus reclaimed water. This collected data will be analyzed and discussed in the City's Wastewater Facilities Plan that is to be completed in Year 2006.

Backwash water is currently discharged into the Backwash Ponds at both the Nonpareil and Cooper Creek WTPs. Supernatant from these ponds overflows into a creek adjoining the Nonpareil WTP site and into Cooper Creek at the Cooper Creek WTP. During peak water usage (June through August), the amount of backwash water that could be recycled averaged from June through October 9.6 million gallons per year (gpy) from the Nonpareil WTP and 12.6 million gpy from the Cooper Creek WTP. The percentage of backwash produced should be reduced with the installation of new treatment facilities that are better equipped to treat iron and manganese in the raw water. However, the production from the plant will also increase. For the purposes of this study, it will be anticipated that the amount of backwash produced from Cooper Creek WTP will be approximately the same amount as is produced now.

City staff has expressed concerns about recycling the backwash water into the treatment system. One concern is the introduction of the filter wash water, with viruses, other microbiological agents and any accumulated algae in the ponds, back into the system. While the treatment processes at the City's WTPs are capable of handling a wide variety of different raw water conditions, the effect of the backwash water on the WTP operation is not known at this time. Another concern is how much of the backwash water would be available for recycling. During the dry season, water may be "lost" in the backwash ponds due to evaporation and seepage. The exact amount of water being discharged from the backwash ponds is not currently known. Water quality and flow data from the backwash pond should be collected to further evaluate whether recycling of the backwash water at the WTPs is feasible and appropriate.

If a backwash recycle system was to be utilized, installation of a pump station and 4-inch diameter pipeline would be needed. To meet EPA's Filter Backwash Recycle Rule, the backwash water would have to undergo all the WTP's treatment processes and require introduction at the head of the WTP treatment processes. Operation of the pump station would be initiated with the WTP's call for raw water. At the Nonpareil WTP, the backwash pump station operation would coincide with the raw water pump station. For Cooper Creek WTP, the design and operation of the pump station will be more complicated due to the amount of head available in the raw water main from Cooper Creek. The pump would require sufficient head to overcome the existing raw water head and its operation would coincide with the opening of an electric actuated valve. With this conceptual design, backwash supernatant would be introduced upstream of the introduction of treatment chemicals (alum, potassium permanganate).

Assuming that the WTP backwash water was primarily used during the dry season months (June through October) and that 30 percent of the backwash water is lost to evaporation and seepage, the amount of water recycled during a dry season is estimated to be 6.7 MG per year at Nonpareil WTP and 8.8 MG per year at Cooper Creek WTP (average of both WTPs, 7.7 MG/yr). The estimated cost for installing a recycle pump system at these WTPs is approximately $70,000 each. Taking into account estimated O&M costs and assuming six percent interest over 20 years, the estimated average present worth cost for these pump stations is $130,000. With an average of 23.6 acre-feet per year (7.7 MG/yr), the total amount of potential water available for recycle over 20 years is 472 acre-feet per WTP. The overall average cost for backwash water recycle at the WTPs is approximately $275/acre-feet.

To determine the actual backwash water available for recycle and to address the concerns of City staff, water quality and flow data from the backwash pond should be collected to further evaluate whether recycling of the backwash water at the WTPs is feasible and appropriate. A summary of reuse, recycling, and non-potable water opportunities benchmarks is presented in Table 9.3.14.

TABLE 9.3.14
REUSE, RECYCLING, & NON-POTABLE WATER OPPORTUNITIES BENCHMARKS – YEAR 2005-2010

Benchmark	Start Date	Frequency or Completion
Collect data of water usage at the Oak Hills Golf Course & effluent discharge into Calapooya Creek for the Year 2005-06 Irrigation Season	2005	Oct. 2006
Identify the capital requirements needed for reclaimed water use at the WWTP in the City's Wastewater Facilities Plan	2006	Dec. 2006
Investigate the feasibility of providing non-potable water (Level IV) to the School District and City Parks for irrigation purposes in the City's Wastewater Facilities Plan	2006	Dec. 2006
Provide technical assistance to Murphy Plywood for the design of a non-potable water supply to its new facility.	2006e	Ongoing
Collect water quality and flow data from the backwash pond discharge at the Nonpareil and Cooper Creek WTPs (June – September). Evaluate whether reuse of backwash water is feasible and appropriate.	2006	June 2007

Other Conservation Measures Identified by the Water Supplier to Improve Water Use Efficiency (OAR 690-086-150(6f))

As mentioned in Section 9.3 under Planned Conservation Activities, the water conservation benchmarks represent the City's first organized effort in implementing a water conservation plan. It will take time and resources to implement these initial planned measures and to start to develop a sustainable "water conservation mindset". As the City gains experience and knowledge of their system, and as the public becomes more aware for the need of water conservation, the City can branch out in new water conservation activities. Activities that the City may wish to consider in the future include rebates for installation of drip irrigation and replacement of lawns with alternative landscaping, financing/conducting irrigation audits, and water reuse of backwash water and wastewater treatment effluent (depending on findings).

9.4 Water Conservation Benchmarks

All of the actions or "benchmarks" that the City plans to implement during the period 2006 to 2010 is presented in Table 9.4.1. The City anticipates submitting an updated Water Management and Conservation Plan in 2011 with conservation actions for the time after 2010 based on the experience gained during the 2006 to 2010 time period. The City believes that these benchmarks fully comply with State's requirements for the water conservation element of the required Water Management and Conservation Plan.

TABLE 9.4.1
SUMMARY OF ALL CONSERVATION BENCHMARKS – YEAR 2005 -2010

Benchmark	Start Date	Frequency or Completion
Annual Water Audit		
Install new meters & read existing water meters as described under Metering Benchmarks (Table 9.3.2)	2005	Dec. 2005
Develop electronic spreadsheets & procedure for implementing audits	2005	Dec. 2005
Collect & record monthly meter readings, complete monthly audits	2005	Monthly
Perform annual water audit	2007	Annual
Metering		
Install new meters at the following locations:		
Central Park & Community Building	2006	Nov. 2006
City's WWTP & Triangle Park	2006	June 2007
Public Works	2007	Jan. 2008
Nonpareil WTP & City Library	2008	June 2008
Collect water usage data from existing meters not currently being read	2005	Nov. 2005
Install water meter on Cooper Creek WTP backwash stream	2007 est.	2009 est.
Install water meter on Nonpareil WTP backwash stream	2010 est.	2011 est.
Meter Testing & Maintenance		
Verify 2-inch Meters within system	2007	Every 5 years
Verify ¾-inch Meters	2008	¼ of total meters, Annually from 2008-2012
Verify Large Meters (>2-inch)	Ongoing	Annually
Source Meters	2005	Every 2 years or as needed
Leak Detection Program		
If System Leakage is shown to be >10%, perform leak detection of Priority 1 Areas	2007	January 2008
If System Leakage is shown to be >10% in Annual Audit & leak detection has been completed on Priority No. 1 Areas, then perform leak detection of Priority 2 Areas	2008	March 2009
If System Leakage is shown to be >10% in Annual Audit & leak detection has been completed on Priorities No. 1 & 2, then start on Priority 3 areas.	2009 (dependent on No. 2)	March 2010 (dependent on No. 2)
Leak Occurrence Map of City's Water Distribution System	2006	Ongoing
Public Education		
Creation of a water conservation web page on City's web site	2006	Sep. 2006
Publish water conservation articles in City's quarterly newsletter	2006	Ongoing
Provide water conservation brochures at City Hall & Library	2006	Ongoing
Leak Repair & Replacement		
Design & construct proposed water line replacement presented in the Capital Improvement Plan	2007est	2009est
Repair leaky pipe segments determined from Leak Detection Program and observed or reported.	Ongoing	Ongoing
Technical & Financial Assistance		
Finance a portion of the cost for a water audit of the Sutherlin School District's water usage (focused on outdoor usage)	2006	Aug. 2007
Investigate the feasibility of providing non-potable water to the School District for irrigation purposes in the City's Wastewater Facilities Plan	2006	Dec. 2006
Provide technical assistance to Murphy Plywood for the design of a water supply to its new facility.	2006e	Ongoing
Finance a portion of the cost for a water audit of the motels within the City (focused on indoor usage)	2007	Oct. 2007
Conduct survey of users on the potential participation in a rebate program for the installation of ultra-low-flow toilets and front loading clothes washer. If sufficient interest, then adopt a program for implementation by July 2007.	2006	Oct. 2006 (Survey) July 2007 (Potential Rebate Program)

TABLE 9.4.1 CONTINUED
SUMMARY OF ALL CONSERVATION BENCHMARKS – YEAR 2005 -2010

Benchmark	Start Date	Frequency or Completion
Retrofit/Replacement of Inefficient Fixtures		
Conduct survey of users on the potential participation in a retrofit/replacement program. If sufficient interest, then adopt a program for implementation by July 2007.	2006	Oct. 2006 (Survey) July 2007 (Potential Rebate Program)
Rate Structure		
Evaluate Inclining Block and Seasonal Rate Structures	2006	Jan. 2007
Adoption of Alternate Rate Structure, if accepted	2007	Apr. 2007
Reuse, Recycling & Non-Potable Water Opportunities		
Collect data of water usage at the Oak Hills Golf Course & effluent discharge into Calapooya Creek for the Year 2005 Irrigation Season	2005	Oct. 2006
Identify the capital requirements needed for reclaimed water use at the WWTP in the City's Wastewater Facilities Plan	2006	Dec. 2006
Investigate the feasibility of providing non-potable water (Level IV) to the School District and City Parks for irrigation purposes in the City's Wastewater Facilities Plan	2006	Dec. 2006
Provide technical assistance to Murphy Plywood for the design of a non-potable water supply to its new facility.	2006e	Ongoing
Collect water quality and flow data from the backwash pond discharge at the Nonpareil and Cooper Creek WTPs (June – September). Evaluate whether reuse of backwash water is feasible and appropriate.	2006	June. 2007
Water Management & Conservation Plan (2011-2016)		
Revise and submit Plan to Department of Water Resources	2010	Mar. 2011

Section

10

Water Curtailment Plan

(OAR 690-86-160)

10.1 Background

A water curtailment plan is defined as a short-term, mandatory program intended to drastically reduce water consumption as a result of an emergency, catastrophic event, or serious water shortage. A water provider is to develop a water curtailment plan that would provide planning criteria, specific operating guidelines, and the enforcement measures that may be required in the event of a serious emergency or water shortage (OAR 690-86-160).

Most water systems have critical components, which if damaged, destroyed or contaminated, could cripple or prevent delivery of potable water to consumers. Such crises may last from a few hours to days, weeks and months. As part of a comprehensive water management and conservation plan, a curtailment plan would assist the City in managing a short-term supply deficiency crisis.

In addition to a water curtailment plan, the City should have an ordinance in place for declaration of an emergency and implementation of the curtailment plan in the event of an emergency water shortage. Once the water shortage is over, the City would return to providing normal water service to its customers.

In July 2001, the City compiled a water curtailment plan. This plan contained a number of good action measures within each of the four alert stages. Modifications to this existing plan were made to include 1) a list of predetermined levels of indicators that would invoke or “trigger” an alert stage, 2) stricter measures for Stage 4, the most critical alert stage, and 3) additional measures in each stage to assist in reducing water demand.

A description of the City’s water curtailment plan as required by OAR 690-86-160 is provided below. The City may wish to develop a comprehensive emergency plan for all city operations. This curtailment plan can be used as the water supply element of such a comprehensive emergency plan.

10.2 Water Supply Deficiencies (OAR 690-86-160 (1))

A history of supply deficiencies or emergency water conditions would suggest the need to prepare for future water supply deficiencies. If drought, contamination, system breakdown, or some other event has interrupted or hampered water supply efforts in the past, they are likely to hamper water supply efforts in the future. The severity of historical events can also suggest the relative importance of planning for future events.

A water provider should be prepared for periods of supply deficiency. The development of policy, ordinances, and other measures should not wait until the provider is in the midst of a water shortage. Knowledge of the past deficiencies and information about the causes and indicators of future water supply emergencies will aide water suppliers in providing a consistent and reliable product to the consumers.

Historical Deficiencies

The City staff does not recall any critical water deficiencies within the City. However, the City has 1) been at its maximum treatment capacity on high demand days, and 2) had on asked to limit its water withdrawal from Calapooya Creek as previously discussed in Section 9.2.

Based on historical stream flow data, there exists a possibility under severe drought conditions that the City's most senior water rights could be restricted due to low stream flow. Restrictions of the City's most senior water rights (1924 and 1941) on the Calapooya Creek could occur if following two conditions were met:

1) Senior water right users claim that they are not able to divert the amount of water granted by their certificate and,

2) County Watermaster verified their claim and concluded that reductions or restrictions of diversions from junior water rights would allow the senior water right users to obtain their certificated diversion.

Reductions of the City's 1924 and/or 1941 certificated diversions from Calapooya Creek would likely impact the City's ability to meet existing and anticipated water demand during the summer months. Some form of water curtailment would likely be needed if diversion restrictions are placed on the City's senior water rights for Calapooya Creek. The type of curtailment measures that would be required if these diversions were restricted would depend on such factors as, but not limited to, timing (i.e. early or late summer), amount of required reduction, water demand within the City, and water production from the Cooper Creek WTP.

The City's other water source, Cooper Creek Reservoir, has never presented any water supply issues since the City's diversion is well below the normal reservoir water surface. In consulting with the Sutherlin Water Control District, restrictions from diverting water from Cooper Creek Reservoir are not anticipated (Bing 2005).

10.3 Stages of Alert (OAR 690-86-160 (2))

Curtailment plans typically contain both voluntary and mandatory water use restrictions. These restrictions become more numerous and severe in nature as water shortage become more pressing. In the early stages of a shortage, curtailment plans usually rely on public education and customers implementing voluntary curtailment actions. Specific and mandatory measures are reserved for when the shortage situation becomes increasingly dire.

Water shortage emergencies may occur suddenly or gradually over time. Short-term emergency water supply shortage can come in the form of sudden interruptions, such as loss of power, mechanical/equipment failures, pipeline failures, contamination of the water supply or distribution system, natural disasters (e.g. earthquakes, high winds), and man-made disasters. For immediate shortages, specific measures need to be implemented quickly to reduce water demand and avert a more critical situation. Other shortages, such as supply shortages, may be more gradual in nature, as in the case of a drought. In these circumstances, curtailment measures can be gradually implemented to correspond with the progression of the shortage.

A water curtailment plan should contain at least three levels or stages of alertness or restrictions. The levels should range from an *initial level of concern* to a *severe level-of-alertness* to a *final critical level*. Each level should include predetermined indicators that will invoke a specific level of alertness requiring predetermined actions and an associated list of recommended curtailment measures.

The following are recommended stages of alert for the City of Sutherlin's Water Curtailment Plan.

Alert Stage No. 1: Water Watch

Alert Stage No. 1 is primarily used as a means to inform and educate the public that there is a potential water supply problem. While the supply problem may not yet warrant mandatory water conservation, voluntary conservation by the water users is recommended to reduce the water supply demand and lessen or possibly eliminate the imposition of more advanced alert stage levels. If the public is aware of the potential for problems, they will be more likely to accept and abide by more serious requirements should the alert status be increased.

This level-of-alert could be declared if a water shortage or equipment failure poses a potential threat to the ability of the water system to meet the demands of its customers. It may also be appropriate to declare this alert stage during major construction or maintenance of existing water system components. A possible scenario would include taking one reservoir temporary off-line to paint or clean it or perform some minor maintenance.

Alert Stage No. 2: Water Warning

Alert Stage No. 2 is the first level of action for the City to enact mandatory water use requirements within its water system. This level would include all planned activities requiring temporary conservation including construction and maintenance activities as well as preparing for expected drought conditions.

This level-of-alert could be declared if a water shortage or equipment failure poses a serious threat to the ability of the water system to meet the demands of its customers. It may also be appropriate to declare this alert stage if a component within the water system breaks down or is taken off-line for an extended period of time. This would include major repairs or renovations within the water treatment plant, major renovation of a reservoir, or another major improvement project.

Scenarios that would require this level-of-alert would typically be those that could be planned and prepared for. This alert stage could be instituted as a follow-up status to Level 1 after the public has been informed of potential problems and given an opportunity to carry out voluntary conservation activities.

Alert Stage No. 3: Water Emergency

Alert Stage No. 3 is imposed when water supply conditions are such to raise the alert status from a warning to an emergency status. An example of this type of Alert Stage is a large fire, such as the fire that struck the old Murphy Plywood mill. A wider range of water use activities is affected. This stage contains the most restrictive level of mandatory water conservation activities with higher penalties to enforce the curtailment status. It has been noted by the Sutherlin Fire Chief that during the Murphy Plywood mill fire, public service announcements were issues requesting that Sutherlin's water customers voluntarily conserve water. The results of this conservation campaign were not measured, however, the Fire Chief feels that many citizens complied with the request.

This level-of-alert could be declared if a water shortage or equipment failure poses a severe and immediate threat to the ability of the water system to meet the demands of its customers. Indicators may include an eminent loss of a portion or total source of supply. Other indicators could include a chemical spill in a water supply, severe equipment failure, and other severe water supply issues.

Alert Stage No. 4: Critical Water Supply

The purpose of this alert stage is to provide the minimum amount of water necessary for existing water users to sustain life. This extreme level-of-alert is reserved for extreme water supply problems and would likely include Draconian-type measures, such as terminating water service from the City's distribution system and water rationing.

This final level-of-alert is necessary if scenarios from Level 3 result in disaster conditions that make it impossible for the water system to continue functioning under normal parameters. Indicators of this level include the inability of the water plant to produce additional water or the distribution system to deliver potable water to the consumers. This status is only for the most extreme cases where resources must by managed carefully and water rationed to consumers for the purpose of sustaining life.

See Section 10.5 for a discussion of the various actions required of both the City and of the water users for each Alert Stage.

10.4 Indicators of Water Shortage Severity (OAR 690-86-160 (3))

A water curtailment plan should include a list of predetermined levels of severity or indicators that would invoke or "trigger" a predefined level of water curtailment alert. Triggers provide the City an ability to legally impose restrictions once the emergency conditions of the trigger have been satisfied. In addition, triggers are predetermined reference points that can avoid any guesswork about when to impose restrictions during an emergency.

For most alert stages, one or more indicators are incorporated into a plan to serve as potential triggers for implementation of an alert stage of a curtailment plan. In some cases, one trigger may be sufficient to implement a curtailment alert phase. In other instances, multiple triggers This "and/or" approach to curtailment triggers provides the City with the reference points in assessing an emergency and the flexibility in determining the most appropriate response to a particular water shortages crisis.

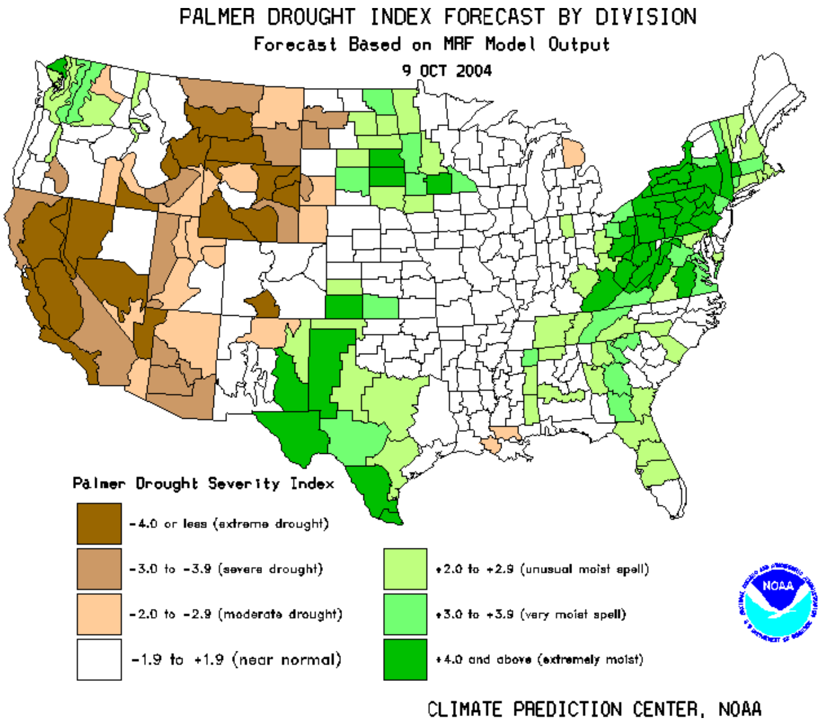
A number of different potential indicators may be utilized for determination of water storage severity and the appropriate alert stage. For the City of Sutherlin, potential water shortage indicators include Palmer Index, Surface Water Supply Index, stream and/or diverted flow, and elevation or capacity of the City's finished water storage tanks. The suitability of these potential indicators of water storage severity are evaluated and discussed below.

Palmer Index

The Palmer drought index (PI) is a widely used scale for measuring drought conditions. This index uses long-term records of temperature and precipitation to determine dryness and is tabulated by the National Weather Service on a weekly basis. PI calculations are made for 350 climate divisions in the United States and posted on the NOAA and National Weather Service websites. The PI is updated weekly and is easily accessible at the following website: *http://www.cpc.ncep.noaa.gov/products/analysis monitoring/cdus/palmer drought/palmer outlook.gif.*

A PI of zero is representative of normal weather in all seasons and in any climactic region. Droughts are depicted as negative index values while wet periods are shown with positive values. Consecutive negative values from week to week can provide initial warning of an impending drought. The magnitude of long-term negative values can assist the City in determining the severity of the drought condition. A copy of the PI for October 9, 2004 is shown in Figure 10.4.1. For this time period, Sutherlin is in the white band (near normal conditions) just west of the brown area depicting the Klamath Basin. Even though the PI is not necessarily supply specific, this index can provide valuable information to forecast and assess the severity of a potential or actual water supply crisis.

FIGURE 10.4.1
ILLUSTRATION OF PALMER DROUGHT INDEX



For its water curtailment plan, the City would be interested in the negative or drought index regime. Conveniently, the negative PI regime is divided into three drought levels: moderate drought (-2 to –3), severe drought (-3 to –4), and extreme drought (-4 and lower). Theses three tiers of the negative PI are recommended as triggers for the first three levels of the curtailment plan.

Surface Water Supply Index

The Surface Water Supply Index (SWSI) is an index that describes the current state of water resources within the major river basins in the state of Oregon. Calculated monthly by the National Resource Conservation Service (NRCS), the SWSI can be used to identify which river basins are above, below, or at the normal surface water supplies. The SWSI for Oregon is updated monthly and can be viewed and downloaded at the following websites: *http://www.or.nrcs.usda.gov/snow/watersupply/swsi.html*. The Oregon SWSI for September 2004 is shown in Figure 10.4.2.

Historical SWSI data for the Rogue/Umpqua basins since 1975 is summarized in Figure 10.4.3. This historical data can be utilized to evaluate the frequency and reoccurrence intervals expected for the various levels of curtailment.

For the purposes of curtailment triggers, the range of interest is between –1.5 and –4. A recommended division of this range of interest for the first three Alert Stage levels may be as given in Table 10.4.1.

TABLE 10.4.1
RECOMMENDED SWSI VALUES FOR ALERT STAGE LEVELS

Alert Stage	SWSI	% Occurrence[1]
No. 1	- 1.5 to –2.5	14
No. 2	-2.5 to –3.25	9
No. 3	-3.25 to –4.0	<1

[1] - % Occurrence based on data from January 1975 to January 2000.

Based on the criteria shown in Table 10.4.1, the City would have experienced an Alert Stage No. 1 an average of one month every seven months or 1.7 months out of every year. For Alert Stage No. 2, curtailment conditions, based on the SWSI, would have occurred an average of one out of every 11 months or approximately one month per year. Alert Stage No. 3 would have occurred only twice over the past 25 years based on a SWSI below –3.25. The above average occurrences are somewhat misleading as drought conditions usually last through a dry season. Historically, the City would have had Alert Stages in 11 of the last 25 years based on the SWSI index below –1.5.

Combining information from the PI and the SWSI will provide valuable insight to both the "big picture" and the local conditions based on readily available and accepted information.

FIGURE 10.4.2
ILLUSTRATION OF SURFACE WATER SUPPLY INDEX (SWSI)

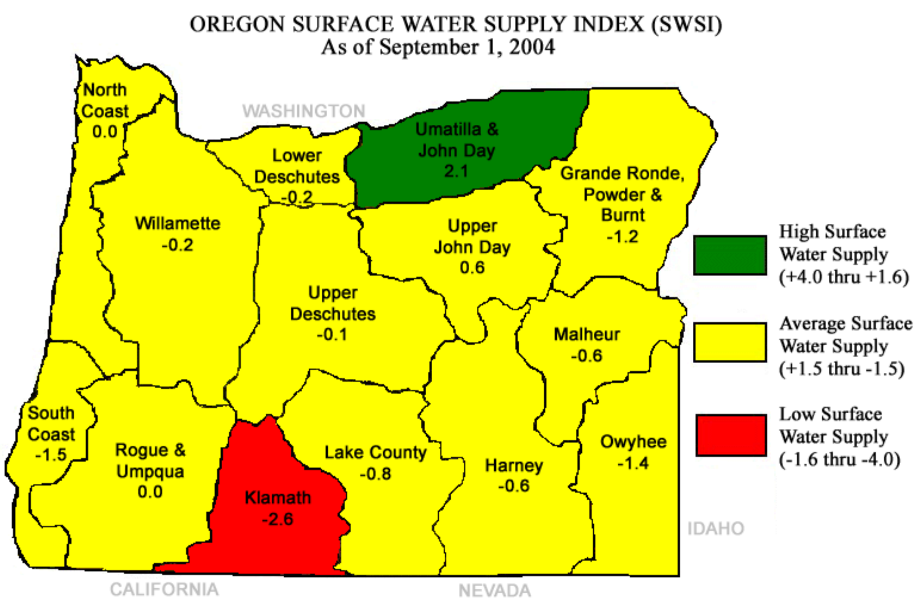
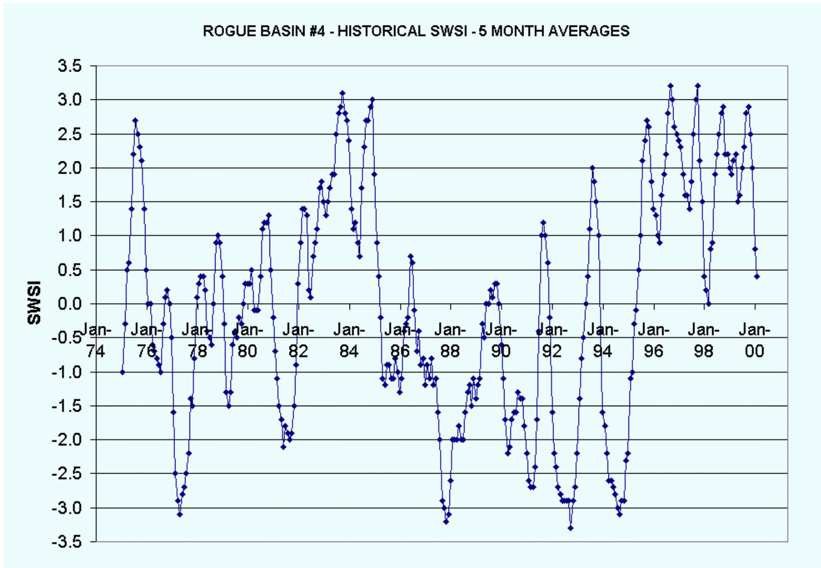


FIGURE 10.4.3
HISTORICAL SWSI FOR ROGUE/UMPQUA BASIN



Stream and/or Diverted Flow

Stream flow and/or the amount of water taken from the point of diversion are potential indicators of water severity. During a drought, the City may be restricted in the amount of water that can be diverted from Calapooya Creek due to instream water rights and the inability of senior water right users to divert their full certificated amount.

Based on historical stream flow data, the Creek flow drops below minimum instream flows roughly 60 percent of the time during the month of August. Since the City does not currently rely on its 1979 water right of 1.0 cfs and the minimum instream water rights supercede this right on a regular basis, the County Watermaster's notification of the City to limit its diversion to its senior water rights is not necessarily a good Alert Stage indicator. The City should however, monitor the stream flow in the Creek at a minimum of every two weeks during the months of July through September. If drought conditions exist, the City may wish to monitor stream flows in the Creek sooner in the season (prior to July) or later in the season (beyond September)and more frequently (e.g. weekly).

The gauging station used by the County Watermaster in evaluating stream flows in the Creek is located at the Rochester Covered Bridge (Station 14320700), which is located a short distance from City's Wastewater Treatment Plant (WWTP) and at the location of the City's wastewater outfall to the Creek. The City already has access to the stream gauge measurements at this site primarily for compliance with its wastewater effluent discharge requirements to the Creek.

Level in Finished Water Tanks / Disruption of Water Production & Delivery

Treated water storage tanks are designed to provide equalization storage, emergency storage, and reserves for fire suppression. In the event that the potable water from the treatment plant is not available, the City's treated water tanks would become the source of water for the community. There are a number of situations that would potentially affect the treatment plant's ability to supply water to the City's distribution system, including the following.

- A break in the City's 14-inch diameter Treated Water Transmission Main (Nonpareil or Cooper Creek).

- A mechanical breakdown or scheduled maintenance at the treatment plant.
- Contamination of raw or treated water by pesticide, chemical spills, sabotage, etc.
- Extended power outage.
- Inability to obtain raw water for basic service due to extreme drought conditions.

If anticipated delivery of treated water to the distribution system is to be disturbed for a period more than 24 hours, then the City may wish to initiate its curtailment plan. However, the decision to initiate the plan and selection of the most appropriate Alert Stage will depend upon a combination of such factors as the available storage in the treated water tanks, time of year or seasonal usage and the anticipated length of the outage or disruption in water production. Consequently, the decision to initiate a specific Alert Stage would depend on how long the existing water storage would satisfy recent water demand and whether water delivery would be restored in this time period.

Reservoir tanks are typically designed for equalization, emergency and fire flow storage. The emergency portion of the finished water storage capacity is typically equal to three days of average daily demand. Any water delivery disruption anticipated to be greater than three days should trigger an Alert Stage No. 3 or No. 4 depending on the available forecasted storage. Other recommended criteria related to finished water storage and disrupted delivery is presented in Table 10.4.2.

TABLE 10.4.2
RECOMMENDED INDICATORS FOR DISRUPTION OF WATER DELIVERY

Alert Stage	Indicator
No. 1	Delivery disruption > 24 hrs., available forecasted storage > 3 days
No. 2	Delivery disruption > 24 hrs., available forecasted storage between 2 & 3 days.
No. 3	Delivery disruption > 24 hrs., available forecasted storage between 1 & 2 days. Delivery disruption > 3 days, available forecasted storage > 3 days.
No. 4	Delivery disruption > 24 hrs, available forecasted storage < 1 day Delivery disruption > 3 days, available forecasted storage < 3 days.

Curtailment of Diversions by Governmental Agencies/Drought Conditions

The County Watermaster, the Department of Water Resources, and potentially other government agencies have the authority to restrict the City's diversion from Calapooya Creek and Cooper Creek Reservoir. Depending upon the timing and extent of the restrictions, any reductions in the City's diversion of water may have serious implications on its ability to provide water to City users. Consequently, curtailment of water diversions by action of/by County, State, and/or Federal agencies is recommended as a Stage Activation Indicator for each Stage.

Another recommend Stage Activation Indicator is the Governor's declaration that a severe, continuing drought exists in Douglas County. Such a declaration is a public acknowledgement by the State that a severe drought is affecting the health and welfare of the County. Depending on its water supply and diversions, the City should utilize the Governor's declaration to activate or advance an alert stage. The Governor also has the authority to order individual state agencies and political subdivisions to implement a water conservation or curtailment plan (ORS 536.720(2)). With a Governor's order, the City would be required to implement one of the alert stages of its adopted curtailment plan.

Staff Assessment

While an endless number of indicators can be compiled and inserted into a curtailment plan, it is impossible to account for every possible water supply crisis that may occur. For the unknown or uncertainty of a crisis, a water provider relies on the judgment of its operators and system manager in handling a potential or real emergency. Few will know more about the viability and condition of the City's water supply and system than the City staff. While the City's engineer and State Agency representatives may understand how the system works, they do not have the staff's day-to-day experience and "feel" of the system's operation. It is therefore recommended that the curtailment plan and ordinance provide the City staff the ability and autonomy to invoke Alert Stages as needed to maintain adequate water service within the City's system.

10.5 Water Use Curtailment Actions (OAR 690-86-160 (4))

Each level-of-alert should include a description of conservation measures appropriate to that level. These measures should provide guidelines, define acceptable and prohibited water usage, and describe the penalties for not abiding by the declaration of water curtailment. A description of potential water curtailment actions that may be employed by the City is described below. A summary of recommended curtailment actions for implementation by the City is presented in Section 10.7.

City's Public Informational Measures

To successfully implement and achieve substantial water-use reductions within the community, the public must be involved, informed and willing to participate with the proposed curtailment measures. An effective public outreach program should be developed to accomplish the following four results (AWWA 1992).

- Keep the public informed about the supply situation.
- What actions are being proposed and being taken.
- How those actions will mitigate the water severity situation.
- How well the public is doing in terms of meeting the plan's goals.

Information measures to be implemented will depend upon the severity (i.e. Alert Stage), and anticipated duration of the water curtailment. The following discussion provides suggestions for informing the public, dealing with the media, and presentation. Portions of this discussion originated from *Drought Management Planning* by AWWA (1992).

Ideas for Informing and Educating the Public

Each community will have to tailor its public outreach to the specific needs and special requirements of its residents. The City may wish to implement one or more of the following suggestions for reaching out to the public during a water curtailment situation.

- Construct and erect a sign indicating the current status of the City's water system by Alert Stage. The City may wish to use a different color and brief description for each Alert Stage. The sign should be on display in a non-hazardous location that would be easily visible to the public. A potential location would be in front of City Hall.

- Provide periodic notices at various Alert Stages to the keep the public informed in a timely manner. These notices should specify such information as when Alert Stages are triggered or terminated, and what actions should be taken or discontinued. The City may wish to use a newsletter type notice that is printed on distinguishable color paper for added recognition. The notices can accompany bills or be distributed by hand.

- Write a fact sheet describing the situation, anticipated time duration of any measures, and actions that the water users can take to help bring relief. The recommended actions for the users should describe the appropriate curtailment measures and also suitable water conservation measures and/or devices. This sheet could be distributed to both the media and the public.

- Conduct public meetings as needed to convey information and enhance the community's participation in dealing with the situation. The City may wish to schedule these meetings at times other than the regularly scheduled times in order to provide enough time for discussion of the water situation.

- Public service advertising should be utilized where possible. Take advantage of large group gatherings in your community (e.g. high school football games, church services, etc.) to relay the City's message. It may also be advantageous for the City to use its staff and/or volunteers to conduct personal visits to residences to discuss water conservation measures and general concerns of the public.

Dealing with the Media

The media can be a great asset in promoting and informing the public in a water crisis. The easiest way to utilize the media is to keep them informed. When dealing with the media, the City should have one person speak for the City and remain as the contact during the entire water crisis in order to prevent inconsistencies in communicating information.

Media inquiries should be responded to immediately to maintain communication and to avoid the media from seeking information from less informed sources. The City may wish to compile a fact sheet (see above) or press packet prior to implementing a water curtailment, and, once a curtailment is in place, to schedule regular press briefings. Effective communication with the media provides the City an opportunity to present an accurate account of the water crisis.

Presentation

It is critical that the City maintain a credible public image at all times, but especially during a water crisis. The kind of information that is released and to whom it is released should be unbiased. Information that is embarrassing or detrimental to the City should be presented openly and frankly just as favorable and supportive information. The City should strive to be the best, most complete and reliable source of information during a water crisis. As such, the City should not withhold information or keep it "confidential".

It is important for the City to communicate precisely and not exaggerate the serious nature of the situation. The City's water users must understand what events will trigger various responses and how their actions can aid themselves and the community to deal with the water crisis.

Non-Essential-Use Restrictions and Bans

Non-essential-use restrictions and bans are used to eliminate some uses of waters and restrict others. Examples of non-essential-use restrictions and bans include the following.

- Restaurants discontinue routinely offering water to customers unless specifically requested.

- Prohibiting the use of water for scenic and recreational fountains, ponds and lakes, except for the minimum amount required to support fish.

- Prohibiting the use of water from hydrants for construction purposes (including dust control), fire drills, line flushing, or any purpose other than fire fighting.

- Prohibiting the use of water to a wash any motorbike, motor vehicle, boat, trailer, airplane, or other vehicle, except at a commercial fixed washing facility.

- Prohibiting the use of water to wash down any sidewalks, walkways, driveways, parking lots, streets, or other hard surfaced areas, or building, or structure. Prohibition of water to run to waste in any gutters or drains.
- Restricting the type and time of watering lawns, bushes, shrubs, trees, vegetable or flower gardens, and fruit trees. Type of watering may be restricted to by hand using either a hose with self-closing nozzle, a container such as a bucket or sprinkler can, or a drip irrigation system. The time of watering may be limited by the hours of the day (e.g. 8 p.m. to 8 a.m.) or by the day of the week (e.g. even numbered addresses on even days, odd numbered addressed on odd days).
- Prohibiting the use of water to fill, refill, or add to any indoor or outdoor swimming pool, hot tub, Jacuzzi pools or where the use of the pool is required by a medical doctor's prescription.
- Prohibiting and/or restricting the use of water for irrigation of public parks and cemeteries.
- Prohibiting new hook-ups to the City's water system or sale of water to persons who are not customers of the City's water system.
- Restricting or prohibiting the use of water for revegetation unless required under an approved erosion and sediment control plan pursuant to NPDES Permit No. 1200-C.

The suitability of a particular measure for a specific Alert Level will depend on such criteria as anticipated water-use reduction, user acceptance, equity, cost, sustainability, legal and contractual issues, and ease of implementation.

As the water provider, the City should take the lead in reducing its water usage by either modifying or eliminating non-critical water use activities until the curtailment event has passed.

Rationing

Rationing measures can be an effective means of reducing water demand during a crisis if it provides equity among the users. Sometimes a percentage reduction or seasonal use allocations are utilized for rationing. The pitfalls of these forms of rationing include favoring historical heavy water users, penalizing customers that have conserved in the past, and additional staff time to research each user's previous water usage. An alternative rationing method is to set fixed allocations per household or capita, or per connection.

For residential users, communities have utilized both the percentage reduction and fixed allocation rationing methods to reduce water usage. The water allotment with the percentage reduction method is generally 70 to 80 percent of the previous year's (non-drought year) monthly account (AWWA 1992). With the fixed allotment method, the allotted water typically ranged from 200 to 400 gallons per day, with an average of approximately 250 gallons per day (AWWA 1992).

Pricing

Rate structures that encourage conservation are helpful, whether or not a water provider is in a water crisis. Pricing structures that can be beneficial during a water crisis include seasonal rates, curtailment water rates, excess-use surcharges, and penalties for wasting water. Some communities utilize seasonal rates that are higher in the summer months to promote water conservation during peak usage. For most communities with a drought management plan examined by AWWA (1992), a surcharging pricing structure was used to penalize users who exceed their designated allotment. A "stepped" approach was typically used with increasingly charges per gallon for incrementally larger amounts of used over the designated allocation. The use of penalties for wasting water will be discussed below.

Enforcement Measures

The enforcement of mandatory water curtailment measures and water rationing must have a legal basis for implementation. For the City, the legal basis would be an ordinance addressing water curtailment. The ordinance empowers the City to implement surcharges and delegates authority to City staff to issue citations for noncompliance. Most water providers employ some sort of punishment for water waste or violation of prohibited practices. Penalties for non-compliance should be spelled out in the ordinance. Generally, most curtailment plans utilize a penalty fee and/or disconnection is used to penalize violators. The actual penalty for each violation would be decided upon by the City Council and incorporated into the ordinance.

Penalties with progressively more stringent consequences are employed for successive violations of water waste or prohibited practices. A response to a first violation may range from a warning with conservation education materials or retrofit kit to a nominal fine. In the case of a second offense, a nominal fee is typically imposed through a citation applied in the customer's bill. Other penalties that have been used for a second offense include installation of a flow restrictor and a 48-hour shutoff period (AWWA 1992). For a third offense, the penalties may include 1) steeper fines, 2) installation of low-flow restrictors, and 3) cutting off the water supply to a user with charges for disconnection and reconnection of the service. Based on a survey of West Coast suppliers (AWWA 1992), a warning was usually sufficient to stop water waste. Second offenses were extremely rarely observed and third offenses were almost unheard of.

Most curtailment plans contain provisions for penalty variances for unusual or emergency circumstances. Granting a temporary variance for prospective uses of water otherwise prohibited should be determined that due to unusual circumstances to fail to grant such variance would cause an emergency condition affecting health, sanitation, or fire protection of the applicant or public. It is recommended that the ordinance contain language stating that variance requests must be received by the implementing agency within a certain time period following notification of the violation (e.g. five working days).

Monitoring

If non-essential water use restrictions and bans are implemented, then active enforcement will likely be necessary to substantially decrease water demand. The City may wish to utilize reactive enforcement, which relies on customers to report violations. Under this scheme, City staff would be dispatched to respond to a complaint. The benefits of this type of monitoring include reduced personnel expense, participation of the entire customer base, and placement of the water provider one step removed from the negative customer contact.

The other general method of monitoring is proactive enforcement. This form of enforcement utilizes designated staff to actively patrol the service area and to issue warnings or citations when they discover a violation or prohibited use. The primary benefit of this type of enforcement is active enforcement of the curtailment plan and opportunities for conservation education. The disadvantages of proactive enforcement are the associated cost and potentially negative image with the public.

For a city as Sutherlin, it is most likely that both types of enforcement would be utilized. While a City staff member would probably not be dedicated to proactive enforcement, staff would likely discover and issue penalties to violators in the course of performing their normal public works functions. The City would also rely on reactive enforcement to also enforce the enacted curtailment measures.

10.6 Example of Implemented Curtailment Plan Actions and Results

It is one thing to propose a water curtailment plan. It is another thing to implement such a plan. The implementation of a water curtailment plan by a nearby community in the time of an emergency is provided in this study to demonstrate the effectiveness of such a plan. The following is a summary of the events leading to the curtailment, actions taken during the emergency, and results of implementing a curtailment plan.

Year: 2001
Community: City of Yoncalla

Because of a drought, the Governor declared a state of emergency for Douglas County in June 2001. In July 2001, the City of Yoncalla experienced some electrical problems at the Adams Creek Pump Station that resulted in this station being unable to convey water for a few days. As a result, the City Council asked the water users to curtail their water use by imposing a set of voluntary guidelines similar to the Alert Stage 1 actions shown in Table 10.7.1.

In the latter part of July 2001, the City discovered that a section of the Raw Water Transmission Main underneath Interstate 5 was leaking. Due to the size of the leak, the City Council convened a special meeting to establish mandatory water restrictions and raise user rates that were effective on August 1, 2001. These actions were deemed necessary by the City Council since a number of the users were not complying with the voluntary curtailment guidelines. The mandatory guidelines adopted by the Council restricted the following.

- Washing of vehicles, structures, or paved surfaces.
- Outside watering for even-numbered addresses on even-numbered days and odd-numbered addresses on odd-numbered days.
- Outside watering on Sundays.
- Any outside watering not done by hand with a hose fitted with a nozzle.
- Outside watering from 9 a.m. to 9 p.m.
- Filling of swimming pools, ponds or hot tubs with water.
- Fire department's use of water for fire drills and truck washing.
- Sale of water to users not on the City's water system.

The City Council also adopted a $200 fine for violators of the mandatory water restrictions. In addition, the Council approved emergency water rates to further encourage water use curtailment. Normally, water users within the City pay $1.75 per 1,000 gallons in excess of 3,500 gallons. With the emergency rates, City water users were required to pay is given in Table 10.6.1

TABLE 10.6.1.
NORMAL AND EMERGENCY WATER RATES IN CITY OF YONCALLA
YEAR 2001

Monthly Usage (gallons)	Rate ($/1,000 gallons)	
	Inside City	Outside City
Normal Rates		
>3,500	1.75	3.50
Emergency		
3,500 to 5,000	3.50	7.00
5,000 to 7,000	5.25	10.50
>7,000	7.00	14.00

The implementation of the mandatory water curtailment measures resulted in a significant reduction of water usage in the month of August (highest demand month) as compared to other years. Overall, the daily amount of water produced in August 2001 was approximately 31 percent and 45 percent less than what was observed in August of 1999 and 2000. Consequently, the mandatory water curtailment measures were considered a success.

After a new section of the Raw Water Transmission Main was installed, the City Council lifted a number of the existing mandatory water curtailment measures and emergency water rates. Several of the mandatory curtailment measures remained in effect as of September 1, 2001 because of the drought conditions. These measures included the even-odd water days by address, prohibiting water on Sundays and outside between 9 a.m. and 8 p.m., and watering must be done with a hose fitted with a handheld nozzle only.

For the City of Yoncalla, the implementation of water curtailment measures allowed the City to effectively conserve water within its service area during the simultaneous occurrence of a emergency situation and drought conditions.

10.7 Water Curtailment Plan

The recommended water curtailment plan for the City of Sutherlin is provided in Table 10.7.1.

Section

11

Water Supply Plan

(OAR 690-086-170)

11.1 Introduction

The final element of the Water Management and Conservation Plan is a long-range water supply plan, as required under OAR 690-086-170. This plan includes an evaluation of projected water demand and a comparison of the demand with available supplies. Where additional water supply is needed, the sources and diversion from these sources are identified and evaluated. Mitigation actions to comply with Federal and State legal requirements associated with the construction and diversion from the source are also identified and discussed.

This section is culmination of evaluation and analysis compiled and discussed in previous sections. Thus, much of the information provided in this section is text or tables taken directly from other sections or a summary of what already has been previously addressed.

11.2 Future Population Projections (OAR 690-86-0170(1))

Since 1990 Sutherlin has experienced a growth rate higher than most other communities in Oregon. Based on United States Census data, the City of Sutherlin's population increased from 5,020 to 6,669 between 1990 and 2000. This increase equates to an average annual growth rate of 2.9%. During this same period, the average growth rate in Douglas County was only 0.6%.

Sutherlin's livability characteristics, especially for retired persons and those enjoying outdoor recreation, have attracted a long term growing populace regardless of the local economic climate. Growth is expected to continue at or exceed a rate similar to that experienced in the community during the last decade. The coordinated population projection of 2.7% per year has been selected by Douglas County in its Comprehensive Plan (1997) for the next 25 years (to the Year 2029). The population projections over the next 20 years, using the Year 2004 PSU estimate of the City population (7,360) as the base figure, are summarized in Table 11.2.1.

TABLE 11.2.1
CURRENT POPULATION ESTIMATE AND POPULATION PROJECTIONS

Year	2000	2004	2005	2010	2015	2020	2025
Residential Population	6,669	7,360	7,559	8,636	9,866	11,272	12,878

City staff has expressed concern that the County's adopted 2.7 percent annual growth for the City may be too conservative. This concern is based on a number of observations including recent growth within the City, developers expressing interest in developing residential, commercial, and industrial properties within the City Limits and Urban Growth Boundary (UGB), and property owners outside the City's UGB expressing an interest in annexing into the City. If higher than anticipated growth were to occur, a water master plan based on the 2.7 percent annual growth would be underestimate the required potable water infrastructure to support future users. On the other hand if growth were not to occur as fast as anticipated, then the plan may recommend improvements that may not be needed within the Study

Period (next 20 years). To address both of these concerns, this master plan was compiled to examine the City's potable water infrastructure needs not only for the anticipated 20-year City population of 12,878, but also for population increments leading up to and exceeding this projected population. The population increments leading up to 12,878 are based on a rational, phased approach that is discussed in further in Section 3.3. Two increments of 3,000 capita beyond the anticipated population of 12,878 were examined (15,878 and 18,878) in this plan.

For the calendar Year 2004, there were 2,039 residential potable water connections within the City. The number of equivalent dwelling units (EDUs) for these connections is 3,179 (see Section 6.2 for more details). With a current City population of 7,360, the number of capita per equivalent dwelling unit is 2.32 (7,360 capita/ 3,179 EDUs, rounded). City staff has performed a preliminary assessment of potential future growth due to annexation for the western part of town. Based on this assessment, potential annexation could bring enough land on the west side of town alone for approximately 1,540 new dwelling units or 3,537 capita based on 2.3 capita per dwelling unit. This potential growth is starting to become reality, as the City will be considering a request for annexation of approximately 217 acres west of I-5 at its May 2006 Council Meeting. Approval of this request for annexation itself will increase the size of the current UGB (3,514 acres) by approximately 6 percent to a total UGB of 3,731 acres.

As discussed in Section 9.2, the number of residents living outside the UBG connected to the City's water system is estimated to be 728. City staff considers future growth of potable water users in these currently served areas to be minimal or non-existent. For this Plan, it is assumed that there will be no new individual, residential water connections outside the City's UGB.

The current and future total number of potable water users on the City's system is summarized in Table 11.2.2. With the two 3,000 population increments above the 20-year projection, the anticipated Years when these populations would be achieved, at 2.7 percent annual growth, is 2034 and 2046, respectively.

TABLE 11.2.2
CURRENT AND FUTURE POTABLE WATER USE POPULATION

Year	Population		
	Exist. & Future City Users	Exist Outside Users	Total
2004	7,360	728	8,088
2005	7,559	728	8,287
2010	8,636	728	9,364
2015	9,866	728	10,594
2020	11,272	728	12,000
2025	12,878	728	13,606
2034	15,878	728	16,606
2046	18,878	728	19,606

11.3 Water Demand Projections (OAR 690-86-170(3))

For this Plan, future water demand was based on the current water production parameters (per capita usage reduced (assuming that the amount of backwash water resulting from a new Cooper Creek WTP will be reduced at least one-half, based on percentage, of its current amount), projected growth within the City (see Section 3.3 and Section 11.2), and anticipated nonaccounted water. This methodology assumes that water demand characteristics within the City will basically remain the same as the existing per capita basis with allowances for changes in anticipated nonaccount water.

Currently the nonaccount water within the City is on the order of 29 percent. In order to be in compliance with OAR, Division 86 and to improve system efficiency, the City must work to reduce this level to 15 percent and, once obtained, thence strive for 10 percent.

Two separate scenarios for the amount of nonaccount water were developed in Section 6.3 and evaluated in Section 8.1. The first scenario (Scenario No. 1) is based on the nonaccount water within the City being reduced to 20 percent by the Year 2010, 15 percent by the Year 2015, 12 percent by the Year 2020, and 10 percent for the Years 2025 to 2046. For Scenario No. 2, it is anticipated that the amount of nonaccount water within the City will be reduced to 25 percent by the Year 2010, 20 percent by the Year 2015, and to 15 percent by the Year 2025 through the Year 2046. The future projected water demand for each scenario was calculated assuming these anticipated levels of unaccounted/loss water.
A summary of the water production demand projections using Scenario No. 1 and Scenario No. 2 is presented in Tables 11.3.1 and11.3.2, respectively. The water production demand projections presented in Table 11.3.2 (Ultimate nonaccount water at 15%, the more conservative value) was used in this Plan to evaluate the City's water sources and size its raw water and WTP facilities for future supply and demand.

TABLE 11.3.1
FUTURE WATER PRODUCTION DEMAND – SCENARIO NO. 1,
ULTIMATE NONACCOUNT WATER 10%

Parameter/Year	2010	2015	2020	2025	2034	2046
Total Population	9,364	10,594	12,000	13,606	16,606	19,606
% Nonaccount Water	20	15	12	10	10	10
Water Demand						
ADD, gpd	1,761,800	1,876,000	2,052,500	2,275,500	2,777,300	3,279,000
DDD, gpd	2,376,800	2,530,800	2,769,000	3,069,800	3,746,700	4,423,500
MMD, gpd	2,950,200	3,141,400	3,437,000	3,810,400	4,650,600	5,490,800
PWD, gpd	3,141,400	3,345,000	3,659,700	4,057,300	4,951,900	5,846,500
MDD, gpd	3,615,100	3,849,400	4,211,600	4,669,100	5,698,600	6,728,100

TABLE 11.3.2
FUTURE WATER PRODUCTION DEMAND – SCENARIO NO. 2,
ULTIMATE NONACCOUNT WATER 15%

Parameter/Year	2010	2015	2020	2025	2034	2046
Total Population	9,364	10,594	12,000	13,606	16,606	19,606
% Nonaccount Water	25	20	17	15	15	15
Water Demand						
ADD, gpd	1,879,300	1,993,300	2,176,200	2,409,400	2,940,600	3,471,900
DDD, gpd	2,535,300	2,689,000	2,935,800	3,250,400	3,967,100	4,683,800
MMD, gpd	3,146,900	3,337,800	3,644,100	4,034,600	4,924,200	5,813,800
PWD, gpd	3,350,800	3,554,000	3,880,200	4,296,000	5,243,200	6,190,400
MDD, gpd	3,856,100	4,089,900	4,465,300	4,943,800	6,033,800	7,123,900

11.4 Comparison of Available Supply with Future Demand (OAR 690-86-170(4))

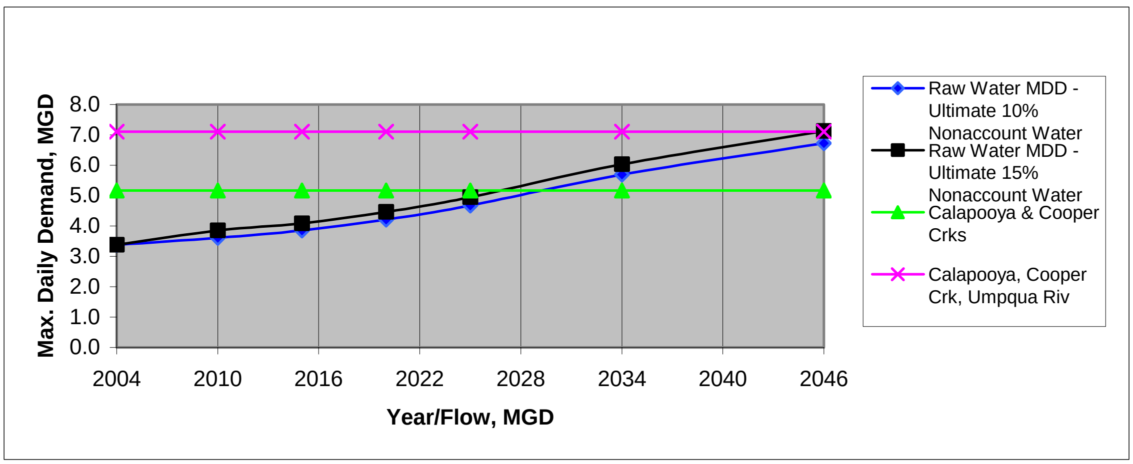
The City has water rights for 4.0 cfs on Calapooya Creek, 5.0 cfs on Cooper Creek with 500 acre-feet of storage in Cooper Creek Reservoir, and 3.0 cfs on the North Umpqua River (see Sections 5.1 and 9.2). As discussed in Section 8.1, the City has not had any difficulty in meeting its water requirements during the wet season months (November through April) nor anticipates any future difficulties for these months because the demand is low and the raw water supply is sufficient. The most critical time for the City is obtaining water during the dry season months (June through October) when demand is high and the supply of raw water is limited.

A projection of the maximum daily demand was made and compared to the City's available water rights. The following assumptions were utilized in this projection:

- Full withdrawal can be made from Cooper Creek,
- City's junior water right on Calapooya Creek is restricted due to low stream flows (60% probability based on historical stream flows, Section 5.1), and
- Ultimate non-accounted water within the City is reduced to 10 or 15 percent (Tables 11.3.1-2).

A plot of projected maximum daily demand versus time is presented in Figure 11.4.1 (same as Figure 8.1.1).

FIGURE 11.4.1
RAW WATER MAX. DAILY DEMAND (MDD) & CITY WATER RIGHTS[(1)] VS. YEAR



[(1)] Water rights for Calapooya Creek do not include its junior right (1.0 cfs) due to instream rights.

Based on the projected maximum daily demand (MDD), the City's existing water rights on Calapooya Creek and Cooper Creek should be sufficient to meet the City's demand until approximately the Year 2025 to the Year 2029 depending on the percentage of unaccounted for water. This conclusion is based on the City fully developing the Cooper Creek water right of 5.0 cfs (3.2 MGD).

Currently, the maximum water production from the Cooper Creek WTP is 1.0 MGD or approximately 1/3 of the water right capacity. The combined water production capacity (3.3 MGD) of its WTPs (Nonpareil and Cooper Creek) equals the current MDD. Consequently, construction of a new Cooper Creek WTP is recommended to increase overall treatment capacity to meet current water demand in the City. Until the City can upgrade the Cooper Creek WTP facilities, it will need to rely on all of its water rights on Calapooya Creek and water production from the Nonpareil WTP to meet the current water demand. Based on historical water diversion from Calapooya Creek (Table 5.1.2), water withdrawals have exceeded 3.0 cfs (sum of City's most senior water rights) consistently on a daily and peak week basis. Thus, the City will need to rely on its junior water right on Calapooya Creek until the new facilities at Cooper Creek can be constructed.

After the Years 2025 to 2029, the City will need to utilize its water right on the North Umpqua River or find another source of water in order to meet the projected MDD demand. If the City develops its water right on the North Umpqua River, the projected MDD is anticipated to exceed all of the City's existing water rights (minus its junior Calapooya Creek water right) between the Years 2046 and 2050, the projected MDD demand. To satisfy long-term demand (beyond the Years 2046), the City will need to pursue conservation of its existing diverted water and/or explore long-range acquisition of future sources of raw water.

11.5 Analysis of Alternate Sources (OAR 690-086-170(5))

Several different raw water sources were evaluated in Section 8.1 as potential resources for the future City use. These alternatives included groundwater sources, surface water sources (Impoundments within Calapooya Creek Watershed, City of Oakland, North Umpqua River and Cooper Creek), water rights purchases, and non-potable water reuse (WTP backwash water reuse and wastewater treatment plant (WWTP) water reuse). A brief summary of the findings from this evaluation is given below.

- **Groundwater Sources** – this water resource is not considered to have sufficient yield to adequately fulfill the City's water demand needs.
- **Impoundments within Calapooya Creek Watershed** – A number of sites have been recommended with the most recent being the proposed Gassy-Norris Creek site. Impoundments in the Calapooya Creek watershed are not considered viable due to the high cost to construct an impoundment and anticipated environmental documentation for and opposition to the project.
- **City of Oakland** – the City of Oakland has the most senior water right on Calapooya Creek and currently has available water. However, the future water demand within the City is anticipated to eventually match or exceed its water right. While a connection with the City of Oakland would be beneficial in the case of an emergency, there does not appear to be a long-term net benefit to the City to acquire, lease or purchase water from Oakland,
- **North Umpqua River** – a total of seven different alternatives were initially evaluated for the development of the City's water right on the North Umpqua River. Three of these alternatives were selected for further analysis. The most cost-effective alternative consisted of water diversion, treatment, and pumping by Umpqua Basin Water Association. A booster pump between Umpqua Basin's distribution system and the City's system would provide the conveyance to the City. For this improvement, the City will need to request and obtain an additional diversion point for their North Umpqua River water right.
- **Cooper Creek** – to fully develop this water right and handle the raw water quality of Cooper Creek Reservoir, new WTP facilities are needed at Cooper Creek. The most cost-effective WTP alternative was the Adsorption Clarifier Followed by Filtration Process.
- **Water Rights Purchases** – the potential exists for the City to purchase existing water rights. Additional research on available and types of water rights near the City's outfalls would be needed.
- **WTP Backwash Water Reuse** – Recycling of backwash water to the WTP's influent was evaluated. While backwash recycling is possible, City staff has expressed concerns about the effect of this recycle on WTP treatment efficiency and how much backwash water would actually be available.
- **WWTP Water Reuse** – City currently pumps reclaimed water to the Oak Hills Golf Course for irrigation. Surplus reclaimed water is available primarily at the beginning (i.e. May) and end (i.e. September & October) of the dry season. Cost for additional treatment and conveyance have not been compiled. These items will be addressed in the City's Wastewater Facilities Plan, which is in progress. Reuse at the WWTP is recommended. However, the amount of anticipated water savings is not known.

Of these source water alternatives, the following were evaluated in further detail: North Umpqua River, Cooper Creek, WTP Backwash Water Reuse, and WWTP Water Reuse.

In addition to the potential sources examined in Section 8.1, several conservation measures were addressed in Section 9. These options are considered potentially viable source alternatives because existing resources are utilized more efficiently and the environmental impact is beneficial. Water conservation results in less water being used to accomplish the same task. Each gallon of water that is saved or conserved through conservation measures becomes one less gallon of water required at the point of diversion. As a number of the conservation measures presented in the Water Conservation Plan were mandated by under OAR 690-086-150, the effectiveness (both cost and amount of water saved) of these mandated measures was not addressed. However for three of the evaluated measures, the cost and anticipated quantity of water conserved were compiled. These measures were 1) rebate for installation of ultra-low-flow toilets, 2) rebate for water efficient clothes washer, and 3) distribution of retrofit/replacement kits to increase the water efficiency of existing plumbing fixtures.

A tabular summary of the water availability, average cost per acre-feet, reliability, feasibility, and likely environmental impacts for the for the selected water source and conservation measure alternatives is presented in Table 11.5.1. Based on this analysis, the most cost-effective alternative is the WTP Backwash Recycle option. This alternative has the potential for providing modest water savings. However, there are concerns with respect to the water quality and quantity that would be recycled. Collection of water quality and flow data is recommended as a conservation benchmark in Section 9.

The second and third most cost-effective alternatives are development of the City's water rights: 1) construction of a new Cooper Creek WTP and 2) development of the North Umpqua River water right. These alternatives are not only considered cost-effective but also provide the most available water. The Cooper Creek WTP alternative has excellent reliability and feasibility with minimal, if any, environmental impacts. The Cooper Creek WTP improvements are considered critical not only to provide water to meet current demand but also provide redundancy in the event the Nonpareil WTP is out of service. The Cooper Creek WTP improvements are considered a Phase I Improvement (see Sections 12.2 and 12.3). Construction of the proposed improvements is anticipated before the water right extension of October 1, 2010. However, the City may need to request an extension of the WTP construction if delays in the schedule occur. In addition, the City should request an extension for full utilization of this water right to Year 2025 by the October 1, 2010 deadline.

The North Umpqua River alternative has good reliability with a possibility of diversion restrictions in the late summer or early fall when stream flows are below minimum instream flows. The North Umpqua River alternative is also considered feasible as the improvements will be constructed in conjunction with the Umpqua Basin Water Association's WTP facility improvements. No environmental impacts have been identified as the proposed diversion of the City's water right would be taken at Umpqua Basin's existing raw water diversion facility. The improvements required at the Umpqua Basin's raw water intake and other facilities needed to accommodate the City's additional hydraulic demand were completed in January-April 2006. Total cost for these improvements was $595,000. The City is in the process of negotiating an agreement with Umpqua Basin for payment of these improvements. Additional treatment and conveyance improvements will be required at Umpqua Basin before the City can obtain water from this source. Based on future water demand projections, the City will need to utilize the North Umpqua River water right by approximately Year 2025 to Year 2029. Since municipal projects typically take approximately five years from conception to completion, the City should anticipate initiating these additional improvements around the Years 2020 and 2024, unless water demand dictates sooner development. The Umpqua Basin WTP Improvements are considered a Phase III Improvement (See Sections 12.2 and 12.3). For completion of these improvements within the above timeframes, the City will need to request an extension of and an additional diversion point to its water right permit on the North Umpqua River before its current extension expires (October 1, 2009). The City should not wait for this Year 2009 deadline but immediately pursue the additional diversion point and permit extension. As a

Table 11.5.1

condition of any extension, the Department of Water Resources will require the development of another Water Management and Conservation Plan similar to what has been presented in Sections 9, 10, and 11 of this Master Plan.

Conservation measures (i.e. rebates and incentives) are slightly less cost-effective than the development of the North Umpqua River Source and provide the least amount of available water. The identified conservation measures in themselves cannot provide enough water savings to satisfy the future water demand needs of the City. While rebates or incentives are neither the most cost effective or provide sufficient water savings for the City, conservation measures are need both short-term and long-term. Short-term, conservation is needed to curb demand until Cooper Creek WTP Improvements are completed. Long-term, conservation is needed to reduce demand to within the City's current water right allocations. In addition, conservation has value in allowing City users to part of the solution and participate in reducing their water consumption. This participation is important in developing a "water conservation mindset". Of the evaluated conservation measures, the most cost-effective were the rebate for installation of ultra-low-flow toilets and retrofit/replacement incentive. As recommended in Section 9.3, the City will survey its customers as to the number of potential participants and type of retrofit kits, adopt the retrofit/replacement program (July 2007), and decide if there is sufficient interest in the ultra-low-flow toilet rebate program (July 2007).

The use of WWTP reclaimed water is considered a potentially viable source of water to the City. Additional information provided in the upcoming Wastewater Facilities Plan should allow a more comprehensive assessment on the cost and potential use of WWTP reclaimed water.

No other conservation measures have been identified and evaluated that would provide water at a cost that is equal to or lower than the cost of other identified sources. As identified at the end of Section 9.3, the City may wish to consider the following activities in the future: rebates for installation of drip irrigation and replacement of lawns with alternative landscaping, financing/conducting irrigation audits, and water reuse of backwash water and wastewater treatment effluent (depending on findings).

11.6 Water Rights Schedule of Use (OAR 690-086-170(2))

Based on the information presented in this Plan, the anticipated schedule for full utilization of the City's existing water rights is presented in Table 11.6.1.

TABLE 11.6.1
SCHEDULE FOR UTILIZATION OF WATER RIGHTS

Source	Permit	Certificate	Use	Rate, cfs	Present Full Utilization	Proposed Full Utilization
Calapooya Creek	S6610	6344	Municipal	0.75	Current	Current
Calapooya Creek	S15016	19629	Municipal	2.25	Current	Current
Calapooya Creek	S44066	-	Municipal	1.00	10/1/2010	10/1/2010
Cooper Creek	S32426	-	Municipal	5.00	10/1/2010	2025
North Umpqua River	S44926	-	Municipal	3.00	10/1/2010	2046-2050

Based on the anticipated water demand, the proposed full utilization for Cooper Creek and North Umpqua River water rights is at a later date than the present full utilization dates. Full utilization of the Cooper Creek WTP may occur faster than shown in Table 11.6.1 if the Nonpareil WTP is off-line during the summer months (primarily July and August). Likewise, full utilization of the North Umpqua River water may occur sooner if one of the City's other WTPs is out of service during the summer months. With respect to the City's water right permit on Calapooya Creek, the City will need to reassess its water needs from this source by the Year 2009 and respond appropriately before the October 1, 2010 deadline for full utilization of water diversion under this permit. Submission of extension request is recommended in January 2010.

11.7 Quantification of Maximum Diversion/Production (OAR 690-086-170(6))

Division 86 Rules require that the maximum rate and monthly volume of water be quantified for any expansion or initial diversions. The rates and volumes for the City's three water rights permits were estimated based on historical flow relationship observed between maximum daily and monthly demand and projected future demand. Assumptions made for the quantification of the maximum diversion and production include 1) percent nonaccounted for water is 15 percent, and 2) maximum rates will equal the maximum diversion rate within each permit, and 3) estimated Maximum Month Demand is equal to 80 percent of Maximum Daily Demand based on historical data (see Table 5.1.4). A summary of calculations for each permit is given below.

Calapooya Creek
Est. Maximum Rate for all Calapooya Water Rights = 4.0 cfs
Est, Maximum Month for all Calapooya Water Rights = 80% of 4.0 cfs or 3.2 cfs.
Est. Maximum Rate for Permit S44066 = 1.0 cfs
Est. Maximum Month for Permit S44096 = 80% of 1.0 cfs or 0.8 cfs.

Cooper Creek
Est. Maximum Rate = 5.0 cfs
Est, Maximum Month = 80% of 5.0 cfs or 4.0 cfs.

North Umpqua River
Est. Maximum Rate = 3.0 cfs
Est. Maximum Month = 80% of 3.0 cfs or 2.4 cfs

The anticipated quantification of the maximum rate and monthly volumes for the City's three water rights permits is given in Table 11.7.1.

TABLE 11.7.1
QUANTIFICATION OF MAXIMUM DIVERSION

Source	Permit	Estimated Max. Rate, cfs	Estimated Max. Month, cfs	Proposed Full Utilization
Calapooya Creek	S44066	1.00	0.8	10/1/2010
Cooper Creek	S32426	5.00	4.0	2025
North Umpqua River	S44926	3.00	2.4	2046-2050

11.8 Mitigation Actions (OAR 690-086-170(7))

Division 86 Rules require that a water management and conservation plan describe mitigation actions that the water supplier is taking to comply with legal requirements, “including by not limited to the Endangered Species Act, Clean Water Act, Safe Drinking Water Act; …”. The City has reviewed the status of its water right permits and find that only permit conditions are those associated with the North Umpqua River permit. In the Final Order for Extension of Time for Permit S-44926, the permit is extended with the following conditions only (Cleary 2004).

1. Water Management and Conservation Plan
   Within two years of granting extension, the permittee shall submit a Water Management and Conservation Plan consistent with OAR Chapter 690, Division 86. The Director may approve an extension of this timeline to complete the required Water Management and Conservation Plan.

2. Fish Screens
   The permittee shall install, maintain, and operate fish screening and by-pass devices as required by the Oregon Department of Fish and Wildlife (ODFW) to prevent fish from entering the proposed diversion. The required screens and by-pass devices are to be in place, functional, and approved by an ODFW representative prior to diversion of any water.”

The City proposes to satisfy both of these conditions of the North Umpqua River permit extension. This plan was compiled to address Condition No. 1. By diverting water through Umpqua Basin’s existing intake screens, Condition No. 2 regarding the fish screens is already addressed and satisfied. The only other mitigation actions potentially need are the following permits for construction of the conveyance system from Umpqua Basin Water Association’s distribution system to the City’s distribution system: 1) 1200-C NPDES permit for erosion control, 2) 404 permit from the US Corps of Engineers and 3) Removal/Fill Permit from the Division of State Lands (DSL). The need for these permits will be determined during the design of the conveyance system and will depend on the alignment of the proposed improvements. The Contractor hired to perform the improvements will be required to comply with the permit requirements.

11.9 Acquisition of New Water Rights (OAR 690-086-170(8))

No acquisition of new water rights is needed within the time frame examined in this Plan. No further analysis per OAR 690-086-170(8) is required.

11.10 Summary of Water Supply Benchmarks

A summary of actions or “benchmarks” that the City plans to implement in regards to Water Supply Plan is presented in Table 11.10.1. Please note that some of the benchmarks (i.e. WTP Backwash, Conservation Measures, and WWTP Reclaimed Water) are identical those summarized in Table 9.4.1.

TABLE 11.10.1
SUMMARY OF WATER SUPPLY BENCHMARKS

Benchmark	Start Date	Frequency or Completion
WTP Backwash		
Collect water quality and flow data from the backwash pond discharge at the Nonpareil and Cooper Creek WTPs (June – September). Evaluate whether reuse of backwash water is feasible and appropriate.	2006	June. 2007
Cooper Creek WTP		
Construct Cooper Creek WTP Improvements	2007	Start Design – Nov 2007 Finish Const. Apr. 2010
Request Extension of Cooper Creek WTP for full utilization by Year 2025.	2010	Jan. 2010 (submit prior to Oct. 1, 2010)
North Umpqua River Water Right		
Enter into Agreement with Umpqua Basin Water Association forthe withdrawal of water from their raw water intake.	2006	July 2006
Request additional point of diversion (POD) for North Umpqua River water right at Umpqua Basin Water Association intake location	2006	July 2006
Request extension of North Umpqua Water Right for construction and full utilization by Year 2050.	2009	Jan. 2009 (submit prior to Oct. 1, 2009)
Conservation Measures		
Conduct survey of users on the potential participation in a rebate program for the installation of ultra-low-flow toilets and front loading clothes washer. If sufficient interest, then adopt a program for implementation by July 2007.	2006	Oct. 2006 (Survey) July 2007 (Potential Rebate Program)
Conduct survey of users on the potential participation in a retrofit/replacement program. If sufficient interest, then adopt a program for implementation by July 2007.	2006	Oct. 2006 (Survey) July 2007 (Potential Rebate Program)
WWTP Reclaimed Water		
Collect data of water usage at the Oak Hills Golf Course & effluent discharge into Calapooya Creek for the Year 2005 Irrigation Season	2005	Oct. 2006
Identify the capital requirements needed for reclaimed water use at the WWTP in the City's Wastewater Facilities Plan	2006	Dec. 2006
Calapooya Creek Water Right Permit (SS44066)		
Reassess the City's water needs from this source in Year 2009. If further utilization of the water diverted from this permit is needed, then the City needs to request an extension of this permit and state additional time needed prior to permit deadline (Oct. 1, 2010)	2009	Review in 2009, Submit Jan. 2010

Section

12

Capital Improvement Plan

12.1 Background

A capital improvement plan (CIP) is a long-term program for replacement of existing or installation of new infrastructure required to improve a system's function or maintenance. The Capital Improvement Plan, for water and wastewater systems, provides the City Council, staff and residents with a systematic approach to dealing with its short-term and long-term infrastructure needs and demands.

Under ORS 223.309(1), a capital plan, public facilities plan, master plan or comparable plan must be prepared before the adoption of system development charges (SDCs). This plan must list the capital improvements that may be funded with improvement fee revenues and include the estimated cost and timing of each improvement. Oregon Revised Statutes discuss which improvements may be funded by SDC revenues (ORS 223.307) and what type of projects qualify for credit purposes. The capital improvement plan may be modified at any time pursuant to ORS 223.309 (2).

Water system improvements recommended in the City of Sutherlin, are provided in this Plan along with associated costs. The recommended improvements for the City's Capital Improvement Plan were derived from the analysis presented in Sections 8, 9, 10, and 11.

12.2 Project Phasing

To assist the City in its planning efforts, the proposed Capital Improvements have been assigned into one of three phases with Phase I being the most critical projects and Phase 3 being long-term projects. A brief description of each Phase and the types of projects within that phase is provided below.

Phase I projects are considered the most critical and should be undertaken as soon as funding can be secured. These projects include improvements that are considered to maintain the quality of the system, maintain health guidelines, bring the system into regulatory compliance, increase fire flow and storage capacity, increase WTP capacity, and provide for future development of the Umpqua River water rights.

Phase II projects are important projects that should be taken as funding becomes available. These improvements include further system improvements to upgrade the existing system and to address the future system needs. While these projects are not included in the "critical" list, they should be considered as important and necessary for continued optimal system performance.

Phase III projects should be implemented as needed to address new development, population growth, annexations, development of water rights, and/or new regulatory requirements. Phase III projects include improvements that may not be considered critical but improve system efficiency and operation.

The phase of each improvement was presented and discussed with City staff and Council. The cost estimates presented in this Plan reflect the basis previously described in Section 7.3. The estimates presented herein are preliminary and are based on the level and detail of planning presented in this Study. As projects proceed and as site-specific information becomes available, the estimates may require updating.

Compilation of an environmental report is typically a requirement of government organizations funding infrastructure improvements to consider any adverse effects that the project may have on the surrounding environment and propose mitigation measures to minimize these impacts. The estimated cost for compiling an environmental report for each Phase was included in this CIP.

A brief description of each Phase of improvements including recommended improvements, associated costs, and estimated percentage and cost eligibility for improvement system development charges (see Section 13) is discussed below. Detailed cost estimates for the CIP project reside in Appendix F.

Phase I Improvements

Phase I improvements called for in this CIP represent the highest priority projects that require addressing in order to ensure the effective treatment of water for the City's residents and customers. These improvements include improvements to construction of a new water treatment plant and related improvements at the Cooper Creek WTP site, new raw water intake improvements at Umpqua Basin Water Treatment Plant to handle the City's additional flow, construction of a supervisory control and data acquisition (SCADA) system, distribution system improvements to improve fire flow and storage, and individual booster pump stations for customers on the Nonpareil water main.

Project Descriptions

1. Cooper Creek Water Treatment Plant Improvements (Total Cost: $3,800,000)

These improvements are needed to fully development the City's water right on Cooper Creek and handle the raw water quality from Cooper Creek Reservoir. The hydraulic capacity of the new WTP will be a minimum of 3.2 MGD. The proposed new WTP will consist of oxidant/coagulation addition, two-train aeration basin and packaged system consisting of adsorption clarifier, and mixed-media filtration. Other WTP improvements include the installation of new 14-inch diameter PVC raw water main, demolition of the treatment equipment and installation of a large doorway in the existing WTP building, new sewer drain field, back-up generator, on-site hypochlorite system, new concrete backwash ponds, new 100,000 gallon concrete clearwell, new treated water pumps and new WTP building. A site plan showing the recommended improvements is displayed in Figure 12.2.1.

2. Umpqua Basin Water Association WTP Intake Improvements (Total Cost: $855,000)

This project consists of improvements to Umpqua Basin Water Association's current raw water intake structure in order to accommodate the diversion of the City's 3.0 cfs water right on the North Umpqua River. The proposed improvements include a new raw water pumps, new intake screens for 8 MGD capacity under NOAA requirements, and a new 18-inch diameter raw water pipe (Black & Veatch 2005a, 2005b). Umpqua Basin is anticipating the WTP improvements, including the raw water improvements, will commence in the Year 2006. Engineers for the Umpqua Basin Water Association estimates the cost for this project to be $855,000 (Black & Veatch 2005b). The actual project cost based on construction is $595,000. Please note that the overall project cost at the Umpqua Basin WTP facilities was kept at the original estimate of $3.834 million due to uncertainties in future construction costs. The treatment portion needed for this water right will be developed as a Phase III project.

3. New 2.0 MG Water Reservoir – Plat M Road (Total Cost: $2,101,400)

A new 2.3 MG reservoir is proposed at the Plat M Road site as recommended in Section 8.4. This reservoir, along with the existing reservoir capacity, is anticipated to provide sufficient water storage until approximately the Year 2015. The cost for this tank was based on a glass-fused-to-steel tank, which is the same tank material that was used for the construction of the Oak Hills Tank. Estimated project cost

Cooper Creek WTP Recommended Improvements Figure 12.2.1

includes anticipated contingency, engineering, legal and administration, geotechnical investigation and real estate/easement expenses.

4. Cathodic Protection for Water Reservoirs (Total Cost: $107,000)

With the exception of the Calapooya Reservoir, all of the City's water reservoirs are without cathodic protection. Installation of cathodic protection is recommended to extend the service life of these tanks. The City may wish to perform a preliminary survey of the tanks by a corrosion engineer before embarking on this improvement. This preliminary study is estimated to cost from $3,500 to $5,000.

5. Water Reservoirs Reconditioning (Total Cost: $127,000)

During site visits to the City's reservoirs, two of the City's tanks were identified as needing reconditioning: 1) North Umpqua and 2) Ridgewater Tank No. 1. The estimated cost for these tanks is for surface preparation and recoating both the inside and outside of the tank (assuming there is no lead based coatings).

6. SCADA Improvements (Total Cost: $206,800)

Installation of a supervisory control and data acquisition (SCADA) system for the City's water system is recommended because of the geographic separation of its facilities (e.g. Nonpareil WTP and City shop). SCADA systems collect data (e.g. reservoir tank water levels, pump run times, total flow pumped, WTP operation, etc.) and provide some control functions from a computer, presumably located at one of the City's facilities, 24 hours per day, 365 days per year. A SCADA system would provide the City with more information on and control of its system using less of staff's resources. For Phase I, the SCADA improvements are proposed at the City's critical water facilities (i.e. Cooper Creek WTP, Nonpareil WTP, Calapooya Reservoir, Umpqua Reservoir and Oak Hills Reservoir). The majority of the SCADA improvements will consist of new electrical equipment (e.g. programmable logic controllers, PLCs; remote telemetry units, RTUs; and radio systems) that are housed in metal cabinets either inside or adjacent to the City's existing structures. With the exception of the Oak Hills Tank site, all of the above facilities have existing electrical service and telephone or radio service.

7. Miscellaneous Reservoir Improvements (Total Cost: $24,000)

This project includes various reservoir improvements required to improve or maintain the performance and investment of the City's reservoirs. The elements of this project include, but are not limited to, installation of seismic chairs and bolts on Ridgewater Tank No. 1, new level gauge on Ridgewater Tank No.1, ladder cage cover on Ridgewater Tank No. 2, and additional coating of several bolts on Ridgewater Tank No. 2.

8. Orenco Water Main Upsizing Improvements (Total Cost: $214,300)

Based on computer modeling of the City's water distribution system, fire flows available to Orenco are below of those required. A new 12-inch diameter main is recommended beginning at the intersection of East Duke Avenue and South Comstock Road, continuing south and then east on Airway Avenue at the end of which it will terminate. The total length of the water main improvement is approximately 1,000 feet.

9. West Side Water Main Upsizing Improvements (Total Cost: $2,285,200)

Installation of a new 18-inch diameter water main is recommended in order to deliver required fire flows and accommodate future growth on the west side of town. This new 18-inch diameter water main is anticipated to remove the hydraulic bottleneck between the Oak Hills Tank and the existing WTPs and other reservoir tanks. This main will begin at the existing 14-inch water main located at the intersection of North Umpqua Street and East 6th Avenue. The new 18-inch diameter main will continue west on East 6th Avenue, north on North State Street and southwest on West 6th Avenue to its intersection with Sherman Street, where it will turn south to the intersection with West Central Avenue. The line will continue west along West Central Avenue, to just short of Interstate 5 and connect to the existing water main which crosses underneath Interstate-5. The new main will also be installed on the west side f Interstate 5 on Highway 138 and terminates where the 12-inch diameter main from the Oak Hill development intersects with Highway 138. The total length of this water main improvement is approximately 10,850 feet.

10. High School/Middle School Water Main Upsizing Improvements (Total Cost: $742,700)

This water main improvement is proposed to provide sufficient fire flows to the Sutherlin High School and Sutherlin Middle School with the installation of a 14-inch diameter main loop. The proposed 14-inch diameter PVC main will begin at the intersection of North Umpqua Street and East 4th Avenue, where it will connect to the existing 14-inch reinforced concrete pipe. The main will continue east on East 4th Avenue and turn south on Mardonna Street. The main will be connected to the existing 14-inch diameter reinforced concrete watermain at the intersection of Mardonna Street and East Central Avenue. The total length of the improvement is approximately 3,900 feet.

11. Reservoir Piping – Plat M Road Reservoir (Total Cost: $781,900)

This improvement connects the proposed new 2.0 MG reservoir planned in Item No. 3 in Phase I of this CIP to the new West Side Water Main as described in Item No. 10 in Phase I of this CIP. This project involves the installation of approximately 4,500 feet of 18-inch diameter PVC pipe from the new West Side main along Plat M Road south to the new reservoir location.

12. Central Avenue Water Main Upsizing Improvements (Total Cost: $913,600)

The existing main extending along West Central Avenue is undersized and must be upsized if fire flow and future demand requirements are to be met along this well traveled road. An 18-inch diameter PVC pipe will be installed beginning at the intersection of North Umpqua Street and East Central Avenue, where it will connect with the existing 14-inch diameter reinforced concrete water main. The new main will continue south to the alleyway between East Central Avenue and East Everett Avenue, and thence continue west to Front Street. The main continues north on Front Street and then west on West Central Avenue where it will terminate at the intersection with Sherman Street. The total length of the improvement is approximately 3,800 feet.

13. Nonpareil Individual Booster Pump Stations (Total Cost: $135,000)

As discussed in Section 5.5, observations made by City staff of various locations along the Nonpareil water main demonstrate that the pressure at most of these services drop below 20 psi when the WTP treated water pumps are off. To avoid a potential backflow condition and insure a minimum of 20 psi at these connections, installation of individual pump stations is recommended. These pump stations would consist of a single pump system with a small hydropneumatic tank housed in a fiberglass or plastic enclosure. The proposed booster pump facilities would be similar to that used for well pump system with the exception that the water pumped originates from a water main. The estimated cost for these improvements is based on a total of 17 connections. Total cost may be less if it is found that not all of these connections are observed with pressures below 20 psi.

A summary of the Phase I improvements is presented in Table 12.2.1.

TABLE 12.2.1
SUMMARY OF PHASE I WATER SYSTEM PROJECTS

No.	Project Description	Project Cost, $	Est. % SDC	SDC Eligible, $
1	Cooper Creek WTP Improvements	3,800,000	37.5	1,425,000
2	Umpqua Basin WTP Intake Improvements	595,000	100	595,000
3	New 2.3 MG Reservoir (Plat M Road Reservoir)	2,101,400	45	945,630
4	Cathodic Protection for Reservoirs	107,000	0	0
5	Tank Reconditioning	127,000	0	0
6	SCADA Improvements	206,800	0	0
7	Miscellaneous Reservoir Improvements	24,000	0	0
8	Orenco Water Main Upsizing Improvements	214,300	0	0
9	West Side Water Main Upsizing Improvements	2,285,200	25	571,300
10	High School / Middle School Water Main Upsizing Improvements	742,700	0	0
11	Reservoir Piping - Plat M Road Reservoir	781,900	25	195,475
12	Central Avenue Water Main Upsizing Improvements	913,600	25	228,400
13	Nonpareil Individual Booster Pump Stations	135,000	0	0
-	Environmental Report	40,000	0	0
	Total	12,073,900	32.8	3,960,805

Phase II Improvements

Phase II improvements of this CIP represent important projects that require addressing once Phase I Improvements have been addressed and financing is available. These projects include additional SCADA system improvements, a new 1.0 MG reservoir for the Oak Hills area, upgrade of the Nonpareil WTP, and installation of a multi-level intake at the Cooper Creek Reservoir. These improvements are discussed in detail below.

Project Descriptions

1. SCADA Improvements (Total Cost: $164,400)

The Phase II SCADA improvements are intended to install SCADA system components on those City water facilities that were addressed in Phase I. SCADA equipment will be installed at the following City facilities with this improvement: Tanglewood Reservoir and Pump Station, Upper Umpqua Reservoir & Pump Station, Ridgewater Reservoirs and Schoon Mountain Reservoirs and Pump Station.

2. New 1.0 MG Reservoir – Oak Hills (Total Cost: $942,300)

A new 1.0 MG glass-fused-to-steel tank is proposed for the Oak Hills site next to the existing 1.0 MG tank. The additional capacity from this tank with the sum of the capacity of the existing tanks and proposed 2.0 MG tank (Phase I) should provide sufficient water storage until approximately the Year 2025. Estimated project cost includes anticipated contingency, engineering, legal and administration, and geotechnical investigation expenses.

3. Reservoir Piping – Duke Road Water Main Improvements (Total Cost: $695,300)

This improvement provides a new 18-inch diameter PVC water main from the proposed Plat M Reservoir Main (Item No. 3, Phase I) along West Duke Road east to the intersection of Duke Road and South Comstock Road. Total length of this water main is approximately 3,400 lineal feet. This main is needed to provide adequate looping of the 18-inch water mains within the City's distribution system.

4. Central Avenue Hydrants (Total Cost: $64,800)

The purpose of this project is to install three new hydrants along Central Avenue where no hydrants currently reside. The main line is currently installed parallel to Central Avenue in the alleyway directly to the south. The new hydrants will be brought to Central Avenue from the main line along Calapooya Street, State Street and Umpqua Street.

5. Foster Avenue Looping Improvements (Total Cost: $199,500)

A new 8-inch diameter water main will be installed to loop the existing water mains and increase the available fire flow on Foster Avenue. The total length of the improvement is approximately 1,600 feet.

6. Cooper Creek Multiple Level Intake Upgrade (Total Cost: $172,600)

Currently, the raw water intake from Cooper Creek Reservoir is located approximately 38 feet below the permanent pool elevation. With this fixed location, the City is only able to remove water from the reservoir at this depth. The intent of this improvement is to construct a multi-level intake structure that would allow the City to withdraw water from two other higher depths (approximately 28 and 18 feet below the permanent pool elevation) and acquire better raw water quality from the reservoir.

The main components of these intakes would be 16-inch diameter ductile iron piping and appurtenances (elbows and tees), sluice gates, stainless steel stems encased in Schedule 80 casing pipe, and concrete supports for the piping. The new intakes would be aligned in a similar manner as the existing intake with the new stems and stem guides offset approximately 10 and 15 feet from the existing stems (to the north) and along the inside face of the dam. The majority of the installation would be installed with the use of underwater divers.

7. Nonpareil Water Treatment Plant Improvements (Total Cost: $1,301,200)

Nonpareil WTP currently supplies the City with most of the water that it uses. While this WTP is in good condition, improvements are needed to improve its reliability and treatment efficiency. Proposed WTP improvements include the following.

- Construction of a new concrete backwash pond
- Onsite hypochlorite generation
- New control system
- Refurbish contact clarifier through sandblasting, repainting and pressure grouting of cracks
- New magnetic flow meter for the raw water influent line.
- Upgrade to air scour system and new filter media
- Compressor upgrade for cleaning intake screen
- Installation of filter to waste piping

This project is placed into Phase II priority since a new Cooper Creek WTP needs to be constructed and in operation prior to taking the Nonpareil WTP out of service. Phase II water system improvements, associated cost and SDC eligibility are summarized in Table 12.2.2.

TABLE 12.2.2
SUMMARY OF PHASE II WATER SYSTEM PROJECTS

No.	Project Description	Project Cost, $	Est. % SDC	SDC Eligible, $
1	SCADA Improvements	164,400	0	0
2	New 1.0 MG Reservoir (Oak Hills)	942,300	100	942,300
3	Duke Road Water Main Improvements	695,300	25	173,825
4	Central Avenue Hydrants	64,800	0	0
5	Foster Avenue Looping Improvements	199,500	0	0
6	Cooper Creek Multiple Level Intake Upgrade	172,600	0	0
7	Nonpareil WTP Improvements	1,301,200	0	0
-	Environmental Report	15,000	0	0
Total		3,555,100	31.4	1,116,125

Phase III Improvements

Phase III improvements represent the long-term projects that are needed to develop the North Umpqua River water right, to improve water quality in the Cooper Creek Reservoir, increase fire flow and storage in the distribution system, and connect to the City of Oakland's water system. The exact timing of these improvements is not known at this time and will be dependent on such factor as new industrial and commercial development, population growth and new regulatory requirements. These improvements are discussed in detail below.

Project Descriptions

1. New 0.5 MG Reservoir – Umpqua (Total Cost: $750,000)

A new 0.5 MG water reservoir is proposed next to the existing 1.25 MG Umpqua Tank. This reservoir, along with the existing reservoir capacity, Phase I/II tanks, and the 2.0 MG tank proposed for Phase III (see immediately below), will provide sufficient storage to satisfy the City's needs to approximately the Year 2046. The cost for this tank was based on a glass-fused-to-steel tank with an aluminum dome roof. Estimated project cost includes anticipated contingency, engineering, legal and administration, and geotechnical investigation expenses.

2. New 2.0 MG Reservoir – Sherwood Street (Total Cost: $1,890,000)

A new 2.0 MG reservoir is proposed north of Sherwood Street on the northeast hills surrounding the City. This tank along with the existing tanks and other proposed tanks should provide enough potable water storage to meet the City's needs until approximately Year 2046. The cost for this tank was based on a glass-fused-to-steel tank with an aluminum dome roof. Estimated project cost includes anticipated contingency, engineering, legal and administration, geotechnical investigation, and real estate/easement expenses.

3. Development of North Umpqua Water Right - Umpqua Basin Water Treatment Plant Improvements (Total Cost: $7,363,000)

This improvement is needed to fully develop and utilize the City's North Umpqua River water right. It is anticipated that this water right will be needed somewhere near the Years 2025 and 2029. The improvement consists of 1) upgrades to the Umpqua Basin Water Association's WTP, and 2) construction of a new booster pump station and approximately 3.5 miles of transmission main to convey water from the Umpqua Basin's distribution system to the City's system. The cost for the treatment plant upgrades to handle Sutherlin's 3 cfs water right is for upgrading Umpqua Basin's WTP capacity from 6 MGD to 8 MGD. These upgrades include an additional 2 MGD membrane system with chemical clean-in-place equipment, a higher capacity on-site chlorine generation system, additional site piping, new pumps for finished water pump station, larger concrete clearwell, and larger standby generator. The booster pump station would be a duplex unit housed in a CMU building along old Highway 99 somewhere between Wilbur and the South Sutherlin (Exit 135 on Interstate 5). The proposed transmission main would be 20-inch O.D. HDPE pipe (16-inch I.D.) located in the roadway with controlled density backfill.

4. Cooper Creek Hypolimnetic Aeration System (Total Cost: $572,400)

This project consists of the installation of hypolimnetic aeration system for adding oxygen to the waters of the Cooper Creek Reservoir. The purpose of hypolimnetic aeration is to introduce a sufficient amount of oxygen into the hypolimnion to avoid anoxic conditions. Successful hypolimnetic aeration will reduce taste and odor problems in the water supply associated with iron, manganese and sulfur. The advantage of the hypolimnetic aeration system would be that it would benefit not only the WTP raw water feed but also the reservoir water quality.

The proposed system is based on recommendations provided by Kennedy/Jenks Consultants (Bogus 2003) and Tetra Tech (2003). The proposed aeration system consists of micro-bubble diffusers should be designed to provide 327 kg per day of oxygen to the hypolimnion at an estimated oxygen transfer rate of 21 percent. Kennedy/Jenks provided two preliminary engineer's estimate of probable cost: 1) sole source hypolimnetic aeration system and 2) custom hypolimnetic aeration system (Bogus 2003). The cost for the custom system was updated using Engineering News Record's (ENR) Construction Cost Index (CCI) and included in this CIP. The estimated cost for these systems ranged from $376,000 to $516,000 (Ibid 2003).

5. Reservoir Piping – Sherwood Street Reservoir (Total Cost: $441,500)

This improvement provides for the installation of a new 14-inch diameter PVC pipe to connect to the proposed new 2.0 MG reservoir planned in Item No. 2, Phase III of this CIP with the existing distribution system. This project involves the installation of approximately 2,000 feet of water main beginning with a connection to the new 14-inch diameter PVC main identified as Item No. 11, Phase I of this CIP at the intersection of East 4th Avenue and Mardonna Street. From this location, the new water main will follow East 4th Avenue east and change direction north on Sherwood Street. It will follow Sherwood Street to the site of the the new 2.0 MG reservoir.

6. Oakland Tie-in (Total Cost: $443,900)

Although long-term purchase or leasing a portion of the City of Oakland's water right on the Calapooya Creek does appear to be viable for the City, a interconnection via the Union Gap Water District could be beneficial to one or both parties in the case of an emergency. An interconnection between the two Cities has been suggested by a number of parties and documented in both Cities' previous Water Master Plans. An intergovernmental agreement acceptable to and approved by all parties would have to be executed prior to construction of this project. The proposed project includes installation of approximately 3,000 lineal feet of 8-inch diameter water main for the inter-tie connection.

A summary of Phase III water system improvements, associated cost and SDC eligibility is given in Table 12.2.3.

TABLE 12.2.3
SUMMARY OF PHASE III WATER SYSTEM PROJECTS

No.	Project Description	Project Cost, $	Est. % SDC	SDC Eligible, $
1	New 0.5 MG Reservoir (Umpqua)	750,000	100	750,000
2	New 2.0 MG Reservoir (Northeast)	1,890,000	100	1,890,000
3	Umpqua Basin WTP Improvements	7,363,000	100	7,363,000
4	Cooper Crk Hypolimnetic Aeration System	572,400	0	0
6	Reservoir Piping - Sherman Road Reservoir	441,500	100	441,500
7	Oakland Tie-in	443,900	0	0
-	Environmental Report	40,000	0	0
Total		11,500,800	90.8	10,444,500

12.3 Summary of Phased Improvements

A summary of the cost and SDC eligibility of the recommended capital improvements is provided in Table 12.3.1. A map showing the distribution improvements is given in Figure 12.3.1.

TABLE 12.3.1
IMPROVEMENT PHASING & COSTS

Phase I	Project Description	Est. Cost ($)
1	Cooper Creek WTP Improvements	3,800,000
2	Umpqua Basin WTP Intake Improvements	595,000
3	New 2.3 MG Reservoir (Southeast)	2,101,400
4	Cathodic Protection	107,000
5	Tank Reconditioning	127,000
6	SCADA Improvements	206,800
7	Miscellaneous Reservoir Improvements	24,000
8	Orenco Water Main Upsizing Improvements	214,300
9	West Side Water Main Upsizing Improvements	2,285,200
10	High School / Middle School Water Main Upsizing Imp.	742,700
11	Reservoir Piping - Plat M Road Reservoir	781,900
12	Central Avenue Water Main Upsizing Improvements	913,600
13	Nonpareil Individual Booster Pump Stations	135,000
-	Environmental Report	40,000
	Total Phase I Costs	12,073,900
Phase II	**Project Description**	**Est. Cost ($)**
1	SCADA Improvements	164,400
2	New 1.0 MG Reservoir (Oak Hills)	942,300
3	Duke Road Water Main Improvements	695,300
4	Central Avenue Hydrants	64,800
5	Foster Avenue Looping Improvements	199,500
6	Cooper Creek Multiple Level Intake Upgrade	172,600
7	Nonpareil WTP Improvements	1,301,200
-	Environmental Report	15,000
	Total Phase II Costs	3,555,100
Phase III	**Project Description**	**Est. Cost ($)**
1	New 0.5 MG Reservoir (Umpqua)	750,000
2	New 2.0 MG Reservoir (Northeast)	1,890,000
3	Umpqua Basin WTP Improvements	7,363,000
4	Cooper Crk Hypolimnetic Aeration System	572,400
5	Reservoir Piping – Sherwood Street Reservoir	441,500
6	Oakland Tie-in	443,900
-	Environmental Report	40,000
	Total Phase III Costs	11,500,800

Figure 12.3.1 – Distribution System Improvements

References

AWWA (American Water Works Association), *Drought Management Planning*, Denver, CO, 1992.

AWWA, *Principles of Water Rates, Fees and Charges*, AWWA M1, 5th Edition, Denver, CO, 2000.

Bing, N, Sutherlin Water Control District, personal communication with D. Jepsen, The Dyer Partnership Engineers & Planners, Inc., March 16, 2005.

Black & Veatch, Basis of Design Report – *Addendum, Sutherlin Intertie Analysis, Draft, for the Umpqua Basin Water Association Water Treatment Plant Improvements*, Project No. 138981, Lake Oswego, May 31, 2005a

Black & Veatch, Section 13.0 – *Sutherlin Supply Option, Basis of Design Report for Umpqua Water Basin Association Water Treatment Plant Improvements*, Lake Oswego, July 11, 2005b.

Bogus, B., Kennedy/Jenks Consultants, Letter Report to Mr. David Philippi, BTS Engineering & Surveying Concerning *Cooper Creek Hypolimnetic Aeration Project*, K/J Project No. 036302.00, Kennewick, WA, August 14, 2003.

Brown & Caldwell Consulting Engineers, *City of Sutherlin Reclamation Water Use Plan*, Eugene, September 30, 2003.

Bryan, L., M., *Water Usage Report – Developing Design Indicator Numbers for Community Water System Projects*, November 2000.

Cleary, P.R, Oregon Department of Water Resources, Final Order Extension of Time for Permit Number S-44926, May 7, 2004.

Douglas County Planning Department, *Douglas County Comprehensive Plan*, Project No. 1367-01, Roseburg, November 1997.

Federal Register, Volume 68, Number 186, Pages 55410-55411, September 25, 2003.

FEMA Map Specialist, email correspondence regarding FEMA Hazard Mapping for the Sutherlin Area, FEMA's Community Status Book, http://www.fema.gov/fema/csb.shtm, Accessed: January 13, 2005.

Fenney, G., Surveys *Uncover Undetected Leaks*, Opflow (AWWA), Volume 25, Number 9, September 1999.

Groshong, N, Umpqua Water Basin Association, personal communication with D. Jepsen, The Dyer Partnership Engineers & Planners, Inc., August 12, 2005.

Harlan, Gessford & Erichsen Architects Engineers, *Douglas County Water & Sewerage Comprehensive Plan*, Coos Bay, May 1970.

HGE Engineers & Planners, Inc., *City of Sutherlin Capital Improvement Program For Water System, Storm Drainage, and Street Improvements*, Project No. 1746-E-74, Coos Bay, February 1975.

HGE Engineers & Planners, Inc., *City of Sutherlin Water, Wastewater, and Stormwater Engineering Study, Part II – Water*, Project No. 9498, Coos Bay, 1997.

International Engineering Company, Inc., *Gassy-Norris Creek Damsite Reconnaissance Report*, San Francisco, CA, August 1982.

National Resource Conservation Service, Soils Maps, Key and Soils Types Descriptions, Accessed: January, 2005, http://soils.usda.gov/.

NRWA (National Rural Water Association), *Water Rates: Information for Decision Makers, Rural and Small Systems Training Guide*, 1990.

Madin, I.P. and Z. Wang, Oregon Department of Geology and Mineral Industries (DOGAMI), *Relative Earthquake Hazard Maps of Selected Urban Areas in Western Oregon: Ashland, Cottage Grove, Grants Pass, Roseburg, Sutherlin-Oakland, Interpretative Map Series 9, IMS-09*, January 2000.

Oregon Department of Environmental Quality, Western Region Environmental Cleanup Division, Fact Sheet, *Watershed Contamination: Arsenic and Mercury Found in the Calapooya/Sutherlin Area*, Eugene, no date.

Robert E. Meyer Consultants, *Oakland-Sutherlin Water Study* for Douglas County, Beaverton, December 1979.

Robison, J.H., *Availability and Quality of Groundwater in the Sutherlin Area*, Douglas County, Oregon, Water Resources Investigations 74-32, Portland, 1975.

Tetra Tech Inc., *Cooper Creek Reservoir Hypolimnetic Aeration Considerations and Calculations*, Seattle, WA, July 30, 2003.

Wells, S.A.; R.L. Annear Jr.; C. Berger; and M. Systma; *Modeling and Analysis of Cooper Creek Reservoir Water Quality*, March 2000.

APPENDIX

A

<u>Oregon Revised Statues 223.297 TO 223.324 System Development Charges</u>

<u>72nd Oregon Legislative Assembly -- 2003 Regular Session Senate Bill 939</u>

ORS 223.297 TO 223.324

223.297 Policy. The purpose of ORS 223.297 to 223.314 is to provide a uniform framework for the imposition of system development charges by governmental units for specified purposes and to establish that the charges may be used only for capital improvements. [1989 c.449 §1; 1991 c.902 §25]

Note: 223.297 to 223.314 were added to and made a part of 223.205 to 223.295 by legislative action, but were not added to and made a part of the Bancroft Bonding Act. See section 10, chapter 449, Oregon Laws 1989.

223.299 Definitions for ORS 223.297 to 223.314. As used in ORS 223.297 to 223.314:

(1)(a) "Capital improvement" means facilities or assets used for the following:

(A) Water supply, treatment and distribution;

(B) Waste water collection, transmission, treatment and disposal;

(C) Drainage and flood control;

(D) Transportation; or

(E) Parks and recreation.

(b) "Capital improvement" does not include costs of the operation or routine maintenance of capital improvements.

(2) "Improvement fee" means a fee for costs associated with capital improvements to be constructed.

(3) "Reimbursement fee" means a fee for costs associated with capital improvements already constructed or under construction.

(4)(a) "System development charge" means a reimbursement fee, an improvement fee or a combination thereof assessed or collected at the time of increased usage of a capital improvement or issuance of a development permit, building permit or connection to the capital improvement. "System development charge" includes that portion of a sewer or water system connection charge that is greater than the amount necessary to reimburse the governmental unit for its average cost of inspecting and installing connections with water and sewer facilities.

(b) "System development charge" does not include any fees assessed or collected as part of a local improvement district or a charge in lieu of a local improvement district assessment, or the cost of complying with requirements or conditions imposed upon a land use decision, expedited land division or limited land use decision. [1989 c.449 §2; 1991 c.817 §29; 1991 c.902 §26; 1995 c.595 §28]

Note: See note under 223.297.

223.300 [Repealed by 1975 c.642 §26]

223.301 Certain system development charges and methodologies prohibited. (1) As used in this section, "employer" means any person who contracts to pay remuneration for, and secures the right to direct and control the services of, any person.

(2) A governmental unit may not establish or impose a system development charge that requires an employer to pay a reimbursement fee or an improvement fee based on:

(a) The number of individuals hired by the employer after a specified date; or

(b) A methodology that assumes that costs are necessarily incurred for capital improvements when an employer hires an additional employee.

(3) A methodology set forth in an ordinance or resolution that establishes an improvement fee or a reimbursement fee shall not include or incorporate any method or system under which the payment of the fee or the amount of the fee is determined by the number of employees of an employer without regard to new construction, new development or new use of an existing structure by the employer. [1999 c.1098 §2]

Note: See note under 223.297.

223.302 System development charges; use of revenues; review procedures. (1) Governmental units are authorized to establish system development charges, but the revenues produced therefrom shall be expended only in accordance with ORS 223.297 to 223.314. If a governmental unit expends any such revenues in violation of the limitations described in ORS 223.307, the governmental unit shall replace the misspent amount with moneys derived from other sources. Replacement moneys shall be deposited in a fund designated for the system development charge revenues not later than one year following a determination that the funds were misspent.

(2) Governmental units shall adopt administrative review procedures by which any citizen or other interested person may challenge an expenditure of system development charge revenues. Such procedures shall provide that such a challenge must be filed within two years of the expenditure of the system development charge revenues. The decision of the governmental unit shall be judicially reviewed only as provided in ORS 34.010 to 34.100.

(3)(a) A governmental unit must advise a person who makes a written objection to the calculation of a system development charge of the right to petition for review pursuant to ORS 34.010 to 34.100.

(b) If a governmental unit has adopted an administrative review procedure for objections to the calculation of a system development charge, the governmental unit must provide adequate notice regarding the procedure for review to a person who makes a written objection to the calculation of a system development charge. [1989 c.449 §3; 1991 c.902 §27; 2001 c.662 §2]

Note: See note under 223.297.

223.304 Determination of amount of system development charges; methodology; credit allowed against charge; limitation of action contesting methodology for imposing charge; notification request. (1)(a) Reimbursement fees shall be established or modified by ordinance or resolution setting forth a methodology that considers the cost of the existing facility or facilities, prior contributions by existing users, gifts or grants from federal or state government or private persons, the value of unused capacity available to future system users, rate-making principles employed to finance publicly owned capital improvements and other relevant factors identified by the local government imposing the fee.

(b) The methodology for establishing or modifying a reimbursement fee shall:

(A) Promote the objective of future system users contributing no more than an equitable share to the cost of existing facilities.

(B) Be available for public inspection.

(2)(a) Improvement fees shall:

(A) Be established or modified by ordinance or resolution setting forth a methodology that considers the cost of projected capital improvements needed to increase the capacity of the systems to which the fee is related.

(B) Be calculated to obtain the cost of capital improvements for the projected need for available system capacity for future users.

(b) The methodology for establishing or modifying improvement fees shall be available for public inspection.

(3) The ordinance or resolution that establishes or modifies an improvement fee shall also provide for a credit against such fee for the construction of a qualified public improvement. A "qualified public improvement" means a capital improvement that is required as a condition of development approval, identified in the plan adopted pursuant to ORS 223.309 and either:

(a) Not located on or contiguous to property that is the subject of development approval; or

(b) Located in whole or in part on or contiguous to property that is the subject of development approval and required to be built larger or with greater capacity than is necessary for the particular development project to which the improvement fee is related.

(4)(a) The credit provided for in subsection (3) of this section shall be only for the improvement fee charged for the type of improvement being constructed, and credit for qualified public improvements under subsection (3)(b) of this section may be granted only for the cost of that portion of such improvement that exceeds the government units minimum standard facility size or capacity needed to serve the particular development project or property. The applicant shall have the burden of demonstrating that a particular improvement qualifies for credit under subsection (3)(b) of this section.

(b) When the construction of a qualified public improvement gives rise to a credit amount greater than the improvement fee that would otherwise be levied against the project receiving development approval, the excess credit may be applied against improvement fees that accrue in subsequent phases of the original development project. This subsection shall not prohibit a unit of government from providing a greater credit, or from establishing a system providing for the transferability of credits, or from providing a credit for a capital improvement not identified in the plan adopted pursuant to ORS 223.309, or from providing a share of the cost of such improvement by other means, if a unit of government so chooses.

(c) Credits shall be used in the time specified in the ordinance but not later than 10 years from the date the credit is given.

(5) Any unit of local government that proposes to establish or modify a system development charge shall maintain a list of persons who have made a written request for notification prior to adoption or amendment of a methodology for any system development charge.

(6) Written notice shall be mailed to persons on the list at least 90 days prior to the first hearing to establish or modify a system development charge, and the methodology supporting the system development charge shall be available at least 60 days prior to the first hearing. The failure of a person on the list to receive a notice that was mailed does not invalidate the action of the local government. The unit of local government may periodically delete names from the list, but at least 30 days prior to removing a name from the list must notify the person whose name is to be deleted that a new written request for notification is required if the person wishes to remain on the notification list. Legal action intended to contest the methodology used for calculating a system development charge may not be filed after 60 days following adoption or modification of the system development charge ordinance or resolution by the local government. A person shall request judicial review of the methodology used for calculating a system development charge only as provided in ORS 34.010 to 34.100.

(7) A change in the amount of a reimbursement fee or an improvement fee is not a modification of the system development charge if the change in amount is based on the

periodic application of an adopted specific cost index or on a modification to any of the factors related to rate that are incorporated in the established methodology. [1989 c.449 §4; 1991 c.902 §28; 1993 c.804 §20; 2001 c.662 §3]

Note: See note under 223.297.

223.305 [Repealed by 1971 c.325 §1]

223.307 Authorized expenditure of system development charges. (1) Reimbursement fees shall be spent only on capital improvements associated with the systems for which the fees are assessed including expenditures relating to repayment of indebtedness.

(2) Improvement fees shall be spent only on capacity increasing capital improvements, including expenditures relating to repayment of debt for such improvements. An increase in system capacity may be established if a capital improvement increases the level of performance or service provided by existing facilities or provides new facilities. The portion of such improvements funded by improvement fees must be related to current or projected development.

(3) System development charges shall not be expended for costs associated with the construction of administrative office facilities that are more than an incidental part of other capital improvements.

(4) Any capital improvement being funded wholly or in part with system development charge revenues shall be included in the plan adopted by a governmental unit pursuant to ORS 223.309.

(5) Notwithstanding subsections (1) and (2) of this section, system development charge revenues may be expended on the direct costs of complying with the provisions of ORS 223.297 to 223.314, including the costs of developing system development charge methodologies and providing an annual accounting of system development charge expenditures. [1989 c.449 §5; 1991 c.902 §29]

Note: See note under 223.297.

223.309 Preparation of plan for capital improvements financed by system development charges; modification. (1) Prior to the establishment of a system development charge by ordinance or resolution, a governmental unit shall prepare a capital improvement plan, public facilities plan, master plan or comparable plan that includes a list of the capital improvements that may be funded with improvement fee revenues and the estimated cost and timing for each improvement.

(2) A governmental unit that has prepared a plan and the list described in subsection (1) of this section may modify such plan and list at any time. [1989 c.449 §6; 1991 c.902 §30; 2001 c.662 §4]

Note: See note under 223.297.

223.310 [Amended by 1957 c.397 §3; repealed by 1971 c.325 §1]

223.311 Deposit of system development charge revenues; annual accounting. (1) System development charge revenues shall be deposited in accounts designated for such moneys. The governmental unit shall provide an annual accounting, to be completed by January 1 of each year, for system development charges showing the total amount of system development charge revenues collected for each system and the projects that were funded in the previous fiscal year.

(2) The governmental unit shall include in the annual accounting a list of the amount spent on each project funded, in whole or in part, with system development charge revenues. [1989 c.449 §7; 1991 c.902 §31; 2001 c.662 §5]

Note: See note under 223.297.

223.312 [1957 c.95 §4; repealed by 1971 c.325 §1]

223.313 Application of ORS 223.297 to 223.314. (1) ORS 223.297 to 223.314 shall apply only to system development charges in effect on or after July 1, 1991.

(2) The provisions of ORS 223.297 to 223.314 shall not be applicable if they are construed to impair bond obligations for which system development charges have been pledged or to impair the ability of governmental units to issue new bonds or other financing as provided by law for improvements allowed under ORS 223.297 to 223.314. [1989 c.449 §8; 1991 c.902 §32]

Note: See note under 223.297.

223.314 Establishment or modification of system development charge not a land use decision. The establishment, modification or implementation of a system development charge, or a plan as provided for in ORS 223.309, or any modification of a plan, is not a land use decision pursuant to ORS chapters 195 and 197. [1989 c.449 §9; 2001 c.662 §6]

Note: See note under 223.297.

223.315 [Repealed by 1971 c.325 §1]

Appendix B – Water Right Certificates & Permits

Application No. 59416 Permit No. 44926

STATE OF OREGON WATER RESOURCES DEPARTMENT

Application for Permit to Appropriate Surface Water

I, City of Sutherlin (Name of Applicant)

of P.O. Box 459 (Mailing Address), Sutherlin (City)

State of Oregon, 97479 (Zip Code) Phone No. 459-2856 do hereby

make application for a permit to appropriate the following described waters of the State of Oregon:

1. The source of the proposed appropriation is North Umpqua River

, a tributary of Umpqua River

2. The point of diversion is to be located 1120 ft. N (N. or S.) and 2320 ft. E (E or W.)

from the SW corner of Section 11 (Public Land Survey Corner)

(If there is more than one point of diversion, each must be described)

being within the SE ¼ of the SW ¼ of

Sec. 11 Tp. 26 S (N. or S.) R. 5 W (E. or W.), W. M., in the county of Douglas

3. Location of area to be irrigated, or place of use if other than irrigation.

Township	Range	Section	List ¼ ¼ of Section	List use and/or number of acres to be irrigated
25 S	5 W	15 16	W½NW¼ All	Municipal Water
		17	S½NE¼ S½	" "
		18	SE¼NE¼ SW¼	
			NE¼SE¼ S½SE¼	
		19	E½ N½NW¼	
		20	SE¼NW¼ All	
		21 22	W½ SW¼NW¼	
		29	NW¼SW¼ N½NE¼	
			N½NW¼ SW¼NW¼	
		30	W½SW¼ NE¼	
			E½SE¼	
25 S	6 W	13	N½SE¼ SE¼SE¼	
		24	NE¼NE¼	

Form 690-1-0-1-77

4. The amount of water which the applicant intends to apply to beneficial use is Three

cubic feet per second (If water is to be used from more than one source, give quantity from each)

5. The use to which the water is to be applied is Municipal Water Supply

6. DESCRIPTION OF WORKS

Include dimensions and type of construction of diversion dam and headgate, length and dimensions of supply ditch or pipeline, size and type of pump and motor, type of irrigation system to adequately describe the proposed distribution system.

Diversion System shallbe submerged inlet with a concrete sump for pumping purposes. A diversion dam or headgate will not be necessary. Water will be stage pumped up approximately 480' through a 12" line 10500' tothe crest of the Cooper Creek Drainage, then gravity flow through a 12" pipe line an additional 5600' to discharge into the southeast end of Cooper Creek Reservoir. Water will then be taken out of the Cooper Creek Reservoir below the dam at the existing City Water Treatment facility at Cooper Creek.

If for domestic use state number of families to be supplied 3000

7. Construction work will begin on or before See Remarks

8. Construction work will be completed on or before

9. The water will be completely applied to the proposed use on or before

Application No. 59416 Permit No. 44926

Remarks: After water right is approved, the process of financing and construction will begin.

[signature]

Signature of Applicant

City Manager

This permit, when issued, is for the beneficial use of water. By law, the land use associated with this water use must be in compliance with statewide land-use goals and any local acknowledged land-use plan. It is possible that the land use you propose may not be allowed if it is not in keeping with the goals and the acknowledged plan. Your city or county planning agency can advise you about the land-use plan in your area.

This is to certify that I have examined the foregoing application, together with the accompanying maps and data, and return the same for ....

In order to retain its priority, this application must be returned to the Water Resources Director with corrections on or before ...., *19*..........

WITNESS my hand this .... *day of* ...., *19*..........

.... *Water Resources Director*

By ....

This instrument was first received in the office of the Water Resources Director at Salem, Oregon, on the 15th *day of* Oct. *19* 79, *at* 11:00 *o'clock* A *M.*

Application No. 59416

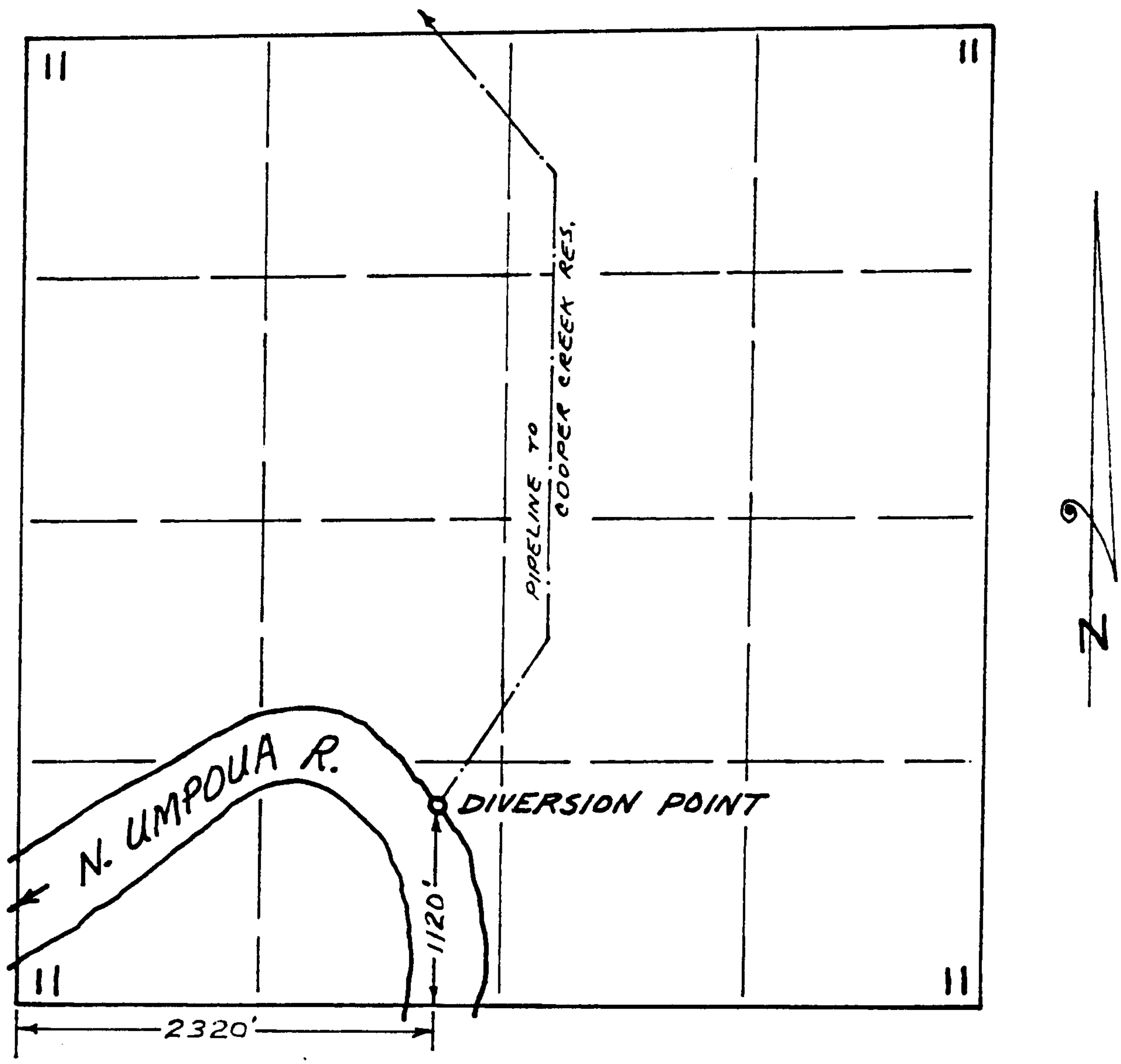
Permit No. 44926

44926

T. 26 S. R. 5 W. W.M.

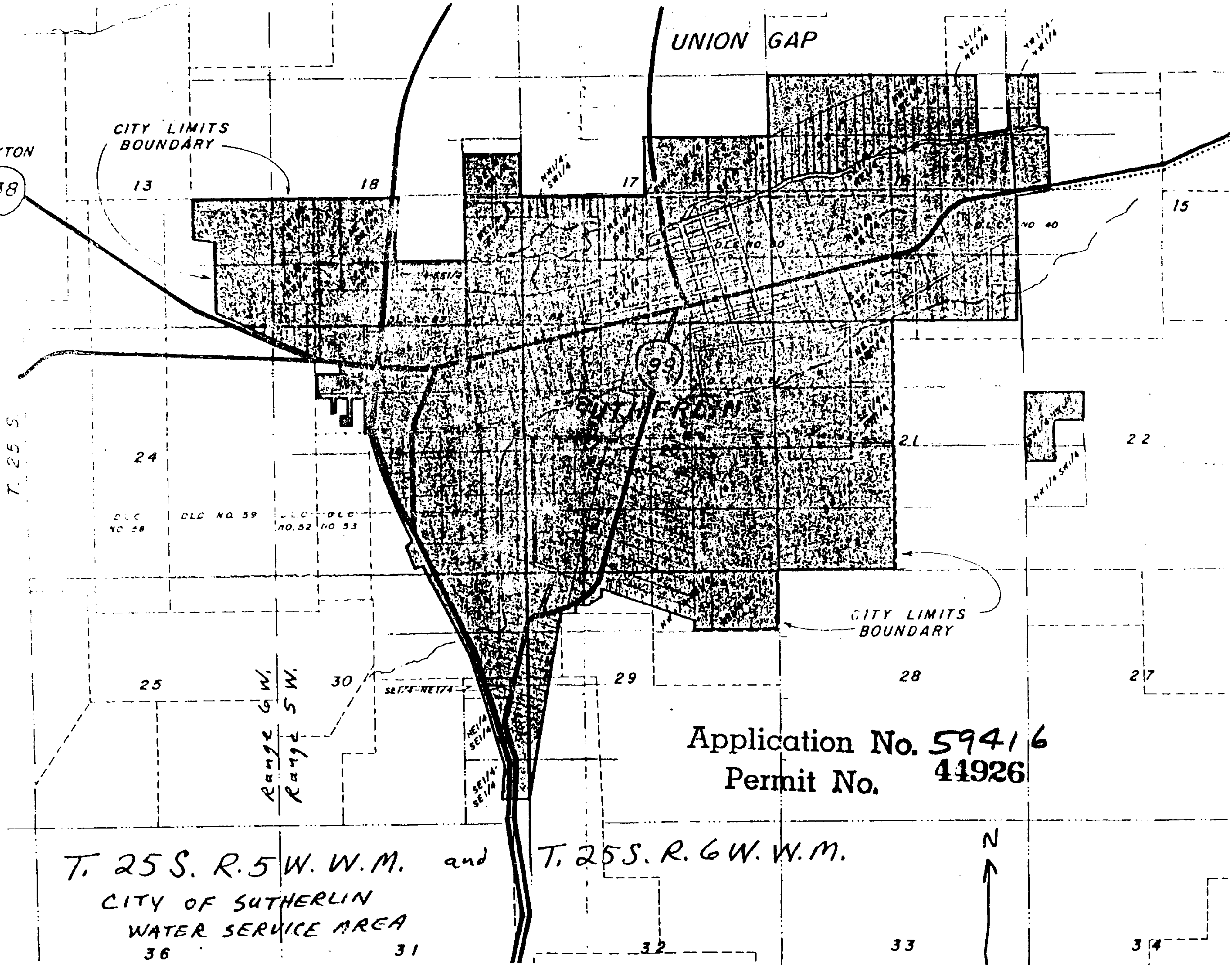
SECTION 11

1" = 1000'



CITY OF SUTHERLIN

Application No. 59416
Permit No. 44926



Application No. 59416
Permit No. 41926

T. 25 S. R. 5 W. W. M. and T. 25 S. R. 6 W. W. M.
CITY OF SUTHERLIN
WATER SERVICE AREA

Application No. 59416 Permit No. 44926

Permit to Appropriate the Public Waters of the State of Oregon

This is to certify that I have examined the foregoing application and do hereby grant the same SUBJECT TO EXISTING RIGHTS INCLUDING THE EXISTING FLOW POLICIES ESTABLISHED BY THE WATER POLICY REVIEW BOARD and the following limitations and conditions:

The right herein granted is limited to the amount of water which can be applied to beneficial use and shall not exceed 3.0 *cubic feet per second measured at the point of diversion from the stream, or its equivalent in case of rotation with other water users, from* North Umpqua River

The use to which this water is to be applied is municipal

If for irrigation, this appropriation shall be limited to .... *of one cubic foot per second or its equivalent for each acre irrigated*

and shall be subject to such reasonable rotation system as may be ordered by the proper state officer.

The priority date of this permit is October 15, 1979

Actual construction work shall begin on or before July 14, 1981 *and shall*

Extended to October 1987, 10-1-97

*thereafter be prosecuted with reasonable diligence and be completed on or before October 1, 19*82

Extended to October 1987, [illegible] 97

*Complete application of the water to the proposed use shall be made on or before October 1, 19*83

[illegible] 97

WITNESS my hand this 14th *day of* July, 1980

[signature]

WATER USES, PROJECTED NEEDS

1. POPULATION AND GROWTH:

	Current (year: 2000)	2020	2030	2040	2050	2060	2070
Population:	7020	12640	17696	24774	34684	48558	67981
Growth rate:	28% (IN PAST DECADE 1990 TO 2000)	*0.8%	*0.4%	*0.4%	*0.4%	*0.4%	*0.4%

*GROWTH RATE BASED ON 0.04% PER YEAR (0.4% PER DECADE)

2. EXISTING WATER RIGHTS AND PERMITS:

Groundwater:

Permit/Application number	Description	Amount	Priority Date
	N/A		

Surface Water:

POD ID	Permit/Application number		Description	Amount	Priority Date
12234	S15016	S19502	NON PARIEL	2.25 c	9-5-1941
12232	S.6610	S9945	NON PARIEL	0.75 c	12-3-1924
12233	S.44066	S50288	NON PARIEL	1.0 c	1-29-1979
12235	S.32426	S44016	COOPER CREEK	5.0 c	8-29-1967
12236	S.44926	S59416	NORTH UMPQUA	3.0 c	10-15-1979

Pending permits:

Permit/Application number	Description	Amount	Priority Date
	N/A		

3. EXISTING AND FUTURE WATER USE:

	Current (year: 2000)
Current peak demand:	2.419 MGD
Current water use:	APPROX. 1.2 MGD (APRIL)

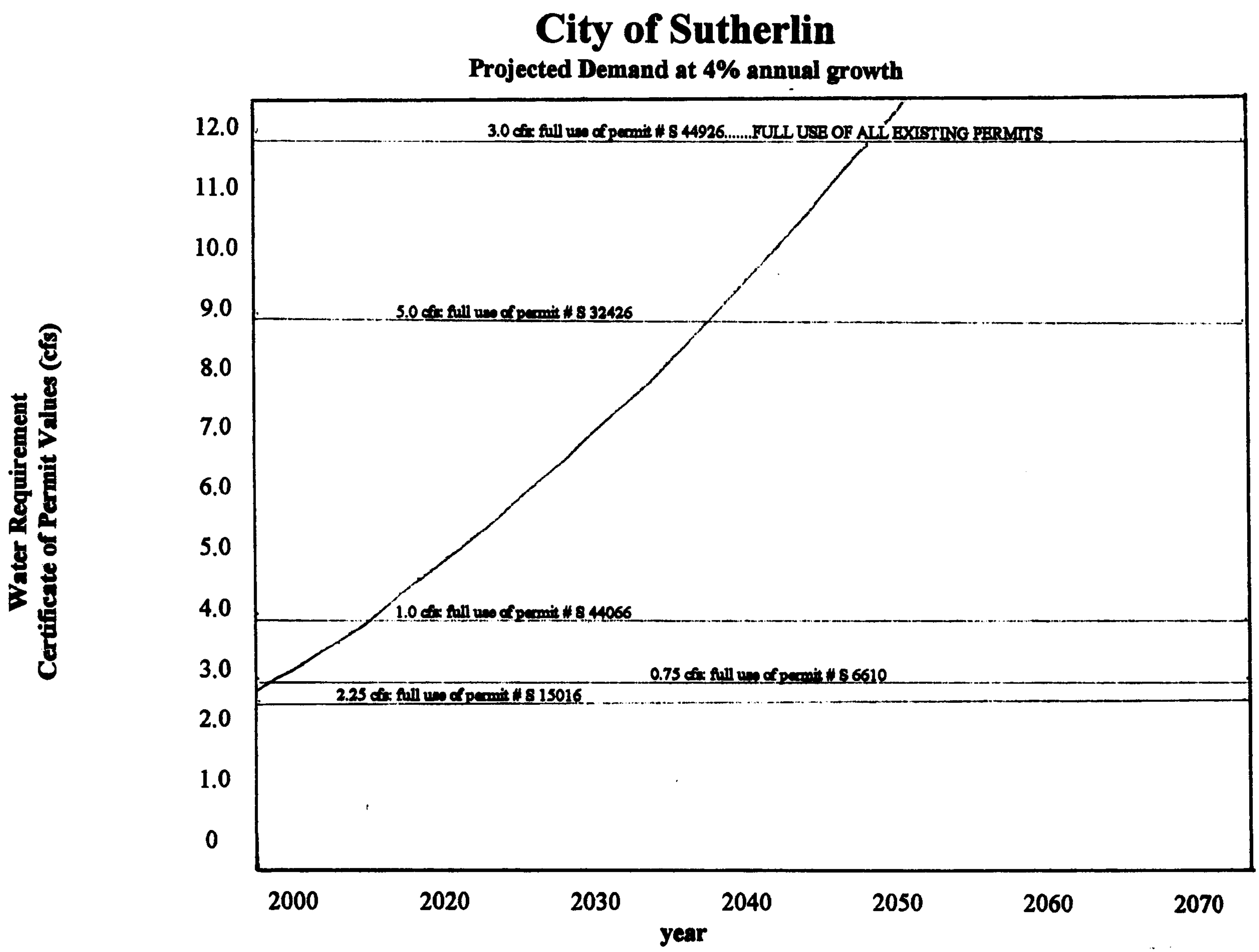
	Current (year: 2000)	2020
Peak day demand (gallons/capita/day):	APPROX. 345 GAL./CAP./DAY	↓
Peak daily demand (MGD):	2.419 MGD	4.361 MGD ESTIMATED
Average daily demand (gallons/capita/day):	APPROX 159 GAL./CAP./DAY	
Average summer demand (gallons/capita/day):	APPROX 253 GAL./CAP./DAY	

4. EXPLANATION FOR PROJECTED GROWTH RATE:

INFLUX OF OUT-OF-STATE PEOPLE RELOCATING TO THE SUTHERLIN AREA. A FAVORED VACATION AREA CONTINUES TO BE A TARGETED RELOCATION AREA FOR THOSE WHO VACATION OR PASS THROUGH SUTHERLIN AND ARE COMPELLED TO BECOME RESIDENT. BUSINESSES HAVE BEGUN TO EXPRESS INTEREST IN SUTHERLIN BECAUSE OF THE ECONOMIC ATTRACTABILITY OF THE AREA AND TO ACCESS TO I-5, HWY 138, AND RAILWAY.

5. EXPLANATION FOR EXTENSION TIME PERIOD:

RESEARCHING ALTERNATIVES & SYSTEMS TO UTILIZE THIS RIGHT TO THE BEST APPLICAT THIS RIGHT WILL ENHANCE GREATLY THE ABILITY OF SUTHERLIN'S INDUSTRIAL DEVELOPMENT CAPABILITIES, THUS CREATING FAMILY-SUPPORTIVE EMPLOYMENT FOR THE SUTHERLIN AREA.


City of Sutherlin
Projected Demand at 4% annual growth
Water Requirement
Certificate of Permit Values (cfs)
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0
3.0 cfs: full use of permit # S 44926.......FULL USE OF ALL EXISTING PERMITS
5.0 cfs: full use of permit # S 32426
1.0 cfs: full use of permit # S 44066
0.75 cfs: full use of permit # S 6610
2.25 cfs: full use of permit # S 15016
2000
2020
2030
2040
2050
2060
2070
year

APPLICATION FOR EXTENSION OF TIME
TO THE WATER RESOURCES DIRECTOR OF OREGON

I, The CITY OF SUTHERLIN
NAME

P.O. BOX 459 | Sutherlin | Or. | 97479 | (541) 459-2857
ADDRESS | CITY | STATE | ZIP | PHONE

owner of record, or duly authorized agent, of Application No. 59416, Permit No. 44926, do hereby request that the time in which to:

[X] complete the construction of diversion/appropriation works and/or purchase and installation of the equipment necessary to the use of water, which time now expires on October 1, 1997, be extended to October 1, 2009,

and/or the time in which to:

[X] accomplish beneficial use of water to the full extent under the terms of the permit, which time now expires on October 1, 1997, be extended to October 1, 2009.

NOTE: The extension of time requested should be long enough to finish the project. Should this request be approved, it will be the Department's expectation that you will complete your project within the new time period allowed. Future extensions may not be granted.

Enclosed is an instruction sheet to assist you in completing the information on the permit extensions application form. Oregon Water Law and Administrative Rules requires this information to be considered by the Water Resources Department when reviewing a permit extension. All items must be completed or the application will be returned. Please feel free to provide the Department with any additional information that would aid us in making our decision. Please use additional sheets of paper as needed to fully respond to the questions.

After reviewing the application form and the instruction sheet, if you have any questions, please contact the Department at 1-800-624-3199, or locally in the Salem vicinity at (503) 378-3739, and request assistance from the Water Rights Division, permit extensions personnel.

1-Did water system construction/well drilling begin within the time specified in the permit [yes/no]?
NO This permit is slated to be utilized in conjunction with increasing demand corresponding with the City's population growth. This permit is targeted for the development of a commercial enterprize zone at the south end of Sutherlin and will be a key factor in the creation of employment.

2-Has construction of diversion/appropriation works, distribution system, and use of water, if any, been accomplished consistent with the limitations and conditions of this permit [yes/no]? NO

No water yet utilized under this water right at this point in time. Again, this right is intended to serve new businesses in the City's enterprize zone which will, in turn, contribute to the creation of substantial employment opportunities for area citizen

CALLED [illegible] ... [illegible] (8..) 6.. 3199 ... $ 1.2 million ...

4-Cost of project to date approx. $80,000.00 Estimated remaining cost to complete the project undetermined at th time

5-Please list the reasons why the project was not constructed, and/or water not beneficially used within permit time limits under the appropriate categories below. Please provide supporting information for each reason identified.

A) The project is of a size and scope that the original intent was to phase it in over a period longer than the timeframes allowed in the permit. not applicable

B) Financing and/or cash-flow needs to develop the project precluded completion of the project within authorized timeframes. not applicable

C) Good faith attempts to comply with permit conditions and/or to acquire permits from other agencies, or otherwise comply with government regulations, delayed completion of the project. not applicable

D) Acts of God or other unforeseen events delayed full development of the water system and use of water. This project not yet completed due to extended study of diversion alternatives to avoid water loss by evaporation during transfer from source to the storage reservoir. Also, as mentioned before, this water right will be devoted to serving the demand of population growth and commercial expansion.

6-Please identify the economic market or markets to which beneficial use of water under the permit is responding. Sutherlin's population growth has been rapidly increasing during the past five years. Continued growth and the demand for water which results will be covered by this water right, as well as new business locating within the enterprise zone. This will be a crucial component in the economic future of the community.

8-Will the income or use from the water development project authorized by this permit provide reasonable returns against the investment in the project? Yes.

9-If the extension request is denied, is the current level of water use economically feasible?
No.

I am the permittee, or have authorization from the permittee, to apply for an extension of time under this permit. I understand that false or misleading statements in this extension application are grounds for the Department to suspend processing of the request and/or reason to deny the extension.

Signature Don Moore
City Manager

Date July 13, 1999

MAIL COMPLETED APPLICATION AND STATUTORY FEE OF $ 100 TO:

WATER RIGHT PERMIT EXTENSIONS
WATER RESOURCES
158 12TH ST NE
SALEM, OREGON 97310

:\exchange\leep\extfrm98
vised: June 21, 1999

Oregon
John A. Kitzhaber, M.D., Governor

Water Resources Department
Commerce Building
158 12th Street NE
Salem, OR 97310-0210
(503) 378-3739
FAX (503) 378-8130

CERTIFIED MAIL
Return Receipt Requested

March 17, 2000

City of Sutherlin
Louis Douglas, Supt.
P.O. Box 459
Sutherlin, Oregon 97479-0459

RE: File # S-59416 (Permit 44926)

Dear Mr. Douglas:

The Department is currently in the process of evaluating your request for an extension on the above referenced permit. However, based upon continued review, the Department has determined that additional information is necessary in order to evaluate your extension request. The following information must be received:

- Please supply an analysis of need for this permit. Please complete the attached form and supply a graph showing water needs over time. An example of what this graph should look like is attached. This analysis should show when other existing rights will be exhausted and when this permit will become a necessary source for the City. Your Master Plan would likely be a good source of information.

- The estimated remaining cost of the project needs to be identified. If you are not sure what this cost will be, please provide your best estimate.

- The applicant has the option of delaying processing of the extension application. Under the current extension rules, the holder of a municipal permit may elect to postpone processing of their extension requests. The new rules provide an opportunity for holders of permits for municipal use to delay action on permit extensions through June 30, 2001. This temporary delay for municipal use permit holders was included in the new permit extension rules to provide time for the Department to convene a work group to review issues relating to community water supply, and recommend changes, if appropriate, to current laws and rules. If you wish to take advantage of the temporary delay for municipal use permit holders, please submit a written request to the Department to hold your extension request until June 30, 2001, by the deadline identified below. If

COPY

Oregon Water Resources Department
Water Rights Division

Water Right Permit Extension Application
for Permit Number 44926

Water Right Application Number S-59416

Proposed Final Order

Please read this Proposed Final Order in it's entirety, it contains additional conditions, not included in the original permit.

This Proposed Final Order applies only to permit number 44926.

Summary of Recommendation

The Department proposes to:
grant the extension for complete construction of the water system from October 1, 1982, to October 1, 2009, and
grant the extension for complete application of water from October 1, 1983, to October 1, 2009.

Application History

Permit no. 44926 was granted by the Water Resources Department on July 14, 1980. The permit authorizes use of 3.0 cubic feet per second of water from the North Umpqua River for Municipal Use in the Umpqua River basin. It specified that construction must be completed by October 1, 1982, and water applied to full beneficial use by October 1, 1983. A copy of permit no. 44926 is attached.

On April 1, 1998, the Department received an application from City of Sutherlin for an extension of time to complete construction and to apply water to full beneficial use. The applicant has requested until October 1, 2009, to complete construction of the water system and until October 1, 2009, to apply water to full beneficial use. This is the fourth permit extension request.

Findings of Fact

ORS 537.230(2) and 537.630 (1) allows the Department to grant an extension of time to perfect a water right for good cause. In evaluating good cause, the Department has considered the written record in the permit application file in relation to the requirements of ORS 537.230(2), ORS 537.630 (1) and ORS 539.010(5) and makes the following findings.

1. The applicant is legally entitled to apply for an extension on this permit.

PLACED IN U.S. MAIL
JUL 25 2000

Conditions

Within two years of granting this extension, the permittee shall submit a Water Management and Conservation Plan consistent with OAR Chapter 690, Division 86. The Director may approve an extension of this timeline to complete the required Water Management Conservation Plan.

The permittee shall install, maintain, and operate fish screening and by-pass devices as required by the Oregon Department of Fish and Wildlife to prevent fish from entering the proposed diversion. The required screens and by-pass devices are to be in place, functional and approved by an ODFW representative prior to diversion of any water.

The permittee must submit a written progress report to the Department by October 1, 2005. The report must be received by the Department not sooner than 90 days prior to the due date. The permittee's report must describe in detail the work done each year since the last extension was granted or the last progress report submitted. The report shall include:

a) The amount of construction completed;
b) The amount of beneficial use of water being made, including the total volume of water used, water used relative to the specific authorizations (types of use, acres irrigated, etc.) contained in the permit, and the percent of the total allowable water use that this represents;
c) A review of the permittee's compliance with terms and conditions of the permit and/or previous extension; and
d) Financial investments made toward developing the beneficial water use.

The Department will review the progress report to determine whether the permittee is exercising diligence towards completion of the project and complying with the terms and conditions of the permit and extension.

Failure to submit a progress report by the due date above will result in cancellation of the undeveloped portion of the permit **by the Department pursuant to ORS 537.260 or 537.410 to 537.450. Within one year after cancellation, the permittee must submit a final proof survey pursuant to ORS 537.230 and 537.250.**

If the Department finds that diligence is questionable, the Department may:
a) request the permittee to submit additional information with which to evaluate diligence;
b) apply additional conditions and performance criteria for perfection of the right; or
c) cancel the undeveloped portion of the permit pursuant to ORS 537.260 or 537.410 to 537.450. The Department will grant the permittee a hearing on the cancellation, if one is requested.

In determining whether the permittee has been diligent, the Department will consider information submitted to the Department by the permittee and any information submitted during the 30-day public comment period following public notice of submittal of the progress report.

your questions. You can reach me toll free within Oregon at 1-800-624-3199 extension 331. Outside of Oregon you can dial 1-503-378-8455.

If you have questions about how to file a protest or if you have previously filed a protest and want to know the status, please contact Brendalee Wilson. Her extension number is 276.

If you have other questions about the Department or any of its programs please contact our Water Rights Information Group at extension 201. Address all other correspondence to: Water Rights Section, Oregon Water Resources Department, 158 12th ST. NE Salem, OR 97310, Fax: (503)378-2496

Before the

Oregon Water Resources Department

In the matter of the Application for an)
Extension of Permit Number 44926)
Water Right Application Number 59416)
City of Sutherlin (Applicant))

Protest of Proposed Final Order
Oregon Trout (Protestant)

Introduction

Oregon Trout (Protestant) files this protest and a check for $25 pursuant to OAR 690-320-0010(8). Protestant strongly opposes the proposed extension of this permit. Information before this agency, and argument presented in this protest show that significant questions exist relating to this proposed use of water. This proposed extension would allow the allocation of water far in excess of what is justified by Applicant. Applicant has not shown a need for water sufficient to ensure that the proposed use will not result in waste. Applicant has indicated that their other sources of water will be able to meet demand until the year 3039, even if the recent high (but over-stated) growth trends continue. The need for water beyond that is speculative at best and does not satisfy the required showing that the water will be put to beneficial use. In addition, Applicant's permitted rights are so far in excess of demonstrated needs that Applicant appears to have no plan to fully develop their water right. They rely only on possible future use by possible future commercial and residential users. With no plan for future application to beneficial use, and with no efforts to develop the water to date, the Department cannot make a finding of diligence

Applicant has not shown demand for water, the ability to beneficially use the permitted amount, or diligence in development and use of the permitted amount. The Department must deny the application for extension on the grounds that the

Department has insufficient information to justify a finding of good cause under ORS 537.230(2).

Statement of Protestant's Interest

Oregon Trout is a non-profit organization whose mission is to protect and restore native fish and their habitat. Many of Oregon's native fish species are in decline due to degradation of their habitat. While the factors that contribute to habitat degradation are numerous, primary among them is the reduction of instream flows due to the appropriation of water for out-of-stream uses. Where the Department's permitting practices promote an inefficient use of water for out-of-stream values, Oregon Trout's interest in preserving fish habitat is undermined. Granting of rights far in excess of envisioned beneficial use discourages conservation and so encourages this sort of inefficient use of water.

Extending permits for which there is no need within the next forty years, and for which the need—even then—is based on speculative population and commercial forecasts, is contrary to the state's duty to hold the public resource in trust and allocate it in a way that considers a broad array of public interests, including the survival of fish. When the department approves an extension for developing a use that will not exist for many decades, it does so without any knowledge of the future condition of fish (and other aspects of the public interest) at the time of the actual use, and is therefore unable to judge the impact. Organizations such as Oregon Trout and their members are also unable to judge the impact or to provide comments based on the state of the public interest at stake at the time of the actual proposed use. In short, granting extensions of long duration when development will not commence within four decades undermines Oregon Trout's ability to monitor and safeguard fish populations that may be threatened at present or in the future.

The Department is aware that the Umpqua River is home to a number of state sensitive and federally listed fish species. Oregon Coastal Native (OCN) Coho salmon are listed as a threatened species under the federal ESA, and Cutthroat Trout are on the state sensitive species list as well as a candidate species under the ESA. The Umpqua also sustains populations of Spring and Fall Chinook, Summer and Winter Steelhead, and Pacific Lamprey, which are designated as a state sensitive species. Oregon Trout's membership has an interest in protecting these species and their habitat. Maintaining adequate instream flows through appropriate permitting practices is an important strategy for halting the downward trend in the water quality and water quantity which are necessary for fish health.

In addition, Oregon Trout is a member of the Water Resources Department's work group formed to address Community Water Supply issues, including extensions of time for municipal permits. Oregon Trout has invested staff resources and money in working on issues raised by this extension request.

Oregon Trout is representing its organizational interests, the interests of its members and the public interest in the water resources at stake in the extension request.

Statement of Public Interest

Oregon Trout's interest in instream flows and fish habitat is directly related to the public's interest in prudent management of the state's water resources. Water is a publicly owned resource, ORS 537.110, and the Department is charged with ensuring that extensions are granted for permits only when the applicant shows the ability to apply water to a beneficial use. ORS 539.010(5), OAR 690-320-0010(7). Where an appropriation of water is not for a beneficial use, the water is wasted. OAR 690-400-010(16). In addition, the public has entrusted the Department with the responsibility of "diligently enforc[ing] laws concerning cancellation, release and discharge of excessive unused claims to waters of this state to the end that such excessive and unused amounts may be made available for appropriation and beneficial use by the public." ORS 536.340(1)(b). The public interest is impaired when permits are extended without a proper showing that the permitted water right will be put to beneficial use within a reasonable time period.

The public also shares Oregon Trout's interest in protecting fish species. The Oregon Legislature has endorsed and funded the Oregon Plan for Salmon and Watersheds, which aims to restore Oregon's wild salmon and trout populations. Under that plan, the Department is charged with protecting the public's interest in salmon and trout by conducting their permitting actions in a manner that will "minimize and mitigate adverse effects of the actions on salmonids or the habitat they depend on." Executive Order No. EO 99-01, paragraph 1(d)(a). The Oregon Plan forces the question of "whether it is good public policy to continue to issue water rights in those cases where there is little or no chance that the permittee will ever be able to use water." Letter from Governor John Kitzhaber to Martha Pagel, April 26, 2000. The issuance of extensions raises the same question.

Proposed Approval of Extension will Impair Protestant's and Public' Interests

The facts available to the Department do not show that water will be put to use under this permit within the reasonably foreseeable future. By the Applicant's own estimate, Applicant could not begin to make use of the water under this permit until 2039. Applicant does not expect to complete application of water under the permit until the year 2050.

Even these estimates, though, are inaccurate. Applicant's forecast assumes a rate of growth of four percent, which appears to be based on an erroneous calculation of the rate of growth over the past ten years. In fact, Sutherlin's annualized rate of growth over the past 10 years has been 2.5 percent. The Department, though, has accepted Applicant's estimates, with the result that the projected need for water under this permit has been exaggerated. Even the very long period proposed for this extension would not allow Applicant to develop the full amount of the water, assuming a continuation of past rates of consumption.

Approving the extension under these circumstances discourages the use of conservation as a source of water supply. It also encourages the wasteful use of water in quantities large enough to perfect unneeded water rights. By over-allocating water to out-of-stream uses, the Department ensures that those uses will take precedence over competing demands for water for instream use. This practice, especially when considered in the aggregate with other permitting decisions, contributes to the waste of water allocated for out-of-stream uses. This impairs Protestant's interest in instream uses. The loss of this water for fish habitat will have a long-term effect on the ability of Oregon Trout, the Public, and the State to protect sensitive fish species.

Extension Law

Oregon law provides that "the department, for good cause shown, shall order and allow an extension of time, . . . within which irrigation or other works shall be completed or the right perfected." ORS 537.230(2). The applicant bears the burden of showing that good cause exists for the extension. In determining good cause, the Department must give due weight to:

"the cost of the appropriation and application of the water to a beneficial purpose, the good faith of the appropriator, the market for water or power to be supplied, the present demands therefor (sic), and the income or use that may be required to provide fair and reasonable returns upon the investment." ORS 539.010(5).

Under the current circumstances, Applicant has not shown that good cause exists for granting this extension.

1. The Applicant Must Show the Extent of the Proposed Beneficial Use and that this Use Will Occur within a Reasonable Time

In determining whether to grant an extension, the Department is to consider the merits of the applied-for extension as they relate to "the appropriation and application of the water to a beneficial purpose." See ORS 539.010(5).

a. Need Must be Justified Based Upon Projected Demands within Applicant's Service Area

In forecasting the need for future water supply, it is typical for municipalities to prepare water demand forecasts that are based on "reasonable service area delineations, growth patterns, land use . . . and shifts in per capita water demand brought about by conservation." ("Long-Term Water Supply Planning", League of Oregon Cities, February 2000.) In this case, Applicant has projected demand based only on past population growth in Sutherlin. Applicant does not address the issue of the geographic reach of the water supply district and does not indicate whether all of future growth in the community is expected to be served by the municipal water provider. Based on the lack of evidence in the record, it appears to be only an unstated assumption that past growth has occurred within the district boundary and that future growth will also occur within the boundary. Without a map of the district boundaries showing adjacent water utility districts, and illustrating the correlation between past growth and the water provider in question, it is impossible to judge Applicant's forecast of future need. Under these circumstances, the Department is without knowledge as to the accuracy of Applicant's projected needs and is unable to make a finding of good cause.

b. Demand Projections must Reflect Limitations to Growth Imposed by State and Local Land Use Laws

The record is also devoid of any description of the way that land use may affect forecasting of future water use within Applicant's service area. Again, the Department's decision appears to have been based upon the assumption—rather than any assurance--that Applicant's purported water needs are consistent with its demonstrated commitment to a local zoning scheme. Neither is there any consideration of the county's role in allocating growth throughout the region. While zoning may change to accommodate growth at the instigation of the city and upon the approval of its citizens, it is not the foregone conclusion that it appears to be in the Department's record. Nor is it clear from the department's record what the present zoning may provide for. Many municipal water providers in Oregon serve "exception areas"(communities that are neither incorporated nor unincorporated) where exclusive farm use (or other) zoning has permitted rural residential growth in the past, but now preserves the rural character of those communities. In such situations, where zoning changes are exceptionally difficult to bring about, it is not valid to assume continuing exponential growth in population with a corresponding increase in water demand. In short, without information regarding the constraints on growth imposed by land use planning, the Department is unable to judge Applicant's demand forecasting, and therefore may not make the finding of need necessary to show good cause for granting the requested extension.

c. Demand Projections Must be Based on Minimum Levels of Efficiency and Conservation.

Applicant's method of projecting future demand also fails to take into account the existence of water use efficiency, and of conservation. Failure to consider the potential of conservation as a source of future water supply prevents the Department from weighing the projected need against available sources, and so prevents a finding that the water under this permit will be put to beneficial use.

Beneficial use is the basis, measure and limit of all rights to the use of water in Oregon. ORS 537.525(3), 540.610(1). "Beneficial use" in Oregon is essentially the efficient use of water for a purpose consistent with the laws and best interests of the people of this state. OAR 690-300-010(5). Oregon law calls for the state to "aggressively promote" water conservation and places a "high priority" on eliminating waste and improving the efficiency of water use. ORS 537.460(2)(a), OAR 690-410-060(1).

Thus, under this statutory structure, the "good cause" determination necessarily includes consideration of whether the water will be put to a beneficial use without waste. There is nothing in the file that indicates that Applicant's demand projections were evaluated in the context of water use efficiency. In fact, there is nothing in the file to show whether Applicant's present use of water is subject to any efficiency or conservation measures. There is no information regarding how the use of storage, if any exists, contributes to the meeting of peak need. There is no information regarding efficiency of Applicant's treatment plant; losses of water due to leakage; prevention of leakage through leak detection programs; use of variable rate structures; consumer conservation measures; or curtailment plans. Without this information, it is impossible for the Department to determine the actual present need for an additional diversion of water from the North Umpqua. The Department can judge the potential for future conservation as a source of water only if it has information regarding present conservation and efficiency. Since the record contains no information on present efficiency and conservation measures, the Department cannot make an accurate assessment of Applicant's likelihood of putting additional water to beneficial use. The Department therefore cannot make a finding of good cause to grant the requested extension.

d. <u>The Proposed Beneficial Use must not be Forecasted Using Arbitrary and Unscientific Methods</u>

The Department may grant extensions of time for the purpose of developing permitted water rights only if the applicant has satisfied the burden of showing good cause for granting the extension. ORS 537.230(2). Good cause may be shown only upon demonstration that there is a market for the water to be supplied. ORS 539.010(5). In other words, extensions can be granted only in order to allow the applicant to "complete construction or to apply the water to a beneficial use." OAR 690-320-0010(6). Beneficial use is the basis, measure and limit of all rights to the use of water in Oregon. ORS 537.525(3), 540.610(1).

In the present case, Applicant projects an increase in beneficial use in accordance with past population growth within Sutherlin. Applicant, however, assumes a future annual rate of growth of four percent. There is nothing in the record to support this high rate of growth. The rate is far above the annual rate of growth for Oregon as a whole, forecasted by the Oregon Office of Economic Analysis to not exceed 1.69%, and even far above the annual rate of growth experienced by Sutherlin within the past ten years of 2.5%[1]. As it turns out, however, Applicant's actual calculations do not even reflect a four percent growth rate, but instead appear to be of an unknown mathematical origin. Given the arbitrary assumption of future growth rate and the uncertain mathematics underlying the calculations, the Department is unable to adequately judge Applicant's need for water under this permit and cannot make a finding of good cause necessary to grant an extension.

---

[1] **Applicant indicates in their application that they have grown by 28% over the past 10 years. This translates to an annualized rate of growth of 2.5%.**

In addition to the questionable assumptions and the mysterious math underlying Applicant's forecast, there is also the more fundamental question of the reliability of long-term projections. Applicant identifies a number of assumptions suggesting that structural change to Sutherlin's growth rate can be expected to result from expanded commercial activity, high rates of immigration, and increased recreational visitation. These assumptions, though, are speculative. At the very most, these assumptions may be viewed as current conditions, the current impact of which may have an effect until different or even contradictory circumstances reveal themselves. Applicant provides no explanation of the method by which they have projected long-term demographic forces. Since the Department appears also to have no reliable model for predicting commercial, recreational and immigration trends in future decades, the Department cannot make an accurate determination of Applicant's likelihood of applying water under this permit to beneficial use. The Department must therefore deny this request for an extension.

e. Need Must be Considered in Conjunction with Supply

Whether Applicant will put their permitted water right to beneficial use depends on the demand for water and alternative supplies. The Department must first consider alternative sources of water in order to ensure that the permit under consideration for extension is necessary for the proposed beneficial use and so will, in fact, be put to beneficial use. In the present case, Applicant can draw water under other certificated and permitted water rights. Applicant has the following water rights and sources:

Source	Priority Date	Quantity	Low Flow
Calapooia Creek	1924	.75 cfs	?
Calapooia Creek	1941	2.25 cfs	?
Cooper Creek	1967	5 cfs	?
Calapooia Creek	1979	1 cfs	?
North Umpqua	1979	3 cfs	3 cfs
	Total:	11 cfs	? cfs

In determining the extent of a proposed beneficial use, logic requires that the Department compare the demand for water against the existing and applied-for supply. Where the applied-for source of water far exceeds the projected demands, the Department must make a determination as to what portion of the additional water does not contemplate the application of water to a beneficial use.

In the present case, there is no clear discussion in the record regarding the reliability of existing sources of water. There is no evidence in the record to show the actual supply of water available to Applicant during periods of low flow. Without this information, it is impossible to judge existing supply and it is therefore impossible to determine the extent to which the present permit is likely to be put to beneficial use.[2]

Given the available information, the record suggests that Applicant is far from exhausting supplies available under other permits. Applicant's present peak demand is 2.419 million gallons per day (mgd), while supply available under other permits is 5.170 mgd. According even to Applicant's estimate, Applicant cannot put these existing supplies to beneficial use until the year 2039. Since the record does not provide information regarding the use of storage to meet peak demand, or of conservation to extend existing supply, it appears reasonable to assume that these methods could be used to satisfy projected demand out of existing sources until a date even later than 2039. Complete application of the permitted 3 cfs cannot be forecasted to occur at all, other than according to the most speculative model. Since the Department has no reliable information regarding the likelihood that Applicant will apply all of the permitted water to beneficial use, the Department cannot grant the requested extension. The Department's proposed final order approving an extension for a period of nine years must be withdrawn and the extension request denied.

2. <u>The Department Failed to Consider the Competing Demands for Water as Fish Habitat and so Cannot Find Good Cause to Grant an Extension</u>.

The Department has limited its analysis of market value of water to the value of water for municipal use only, and so has failed to conduct an adequate analysis of demands for water. The good cause standard requires analysis of demand, and is not limited to consideration of out-of-stream uses. ORS 537.230 and 539.010. The good cause analysis can include whether the water would be of greater value for instream uses, such as fish habitat. Id. and Letter to Dick Bailey from Steve Sanders, pg. 8 (6/26/97).

The application that the Department uses in evaluating extension requests does not give the applicant the opportunity to explain whether there are competing demands on water for other uses, and for fish habitat in particular. The file contains no information regarding the existence of sensitive or threatened species in the Umpqua River or its tributaries, and does not contain any information relating to the potential impact of the proposed out-of-stream use on instream flows during critical, low flow times of the year.

[2] This lack of information also makes it impossible for the Department to consider the potential benefit of allowing Applicant to relinquish unreliable rights in favor of perfecting more reliable rights from sources where the impact of the diversion is less significant during low flow periods. This would serve Applicant's interest in reliability of supply while also allowing the Department to restore flows to over-appropriated streams where sensitive fish species may exist.

Since the Department has failed to consider competing demands for the water, the Department cannot find that good cause exists for granting the extension, and must deny the extension request.

3. The Department Cannot Grant the Extension as Proposed Since Applicant has not Demonstrated Diligence in Developing the Permitted Amount.

Oregon law requires that the Department, in reviewing an application for an extension, consider the good faith of the applicant in pursuing application of the water. ORS 537.230(2), ORS 539.010(5). Logically, good faith includes a consideration of the diligence that the applicant has demonstrated in pursuing application of the permitted amount. Lack of diligence argues in favor of denial of the extension request and a requirement that the applicant "prove up" on the amount that they have appropriated for beneficial use.

The Department's extensions application form asks a number of questions designed to allow the applicant to show their diligence in pursuing construction and application to beneficial use. In instructions that accompany the application form, the Department asks for information that would be "useful in evaluating the time needed to complete the project and beneficially use water," such as might be provided in a business plan or a "phasing schedule showing how the project is to be fully developed and water applied in increments." Such a plan for development of the water would permit the Department to assess Applicant's progress.

In the present case, Applicant fails to set forth a plan for appropriating the full amount of their permitted right. The assumption is that water will be applied at a rate which corresponds to future population growth in Applicant's service area. As discussed above, the application fails to put forth any specific data relating to "reasonable service area delineations, growth patterns, land use . . . and shifts in per capita water demand brought about by conservation." ("Long-Term Water Supply Planning," League of Oregon Cities, February 2000). Applicant has also failed to provide information on how they plan to use water under this permit in conjunction with water under all of its other permits. There is no information regarding Applicant's progress in applying water under its other permits[3]. As a result, Applicant is unable to demonstrate their diligence in advancing toward a defined goal. The reasons given by Applicant for delays in developing water under this permit do not relate to the slow growth in population, or to the existence of other water sources, which are the true limit on their ability to use water. Instead, Applicant indicates that the delay in applying water under the permit is due to time spent "researching alternatives and systems to utilize this right to the best application."

[3] Municipalities are required to keep records of monthly use of water from their various sources. These records are often in the file and are helpful in determining trends in water use and relative dependence on different sources.

Applicant, therefore, does not address the cause for lack of diligence, unless it is due to the scope of the proposed use. Certainly, the scope of the permit is very large: 3 cfs, when Applicant has estimated that present supplies are adequate to meet demand until 2039, without, apparently, even considering future conservation. Since Applicant has not applied any water under this permit during the twenty years of its existence, and since Applicant does not plan on commencing development within the next forty years, the Department must deny the requested extension on the grounds that Applicant has failed to use diligence in appropriating the water and applying it to beneficial use.

4. The Law Does Not Allow Extensions for Arbitrary Lengths of Time

Water allocation in Oregon is built around a concept that the water will be used beneficially within a reasonable period of time. Beneficial use is the basis, measure and limit of all rights to the use of water in Oregon. ORS 537.525(3), 540.610(1). Water use permits in the state are only granted upon a showing of the intent and ability to use water beneficially. See ORS 537.170(8), ORS 537.190(1), ORS 537.140(1) and OAR 690-310-040(1)(a)(H) and (P). While the permit system essentially creates priority dates based on when applications for permits are filed, the permit system was meant only to make a record of water rights, not to eliminate the principle that water rights can be acquired and maintained only through use. *See* Water Rights in Oregon: An Introduction to Oregon's Water Law and Water Rights System at 14 (Oregon Water Resources Department, 1997). Permits can only be extended for a "reasonable" time period necessary to make beneficial use. OAR 690-320-0010(7).

Nine years is not a reasonable time period in which to complete water use under this permit. Applicant, by their own estimate, will not begin developing water under this permit until 2039. Applicant's estimate of the time required to complete application of the water suggests that the permit cannot be perfected until nearly 2050. This estimate, though, is nothing more than speculative, and clearly under-states the actual time necessary for completion by assuming a rate of future growth far above historical trends. The actual time necessary for full application of the water under this permit to beneficial use is unknown, and the Department may not grant extensions for periods of time which are arbitrarily determined. Since the Department has no rational, non-arbitrary method of determining "the reasonable time period necessary to complete construction and application of water to beneficial use," OAR 690-320-0010(7), the Department must withdraw the PFO approving an extension and deny Applicant's request.

Granting the extension for nine years, as proposed, would inevitably lead to Applicant's inability to apply water within the extension period, and to their re-applying for additional extensions. There are good policy reasons for not perpetuating the existence of water use permits which cannot be shown to be justified by a defined benefical use within a reasonable time period. The "good cause" determination in an extension is a broad-based determination that must look at a divergent range of considerations. It is virtually impossible to predict what will be needed twenty, let alone fifty, years from now. The decision as to need should not be made fifty years in advance of the actual use. The decision should be made at the time the need is real, with knowledge and wisdom acquired in the intervening period. It should also be made with knowledge of the other factors that must be considered under the Department's good cause analysis, such as competing demands on the resource for other uses, such as fish and recreation. It is impossible at this time to make an informed judgement of the sort contemplated by the good cause determination. The Department must therefore deny Applicant's request for an extension.

Conclusion

Applicant has not shown good cause for the requested extension. The facts in the record do not permit the Department to approve the requested extension of permit number 44926. Applicant has failed to show that market conditions for water within their water supply district are such that there is a need for additional municipal water sources under this permit. Applicant has also failed to demonstrate how they will put the permitted water to beneficial use, and failed to show diligence. In sum, the facts are inadequate to support a finding of "good cause" for extension.

Requested Remedy

Oregon Trout requests that the PFO approving the extension for Permit No. 44926 be withdrawn and that the extension request be denied. Failing this, Protestant requests a contested case on the proposed extension.

Submitted this _______ day of August, 2000.

Aubrey Russell
Water Policy Advocate
Oregon Trout
117 S.W. Naito Parkway
Portland, Oregon 97204
(503) 222-909

CERTIFICATE OF SERVICE

I hereby certify that on August _____, 2000 I filed this Protest of the Proposed Final Order, by delivering the original to Paul Cleary at the Water Resources Department at the address set forth below. I further certify that I served a copy of said Protest on all the entities known to us to be parties in this proceeding by mailing said copy to the address set forth below, registered mail, by placing said copy in the United States Post Office in Portland, Oregon on August ____, 2000.

Paul Cleary, Director
Water Resources Department
158 12th Street N
Salem, Oregon 97310

City of Sutherlin
P.O. Box 459
Sutherlin, Oregon 97479

Oregon Trout
117 S.W. Naito Parkway
Portland, Oregon 97204

Signed this ______ day of August, 2000

____

Aubrey Russell
Oregon Trout

City of
SUTHERLIN
Public Utilities Department

126 E. Central • Sutherlin, Oregon 97479 • Plant Office: 541.459-5768 •City Hall: 541.459.2856 • Fax: 541.459.0025

27 November 2000

FILE COPY

To: BRENDALEE S. WILSON, Special Projects Coordinator.
From: LOUIS DOUGLAS, Supt. Public Utilities.
Subj: Additional Information for Water Right Extention.

Brendalee:

Enclosed is a copy of the Water section of our Master Plan which we mentioned sending you at our recent meeting in Sutherlin. Hope this provides the remaining information you needed. After multiple sweeps through the previous "file system", I was unable to locate anything in the way of a former conservation plan other than a price proposal from an engineering company for putting one together.

Again, I want to express our gratitude for your time and efforts expended on our request for the Umpqua River Water Right extention. We really appreciate the level of attention you have put into assisting us on this important community asset.

Please let me know if I can be of further assistance.

Respectfully,

Lou Douglas
Supt.

City of
SUTHERLIN
Public Utilities Department

126 E. Central • Sutherlin, Oregon 97479 • Plant Office: 541.459-5768 • City Hall: 541.459.2856 • Fax: 541.459.0025

15 October 2002

To: Lisa Juul.
From: Louis Douglas.
Subj: Water right on Umpqua River, Permit #44926, App.#S59416.

Ms. Juul,

I just wanted to send you some information to update your agency on growth changes, etc. which have taken place since our meeting with your predecessor on Sept. 5, 2000. To refresh you on the status of this water right, the proposed final order for the extension was mailed to me on July 25, 2000. A protest was filed by Oregon Trout on August 2, 2000.

Your predecessor, Brendalee Wilson, met with myself, City Manager Don Moore, and Roseburg branch of Water Resources representative Dave Williams on September 5, 2000. At that meeting, Ms. Wilson stated that she saw no problem with the extension, given the remarkedly rapid growth rate in Sutherlin, but that the process was a long one. She told me to be extra patient and that when I reached the point that I would normally think she forgot about us, to be still more patient. She repeated that the process was a long one.

During the past five years or so, the City of Sutherlin has been referred to as "the fastest growing city in Douglas County and one of the the fastest growing cities in Oregon." Our growth rate projections were derived from current trends and by trends of the past decade. Our moderate climate and forested hills setting has drawn remarkable numbers of new residents, many of which are retirees from out-of-state. Our location on the I-5 corridor and at the intersection of Highway 138 to the coast, make Sutherlin a very attractive location for business ventures.

The City has water rights on three sources (Calapooya Creek, Cooper Creek Reservoir, and North Umpqua River) with only the Calapooya and Cooper Creek rights currently in use. All of these rights are subject to curtailment during low-flow periods each year. The right on the Umpqua River, now in process of extension, is planned to service the rapid growth of west-side residential and south-side industrial/commercial ventures. We prefer to plan our infrastructure expansion to accommodate arising growth needs as opposed to using a "knee-jerk" approach in trying to catch up with growth. Hopefully, the information in this letter will provide you with additional data to expedite the extension of this water right which is integral to the future of this city.

Since the meeting with Ms. Wilson, the following developments have taken place:

Residential

Completed:

...Mont Claire subdivision (west side) **102** homes.
...Westlake subdivision (west side) **66** homes.
...Meadows manufactured home park (south side) **194** manufactured homes.
...Silver Glen manufactured home park (east side) **54** spaces.
...Qual Run subdivision (east side) **23** homes.
...Swale Creek Apartments (east side) **33** family units.

Under Construction:

...Mont Clair subdivision (west side) **68** homes.
...Quail Run subdivision phase 2 (east side) **51** homes.
...Willow Creek Apartments (central) **20** family units.
...Calapooya Crossing (central) **16** family units.
...Taylor Street Apartments (central) **12** family units.

On Blueprints:

...Micholetti subdivision (west side) **84** apartments, **16** townhouses, **14** duplexes.
...Forest Heights subdivision (east side) **62** homes.
...Quail Run subdivision phase 3 (east side) **26** homes.
...Oak Hills Assisted Living Facility (west side) **60** units.

In Planning:

...Comstock subdivision (large subdivision on north side).
...Stearns Lane subdivision (large subdivision on west side).

Major Industrial / Commercial

...The site slated for Hyundai Disk Mfg has now been taken by ATT R&D, a Korean company which will be manufacturing electric vehicles. Upon full completion, they will provide approximately **600** jobs with an estimated average wage of $17 hr.
...Adjacent to ATT R&D, there are plans for satellite industries to support ATT R&D (ie the company making the battery packs for the vehicles, etc.).

Other Industrial / Commercial

Completed:

...Ray's Food Place (huge supermarket).
...East wing of strip mall adjacent to Ray's Food Place.
...Umpqua Office Suites.
...Double R Powder Coating (south side).
...Orenco Manufacturing has completed an additional **20,000 sq. ft.** building expansion to accommodate a 26% sales increase in their business. They have plans for an **additional 20,000 sq. ft.** building as well.
...Murphy Plywood Company has completed a **90,000 sq. ft.** building expansion

On Blueprints / In Planning:

...Dakota Pizza Parlour (west side).
...Oak Hills Plaza strip mall (west side).
...Retail Shopping Plaza (south side).
...Other various businesses as the sewer line extension is completed in the city's industrial park (south side).

As you can see, our city is still in a rapid growth phase, and there are many favorable indications that the type of growth we are experiencing, along with promising commercial enterprises in the making, will substantially improve the quality of life for not only the citizens of Sutherlin, but of Douglas County as well.

I hope this update proves to be of value to your process of extending our Umpqua River water right. As mentioned several times before, this right is a vital necessity to the welfare of the City of Sutherlin.

Thank you very much for your time and efforts in the consideration of our water right extension.

Respectfully,

Louis Douglas
Supt. Public Utilities

Oregon
Theodore R. Kulongoski, Governor

Water Resources Department
Commerce Building
158 12th Street NE
Salem, OR 97301-4172
503-378-3739
FAX 503-378-8130

received 08.29.05

August 29, 2003

City of Sutherlin
Attn: Louis Douglas
126 East Central Ave.
Sutherlin, OR 97479

REFERENCE: Application #S-59416 (Permit #S-44926)

Dear Permit Holder:

As you are aware, on July 25, 2000, the Department issued a proposed final order in accordance with Oregon Administrative Rule (OAR) Division 690, Chapter 320 to grant an extension of time in which to complete construction and accomplish full beneficial use of water under Permit #S-44926 through October 1, 2009.

The Department received a protest to the proposed final order for extension of Permit #S-44926 from Oregon Trout on August 24, 2000. I have enclosed a copy of the protest for your reference.

The Department will first try to reach an informal negotiated resolution with both parties. If this approach fails, the Department will then proceed with a formal hearing process.

If you have any questions or concerns regarding the protest, you may contact me by telephone at (503) 378-8455, extension [redacted]. 986-0824

Sincerely,

Renee Moulun

Renee Moulun
Hearings Coordinator
Water Rights and Adjudication Division

enclosure

cc: Appl #S-59416 (Permit #S-44926)

Oregon Water Resources Department
Water Rights Division

Water Rights Application
Number S-44016

Cooper Creek

Final Order
Extension of Time for Permit Number S-32426

Application History
On October 4, 2000, the City of Sutherlin submitted an application to the Department for an extension of time for permit number S-32426. The Department issued permit number S-32426 on October 19, 1967. The permit called for completion of construction of the water development project by October 1, 1969, and complete application of water to the full beneficial use by October 1, 1970. In accordance with OAR 690-320-0010(8), on March 20, 2001, the Department issued a Proposed Final Order proposing to extend the time to complete development of the water development project to October 1, 2010, and/or the time to fully apply water to beneficial use to October 1, 2010. The protest period closed May 4, 2001. No protest was filed.

On March 20, 2001, the Department issued a Proposed Final Order to approve the extension of time to complete development of the water development project to October 1, 2010 and the time to fully apply water to beneficial use to October 1, 2010. However, a condition included in the Proposed Final Order referenced the wrong year in which to submit a written progress report to the Department. Therefore, the following condition shall apply to the approval of the extension of time request for permit number S-32426:

The permittee must submit a written progress report to the Department by October 1, 2005. The report must be received by the Department not sooner than 90 days prior to the due date. The permittee's report must describe in detail the work done each year since the last extension was granted or the last progress report submitted. The report shall include:

a) The amount of construction completed;
b) The amount of beneficial use of water being made, including the total volume of water use, water used relative to the specific authorizations(types of use, acres irrigated, etc.) contained in the permit, and the percent of the total allowable water use that this represents;
c) A review of the permittee's compliance with terms and conditions of the permit and/or previous extension; and
d) Financial investments made toward developing the beneficial water use.

The Department will review the progress report to determine whether the permittee is exercising diligence towards completion of the project and complying with the terms of the permit and extension.

Failure to submit a progress report by the due date above may result in cancellation of the undeveloped portion of the permit by the Department pursuant to ORS 537.260 or 537.410 to 537.450. Within one year after cancellation, the permittee must submit a final proof survey pursuant to ORS 537.230 and 537.250.

If the Department finds that diligence is questionable, the Department may:

a) request the permittee to submit additional information with which to evaluate diligence;
b) apply additional conditions and performance criteria for perfection of the right; or
c) cancel the undeveloped portion of the permit pursuant to ORS 537.260 or 537.410 to 537.450. The Department will grant the permittee a hearing on the cancellation, if one is requested.

In determining whether the permittee has been diligent, the Department will consider information submitted to the Department by the permittee and any information submitted during the 39-day public comment period following public notice of submittal of the progress report.

If information is received through the public notice process indicating that the applicant has not been diligent towards completing the project, and if the director determines there are significant disputes related to the use of water, the Department will conduct a hearing.

The applicant has demonstrated good cause for the permit extension pursuant to ORS 537.230, 537.248, 537.630 and/or 539.010(5).

Order

The extension of time for Application Number S-44016, Permit Number S-32426, therefore, is approved. The deadline for completing construction is extended to October 1, 2010. The deadline for applying water to full beneficial use is extended to October 1, 2010.

DATED: February 26, 2002

Paul R. Cleary, Director

Appeal Rights

Under the provisions of ORS 536.075, the applicant may appeal this order by filing a petition for review in the Circuit Court for Marion County or the circuit court for the county in which the applicant resides or has a principal business office. The petition for review must be filed within 60 days after the date this order is served. ORS 183.484.

Abstract of Permit No. 32426

Application No. 44016 *Certificate No.*

Name City of Sutherlin

Address P. O. Box 459
Sutherlin, Oregon

Source of water supply Cooper Creek & from 500.0 acre feet of stored water in Coope Creek Res. to be constructed under Appl. No. R-33574, Permit

Use Municipal

Point of diversion 2097.29' N. & 4174.09' W. from SE cor. Sec. 22, being within NW¼ SW¼, Sec. 22, T. 25 S., R. 5 W., W. M., county of Dougla

Number of acres

DESCRIPTION OF LAND TO BE IRRIGATED OR PLACE OF USE

Twp.	Range	Sec	NE¼				NW¼				SW¼				SE¼			
			NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼
25S	5W	15	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		16	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		17	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		18	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		19	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		20	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		21	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		29	x	x	x	x	x	x	x	x								
		30	x	x	x	x	x	x	x	x								

Priority date August 29, 1967 ✓

Amount of water 5.0 c.f.s.

Time limit to begin construction October 19, 1968

Time limit to complete construction 10-1-69 *extended to* 10-1-80 *extended to* 10/1/95 10/1/20[illegible]

Time limit to completely apply water 10-1-70 *extended to* 10 1 80 *extended to* 10/1/95 10/1/20[illegible]

Remarks: * No. R-4965.

I map.

Reservoir- 1M--1-78

A/# R-33574

SP*32555-690

STATE OF OREGON

COUNTY OF DOUGLAS

CERTIFICATE OF WATER RIGHT

This Is to Certify, *That* SUTHERLIN WATER CONTROL DISTRICT

of P. O. Box 459, Sutherlin *, State of* Oregon, 97479 *, has made*

proof to the satisfaction of the Water Resources Director, of a right to store the waters of Cooper Creek, tributary Sutherlin Creek appropriated under Permit No. 32425 in Cooper Creek Reservoir

for the purposes of recreation and Permit 32426 for municipal

under Reservoir Permit No. R-4965 *, and that said right to store said waters has been perfected in accordance with the laws of Oregon; that the priority of the right hereby confirmed dates from* January 27, 1960 for 3440 a.f. and March 31, 1964 for 460.0 a.f.

that the amount of water entitled to be stored each year under such right, for the purposes aforesaid, shall not exceed 3900.0 acre feet, being 3400 a.f. for recreation and 500 a.f. for municipal

The reservoir is located in

S$\frac{1}{2}$ NW$\frac{1}{4}$
N$\frac{1}{2}$ SW$\frac{1}{4}$
SE$\frac{1}{4}$
Section 22
W$\frac{1}{2}$ SW$\frac{1}{4}$
SE$\frac{1}{4}$ SW$\frac{1}{4}$
Section 23
SW$\frac{1}{4}$ NE$\frac{1}{4}$
N$\frac{1}{2}$ NW$\frac{1}{4}$
SE$\frac{1}{4}$ NW$\frac{1}{4}$
Section 26
T. 25 S., R. 5 W., W. M.

Basin 16, Vol. 2 Sutherlin Cr. & Misc.

WITNESS the signature of the Water Resources Director, affixed this date. October 5, 1979

James E. Sexson
Water Resources Director

Recorded in State Record of Water Right Certificates, Volume 42 *, page* 48586

Abstract of Permit No. 32426

Application No. 44016 *Certificate No.*

Name	City of Sutherlin
	P. O. Box 459
Address	Sutherlin, Oregon
Source of water supply	Cooper Creek & from 500.0 acre feet of stored water in Coop
	Creek Res. to be constructed under Appl. No. R-33574, Permi
Use	Municipal
Point of diversion	2097.29' N. & 4174.09' W. from SE cor. Sec. 22, being withi
	NW¼ SW¼, Sec. 22, T. 25 S., R. 5 W., W. M., county of Dougl
Number of acres	

DESCRIPTION OF LAND TO BE IRRIGATED OR PLACE OF USE

Twp.	Range	Sec.	NE¼				NW¼				SW¼				SE¼			
			NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼
25S	5W	15	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		16	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		17	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		18	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		19	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		20	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		21	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		29	x	x	x	x	x	x	x	x								
		30	x	x	x	x	x	x	x	x								

Priority date	August 29, 1967 ✓				
Amount of water	5.0 c.f.s.				
Time limit to begin construction	October 19, 1968				
Time limit to complete construction	10-1-69	*extended to* 10-1-80	*extended to* 10/1/95	10/1/20	
Time limit to completely apply water	10-1-70	*extended to* 10-1-80	*extended to* 10/1/95	10/1/2	

Remarks: * No. R-4965.

PERMIT—30193—500—12-26.

STATE OF OREGON

COUNTY OF DOUGLAS

CERTIFICATE OF WATER RIGHT

This is to Certify, *That* City of Sutherlin

of Sutherlin *, State of* Oregon *, has made proof to the satisfaction of the STATE ENGINEER of Oregon, of a right to the use of the waters of* Calapooia Creek *a tributary of* Umpqua River *for the purpose of* Municipal *under Permit No.* 6610 *of the State Engineer, and that said right to the use of said waters has been perfected in accordance with the laws of Oregon; that the priority of the right hereby confirmed dates from* December 3, 1924;

that the amount of water to which such right is entitled and hereby confirmed, for the purposes aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not exceed 0.75 cubic foot per second;

The use hereunder for irrigation shall conform to such reasonable rotation system as may be ordered by the proper state officer.

The amount of water used for irrigation, together with the amount secured under any other right existing for the same lands, shall be limited to one-eightieth of one cubic foot per second per acre, or its equivalent in case of rotation.

A description of the lands irrigated under the right hereby confirmed, and to which such right is appurtenant (or, if for other purposes, the place where the water is put to beneficial use), is as follows: Northeast Quarter of the Southeast Quarter (NE¼SE¼), Northwest Quarter of the Southeast Quarter (NW¼SE¼), Southwest Quarter of the Southeast Quarter (SW¼SE¼), and Southeast Quarter of the Southeast Quarter (SE¼SE¼) of Section Seventeen (17), Township Twenty-five South, Range Five West of the Willamette Meridian, in Douglas County, Oregon.

Change in pt. of div. approved: See Sp. Or. Vol. 2, p. 275.

The right to the use of the water for irrigation purposes is restricted to the lands or place of use herein described.

Rights to the use of water for power purposes are limited to a period of forty years from the date of priority of the right, as herein set forth, subject to a preference right of renewal under the laws existing at the date of the expiration of the right for power purposes, as hereby confirmed and limited.

WITNESS the signature of the State Engineer,

affixed this 1st *day*

of July *, 192*6.

RHEA LUPER,

State Engineer.

Recorded in State Record of Water Right Certificates, Volume 6 *, page* 6344 .

BEFORE THE STATE ENGINEER OF OREGON

DOUGLAS COUNTY

IN THE MATTER OF THE APPLICATION OF THE CITY OF SUTHERLIN, OREGON, FOR APPROVAL OF A CHANGE IN POINT OF DIVERSION OF WATER FROM CALAPOOYA CREEK.	O R D E R APPROVING APPLICATION

On June 4, 1942, the City of Sutherlin, Oregon, filed an application for approval of a change in point of diversion of water from Calapooya Creek.

Certificate of Water Right recorded at page 6344, Volume 6, State Record of Water Right Certificates, was issued to the City of Sutherlin, confirming a right to the use of 0.75 cubic foot per second of water from Calapooya Creek for municipal water supply within the corporate limits of the City of Sutherlin, with a date of priority of December 3, 1924, through the city's pipe-line, the point of diversion of said pipe-line being located South 24° 02' East 1,606 feet from the Northeast corner of the Clinton Sutherlin D.L.C. #49, in Township 25 South, Range 4 West, W. M.

The applicant herein proposes to change the present point of diversion to a point to be located approximately N. 86° 24' E. 2,113.2 feet from the Northeast corner of the Clinton Sutherlin D.L.C.#49, in Township 25 South, Range 4 West, W. M.

Notice by publication was given in the Sutherlin Sun, a newspaper of general circulation in Douglas County, for a period of at least three weeks and not less than one publication each week, being the issues of June 19, 26, July 3 and 10, 1942.

No objections having been filed, it appears that the proposed change in point of diversion of water may be made without injury to existing rights and the application should be approved.

NOW, THEREFORE, it hereby is ORDERED that the present point of diversion located S. 24° 02' E. 1,606 ft. from the NE corner of the Clinton Sutherlin D.L.C. #49 in Tp. 25 S., R. 4 W., W. M., be and the same hereby is changed to a point upstream to be located N. 86° 24' E. 2,113.2 ft. from the NE corner of the Clinton Sutherlin D.L.C.#49, in T.25 S.R.4 W.W.M.

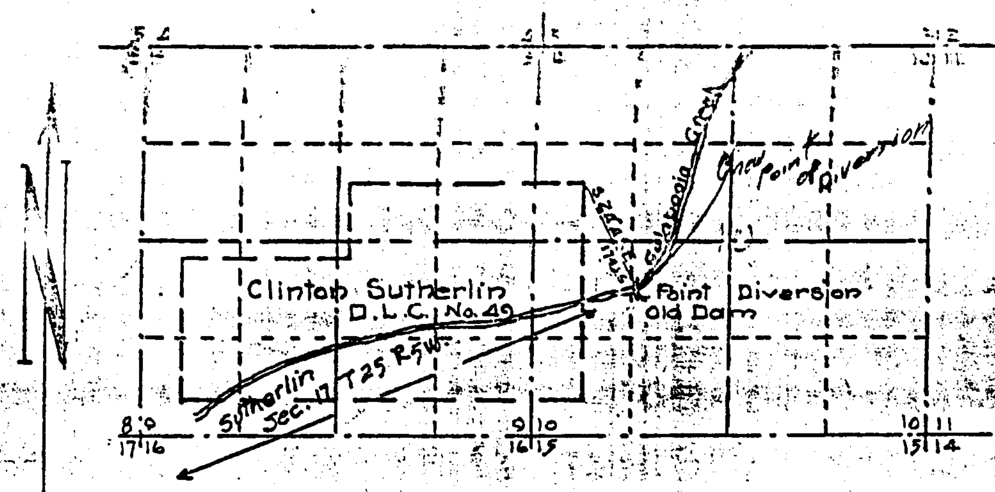
It is further ORDERED that construction work shall be completed on or before October 1, 1947, or such extension of time as may be granted by the State Engineer for good cause shown.

Dated at Salem, Oregon, this 29th day of October, 1942.

CHAS. E. STRICKLIN
State Engineer.

Spec. Order Record,
Vol. 4, page 275.

6610



CITY OF SUTHERLIN
WATER SUPPLY
Sec. 10 T. 25 S. R. 4 W.
Douglas Co. Oregon.

Scale 2 in. = 1 mile

CERTIFICATE OF SURVEYOR.

I, H. L. Eppstein, of Roseburg, Ore., do hereby certify that this map was made from notes taken during an actual survey made by me and that it correctly represents the works described in the accompanying application, together with the location of streams in the immediate vicinity.

H. L. Eppstein

Registered Professional Engineer

License No. 1011

Nov. 8. 1920

STATE ENGINEER
RECEIVED
DEC 3 1924
SALEM OREGON

Application No. 9945

Permit No. 6610

Permit A-1—1M—3-50 State Printing Dept.

STATE OF OREGON

COUNTY OF DOUGLAS

CERTIFICATE OF WATER RIGHT

This Is to Certify, *That* CITY OF SUTHERLIN

of Sutherlin *, State of* Oregon *, has made proof to the satisfaction of the STATE ENGINEER of Oregon, of a right to the use of the waters of* Calapooia River *a tributary of* Umpqua River *for the purpose of* municipal use *under Permit No.* 15016 *of the State Engineer, and that said right to the use of said waters has been perfected in accordance with the laws of Oregon; that the priority of the right hereby confirmed dates from* September 5, 1941

;

that the amount of water to which such right is entitled and hereby confirmed, for the purposes aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not exceed 2.25 cubic feet per second,

or its equivalent in case of rotation, measured at the point of diversion from the stream. The point of diversion is located in the NE¼ SW¼, Section 10, Township 25 South, Range 4 West, W. M.

The amount of water used for irrigation, together with the amount secured under any other right existing for the same lands, shall be limited to - - - - *of one cubic foot per second per acre,*

and shall conform to such reasonable rotation system as may be ordered by the proper state officer.

A description of the place of use under the right hereby confirmed, and to which such right is appurtenant, is as follows:

All of Section 16;
S½ & S½ NE¼
Section 17;
SE¼ Section 18;
E½ Section 19;
All of Section 20;
W½ Section 21;
N½ N½ Section 29;

All in Township 25 South, Range 5 West, W. M.

The right to the use of the water for the purposes aforesaid is restricted to the lands or place of use herein described.

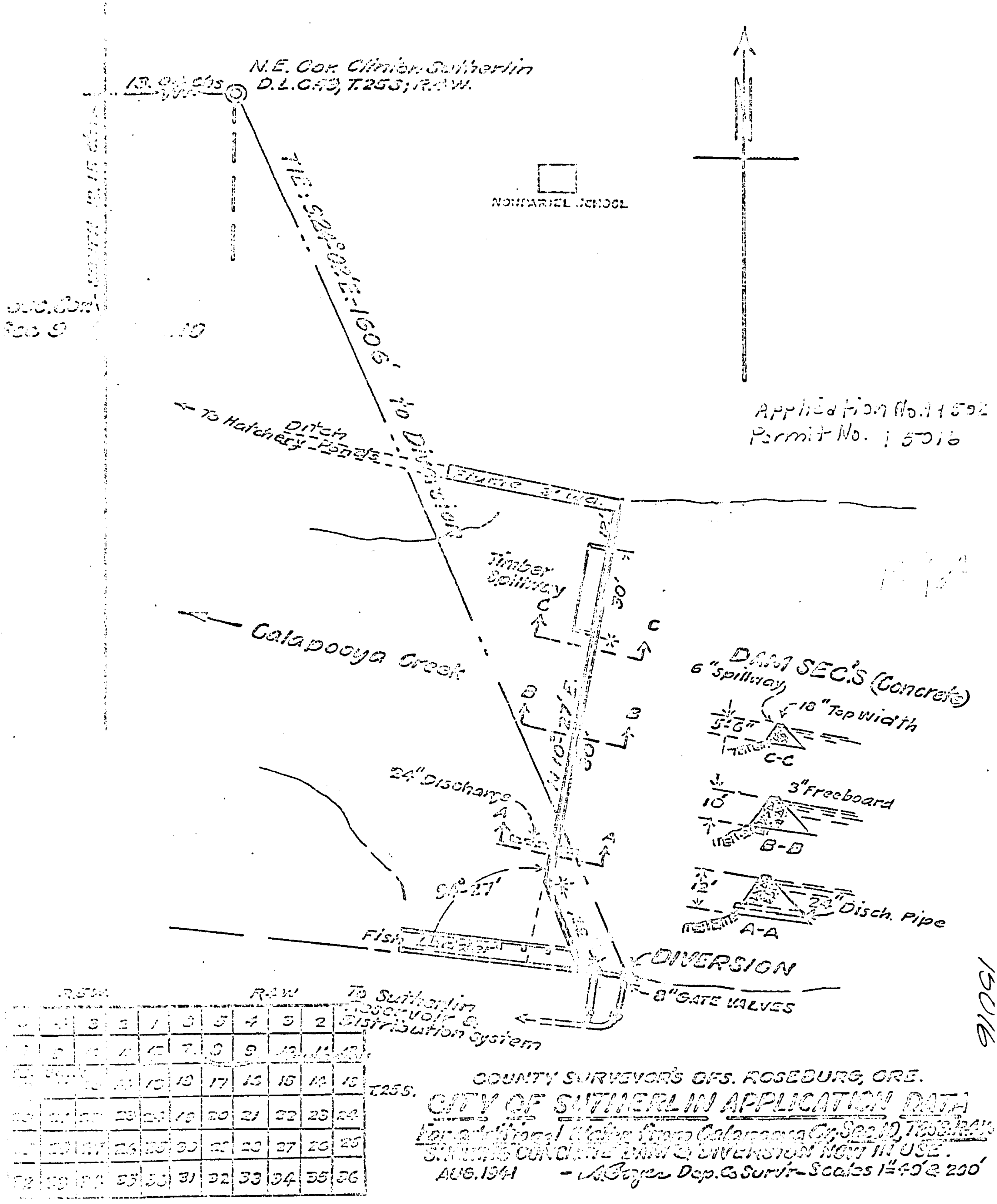
WITNESS the signature of the State Engineer, affixed

this 31st *day of* May *,* 1951 .

CHAS. E. STRICKLIN
State Engineer

Recorded in State Record of Water Right Certificates, Volume 14 *, page* 19629

15016


N.E. Cor. Clinton Sutherlin
D.L.C. 49, T.25S.; R.4W.
NONPARIEL SCHOOL
TIE: S.24°08'E.-1606' to Diversion
Application No. 11592
Permit No. 15016
To Hatchery Ponds
Ditch
Flume
Timber Spillway
30'
Calapooya Creek
C
B
A
DAM SEC'S (Concrete)
6" Spillway
18" Top Width
5'-6"
C-C
3" Freeboard
10'
B-B
12'
24" Disch. Pipe
A-A
N.10°27'E.
50'
24" Discharge
94°27'
Fish Ladder
DIVERSION
8" GATE VALVES
To Sutherlin Reservoir & Distribution System
R.5W.
R.4W.
T.25S.
COUNTY SURVEYOR'S OFS. ROSEBURG, ORE.
CITY OF SUTHERLIN APPLICATION DATA
For additional Water from Calapooya Cr. Sec. 10, T25S. R4W.
Showing Concrete Dam & Diversion Now in Use.
AUG. 1941 - A. Boyer Dep. Co. Survr. - Scales 1"=40' & 200'

15016

Application No. 58285   Permit No. 44066

RECEIVED
JAN 29 1979
WATER RESOURCES DEPT.
SALEM, OREGON

STATE OF OREGON WATER RESOURCES DEPARTMENT

Application for Permit to Appropriate Surface Water

I, CITY OF SUTHERLIN (Name of Applicant)

of P.O. Box 459 (Mailing Address), Sutherlin (City)

State of Oregon, (Zip Code) Phone No. 459-2856 do hereby make application for a permit to appropriate the following described waters of the State of Oregon:

1. The source of the proposed appropriation is Calapooia Creek, a tributary of Umpqua River

2. The point of diversion is to be located 1182 ft. South (N. or S.) and 2224 ft. East (E. or W.) from the Northwest corner of Section 10 (Public Land Survey Corner)

(If there is more than one point of diversion, each must be described)

being within the North E. ¼ of the N. West ¼ of Sec. 10 Tp. 25S (N. or S.) R. 4 W. (E. or W.), W. M., in the county of Douglas

3. Location of area to be irrigated, or place of use if other than irrigation.

Township	Range	Section	List ¼ ¼ of Section	List use and/or number of acres to be irrigated
City	of	Sutherlin		Municipal Water
25S	5W	15	D.L.C. #40 NW ¼ - NW ¼	
25S	5W	16	NW ¼ - NW ¼ SE ¼ - NW ¼	NE ¼ - NW ¼ SW ¼ - NW ¼
			SW ¼ - NE ¼ NW ¼ - SE ¼	NE ¼ - NE ¼ SW ¼ - SE ¼
25S	5W	17	D.L.C. #50 NW ¼ - SW ¼	D.L.C. #40 NE ¼ - SW ¼
			SE ¼ - SW ¼ SE ¼ - NE ¼	SW ¼ - NE ¼ D.L.C. #52
25S	5W	18	D.L.C. #50 NW ¼ - SW ¼	SW ¼ - SW ¼
25S	5W	18	NE ¼ - SW ¼ SW ¼ - SE ¼	SE ¼ - SW ¼ SE ¼ - NE ¼
			NE ¼ - SE ¼ D.L.C. #53	D.L.C. #52
25S	5W	19	D.L.C. #53 D.L.C. #37	D.L.C. #52 D.L.C. #39

Form 690-1-0-1-77

25S	5W	20	NW ¼ - SE ¼ SW ¼ - SE ¼	NE ¼ - SE ¼ D.L.C. #39	SE ¼ - SE ¼ D.L.C. #51
25S	5W	21	D.L.C. #52 NE ¼ - NE ¼ NW ¼ - SW ¼	SE ¼ - NE ¼ SW ¼ - SW ¼	NE ¼ - SW ½ SE ¼ - SW ½

Calapooya Cr

Basin 16, Vol. 1

Township	Range	Section	List ¼ - ¼ Section or D.L.C.
25S	5W	22	SW ¼ - NW ¼ NW ¼ - SW ¼
25S	5W	29	NW ¼ - NE ¼ NE ¼ - NE ¼ D.L.C. #39 D.L.C. #38
25S	5W	30	SE ¼ - NE ¼ NE ¼ - SE ¼ SE ¼ - SE ¼ D.L.C. #37 D.L.C. #39 D.L.C. #38
25S	6W	13	D.L.C. #59

Application No. 58288
Permit No. 44066

RECEIVED
APR 23 1979
WATER RESOURCES DEPT.
SALEM, OREGON

Oregon Water Resources Department
Water Rights Division

Water Rights Application
Number S-58288
1.0 cfs CA/A004A

Final Order
Extension of Time for Permit Number S-44066

Application History
On October 9, 2000, the City of Sutherlin submitted an application to the Department for an extension of time for permit number S-44066. The Department issued permit number S-44066 on May 11, 1979. The permit called for completion of construction of the water development project by October 1, 1981, and complete application of water to the full beneficial use by October 1, 1982. In accordance with OAR 690-320-0010(8), on April 24, 2001, the Department issued a Proposed Final Order proposing to extend the time to complete development of the water development project to October 1, 2010, and/or the time to fully apply water to beneficial use to October 1, 2010. The protest period closed June 8, 2001. No protest was filed.

The applicant has demonstrated good cause for the permit extension pursuant to ORS 537.230, 537.248, 537.630 and/or 539.010(5).

At time of issuance of the Proposed Final Order the Department concluded that, based on the factors demonstrated by the applicant, the permit may be extended subject to the following conditions:

The permittee must submit a written progress report to the Department by October 1, 2005. The report must be received by the Department not sooner than 90 days prior to the due date. The permittee's report must describe in detail the work done each year since the last extension was granted or the last progress report submitted. The report shall include:

a) The amount of construction completed;
b) The amount of beneficial use of water being made, including the total volume of water used, water used relative to the specific authorizations (types of use, acres irrigated, etc.) contained in the permit, and the percent of the total allowable water use that this represents;
c) A review of the permittee's compliance with terms and conditions of the permit and/or previous extension; and
d) Financial investments made toward developing the beneficial water use.

The Department will review the progress report to determine whether the permittee is exercising diligence towards completion of the project and complying with the terms and conditions of the permit and extension.

Failure to submit a progress report by the due date above may result in cancellation of the undeveloped portion of the permit by the Department pursuant to ORS 537.260 or 537.410 to 537.450. Within one year after cancellation, the permittee must submit a final proof survey pursuant to ORS 537.230 and 537.250.

If the Department finds that diligence is questionable, the Department may:

a) request the permittee to submit additional information with which to evaluate diligence;
b) apply additional conditions and performance criteria for perfection of the right; or
c) cancel the undeveloped portion of the permit pursuant to ORS 537.260 or 537.410 to 537.450. The Department will grant the permittee a hearing on the cancellation, if one is requested.

In determining whether the permittee has been diligent, the Department will consider information submitted to the Department by the permittee and any information submitted during the 30-day public comment period following public notice of submittal of the progress report.

If information is received through the public notice process indicating that the applicant has not been diligent toward completing the project, and if the director determines there are significant disputes related to the use of water, the Department will conduct a hearing.

Order

The extension of time for Application Number S-58288, Permit Number S-44066, therefore, is approved. The deadline for completing construction is extended to October 1, 2010. The deadline for applying water to full beneficial use is extended to October 1, 2010.

DATED: February 26, 2002

Paul R. Cleary, Director

Appeal Rights

Under the provisions of ORS 536.075, the applicant may appeal this order by filing a petition for review in the Circuit Court for Marion County or the circuit court for the county in which the applicant resides or has a principal business office. The petition for review must be filed within 60 days after the date this order is served. ORS 183.484.

Oregon Water Resources Department
Water Rights Division

Water Rights Application
Number S-59416

Final Order
Extension of Time for Permit Number S-44926

Appeal Rights
This is a final order other than contested case. Pursuant to ORS 536.075 and OAR 137-004-080 and OAR 690-01-005 you may either petition the Director for reconsideration of this order or petition for judicial review of this order. As provided in ORS 536.075, this order is subject to judicial review under ORS 183.484. Any petition for judicial review of the order must be filed within the 60 day time period specified by ORS 183.484(2).

Application History
On APRIL 8, 1998, the CITY OF SUTHERLIN submitted an application to the Department for an extension of time for permit number S-44926. The Department issued permit number S-44926 on JULY 14, 1980. The permit called for completion of construction of the water development project by OCTOBER 1, 1982, and complete application of water to the full beneficial use by OCTOBER 1, 1983. In accordance with OAR 690-320-0010(8), on JULY 25, 2000, the Department issued a Proposed Final Order proposing to extend the time to complete construction of the water development project and the time to fully apply water to beneficial use to OCTOBER 1, 2009. The protest period closed SEPTEMBER 8, 2000, in accordance with OAR 690-320-0010(11). One written protest from OREGON TROUT was filed with the Department on AUGUST 24, 2000.

The applicant has demonstrated good cause for the permit extension pursuant to ORS 537.230, 537.248, 537.630 and/or 539.010(5).

At time of issuance of the Proposed Final Order the Department concluded that, based on the factors demonstrated by the applicant, the permit may be extended subject to the following conditions:

Conditions

1. **Water Management and Conservation Plan**
   Within two years of granting this extension, the permittee shall submit a Water Management and Conservation Plan consistent with OAR Chapter 690, Division 86. The Director may approve an extension of this timeline to complete the required Water Management and Conservation Plan.

2. **Fish Screens**

The permittee shall install, maintain and operate fish screening and by-pass devices as required by the Oregon Department of Fish and Wildlife (ODFW) to prevent fish from entering the proposed diversion. The required screens and by-pass devices are to be in place, functional and approved by an ODFW representative prior to diversion of any water.

3. **Progress Reporting Checkpoints**

In accordance with OAR 690-320-0010(10), the permittee must submit a written progress report to the Department by October 1, 2005. The report must be received by the Department not sooner than 90 days prior to the due date. The permittee's report must describe in detail the work done each year since the last extension was granted or the last progress report submitted. The report shall include:

a) The amount of construction completed;
b) The amount of beneficial use of water being made, including the total volume of water used, water used relative to the specific authorizations (types of use, acres irrigated, etc.) contained in the permit, and the percent of the total allowable water use that this represents;
c) A review of the permittee's compliance with terms and conditions of the permit and/or previous extension; and
d) Financial investments made toward developing the beneficial water use.

The Department will review the progress report to determine whether the permittee is exercising diligence towards completion of the project and complying with the terms and conditions of the permit and extension.

Failure to submit a progress report by the due date above may jeopardize continued development under the permit.

The Department will take into consideration annual reports submitted under OAR 690, Division 86 or ORS 537. 099, and any other report that demonstrates diligence.

Other reports, however, are not a substitute for the progress reports and anything submitted must clearly show that diligence towards perfecting the water right permit is being attempted.

If the Department finds that diligence is questionable, the Department may:

a) request the permittee to submit additional information with which to evaluate diligence; or
b) apply additional conditions and performance criteria for perfection of the right; or
c) cancel the undeveloped portion of the permit pursuant to ORS 537.260 or 537.410 to 537.450. The Department will grant the permittee a hearing on the cancellation, if one is requested.

In determining whether the permittee has been diligent, the Department will consider any information submitted to the Department by the permittee and any information submitted during the 30-day public comment period following public notice of submittal of the progress report.

If information is received through the public notice process indicating that the applicant has not been diligent toward completing the project, and if the director determines there are significant disputes related to the use of water, the Department will conduct a hearing.

Oregon Trout's protest filed with the Department on August 24, 2000, raised concerns about the existence of listed sensitive fish species in the Umpqua River and how those species could be affected by the diversion of water under Permit #S-44926. On May 6, 2004, however, the protest to the Proposed Final Order for Extension of Time for Permit #S-44926 was withdrawn by Oregon Trout.

Based upon further review of the record, the Department determined that given the date of issuance of this Final Order for Extension of Time for Permit #S-44926 and given the duration of the extension of time for Permit #S-44926 (being not greater than five years), the inclusion of a condition requiring the permit holder to submit a progress report by October 1, 2005, is no longer appropriate.

The Department's continuing evaluation, therefore, reveals that the following modifications must be made to the Proposed Final Order:

The inclusion of the "Progress Reporting Checkpoints" condition in the Proposed Final Order for Extension of Time for Permit #S-44926 [pursuant to OAR 690-320-0010(10)] is no longer appropriate, and is therefore removed. Permit #S-44926 should be extended with the following conditions only:

1. **Water Management and Conservation Plan**
   Within two years of granting this extension, the permittee shall submit a Water Management and Conservation Plan consistent with OAR Chapter 690, Division 86. The Director may approve an extension of this timeline to complete the required Water Management and Conservation Plan.

2. **Fish Screens**
   The permittee shall install, maintain and operate fish screening and by-pass devices as required by the Oregon Department of Fish and Wildlife (ODFW) to prevent fish from entering the proposed diversion. The required screens and by-pass devices are to be in place, functional and approved by an ODFW representative prior to diversion of any water.

The factors shown by the applicant, together with the Department's determination referenced above and the modifications made herein, establish good cause for the permit extension.

Order

The extension of time for Application Number S-59416, Permit Number S-44926, therefore, is approved with the above modifications to the Proposed Final Order. The deadline for completing construction is extended to OCTOBER 1, 2009. The deadline for applying water to full beneficial use is extended to OCTOBER 1, 2009.

DATED: May 7, 2004

Paul R. Cleary, Director

Appendix C – Water Use and Projected Demand Documentation

Nonpariel WTP Water Pumped to the City

Month	2000	2001	2002	2003	2004	Ave
Jan	32.901	29.903	31.257	31.768	32.451	31.656
Feb	35.255	28.089	27.937	27.979	30.762	30.0044
Mar	40.753	30.569	30.67	31.213	34.564	33.5538
Apr	33.903	31.086	31.651	32.813	35.082	32.907
May	37.85	44.818	38.692	39.43	46.531	41.4642
Jun	51.891	47.694	49.427	52.093	44.851	49.1912
Jul	52.976	52.54	55.127	57.014	54.548	54.441
Aug	52.561	49.117	53.811	55.847	53.231	52.9134
Sep	47.822	42.785	48.271	50.319	45.537	46.9468
Oct	38.695	36.689	37.633	39.957	39.437	38.4822
Nov	31.954	30.757	31.426	32.552	34.617	32.2612
Dec	31.596	31.889	31.278	32.827	35.611	32.6402
Total	488.157	455.936	467.18	483.812	487.222	476.4614

Nonpariel WTP Backwash

Month	2000	2001	2002	2003	2004	Ave
Jan	2.3755	2.1168	2.6225	2.4931	1.8581	2.293
Feb	1.5288	2.3285	1.2348	1.5288	1.5406	1.632
Mar	1.5876	1.8228	1.7875	1.9522	1.7052	1.771
Apr	1.4818	1.9404	2.6813	2.5049	2.0227	2.126
May	1.6229	2.6401	2.8224	2.5284	2.3755	2.398
Jun	3.2222	2.5284	2.6107	3.0811	2.5519	2.799
Jul	2.0815	1.9286	1.3877	2.1168	1.8463	1.872
Aug	2.1168	2.8812	1.3877	1.5994	1.6346	1.924
Sep	2.058	1.2113	1.1172	1.717	1.3406	1.489
Oct	1.717	1.8346	1.2113	2.058	1.9992	1.764
Nov	2.7989	1.9051	2.1168	2.1286	2.4343	2.277
Dec	2.399	3.7162	2.4108	2.352	2.2932	2.634
Total	24.99	26.854	23.3907	26.0603	23.6022	24.97944

Nonpariel WTP Production

Month	2000	2001	2002	2003	2004	Ave
Jan	35.2765	32.0198	33.8795	34.2611	34.3091	33.9492
Feb	36.7838	30.4175	29.1718	29.5078	32.3026	31.6367
Mar	42.3406	32.3918	32.4575	33.1652	36.2692	35.32486
Apr	35.3848	33.0264	34.3323	35.3179	37.1047	35.03322
May	39.4729	47.4581	41.5144	41.9584	48.9065	43.86206
Jun	55.1132	50.2224	52.0377	55.1741	47.4029	51.99006
Jul	55.0575	54.4686	56.5147	59.1308	56.3943	56.31318
Aug	54.6778	51.9982	55.1987	57.4464	54.8656	54.83734
Sep	49.88	43.9963	49.3882	52.036	46.8776	48.43562
Oct	40.412	38.5236	38.8443	42.015	41.4362	40.24622
Nov	34.7529	32.6621	33.5428	34.6806	37.0513	34.53794
Dec	33.995	35.6052	33.6888	35.179	37.9042	35.27444
Total	513.147	482.79	490.5707	509.8723	510.8242	501.44084

Nonpariel WTP % Backwash

Month	2000	2001	2002	2003	2004	Ave
Jan	6.7%	6.6%	7.7%	7.3%	5.4%	6.8%
Feb	4.2%	7.7%	4.2%	5.2%	4.8%	5.2%
Mar	3.7%	5.6%	5.5%	5.9%	4.7%	5.0%
Apr	4.2%	5.9%	7.8%	7.1%	5.5%	6.1%
May	4.1%	5.6%	6.8%	6.0%	4.9%	5.5%
Jun	5.8%	5.0%	5.0%	5.6%	5.4%	5.4%
Jul	3.8%	3.5%	2.5%	3.6%	3.3%	3.3%
Aug	3.9%	5.5%	2.5%	2.8%	3.0%	3.5%
Sep	4.1%	2.8%	2.3%	3.3%	2.9%	3.1%
Oct	4.2%	4.8%	3.1%	4.9%	4.8%	4.4%
Nov	8.1%	5.8%	6.3%	6.1%	6.6%	6.6%
Dec	7.1%	10.4%	7.2%	6.7%	6.0%	7.5%
Average	4.9%	5.6%	4.8%	5.1%	4.6%	5.0%

Cooper Creek WTP Water Pumped to the City

Month	2000	2001	2002	2003	2004	Ave
May		0.55	0.349	2.113	2.113	1.281
Jun	5.076	0.49	3.03	9.431	5.312	4.668
Jul	13.545	8.851	13.106	19.356	17.962	14.564
Aug	12.579	10.967	14.341	15.587	14.12	13.519
Sep	0.621	5.904	4.052	3.625	0.308	2.902
Nov			0.353			0.353
Total	31.821	26.762	35.231	50.112	39.815	36.748

Cooper Creek WTP Backwash

Month	2000	2001	2002	2003	2004	Ave
Feb		0.0235				0.0235
Apr			0.0118			0.0118
May		0.2234	0.7291		0.4704	0.4743
Jun	1.4582	0.1646	0.882	1.3289	1.0231	0.9714
Jul	4.3982	3.5868	4.751	7.2089	4.5511	4.8992
Aug	5.3038	4.8804	4.9862	6.8443	3.9514	5.1932
Sep	0.4116	2.599	1.223	1.6346	0.047	1.1830
Oct			0.0941			
Nov			0.1764			0.1764
Total	11.5718	11.4777	12.8536	17.0167	10.043	12.59256

Cooper Creek WTP Production

Month	2000	2001	2002	2003	2004	Ave
Feb	0	0.0235	0	0	0	0.0047
Apr	0	0	0.0118	0	0	0.0024
May	0	0.7734	1.0781	2.113	2.5834	1.3096
Jun	6.5342	0.6546	3.912	10.7599	6.3351	5.6392
Jul	17.9432	12.4378	17.857	26.5649	22.5131	19.4632
Aug	17.8828	15.8474	19.3272	22.4313	18.0714	18.7120
Sep	1.0326	8.503	5.275	5.2596	0.355	4.0850
Oct	0	0	0.0941	0	0	0.0188
Nov	0	0	0.5294	0	0	0.1059
Dec				0.1411		
Total	43.3928	38.2162	48.0728	67.2698	49.858	49.36192

Cooper Creek WTP % Backwash

Month	2000	2001	2002	2003	2004	Ave
May		29%	68%		18%	38%
Jun	22%	25%	23%	12%	16%	17%
Jul	25%	29%	27%	27%	20%	25%
Aug	30%	31%	26%	31%	22%	28%
Sep	40%	31%	23%	31%	13%	29%
Nov			33%			33%
Average	27%	30%	27%	25%	20%	26%

% = ((Backwash, MG)/(Water Pumped, MG) + (Backwash, MG)) * 100

Total WTP Water Pumped to the City

Month	2000	2001	2002	2003	2004	Ave
Jan	32.901	29.903	31.257	31.768	32.451	31.656
Feb	35.255	28.089	27.937	27.979	30.762	30.0044
Mar	40.753	30.569	30.67	31.213	34.564	33.5538
Apr	33.903	31.086	31.651	32.813	35.082	32.907
May	37.85	45.368	39.041	41.543	48.644	42.4892
Jun	56.967	48.184	52.457	61.524	50.163	53.859
Jul	66.521	61.391	68.233	76.37	72.51	69.005
Aug	65.14	60.084	68.152	71.434	67.351	66.4322
Sep	48.443	48.689	52.323	53.944	45.845	49.8488
Oct	38.695	36.689	37.633	39.957	39.437	38.4822
Nov	31.954	30.757	31.779	32.552	34.617	32.3318
Dec	31.596	31.889	31.278	32.827	35.611	32.6402
Total	519.978	482.698	502.411	533.924	527.037	513.2096

Total WTP Backwash

Month	2000	2001	2002	2003	2004	Ave
Jan	2.3755	2.1168	2.6225	2.4931	1.8581	2.293
Feb	1.5288	2.352	1.2348	1.5288	1.5406	1.637
Mar	1.5876	1.8228	1.7875	1.9522	1.7052	1.771
Apr	1.4818	1.9404	2.6931	2.5049	2.0227	2.129
May	1.6229	2.8635	3.5515	2.5284	2.8459	2.682
Jun	4.6804	2.693	3.4927	4.41	3.575	3.770
Jul	6.4797	5.5154	6.1387	9.3257	6.3974	6.771
Aug	7.4206	7.7616	6.3739	8.4437	5.586	7.117
Sep	2.4696	3.8103	2.3402	3.3516	1.3876	2.672
Oct	1.717	1.8346	1.3054	2.058	1.9992	1.783
Nov	2.7989	1.9051	2.2932	2.1286	2.4343	2.312
Dec	2.399	3.7162	2.4108	2.4931	2.2932	2.662
Total	36.5618	38.3317	36.2443	43.2181	33.6452	37.60022

Total WTP Production

Month	2000	2001	2002	2003	2004	Ave
Jan	35.2765	32.0198	33.8795	34.2611	34.3091	33.9492
Feb	36.7838	30.441	29.1718	29.5078	32.3026	31.6414
Mar	42.3406	32.3918	32.4575	33.1652	36.2692	35.32486
Apr	35.3848	33.0264	34.3441	35.3179	37.1047	35.03558
May	39.4729	48.2315	42.5925	44.0714	51.4899	45.17164
Jun	61.6474	50.877	55.9497	65.934	53.738	57.62922
Jul	73.0007	66.9064	74.3717	85.6957	78.9074	75.77638
Aug	72.5606	67.8456	74.5259	79.8777	72.937	73.54936
Sep	50.9126	52.4993	54.6632	57.2956	47.2326	52.52066
Oct	40.412	38.5236	38.9384	42.015	41.4362	40.26504
Nov	34.7529	32.6621	34.0722	34.6806	37.0513	34.64382
Dec	33.995	35.6052	33.6888	35.3201	37.9042	35.30266
Total	556.5398	521.0297	538.6553	577.1421	560.6822	550.80982

Total WTP % Backwash

Month	2000	2001	2002	2003	2004	Ave
Jan	6.7%	6.6%	7.7%	7.3%	5.4%	6.8%
Feb	4.2%	7.7%	4.2%	5.2%	4.8%	5.2%
Mar	3.7%	5.6%	5.5%	5.9%	4.7%	5.0%
Apr	4.2%	5.9%	7.8%	7.1%	5.5%	6.1%
May	4.1%	5.9%	8.3%	5.7%	5.5%	5.9%
Jun	7.6%	5.3%	6.2%	6.7%	6.7%	6.5%
Jul	8.9%	8.2%	8.3%	10.9%	8.1%	8.9%
Aug	10.2%	11.4%	8.6%	10.6%	7.7%	9.7%
Sep	4.9%	7.3%	4.3%	5.8%	2.9%	5.1%
Oct	4.2%	4.8%	3.4%	4.9%	4.8%	4.4%
Nov	8.1%	5.8%	6.7%	6.1%	6.6%	6.7%
Dec	7.1%	10.4%	7.2%	7.1%	6.0%	7.5%
Average	6.6%	7.4%	6.7%	7.5%	6.0%	6.8%

PROJECTED WATER DEMAND CALCULATIONS														
WATER PUMPED TO CITY FOR CONSUMPTION														
Existing Water Demand - Scenario No. 1					**Projected Water Demand**									
Year	2004		2010		2015		2020		2025		2034		2046	
Population	7,360		9364		10,594		12000		13,606		16606		19606	
Unacc. Water, %	29		20		15		12		10		10		10	
Parameter	gpd	gpcd/y	gpd	gpcd/y	gpd/y	gpcd/y	gpd/y	gpcd/y	gpd/y	gpcd/y	gpd/y	gpcd/y	gpd/y	gpcd/y
AAD	533,924,000	72,544	602,880,720	64,383	641,949,730	60,596	702,358,029	58,530	778,660,124	57,229	950,347,642	57,229	1,122,035,160	57,229
ADD	1,462,800	199	1,651,722	176	1,758,760	166	1,924,261	160	2,133,307	157	2,603,682	157	3,074,057	157
DDD	1,981,890	269	2,237,853	239	2,382,874	225	2,607,106	217	2,890,334	212	3,527,627	212	4,164,919	212
MMD	2,463,500	335	2,781,663	297	2,961,926	280	3,240,647	270	3,592,701	264	4,384,859	264	5,177,017	264
PWD	2,679,100	364	3,025,108	323	3,221,147	304	3,524,261	294	3,907,126	287	4,768,612	287	5,630,098	287
MDD	2,966,000	403	3,349,061	358	3,566,093	337	3,901,667	325	4,325,533	318	5,279,274	318	6,233,015	318
PHD	4,100,000	557	4,629,518	494	4,929,529	465	5,393,404	449	5,979,328	439	7,297,715	439	8,616,103	439
Existing Water Demand - Scenario No. 2					**Projected Water Demand**									
Year	2004		2010		2015		2020		2025		2034		2046	
Population	7,360		9364		10,594		12000		13,606		16606		19606	
Unacc. Water, %	29		25		20		17		15		15		15	
Parameter	gpd	gpcd/y	gpd	gpcd/y	gpd/y	gpcd/y	gpd/y	gpcd/y	gpd/y	gpcd/y	gpd/y	gpcd/y	gpd/y	gpcd/y
AAD	533,924,000	72,544	643,072,768	68,675	682,071,588	64,383	744,668,753	62,056	824,463,661	60,596	1,006,250,444	60,596	1,188,037,228	60,596
ADD	1,462,800	199	1,761,837	188	1,868,682	176	2,040,181	170	2,258,796	166	2,756,840	166	3,254,884	166
DDD	1,981,890	269	2,387,043	255	2,531,804	239	2,764,160	230	3,060,354	225	3,735,134	225	4,409,914	225
MMD	2,463,500	335	2,967,107	317	3,147,046	297	3,435,866	286	3,804,036	280	4,642,792	280	5,481,547	280
PWD	2,679,100	364	3,226,782	345	3,422,468	323	3,736,566	311	4,136,957	304	5,049,119	304	5,961,280	304
MDD	2,966,000	403	3,572,332	381	3,788,974	358	4,136,708	345	4,579,976	337	5,589,820	337	6,599,663	337
PHD	4,100,000	557	4,938,153	527	5,237,625	494	5,718,308	477	6,331,053	465	7,726,993	465	9,122,933	465
TREATED WATER PRODUCED														
Existing Water Demand - Scenario No. 1					**Projected Water Demand**									
Year	2004		2010		2015		2020		2025		2034		2046	
Population	7,360		9364		10,594		12000		13,606		16606		19606	
Unacc. Water, %	29		20		15		12		10		10		10	
Parameter	gpd	gpcd/y	gpd	gpcd/y	gpd/y	gpcd/y	gpd/y	gpcd/y	gpd/y	gpcd/y	gpd/y	gpcd/y	gpd/y	gpcd/y
AAD	577,142,000	78,416	651,680,360	69,594	693,911,775	65,500	759,209,770	71,287	841,688,070	61,862	1,027,272,681	61,862	1,212,857,291	61,862
ADD	1,581,200	215	1,785,413	191	1,901,115	179	2,080,012	195	2,305,979	169	2,814,426	169	3,322,874	169
DDD	2,162,000	294	2,441,224	261	2,599,425	245	2,844,034	267	3,153,002	232	3,848,210	232	4,543,418	232
MMD	2,764,000	376	3,120,973	333	3,323,224	314	3,635,944	341	4,030,942	296	4,919,728	296	5,808,514	296
PWD	2,931,000	398	3,309,541	353	3,524,012	333	3,855,626	362	4,274,490	314	5,216,976	314	6,159,463	314
MDD	3,382,000	460	3,818,788	408	4,066,260	384	4,448,901	418	4,932,216	363	6,019,725	363	7,107,234	363
Existing Water Demand - Scenario No. 2					**Projected Water Demand**									
Year	2004		2010		2015		2020		2025		2034		2046	
Population	7,360		9364		10,594		12000		13,606		16606		19606	
Unacc. Water, %	29		25		20		17		15		15		15	
Parameter	gpd	gpcd/y	gpd	gpcd/y	gpd/y	gpcd/y	gpd/y	gpcd/y	gpd/y	gpcd/y	gpd/y	gpcd/y	gpd/y	gpcd/y
AAD	577,142,000	78,416	695,125,717	74,234	737,281,261	69,594	804,945,299	70,858	891,199,133	65,500	1,087,700,485	65,500	1,284,201,838	65,500
ADD	1,581,200	215	1,904,441	203	2,019,935	191	2,205,314	194	2,441,625	179	2,979,981	179	3,518,337	179
DDD	2,162,000	294	2,603,972	278	2,761,889	261	3,015,361	265	3,338,472	245	4,074,575	245	4,810,678	245
MMD	2,764,000	376	3,329,038	356	3,530,926	333	3,854,976	339	4,268,056	314	5,209,124	314	6,150,192	314
PWD	2,931,000	398	3,530,177	377	3,744,263	353	4,087,893	360	4,525,931	333	5,523,857	333	6,521,784	333
MDD	3,382,000	460	4,073,374	435	4,320,402	408	4,716,907	415	5,222,346	384	6,373,827	384	7,525,307	384

TREATED WATER PRODUCED - W/MODIFIED BACKWASH RATES														
Existing Water Demand - Scenario No. 1					**Projected Water Demand**									
Year	2004		2010		2015		2020		2025		2034		2046	
Population	7,360		9364		10,594		12000		13,606		16606		19606	
Unacc. Water, %	29		20		15		12		10		10		10	
Parameter	gpd	gpcd/y	gpd	gpcd/y	gpd/y	gpcd/y	gpd/y	gpcd/y	gpd/y	gpcd/y	gpd/y	gpcd/y	gpd/y	gpcd/y
AAD	577,142,000	77,260	642,073,093	68,568	683,681,920	64,535	748,017,273	70,236	829,279,653	60,950	1,012,128,320	60,950	1,194,976,986	60,950
ADD	1,581,200	212	1,761,837	188	1,876,010	177	2,052,545	193	2,275,528	167	2,777,261	167	3,278,995	167
DDD	2,162,000	286	2,376,817	254	2,530,844	239	2,769,000	260	3,069,816	226	3,746,683	226	4,423,549	226
MMD	2,764,000	355	2,950,245	315	3,141,433	297	3,437,045	323	3,810,436	280	4,650,603	280	5,490,769	280
PWD	2,931,000	378	3,141,388	335	3,344,962	316	3,659,727	344	4,057,309	298	4,951,909	298	5,846,509	298
MDD	3,382,000	435	3,615,089	386	3,849,361	363	4,211,591	395	4,669,126	343	5,698,626	343	6,728,126	343
Existing Water Demand - Scenario No. 2					**Projected Water Demand**									
Year	2004		2010		2015		2020		2025		2034		2046	
Population	7,360		9364		10,594		12000		13,606		16606		19606	
Unacc. Water, %	29		25		20		17		15		15		15	
Parameter	gpd	gpcd/y	gpd	gpcd/y	gpd/y	gpcd/y	gpd/y	gpcd/y	gpd/y	gpcd/y	gpd/y	gpcd/y	gpd/y	gpcd/y
AAD	577,142,000	77,260	684,877,966	73,139	726,412,041	68,568	793,078,554	69,813	878,060,809	64,535	1,071,665,280	64,535	1,265,269,750	64,535
ADD	1,581,200	212	1,879,292	201	1,993,261	188	2,176,193	192	2,409,382	177	2,940,630	177	3,471,877	177
DDD	2,162,000	286	2,535,272	271	2,689,022	254	2,935,807	258	3,250,393	239	3,967,076	239	4,683,758	239
MMD	2,764,000	355	3,146,928	336	3,337,772	315	3,644,096	321	4,034,579	297	4,924,167	297	5,813,756	297
PWD	2,931,000	378	3,350,814	358	3,554,022	335	3,880,193	342	4,295,974	316	5,243,198	316	6,190,422	316
MDD	3,382,000	435	3,856,095	412	4,089,946	386	4,465,301	393	4,943,780	363	6,033,839	363	7,123,898	363

Reservoir Capacity Calculations							
Parameter	2004	2010	2015	2020	2025	2034	2046
Interagency Reservoir Sizing Capacity Method							
Population, capita	7,360	9,364	10,594	12,000	13,606	16,606	19,606
ADD, gpd	1,462,800	1,761,837	1,868,682	2,040,181	2,258,796	2,756,840	3,254,884
3.0 X ADD, gal	4,388,400	5,285,510	5,606,047	6,120,542	6,776,388	8,270,521	9,764,653
Residential Fire Flow, gal	180,000	180,000	180,000	180,000	180,000	180,000	180,000
Total, gal	4,568,400	5,465,510	5,786,047	6,300,542	6,956,388	8,450,521	9,944,653
Existing Reservoir Storage in the City, gal	3,519,000	3,519,000	3,519,000	3,519,000	3,519,000	3,519,000	3,519,000
Difference, gal	**1,049,400**	**1,946,510**	**2,267,047**	**2,781,542**	**3,437,388**	**4,931,521**	**6,425,653**
Alternate Reservoir Sizing Capacity Method							
Population, capita	7,360	9,364	10,594	12,000	13,606	16,606	19,606
ADD, gpd	1,462,800	1,761,837	1,868,682	2,040,181	2,258,796	2,756,840	3,254,884
MDD,gpd	2,966,000	3,572,332	3,788,974	4,136,708	4,579,976	5,589,820	6,599,663
Equalization Storage - 0.25 X MDD	741,500	893,083	947,244	1,034,177	1,144,994	1,397,455	1,649,916
Emergency Storage							
3 X ADD, gal	4,388,400	5,285,510	5,606,047	6,120,542	6,776,388	8,270,521	9,764,653
MDD, gpd	2,966,000	3,572,332	3,788,974	4,136,708	4,579,976	5,589,820	6,599,663
Fire Flow, gal - 4,500 gpm for 3 hours	810,000	810,000	810,000	810,000	810,000	810,000	810,000
Minimum Total, gal	4,517,500	5,275,415	5,546,218	5,980,885	6,534,970	7,797,274	9,059,579
Existing Reservoir Storage in the City , gal	3,519,000	3,519,000	3,519,000	3,519,000	3,519,000	3,519,000	3,519,000
Minimum Difference, gal	**998,500**	**1,756,415**	**2,027,218**	**2,461,885**	**3,015,970**	**4,278,274**	**5,540,579**
Maximum Total, gal	5,939,900	6,988,593	7,363,290	7,964,719	8,731,382	10,477,976	12,224,569
Existing Reservoir Storage in the City , gal	3,519,000	3,519,000	3,519,000	3,519,000	3,519,000	3,519,000	3,519,000
Maximum Difference, gal	**2,420,900**	**3,469,593**	**3,844,290**	**4,445,719**	**5,212,382**	**6,958,976**	**8,705,569**

Appendix D – Analysis and Improvement Alternatives

13.0 SUTHERLIN SUPPLY OPTION

13.1 Executive Summary

The Umpqua Basin Water Association (UBWA) is planning to modify their existing surface water treatment plant to replace filters and other facilities that have reached the end of their service life and to provide the ability to meet future water demands, while meeting all current and reasonably foreseeable future regulatory requirements. The proposed treatment capacity for the new facility is 6 million gallons per day (MGD).

The City of Sutherlin, approximately 4 miles to the northeast of the UBWA service area, has a permit for use of 3 CFS of water from the North Umpqua River. The City of Sutherlin is planning long-term water supply strategies. Sutherlin has asked UBWA about the potential feasibility of treating this 3 CFS (1.94 MGD) at the UBWA water treatment plant and delivering it to Sutherlin.

This concept would require moving the Sutherlin water right to the UBWA intake, and upgrading the proposed UBWA Water Treatment Plant facilities to a capacity of 8 MGD, to allow for 2 MGD dedicated to Sutherlin.

It would be feasible to provide for the additional capacity for Sutherlin by modifying the recommended project to accommodate the additional capacity on the project site. We have presented two options:

- Buildout Option: Build maximum capacity initially, or
- Phased Option: Build only the 4 MGD needed by UBWA, and provide space, facilities, and hydraulic capacity for future expansion to 8 MGD

Additional facilities required would include a transmission main to connect Sutherlin, and possibly a pump station and reservoir. These are not part of the scope of this analysis.

Table 13-1. Opinion of Probable Construction Costs – UBWA WTP Expansion Alternatives

	Project without Sutherlin (6 MGD)	Project with Sutherlin (8 MGD)	Difference in cost
Buildout Option: Cost of Project with Maximum Capacity	**$10,965,000**	**$14,800,000**	**$3,835,000**
Phased Option: 6 MGD initially – cost of first phase only	**$8,695,000**	**$9,530,000**	**$835,000**

The preliminary Opinion of Probable Construction Costs includes 25 percent contingency, engineering, and construction management costs. Additional detail of improvements is found in Tables 13-13 and 13-14.

13.2 Overview

The UBWA Water Treatment Plant is a 4 MGD conventional surface water treatment plant. The UBWA is planning to modify their existing surface water treatment plant to provide 6 MGD capacity, while meeting all current and reasonably foreseeable future regulatory requirements.

UBWA has contracted with Black & Veatch Corporation to provide preliminary engineering, design, and construction administration services for the proposed treatment plant. The first task of the engineering services was to perform an Alternative Technologies Assessment (Appendix B), to compare membrane treatment to conventional treatment for this application. The assessment evaluated treatment technology to meet current and anticipated drinking water regulations, at a capacity of 6 MGD. The Alternative Technologies Assessment presented an evaluation of two alternatives that will provide the desired inactivation of *Giardia lamblia* and *Cryptosporidium* to meet the anticipated requirements of the Long-Term 2 Enhanced Surface Water Treatment Rule (LT2). The alternatives evaluated were conventional treatment with ultraviolet (UV) and chlorine disinfection (coagulation, sedimentation, and rapid sand filtration followed by UV and chlorine disinfection), and membrane filtration (microfiltration or ultrafiltration-MF/UF) followed by chlorine disinfection.

The City of Sutherlin, approximately 4 miles to the northeast of the UBWA service area, has a permit for use of 3 CFS of water from the North Umpqua River. The City of Sutherlin is planning long-term water supply strategies. Sutherlin has asked UBWA about the potential feasibility of treating this 3 CFS (1.94 MGD) and delivering it to Sutherlin.

This concept would require moving the Sutherlin water right to the UBWA intake, and upgrading the proposed UBWA Water Treatment Plant facilities to a capacity of 8 MGD, to allow for 2 MGD dedicated to Sutherlin. This chapter provides a general description of the improvements needed to increase the maximum plant capacity from 6 MGD to 8 MGD. A discussion of water rights transfers is also provided at the end of this chapter.

13.3 Treatment Process Overview

The design criteria associated with each of the proposed treatment facilities are presented in the following sections. Table 13-2 presents the plant capacity design for the new facilities for a net production capacity of 6 MGD and 8 MGD. For UBWA capacity only, the net production capacity will be 6 MGD. For UBWA plus Sutherlin, the net production capacity will be 8 MGD.

Table 13-2. Plant Capacity Design Range

Criteria	Capacity, MGD	Capacity, MGD	Remarks
Design (maximum)	6.0	8.0	Net filtered water capacity from membrane system
Maximum hydraulic capacity	6.0	8.0	Hydraulics through the plant will be capable of 10% additional flow at greater velocities without causing damage to facilities or overflowing process structures.
Average	3.0	4.0	
Minimum	1.0	1.0	1 Package Treatment Unit on line

13.4 Raw Water Supply and Intake Pump Station

The plant will be designed to treat the North Umpqua River water from the existing intake location. For UBWA capacity only, the intake requires 6 MGD capacity at anticipated low water level. For UBWA plus Sutherlin, the intake requires 8 MGD capacity.

13.4.1 Intake Pumps and Screens

The UBWA's river intake is located on the south bank of the North Umpqua River. Currently, two 18-inch diameter by 54-inch long, stainless steel T-screens are located on the river and are connected to 14-inch raw water lines. The 1993 project also included replacement of the original pumps with two 48 HP submersible pumps inside a new wetwell. Each pump has a pumping capacity of 2 MGD. Two 25 HP pumps were installed in the early 1980's in drywells, giving a total intake capacity of 6 MGD. A 100 gallon air receiver is used for the air burst system for cleaning the intake screens. The control building next to the intake houses the Motor Control Center (MCC) and 80-gallon air receiver for operating the pneumatic control valves.

Intake Pumps

Two 48 HP pumps operating in parallel with one 25 HP pump can produce 6 MGD, provided the following improvements are made:

- New intake screens for the 25 HP pumps
- Replace 12-inch pipe raw water pipe with 16-inch pipe downstream of the intake pump control building.

To provide 8 MGD capacity, the following improvements would be needed:

- New wetwell adjacent to the existing wetwell, replacing the two steel drywells.
- Two 48 HP pumps to replace the two 25 HP pumps.
- New intake screens for 8 MGD capacity under current NOAA requirements.
- Replace 12-inch pipe raw water pipe with 18-inch pipe

We recommend adding AFDs to the 48 HP pumps to regulate flow through the treatment facilities. Alternative 1 is limited to producing 4 MGD by operating the 48 HP pumps in parallel. Alternative 2 uses both 48 HP pumps with a 25 HP pump operating in parallel to produce 6 MGD. To operate the pumps in parallel, a new intake would be required for the 25 HP pumps since currently the pump withdraws water from the 4 MGD wetwell. It is assumed that all screens would have to be replaced since modification to an intake typically requires the screens to be updated. Alternative 3 is to build a new 4 MGD intake similar to the existing 4 MGD intake except 2 feet lower to address vortexes being formed within the river at the intake when the river is at minimum water level. The two new 2 MGD pumps will be similar to the existing pumps.

13.4.1.1 Cost Analysis

Table 13-3 shows the probable cost of the alternatives to produce 6 MGD and 8 MGD.

Table 13-3. Opinion of Probable Construction Cost

Item	6 MGD	8 MGD
AFD (1)	$30,000	$60,000
Pumps	Not Applicable	$20,000
Screens	$21,000	$28,000
Intake (2)	$30,000	$30,000
Installation Labor & Equipment	$10,000	$20,000
Electrical	$10,000	$90,000
Instrumentation and Controls	$10,000	$60,000
In-water work	$40,000	$40,000
Wetwell	Not Applicable	$444,000
Subtotal to nearest $10,000	**$150,000**	**$790,000**
Contingency (25%)	$40,000	$200,000
Subtotal	**$190,000**	**$990,000**
Engineering (20%)	$30,000	$160,000
Total (rounded to ten thousand)	**$220,000**	**$1,150,000**

1. AFD cost incorporated the required building addition and a cooling system cost.
2. Intake cost includes pipeline and air burst system (piping, compressor, and receiver)
3. Pipeline modifications includes upgrading existing 12-inch pipeline and apparatuses to 16-inches (6 MGD) and to 18-inches (8 MGD)

13.5 Pretreatment Facilities

The existing pretreatment facilities consist of chemical injection and a static mixer located on the 12-inch plant influent pipeline, and a flocculation-sedimentation basin. At the current plant capacity of 4 MGD, the existing pretreatment facilities have been effective in reducing raw water turbidity to levels that can be removed by the filters (less than 10 NTU). The effectiveness of the pretreatment facilities at 6 MGD and 8 MGD was evaluated.

13.5.1 Chemical Injection and Rapid Mix

PACl and chlorine (Cl) are currently fed into a static mixer upstream of the flocculation-sedimentation basin. A new chemical injector and static mixer will be installed on the new influent pipeline.

13.5.2 Flocculation-Sedimentation Basin

The existing flocculation-sedimentation basin serves primarily as a sedimentation basin as it has no formal flocculation facilities. The existing basin is approximately 40 feet wide by 110 feet long, an approximate surface area of 4400 square feet. Coagulated water enters the basin through a tee diffuser on the south or upstream end. Basin effluent is collected on the north or downstream end by two weir troughs which feed the existing 16-inch settled water pipeline.

To determine the effectiveness of the existing flocculation-sedimentation basin, the overflow rate and weir loading rate were calculated for a range of lows assuming no new improvements to the sedimentation basin. Table 13-4 below summarizes the basin capacities at both 4 MGD, 6 MGD, and 8 MGD.

Table 13-4. Sedimentation Basin Capacity

Flow, MGD	4	6	8
Length, ft	110	110	110
Width, ft	40	40	40
Surface Area, sf	4400	4400	4400
Overflow Rate, gpd/sf	910[1]	1365[1]	1820[1]
Weir Loading Rate, gpd/ft (2 existing weirs)	25,000[2]	37,500[2]	50,000[2]
Weir Loading Rate, gpd/ft (3 weirs; 2 existing plus 1 new)	16,670	25,000	33,333
Weir Loading Rate, gpd/ft (4 weirs; 2 existing plus 2 new)	12,500	18,750	25,000
CT Required for 0.5-log *Giardia* inactivation, min-mg/L	25[3]	25[3]	25[3]
Estimated CT through the basin, min-mg/L	15.8[3]	10.4[3]	7.9[3]

[1] Overflow rates of 800-1200 gpd/sf are desirable for conventional plants
[2] Weir loading rates of 20,000 gpd/ft are desirable for conventional plants
[3] Assumes 10°C, pH 8.0, 0.4 mg/L residual

The existing sedimentation basin will provide minimal turbidity removal at 6 MGD. Although not ideal for a conventional water treatment plant, the overflow rate at 6 MGD is acceptable for a membrane system treating a high quality source such as the North Umpqua River. In addition, the membrane treatment system is being designed to be capable of meeting the water quality goals in direct filtration mode with little or no pretreatment.

The existing sedimentation basin will provide little if any turbidity removal at 8 MGD. However, a flow of 8 MGD will only be required in the summer when raw water turbidity is low and pretreatment is not necessary. The overflow rate at 8 MGD is therefore considered acceptable for a membrane system designed for direct filtration with little or not pretreatment. One additional weir is recommended for 6 MGD, however two additional weirs are recommended for 8 MGD.

The CT required for 0.5-log *Giardia* inactivation (assuming 10 degrees Celcius, pH 8.0, 0.4 mg/L residual) is much greater than the estimated CT through the basin at 4 MGD, 6 MGD, and 8 MGD. Significant improvement in basin performance with respect to both turbidity removal and disinfection credit will require substantial and costly modifications. Therefore, significant modifications to the sedimentation basin are not recommended at this time.

13.5.3 Residuals Drawoff Control

The settled solids or residuals that collect in the sedimentation basins will continue to be manually removed by flushing to the existing backwash lagoons. The existing basin drain to the backwash lagoons is slightly above the floor of the basin making it difficult to flush solids from the basin. The existing drain inlet will be modified (lowered) for better drainage.

13.6 Membrane Filtration Facility

The performance and design requirements for an 8 MGD membrane system will be the same as those specified for the 6 MGD system. The membrane filtration facility will be similar to that required for 6 MGD except the facility will be large enough to house 8 MGD. The membrane filtration facility will be located in a new membrane building to the west of the existing filter building. It is assumed that the new membrane building will be a pre-fabricated metal building.

13.7 Chemical Facilities

This section describes the additional chemical feed capacity and components required with increasing the maximum plant capacity from 6 MGD to 8 MGD. The chemical feed systems will be housed in the existing filter building, and will be installed after the new membrane system is on-line. In this way, the WTP can keep producing water while the existing filters are demolished and removed and the new chemical systems installed in the building.

13.7.1 Coagulant PACl

Additional storage and feed capacity will not be required to increase plant capacity to 8 MGD. The 5000 gallon storage tank will provide 16 days of storage at a maximum flow of 8 MGD and maximum dosage of 27.7 mg/l. The maximum chemical feed flow at 8 MGD is 12.9 gph and within the range of the existing diaphragm metering pumps (0.3 to 24 gph) which will be relocated and reused for the new PACl system.

13.7.2 Disinfection

Onsite Generation
A maximum chlorine production of 196 ppd is required at 6 MGD. Additional onsite hypochlorite generation capacity will be required to increase plant capacity to 8 MGD. A maximum chlorine production of 260 ppd is required at 8 MGD.

Delivered Sodium Hypochlorite
Three totes and three metering pumps (0.11 – 4.11 gph) are required for 6 MGD. Three totes provide 4.6 days of storage at 6 MGD. One additional tote and slightly larger metering pumps (0.11 – 5.3 gph) will be required to increase plant capacity to 8 MGD. One additional tote (four total) will provide 4.6 days of storage at 8 MGD.

Onsite Generation Versus Delivered Sodium Hypochlorite
The advantages and disadvantages of onsite hypochlorite generation and delivered sodium hypochlorite are discussed in detail in section 4.5.2 of the Basis of Design Report. Table 13-5 summarizes the operating costs for each alternative at the design average plant capacity of 4 MGD. Annual O&M costs consist of expected equipment maintenance and an estimated cost for the labor associated with each system.

Table 13-5. Annual Operation and Maintenance Costs

Alternative	O&M Costs
On-Site Generation	
Salt ($0.05/lb)	$4,000
Electricity ($0.06/kWhr)	$4,000
Annual O&M	$15,000
Total Annual O&M	**$23,000**
Delivered Sodium Hypochlorite	
Annual Cost for Liquid Sodium Hypochlorite @ $2.51/gallon	$62,000
Annual O&M	$11,000
Total Annual O&M	**$73,00**

Table 13-6 summarizes the capital and annual O&M costs for each type of system at both 6 MGD and 8 MGD. Costs assume redundant systems will be provided and include equipment, installation, piping, and electrical supplier costs. Because either alternative will be located in an existing building, civil/structural modification costs were assumed to be equal for each alternative. A discount rate of 4 percent over 15 years was assumed for this analysis. These costs do not include contingencies.

Table 13-6. Estimated 15 year Present Worth Analysis			
Alternative	Annual O&M Costs	Capital Costs	Present Worth
6 MGD Onsite Generation Two – 200 ppd systems	$20,960	$470,000	$710,000
8 MGD Onsite Generation Two – 275 ppd systems	$23,000	$545,000	$810,000
6 MGD Sodium Hypochlorite Delivered in Totes	$33,500	$105,000	$480,000
8 MGD Sodium Hypochlorite Delivered in Totes	$73,000	$105,000	$920,000
1. Cost does not include building or structural costs. 2. Cost does not include HVAC or sprinkler costs. 3. Costs represent higher of three onsite generation system manufacturer's contacted.			

Recommendation
The advantages and disadvantages of onsite hypochlorite generation and delivered sodium hypochlorite are discussed in detail in section 4.5.2 of the Basis of Design Report. Our recommendation is to replace the existing chlorine gas system with an onsite hypochlorite generation system with a capacity that meets the UBWA's redundancy requirements. Two 275 ppd systems is the most costly option but will provide 100% disinfection redundancy at a maximum flow of 8 MGD. However, two smaller systems could be installed at a lower cost and less redundancy. It should also be noted that the maximum capacity of 8 MGD is not needed in the near future, therefore two smaller systems could be installed now with expansion capabilities for the future.

13.8 Clearwell

13.8.1 Introduction

The existing clearwell's water level is allowed to fluctuate to serve the finished water pumps. In the initial BDR, B&V recommended that the finished water pumps be fitted with AFD's to maintain this level steady. This will allow the full volume of the existing clearwell to be counted toward the disinfection CT total.

The clearwell system to provide for UBWA plus Sutherlin's needs will provide a 0.5 log inactivation of *Giardia* cysts and 4 log inactivation of viruses at a flow of 8.0 MGD. This analysis uses the recommended cast in place concrete tank.

To determine the theoretical CT required to provide a 0.5 log inactivation of Giardia cysts and 4 log inactivation of viruses for each clearwell options, assumptions were made based on the Water Quality Report for chlorine free residual, temperature, water depth, pH, and baffling factor, and are shown in Table 13-7. The clearwell water depth and overflow elevation assumed is the same as the existing clearwell. This will allow either clearwell to be taken off-line and retain operational capability. The baffling factor for the steel tank assumes a poor baffling system typical for this type of tank and same as the baffling factor of the existing steel tank. The concrete tank will be designed to provide a superior baffling system thus the higher value assumed. The design clearwell flow rate is 6.0 MGD or 8 MGD.

Table 13-7. Clearwell Assumptions

Parameter	Concrete Tank
Chlorine Free Residual, mg/L	0.8
Water Temperature, degrees Celsius	10
Water pH	8
Water Depth, ft	15.85
Baffling Factor (Hydraulic Efficiency)	0.7

Table 13-8. Clearwell Options

Item	Existing Steel Tank Clearwell	Clearwell With AFDs on Pumps	
		New Clearwell for 6 MGD	New Clearwell for 8 MGD
Diameter or Length by Width (1), ft	46	43 by 29	64 by 29
Wall Height (2), ft	16	18	18
Capacity, gallons	198,000	109,000	174,000
Detention Time, minutes	47	26	32
Effective Detention Time, minutes	14.5 @ 6 MGD 10.5 @8 MGD	18.5	22
Surface Area, ft^2	1,650	920	1460

(1) Concrete tank dimensions include assumed wall and baffle thicknesses.
(2) Water depth on the existing steel tank is 15.85 feet. The new tank will have the same water depth as the existing, but with a freeboard of 2.15 feet and wall height of 18 feet.

13.8.2 Cost Analysis

A preliminary cost analysis was completed for the 6 MGD and 8 MGD plant capacity:

Table 13-9. Opinion of Probable Construction Cost		
	Clearwell With AFDs on Pumps	
Item	**New Clearwell for 6 MGD**	**New Clearwell for 8 MGD**
Mobilization (8 percent)	$18,000	$23,000
Tank Cost	$168,000	$205,000
Coatings	Not Applicable	Not Applicable
Foundation	$44,000	$65,000
Earthwork	$11,000	$15,000
Retaining Wall	Not Applicable	Not Applicable
RVS on Pumps	Not Applicable	Not Applicable
Subtotal	**$241,000**	**$308,000**
Contingency (25 percent)	$61,000	$77,000
Subtotal	**$302,000**	**$385,000**
Engineering (20 percent)	$61,000	$77,000
Total (rounded up to ten thousand)	**$370,000**	**$470,000**
Cost/Gallon	**$3.39**	**$2.71**

The 8 MGD clearwell would cost approximately $100,000 more than a 6 MGD clearwell.

13.9 Finished Water Pump Station

13.9.1 Introduction

The finished water pump station was evaluated to determine if the existing pumps and system are capable of producing and conveying 6 MGD for UBWA only, and 8 MGD for UBWA plus Sutherlin.

13.9.2 Pump Station Evaluation

The pump station and distribution system were evaluated at current and future demands. The College and Gawler distribution systems, shown in Figures 4.7.1 and 4.7.2, respectively, were evaluated using a simplified version of the UBWA distribution system model for current conditions and future pipeline upgrades required to provide a total of 6 and 8 MGD.

Four existing finished water pumps discharge water into the distribution system. Both Gawler and College distribution systems have a lead and lag pump to provide the necessary head and discharge requirements and redundancy for each distribution system. Pump No. 1 is rated at 1200 gpm (125 HP pump) and Pump No. 2 is rated at 750 gpm (75

HP pump), and both discharge to the Gawler system. Pump No. 3 and 4 (75 HP pumps) are rated at 750 gpm and discharge to the College system. Pump No. 1 , the 125 HP pump on the Gawler side, is used frequently to meet high system demands, but this causes high pressures in the distribution system.

13.9.3 Pump Configuration Alternatives

The existing finished water pumps and distribution system were evaluated to determine the existing and new pump combinations capable of conveying a total of 6 MGD and 8 MGD and are given below.

Alternative 2

For 6 MGD:

- Gawler Zone – Install two new 150 HP pumps with AFDs. Reconstruct existing pump station piping and building.
- College Zone – Install two new 150 HP pumps with AFDs in a new pump station building.

The total of 8 MGD maximum capacity provides a firm 6 MGD with one pump out of service. Piping should be arranged so that one Gawler pump can act as backup to College zone and vice versa.

For 8 MGD:

- Gawler Zone – Same as the 6 MGD (Gawler zone demand is unchanged)
- College Zone – Install three new 150 HP pumps with AFDs in a new pump station building.

The total of 10 MGD maximum capacity provides a firm 8 MGD with one pump out of service. Piping should be arranged so that one Gawler pump can act as backup to College zone and vice versa.

To deliver 3 MGD for UBWA plus 2 MGD for Sutherlin, through the College zone to the Sutherlin intertie, will require some distribution piping upgrades, plus an approximately 4-mile intertie pipe from the vicinity of Wilbur to Sutherlin. The Sutherlin intertie itself may require additional pumping and storage. Analysis of these needs is beyond the scope of this study.

13.9.4 Cost Analysis

Table 13-10 shows the probable cost of the both alternatives to produce 6 MGD and 8 MGD.

Table 13-10. Opinion of Probable Construction Cost - Finished Water Pump Station

Item	Alternative 1	Alternative 2
	6 MGD – UBWA only	8 MGD – UBWA plus Sutherlin
AFD	$140,000	$175,000
New Pumps	$240,000 (4 pumps)	$300,000 (5 pumps)
Installation 15 percent	$60,000	$70,000
New Pump Station Building	$200,000	$260,000
Pump Station Piping	$120,000	$150,000
Distribution System Upgrades	Not Included	Not Included
Electrical (15 percent)	$115,000	$140,000
Instrumentation and Controls (10 percent)	$75,000	$100,000
Subtotal	**$950,000**	**$1184,000**
Contingency (25 percent)	$240,000	$300,000
Subtotal	**$1,190,000**	**$1,500,000**
Engineering	$190,000	$220,000
Total (rounded to nearest ten thousand)	**$1,380,000**	**$1,720,000**

13.10 Residuals Treatment

Two existing backwash lagoons are currently used to collect filter backwash water and solids produced in the flocculation-sedimentation basin. The lagoons operate in series and the decant is discharged to the North Umpqua River. Backwash flows for conventional water treatment plants are typically 1 to 5 percent of plant capacity. Per the UBWA, each of the two existing filters uses approximately 20,000 gallons per backwash and is backwashed every other day during summer months. However, during the winter months a filter may be backwashed every 4 hours or 6 times per day. This equates to backwash flows ranging from 0.5 to 6 percent of plant capacity.

The following table summarizes the existing summer and winter backwash flows, and anticipated backwash flows from a 4 MGD and 6 MGD membrane filtration system.

Table 13-11. Backwash Flows					
Existing Backwash Flows, gpd (2 filters in service)*		**Membrane Backwash Flows @ 6 MGD, gpd**		**Membrane Backwash Flows @ 8 MGD, gpd**	
Summer	Winter	Submerged	Pressure	Submerged	Pressure
20,000	240,000	59,000	194,000	85,000	258,000
* Per the UBWA, each of the two existing filters use approximately 20,000 gallons per backwash and are backwashed every other day during summer months. However, during the winter months a filter may be backwashed every 4 hours or 6 times per day.					

The two existing backwash lagoons are adequate to handle backwash flows from a 6 MGD submerged or pressure membrane system. The two existing backwash lagoons are also adequate to handle the backwash flows from an 8 MGD submerged membrane system but may need to be slightly enlarged to handle the backwash flow from an 8 MGD pressure membrane system.

Recommendation
It is our recommendation that the UBWA continue to discharge backwash water to the lagoons with an added step of dechlorination prior to river discharge in order to meet the NPDES permit requirements. If over time, this process appears to be inadequate, a treatment step (i.e. packaged inclined plate settler and backwash return pump station) can be added to allow the backwash water to be returned to the head of the plant.
If a pressure membrane system is the selected process, the lagoons are adequate to handle backwash flows for many years to come. In the future when 8 MGD production is actually required, the easterly lagoon could be enlarged at that time.

13.11 Civil and Site Development

A conceptual layout of major structures and facilities for the UBWA WTP is shown on **Drawing C-1**. The proposed layout shows facilities for the water treatment plant based on a buildout capacity of 8 MGD. The site plan shows the increased sizes of site piping for the 8 MGD capacity.

13.11.1 Major Yard Piping

Table 13-12 summarizes the major process piping on the site and the estimated pipe sizes.

Table 13-12. Design Criteria and Sizing for Major Yard Piping		
Pipeline	**Design Capacity – 6 MGD**	**Design Capacity – 8 MGD**
Raw Water	16	18
Settled Water	16	18
Membrane Filtrate	16	18
Finished Water Discharge	18-inch Gawler and 14-inch existing	18
Membrane Backwash	18	18
Decant and Solids Piping	Existing	Existing
Plant Service Water	1-1/2 Existing	1-1/2 Existing

13.12 Opinion of Probable Project Costs

The options discussed above for each process component are summarized in this section, including anticipated project costs for each alternative. The difference between the 6 MGD and the 8 MGD project cost is the estimated cost to provide for the Sutherlin 1.94 MGD capacity at the UBWA water treatment plant. This does not include transmission mains or additional pumping that may be required for the intertie connection, nor does it include any distribution upgrades that may be necessary.

The necessary improvements for the full capacity of 6 MGD (UBWA only) and 8 MGD (UBWA plus Sutherlin) are summarized in Table 13-13 The opinion of probable costs for each component includes a 25% contingency and estimated engineering costs.

13.12.1 Improvements Needed for 4 MGD Initial with Phased Future 6 MGD or 8 MGD

If Sutherlin does not need immediate capacity, but needs future capacity at the UBWA WTP, the WTP improvements can be built with 4 MGD capacity initially, and to have space and hydraulic capacity for future installation of an additional 2 MGD for UBWA, plus 2 MGD for Sutherlin. The facilities needed are described below in Table 13-14.

Table 13-13. Summary of UBWA WTP Improvements needed for 6 MGD maximum capacity (UBWA only) and 8 MGD maximum capacity (UBWA plus Sutherlin capacity)

Component	6 MGD Capacity	8 MGD Capacity
Membrane Filtration System	6 MGD membrane system with chemical Clean-In-Place (CIP) equipment for membrane cleaning. Pre-engineered building. **$6,820,000**	**8 MGD** membrane system with chemical Clean-In-Place (CIP) equipment for membrane cleaning. Pre-engineered building. **$8,960,000**
Chlorine system	On-site generation system for chlorine, two redundant 200 ppd units. **$700,000**	On-site generation system for chlorine two redundant 275 ppd units. **$870,000**
Coagulant system	PACl system for chemical coagulant for conditioning of water. **$90,000**	PACl system for chemical coagulant for conditioning of water. **$90,000**
Sitework	Upgrade all site piping to 6 MGD capacity. Paving, grading, drainage, stormwater detention, and other improvements. **$1,000,000**	Upgrade all site piping to **8 MGD** capacity. Paving, grading, drainage, stormwater detention, and other improvements. **$1,060,000**
Finished Water Pump Station	Upgrades to existing pump station for College zone and new pump station for Gawler zone to pump 3 MGD to both zones. AFDs on all pumps. **$1,380,000**	New pumps and new pump station to pump 3 MGD to Gawler and 5 MGD to College zone (includes 2 MGD to Sutherlin). AFDs on all pumps. One redundant pump can be switched to either zone. **$1,720,000**
Intake Pump Station	Existing pump station with added 2 MGD screen capacity and AFDs on the 2 large pumps **$220,000**	Upgrades to pump **8 MGD** at the expected low water, new screens, new wetwell, AFDs on all pumps **$1,150,000**
Chlorine Contact Basin (Clearwell)	Concrete clearwell with interior baffle walls with a baffling factor of 0.7 to obtain sufficient disinfection credit for 6 MGD. **$420,000**	Concrete clearwell with interior baffle walls with a baffling factor of 0.7 to obtain sufficient disinfection credit for 8 MGD. **$510,000**
Standby Power	Diesel generator set and ATS for 800kW generator set capable of powering half of ultimate capacity (3 MGD). **$335,000**	Diesel generator set and ATS for 1000kW generator set capable of powering half of ultimate capacity (4 MGD). **$440,000**
Total Project	**$10,965,000**	**$14,800,000**

Table 13-14. Summary of UBWA WTP Improvements needed for Phased Project

Component	4 MGD Initial Capacity, Expandable to 6 MGD	4 MGD Initial Capacity, Expandable to 8 MGD for Sutherlin
Membrane Filtration System	4 MGD membrane system. Pre-engineered building and piping sized for 6 MGD **$5,830,000**	4 MGD membrane system. Pre-engineered building and piping sized for 8 MGD **$6,430,000**
Chlorine system	On-site generation system for chlorine, one 200 ppd unit. **$480,000**	On-site generation system for chlorine, one 200 ppd unit. **$480,000**
Coagulant system	PACl system for chemical coagulant for conditioning of water. **$90,000**	PACl system for chemical coagulant for conditioning of water. **$90,000**
Sitework	Upgrade all site piping to 6 MGD capacity. Paving, grading, drainage, stormwater detention, and other improvements. **$850,000**	Upgrade all site piping to **8 MGD** capacity. Paving, grading, drainage, stormwater detention, and other improvements. **$910,000**
Finished Water Pump Station	Upgrades to existing pump station, rebuild existing pumps, new piping, AFDs on two pumps, 4 MGD capacity **$450,000**	Upgrades to existing pump station, rebuild existing pumps, new piping, AFDs on two pumps, 4 MGD capacity **$450,000**
Intake Pump Station	Existing pump station with added 2 MGD screen capacity and AFDs on the 2 large pumps **$220,000**	Existing pump station with added 2 MGD screen capacity and AFDs on the 2 large pumps **$220,000**
Chlorine Contact Basin (Clearwell)	Concrete clearwell with interior baffle walls with a baffling factor of 0.7 to obtain sufficient disinfection credit for 6 MGD. **$420,000**	Concrete clearwell with interior baffle walls with a baffling factor of 0.7 to obtain sufficient disinfection credit for 8 MGD. **$510,000**
Standby Power	Diesel generator set and ATS for 800kW generator set capable of powering half of ultimate capacity (3 MGD). **$335,000**	Diesel generator set and ATS for 1000kW generator set capable of powering half of ultimate capacity (4 MGD). **$440,000**
Total Project	**$8,695,000**	**$9,530,000**

13.13 Water Rights Transfers

The City of Sutherlin has a water rights permit for use of 3 CFS (1.94 MGD) from the North Umpqua River. The City of Sutherlin is planning long-term water supply strategies and has asked UBWA to consider treating this 3 CFS and delivering it to Sutherlin. This concept will require moving the Sutherlin water right to UBWA intake. A discussion of water rights transfers and applicable regulations is presented below.

The use of water under a water right is restricted to the terms and conditions described in the water right certificate: place of use, point of diversion, and type of use. Changing the point of diversion for a water right is classified as a water rights transfer by Oregon Law and the procedure for applying for a transfer is outlined in Oregon Administrative Rules (OAR) Chapter 690 Division 380 "Water Rights Transfers".

Briefly, the process to transfer a water right begins with filing a transfer application with the Oregon Water Resources Department (WRD). There are three types of transfers: permanent, temporary, and time-limited. Most likely this application would be for a permanent transfer. An application for a permanent transfer requires a map prepared by a certified water right examiner (CWRE). The applicant must submit an application form describing the current water right, the proposed change and provide evidence of water use, land ownership or consent by the landowner, and, in most cases, compliance with local land use plans.

The WRD then determines if the proposed change will injure other water rights. The public is offered a chance to comment and protest a proposed transfer if they believe an existing water right would be injured. The application may be approved conditionally in order to eliminate potential injury to other water rights. If conditional approval will not eliminate injury, the application is denied.

After the transfer is approved, the applicant must make the change. In the case of a change in use or place of use, any portion of the water right involved in the transfer that is not changed is lost. Following completion of the change, a CWRE must prepare a final proof map and site report to be submitted with the applicant's claim of beneficial use. The map and claim of beneficial use describe the completed change and the extent of the modified water right. A new water right certificate is then issued to confirm the modified water right.

References

Oregon Department of Water Resources "Aquabook" – "An Introduction to Oregon's Water Laws and Water Rights System, Water Rights in Oregon" (November 2004), http://www1.wrd.state.or.us/pdfs/aquabook.pdf

Oregon Department of Water Resources website: www.wrd.state.or.us

Oregon Administrative Rules (OAR) Chapter 690 Division 380 "Water Rights Transfers"

Oregon Revised Statutes (ORS) 540.510—540.520.

Appendix E – Water Conservation Documentation

Ultra-Low-Flush Toilet Rebate Program

Measure		Value	Comments
MEASURE COST			
Labor	$	6,160	1 hr per rebate, 8 hrs/yr annual review, $40/hr labor
Marketing	$	2,000	Brochures, advertisement
Incentive - Rebate	$	34,200	$150/toilet, participating units, 2 toilets per unit
Total Cost - 5-Year Period	$	42,360	
MEASURE SAVINGS			
Pre 1980 Housing Units			
No. of Pre 1980 Housing Units		1511	
Participation Level		5%	
Total Participating Units		76	5 Year Period, 1% of Households per Year
Number of Flushes/Day		9	Assumes 2.3 persons/household, 4 flushes/day-person
Gallons Saved per Flush		3.4	Old models 5 gal/flush; new model 1.6 gal/flush
Total Gallons Conserved Per Household/day		30.6	# flushes/day X gallons saved/flush
Total 10-Year Dry Season Savings, gpy		1,969,783	Critical Period: June - September, 121 days
Total Annual Savings		5,941,908	10 year life
1980-1994 Housing Units			
No. of 1980-94 Housing Units		760	
Participation Level		5%	
Total Participating Units		38	5 Year Period, 1% of Households per Year
Number of Flushes/Day		9	Assumes 2.3 persons/household, 4 flushes/day-person
Gallons Saved per Flush		1.9	Old models 3.5 gal/flush; new model 1.6 gal/flush
Total Gallons Conserved Per Household/day		17.1	# flushes/day X gallons saved/flush
Total 5-Year Dry Season Savings, gpy		550,381	Critical Period: June - September, 121 days
Total 10-year Annual Savings		1,660,239	10 year life
SUMMARY COST PER WATER SAVED			
Total Savings - 10-Year Period, gallons		2,520,164	
Total Savings - 10-Year Period, AF		7.73463	
Cost Per MG - Dry Season, 10 Year Period, $/MG	$	16,808	Total 5-Yr Cost/Total 10-Yr Savings in MG: Dry Season
Cost Per AF - Dry Season, 10 Year Period, $/AF	$	5,477	Total 5-Yr Cost/Total 10-Yr Savings in AF: Dry Season
Total Annual Savings - 10-Year Period, gallons		7,602,147	
Total Annual Savings - 10-Year Period, AF		23.33172	
Annual Cost Per MG - Dry Season, 10 Years, $/MG	$	5,572	Total 5-Yr Cost/Total 10-Yr Savings in MG: Year-Round
Annual Cost Per AF - Dry Season, 10 Years, $/AF	$	1,816	Total 5-Yr Cost/Total 10-Yr Savings in AF: Year-Round

Front Loading Washers Rebate Program

Measure		Value	Comments
MEASURE COST			
Labor	$	7,400	1 hr per rebate, 8 hrs/yr annual review, $40/hr labor
Marketing	$	2,000	Brochures, advertisement
Incentive - Rebate	$	21,750	$150/washer, 189 participating units,
Total Cost - 5-Year Period	$	31,150	
MEASURE SAVINGS			
No. of Housing Units		2907	Assuming 2,907 Housing Units (Census 2000)
Participation Level		5%	
Total Participating Units		145	5 Year Period, 20% of Households per Year
Number of Loads/Day		0.85	2.3 persons/household, 0.37 loads per person-day
Gallons Saved per Flush		15	Old models 40 gal/load; new models 25 gal/load
Total Gallons Conserved Per Household/day		12.765	# loads/day X gallons saved/load
Total Dry Season Savings, gpy		1,567,733	Critical Period: June - September, 121 days
Total Savings		4,729,113	10 Years
SUMMARY COST PER WATER SAVED			
Total Savings - 10-Year Period, gallons		1,567,733	
Total Savings - 10-Year Period, AF		4.81153	
Cost Per MG - Dry Season, 10 Year Period, $/MG	$	19,869	Total 5-Yr Cost/Total 10-Yr Savings in MG: Dry Season
Cost Per AF - Dry Season, 10 Year Period, $/AF	$	6,474	Total 5-Yr Cost/Total 10-Yr Savings in AF: Dry Season
Total Annual Savings - 10-Year Period, gallons		4,729,113	
Total Annual Savings - 10-Year Period, AF		14.51410	
Annual Cost Per MG - Dry Season, 10 Years, $/MG	$	6,587	Total 5-Yr Cost/Total 10-Yr Savings in MG: Year-Round
Annual Cost Per AF - Dry Season, 10 Years, $/AF	$	2,146	Total 5-Yr Cost/Total 10-Yr Savings in AF: Year-Round

Residential Fixture Retrofit Kit Program

Measure		Value	Comments
MEASURE COST			
Labor	$	3,560	0.5 hr per rebate, 4 hrs/yr annual review, $40/hr labor
Marketing	$	2,000	Brochures, advertisement
Retrofit Kits	$	3,420	$30/kit, 114 participating units,
Total Cost - 5-Year Period	$	8,980	
MEASURE SAVINGS			
No. of Housing Units		2271	Assuming 2,907 Pre 1994 Households
Participation Level		5%	
Total Participating Units		114	5 Year Period, 20% of Households per Year
Number of Gallons Per Household-Day w/ Toilet Dam		2	2.3 persons/household, 1.0 gpcd
Number of Gallons Per Household-Day w/ Showerhd		9	2.3 persons/household, 3.7 gpcd
Number of Gallons Per Household-Day w/ Faucet		1	2.3 persons/household, 0.5 gpcd
Total 5-Year Dry Season Savings, gpy		494,929	Critical Period: June - September, 121 days
Total 5-Year Annual Savings, gpy		1,492,967	365 days, 5 Years
SUMMARY COST PER WATER SAVED			
Total Savings - 5-Year Period, gallons		494,929	
Total Savings - 5-Year Period, AF		1.51898	
Cost Per MG - Dry Season, 5 Year Period, $/MG	$	18,144	Total 5-Yr Cost/Total 5-Yr Savings in MG: Dry Season
Cost Per AF - Dry Season, 5 Year Period, $/AF	$	5,912	Total 5-Yr Cost/Total 5-Yr Savings in AF: Dry Season
Total Annual Savings - 5-Year Period, gallons		1,492,967	
Total Annual Savings - 5-Year Period, AF		4.58206	
Annual Cost Per MG - Dry Season, 5 Years, $/MG	$	6,015	Total 5-Yr Cost/Total 5-Yr Savings in MG: Year-Round
Annual Cost Per AF - Dry Season, 5 Years, $/AF	$	1,960	Total 5-Yr Cost/Total 5-Yr Savings in AF: Year-Round

Appendix F – Capital Improvement Plan

Item	Description	Unit	Quantity	Unit Price	Total
Nonpareil Individual Booster Pump Stations					
1	Construct Facilities & Temporary Controls	LS	1	$ 7,650	$ 7,650
2	Site Preparation	LS	1	$ 5,100	$ 5,100
3	Individual Booster Pump Stations to Nonpareil	EA	17	$ 5,000	$ 85,000
	Total Construction Cost				$ 97,750
	Contingency				$ 14,630
	Engineering				$ 16,620
	Legal/Admin/Finance				$ 6,000
					$ 135,000

Item	Description	Unit	Quantity	Unit Price	Total
New Reservoir Piping to Distribution System					
Plat M Road Reservoir - Phase 1					
1	Construct Facilities & Temporary Controls	LS	1	$ 44,025	$ 44,025
2	Site Preparation	LS	1	$ 29,350	$ 29,350
3	Foundation Stabilization	CY	100	$ 30	$ 3,000
4	Electrical / Controls	LS	1	$ 5,000	$ 5,000
5	AC Pavement R & R	LF	2550	$ 22	$ 56,100
6	18-Inch Waterline, Class B	LF	2000	$ 75	$ 150,000
7	18-inch Waterline, Class C	LF	2500	$ 85	$ 212,500
8	18" Valves	EA	4	$ 3,800	$ 15,200
9	18" x 14" x 12" Tee	EA	1	$ 2,180	$ 2,180
10	18" 90 Degree Elbow	EA	2	$ 1,450	$ 2,900
11	18" 45 Degree Elbow	EA	4	$ 1,220	$ 4,880
12	18" Wye	EA	1	$ 3,475	$ 3,475
13	18" Miscellaneous Fittings	EA	6	$ 2,200	$ 13,200
14	8-Inch Class C	LF	50	$ 55	$ 2,750
15	2" Waterline, Class C	LF	4	$ 45	$ 180
16	2" Connections	EA	4	$ 700	$ 2,800
17	1" Service Connections	EA	25	$ 500	$ 12,500
18	1" Service Line @ 20'/conn.	LF	25	$ 100	$ 2,500
	Total Construction Cost				$ 562,540
	Contingency				$ 84,360
	Engineering				$ 95,600
	Legal/Admin/Finance				$ 39,400
	Total Project Cost				**$ 781,900**

Item	Description	Unit	Quantity	Unit Price	Total
High School / Middle School Water Main Upsizing Improvements					
1	Construct Facilities & Temporary Controls	LS	1	$ 41,811	$ 41,811
2	Waterline Demolition & Abandonment	LS	1	$ 18,583	$ 18,583
3	Site Preparation	LS	1	$ 9,291	$ 9,291
4	Foundation Stabilization	CY	50	$ 10	$ 500
5	AC Pavement R & R	LF	4000	$ 22	$ 88,000
6	14-inch Waterline, Class C	LF	3900	$ 75	$ 292,500
7	8-Inch Class C	LF	100	$ 55	$ 5,500
8	2" Waterline, Class C	LF	50	$ 45	$ 2,250
9	2" Connections	EA	6	$ 700	$ 4,200
10	1" Service Connections	EA	40	$ 500	$ 20,000
11	1" Service Line @ 20'/conn.	LF	40	$ 100	$ 4,000
12	14" Valves	EA	3	$ 2,500	$ 7,500
13	14" Tees	EA	1	$ 1,115	$ 1,115
14	14" X 8" Tees	EA	1	$ 1,115	$ 1,115
15	14" 90 Degree Elbow	EA	1	$ 810	$ 810
16	14" Miscellaneous Fittings	EA	6	$ 1,150	$ 6,900
17	8" Miscellaneous Fittings	EA	6	$ 450	$ 2,700
18	Hydrant Reconnection	EA	8	$ 2,000	$ 16,000
19	Combination Air Valve	EA	1	$ 1,400	$ 1,400
20	Landscaping	LS	1	$ 5,000	$ 5,000
21	Concrete	LS	1	$ 5,000	$ 5,000
22	Gravel Surfacing	CY	5	$ 15	$ 75
	Total Construction Cost				$ 534,250
	Contingency				$ 80,250
	Engineering				$ 90,800
	Legal/Admin/Finance				$ 37,400
	Total Project Cost				**$ 742,700**

Item	Description	Unit	Quantity	Unit Price	Total
Central Avenue Water Main Upsizing Improvements					
1	Construct Facilities & Temporary Controls	LS	1	$ 51,434	$ 51,434
2	Waterline Demolition & Abandonment	LS	1	$ 22,860	$ 22,860
3	Site Preparation	LS	1	$ 11,430	$ 11,430
4	Foundation Stabilization	CY	50	$ 10	$ 500
5	AC Pavement R & R	LF	3900	$ 22	$ 85,800
6	18-inch Waterline, Class C	LF	3800	$ 85	$ 323,000
7	8-Inch Class C	LF	100	$ 55	$ 5,500
8	2" Waterline, Class C	LF	100	$ 45	$ 4,500
9	2" Connections	EA	4	$ 700	$ 2,800
10	1" Service Connections	EA	5	$ 500	$ 2,500
11	1" Service Line @ 20'/conn.	LF	5	$ 100	$ 500
12	18" Valves	EA	7	$ 3,800	$ 26,600
13	18" x 8" Tees	EA	7	$ 2,180	$ 15,260
14	18" Cross	EA	1	$ 2,710	$ 2,710
15	18" 45 Degree Elbow	EA	1	$ 1,220	$ 1,220
16	18" 45 Degree Wye	EA	1	$ 3,475	$ 3,475
17	18" Miscellaneous Fittings	EA	15	$ 2,200	$ 33,000
18	8" Miscellaneous Fittings	EA	15	$ 450	$ 6,750
19	New Hydrant & Connection	EA	3	$ 3,500	$ 10,500
20	New Hydrant 14" Waterline	EA	400	$ 75	$ 30,000
21	Hydrant Reconnection	EA	4	$ 2,000	$ 8,000
22	Combination Air Valve	EA	2	$ 1,400	$ 2,800
23	Landscaping	LS	1	$ 1,000	$ 1,000
24	Concrete	LS	1	$ 5,000	$ 5,000
25	Gravel Surfacing	CY	5	$ 15	$ 75
	Total Construction Cost				$ 657,214
	Contingency				$ 98,686
	Engineering				$ 111,700
	Legal/Admin/Finance				$ 46,000
	Total Project Cost				**$ 913,600**

Item	Description	Unit	Quantity	Unit Price	Total
West Side Water Main Upsizing Improvements					
1	Construct Facilities & Temporary Controls	LS	1	$ 128,662	$ 128,662
2	Waterline Demolition & Abandonment	LS	1	$ 57,183	$ 57,183
3	Site Preparation	LS	1	$ 28,592	$ 28,592
4	Foundation Stabilization	CY	100	$ 10	$ 1,000
5	AC Pavement R & R	LF	10950	$ 22	$ 240,900
6	18-inch Waterline, Class C	LF	10850	$ 85	$ 922,250
7	8-Inch Class C	LF	100	$ 55	$ 5,500
8	2" Waterline, Class C	LF	100	$ 45	$ 4,500
9	2" Connections	EA	4	$ 700	$ 2,800
10	1" Service Connections	EA	80	$ 500	$ 40,000
11	1" Service Line @ 20'/conn.	LF	80	$ 100	$ 8,000
12	18" Valves	EA	18	$ 3,800	$ 68,400
13	18" Tees	EA	3	$ 2,180	$ 6,540
14	18" x 18" x 8" Tees	EA	1	$ 2,180	$ 2,180
15	18" x 12" Tees	EA	1	$ 2,180	$ 2,180
16	14" x 14" x 18" Tees	EA	1	$ 2,180	$ 2,180
17	18" 90 Degree Elbow	EA	2	$ 1,450	$ 2,900
18	18" 45 Degree Elbow	EA	6	$ 1,220	$ 7,320
19	18" 45 Degree Wye	EA	1	$ 3,475	$ 3,475
20	18" x 18" x 8" Wye	EA	8	$ 3,475	$ 27,800
21	18" Miscellaneous Fittings	EA	20	$ 2,200	$ 44,000
22	8" Miscellaneous Fittings	EA	20	$ 450	$ 9,000
23	Hydrant Reconnection	EA	3	$ 2,000	$ 6,000
24	Combination Air Valve	EA	3	$ 1,400	$ 4,200
25	Landscaping	LS	1	$ 8,000	$ 8,000
26	Concrete	LS	1	$ 10,000	$ 10,000
27	Gravel Surfacing	CY	30	$ 15	$ 450
	Total Construction Cost				$ 1,644,011
	Contingency				$ 246,689
	Engineering				$ 279,500
	Legal/Admin/Finance				$ 115,000
	Total Project Cost				**$ 2,285,200**

Item	Description	Unit	Quantity	Unit Price	Total
Orenco Water Main Upsizing Improvements					
1	Construct Facilities & Temporary Controls	LS	1	$ 12,063	$ 12,063
2	Waterline Demolition & Abandonment	LS	1	$ 5,361	$ 5,361
3	Site Preparation	LS	1	$ 2,681	$ 2,681
4	Foundation Stabilization	CY	20	$ 10	$ 200
5	AC Pavement R & R	LF	1010	$ 22	$ 22,220
6	12-inch Waterline, Class C	LF	1000	$ 70	$ 70,000
7	8-Inch Class C	LF	10	$ 55	$ 550
8	2" Waterline, Class C	LF	10	$ 45	$ 450
9	2" Connections	EA	2	$ 700	$ 1,400
10	1" Service Connections	EA	15	$ 500	$ 7,500
11	1" Service Line @ 20'/conn.	LF	15	$ 100	$ 1,500
12	12" Valves	EA	3	$ 2,000	$ 6,000
13	12" Tees	EA	1	$ 645	$ 645
14	12" X 8" Tees	EA	1	$ 645	$ 645
15	12" 90 Degree Elbow	EA	1	$ 620	$ 620
16	12" Miscellaneous Fittings	EA	6	$ 650	$ 3,900
17	8" Miscellaneous Fittings	EA	6	$ 450	$ 2,700
18	Combination Air Valve	EA	1	$ 1,400	$ 1,400
19	Hydrant Reconnection	EA	2	$ 2,000	$ 4,000
20	Landscaping	LS	1	$ 5,000	$ 5,000
21	Concrete	LS	1	$ 5,000	$ 5,000
22	Gravel Surfacing	CY	20	$ 15	$ 300
	Total Construction Cost				$ 154,135
	Contingency				$ 23,165
	Engineering				$ 26,200
	Legal/Admin/Finance				$ 10,800
	Total Project Cost				**$ 214,300**

SCADA System Estimate

Item	Description	Unit	Quantity	Unit Price	Total
Phase I - Cooper Creek WTP, Nonpareil WTP, Calapooya Res., Umpqua Res. & Oak Hills Res					
	Equipment				
1	RTUs	EA	1	$ 3,000	$ 3,000
2	MTU	EA	1	$ 4,000	$ 4,000
3	Radios & Antennas (New)	EA	2	$ 2,500	$ 5,000
4	Surge Suppressor & Bulkhead Fittings	LS	1	$ 1,000	$ 1,000
5	Battery Backup	EA	2	$ 800	$ 1,600
6	Enclosures	EA	2	$ 1,000	$ 2,000
7	Level Transmitter	EA	1	$ 3,500	$ 3,500
8	Host Computer	EA	1	$ 1,000	$ 1,000
9	Laptop Computer	EA	1	$ 1,500	$ 1,500
10	Printer	EA	1	$ 300	$ 300
11	Misc. Hardware	LS	1	$ 5,000	$ 5,000
12	Autodialer	EA	1	$ 3,000	$ 3,000
13	Software	LS	1	$ 25,000	$ 25,000
			Subtotal		$ 55,900
	Spare Parts				
1	RTU - Spare Part	EA	1	$ 3,000	$ 3,000
2	MTU - Spare Part	EA	1	$ 4,000	$ 4,000
3	Radio - Spare Part	EA	1	$ 2,500	$ 2,500
			Subtotal		$ 9,500
	Installation				
1	Cost for Radio Installation Sites	EA	2	$ 5,000	$ 10,000
2	Electrical Service to Oak Hills Reservoir	LS	1	$ 25,000	$ 25,000
3	Software Configuration	LS	1	$ 25,000	$ 25,000
			Subtotal		$ 60,000
	Total Construction Cost				$ 125,400
	Contingency @ 20%				$ 25,080
	Engineering				$ 40,000
	Radio Licenses				$ 7,500
	Legal/Admin/Financ @ 7%				$ 8,780
	Total Project Cost				**$ 206,760**

Item	Description	Unit	Quantity	Unit Price	Total
Phase II - Tanglewood Res & PS, N. Umpqua Res. & PS, Ridgewater Tanks, Schon Mt. Tanks & PS					
	Equipment				
1	RTUs	EA	2	$ 3,000	$ 6,000
2	Radios & Antennas (New)	EA	2	$ 2,500	$ 5,000
3	Surge Suppressor & Bulkhead Fittings	LS	1	$ 1,500	$ 1,500
4	Battery Backup	EA	8	$ 800	$ 6,400
5	Enclosures	EA	2	$ 1,000	$ 2,000
6	Level Transmitter	EA	1	$ 3,500	$ 3,500
7	Misc. Hardware	EA	1	$ 3,500	$ 3,500
			Subtotal		$ 27,900
	Installation				
1	Cost for Radio Installation Sites	EA	2	$ 5,000	$ 10,000
2	Electrical Service to Reservoir Sites	LS	2	$ 20,000	$ 40,000
3	Software Configuration	LS	1	$ 20,000	$ 20,000
			Subtotal		$ 70,000
	Total Construction Cost				$ 97,900
	Contingency @ 20%				$ 19,580
	Engineering				$ 35,000
	Radio Licenses				$ 5,000
	Legal/Admin/Financ @ 7%				$ 6,850
	Total Project Cost				**$ 164,330**

Preliminary Construction Cost Estimate - Glass-Fused-to-Steel

9/11/05

Item	Description	Unit	Quantity	Unit Price	Total	Comments
2.3 MG GFTS Reservoir - Phase I						
1	Construction Facilities & Temporary Controls	LS	1	$ 55,700	$ 55,700	Cost w/respect non-tank items
2	2.3 MG GFTS Tank w/ Alum Dome Roof	LS	1	$ 1,000,000	$ 1,000,000	Revised 5/1/06
3	Access Road	LS	1	$ 38,000	$ 38,000	Assume 500 LF new access rd
4	Earthwork/Gravel Surfacing	LS	1	$ 80,000	$ 80,000	
5	Site Piping	LS	1	$ 100,000	$ 100,000	
6	Interior Piping	LS	1	$ 38,000	$ 38,000	
7	Exterior Liquid Level Indicator	LS	1	$ 2,500	$ 2,500	
8	Elec. Liquid Level Indicator	LS	1	$ 3,500	$ 3,500	
9	Handrail	LF	45	$ 63	$ 2,835	
10	Chain Link Fence	LF	1000	$ 25	$ 25,000	
11	16' Double Swing Gate	EA	1	$ 1,500	$ 1,500	
12	Electrical On-site	LS	1	$ 15,000	$ 15,000	
13	Electrical - New Service	LS	1	$ 20,000	$ 20,000	
14	Telemetry	LS	1	$ 15,000	$ 15,000	
15	CMU Building	LS	1	$ 30,000	$ 30,000	
	Total Construction Cost				$ 1,427,035	
	Contingency @ 15%				$ 214,055	
	Engineering @ 20%				$ 285,407	
	Legal, Admin, Financing @ 7%				$ 99,892	
	Geotech Investigations				$ 25,000	
	Real Estate Purchase/Easements				$ 50,000	
	Total Project Cost				$ 2,101,390	

Item	Description	Unit	Quantity	Unit Price	Total	Comments
1.0 MG GFTS Reservoir - Oak Hills Site - Phase II						
1	Construction Facilities & Temporary Controls	LS	1	$ 26,375	$ 26,375	Cost w/respect non-tank items
2	1.0 MG GFTS Tank w/ Alum Dome Roof	LS	1	$ 450,000	$ 450,000	
3	Earthwork/Gravel Surfacing	LS	1	$ 35,000	$ 35,000	
4	Site Piping	LS	1	$ 40,000	$ 40,000	
5	Interior Piping	LS	1	$ 32,000	$ 32,000	
6	Exterior Liquid Level Indicator	LS	1	$ 2,500	$ 2,500	
7	Elec. Liquid Level Indicator	LS	1	$ 3,500	$ 3,500	
8	Handrail	LF	45	$ 63	$ 2,835	
9	Electrical On-site	LS	1	$ 15,000	$ 15,000	
10	Electrical	LS	1	$ -	$ -	Assume service is available
11	Telemetry	LS	1	$ 15,000	$ 15,000	
12	CMU Building	LS	1	$ 30,000	$ 30,000	
	Total Construction Cost				$ 652,210	
	Contingency @ 15%				$ 97,832	
	Engineering @ 20%				$ 130,442	
	Legal, Admin, Financing @ 7%				$ 45,655	
	Geotech Investigations				$ 15,000	
	Real Estate Purchase/Easements				$ -	Existing Oak Hills Tank site
	Total Project Cost				$ 941,139	

Miscellaneous Reservoir Improvements

Item	Description	Unit	Quantity	Unit Price	Total	Comments
Cathodic Protection						
1	Umpqua Tank	LS	1	$ 15,000	$ 15,000	
2	Tanglewood Tank	LS	1	$ 10,000	$ 10,000	
3	Upper Umpqua Tank	LS	1	$ 10,000	$ 10,000	
3	Oak Hills Reservoir	LS	1	$ 5,000	$ 5,000	
3	Ridgewater No. 1 & No. 2	LS	2	$ 10,000	$ 20,000	
5	Schoon Mt No. 1 & No. 2	LS	2	$ 5,000	$ 10,000	
	Total Construction Cost				$ 70,000	
	Contingency @ 15%				$ 10,500	
	Engineering				$ 22,000	
	Legal, Admin, Financing @ 7%				$ 4,900	
	Total Project Cost				$ 107,400	

Item	Description	Unit	Quantity	Unit Price	Total
Tank Reconditioning					
1	North Umpqua Tank				
	Exterior	SF	2270	$ 5	$ 11,350
	Interior	SF	2940	$ 15	$ 44,100
				Subtotal	$ 55,450
2	Ridgewater No. 1				
	Exterior	SF	1287	$ 5	$ 6,435
	Interior	SF	1450	$ 15	$ 21,750
				Subtotal	$ 28,185
	Total Construction Cost				$ 83,635
	Contingency @ 15%				$ 12,545
	Engineering				$ 25,000
	Legal, Admin, Financing @ 7%				$ 5,854
	Total Project Cost				$ 127,035

Miscellaneous Improvements

Item	Description	Unit	Quantity	Unit Price	Total	Comments
1	Ridgewater Tanks					
	Seismic Chairs & Bolts on Tank No. 1	LS	1	3000	$ 3,000	
	New Level Gauge on Tank No. 1	LS	1	$ 1,500.00	$ 1,500	
	Ladder Cage Cover for Tank No. 2	LS	1	$ 500	$ 500	
	Additional Coating of Bolts on Tank No. 2	LS	1	$ 300	$ 300	
	Total Construction Cost				$ 5,300	
	Contingency @ 15%				$ 795	
	Engineering Review & Investigation				$ 5,000	Structural for seismic bolts
	Legal, Admin, Financing @ 7%				$ 371	
	Total Project Cost				$ 11,466	

Item	Description	Unit	Quantity	Unit Price	Total
Cooper Creek Multiple Level Intake Upgrade					
1	Construct Facilities & Temporary Controls	LS	1	$ 9,514	$ 9,514
2	Mobilitzation/Demobilization	LS	1	$ 4,229	$ 4,229
3	Site Preparation	LS	1	$ 2,114	$ 2,114
4	1.5" Stainless Rod for Control Stems	LF	225	$ 10	$ 2,250
5	Schedule 80 PVC for Casing Stainless Rod	LF	225	$ 5	$ 1,125
6	PVC Casing Supports	EA	60	$ 5	$ 300
7	16" Class 54 Ductile Iron Pipe for Intake	EA	100	$ 30	$ 3,000
8	16" D.I. Elbows	EA	4	$ 1,500	$ 6,000
9	16" D.I. Tees	LF	4	$ 2,200	$ 8,800
10	16" Valves	EA	3	$ 3,800	$ 11,400
11	Electric Actuator	EA	3	$ 5,000	$ 15,000
12	Control Box	LS	1	$ 6,000	$ 6,000
13	Concrete Intake Supports	EA	15	$ 400	$ 6,000
14	Boat, Barge, Crane and Other Equipment (per day)	EA	14	$ 360	$ 5,040
15	Diving Contractor Services (3-Man Team, per day)	EA	11	$ 2,700	$ 29,700
16	Diving Contractor Services (5-Man Team, per day)	EA	3	$ 3,700	$ 11,100
	Total Construction Cost				$ 121,572
	Contingency				$ 18,228
	Engineering				$ 24,300
	Legal/Admin/Finance				$ 8,500
	Total Project Cost				**$ 172,600**

Item	Description	Unit	Quantity	Unit Price	Total
New Reservoir Piping to Distribution System					
Duke Road Reservoir - Phase 2					
1	Construct Facilities & Temporary Controls	LS	1	$ 39,147	$ 39,147
2	Site Preparation	LS	1	$ 26,098	$ 26,098
3	Foundation Stabilization	CY	100	$ 30	$ 3,000
4	Electrical / Controls	LS	1	$ 5,000	$ 5,000
5	AC Pavement R & R	LF	3450	$ 22	$ 75,900
6	18-inch Waterline, Class C	LF	3400	$ 85	$ 289,000
7	18" Valves	EA	4	$ 3,800	$ 15,200
8	18" x 14" x 12" Tee	EA	1	$ 2,180	$ 2,180
9	18" 90 Degree Elbow	EA	2	$ 1,450	$ 2,900
10	18" 45 Degree Elbow	EA	4	$ 1,220	$ 4,880
11	18" Wye	EA	1	$ 3,475	$ 3,475
12	18" Miscellaneous Fittings	EA	6	$ 2,200	$ 13,200
13	8-Inch Class C	LF	50	$ 45	$ 2,250
14	2" Waterline, Class C	LF	4	$ 45	$ 180
15	2" Connections	EA	4	$ 700	$ 2,800
16	1" Service Connections	EA	25	$ 500	$ 12,500
17	1" Service Line @ 20'/conn.	LF	25	$ 100	$ 2,500
	Total Construction Cost				$ 500,210
	Contingency				$ 75,090
	Engineering				$ 85,000
	Legal/Admin/Finance				$ 35,000
	Total Project Cost				**$ 695,300**

Item	Description	Unit	Quantity	Unit Price	Total
Foster Avenue Looping Improvements					
1	Construct Facilities & Temporary Controls	LS	1	$ 11,232	$ 11,232
2	Waterline Demolition & Abandonment	LS	1	$ 4,992	$ 4,992
3	Site Preparation	LS	1	$ 2,496	$ 2,496
4	Foundation Stabilization	CY	10	$ 10	$ 100
5	AC Pavement R & R	LF	1000	$ 22	$ 22,000
6	8-Inch Waterline, Class B	LF	600	$ 45	$ 27,000
7	8-inch Waterline, Class C	LF	1000	$ 55	$ 55,000
8	2" Waterline, Class C	LF	10	$ 45	$ 450
9	2" Connections	EA	2	$ 700	$ 1,400
10	1" Service Connections	EA	10	$ 500	$ 5,000
11	1" Service Line @ 20'/conn.	LF	10	$ 100	$ 1,000
12	8" Valves	EA	1	$ 1,500	$ 1,500
13	8" 90 Degree Elbow	EA	1	$ 500	$ 500
14	8" 45 Degree Elbow	EA	2	$ 450	$ 900
15	8" Miscellaneous Fittings	EA	4	$ 450	$ 1,800
16	Hydrant Reconnection	EA	2	$ 2,000	$ 4,000
17	Landscaping	LS	1	$ 2,000	$ 2,000
18	Concrete	LS	1	$ 2,000	$ 2,000
19	Gravel Surfacing	CY	10	$ 15	$ 150
	Total Construction Cost				$ 143,520
	Contingency				$ 21,530
	Engineering				$ 24,400
	Legal. Admin./Finance				$ 10,050
	Total Project Cost				**$ 199,500**

Item	Description	Unit	Quantity	Unit Price	Total
Nonpareil Miscellaneous Upgrades and Repairs					
1	Construct Facilities & Temporary Controls	LS	1	$ 49,667	$ 49,667
2	Site Preparation	LS	1	$ 33,111	$ 33,111
3	New Underdrain & Filter Media	LS	1	$ 110,000	$ 110,000
4	Blower, Piping & Installation	LS	1	$ 60,000	$ 60,000
5	Intake Magnetic Meter	EA	1	$ 5,000	$ 5,000
6	Grout	CY	8	$ 100	$ 800
7	Control System Upgrade	LS	1	$ 187,000	$ 187,000
8	Sodium Hypochlorite Generation (2-Hypo 20)	LS	1	$ 60,000	$ 60,000
9	Sandblasting & Repainting	LS	1	$ 22,000	$ 22,000
10	Pressure Grouting per Foot (Contact Clarifier)	EA	250	$ 63	$ 15,750
11	Electric Actuators	EA	8	$ 3,888	$ 31,104
12	Butterfly Valves	EA	8	$ 3,888	$ 31,104
13	4-20mA Sending Receiving Equipment	LS	8	$ 1,300	$ 10,400
14	Air Compressor System Upgrade	LS	1	$ 12,050	$ 12,050
15	Existing Compressor Trade-in Allowance	LS	1	$ (1,250)	$ (1,250)
16	10" D.I. Pipe	EA	40	$ 80	$ 3,200
17	10" D.I. Tees	EA	6	$ 300	$ 1,800
18	10" D.I. 45 Degree Elbows	EA	4	$ 200	$ 800
19	10" D.I. 90 Degree Elbows	EA	2	$ 300	$ 600
20	Gravel Surfacing	CY	50	$ 30	$ 1,500
	Total Construction Cost				$ 634,637
	Contingency				$ 95,200
	Engineering				$ 107,700
	Legal/Admin/Finance				$ 44,463
	Total Project Cost				$ 882,000

Item	Description	Unit	Quantity	Unit Price	Total
Nonpareil New Backwash Pond					
1	Construct Facilities & Temporary Controls	LS	1	$ 23,544	$ 23,544
2	Site Preparation	LS	1	$ 15,696	$ 15,696
3	Foundation Stabilization	CY	30	$ 30	$ 900
4	Drains & Associated Materials	LS	1	$ 10,000	$ 10,000
5	Site Piping	LS	1	$ 5,000	$ 5,000
6	Concrete	CY	375	$ 600	$ 225,000
7	Aggregate Base	CY	440	$ 30	$ 13,200
8	Electrical / Controls	LS	1	$ 7,500	$ 7,500
	Total Construction Cost				$ 300,840
	Contingency				$ 45,160
	Engineering				$ 51,000
	Legal/Admin/Finance				$ 21,000
	Total Project Cost			**Total**	**$ 418,000**

Item	Description	Unit	Quantity	Unit Price	Total
New Reservoir Piping to Distribution System					
Sherwood Street Reservoir					
1	Construct Facilities & Temporary Controls	LS	1	$ 24,861	$ 24,861
2	Site Preparation	LS	1	$ 16,574	$ 16,574
3	Foundation Stabilization	CY	30	$ 30	$ 900
4	Electrical / Controls	LS	1	$ 2,000	$ 2,000
5	AC Pavement R & R	LF	2030	$ 22	$ 44,660
6	14-Inch Waterline, Class B	LF	500	$ 65	$ 32,500
7	14-inch Waterline, Class C	LF	2000	$ 75	$ 150,000
8	14" Valves	EA	5	$ 2,500	$ 12,500
9	14" Tees	EA	1	$ 1,115	$ 1,115
11	14" Cross	EA	3	$ 1,380	$ 4,140
12	14" 90 Degree Elbow	EA	2	$ 810	$ 1,620
13	14' 45 Degree Elbow	EA	2	$ 700	$ 1,400
14	14" Miscellaneous Fittings	EA	6	$ 1,150	$ 6,900
15	8-inch Class C	LF	30	$ 55	$ 1,650
16	2" Waterline, Class C	LF	30	$ 45	$ 1,350
17	2" Connections	EA	5	$ 700	$ 3,500
18	1" Service Connections	EA	20	$ 500	$ 10,000
19	1" Service Line @ 20'/conn.	LF	20	$ 100	$ 2,000
	Total Construction Cost				$ 317,670
	Contingency				$ 47,630
	Engineering				$ 54,000
	Legal/Admin/Finance				$ 22,200
	Total Project Cost				**$ 441,500**

Item	Description	Unit	Quantity	Unit Price	Total
City of Oakland Water System Tie-in					
1	Construct Facilities & Temporary Controls	LS	1	$ 24,984	$ 24,984
2	Waterline Demolition & Abandonment	LS	1	$ 11,104	$ 11,104
3	Site Preparation	LS	1	$ 5,552	$ 5,552
4	Foundation Stabilization	CY	50	$ 10	$ 500
5	AC Pavement R & R	LF	3000	$ 22	$ 66,000
6	8-inch Waterline, Class C	LF	3000	$ 55	$ 165,000
12	8" Valves	EA	6	$ 1,500	$ 9,000
13	8" Tees	EA	1	$ 500	$ 500
15	8" 90 Degree Elbow	EA	3	$ 500	$ 1,500
15	8" 45 Degree Elbow	EA	4	$ 450	$ 1,800
16	8" Miscellaneous Fittings	EA	10	$ 450	$ 4,500
8	2" Waterline, Class C	LF	1	$ 45	$ 45
9	2" Connections	EA	1	$ 700	$ 700
10	1" Service Connections	EA	1	$ 500	$ 500
11	1" Service Line @ 20'/conn.	LF	1	$ 100	$ 100
19	New Hydrant & Connection	EA	3	$ 3,500	$ 10,500
18	Hydrant Reconnection	EA	1	$ 2,000	$ 2,000
19	Combination Air Valve	EA	3	$ 1,400	$ 4,200
20	Landscaping	LS	1	$ 5,000	$ 5,000
21	Concrete	LS	1	$ 5,000	$ 5,000
22	Gravel Surfacing	CY	50	$ 15	$ 750
	Total Construction Cost				$ 319,234
	Contingency				$ 47,966
	Engineering				$ 54,300
	Legal/Admin/Finance				$ 22,400
	Total Project Cost				**$ 443,900**

Preliminary Construction Cost Estimate - Glass-Fused-to-Steel

Item	Description	Unit	Quantity	Unit Price	Total	Comments
0.5 MG GFTS Reservoir - Umpqua Site - Phase III						
1	Construction Facilities & Temporary Controls	LS	1	$ 21,875	$ 21,875	Cost w/respect non-tank items
2	0.5 MG GFTS Tank w/ Alum Dome Roof	LS	1	$ 350,000	$ 350,000	
3	Earthwork/Gravel Surfacing	LS	1	$ 35,000	$ 35,000	
4	Site Piping	LS	1	$ 40,000	$ 40,000	
5	Interior Piping	LS	1	$ 32,000	$ 32,000	
6	Exterior Liquid Level Indicator	LS	1	$ 2,500	$ 2,500	
7	Elec. Liquid Level Indicator	LS	1	$ 3,500	$ 3,500	
8	Handrail	LF	45	$ 63	$ 2,835	
9	Electrical On-site	LS	1	$ 15,000	$ 15,000	
10	Electrical	LS	1	$ -	$ -	Service is available
11	Telemetry	LS	1	$ 15,000	$ 15,000	
	Total Construction Cost				$ 517,710	
	Contingency @ 15%				$ 77,657	
	Engineering @ 20%				$ 103,542	
	Legal, Admin, Financing @ 7%				$ 36,240	
	Geotech Investigations				$ 15,000	
	Real Estate Purchase/Easements				$ -	Existing Umpqua Tank site
	Total Project Cost				$ 750,149	

Item	Description	Unit	Quantity	Unit Price	Total	Comments
2.0 MG GFTS Reservoir - Northeast Site - Phase III						
1	Construction Facilities & Temporary Controls	LS	1	$ 55,700	$ 55,700	Cost w/respect non-tank items
2	1.0 MG GFTS Tank w/ Alum Dome Roof	LS	1	$ 850,000	$ 850,000	
3	Earthwork/Gravel Surfacing	LS	1	$ 80,000	$ 80,000	
4	Access Road	LS	1	$ 38,000	$ 38,000	Assume 500 LF new access rd
5	Site Piping	LS	1	$ 100,000	$ 100,000	
6	Interior Piping	LS	1	$ 38,000	$ 38,000	
7	Exterior Liquid Level Indicator	LS	1	$ 2,500	$ 2,500	
8	Elec. Liquid Level Indicator	LS	1	$ 3,500	$ 3,500	
9	Handrail	LF	45	$ 63	$ 2,835	
10	Chain Link Fence	LF	1000	$ 25	$ 25,000	
11	16' Double Swing Gate	EA	1	$ 1,500	$ 1,500	
12	Electrical On-site	LS	1	$ 15,000	$ 15,000	
13	Electrical	LS	1	$ 20,000	$ 20,000	
14	CMU Building	LS	1	$ 30,000	$ 30,000	
15	Telemetry	LS	1	$ 15,000	$ 15,000	
	Total Construction Cost				$ 1,277,035	
	Contingency @ 15%				$ 191,555	
	Engineering @ 20%				$ 255,407	
	Legal, Admin, Financing @ 7%				$ 89,392	
	Geotech Investigations				$ 25,000	
	Real Estate Purchase/Easements				$ 50,000	
	Total Project Cost				$ 1,888,390	

Appendix G – Comments

Appendix

G

Comments

G-1 Comments From Local Goverments (OAR 690-085-120/125)

Per OAR 690-085-120, a municipal water supplier shall make available for review by each affected local government along with a request for comments relating to the consistency with the local government's comprehensive land use plan. The plan shall be made available with a request for comments at least 30 days prior to submitting a draft plan to the Oregon Department of Water Resources. The Water Management and Conservation Plan submitted to the Department by a municipal water supplier shall include a list of the affected local governments to whom the draft plan was made available pursuant to OAR 690-085-0120 and a copy of any comments on the plan provided by the local governments (OAR 690-085-125(5)). A summary of the affected local governments contacted by commenting on the City's Water Management and Conservation Plan (WMCP) is presented in Table G-1. A sample copy of the letter sent to these local governments is provided at the end of this section.

TABLE G-1. LOCAL GOVERNMENTS CONTACTED ABOUT COMMENTS ON THE CITY'S WMCP

Local Government	Contact	Date Sent	Comments Received
City of Roseburg	Clay Baumgartner	9/15/05	None
Cow Creek Band of Umpqua Indians	Ron Doan, General Manager	9/15/05	None
City of Oakland	Planning Commission	9/15/05	None
Douglas County Planning Commission	Keith Cubic	9/15/05	10/04/05 Letter from Stephanie Morgan, Planner, see attached
Umpqua Basin Water Association	Noel Groshong, General Manager	9/15/05	None
Sutherlin Water Control District	Blair Nash, District Manager	9/15/05	None
Union Gap Water District	Kim	9/15/05	None

Only one comment has been received from these local governments. The Douglas County Planning Department wrote in their October 4, 2005 letter that the Department had reviewed the draft copy of the Plan and has no objections at this time. A copy of this letter is provided at the end of this section.

G-2 Comments From State Agencies

Draft copies of this Water Master Plan dated August 2005 were sent to the Oregon Department of Human Services, Drinking Water Program and to the Oregon Department of Water Resources.

A copy of the Plan was sent to the Drinking Water Program in December 2005 for review and approval of the Master Plan.

A copy was sent to the Department of Water Resources in December 2005 for review and approval of the City's Water Management and Conservation Plan presented in Sections 9 through 11, Appendix B, C, E and this section. Comments received from the Department of Water Resources are included at the end of this appendix section along with a response to these comments and a summary of revisions made to the Plan.

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.

September 15, 2005

Sutherlin Water Control District
P.O. Box 1167
Sutherlin, OR 97479

Attn: Blair Nash, District Manager

RE: Draft Water Management and Conservation Plan
City of Sutherlin
Project No. 146.01/03

Dear Blair:

On behalf of the City of Sutherlin, we are submitting a draft copy of the City's Water Management and Conservation Plan (Sections 9, 10, and 11, and Appendix E of the City's draft Water Master Plan) for your agency's review and comment. This draft of the Water Management and Conservation Plan is being provided to your agency in accordance with OAR 690-086-0120(8), which states that a ..."municipal water provider shall make available for review by each affected local government along with a request for comments relating to consistency with the local government's comprehensive land use plan". We respectively request your comments on this draft Plan. Please submit your comments to Mr. David Jepsen PE, The Dyer Partnership Engineers & Planners, Inc., 1330 Teakwood Avenue, Coos Bay, OR 97420 by October 5, 2005.

If you have any questions or comments about the City's draft Water Management and Conservation Plan, please contact me.

Sincerely,
THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.

David Jepsen

David Jepsen PE

cc: Bud Schmidt, City of Sutherlin

1330 TEAKWOOD AVENUE
COOS BAY, OREGON 97420
TELEPHONE: (541) 269-0732
FAX: (541) 269-2044

146.01

DOUGLAS COUNTY

PLANNING DEPARTMENT

Room 106, Justice Building
Douglas County Courthouse, Roseburg, Oregon 97470
(541) 440-4289 / Fax (541) 440-6266

RECEIVED
OCT 06 2005

October 4, 2005

David Jepsen, PE
The Dyer Partnership Engineers & Planners, Inc.
1330 Teakwood Avenue
Coos Bay, OR 97420

RE: Draft Water Management and Conservation Plan
City of Sutherlin
Project No. 146.01/03

Dear Mr. Jepsen,

The Douglas County Planning Department has reviewed the City of Sutherlin's draft copy of the City's Water Management and Conservation Plan. The Douglas County Planning Department has no objections at this time.

Sincerely,

Stephanie Morgan
Planner

cc: Phil Stenbeck, Senior Planner

Oregon
Theodore R. Kulongoski, Governor

Department of Human Services
Drinking Water Program
2860 State Street
Medford, OR 97504
(541) 776-6229 ext. 284
Fax (541) 776-6013

RECEIVED
JAN 1 7 2006

January 12, 2006

Dave Jepsen, P.E.
The Dyer Partnership
1330 Teakwood Ave.
Coos Bay, OR 97420

RE: Plan Review #327-2005 / Approval

Dear Dave:

We have received a draft copy dated August 2005 of the **Water Master Plan for the City of Sutherlin**. The $250 plan review fee was received separately.

We note that this plan examines the current condition of the City's water system, predicts future demands based on projected population increases and required fire flows, offers recommendations as to how best meet these demands, and examines funding alternatives for these projects. Specifically, we note the following:

Raw Water Sources: The Non-Pariel and Cooper Creek sources will continue to provide water to the City. Additional water may be acquired through full development of water rights on the North Umpqua River, and with the possible connection to the Umpqua Basin Water Association for purchase of treated water.

Water Treatment: We agree that major improvements or plant replacement are needed at the Cooper Creek plant in order to increase capacity and effectively treat the iron and manganese problem. The existing water right at this location might then be better utilized.

Storage: The report recommends that an additional 3.0 MG of storage be provided within the next 20 years, and the Plat M Road property is suggested as a site for one or two tanks.

Distribution: A phased Capital Improvement Plan is presented which addresses the needs of the water distribution system, particularly those involving fire flow requirements and the demands of future growth.

Financing: Alternatives are presented for the financing of the recommended improvements. Water rates, SDC's, and loans appear to be the most likely funding sources. As noted in the report, the City is not likely to qualify for State revolving loan fund monies because there are no health risk or compliance issues.

We also note that Water Management, Conservation, and Curtailment Plans are included in this document. We support these policies as they directly relate to the availability of drinking water for the City.

We find that this document meets the requirements for public water system Master Plans as specified in OAR 333-061-0060 (5), and it is approved.

Thank you for submitting this plan for our review.

Sincerely,

Scott G. Curry, P.E.
Regional Engineer
Drinking Water Program

cc: City of Sutherlin

Dave Jepsen

Oregon

Theodore R. Kulongoski, Governor

Water Resources Department
North Mall Office Building
725 Summer Street NE, Suite A
Salem, OR 97301-1266
503-986-0900
FAX 503-986-0904

April 12, 2006

RECEIVED
APR 14 2006

Bud Schmidt
City of Sutherlin
126 E Central
Sutherlin, OR 97479

SUBJECT: Water Management and Conservation Plan

Dear Mr. Schmidt:

Our Department has completed a review of Sutherlin's water management and conservation plan submitted on December 30, 2005.

Pursuant to OAR 690-086-0905 [2002], the Department published notice of the availability of the plan for review on January 3, 2006. No public comments were received during the 30-day public comment period.

Overall, the City's plan was very good and includes most of the elements required by OAR 690-086 [2002]. Our main concern about the plan revolves around the schedule for development of the North Umpqua River permit, more analysis and proactive language is needed. If the City intends to apply for an additional extension of time for any of permits under OAR 690 315, you should be aware that the date for the WMCP in the conditions of that extension may result in a different deadline than one resulting from this review. The results of our review are provided in the attached worksheet.

There are two alternatives available to the City in response to this review. The City may choose to:

1. Identify information in the draft plan that we may have missed that would alter the results of the review and provide a basis for concluding that the plan is fully consistent with OAR Chapter 690, Division 86 [2002].

2. Modify the draft plan to address the deficiencies identified in the attached comments and worksheet. An addendum letter would suffice.

Please notify us by July 15, 2006 of the alternative you wish to pursue or if you would like additional time to evaluate these alternatives. If you select to modify your plan under Alternative 2, please indicate the date by which you can submit the additional information. If you do not notify us by August 15, 2006 of the alternative you wish to pursue, we will issue a proposed final order on your water management and conservation plan as we understand it now

We appreciate your cooperation in this effort and your commitment to water management and conservation. If you have any questions, please do not hesitate to contact me at 503-986-0887.

Regards,

Bill

Bill Fujii, NRS III
Field Services Division

Enclosure

Cc Dave Jepsen – Dyer Partnership

Water Resources Department
Municipal Water Management and Conservation Plan Review Worksheet
(OAR Chapter 690, Division 086 – 2002)

Supplier:	Sutherlin
Reviewer:	Fujii
Date:	4/12/2006
Public Notice	Jan 3, 06
Complete	Dec 30, 05

OAR 690-086-0140 – Water Supplier Description	
(1) A description of the supplier's source(s) of water; including diversion, storage and regulation facilities; exchange agreements; intergovernmental cooperation agreements; and water supply or delivery contracts;	page 9-6, 9-8 also see page 3-6 through 3-8 acceptable
(2) A delineation of the current service areas and an estimate of the population served and a description of the methodology(ies) used to make the estimate;	page 9-8, table 9.2.1, 9.2.2 acceptable
(3) An assessment of the adequacy and reliability of the existing water supply considering potential limitations on continued or expanded use under existing water rights resulting from existing and potential future restrictions on the community's water supply;	The discussion related to the 1978 water right on page 9-5 should include somewhat simpler language. This water right faces almost annual regulation. Readers should also see page 8-1 figure 8.1.1 includes a foot note related to priority date Calapooya Creek of instream right.
(4) A quantification of the water delivered by the water supplier that identifies current and available historic average annual water use, peak seasonal use, and average and peak day use;	table 9.2.3, page 9-6,appendix C did not find peak day
(5) A tabular list of water rights held by the municipal water supplier that includes the following information:	
(a) Application, permit, transfer, and certificate numbers (as applicable);	page 9-6, 9-7, table 9.2.4 acceptable
(b) Priority date(s);	page 9-7, table 9.2.4 acceptable
(c) Source(s) of water;	page 9-7, table 9.2.4 acceptable
(d) Type(s) of beneficial uses specified in the right;	page 9-7, table 9.2.4 acceptable
(e) Maximum instantaneous and annual quantity of water allowed under each right;	page 9-7, table 9.2.4 acceptable
(f) Maximum instantaneous and annual quantity of water diverted under each right to date;	page 9-7, table 9.2.4 acceptable

(5) If the supplier proposes to expand or initiate diversion of water under an extended permit for which resource issues have been identified under OAR 690-086-0140(5)(i), a description of the specific activities, along with a schedule that establishes five-year benchmarks, for implementation of:	
(a) A system-wide leak repair or line replacement program to reduce system leakage to no more than 15 percent or sufficient information to demonstrate that system leakage currently is no more than 15 percent.	page 9-17 acceptable
(6) If the supplier serves a population greater than 1,000 and proposes to expand or initiate diversion of water under an extended permit for which resource issues have been identified under OAR 690-086-0140(5)(i), or if the supplier serves a population greater than 7,500, a description of the specific activities, along with a schedule that establishes five-year benchmarks, for implementation of each of the following measures; or documentation showing that implementation of the measures is neither feasible nor appropriate for ensuring the efficient use of water and the prevention of waste:	
(a) A system-wide leak repair program or line replacement to reduce system leakage to 15 percent, and if the reduction of system leakage to 15 percent is found to be feasible and appropriate, to reduce system leakage to 10 percent;	page 9-18 acceptable
(b) Technical and financial assistance programs to encourage and aid residential, commercial and industrial customers in implementation of conservation measures;	page 9-18 could use more details
(c) Supplier financed retrofitting or replacement of existing inefficient water using fixtures, including distribution of residential conservation kits and rebates for customer investments in water conservation;	page 9-21 needs more description
(d) Adoption of rate structures, billing schedules, and other associated programs that support and encourage water conservation;	page 9-23 acceptable
(e) Water reuse, recycling, and non-potable water opportunities; and	Page 9-11 reclaimed water used on 95 acre golf course also see page 9-23. The lack of details on the water reuse in the water treatment process needs more description. Water quality concerns should be analyzed on a cost benefit basis.
(f) Any other conservation measures identified by the water supplier that would improve water use efficiency.	page 9-24
OAR 690-086-0160 – Municipal Water Curtailment Element	
(1) A description of the type, frequency and magnitude of supply deficiencies within the past 10 years and current capacity limitation. The description shall include an assessment of the ability of the water supplier to maintain delivery during long-term drought or other source shortages caused by a natural disaster, source contamination, legal restrictions on water use, or other circumstances;	page 10-1, 10-2 also see page 9-5 acceptable

(2) A list of three or more stages of alert for potential shortage or water service difficulties. The stages shall range from a potential or mild alert, increasing through a serious situation to a critical emergency;	Section 10.3 four stages identified acceptable
(3) A description of pre-determined levels of severity of shortage or water service difficulties that will trigger the curtailment actions under each stage of alert to provide the greatest assurance of maintaining potable supplies for human consumption; and	Section 10.4 acceptable
(4) A list of specific standby water use curtailment actions for each stage of alert ranging from notice to the public of a potential alert, increasing through limiting nonessential water use, to rationing and/or loss of service at the critical alert stage.	Section 10.5 acceptable
OAR 690-086-0170 – Municipal Water Supply Element	
(1) A delineation of the current and future service areas consistent with state land use law that includes available data on population projections and anticipated development consistent with relevant acknowledged comprehensive land use plans and urban service agreements or other relevant growth projections;	page 11-1 Douglas County has had an opportunity to review the growth projections being discussed. This aspect of the plan would be strengthened by an estimate in acres of the size of the current city limits and the acreage of the potential annexations within the UGB.
(2) An estimated schedule that identifies when the water supplier expects to fully exercise each of the water rights and water use permits currently held by the supplier;	page 11-8 – given the 2009 deadline on the North Umpqua source, this aspect of the plan needs to be strengthened through out the plan.
(3) Based on the information in (1), an estimate of the water supplier's water demand projections for 10 and 20 years, and at the option of the municipal water supplier, longer periods;	page11-2
(4) A comparison of the projected water needs and the sources of water currently available to the municipal water supplier and to any other suppliers to be served considering the reliability of existing sources;	It appears that the assumption of participation in the conservation programs is 5%. This seems like a conservative estimate. Given the nature of the estimates, it seems the reliability should score higher and therefore the cost effectiveness should rate higher.
(5) If any expansion or initial diversion of water allocated under existing permits is necessary to meet the needs shown in (3), an analysis of alternative sources of water that considers availability, reliability, feasibility and likely environmental impacts. The analysis shall consider the extent to which the projected water needs can be satisfied through:	
(a) Implementation of conservation measures identified under OAR 690-086-0150;	Initiation of Water Conservation Benchmark tasks are item number one of seventeen on project implementation summary table 13.6.1 on page 13-16

(b) Interconnection with other municipal supply systems and cooperative regional water management; and	Extension of North Umpqua permit with additional point of diversion and relationship with the Umpqua Basin Water Association discussed on page 13-15
(c) Any other conservation measures that would provide water at a cost that is equal to or lower than the cost of other identified sources.	not found, needs more details.
(6) If any expansion or initial diversion of water allocated under existing permits is necessary to meet the needs shown in (3), a quantification of the maximum rate and monthly volume of water to be diverted under each of the permits;	page 11-6 needs more description
(7) For any expansion or initial diversion of water under existing permits, a description of mitigation actions the water supplier is taking to comply with legal requirements including but not limited to the Endangered Species Act, Clean Water Act, Safe Drinking Water Act; and	Initiation of Water Conservation Benchmark tasks are item number one of seventeen on project implementation summary table 13.6.1 on page 13-16 page 11-9 needs more description
(8) If acquisition of new water rights will be necessary within the next 20 years to meet the needs shown in (3), an analysis of alternative sources of the additional water that considers availability, reliability, feasibility and likely environmental impacts and a schedule for development of the new sources of water. The analysis shall consider the extent to which the need for new water rights can be eliminated through:	
(a) Implementation of conservation measures identified under OAR 690-086-0150;	not found, needs more details
(b) Interconnection with other municipal supply systems and cooperative regional water management; and	No new water right proposed but extension of North Umpqua permit with additional point of diversion and relationship with the Umpqua Basin Water Association discussed on page 13-15
(c) Any other conservation measures that would provide water at a cost that is equal to or lower than the cost of other identified sources.	not found, needs more details
OAR 690-086-0125 – Additional Requirements	
(5) A list of the affected local governments to whom the draft plan was made available pursuant to 0120(6) and a copy of any comments on the plan provided by the local governments;	Appendix G-1 Acceptable
(6) A proposed date for submittal of an updated plan within no more than 10 years based on the proposed schedule for implementation of conservation measures, any relevant schedules for other community planning activities, and the rate of growth or other changes expected by the water supplier; or an explanation of why submittal of an updated plan is unnecessary and should not be required by the Department; and	Ten years for update would be acceptable if all other discrepancies are dealt with.

(7) If the municipal water supplier is requesting additional time to implement metering as required under OAR 690-086-0150(4)(b) or a benchmark established in a previously approved plan, documentation showing additional time is necessary to avoid unreasonable and excessive costs.	NA

February 7, 2003 - dp

Response to Water Resources Department's Comments on the City of Sutherlin's Water Master Plan (Draft, August 2005)
May 5, 2006

Based on Municipal Water Management and Conservation Plan Review Worksheet

1. ***Page 1 of Worksheet, OAR 690-086-0140(3) - Discussion on Page 9-5 should have simpler language and references to Figure 8.1.1.***

The text has been modified as requested.

2. ***Page 1 of worksheet, OAR 690-086-140 (4) - Did not find peak day***

Peak day is equivalent to MDD (maximum daily demand), which is shown in Table 9.2.3, Page 9-6.

3. ***Page 2 of worksheet, OAR 690-086-140(g, h) – reference is not given to which Appendix. It should be made more clear that the North Umpqua option could be connected to the upgrades at Umpqua Basin Water Association.***

The correct reference is Appendix C – this modification has been made. A footnote indicating the City's proposed plan to divert, treat and convey water from North Umpqua River at the facilities of Umpqua Basin Water Association.

4. ***Page 2 of worksheet, OAR 690-086-140(7) – needs more detail on relationship with Umpqua Basin Water Association.***

The text was expanded to include information on the City and Umpqua Basin Water Association's relationship.

5. ***Page 2 of worksheet, OAR 690-086-140 (9) – not found, needs more details; Page 3, OAR 690-086-150(4a) more description, (4b) needs more detail, & 4(e) needs more detail.***

For 150(4a) - Additional text was added to state that the City does not know what the system losses due to the lack of water audits and unmetered uses. Reference has been added to proposed elements in water conservation plan and to the conservation benchmarks.

For 150(4b) – A schedule was compiled and shown in the text for the meter installation and meter readings at the specified locations.

For 150(4e) – Additional text was added to that stated once audits are performed and additional meters are added, the City should have a better handle on system losses and need for leak detection.

6. ***Page 3 of worksheet, OAR 690-086-150 (4f) – expand on this section.***

Discussion on public education has been expanded to include more sources of information and references.

7. ***Page 4 of worksheet, OAR 690-086-150(6b) – could use more details***

Additional details on the technical and financial assistance programs were added to the text. Significant revisions were performed on the rebate program text and calculations. The water savings period was increased to 10 years and the rebates were increased to $150 each for the toilet rebate and front-loading clothes washer to better reflect actual costs and encourage participation. The end result is that the total water savings is substantially higher and the cost per acre-feet was reduced. These new results were also used to modify Table 11.5.1.

8. ***Page 4, OAR 690-086-150(6c) – needs more description***

Additional description about the proposed retrofit/replacement program was provided in the text. Costs for the program were revised to $30 per unit so as to include additional retrofit devices and also revised as an error was found in the spreadsheet calculations. The net result was that this program cost significantly less than shown in the draft report. Our recommendation is for the City to still conduct a survey in order to tailor their selection of the most appropriate retrofit devices to the public.

9. ***Page 4, OAR 690-086-150 (e) – The lack of details on the water reuse in the water treatment process needs more description. Water quality concerns should be analyzed on a cost benefit basis.***

The text from Section 8.1 on the WTP backwash was copied over and included under this section to provide a more complete discussion on the WTP backwash.

Additional investigations are recommended to determine the feasibility of using this source and to address concerns of City staff. We are not sure whether a cost benefit basis would be entirely helpful at this point. Based on the results presented in Table 11.5.1, the WTP Backwash Water Recycle appears to be very cost-effective. However, issues revolving around the proposed recycle of the WTP Backwash Water Recycle are more about the finished potable water quality being sent out from the WTPs than cost-effectiveness.

10. ***Page 5 of worksheet, OAR 690-086-170(1) – The aspect of the growth projections would be strengthened by an estimate in acres of the size of the current city limits and the acreage of the potential annexations within the UGB.***

A discussion of the number of potential dwelling units that could result from the annexation of land on the west side of town was added to the text. Based on City's staff's preliminary assessment, approximately 1,538 new dwelling units (equivalent to approximately 3,500 people could result from the potential annexation of property adjacent to the City's west UGB boundary. City will be considering annexation of approximately 217 acres (approximate 6 percent increase in the UGB) at its May 2006 Council meeting.

11. ***Page 5 of worksheet, OAR 690-086-170 (2) – page 11-8 – given the 2009 deadline on the North Umpqua source, this aspect of the plan needs to be strengthened throughout the plan.***

We have attempted to strength this section and other sections by providing additional information on the importance and timing of the Cooper Creek WTP improvements and development of the water rights on the North Umpqua River, recent construction work completed by Umpqua Basin to handle the future City water flows, and the City's negotiations for payment of the constructed improvements. We believe the City's payment for the Umpqua Basin Improvements demonstrates its intentions to proceed with development of the North Umpqua River water rights.

12. ***Page 5 of worksheet, OAR 690-086-170 (4) – it is assumed that the level of participation in the conservation programs is 5 %. This seems like a conservative estimate.***

We have revisited and revised our water conservation calculations by looking at a 10-year period (5 years of rebates and 10 years of savings), and increasing the offered rebates to better reflect the cost of toilets and front-end washers. With these modifications, the water conservation measures appear to be more viable than shown in the draft report. We have also shown the basis of our calculations in Table 11.5.1 for these items to make it easier on the reader.

13. ***Page 6 of worksheet, OAR 690-086-170 (5c) – not found, needs more detail.***

Text dealing with this OAR requirement has been added to the report.

14. ***Page 6 of worksheet, OAR 690-086-170 (6) – page 11-6 needs more description***

Additional information has been added to the text in relation the basis for quantification of the maximum rate and monthly volume of water. Some of the information was revised due to the reassessment of the calculated values.

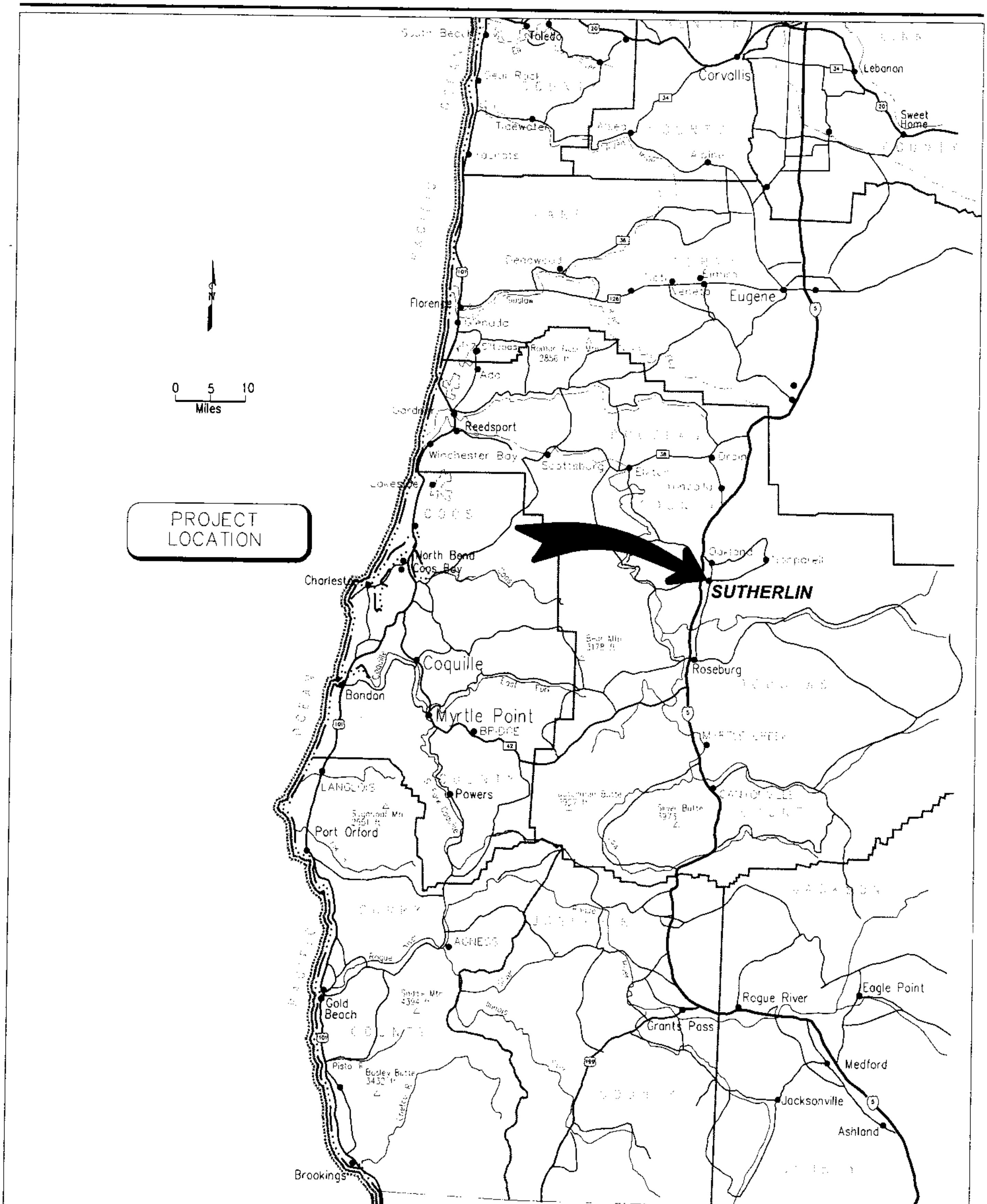
15. ***Page 6 of worksheet, OAR 690-086-170(7) – page 11-9 needs more description***

The text was modified to indicate that the proposed water diversion at Umpqua Basin Water Association's point of diversion should comply with the Department of Water Resources condition with respect to fish screens since the existing screens will be utilized.

A new Section 11.10 (Summary of Water Supply Benchmarks) has been added to the text to summarize the City's needed actions or benchmarks for water supply. Within this section, Table 11.10.1 provides a summary of these benchmarks.

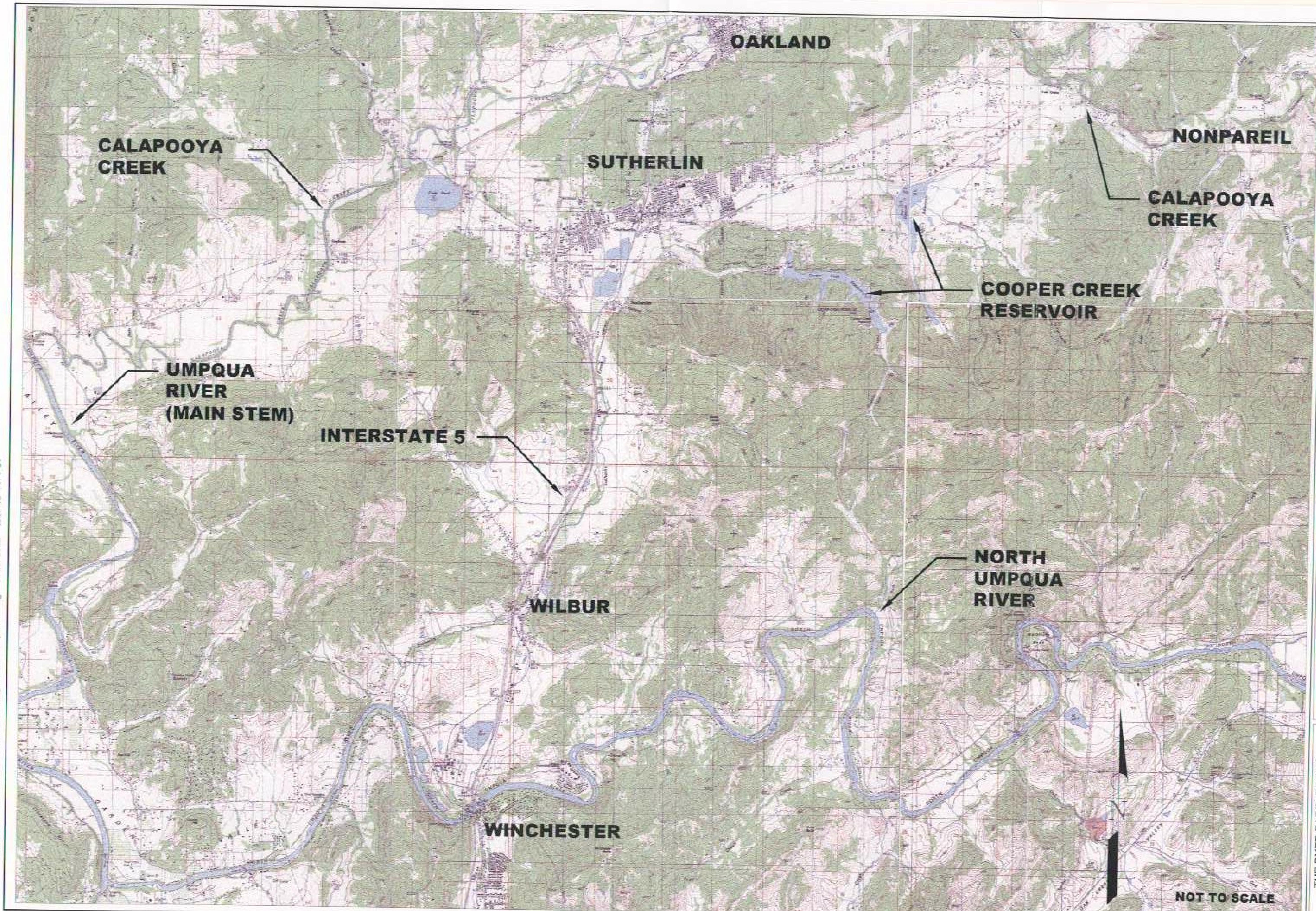
16. ***Page 6 of worksheet, OAR 690-086-170 (8a,c) – not found, needs more detail***

In our analysis, we do not show the City needing acquisition of new water rights. Therefore, we did not address the items in this subsection as we did not think it pertains to the City. Text has been added to address this point in the revised Plan (see Section 11.9)



\\Dyer\projects\01Active\146.03\dwg\LOC-MAP.dwg 8/30/2005 10:17:45 AM PST

THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	CITY OF SUTHERLIN WATER MASTER PLAN	FIGURE NO.
DATE: SEPTEMBER, 2005	LOCATION MAP	3.1.1
PROJECT NO.: 146.03		



\\Dyer\projects\0Active\146.03\dwg\USGSStudyArea.dwg 8/30/2005 10:17:45 AM PST

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS
DATE: SEPTEMBER, 2005
PROJECT NO.: 146.03

CITY OF SUTHERLIN
WATER MASTER PLAN
STUDY AREA MAP

FIGURE NO.
3.1.2

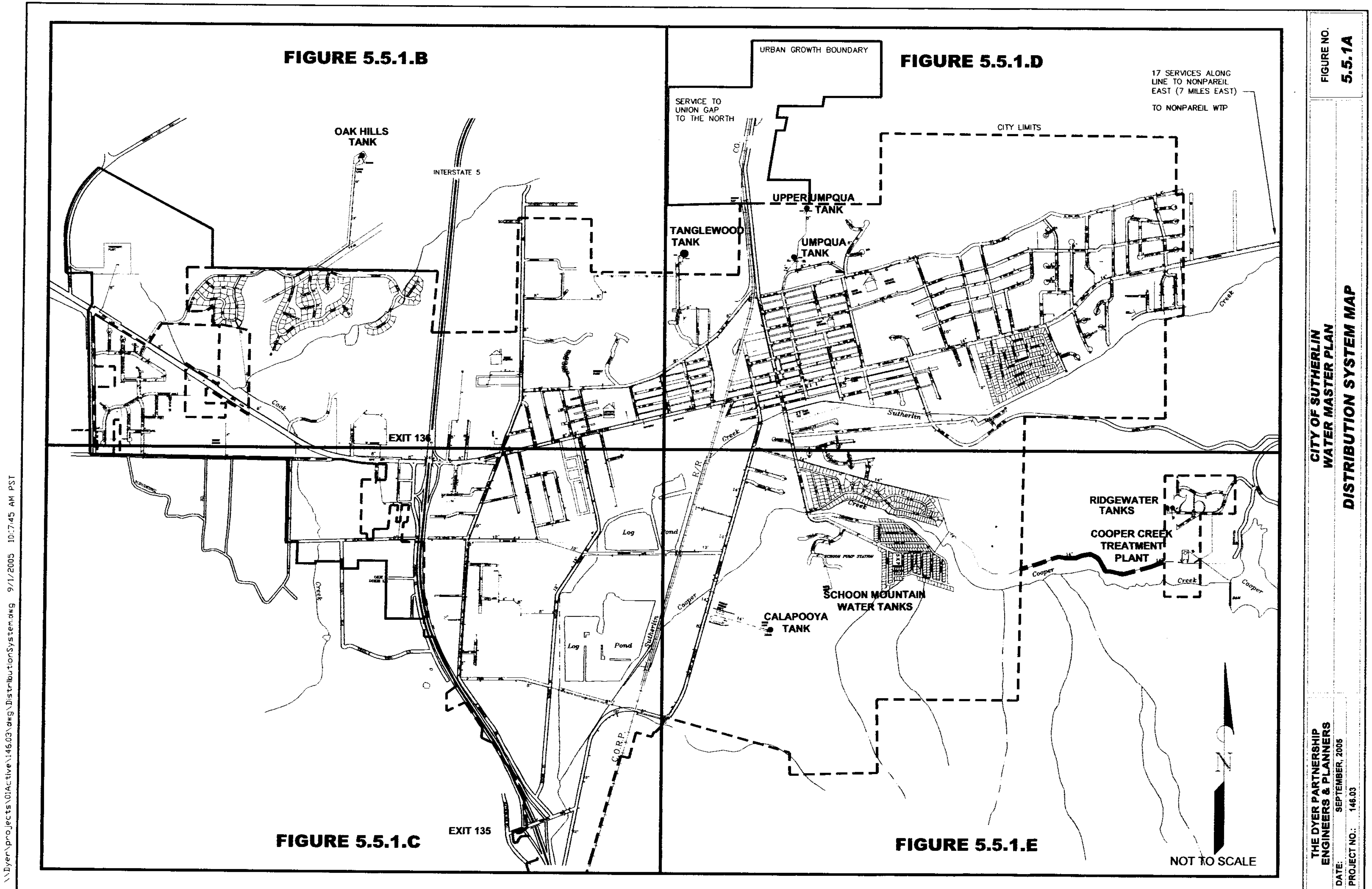
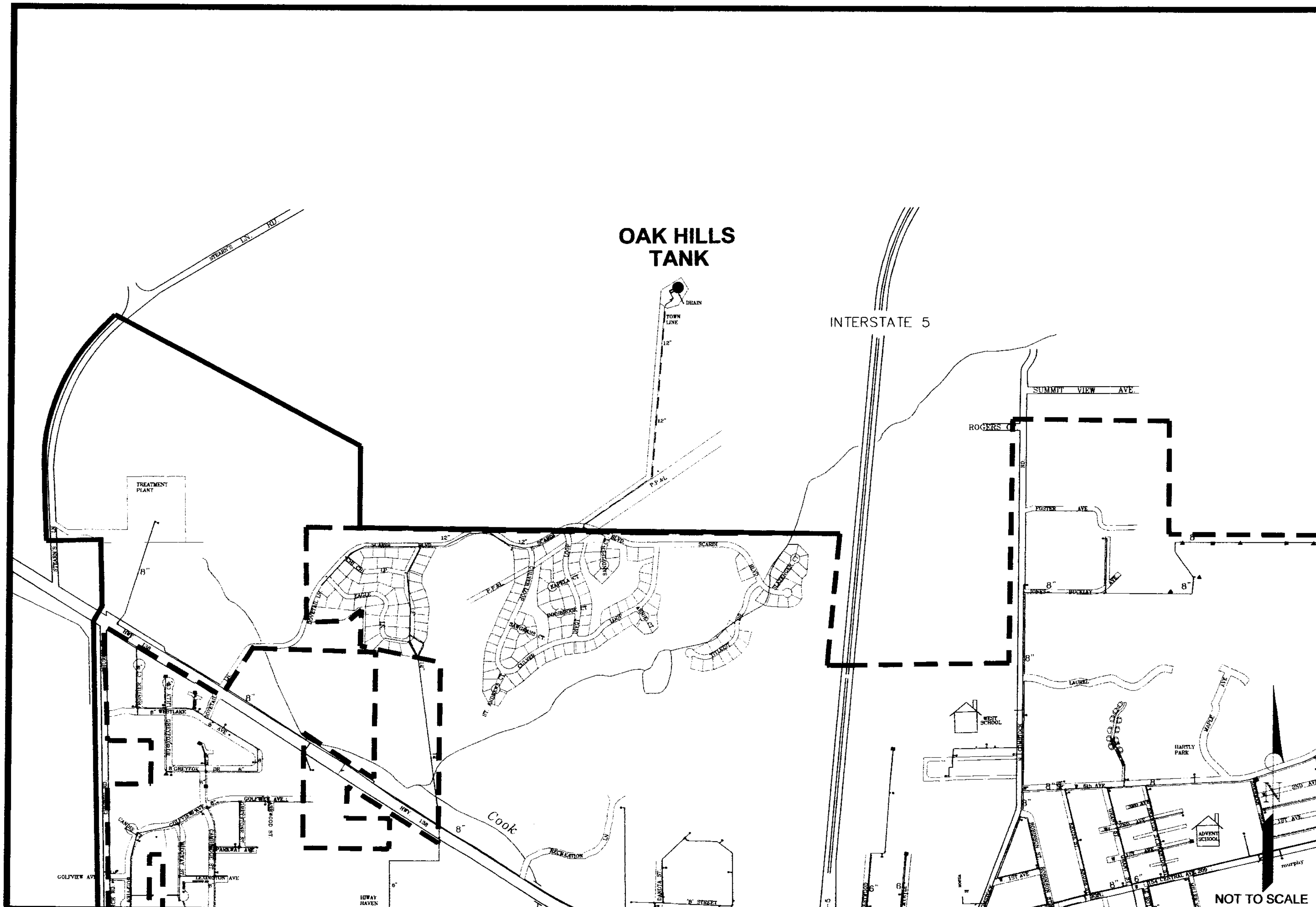


FIGURE 5.5.1.B
FIGURE 5.5.1.C
FIGURE 5.5.1.D
FIGURE 5.5.1.E
OAK HILLS TANK
INTERSTATE 5
EXIT 136
EXIT 135
URBAN GROWTH BOUNDARY
SERVICE TO UNION GAP TO THE NORTH
17 SERVICES ALONG LINE TO NONPAREIL EAST (7 MILES EAST)
TO NONPAREIL WTP
CITY LIMITS
UPPER UMPQUA TANK
TANGLEWOOD TANK
UMPQUA TANK
RIDGEWATER TANKS
COOPER CREEK TREATMENT PLANT
SCHOON MOUNTAIN WATER TANKS
CALAPOOYA TANK
Cook
Sutherlin
Creek
Cooper
Log
Pond
R/R
C.O.R.P.
NOT TO SCALE
N
\\Dyer\projects\01Active\146.03\dwg\DistributionSystem.dwg 9/1/2005 10:7:45 AM PST
FIGURE NO.
5.5.1A
CITY OF SUTHERLIN
WATER MASTER PLAN
DISTRIBUTION SYSTEM MAP
THE DYER PARTNERSHIP
ENGINEERS & PLANNERS
DATE: SEPTEMBER, 2005
PROJECT NO.: 146.03



CITY OF SUTHERLIN
WATER MASTER PLAN

DISTRIBUTION SYSTEM MAP

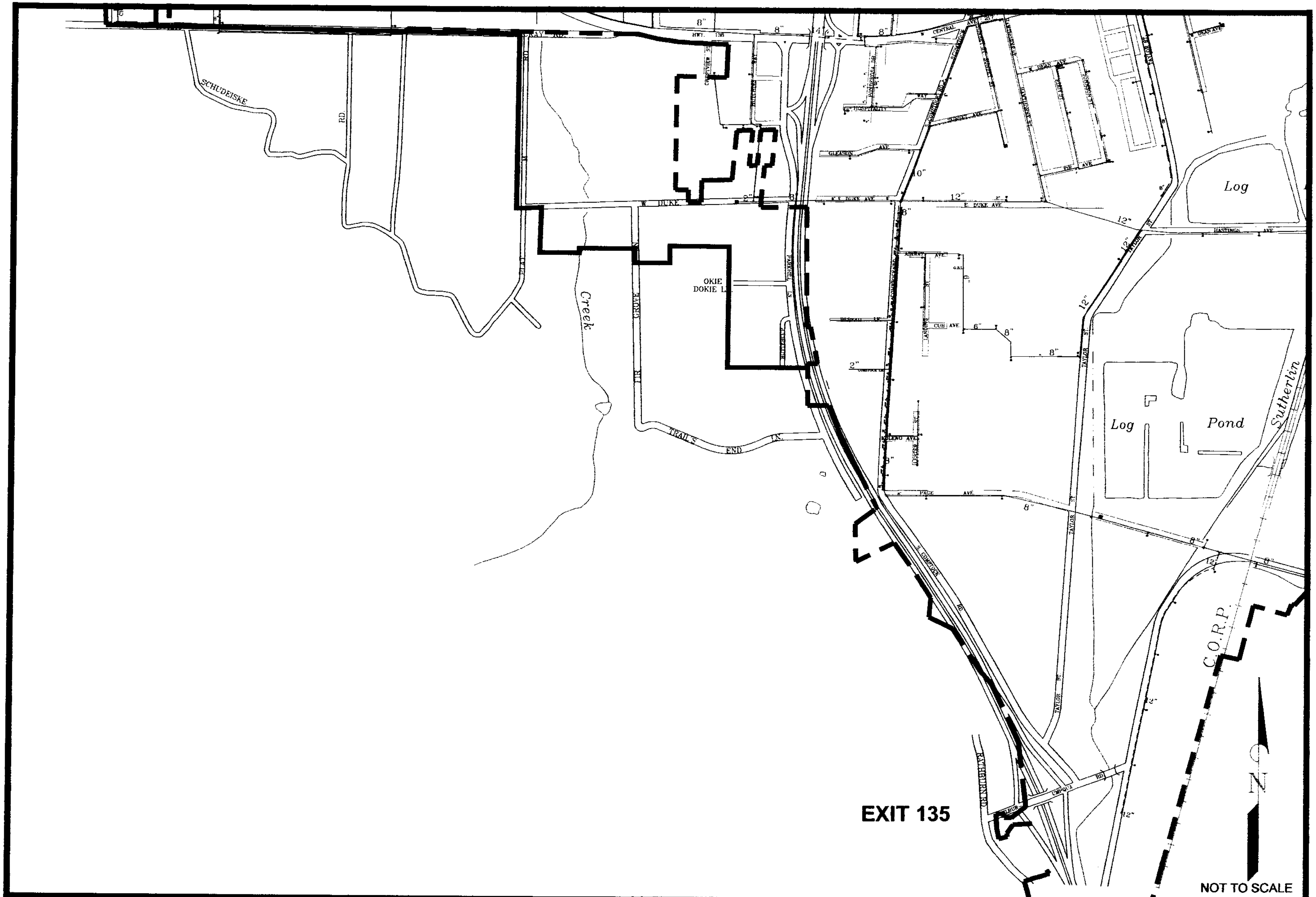
FIGURE NO. **5.5.1B**

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS

DATE: SEPTEMBER, 2005

PROJECT NO.: 146.03

\\Dyer\projects\01Active\146.03\dwg\DistributionSystem.dwg 9/1/2005 10:17:45 AM PST



\\Dyer\projects\01Active\146.03\dwg\DistributionSystem.dwg 9/1/2005 10:7:45 AM PST

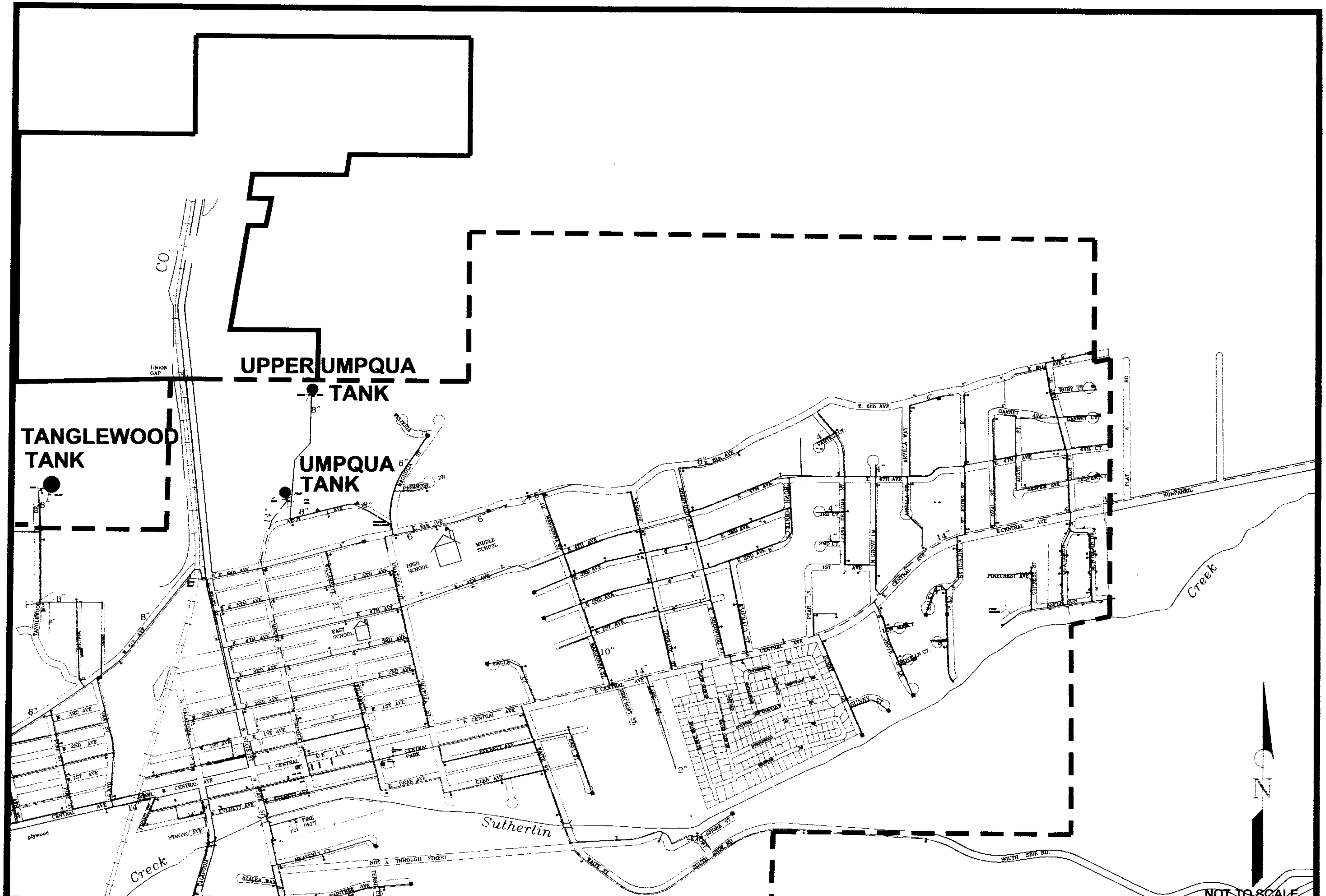
CITY OF SUTHERLIN
WATER MASTER PLAN

DISTRIBUTION SYSTEM MAP

FIGURE NO.
5.5.1C

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS

DATE: SEPTEMBER, 2005
PROJECT NO.: 146.03



\\Dyer\projects\01Active\146.03\dwg\DistributionSystem.dwg 9/1/2005 10:17:45 AM PST

CITY OF SUTHERLIN
WATER MASTER PLAN

DISTRIBUTION SYSTEM MAP

FIGURE NO.
5.5.1D

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS
DATE: SEPTEMBER, 2005
PROJECT NO.: 146.03

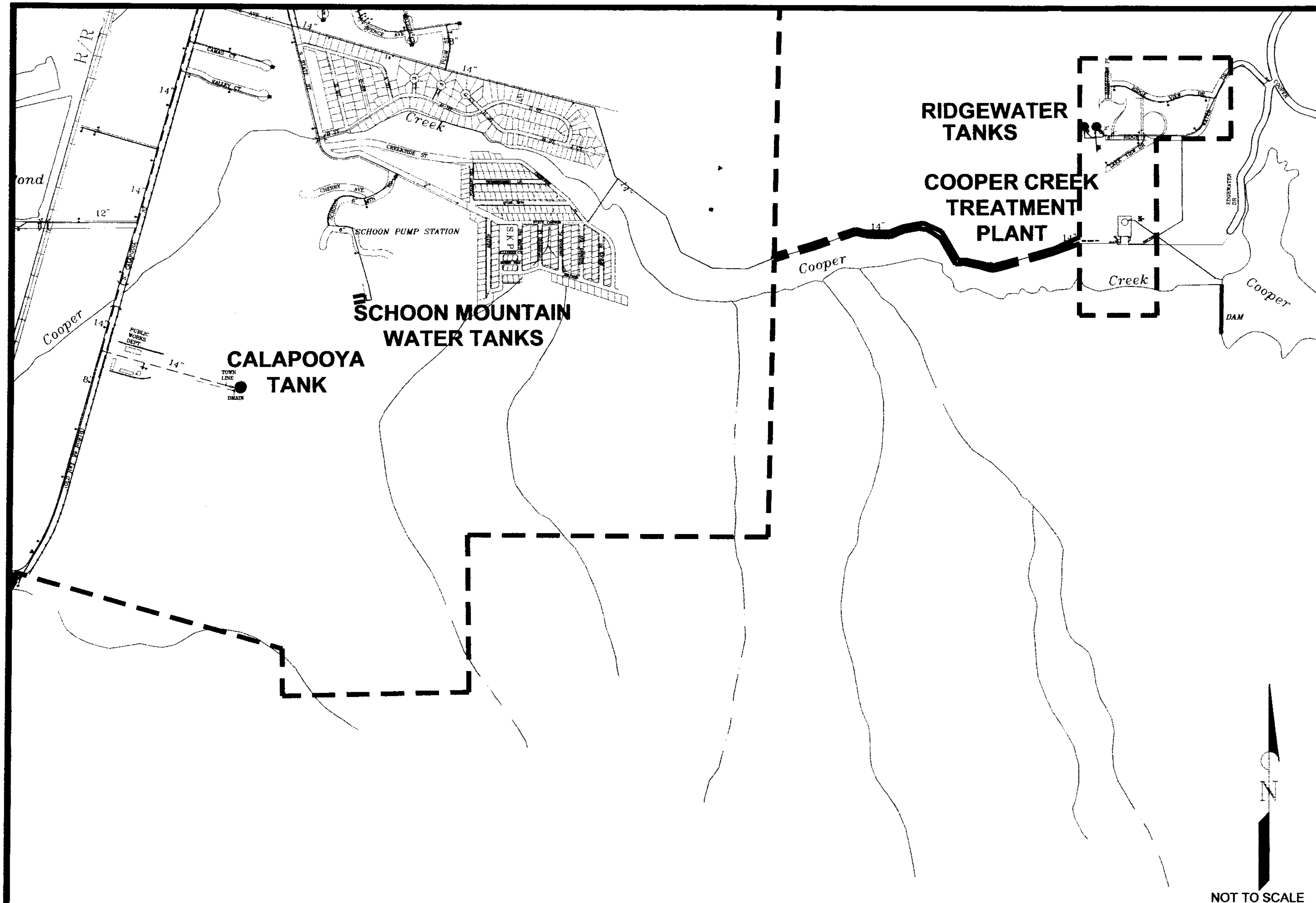


FIGURE NO.
5.5.1E

CITY OF SUTHERLIN
WATER MASTER PLAN
DISTRIBUTION SYSTEM MAP

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS
DATE: SEPTEMBER, 2005
PROJECT NO.: 146.03

\\Dyer\projects\01Active\146.03\dwg\DistributionSystem.dwg 9/1/2005 10:17:45 AM PST

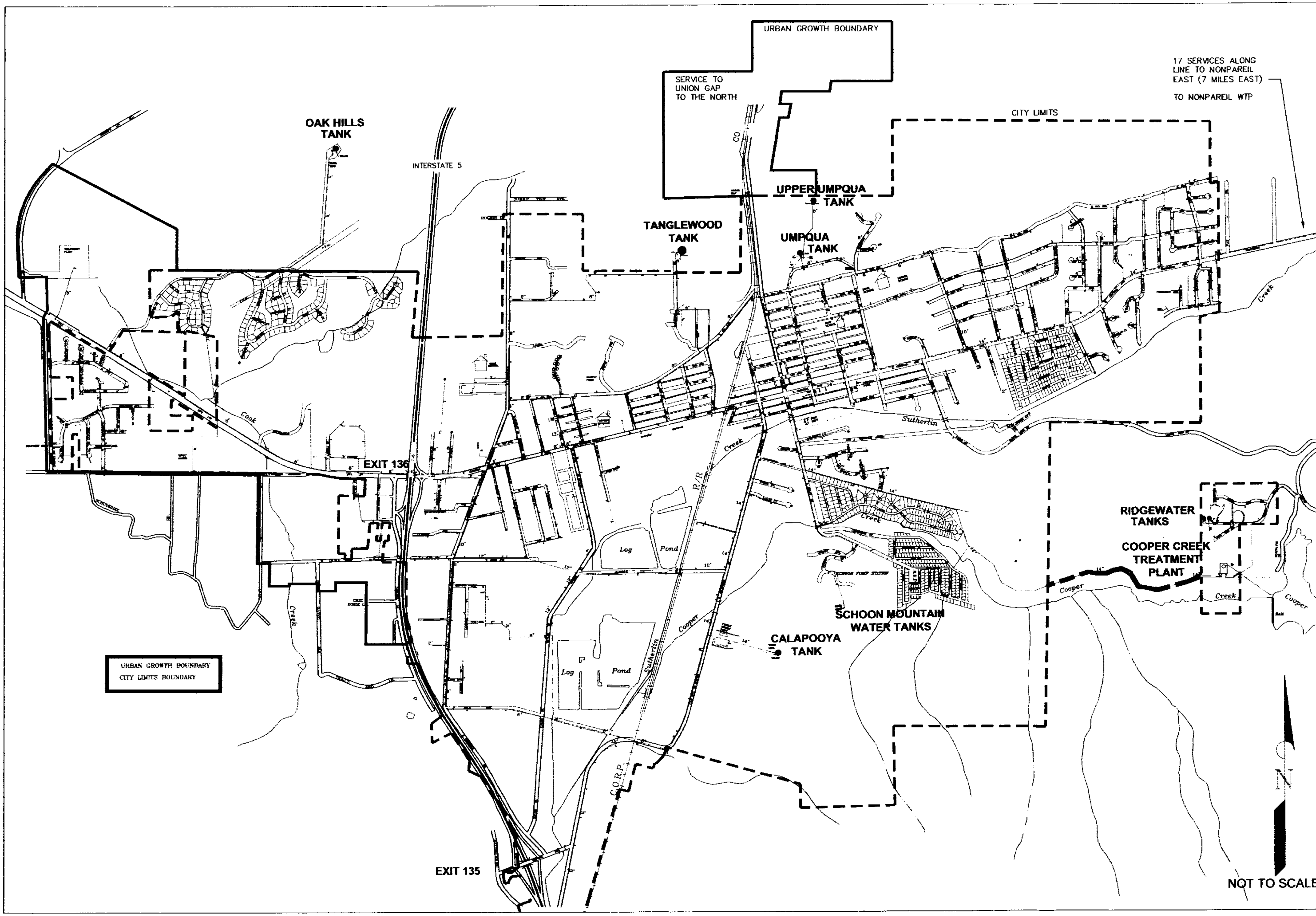


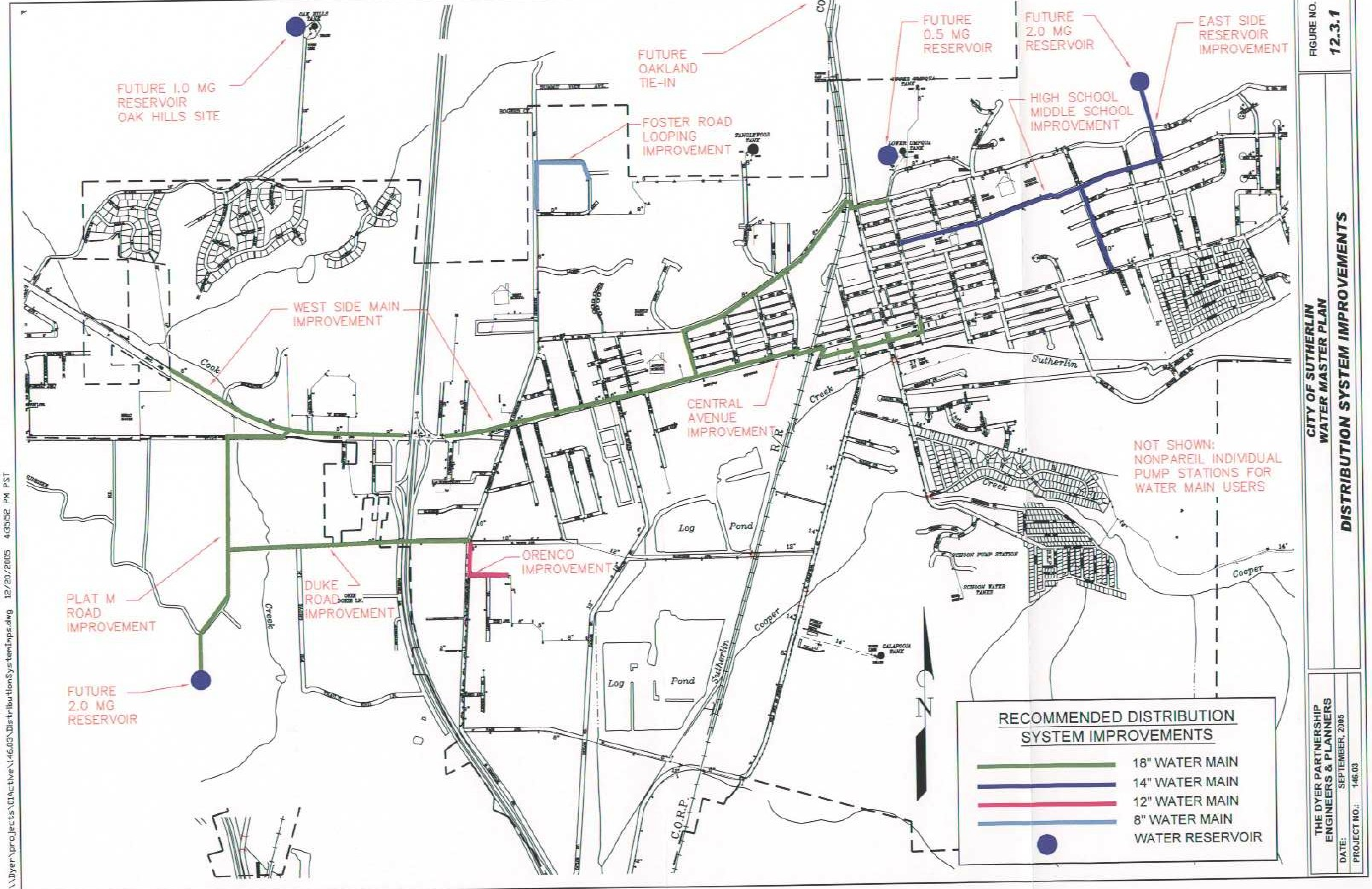
FIGURE NO. **9.2.1**

CITY OF SUTHERLIN
WATER MASTER PLAN
WATER SERVICE AREA

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS

DATE: SEPTEMBER, 2005
PROJECT NO.: 146.03

\\Dyer\projects\01Active\146.03\dwg\ServiceArea.dwg 9/1/2005 10:17:45 AM PST



\\Dyer\projects\01Active\146.03\DistributionSystemImps.dwg 12/20/2005 4:35:52 PM PST