WATER SYSTEM

MASTER PLAN, PHILOMATH, OREGON

Final Draft
August, 2005

Prepared for:

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WESTECH
AUG 02 2005
RECEIVED

July 29, 2005

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Re: City of Philomath Master Plan, PR #103-2005

Dear Mr Brugato:

We have received the water system master plan draft. The plan deals with water supply for Philomath through the year 2029. This plan adequately meets the requirements for a water system Master Plan, OAR 333-061-0060(5).

Please submit a copy of the final plan when complete.

If you have any questions please call me at the above number. If you would like this information in an alternate format, please contact Marsha Fox at (503) 731-4899.

Sincerely,

Tom Charbonneau, P.E.
Department of Human Services
Drinking Water Program

cc: Karen Kelley, Department of Human Services
John Potts, Department of Human Services

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FOREWORD

USING THIS REPORT

Because this report will be used by many people whose needs for detailed information will differ widely, an Executive Summary has been included at the beginning of this report. This executive summary contains a summary and overview that briefly describes the content and main conclusions of the report. Thus, readers may gain a good general understanding of the direction of the report and its contents by reading the Executive Summary. If a reader wishes to explore the subject in greater detail, the appropriate section in the text can be consulted. Each section has also been generally organized so as to move from the general to the specific.

EXECUTIVE SUMMARY

INTRODUCTION

This Water System Master Plan provides recommendations and a master plan for water production, treatment, distribution and storage within the City of Philomath. The City's previous planning effort was completed in 1984 and included recommendations based on 20-year projections. As such, the previous planning document is outdated and a new master plan is needed.

The City's current development standards require findings that adequate capacity is available in the utility systems prior to development occurring. Without a current water system master plan which identifies area-wide improvements required with a schedule guiding their construction, implementation of these policies is difficult. Without a community wide understanding of how the water system works and how development within the community impacts its performance, it is difficult at best to determine what improvements to the water system are necessary to facilitate new development.

PROJECT OBJECTIVES

The purpose of this study is to evaluate the City's water system with respect to its existing and future needs, identify improvements and associated costs necessary to meet those needs, and provide the City with a design guide for future growth of the City's water system. It is intended that the information contained herein assist the City in the planning and implementation of capital improvements to the water system, as well as ongoing system maintenance.

This evaluation and master plan accomplishes the following specific objectives:

- Maps the existing water system based on field data collection and as-built drawings.
- Identifies current and future water system deficiencies on a prioritized basis
- Provides an evaluation of the options for correcting these deficiencies with preliminary construction cost estimates for recommended alternatives.
- Provides the City with a Water System Master Plan which addresses concerns of both the City and regulating authorities.
- Provide specific recommendations to the community and City Council for action.

BACKGROUND INFORMATION

Philomath's original water system was designed to distribute water from Corvallis' Rock Creek Facility. For many years all water for Philomath's system was purchased from Corvallis. As demand due to population growth in the Corvallis-Philomath area increased beyond the capacity of the Rock Creek facility, both Corvallis and Philomath began to seek alternate water sources. Corvallis constructed the Taylor Water Treatment Plant and now draws most of its water from the Willamette River. In the 1970's Philomath drilled two municipal wells. For a time, these wells served as the primary water source for the City. Due to quality problems in the wells and the rising costs of purchasing water from Corvallis, the City of Philomath decided to construct a new water treatment facility and use the Marys River as its primary source.

The City currently obtains municipal drinking water from two sources. These are the Marys River and the 11th Street well. Water from the Marys River is withdrawn and treated at the City's water treatment plant (WTP) constructed in 1985. The 11th Street well was developed in 1977. The Marys River serves as the City's primary water source and the 11th Street well is used primarily as a backup source.

Storage is provided in a 1.25 million-gallon cast-in-place concrete reservoir that was constructed in 1994. The reservoir is located atop Neabeack hill on the east end of the City. Most of the City's transmission and distribution piping is constructed of cast iron, ductile iron, and PVC pipe. While there are some 12 and 16-inch transmission lines capable of delivering major fire flows, the majority of the distribution system piping is 6 and 8-inches in size. A detailed description of the existing facilities is included in **Section 4**. The major components of the water system are shown in **Figure 4-1**. Detailed water system maps are included in **Appendix A**. A schematic representation of the water system is presented in **Figure 4-2.**

BASIS FOR MASTER PLANNING

As the City continues to grow and as the existing facilities continue to age, improvement will be required. However, haphazard improvements that do not adequately consider all of the issues that impact the system may end up costing the City more in the long run than well thought-out, carefully-applied solutions. For example, if a particular water line is too small to deliver adequate quantities of water for fighting fires in the surrounding area, a logical solution is to replace the pipe with a larger pipe. However, if the larger pipe is sized only to accommodate the existing conditions with no considerations for growth in the surounding area, the pipe size may need to be increased a second time to accommodate the increases in demand resulting from population growth. Instead of replacing the pipe twice, a more cost-effective solution is to replace the pipe once with a pipe sized to accommodate the existing conditions plus the anticipated future growth. As this example illustrates, some water facilities cannot be expanded incrementally to accommodate growth. More often that not, the most cost effective solution is to initially size the facilities to accommodate anticipated growth within the planning period. Therefore, this Master Plan not only considers the existing deficiencies, but also considers what improvements are going to be required during the planning period as the City grows and develops. The intent of the recommendations proposed in the plan is to provide the City with reliable water facilities that not only meet current demands, but that will also adequately serve the City well into the future.

The Oregon Health Division (OHD) recommends a minimum 20-year planning period for master planning. This planning period begins once the construction of the required improvements is completed. The intent of this approach is to construct improvements that have minimum design life of 20-years. Based on the project schedule outlined in **Section 7**, the construction of the first phase of the recommended improvements should be completed during the 2009 calendar year. Based on a 20-year planning period, the recommended improvements are expected to serve the City's needs until 2029. In order to assess the City's needs in the year 2029, population growth projections must be made to determine future wastewater flows and loads. Based on historic population trends, the projected population in 2029 is approximately 7,365 (see **Section 2**). Projected water demands are based, in part, on this population. The improvements recommended in this plan are based on development of land within the UGB in its present location, as well as the existing land use zoning for these areas. It is assumed that no significant development will occur within the study area that will require major changes to the existing zoning, and that there will be no significant expansions of the UGB within the study period. Changes in any of these assumptions could change the recommendations contained in this plan. Should significant changes in any of the above occur, the master plan should be updated accordingly.

Section 5 discusses the evaluation of the historical water use rates, then projects these patterns into the future to provide a basis for sizing treatment, pumping, and distribution facilities. The projected demands were determined based on a number of variables including the following.

- Rate of projected population increases.
- Land use zoning within the study area.
- Projected per capita flowrates.
- Projected fireflow demand.

Philomath's current (2002) water demand is as follows:

• Population	4,100	
• Average Daily Demand	488,000 gallons/day	119 gallons/capita/day
• Maximum Month Demand	763,000 gallons/day	186 gallons/capita/day
• Maximum Day Demand	1,005,000 gallons/day	245 gallons/capita/day

Projecting the per capita flows to 2029, the demands are as follows:

• Population	7,365
• Average Daily Demand	876,000 gallons/day
• Maximum Month Demand	1,370,000 gallons/day
• Maximum Day Demand	1,804,000 gallons/day

Fire flows are based on the flowrates required to provide adequate fire protection to various sizes and types of structures anticipated in a given zone. The City's Public Works Design Standards contains recommendations fire flowrates and duration. These are listed as follows.

- Residential Single Family — 1,000 gpm for 2 hours
- Residential Multi-Family — 2,500 gpm for 2 hours
- Commercial — 3,500 gpm for 3 hours
- Industrial — 4,000 gpm for 4 hours

WATER SYSTEM EVALUATION AND RECOMMENDATIONS

The primary purpose of the Water Master Plan is to provide the City a guide for developing and maintaining the water system in a logical, cost efficient manner. Using the water demand projections, the long term needs of the water system were determined for water supply, treatment, storage and distribution. A graphical representation of the recommended improvements is shown on **Figure 6-1**. Brief discussions of the recommended improvements follow. More detailed analysis and discussion is presented in **Section 6**.

- Water Supply Water Rights

An analysis of the City's existing water rights and water supplies identified three areas of work for the next planning period. These include work to solidify the City's existing water rights, development of a Water Management and Conservation Plan, and obtaining additional early water rights. A more detailed analysis of the City's water supply and water rights is presented in **Section 6.2.** A brief summary of this work follows.

A review of the City's current water rights, showed that some work needs to be done to ensure the rights remain valid through and beyond the planning period. The specific items required to strengthen the City's overall water rights position are listed in **Section 6.2.1**. At the time this plan was written, the City had begun work with a Certified Water Rights Examiner to perform these tasks. As such, this work element is considered complete for the purposes of this planning effort, and no budgetary provisions are recommended.

To date, the City has not prepared a Water Management and Conservation Plan (WMCP) in accordance with the guidelines set forth in OAR 690-86. It is recommended that the City prepare and obtain approval for such a plan early in the planning period. Completion of a WMCP will likely be a condition of approval for the water rights work discussed in the previous paragraph. It is recommended that the City implement a formal water conservation program in accordance with State guidelines following the completion of the WMCP. A budget of $20,000 is recommended.

Based on the analysis of alternative water supplies presented in **Section 6.2**, it is clear that the most cost-effective strategy for ensuring reliable water supplies through the planning period is to continue to use the Marys River as the primary source. It is recommended that the City work to obtain early water rights that predate the 1964 in-stream water right owned by the State of Oregon. It is recommended that the City continue to work toward defining a list of target water rights that are transferable and may be obtained at a reasonable cost. As part of this work, the City should develop a plan for obtaining early water rights that targets several water rights as well as a step by step plan for purchasing, and transferring each water right as demand requires. A key element of this plan is the identification of how each right will be exercised from the date of purchase to the date of transfer to municipal use at the WTP. Due to the importance of this work it is recommended that a budget of $50,000 be reserved for the development of a water rights acquisition plan as well as for the purchase of the water rights.

- Water Production Facilities

The City owns and operates two water production facilities. These are the Marys River Water Treatment Plant and the 11th Street Well. The 11th Street Well is intended as an emergency backup water supply only. Thus, for long range planning purposes, the Marys River Water Treatment Plant must be able to satisfy essentially all of the City's demands. Common practice is to size water production facilities to meet or exceed maximum day demands. As discussed in **Section 5**, the existing maximum day demand is approximately 1.07 MGD and is expected to grow to 1.80 MGD by the end of the planning period. The nominal capacity of the Marys River Water Treatment Plant is approximately 1.0 MGD. Therefore, additional treatment capacity is required. The analysis summarized in Section 6, shows that expansion of the existing Marys River Water Treatment Plant is the most cost effective means of providing additional treatment capacity. The recommended improvements will increase the capacity of the treatment plant to 2.0 MGD. The estimated overall project cost of the treatment plant expansion is $3,252,000. A detailed discussion of the recommended improvements is included in **Section 6.3**.

- Water Storage Facilities

Water system storage serves three purposes: it equalizes daily variations between supply and use; it provides a reserve for fire fighting; it provides a reserve that can be used during an emergency interruption of supply. The total recommended storage in the system is the sum of the operational, fire, and emergency storage. An analysis of the storage requirement for the City is presented in **Section 6.4**. Based on this analysis, a new 1.75 million gallon reservoir is recommended. The City currently has a site identified for this reservoir in the hills west of town. The total project cost for the reservoir is estimated to be approximately $2,835,000. A detailed cost breakdown is included in **Appendix E**.

In addition to the construction of a new water reservoir, some work at the existing reservoir atop Neabeack Hill is recommended. The Neabeack Hill Reservoir is in relatively good condition with the exception of some leaks around the exterior of the tank. In order to reduce existing and future leakage, it is recommended that the interior of the tank be coated with a sealing material. This will require draining the tank and removing it from service. Since the Neabeack Hill Reservoir is the only storage reservoir in the City's system, it cannot easily be removed from service until the new tank is constructed. In addition to the interior coating, the tank inlet and outlet valving must also be reconfigured to properly operate the reservoir when the new reservoir is constructed. The recommended improvements for the Neabeack Hill Reservoir are discussed in detail in **Section 6.4.6**. The total estimated construction cost for the Neabeack Hill Reservoir Improvements is approximately $245,000.

- Water Pumping Facilities

The City owns and operates three pump stations. These are the Neabeack Hill Domestic Pump Station, the Neabeack Hill Fire Pump Station, and the Starlight Village Pump Station. Each of the pump stations was evaluated and a list of improvements for each station was compiled. The primary shortcoming of each station is the lack of auxiliary power. The results of this work are presented in **Section 6.5**. In addition to the Starlight Village Development, the Starlight Village Pump Station will eventually serve the entire contiguous portion of the upper service level on the western edge of the UGB (See **Figure 6-1**). The pump station currently lacks the capacity to serve the entire area. As such, upgrades will become necessary as development continues. By the time the upgrades are required, it is likely that the existing pumping facilities will be near the end of their useful life. Therefore, a complete replacement of the pump station is envisioned. It is envisioned that a new pump station will be constructed adjacent to the original pump station. An above grade structure will house the pump station and controls. The construction of a new pump station to serve this area is identified as the Starlight Village Phase 2 Improvements.

The estimated project cost for the Neabeack Hill Fire Pump Station improvements is $146,000. The cost for the Neabeack Hill Domestic Pump Station improvements are included in the project cost for the Neabeack Hill Reservoir Improvements. The estimated project cost for the Starlight Village Pump Station Phase 1 Improvements is $268,000. The estimated project cost for the Starlight Village Pump Station Phase 2 Improvements is $470,000. Detailed cost breakdowns are included in **Appendix E.**

- Water Distribution Facilities

An analysis of the existing distribution system was performed to assess its ability to maintain adequate pressures under peak domestic and fire demands. The analysis enabled the identification of system shortcomings. Alternatives for Long-range distribution system improvements to address these shortcomings were simulated and analyzed to develop a recommended set of distribution system improvements. A discussion of this analysis is presented in **Section 6.6**. The recommended distribution system improvements are listed in the following table.

RECOMMENDED DISTRIBUTION SYSTEM IMPROVEMENTS				
Location	Existing Size (inch)	Recommended Size (inch)	Length (feet)	Total Project Cost
Dampier Street (Pioneer Street to West Reservoir)	NA	12	1100	$142,000
Marylin Drive Service Relocation	NA	NA	NA	$4,000
20th Street Waterline Extension (Main to Applegate)	NA	10	640	$74,000
High School Site Waterline Extension (Applegate to end)	NA	10	1580	$183,000
Ash Street Waterline Extension (19th to 18th)	NA	8	280	$29,000
Main Street Waterline Replacement (9th to 14th)	8	8	2020	$234,000
Applegate Street Waterline Replacement (Newton Creek Bridge to 30th Street)	8	8	2860	$292,000
Canberra Street (connect to 12" in Pioneer St.)	NA	8	35	$4,000
College Street (12th to 13th)	NA	12	200	$26,000
12th Street (Pioneer to College)	NA	8	120	$12,000
8th Street (Main to Pioneer)	NA	8	500	$51,000
College Street (19th to 20th)	6	12	620	$80,000
19th Street (College to End)	6	12	600	$78,000
12th Street (Monroe to Houser)	4	10	1050	$121,000
12th Street (Pioneer to Grant)	2	10	900	$104,000
Benton View Drive Waterline Extension	NA	8	600	$61,000
Upper Philomath Service Level Transmission Main (Pioneer Street to end)	NA	10	4600	$532,000
Middle School Site Waterline Extension (From existing FH to Chapel Drive)	NA	10	1120	$129,000
North Arterial Transmission Main				
Pioneer Street to 9th Street	NA	12	2200	$291,000
9th Street to Hills Road	NA	12	3400	$439,000
Hills Road to Existing System in Green Road	NA	12	4200	$543,000
Green Road to Boulevard Street	NA	12	4550	$588,000
Boulevard Street to Corvallis-Newport Highway	NA	12	6050	$861,000
South Arterial Transmission Main				
13th Street to Chapel Drive	NA	10	1950	$225,000
Chapel Drive to 19th Street (Including 15th Street)	NA	10	2450	$283,000
19th Street to Southwood Drive	NA	10	4950	$576,000

RECOMMENDED CAPITAL IMPROVEMENT PRIORITIES

As summarized in the previous sections, the water system has a number of deficiencies which inhibit the City's ability to provide the required flows to many areas. Some of these deficiencies are more critical than others. In order to assist the City in the planning and scheduling the construction of needed improvements, the improvements recommended in previous sections are grouped as Priority 1, Priority 2 and Priority 3 as outlined in **Section 7.1**. The prioritization of improvements factors in the criticality, cost, and benefit of each project allowing essential, high benefit to cost projects to be identified and constructed first, while less critical, lower value projects to be delayed until a later time. Each of the projects identified in the plan were examined and assigned a priority for implementation as listed in the following table.

RECOMMENDED PROJECT PRIORITIES		
Project	Priority	Recommended Project Budget*
Obtain Additional Early Water Rights	1	$50,000
Water Management and Conservation Plan	1	$20,000
Water Treatment Plant Expansion	1	$3,252,000
1.75 MG West Side Reservoir	1	$2,835,000
Dampier Street Waterline (Pioneer St. to West Side Reservoir)	1	$142,000
Neabeack Hill Reservoir Improvements	1	$245,000
Starlight Village Pump Station Phase I Improvements	1	$268,000
Neabeack Hill Fire Pump Station Aux Power Improvements	1	$146,000
Marylin Drive Service Relocation	1	$4,000
20th Street Waterline Extension (Main to Applegate)	1	$74,000
High School Site Waterline Extension (Applegate to end)	1	$183,000
Priority 1 Subtotal		**$7,219,000**
Ash Street Waterline Extension (19th to 18th)	2	$29,000
Main Street Waterline Replacement (9th to 14th)	2	$234,000
Applegate Street Waterline Replacement (Newton Creek Bridge to 30th Street)	2	$292,000
Canberra Waterline Extension (connect to 12" in Pioneer)	2	$4,000
College Street Waterline Extension (12th to 13th)	2	$26,000
12th Street (Pioneer to College)	2	$12,000
8th Street (Main to Pioneer)	2	$51,000
College Street (19th to 20th)	2	$80,000
19th Street (College to End)	2	$78,000
12th Street (Monroe to Houser)	2	$121,000
12th Street (Pioneer to Grant)	2	$104,000
Benton View Drive Waterline Extension	2	$61,000
Water Master Plan Update	2	$40,000
Priority 2 Subtotal		**$1,132,000**
Starlight Village Pump Station Phase II Improvements	3	$470,000
Upper Service Level Transmission Main (Pioneer Street to end)	3	$532,000
Middle School Site Waterline Extension	3	$129,000
North Arterial Transmission Main		
Pioneer Street to 9th Street	3	$291,000
9th Street to Hills Road	3	$439,000
Hills Road to Existing System in Green Road	3	$543,000
Green Road to Boulevard Street	3	$588,000
Boulevard Street to Corvallis-Newport Highway	3	$861,000
South Arterial Transmission Main		
13th Street to Chapel Drive	3	$225,000
Chapel Drive to 19th Street (Including 15th Street)	3	$283,000
19th Street to Southwood Drive	3	$576,000
Priority 3 Subtotal		**$4,937,000**
GRAND TOTAL		**$13,288,000**
*Costs are 2004 dollars and assume dry weather construction. ENR 20 Cities Index = 6956 (March 2004)		

FINANCING

Philomath does not currently have the resources nor is the City's existing user fee structure sufficient to fund the recommended improvements. Therefore, alternative funding sources must be pursued. Several potential funding sources are identified and discussed in **Section 7** of the Master Plan. All likely funding options will require the City to increase user rate and SDC's. We recommend that the City perform a user fee study and implement new user rates and SDC's as soon as possible.

IMPLEMENTATION PLAN

We recommend the City begin working toward the implementation of the Priority 1 improvements as soon as possible. The recommended implementation plan shows construction of the improvements in 2009. A two-phase implementation plan is recommended. This is discussed in greater detail in **Section 7**. The first phase includes the development of a funding plan for the recommended improvements. This should include an evaluation of the current user rates and SDC fees. The rates and fees should be increased as required. The second phase includes the implementation (i.e., construction) of the priority 1 improvements. A third and final phase of the implementation plan also exists. This includes the construction of the priority 2 improvements. These improvements are heavily dependent upon growth and may or may not be required during the planning period. Nonetheless, the City should plan for these improvements to avoid future crisis situations. The City should periodically evaluate the demands placed on the utility to determine how actual growth compares to the projections presented herein. If growth occurs faster than anticipated, the priority 2 improvements may be needed sooner. Should growth occur slower than anticipated, the priority 2 improvements may be delayed. The following table lists milestones and recommended completion dates for the first two phases of the implementation plan.

PROPOSED IMPLEMENTATION SCHEDULE (Priority 1 Projects – 2009 Construction)	
Milestone	Date
PHASE I	
Submit Draft Water Master Plan to OHD & City	5/15/05
Receive Comments from OHD & City	7/15/05
Submit Final Master Plan to OHD & City	9/01/05
OHD Approval of Final Master Plan	10/01/05
City Adopts Final Master Plan	10/15/05
Perform Rate Study & SDC Analysis	1/01/06
Update CIP	6/01/06
Implement New User Rates and SDC's	7/01/06
Conduct Funding Meeting with OECDD and RUS	1/01/07
Submit Funding Applications	3/01/07
Finalize Funding Package	5/01/07
PHASE II	
Select Design Consultant Prepare Predesign Reports	6/01/07
Submit predesign report to OHD, OEDD & City	9/01/07
OHD, OEDD & City approval of predesign report	11/01/07
Funding for Detailed Design Secured	12/01/07
Start Final Design of Recommended Improvements	1/01/08
Complete Final Design of Recommended Improvements	10/01/08
OHD, OEDD & City Approval of Plans & Specifications	12/01/08
Advertise for Construction Bids	1/01/09
Receive Construction Bids	2/01/09
Award Contracts	2/15/09
Start Construction	4/1/09
Complete Construction of Recommended Improvements	12/31/09

CITY OF PHILOMATH
Water System Master Plan,
Philomath, Oregon

Section 1

INTRODUCTION

SECTION 1 INTRODUCTION

1.1. Background & Need

The City of Philomath is located on Highway 20 approximately five miles west of Corvallis in Benton County, Oregon. The current population of Philomath is approximately 4,100. The City was founded in 1882. The past economic activity in Philomath has centered around the forest products industries. With the decline of the forest products industries in western Oregon, the future prosperity of Philomath appears to be tied to diversified light industries together with a growing residential community. Many Philomath residents work in Corvallis and other nearby communities. The City is bisected east to west by the Corvallis-Newport Highway 22/34, while the Marys River is located just south of town.

The City of Philomath owns, operates and maintains the water utility serving the community. The City uses the Marys River as its primary water source with groundwater as a backup source. Under typical operations, water is withdrawn from the Marys River, treated at the Water Treatment Plant (WTP) and pumped into the distribution system. A single 1.25 MG concrete reservoir provides storage for the community. The City's distribution system contains a variety of pipe types. Since the mid 1980's, the City has standardized on ductile iron pipe as the material of choice.

The City adopted the existing planning document in 1984. This document outlined the recommended improvements to the water system including the construction of a new water treatment plant using the Marys River as the water source. Major water system improvements were constructed in 1985. These improvements included the existing Water Treatment Plant, a water booster pump station and distribution system improvements. The City's 1.25 MG reservoir was constructed in 1993 and continues to serve as the City's reservoir. With construction of the 1.25 MG reservoir at a higher overflow elevation, the City's booster pump station and original 0.5 MG reservoir were removed from service. In 1995, the "CT" Improvement Project was constructed. These improvements provide the required contact time per the Health Division requirements between the treatment plant and the nearest water system user. During the past decade, the City and private developers have constructed additions and improvements to the distribution system. Residential development on Neabeack Hill and in the hills on the West Side of the City has occurred above the elevation that can be adequately served by the main service level. As such, pump stations were constructed to serve these areas. Though these areas are on opposite sides of the City, they are at generally at the same elevation and are therefore considered to be two service areas within the upper service level. With the construction of these stations, the water system now operates on two service levels. Pressure in the main service level is maintained by the water level in the City's 1.25 MG reservoir. Pressure in the upper service level is maintained by the pump stations. Within the past few years, the City has also upgraded the control system at the WTP to reflect current technology. The City's former intertie with the City of Corvallis' water system is no longer in use, but should be considered an emergency supply source. Using the intertie on an emergency basis is discussed in greater detail in **Section 4.2.4**.

Some of the reasons for the preparation of a new master plan at this time include the following:

- The existing Water System Analysis is now 20 years old. The typical life and planning horizon for a master planning document is 20 years. As such the existing document is nearing the end of its useful life.

- The existing population of the City is now about 4,100. The design year population in the 1984 document was 4,488 in the year 2005. The community is now approaching the design year population of the Water System Analysis. Planning for the future and beyond a design year population of 4,488 is prudent.

- Construction, operation and replacement costs for water system components have increased very significantly since 1985 when the WTP and associated improvements were constructed. It is appropriate to have a more current master planning document which lists recommended improvements together with the estimated costs of construction. The recommended projects and their associated costs can then be included in a capital improvement plan that serves as a basis to help determine the appropriate system development charges (SDC) for the utility. Note that the preparation of a new Master Plan will include a listing of recommended projects together with costs. However, comprehensive SDC user fee studies are not part of the Master Plan. Upon adoption of this plan, the City should perform an analysis of its SDC and user fees and make changes accordingly to ensure that funding is in place for the recommended improvements. The SDC and user fee analysis may be performed by City staff or by an outside consultant. Most Cities of the size of Philomath typically contract with consultants to perform this work.

- The Master Plan will allow the City to review its key assumptions regarding growth within the community. Eighteen years ago, the City made a conscious decision that commercial and industrial growth in the community should be limited to essentially "dry" industries. Preparation of the Master Plan will allow a venue to revisit the basic decision.

- User fees for water systems have increased with more stringent environmental conditions and rising construction and operation costs. The Master Plan will provide a recommended project listing with estimated construction costs. This cost data may be of use to the City to help determine if the present user fee system is appropriate.

- The City's current development standards require findings that adequate capacity is available in the utility systems prior to development occurring. Without a current water system master plan that identifies improvements required with a schedule guiding their construction, implementation of these policies is difficult.

1.2. Project Objectives

The purpose of this study is to evaluate the City's water system with respect to its existing and future needs, identify improvements and associated costs necessary to meet those needs, and provide the City with a design guide for future growth of the City's water system. It is intended that the information contained herein assist the City in the planning and implementation of capital improvements to the water system, as well as ongoing system maintenance.

This evaluation and master plan accomplishes the following specific objectives.

- Map the existing water system based on field data collection and as-built drawings.
- Inspect existing facilities and identify current and future water system deficiencies on a prioritized basis, particularly in the following areas:
  - Water Supply Quality and Adequacy
  - Water Treatment Plant Condition and Capacity
  - Transmission and Distribution System Condition and Capacity
  - Water Storage Reservoir Condition and Capacity
  - Maintenance considerations
- Provide an evaluation of the options for correcting these deficiencies with preliminary construction cost estimates for recommended alternatives.
- Provides the City with a Water System Master Plan which addresses concerns of both the City and regulating authorities.
- Provide specific recommendations to the community and City Council for action.

This report does not include a wetland inventory or delineation(s), topographic or aerial surveys, on-site environmental investigations or geotechnical investigations.

1.3. Prior Studies and Work

The following is a summary of some of the studies, reports and documents utilized in the preparation of this master plan.

- Water System Analysis, Philomath , Oregon by Westech Engineering, Inc., December 1984.

- Water System Improvements Design Report, Philomath, Oregon by Westech Engineering, Inc., January 1985
- Water Treatment Plant "CT" Analysis, Philomath , Oregon by Westech Engineering, Inc., January 1992.
- Draft Sewer System Facilities Plan, Philomath, Oregon by Westech Engineering, Inc., May 2003.
- Sewer System Facilities Plan, Philomath, Oregon by Westech Engineering, Inc., April 1985.
- N. Philomath Water & Sewer Study Update, Philomath, Oregon by Westech Engineering, Inc., August 1993.
- Engineer's Report, Hartz Industrial Site Public Infrastructure Improvements, Philomath, Oregon by Westech Engineering, Inc., December 1996.
- Storm Drainage System Master Plan, Philomath, Oregon by Westech Engineering, Inc., March 1998.
- Local Wetlands Inventory for the City of Philomath, for City of Philomath, Oregon by SRI/Shapiro, Inc., August 1996 (Draft).
- Mill Site Conversion Project, Conceptual Development Plan for Willamette Industries Mill Site, for Rural Development Initiatives, Inc. by KCM, Inc., November 1995.
- Topographic Aerial Maps, City of Philomath, Oregon. Panels 332/1256, 332/1259 & 330/1259, April 1989, 330/1256, April 1975.
- Flood Insurance Study, City of Philomath, Benton County, Oregon, by Federal Emergency Management Agency, December 1981.
- Flood Insurance Study, Benton County, Oregon, Unincorporated Areas, by Federal Emergency Management Agency, August 1986.
- Philomath Comprehensive Plan. Adopted March 30, 1983.
- Soil Survey of Benton County Area, Oregon, by USDA Soil Conservation Service, July 1987.
- Geologic Hazards of Eastern Benton County, Oregon, by State of Oregon Department of Geology and Mineral Industries, 1979.

1.4. Authorization

In June of 2002, the City of Philomath authorized Westech Engineering to prepare a Water Master Plan.

Section 2

Study Area & Planning Considerations

SECTION 2
STUDY AREA & PLANNING CONSIDERATIONS

2.1. Study Area

Philomath is situated north of the Marys River near the center of Benton County. The City is located on Highway 20/34 approximately five miles west of Corvallis. The Corvallis-Newport Highway 20/34 bisects Philomath east to west and provides the major road transportation into and through the City. Within the City, highway 20/34 is designated as Main Street. Other major roads include Green Road and West Hills Road entering the City from the north, and Fern Road and Bellfountain Road entering the City from the south. The Southern Pacific Railroad Co. also has a rail line passing through the City.

The City's Comprehensive Plan was developed in 1983 and was updated in 2003. The Comprehensive Plan established a large urban growth boundary (UGB) which encompasses 2,560 acres, approximately 1,300 of which are outside the present City Limits. Eventually the entire area will be part of Philomath and will be served by the City's utility systems.

This report is based on the assumption that there will be no significant changes to the Urban Growth Boundary or zoning. The planning area of this report is limited to the land within the present UGB of the City. The improvements recommended in this plan are based on development of land within the UGB in its present location, as well as the existing land use zoning for these areas. It is assumed that no significant development will occur within the study area that will require major changes to the existing zoning, and that there will be no significant expansions of the UGB within the study period. Changes in any of these assumptions could change the recommendations contained in this master plan. Should significant changes in any of the above occur, the facilities and master plan should be updated accordingly.

2.2. Physical Environment

2.2.1 Climate and Rainfall Patterns

The study area is located in the Willamette Valley along the eastern foothill of the coast range. The climate in Philomath is relatively mild throughout the year, characterized by cool, wet winters and warm, dry summers. Growing seasons in the Willamette Valley are long, and moisture is abundant during most of the year (although summer irrigation is common).

The study area has a predominant winter rainfall climate. Typical distribution of precipitation includes about 50 percent of the annual total from December through February, lesser amounts in the spring and fall, and very little during summer.

Rainfall tends to vary inversely with temperatures -- the cooler months are the wettest, the warm summer months the driest.

Extreme temperatures in the study area are rare. Days with maximum temperature above 90°F occur only 5-15 times per year on average, and below 0°F temperatures occur only about once every 25 years. Mean high temperatures range from the low 80s in the summer to about 40°F in the coldest months, while average lows are generally in the low 50s in summer and low 30s in winter.

Although snow falls nearly every year, amounts are generally quite low. Willamette Valley floor locations average 5-10 inches per year, mostly during December through February. High winds occur several times per year in association with major weather systems.

Relative humidity is highest during early morning hours, and is generally 80-100 percent throughout the year. During the afternoon, humidities are generally lowest, ranging from 70-80 percent during January to 30-50 percent during summer. Annual pan evaporation is about 35 inches, mostly occurring during the period April through October.

Winters are likely to be cloudy. Average cloud cover during the coldest months exceeds 80 percent, with an average of about 26 cloudy days in January (in addition to 3 partly cloudy and 2 clear days). During summer, however, sunshine is much more abundant, with average cloud cover less than 40 percent; more than half of the days in July are clear.

There are extensive weather records for Hyslop Field between Corvallis and Albany. While the data from this weather station is not specifically for the City of Philomath, these values are generally believed to be representative for the immediate area around Philomath. Although there may be daily and weekly variations, the annual average climate is approximately the same. The climate data from Hyslop Field is used throughout the remainder of this document.

The study area receives an average of approximately 43.5 inches of precipitation annually, with the majority of the rainfall occurring during the winter months. The wettest year (since 1910) was 1996 when approximately 73 inches of rainfall was measured. The second wettest year was 1998, with approximately 60 inches of rainfall. Approximately 78% percent of the annual precipitation occurs between November 1 and April 30.

2.2.2 Topography

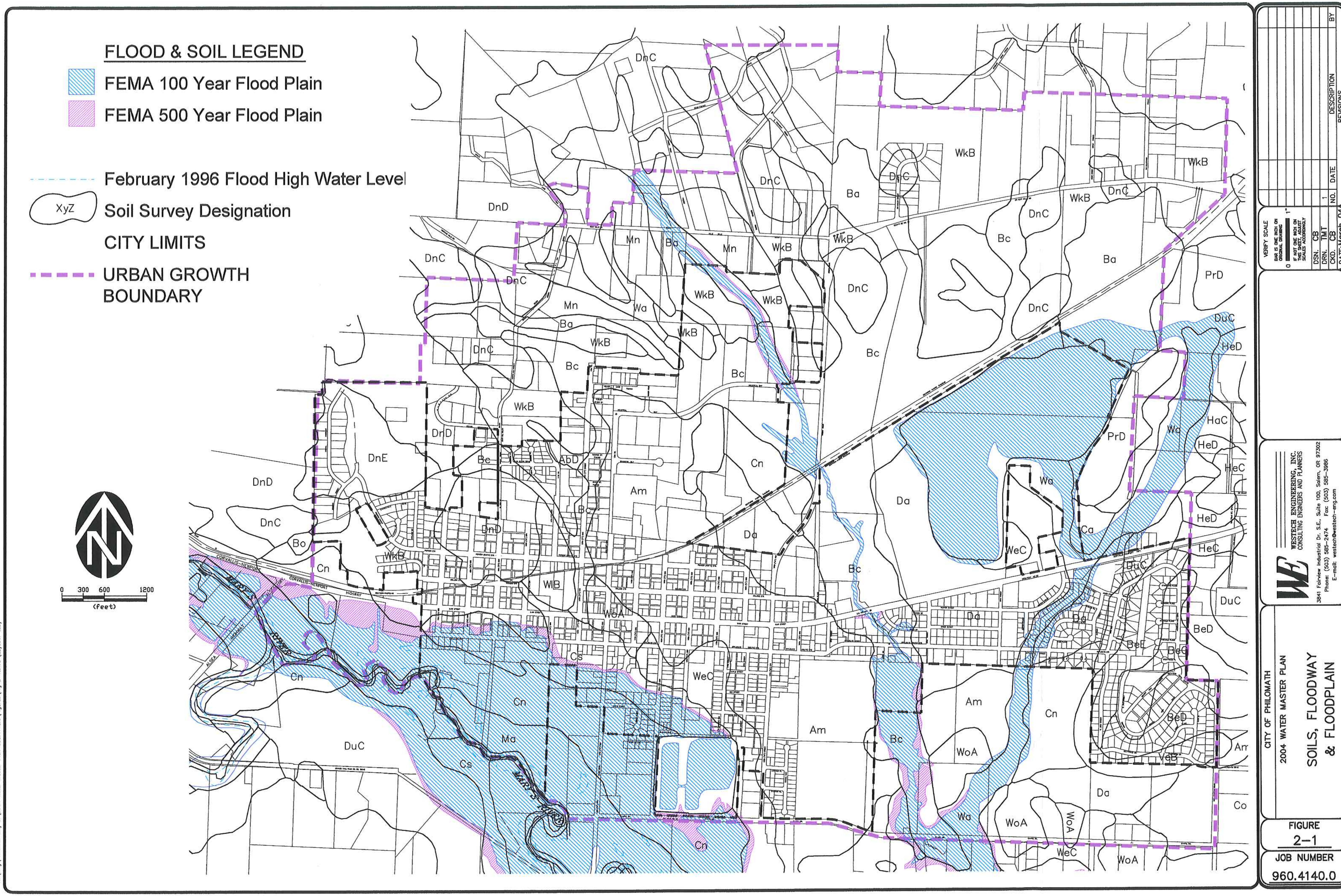
Philomath is located on the western edge of the Willamette Valley, near the point the where Marys River leaves the Coast Range. The City center is located on the second bench north of the Marys River. The natural surface drainage across the study area flows to the south, and the existing storm drainage system intercepts and routes flow into the Marys River.

The topography within the study area ranges from relatively flat south of Main Street and along Newton Creek, to steeper slopes and hills to the north, east and west of the City. Generally, the topography is gently sloping and undulating. Slopes over most of the area are between 0 and 3 percent. The northwest part of Philomath has steeper slopes ranging to 14 percent. The elevation within the study area ranges from approximately 260 feet along the Marys River to a high point of 450 feet at the northwestern corner of the UGB.

2.2.3 Soils

Although a detailed analysis of the soils and geology is outside the scope of this report, a review of the soil survey for Benton County was performed. Most of the soils in the study area were formed from alluvial materials derived from mixed sources. Alluvium is material that has been deposited or is in transit by rivers and streams. The term "mixed" means that the soil particle sizes are generally unsorted.

There are five major soil associations mapped in the study area. These are the McAlpin-Abiqua association, the Waldo-Bashaw association, the Woodburn-Willamette association, the Dayton-Amity association, and the Dixonville-Philomath association. The Local Wetlands Inventory for the City of Philomath contains a detailed description of each of these major associations as well as detailed descriptions of each of the soil types within each association. The reader is referred to that document for a more thorough discussion. This discussion is based from reports and maps prepared by the Soil Conservation Service (now the Natural Resource Conservation Service) showing the approximate locations of the Benton County soil types. The soil types found in the study area are shown in **Figure 2-1**. The reader is referred to the Benton County Soil Survey for detailed definitions and descriptions of the individual soil designations shown in **Figure 2-1**.


FLOOD & SOIL LEGEND
FEMA 100 Year Flood Plain
FEMA 500 Year Flood Plain
February 1996 Flood High Water Level
XyZ
Soil Survey Designation
CITY LIMITS
URBAN GROWTH BOUNDARY
0 300 600 1200
(Feet)
CORVALLIS-NEWPORT HIGHWAY
MARY'S RIVER
CITY OF PHILOMATH
2004 WATER MASTER PLAN
SOILS, FLOODWAY & FLOODPLAIN
WESTECH ENGINEERING, INC.
CONSULTING ENGINEERS AND PLANNERS
3841 Fairview Industrial Dr. S.E., Suite 100, Salem, OR 97302
Phone: (503) 585-2474 Fax: (503) 585-3986
E-mail: westech@westech-eng.com
DSN. CB
DRN. TMT
CKD. CB
DATE: March 04
FIGURE
2-1
JOB NUMBER
960.4140.0

2.2.4 Geologic Hazards

Known geologic hazards within the study area include steep slopes, high seasonal groundwater, flooding, and seismic concerns.

2.2.4.1 Steep/Unstable Slopes.

The only areas of potential slope stability concerns within the study area are on Neabeack Hill in the southeast corner of town. Steep slopes can have the potential for either mass movement or slope erosion. Mass movement results from shifting of rock or soil material in response to gravity, such as landslides and rock slides. These mass movements are often precipitated or aggravated by excessive groundwater. Slope erosion is the removal of soils or rock that occurs as a result of sheet flow, resulting in surface erosion or gully erosion. This is primarily caused by private land use practices (mainly land clearing and road construction) that can exacerbate slope erosion.

The 1979 "Engineering Hazard Map of the Corvallis Quadrangle" identifies no steep slope or mass movement hazards within the study area. However, the geologic hazard maps generally do not identify these types of hazards for areas less than 5 to 10 acres. Therefore, although this area shows no signs of recent movement, it is considered a geologically sensitive area for siting critical facilities, such as pump stations, reservoirs, or treatment plants.

2.2.4.2 High Groundwater.

Seasonal high groundwater is a common occurrence within the study area. The high groundwater levels are caused primarily by perched water tables due to soil saturation and lack of local drainage.

2.2.4.3 Flooding.

The Marys River is the primary stream within the study area, with Newton Creek being the only major tributary within the study area. The Marys River extends approximately 40 miles from its confluence with the Willamette River to its headwaters northwest of Philomath. Newton Creek, the only major tributary in the study area, enters the Marys River at river mile 10.0. The Marys River has a streamflow pattern similar to other Willamette Valley streams. It is typified by high flows during the winter and low flows during the summer months.

The Federal Emergency Management Agency (FEMA) has established a 100-year floodplain designation and insurance ratings for the study area. While sometimes referred to as the "100 year flood", it is more accurate to consider

it the flood having a 1 percent chance of occurrence in any year, or a 10 percent chance of occurrence during any 10 year period.
During a 100-year flood (as defined by the Federal Emergency Management Association, FEMA), the Marys River and Newton Creek rise out of their normal channels creating a large floodplain. Flood profiles and maps for those portions of the Marys River adjacent to the study area are included in the Flood Insurance Study prepared for the City of Philomath as follows.

- Inside City Limits
  - Floodway panel 410011-0001, June 15, 1982.
  - FIRM panel 410011-0001 B, June 15, 1982.

- Outside City Limits
  - Floodway panel 410008-0067 (panel 67 of 250), August 5, 1986.
  - Floodway panel 410008-0090 (panel 90 of 250), August 5, 1986.
  - FIRM panel 410008-0067C (panel 67 of 250), August 5, 1986.
  - FIRM panel 410008-0086C (panel 86 of 250), August 5, 1986.
  - FIRM panel 410008-0090C (panel 90 of 250), August 5, 1986.

It should be noted that the Floodplain and Floodway boundaries shown on the FEMA flood maps are based on flood elevations, and as such the actual boundaries may vary slightly from the location shown. Final determinations of whether property is within the floodway or floodplain must be determined based on a topographic survey of the property in question. Floodplain information is shown in **Figure 2-1**.

2.2.4.4 Seismic.

Based on the current building code (Oregon Structural Specialty Code), the study area is classified as Seismic Zone 3 for purposes of structural design. If the alternative(s) selected by the City include the construction of buildings or other significant structures, a detailed geotechnical report will be required prior to design. Therefore, a more detailed review of local geology and faulting, as well as seismic and settlement considerations specific to the site selected, will be deferred until the predesign report.

2.2.4.5 Stream Erosion

As is common with most valley bottom streams, the Marys River channel is continuously eroding and depositing bank material. This is especially prevalent on the outer bends of the river where undercutting and caving of the banks is common within the study area. The potential for stream bank erosion is an important design issue that must be carefully considered for facilities sited near the Marys River.

2.2.5 Public Health Hazards

Discussions with City staff have not revealed any known or documented chronic public health hazards within the study area.

2.2.6 Energy Production and Consumption

The proposed water system will not produce any electricity or other energy sources. With regards to energy consumption, the major energy consumers in a water treatment and distribution system are the electric motors required to drive pumps and other equipment. It is recommended that these components be specified as having high or premium efficiency motors, which will reduce the operating costs over the life of the project. Depending on the current programs in place with the electric utility providing service, there may be rebates available if high/premium efficiency electrical motors are specified that will tend to offset the slightly higher capital construction cost.

2.2.7 Water Resources

There are two classes of water resources within the study area, namely surface water and groundwater. Surface water includes all drainage channels that convey storm and surface runoff. This includes the Willamette River, the Marys River, and tributaries. The City currently utilizes the Marys River as its primary water supply. Groundwater is also an available resource in the Willamette Valley. In addition to the Marys River, the City also utilized two wells as a backup water supply. The Oregon Department of Water Resources regulates the use of both surface and groundwater resources. Water resource regulations are summarized in **Section 3** of this report.

2.2.8 Flora and Fauna

2.2.8.1 Flora.

The natural vegetation within the study area has been largely replaced by rural residential or agricultural (pasture or seed grass) uses. The area is capable of supporting lowland meadows or forests but to a large extent these have been replaced. Typical native vegetation along lowland foothill areas include such tree species as Douglas fir, Western Red Cedar, big leaf maple, Vine Maple, California black cottonwood, Pacific yew, ash, Oregon oak, and Hawthorn. Shrubs that can be found are snowberry, indian plum and western hazel. Willows and various grasses are also found in this habitat.

2.2.8.2 Fauna.

A variety of wildlife species are found within the study area. Big game species include black-tailed deer and Roosevelt elk. While black tailed deer are very common, the Roosevelt elk are scarce and usually appear during the winter months when the highlands (above 2,500 feet) are snow-covered. Several species of birds and small animals are found in and around the study area. Included in this group are ring-necked pheasant, turkeys, grouse, quail, waterfowl, doves, pigeons, and several varieties of song birds.

Forest Cover and riparian areas provide the habitat necessary for most big-game, bird, and small animal species. The agricultural areas within the study area provide feeding and cover for a variety of waterfowl and song birds.

The Marys river and many of its tributaries are important habitat for a variety of fish. Common fish species found include large mouth bass, rainbow trout, coastal cutthroat trout, dace and sculpin as well as anadromous salmonids, including coho salmon, chinook salmon and steelhead.

2.2.9 Air Quality and Noise

2.2.9.1 Air Quality.

The existing air quality in the study area is generally good. Agricultural, slash and field burning can be significant intermittent air pollution sources, primarily during July and August. During cold periods with stagnant air, residential wood heating may impact local air quality. There are no known air quality monitoring stations located within the study area.

2.2.9.2 Noise.

There are no significant generators or sources of noise in the Philomath study area. Noise levels are low and do not exceed DEQ standards. Noise sources within the study area are largely limited to vehicular traffic. None of the alternatives evaluated herein are expected to generate significant noise.

2.2.10 Environmentally Sensitive Areas

2.2.10.1 Riparian Zone.

Riparian zones include the riparian zone adjacent to the Marys River, as well as incidental riparian zones that are a part of the intermittent drainage channels found throughout the study area. Riparian zones are considered sensitive due to the variety of vegetative and wildlife species that utilize these areas as habitat. Riparian zones provide erosion control, drainage and runoff water quality management, wildlife habitat, and shading for surface waters.

2.2.10.2 Wetlands.

Wetlands are considered to be one of the most biologically productive components of the environment. Their functions and value include primary production, fish and wildlife habitat, flood control, water quality improvement and erosion control and point of entry for groundwater recharge. Detailed wetland surveys or delineations are not included in the scope of this Master Plan. However, a cursory overview of previous wetland surveys and related information is presented below.

The methodology for determining wetland areas is based on the Army Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory, 1987), used by the U.S. Army Corps of Engineers and the Oregon Division of State Lands (DSL). The regulatory definition of wetlands in the 1987 Manual requires that, under normal circumstances, positive indicators of wetland hydrology, hydric soil, and hydrophytic vegetation be present. Wetlands are defined as areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas, but also include seasonal wet meadows, farmed wetlands and other areas that may not appear "wet" all the time. Wetland determinations consist of documenting three criteria: hydrophytic (water-tolerant) vegetation, hydric (wet) soils, and wetland hydrology.

The Oregon Division of State Lands (DSL) is responsible for developing and maintaining the Statewide Wetlands Inventory (SWI). The inventory consists of two types of inventories - the National Wetlands Inventory (NWI) developed by the U.S. Fish and Wildlife Service and Local Wetlands Inventories (LWI) developed by cities according to standards set by the DSL.

The National Wetlands Inventory (NWI) was developed by the U.S. Fish and Wildlife Service (FWS) and is available statewide. Wetlands and deepwater habitats (streams, lakes, estuaries, etc.) are mapped on a USGS quad map base; most are at a scale of 1:24,000. Only those wetlands and other waters that are visible on high altitude aerial photographs are mapped, and most maps date to the mid-1980s. There are 1,865 maps for Oregon. These maps are available from the Oregon Division of State Lands (DSL).

Local Wetlands Inventories (LWIs) are comprehensive maps and information about wetlands throughout a city. They supplement the National Wetlands Inventory in urban areas. In 1990, DSL adopted guidelines and rules for conducting LWIs within urban growth boundaries. The LWI rules were updated in February 2001. LWIs are conducted by wetlands consultants for cities completing wetlands planning under Statewide Goals 5 (Natural

Resources) or 17 (Coastal Shorelands). The City of Philomath completed a LWI in 1996. The LWI is shown in **Figure 2-2**.

Wetlands affect the master planning effort in two ways. First, wetlands decrease the developable land within the UGB. This decreases the density of development at buildout conditions. The second impact involves the construction of sanitary sewer facilities in wetland areas. Construction work that impacts wetland areas is subject to additional permit requirements, and can be prohibited by the magnitude and nature of the impacts.

As discussed in **Section 6**, the projected water distribution system needs are based on the complete development of land within the UGB. Clearly, as can be seen in **Figure 2-2**, much of the land within the UGB is wetland. Therefore, not all of the land within the UGB can be developed. Current regulations allow for the development of wetland areas under the condition that developers undertake approved compensatory mitigation efforts. Therefore, wetland areas are not precluded from development outright. Nonetheless, current regulations are designed to preserve and enhance existing wetlands. As such, the complete development of wetland areas within the UGB will never be realized. The projected water system needs at buildout conditions are based on the assumption that 50% of the wetland areas will ultimately be developed.

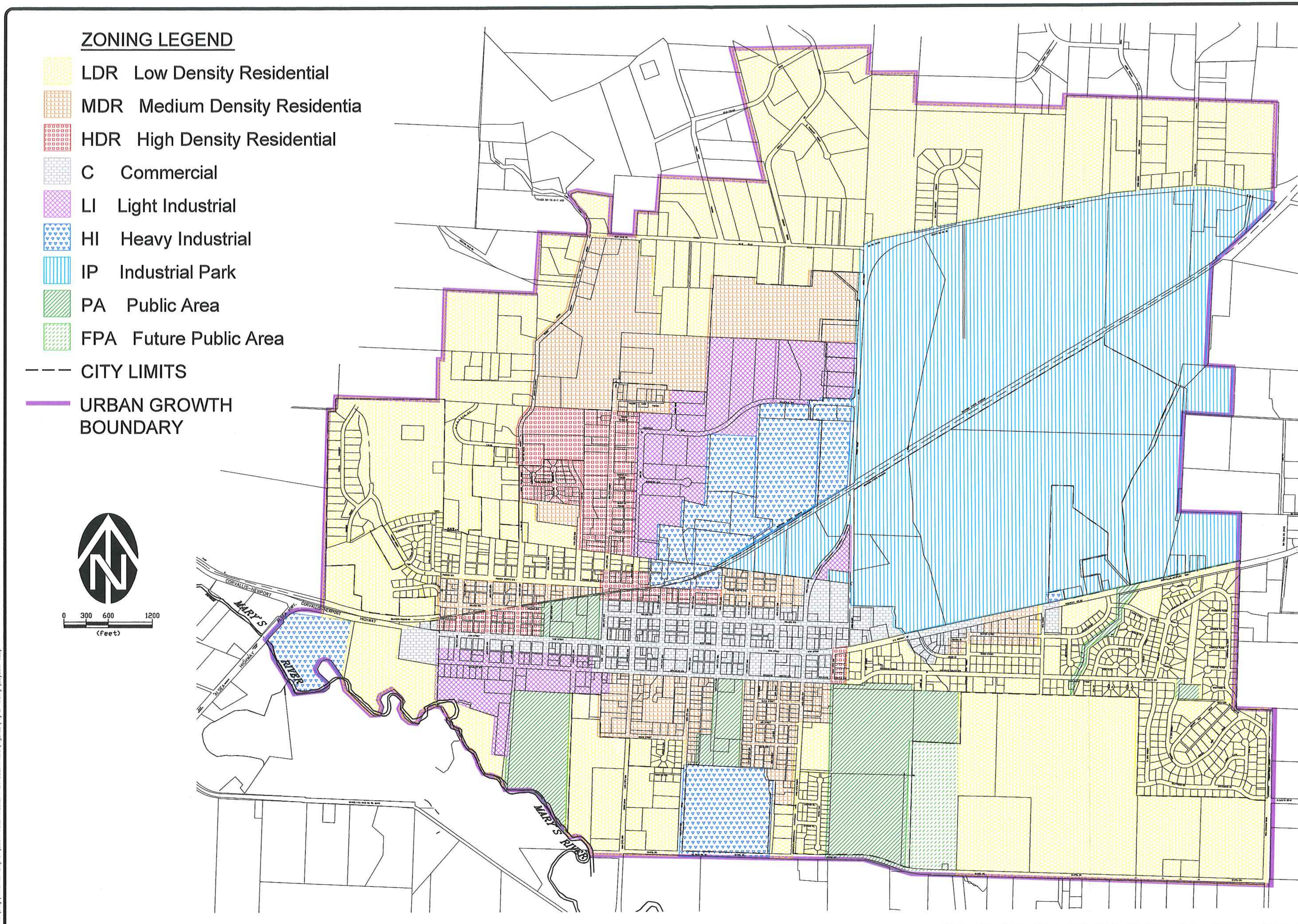
2.2.10.3 Historical and Archaeological Sites.

Incorporated in 1882, Philomath has a rich history as one of the first settlements in the Willamette Valley. Several buildings and structures throughout town are included on the National Register of Historic Places. The selected alternative will likely not have any impact on these historical sites.

The mid Willamette Valley was inhabited with the Calapooia people when the first western settlers arrived in the mid 1840's. It is also likely that prehistoric people inhabited the study area at one time. Remains of these cultures will likely be located adjacent to the Marys River. Therefore, a archaeological assessment may be required during the predesign phase, especially in areas adjacent to the river.

2.2.11 Threatened or Endangered Species.

A comprehensive inventory for threatened or endangered species in the study area has not been completed. Significant discussion and interest in anadromous salmonids exists in the Willamette Basin including the Marys River. The National Marine Fisheries Service (NMFS) is responsible for evaluating the "health" of different species and individual runs under the terms of the Endangered Species Act (ESA). The NMFS has defined the Upper Willamette Evolutionarily Significant Unit (ESU) as the Willamette basin upstream of Willamette Falls (Oregon City). This unit includes the Marys River.



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WESTECH ENGINEERING, INC.
CONSULTING ENGINEERS AND PLANNERS
3841 Fairview Industrial Dr. S.E., Suite 100, Salem, OR 97302
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CITY OF PHILOMATH
2004 WATER MASTER PLAN
ZONING MAP

FIGURE 2-4
JOB NUMBER 960.4140.0

On March 24, 1999, the NMFS listed as threatened all naturally spawned populations of spring chinook salmon in the Upper Willamette ESU. This listing impacts that reach of the Marys River adjacent to the study area which has been classified by the Oregon Department of Fish and Wildlife (ODFW) as providing rearing and migration habitat for spring chinook.

On March 25, 1999, the NMFS listed as threatened all naturally spawned populations of winter run steelhead in the Upper Willamette ESU. This listing also impacts that reach of the Marys River adjacent to the study area which has been classified by the ODFW as providing rearing and migration habitat for winter steelhead.

The NMFS issued the proposed 4(d) rules in December 1999 and the final rules in June 2000. The 4(d) rules are the mechanism under the ESA for protecting threatened as opposed to endangered species. How the listings of steelhead and salmon will impact projects, including public water projects, is not fully known at this time. A general consensus is that work that impacts riparian vegetation or work within the stream channels proper will come under increasing scrutiny. To the extent feasible, alternatives that either do not impact or minimize impacts to riparian zones should be considered.

No other threatened or endangered species are known to reside in the study area. However, a biological inventory has not been completed. If the actual alternative constructed differs from the proposed alternative and results in construction at land sites not considered under this report, it will be necessary to perform both historical/archaeological and biological surveys to assure that impacts to threatened or endangered species do not occur.

2.3. Planning Period

Choosing a "reasonable" design period for which a utility system should be designed is a somewhat arbitrary decision. If the design period is too short, the public faces the prospect of demands exceeding capacity, requiring the system to be continually upgraded or replaced. For systems that do not lend themselves to economical incremental expansion, short design periods lead to excess expenditures of capital. Water treatment, storage, and distribution facilities fall into this category.

On the other hand, choosing a design period which is too long can lead to facilities with excess capacity which may never be needed if population growth does not occur at the projected rates. Such facilities can place an economic burden upon the present population and may become obsolete before being fully used.

The Oregon Health Division (OHD) has established 20 years as being the proper planning period for sanitary sewer system improvements. This report will evaluate the anticipated water supply, treatment, pumping and storage needs during the 20 year planning period. The distribution system piping will be planned for the ultimate development of land within the UGB based on current land use designations. Although this may result in capacities greater than those needed during the 20-year planning period, water distribution lines and storage reservoirs are, by their very nature, unsuited for incremental expansion without extensive capital outlays.

It should be recognized that projections into the future are subject to many variables and inaccuracies. Accordingly, it is recommended that the City review its water system at five-year intervals and this report updated as appropriate.

2.4. Socio-Economic Environment

Growth within the study area will depend on socio-economic conditions within the City of Philomath. The following section contains a general discussion of economic conditions, trends, population, land use, and public facilities relating to both the study area and the City of Philomath.

2.4.1 Economic Conditions and Trends

Population growth and the resultant water demands within the study area are linked to the economic conditions and trends of the City of Philomath and the greater Corvallis-Philomath metropolitan area. Growth in the City of Corvallis has to some extent met resistance from local residents. This has displaced some of the growth that may have occurred in Corvallis to Philomath. Philomath is an attractive town with a rural atmosphere that offers more affordable housing options than Corvallis. Philomath is to some extent evolving into a bedroom community for persons employed in Corvallis. With limited significant industrial or commercial growth expected in the near future, this characterization is likely to remain valid throughout the planning period.

Philomath has experienced rapid levels of development during the past decade. This rapid level of development is anticipated to continue for the immediate future. Currently, the City believes most of the future residential development will occur in the northwest section of town. Two large subdivisions are currently under construction in this area. When completed, these subdivisions will add approximately 172 homes in the City.

2.4.2 Historical Population & Growth Projections

2.4.2.1 Historic Population.

Population histories provide a tool for determining the future growth of the water system. Much of the challenge in projecting water demand within the study area relates to the difficulty in accurately tracking or projecting actual populations. **Figure 2-3** shows the population trends for the City of Philomath from 1940 to the present.

The population in Philomath has steadily increased from approximately 850 people in 1940 to over 4,000 people in 2002. Growth was particularly rapid during the 1970's when the residential areas east of Newton Creek were developed. During the 1960's and 1970's the lumber and logging businesses thrived, jobs were relatively plentiful in and around Philomath, and residential growth boomed. Another rapid growth spurt occurred in the 1990's when the area around Neabeack Hill was developed. The current population of Philomath is approximately 4,100 people

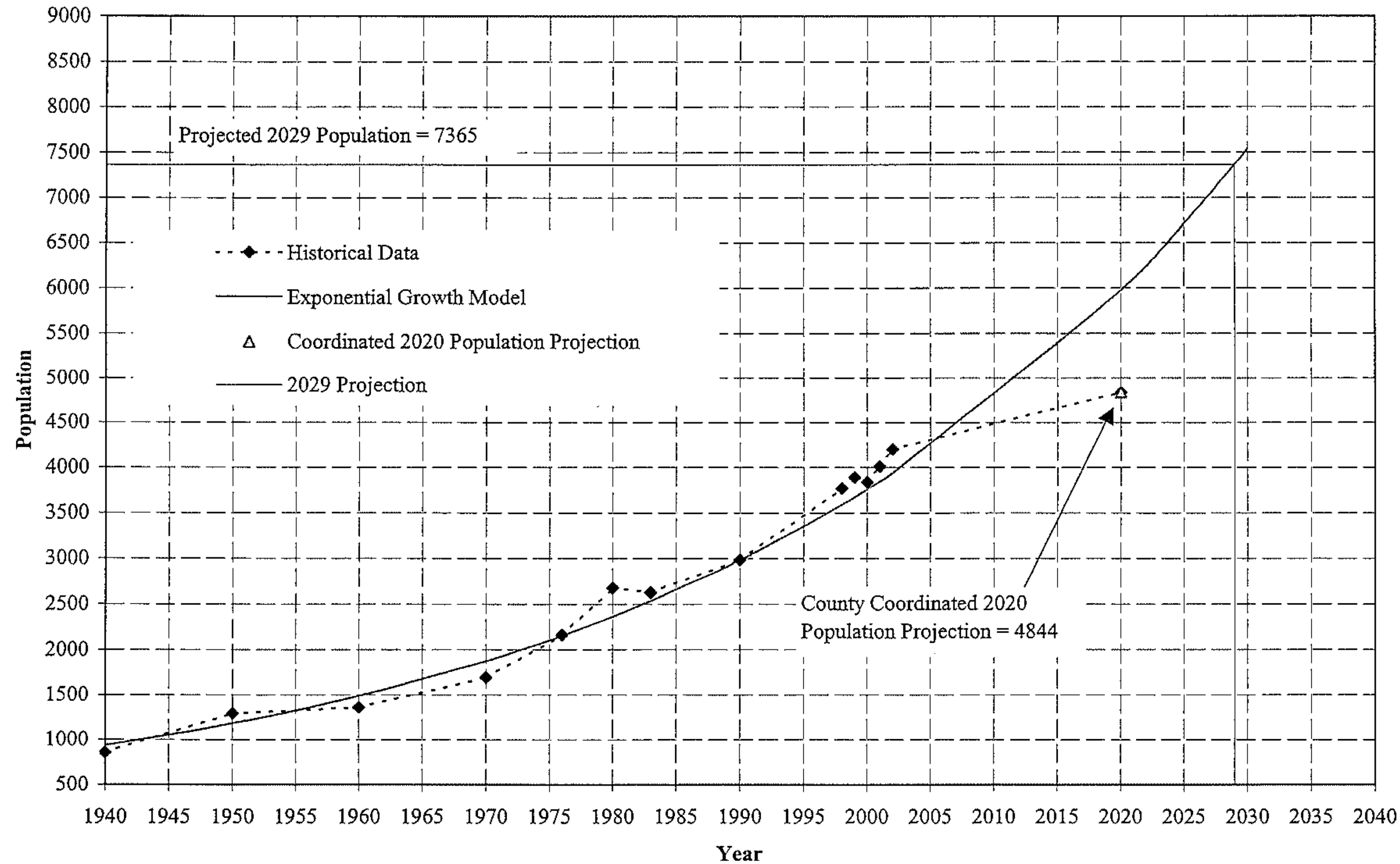
2.4.2.2 Future Population.

To maintain compatibility with local and statewide planning goals, the County population allocations are used as the 'coordinated number' for evaluating population projections. This number has been agreed to by the Department of Land Conservation and Development (DLCD), the Office of the State Economist, and Benton County. In 1998 Benton County made population projections through 2020. The 2020 population allocation for Philomath was projected at 4,844. As described above, the planning period for public water facilities is 20-25 years. Based on past experience, the improvements recommended in this plan will likely not be completed until approximately 2009. Therefore, the current planning period will end approximately 20 years later in the year 2029. As such, population projections must be extended to 2029.

In order to project to the year 2029, an exponential growth model was fit to a population data set that included the historical measurements as well as the County projection for the 2020 population. The model parameters were determined using a least squares regression method. These parameters were used to project the population out to year 2029. The exponential growth model is shown in **Figure 2-3**. Based on this growth model the projected population for 2029 is 7,365. This number will be used throughout the remainder of this plan.

The projected 2029 population of 7,365 is higher than the population projection for 2027 used in the City's recent Wastewater System Facilities Plan. Some discussion on this discrepancy is warranted. The Oregon Department of Environmental Quality (DEQ) is the review agency for wastewater facilities planning documents. The initial draft of the Wastewater Facilities Plan included population projection similar to those presented herein. Before the DEQ would grant final approval of the document, they requested that the City revise the projections to reflect a heavier reliance on the 2020 population allocation set forth by Benton County. The City believes the methodology presented herein more accurately reflects local conditions than that used in the methodology used in the Facilities Plan as required by DEQ.

Figure 2-3
Philomath Population Projections



2.4.2.3 Anticipated Future Development.

Even with the loss of a substantial portion of the lumber industry, Philomath is likely to experience modest growth as a suburb of Corvallis. Corvallis is not only the home of Oregon State University but also is developing into a center for high technology businesses. Both the university and the growing high technology businesses offer new employment opportunities, and spin-off businesses may choose to locate in Philomath. With large tracts of industrial land available, Philomath seems poised to attract some of the spin-off high tech businesses.

As previously described, two subdivisions are currently under construction that will create approximately 172 new homes within the study area. These subdivisions are located in the northwest portion of town. During the planning period, the City anticipates future residential development to continue to be focused in this area.

2.5. Land Use Regulations

2.5.1 Comprehensive Plan

All of the land within the planning area is within the Philomath UGB. The City's Comprehensive Plan was adopted in 1983 and has been revised in 1990, 1993, and most recently in 2003.

2.5.2 Land Use Zoning

The planning area is made up of land in two general categories, namely land inside of City limits and land outside of the City limits but inside of the Urban Growth Boundary.

Land use zoning in the City of Philomath is comprised primarily of residential uses, although the Comprehensive Plan sets aside large areas for industrial development (approximately 800 acres), of which about 500 acres is presently undeveloped. Lesser amounts of land are designated for commercial, office, and public/open space uses.

The location of the UGB, City limits and land use zoning designations within the City of Philomath are shown in **Figure 2-4**.

The total areas contained under each zoning designation are listed in **Table 2-1**.

TABLE 2-1
APPROXIMATE AREAS BY LAND USE ZONE

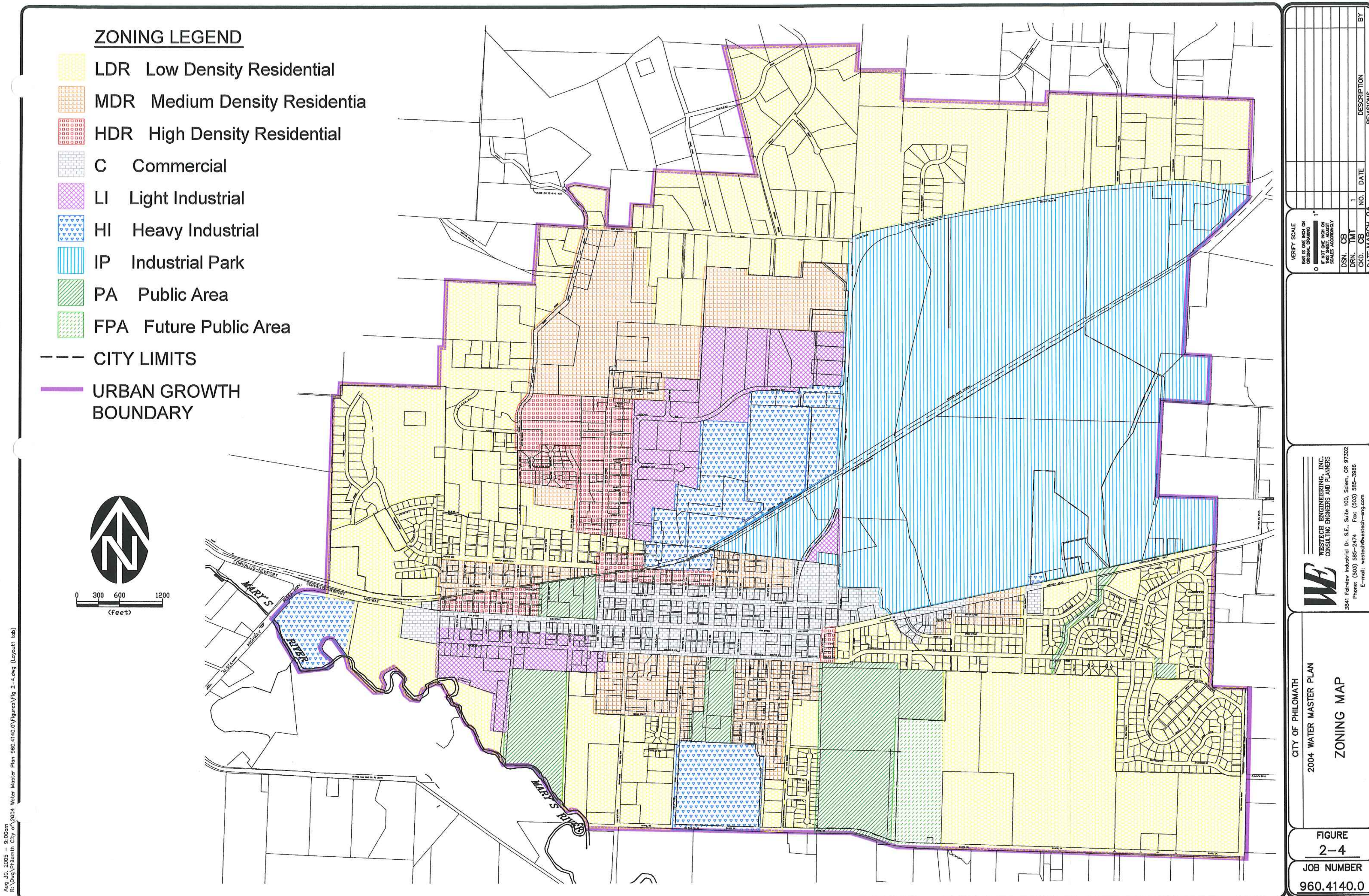
Land Use Category	Area (Acres)
Low Density Residential (R1)	1,094
Medium Density Residential (R2)	228
High Density Residential (R3)	80
Commercial (C)	108
Light Industrial (LI)	124
Heavy Industrial (HI)	142
Industrial Park (IP)	628
Public (P)	154
TOTAL	± 2,558

a. Land Use within City Limits

The majority of the land within the City Limits is currently developed or partially developed. Much of the ongoing and anticipated development within the City is occurring outside the City Limits under deferred or delayed annexation agreements.

b. Land Use outside City Limits but within UGB

The majority of the land inside the UGB but outside the City Limits is undeveloped or underdeveloped. Of the undeveloped land inside the planning area and outside the City Limits, about 35 to 40% appears to be zoned for industrial use and the remainder for residential use. The majority of the industrial zoned land is either undeveloped or being utilized at less than the anticipated zone intensity.


ZONING LEGEND
LDR Low Density Residential
MDR Medium Density Residentia
HDR High Density Residential
C Commercial
LI Light Industrial
HI Heavy Industrial
IP Industrial Park
PA Public Area
FPA Future Public Area
CITY LIMITS
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CONSULTING ENGINEERS AND PLANNERS
3841 Fairview Industrial Dr. S.E., Suite 100, Salem, OR 97302
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E-mail: westech@westech-eng.com
CITY OF PHILOMATH
2004 WATER MASTER PLAN
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Section 3

Regulatory Requirements and Basis of Planning

SECTION 3
REGULATORY REQUIREMENTS AND BASIS OF PLANNING

3.1. Regulating Agencies

Water use regulations considered under this Water System Master Plan include the Safe Drinking Water Act (SDWA) and amendments as administered by the Oregon Health Division (OHD) under OAR 333, as well as water rights and water use regulations administered by the Oregon Water Resources Department (OWRD). A brief overview of regulatory considerations and their applicability to the City is presented below.
The following is a brief summary of the regulatory requirements and standards that form the basis of the master planning effort. The requirements under Federal and State water treatment regulations are summarized first, followed by a discussion of issues relating to the water system design standards proposed for adoption by the City.

3.2. Water Treatment & Distribution Regulations & Standards

Congress passed the original Tittle XIV of the Public Health Service Act, commonly known as the Safe Drinking Water Act, in 1974, and amended it in 1986 and 1996. The Safe Drinking Water Act (SDWA) and the 1986 and 1996 Amendments are federal water quality regulations affecting all public water purveyors. Regulations under the SDWA are promulgated by the US Environmental Protection Agency (USEPA) and administered by the Oregon Health Division (OHD). Some of the general applicable requirements of the SDWA amendments are considered in order to reduce the possibility that implementation of the Water Master Plan will be in conflict with any known or upcoming provisions of the act. However, this does not include all provisions or requirements of the SWDA or OHD, but is limited to those items which are most applicable to the City's current system or which must be considered in the evaluation of alternatives.

The State of Oregon, Department of Human Resources, Health Division (OHD) is the primary regulating authority for public drinking water systems. The requirements of the federal Safe Drinking Water Act and amendments are implemented by Oregon under the Oregon Drinking Water Quality Act of 1981 (ORS 448 as amended). The state of Oregon, through OHD, has exercised primary responsibility for the administration of the drinking water programs in the state, an arrangement called Primacy. The Oregon Drinking Water Quality Act is regulated by the administrative rules outlined under OAR 333-61, Public Drinking Water Systems. In practice, the Oregon drinking water standards match the national standards established under the Safe Drinking Water Act. OHD, under the Primacy Agreement with the USEPA, has up to two years to adopt each federal rule after it is finalized.

OAR 333-61 outlines the responsibilities of the water suppliers, maximum contaminant levels and treatment requirements, sampling, reporting and public notice requirements, operation and maintenance requirements, and cross connection/backflow standards. It also contains the minimum construction standards and plan review requirements for construction of new public water systems and to major additions or modifications to existing public water systems (OAR 333-61-050 & 060). OAR 333-61-060 also outlines the minimum requirements for water system master plans adopted by the community.

The following is a brief overview of some of the applicable current and future drinking water quality standards and other applicable regulatory requirements. This overview is for reference only and does not include all requirements. Future standards described are still under development and are subject to change. This summary is largely based on a comprehensive overview of drinking water standards prepared by the Oregon Health Division that is included in **Appendix B**. The purpose of the following discussions is to provide background information for the recommendations later in this report. For a more thorough discussion of a particular standard the OHD overview in **Appendix B** should be consulted.

3.2.1 Drinking Water Contaminants

Drinking water contaminants are any substances present in drinking water that are known to adversely impact human health. They can be grouped into five general categories as follows.

- *Microbial Contaminants* - such as viruses and bacteria which can come from sewage treatment plants, septic systems, agricultural and livestock operations, and wildlife.
- *Disinfectants and Disinfection By-Products* – chemical disinfectants used in water treatment to kill harmful microbes, and the chemical by-products formed from the reaction of disinfection treatment chemicals with natural substances in the water.
- *Inorganic Chemicals* - such as salts or metals, which can be naturally-occurring or result from urban stormwater runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming. It also includes lead and copper leached into the water from household plumbing and fixtures.
- *Organic Chemicals* - Pesticides and herbicides may come from a variety of sources, such as agriculture, urban stormwater runoff, and residential uses. It also includes synthetic and volatile chemicals which are by-products of industrial processes and petroleum production, and can also come from gas stations, urban stormwater runoff, and septic systems.
- *Radiologic Contaminants* - which can be naturally occurring or result from oil and gas production and mining operations.

Every drinking water system is vulnerable to microbial or chemical contaminants of one type or another from a variety of sources. Disease-causing microorganisms (e.g., bacteria, viruses, protozoas) can be present in surface water (e.g., lakes and streams) or from groundwater (e.g., wells or springs) from human or animal feces.

Microorganisms can also enter the water system through pipe breaks or cross connections. Organic chemicals (e.g., industrial solvents, pesticides) are mainly man-made and can enter drinking water supplies as a consequence of chemical production, storage, use, or disposal in the water source area. Inorganic chemicals can be introduced by human activities (e.g., nitrate from fertilizer) but more often result from natural occurrence in rocks, soils, and mineral deposits (e.g., radon, arsenic). Drinking water treatment which is essential to remove microbes and chemicals can also add or form contaminants in drinking water, such as disinfectant chemicals themselves, byproducts of disinfectants with other materials in the water, and treatment chemicals used in filtering water. Finally, water storage tanks, pipes, and household plumbing that are in direct contact with water can contribute contaminants from either the material used in the tanks and pipes or from internal coatings used to protect the materials from contact with the water (e.g., lead and copper, organics).

Many of the provisions of the drinking water standards apply to the water system regardless of whether it has a surface water source or a groundwater source. However, there are a number of current and anticipated future requirements that are more specifically related to the type of water source utilized. The following discussions outline some of the water quality or treatment standards that are most applicable to either groundwater or surface water. The purpose of these discussions is to provide background information for the recommendations later in this report. For a more thorough discussion of a particular standard the OHD overview in **Appendix B** should be consulted.

3.2.2 Drinking Water Standards and Health Protection

To protect health, national regulations set by the US Environmental Protection Agency limit the amounts of certain contaminants in water provided by public water systems. These limits, or standards, take several forms.

- *Maximum Contaminant Level Goal (MCLG)* – The level of a contaminant in drinking water below which there is no known or expected risk to health, allowing for a margin of safety. All regulated contaminants have an MCLG, although the MCLG is not enforceable.
- *Maximum Contaminant Level (MCL)* – The highest level of a contaminant allowed in drinking water, set as close to the MCLG as feasible using the best available treatment technology.
- *Treatment Technique (TT)* – A required treatment process intended to reduce the level of a contaminant in drinking water. For any contaminant that can not be effectively measured or detected in drinking water, the standard may be a treatment technique requirement instead of an MCL. This means that all water systems at risk of the contaminant must provide continuous water treatment to remove the contaminant at all times. Performance standards (PS) are used to determine whether or not a water system is meeting a specific treatment technique requirement. Performance Standards are measurements of water

quality parameters related to specific treatment processes, such as turbidity, disinfectant residual, pH, or alkalinity.

- *Action Level (AL)* – The concentration of a contaminant, which when exceeded, triggers treatment or other requirements which a water supplier must follow.

Public water suppliers must sample for contaminants routinely to ensure that standards are met, and report results of that sampling to the regulatory agency. Sampling frequencies for public water systems vary by the type of drinking water contaminant.

3.2.3 Public Drinking Water Regulatory Program

In Oregon, public drinking water systems are subject to the Oregon Drinking Water Quality Act (ORS 448 – Water Systems). Under this act, the Department of Human Services has broad authority to set water quality standards necessary to protect public health through insuring safe drinking water. The Department is directed under the Act to require regular water sampling by public water suppliers. These samples must be analyzed in laboratories approved by the Department. The water supplier must report the results of laboratory analysis tests to the Department. The Department must investigate water systems that fail to submit samples, or whose sample results indicate levels of contaminants that are above maximum allowable levels. Water suppliers who fail to sample the water or report the results, or whose water contains contaminants in excess of allowable levels must take corrective action and notify users.

3.2.4 Current Standards

There are now national drinking water quality standards for 95 different contaminants, including 9 microbials, 8 disinfection by-products and residuals, 18 inorganics (including lead and copper), 53 organics, and 7 radiologic contaminants. These standards either have established MCLs or treatment techniques, and are summarized in this section.

3.2.4.1 Microbial Contaminants

Microbial contaminants are regulated in an effort to reduce the risk of waterborne illness. Measurements of Coliform bacteria are used as indicators that other organisms that are potentially harmful may be present. Routine samples must be collected and analyzed for Coliform bacteria. Samples that show the presence of total coliform bacteria must be further examined for fecal coliforms or *E.coli*.

All public water systems must regularly test for coliform bacteria from locations in the distribution system identified in a coliform sampling plan. The number, frequency, and location of the samples are a function of the nature of the source, the treatment facilities, and the size of the population served. All coliform sample results are reported as "coliform absent" or "coliform present". A set of 3-4 repeat samples is required for each positive coliform sample. Repeat sampling continues until the MCL is exceeded or a set of repeat samples with negative results is obtained. No more than 5% positive samples are allowed in any month. Confirmed presence of fecal coliform or *E.coli* is considered an acute health risk and requires immediate notification of the public to take protective action such as boiling or using bottled water.

For surface waters, requirements are set to increase protection of people against gastrointestinal illness from *Cryptosporidium* and other disease producing organisms. These requirements are designed to control pathogenic microorganisms and indicators in surface water sources, including *Cryptosporidium*, *Giardia lamblia*, enteric viruses, and *Legionella*. Requirements are also set to control indicators of microbial contamination including heterotrophic plate count bacteria (HPC), and particulate matter from soil runoff (turbidity).

Water systems must provide a total level of treatment to remove/inactivate 99.9% (3-log) of *Giardia lamblia*, and to remove/inactivate 99.99% (4-log) of viruses. In addition, filtered water systems must achieve 99% (2-log) removal of *Cryptosporidium* control in their watershed control programs. Since direct levels of *Giardia lamblia*, virus, *Cryptosporidium* are analytically difficult to determine, filtration performance standards for turbidity, and CT (concentration * time) calculations for disinfection, are used to determine if a water system is meeting the required removal/inactivation levels. For conventional filtration treatment, the performance standard is 95% of turbidity measurements collected at four-hour intervals must be less than 0.3 NTU and all turbidity measurements must be less than 1 NTU. To comply with the disinfection standard, small systems (e.g., Philomath) must collect at least one residual sample each day and calculate CT at the highest flow. The CT value must meet the required minimum for the particular facility. In addition, a minimum residual of 0.2 mg/L must be maintained at every point in the distribution system. These standards are described in more detail in **Appendix B**.

3.2.4.2 Disinfectants and Disinfection Byproducts

To protect public health, limits on chemical disinfectant residuals and chemical by-products of disinfection are set. Disinfection treatment used to kill microorganisms in drinking water can react with naturally occurring organic and inorganic matter in water to form disinfection by-products. The challenge is to apply levels of disinfection treatment needed to kill microorganisms while limiting the levels of disinfection by-products produced. The primary disinfection by-products of concern in Oregon are the trihalomethanes and the haloacetic acids. Disinfectant residuals must be monitored at the same locations and frequency as coliform bacteria.

Disinfection by-products must be monitored throughout the distribution system at frequencies that vary as a function of the population served, type of water source, and specific disinfectant applied. Systems using surface water sources and conventional filtration treatment must monitor source water for total organic carbon (TOC) and control with enhanced coagulation if TOC exceeds 2.0 mg/L. Compliance with the standards is determined based on meeting maximum levels for disinfectant residuals and disinfection by-products over a running 12-month average of the sample results, computed quarterly. The individual MCLs are listed in **Appendix B**. Surface water systems serving less than 10,000 people and all groundwater systems must have demonstrated compliance with these standards no later than January 2004.

3.2.4.3 Lead and Copper

The purpose of the lead and copper standard is to set treatment technique requirements to control lead and copper in drinking water at the customer's tap. Corrosion of plumbing and plumbing fixtures in buildings and homes is the primary source of lead and copper in potable water in Oregon. Lead comes from lead solder and brass fixtures, and copper comes from copper tubing and brass fixtures.

Lead and copper are monitored by collecting samples from "high-risk" homes. One-liter samples of standing water (first draw after 6 hours of non-use) are collected at homes identified in the water system sampling plan. The number of samples required is based on the population as described in **Appendix B**. In each sampling round, 90% of samples from homes must have lead levels less than or equal to the action level of 0.015 mg/L, and copper levels less than or equal to the action level of 1.3 mg/L. Water systems with lead above the action level must conduct periodic public education, and either install treatment, change water sources, or replace plumbing.

3.2.4.4 Inorganic Contaminants

Inorganic contaminants most often come from the source of water supply, but can also enter water from contact with materials used for pipes and storage tanks. The monitoring requirements depend on the particular contaminant, the water source, and the materials used in the distribution system. Water systems must meet the MCLs listed in **Appendix B**. A separate compliance schedule has been established for Arsenic.

3.2.4.5 Organic Chemicals

Organic chemicals are most often associated with industrial or agricultural activities that affect sources of drinking water supply. Major types of organic chemicals include Volatile Organic Chemicals (VOCs) and Synthetic Organic Chemicals (SOCs). These include industrial and commercial solvents and chemicals, and pesticides used in agriculture and landscaping. Organic chemicals can also enter drinking water from materials in contact with the water such as pipes, valves, and paints and coatings used inside water storage tanks. At least one test for each contaminant from each water source is required during every 3-year compliance period. Public water systems serving more than 3,300 people must test twice during each 3-year compliance period for SOCs. Public water systems using surface water sources must test for VOCs annually. Quarterly follow-up testing is required for any contaminates that are detected. The exceptions are dioxin and acrylamide/epichlorohydrin. Only those systems determined by the Department to be at risk of contamination must monitor for dioxin. Water systems must meet the MCLs listed in **Appendix B**. Systems that cannot meet the MCLs must install or modify treatment systems or develop alternate sources.

3.2.4.6 Radiologic Contaminants

The purpose of this rule is to limit exposure to radioactive contaminants in drinking water. The specific contaminants are listed in **Appendix B**. These contaminants are both natural and man-made. Initial quarterly tests for one year must be completed prior to December 31, 2007 for gross alpha, radium-226, radium-228 and uranium. Subsequent monitoring will be required at 3, 6, or 9-year intervals depending on the initial results. Community systems that cannot meet MCLs listed in **Appendix B** must install treatment or develop alternate water sources.

3.2.4.7 Drinking Water Contaminant Candidate List

The EPA maintains a list of contaminants known or anticipated to occur in public water systems. The purpose of the list is to identify contaminants for future regulation. Every five years, the EPA must publish a decision on whether or not to regulate at least five contaminants.

3.2.5 Future Standards

New and revised drinking water quality standards are mandated under the 1996 federal Safe Drinking Water Act. This section is intended to summarize and preview these standards, currently under development by the USEPA and not yet final. The USEPA is expected to complete an adoption schedule for these standards by 2005. The City should be aware of and familiar with these mandates and deadlines and plan strategically to meet them.

Revisions to the *Cryptosporidium*, virus, coliform bacteria standards are expected. The EPA also plans to establish new disinfection treatment performance standards for groundwater systems at high risk of viral contamination (GWR) and to further increase filtration and disinfection performance requirements (LT2ESWTR). The EPA also plans to further increase the disinfectants and disinfection by-products standards, and to establish a radon standard. Some of these future standards are likely to require major capital investments for some water systems. A more thorough discussion of the future standards is included in **Appendix B**. The EPA has recently proposed two new rules, the Long Term 2 Enhanced Surface Water Treatment Rule and the Stage 2 Disinfection By-products Rule. Detailed discussions of these rules are included in OHD's Fall 2003 Pipeline Newsletter (see **Appendix B**). Brief summaries of the proposed rules are included below.

3.2.5.1 Long Term 2 Enhanced Surface Water Treatment Rule

The EPA currently is proposing the Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) to reduce disease incidence associated with *Cryptosporidium* and other pathogenic microorganisms in drinking water. Under the LT2ESWTR, systems initially conduct source water monitoring for *Cryptosporidium* to determine their treatment requirements. Filtered systems will be classified in one of four risk bins based on their monitoring results. Systems classified in higher risk bins must provide 1 to 2.5-log additional reduction of *Cryptosporidium* levels. The proposed regulation specifies a range of treatment and management strategies collectively termed the "microbial toolbox," that systems may select from to meet their additional treatment requirements.

Cryptosporidium monitoring by large systems (serving at least 10,000 people) will begin six months after the LT2ESWTR is finalized and will last for a duration of two years. Small systems (serving less than 10,000 people) are on a delayed schedule and will start monitoring when the required large system monitoring is completed (approximately 2 ½ years after rule promulgation).

3.2.5.2 Disinfection By-products Rule

EPA is proposing the Stage 2 Disinfection By-products Rule (Stage 2 DBPR) to reduce disease incidence associated with the disinfection byproducts formed by the addition of disinfectants to drinking water. Under the Stage 2 DBPR water systems will be required to meet maximum contaminate levels for total trihalomethanes (TTHM) and haloacetic acids (HAA5) at each monitoring site in the distribution system. Under the rule, systems will first be required to conduct an Initial Distribution System Evaluation (IDSE) to identify the locations with high disinfection byproduct concentrations. These locations will be used as the sampling sites for Stage 2 DBPR compliance monitoring.

3.2.6 Consumer Confidence Reports

On August 19, 1998 the USEPA published the final rule requiring every community water system to prepare and provide customers an annual consumer confidence report (CCR). This rule was mandated by the 1996 amendments to the Safe Drinking Water Act, and became effective as of September 18, 1998. A CCR is a report card for customers on the quality of the water delivered by the water system.

Community water systems must prepare an annual consumer confidence report on source water and the levels of contaminants found in drinking water. The report must be mailed to all customers; however, governors may allow systems serving fewer than 10,000 people to publish the report in a local newspaper rather than mailing it. Governors may allow systems serving fewer than 500 to simply notify customers that a report is available.

Reports must be issued by July 1 of each year. A CCR summarizes data for the previous calendar year. Each annual report must include certain specified information as outlined below. This summary is not complete, nor does it include all requirements. A more complete summary of the CCR requirements is included in **Appendix B**.

1. Information on the source of drinking water, including source water type, commonly used names, and locations;
2. A brief definition of terms;
3. If regulated contaminants are found, the maximum contaminant level goal (MCLG), the maximum contaminant level (MCL), and the level found;
4. If an MCL is violated, information on health effects; and
5. If EPA requires it, information on levels of unregulated contaminants.

Systems must make a good faith effort to reach consumers who do not get water bills, using means recommended by the state primacy agency. This includes customers who are served by the system but are not bill-paying customers, such as renters or workers.

3.3. Water Use Regulations (Water Rights)

3.3.1 Oregon Water Resources Department (OWRD)

The OWRD regulates the use of both surface and groundwater throughout the State of Oregon. Over the years as greater demands are placed on limited water resources, OWRD has been exercising greater control over this water use. The following is a summary of some of the policies and procedures that control the use and allocation of groundwater and surface water sources.

In Oregon, all water is publicly owned. Landowners with water flowing past or under their property do not automatically have the right to divert the water without a permit. Water rights have long been used to control the withdrawal of surface water for municipal or agricultural use. OWRD is the agency charged with issuing and controlling water rights. A water right is authorization from the state to make use of water – either surface water or groundwater. Since 1909, state law has required issuance of a water right before using surface water. Groundwater has been subject to the permit requirements statewide since 1955.

In Oregon, and throughout the Western United States, the use of water is governed by the Prior Appropriation doctrine. The doctrine of Prior Appropriation evolved in the law to promote settlement and development of the West. The basic concept is that people are encouraged to put water to "beneficial use" by taking it from a stream and applying it to the land. The system is basically one of first come, first served. The first person to obtain a water right on any given stream will be the last person to be shut off in times of shortage. Each water right includes a priority date. A senior water right holder is entitled to full delivery of all water allowed under the right before any junior priority dates may be served. The process for ensuring proper distribution according to water right priority dates is called "regulation and distribution." A state watermaster is authorized to regulate junior users in order to protect senior users.

Water rights are issued only for beneficial use, without waste. Each water right includes a designated type of "use" and is limited to that purpose. General categories of beneficial use include, but are not limited to: irrigation, municipal, industrial, commercial and domestic. Since 1987, the law has specifically included instream flow protection as a beneficial use. A water right holder is entitled to use as much water as is necessary, up to the maximum amount shown on the water right, to accomplish the stated beneficial use.

Water rights are issued in two stages: The first stage is the "water right permit," which serves as the initial authorization for a water user to develop the source and begin making use of water. The second stage is the final certificate, which is issued after the water use is fully developed and put to use. Important legal distinctions exist between the permit stage and final certificate stage. At the permit stage, the water right is viewed as personal property, held by the water user. If the permit is not developed and used correctly, it may be subject to cancellation by the state. After the water right has been fully developed and used appropriately, the permit holder is entitled to a certificate. At that stage, the water right becomes "vested" and is treated as an interest in real property. A certificated water right remains valid forever, so long as it is used. If the water right is not used for a period of five or more years, it then becomes subject to forfeiture and cancellation. The process is not automatic. The state must first prove that the water right has not been used. The law includes a presumption of forfeiture upon a showing of non-use for the five-year period. The water right holder then has an opportunity to show whether the non-use was "excused" for one of a number reasons listed in the statutes. Excuses for non-use include, but are not limited to: economic hardship; other government regulations that prevent water use; or participation in a conservation reserve program.

Each permit, when initially approved by the Water Resources Department (OWRD), includes a period of time in which to complete the process of developing the source and putting water to beneficial use. Typically, surface water rights include a 5-year initial period, while ground water rights have a 3-year period. Extensions of time may be granted upon a showing of "good cause." The good cause determination is based on a number of factors, including past diligence of the permit holder.

Until several years ago, permit extensions were routinely granted by the OWRD, largely because there was little or no opposition to the extension requests. In the early 1990s, however, in the face of new Endangered Species Listings and growing attention by environmental groups, the OWRD was advised by the State Attorney General that the past practice of routine permit extensions was not legally sufficient. As a result, the OWRD made substantial changes to the permit extension process. The new rules require a more extensive analysis of the level of diligence shown by the permit holder in developing the water right, as well as consideration of other competing needs for the water. The process also includes a careful review of potential impacts on listed species, or flows necessary for Scenic Waterway purposes. If a permit extension is approved, new conditions may be added to address public interest concerns raised during the review process.

In addition to regulating water rights, the OWRD has regulatory authority over Water Management and Conservation Plans (WMCP) for public water systems. A WMCP is a plan developed by a water supplier that describes the water system and its needs, identifies it sources of water, and explains how the water supplier will manage and conserve those supplies to meet present and future needs. The requirement for completing such plans is tied to the revised rules surrounding water right permit extensions as described under OAR 690-315. These rules call for all suppliers serving over 1,000 people to complete a WMCP in association with water permit extensions. OAR 690-086 details the requirements of WMCPs.

3.4. Water System Design Standards

The City presently has detailed design criteria for water system improvements under City jurisdiction. These Public Works Design Standards (PWDS) provide a uniform set of standards for use by engineers in the design of public water distribution improvements. The intent of these standards is to provide guidelines for the design of public facilities that will provide an adequate service level for the present development as well as for future development. The PWDS cannot provide for all situations. They are intended to assist but not to substitute for competent work by design professionals.

The intent of the Standards is to:

- be consistent with current City Ordinances.
- provide design guidance criteria to the private sector for the design of public improvements within the City of Philomath.
- have sufficient structural strength to withstand all external loads which may be imposed;

- be of materials resistant to both corrosion and erosion with a minimum design life of 75 years;
- be economical and safe to build and maintain;
- meet all design requirements of the Oregon Health Division (OHD).

3.5. Basis of Cost Estimates

In order to compare between different alternatives, the comparative costs of the principal alternatives must be estimated. The cost estimates are based on numerous assumptions necessary due to the relative lack of detail available at the master planning stage. The basic assumptions are summarized below.

3.5.1 Accuracy of Cost Estimates

It is important to note that the cost estimates are estimates made without detailed engineering data or designs. The accuracy or precision of cost estimates is a function of the level to which alternatives are developed (i.e., detail and design) and the techniques used in preparing the actual estimate. Estimates are typically divided into three basic categories as follows:

a. Planning Level Estimates. These are order-of-magnitude estimates made without detailed engineering data. This type of estimate is normally accurate within +35% to –25% (i.e., final cost may be as much as 35% more or 25% less than the estimated amount). A relatively large contingency is typically included to reduce the risk of underestimating. This is particularly important since many times the project financing must be secured before the detailed design can proceed.

b. Budget Estimates. This type of estimate is prepared using process flow sheets, layouts, and equipment details during preliminary design. This type of estimate is typically accurate to within ±25%.

c. Engineer's Estimate. This estimate is prepared based on well-defined engineering data, typically when the construction plans and specifications are completed, and is sometimes called a definitive estimate. Since this type of estimate is based on comprehensive plans and elevations, piping and instrument diagrams, electrical diagrams, equipment data sheets, structural drawings, geotechnical data, and a complete set of specifications, the engineer's estimate is expected to be accurate within +15 percent to -5 percent (i.e., 15% more to 5% less than the estimate).

Since the alternatives (during the master planning process) are not developed in sufficient detail for a more precise estimate, the estimates presented in this document are order-of-magnitude estimates. Even though the final project cost may vary significantly from these estimates, the estimates are necessary to evaluate and compare the alternatives, and will be reasonably accurate relative to each other.

3.5.2 Adjustment of Cost Estimates over Time

As the costs of material, labor and equipment rise over time, comparable changes will occur in the costs presented in this study. However, since the relative costs of the alternatives compared to each other should remain reasonably constant, the recommendations based on the cost estimates should remain valid.

A commonly used indicator of these changes in construction costs is the Engineering News-Record (ENR) construction cost index. The index is computed from the prices for structural steel, Portland cement, lumber, and common labor, and is based on a value of 100 in the year 1913. The construction costs developed in this analysis are based on current ENR 20 cities index (for index number, see **Section 7**). The costs presented herein can be related to those at any time in the past or future by applying the ratio of the then-prevailing cost index to index number used at present.

3.5.3 Engineering & Administrative Costs & Contingencies

The cost of engineering services for major projects typically covers special investigations, pre-design reports, topographic surveying, geotechnical investigations, contract drawings and specifications, construction administration, inspection, project start-up, the preparation of O&M manual narratives, and performance certifications. 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 complex mechanical systems. The higher percentage applies to smaller, more complex projects, projects that involve remodeling of existing plants, or where full time inspection is required by the funding agencies or desired by the Owner.

The City will have administrative costs associated with any construction project. These include internal planning and budgeting/payments, administration of engineering and construction contracts, legal services, and coordination with regulatory and funding agencies. For a typical project of this size, the City's administrative, legal and permitting costs are expected to be about 10 percent of the contract cost.

3.5.4 Construction Costs Estimates

Preliminary construction costs for distribution system improvements recommended in this report are based on a number of assumptions as follows. The cost estimates reflect projects bid in late winter or early spring for summer construction. These estimates are based on construction costs for similar projects and manufacturer's information. The costs do not reflect a detailed investigation of existing utilities and soils. It is important to note that the cost estimates are planning level estimates, not engineering estimates, and are intended to be within the range of plus 35% to minus 25% of the actual project cost.

The elements which comprise these budget estimates for the piping portion of the collection system improvements include:

- Pipeline Construction Cost (materials, installation, service line reconnection, mainline connections, and hydrants)
  - 12-inch Diameter - $95 per foot
  - 10-inch Diameter - $85 per foot
  - 8-inch Diameter - $75 per foot
- Highway Bores - $180/ft
- Construction Contingencies - 10% of estimated construction cost
- Engineering Costs (surveying, engineering design, and construction administration) - 16% of estimated construction cost
- Legal, Permits & Administrative Costs (permitting, administration, legal, easement acquisition and financing) - 10% of estimated construction cost

Example: 800 lineal feet of new 12-inch pipe

Est. Construction Cost =	(800 feet of 12-inch) x $95.00/ft	$76,000
Constr. Contingencies =	$76,000 x 10%	$7,600
Engineering =	$76,000 x 16%	$12,160
Legal, Permits & Admin =	$59,900 x 10%	$7,600
Total Est. Project Cost		$103,360

The estimates of construction costs for reservoirs, treatment facilities, and other non-pipeline projects are based on costs for similar projects and manufacturer's information. Due to the greater complexity of these projects, construction contingencies and engineering costs of 15% and 20% were assumed respectively.

These construction costs are preliminary estimates, but they should help the City in the process of planning and allocating resources in the most cost effective manner. All costs are estimates of probable costs and do not reflect changes that could include increasing labor costs, material, and phased construction dates. Unit costs used for installation of waterlines include excavation and export of material, bedding and backfill, cutting of asphalt, repaving of streets, pipe placement, connections and fire hydrants.

Since the funding sources for the completion of the recommended improvements have not yet been confirmed, the cost estimates outlined above are based on the assumption that each of the projects will be designed and constructed separately with local funds. If multiple items are combined into a single project, there will be significant cost savings on engineering design, bidding and construction administration and inspection services.

CITY OF PHILOMATH
Water System Master Plan,
Philomath, Oregon

Section 4

Existing System

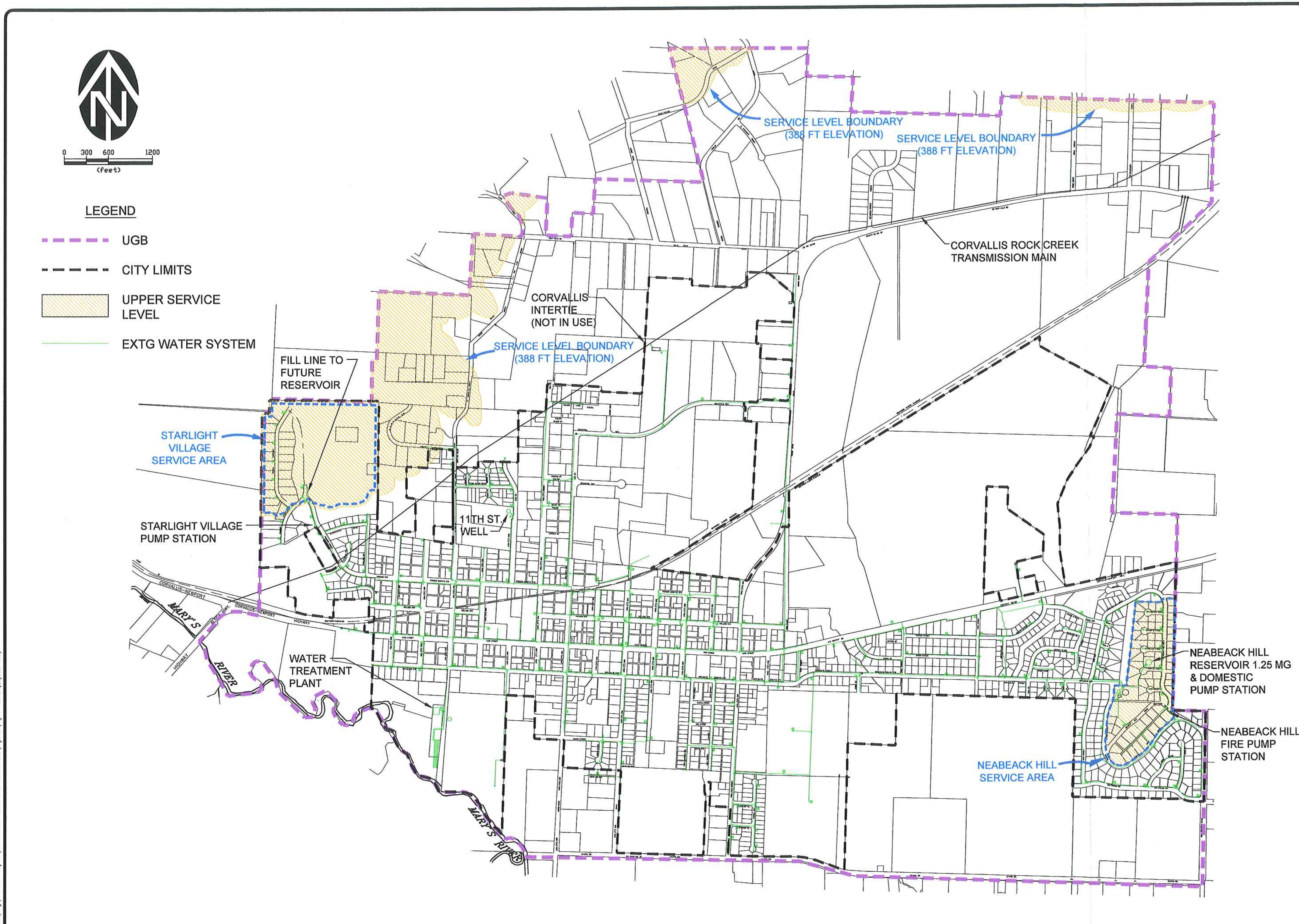
SECTION 4 EXISTING SYSTEM

4.1. General Overview

Philomath's original water system was designed to distribute water from Corvallis' Rock Creek Facility. For many years all water for Philomath's system was purchased from Corvallis. As demand due to population growth in the Corvallis-Philomath area increased beyond the capacity of the Rock Creek facility, both Corvallis and Philomath began to seek alternate water sources. Corvallis constructed the Taylor Water Treatment Plant and now draws most of its water from the Willamette River. In the 1970's Philomath drilled two municipal wells. For a time, these wells served as the primary water source for the City. Due to quality problems in the wells and the rising costs of purchasing water from Corvallis, the City of Philomath decided to construct a new water treatment facility and use the Marys River as its primary source.

The City currently obtains municipal drinking water from two sources. These are the Marys River and the 11th Street well. Water from the Marys River is withdrawn and treated at the City's water treatment plant (WTP) constructed in 1985. The 11th Street well was developed in 1977. The Marys River serves as the City's primary water source and the 11th Street well is used as a backup source only.

Storage is provided in a 1.25 million-gallon cast-in-place concrete reservoir that was constructed in 1994. The reservoir is located atop Neabeack hill on the east end of the City. Most of the City's transmission and distribution piping is constructed of cast iron, ductile iron, and PVC pipe. While there are some 12 and 16-inch transmission lines capable of delivering major fire flows, the majority of the distribution system piping is 6 and 8-inches in size. The major components of the water system are shown in **Figure 4-1**. Detailed water system maps are included in **Appendix A**. A schematic representation of the water system is presented in **Figure 4-2**.



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CITY OF PHILOMATH
2004 WATER MASTER PLAN

EXISTING WATER SYSTEM

FIGURE 4–1

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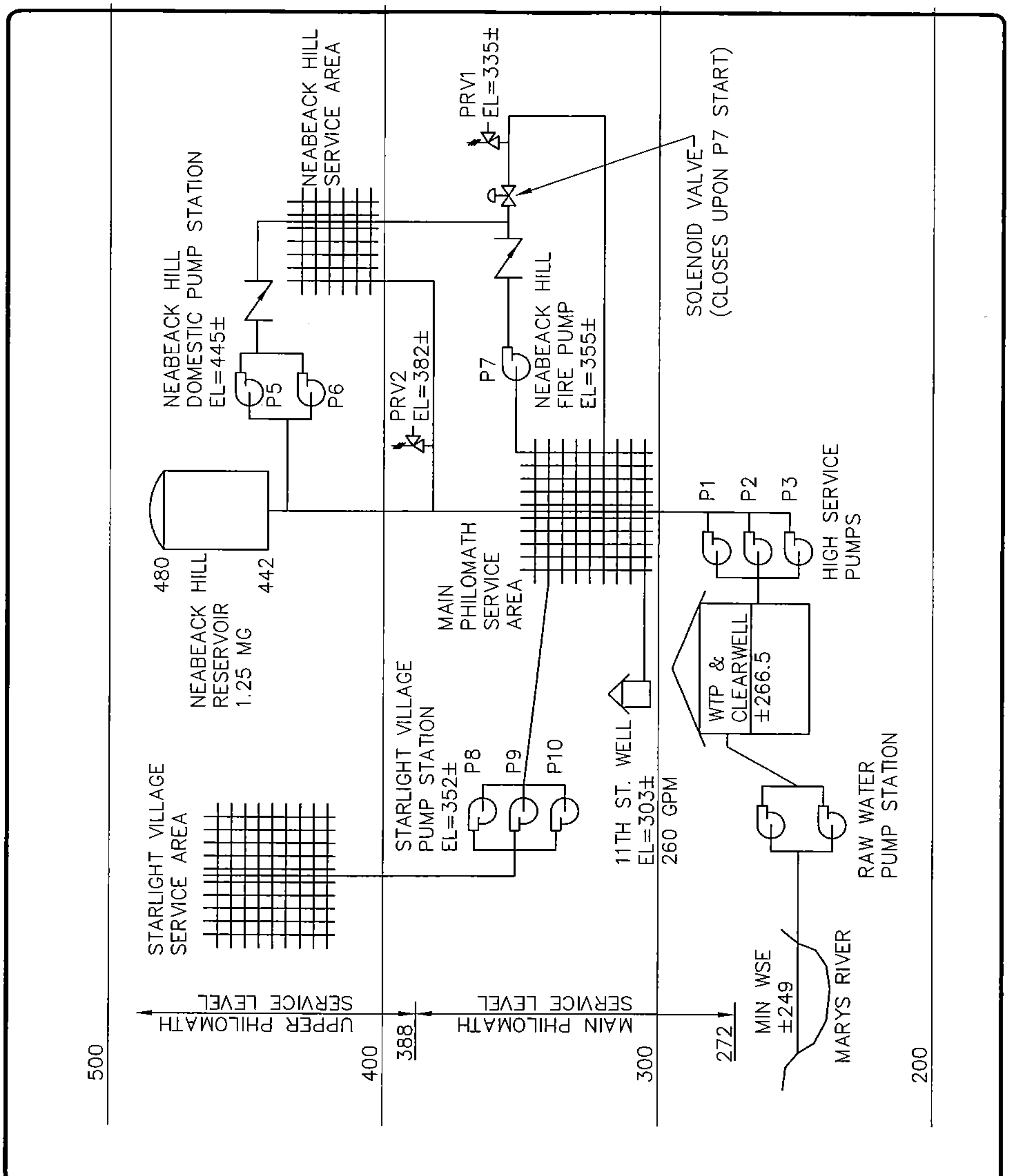

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CITY OF PHILOMATH

2004 WATER MASTER PLAN

EXISTING WATER SYSTEM SCHEMATIC

FIGURE 4-2

JOB NUMBER 960.4140.0

4.2. Water Supply Sources

4.2.1 Current Water Rights

Currently the City's primary source of water is the Marys River. The City's presently owns four separate water rights to draw water from the river. Two of these are irrigation rights. A transfer application for these two irrigation rights is under review by the Oregon Water Resources Department. As part of the transfer application, the City is seeking to move the point of diversion to the water treatment plant and to change the usage category from irrigation to municipal. The City utilizes the 11th Street well as a back-up water source and holds two water rights for this source.

Table 4-1 is a summary of the City-owned water rights.

TABLE 4-1
WATER RIGHTS SUMMARY

Source Name	Permit Rate cfs (gpm)	Appl #	Perm #	Cert#	Priority Date
Marys River	1.00 (449)	N/A	S13556	TO5623	3/11/1939
Marys River (1)	1.00 (449)	T8527	NA	NA	12/8/1952
Marys River (1, 2)	0.19 (86)	T8527	NA	NA	11/5/1964
Marys River	3.5 (1571)	S68266	S49245	N/A	1/28/1985
11th Street Well	0.56 (250)	G7903	G8108	62441	3/9/1977
11th Street Well	0.22 (100)	G10613	G9728	N/A	12/15/1981

(1) An application has been submitted to the WRD to transfer the point of diversion to the Water Treatment plant and to change the use from irrigation to municipal.
(2) The City owns a portion of this right. The total withdrawal rate is 0.32 CFS.

4.2.2 Surface Water Supply

Most of the year there is sufficient water in the Marys River to supply all of the City's Water Demands. However, river flows in the late summer during dry years can become very low. There are many claims for river water for irrigation and other purposes. Together these claims are greater than the available water during some low flow periods. Further, the State of Oregon reserved a water right for 10 CFS with a priority date of June 22, 1964 to maintain flows for aquatic life. Nevertheless, minimum stream flows of less than 10 CFS have occurred once every five years on average. Therefore, although there is enough water available in the Marys River most of each year, during the critical low flow periods, usually occurring in August and September, there is sometimes little water in the river. As the lowest stream flows may coincide with the maximum demands for municipal water, the availability of adequate water during the low flow periods is imperative. To date, the City has been able to meet demands without limiting water use. However, as the population continues to grow, shortages may become more likely. The alternatives for addressing the potential shortages are discussed in **Section 6**.

4.2.2.1 Raw Surface Water Quality

The raw water quality of the Marys River is generally good. The only notable problem with the quality of Marys River water is its tendency to have high turbidity levels in response to large winter storms. During these periods, the City has historically stopped the production of water from the WTP and utilized the 11th Street well and stored water to meet demands. Based on discussions with the City, the plant is typically shut down for one to six days each year in response to high turbidity. This strategy is successful largely due to the short duration of the high turbidity events and the fact that demands are typically lowest during wet winter periods.

4.2.3 Groundwater Supply Sources

The City currently has two municipal wells, the 11th Street well and the 9th Street well. For many years, the 9th Street well served as a backup raw water source at the WTP, but has since been disconnected and is no longer in service. The 11th Street well currently serves as a back-up water supply source.

4.2.3.1 11th Street Well

The 11th Street well is utilized as a supplemental water supply source during periods of high demand or low WTP production. During large storm events, high turbidity in the Marys River can make treatment difficult. During these times, the City has used the 11th Street Well together with stored water to meet demands until the turbidity in the river drops to levels that are more easily treated.

The 11th Street Well discharges directly into the distribution system. The 11th Street well was drilled in 1977. The upper 77 feet of this well was drilled through terrace deposits, and from 77 to 267 feet the well penetrates basalt rock. A 12-inch casing extends from above the surface of the ground to the 80-foot depth, and is perforated at the 76-80 foot level. Static water levels were originally at 17 feet. The well was test pumped at 320 gpm for three days shortly after it was drilled. The well pump is a 50 horsepower pump. From 1977 to late 1983 the 11th Street well served as a primary water source for Philomath. Static water level problems were encountered in the early years of the well, and consequently the production rate was decreased. The City currently pumps the well at approximately 300 gpm on an intermittent basis with no problems. However, extended pumping for several months at this rate has caused excessive drawdown. As such, the firm capacity of the well is more appropriately taken as 260 gpm on a continuous basis. Nonetheless, the City has been able to pump the well at a rate of 500 gpm on an intermittent basis (i.e., one to two weeks) with no problems. Therefore, during periods when the WTP is unavailable, the City may increase production from this well on a short-term basis to provide water to the users.

4.2.3.2 11th Street Well Raw Water Quality

The quality of water from the 11th Street well is problematic. The well water is relatively hard and has iron concentrations near the EPA secondary water quality limits. When the well is pumped heavily for long periods of time, groundwater levels decreased, and the water quality worsens. The City now adds polyphosphates to sequester iron. Chlorine is also added to the well water to prevent contamination of the water in the distribution sytem. This treatment scheme is still in use.

4.2.4 Corvallis Intertie

The City's former intertie with the City of Corvallis' water system is no longer in use, but should be considered at a last-resort, emergency supply source. The intertie originally consisted of a below-grade concrete vault that housed isolation valves, a flow meter, and associated piping. The flow meter has been removed. As such, there is no physical connection between the two water systems. In addition, the City's 1.25 MG reservoir was constructed at a higher elevation than the pre-existing reservoir. Therefore, the pressure in the City's system is higher than the pressure in Corvallis' system. As such, water would no longer flow by gravity from the Corvallis system to the Philomath system if a physical connection existed. Therefore, it is physically impossible to convey water from the Corvallis system to the Philomath system at the present time. Furthermore, the agreement between the two City's has expired. Nonetheless, the existence of the intertie is worth noting. In the event that a prolonged water supply shortage were to occur, the City may wish to consider refurbishing the intertie to provide water to the City on a short-term, emergency, basis. For example, a chemical spill into the Marys River, could render the river water unusable for several weeks. Should such an event occur, the City would first need to obtain a new agreement with the City of Corvallis. Upon execution of a new agreement, the City would need to install a pump to pump water from the Corvallis water system into the Philomath system. This type of mechanical modification could be performed in a matter of days.

4.3. Water Treatment Facilities

4.3.1 Marys River Water Treatment Plant

The water treatment plant was constructed in 1985 as part of a large-scale water system improvement project. This was Philomath's first full-scale water treatment plant and was built to replace existing problem well sources and greatly reduce, if not eliminate, the cost of purchasing additional water from the City of Corvallis. Prior to the construction of the WTP, the City obtained a large portion of its water from Corvallis' Rock Creek facility. Water from the Rock Creek Watershed is conveyed to Corvallis by a 16-inch transmission main that runs through the City of Philomath. Water was withdrawn from this transmission main for use in Philomath. After the construction of the WTP, Rock Creek water was no longer needed.

The Water Treatment Plant is located on the north bank of the Marys River at the south end of 9th Street. The site consists of approximately 2.29 acres on a single tax lot. The river intake, intake pump station, and piping to the WTP are located in easements on the west side of the site.

Raw water is drawn directly from the Marys River and flows by gravity to the intake pump station. Water is pumped into the treatment plant where chemicals are applied before being discharged into one of two packaged treatment units. After passing through the packaged treatment units chlorine is injected and the treated water is discharged into a clearwell. Water is pumped from the clearwell into through a chlorine contact chamber and into the distribution system.

4.3.1.1 Plant Flow Capacities

The nominal capacity of the plant is 694 gpm (1 MGD). The plant was designed to operate at three different rates depending on demand. Those rates are 375 gpm (0.540 MGD), 750 gpm (0.855 MGD), and 1050 gpm (1.512 MGD). The plant was designed to automatically operate at each of the three production rates depending on the water system demand. As demand increased, the water level in the City's storage reservoir decreased and the plant would respond by increasing production. Currently, the high service pumps are started simultaneously rather than sequentially. In essence, the plant is either "on" or "off" and the production rate is more or less constant. The City has the ability to reprogram the control system to start the pumps sequentially as originally designed. However, the more straightforward operational scheme currently used is preferred. Operators have found that they can produce better quality finish water with fewer man-hours by starting the pumps simultaneously rather than sequentially. Sequentially starting the pumps requires varying the chemical feed rates. An automated control system was installed when the plant was constructed to vary the chemical feed rates in response to plant production rates. Plant operators found that keeping the control system in calibration was difficult, and they determined that starting the pumps simultaneously simplified operation and reduced the number of man-hours required to operate the plant.

Table 4-2 outlines some of the design parameters of the City's Water Treatment Plant followed by a brief discussion of the equipment at the WTP.

TABLE 4-2
WATER TREATMENT PLANT DATA

Date Constructed	1985
RAW WATER SUPPLY	
Supply Source	Marys River
Intake Structure	Johnson 16" Ø by 51" long stainless steel intake tee screen with a protective bar screen on the upstream side Open area = 63.8%, Slot opening = 0.125 in. Clean screen capacity = 1050 GPM at maximum through slot velocity of 0.5 ft/sec and pressure drop = 0.1 PSI.
Raw Water Pumps	Peabody Floway Multistage Vertical Turbine
• Number	3
• Size & Speed	20 hp, 3500 RPM
• Design Discharge Rate	375 gpm @ 70' head (each)
• Discharge Line	12" Ductile Iron
WATER TREATMENT PLANT	
Rated Capacity	1050 gpm (1.5 MGD)
Finished Floor Elevation	268.50'±
Raw water flow meter	6" turbo meter
Raw water turbidimeter	Hach, Surface Scatter 5
Static Mixer	Koflo model #12-40-2-6-5 inj.
Number of Clarifier/Filter Units	2 Microfloc Trident Units (TR 210)
Clarifier Area per Unit	35 ft^2
Filter Area per Unit	70 ft^2
Backwash	Filters are backwashed in response to headloss through the filter. Backwash rate is adjustable.
Clearwell volume	40,000 gallons
Effluent flow meter	Sparling 10" tube propeller meter
HIGH SERVICE (FINISHED WATER) BOOSTER PUMPS	
• Type	Peabody Floway Model 10 LMK 4-stage Vertical Turbine
• Number	3
• Size & Speed	40 hp, 1750 RPM
• Static Pressure (Storage Reservoir Full)	214 ft (92 psi)
• Design discharge rate	375 GPM @ 240 ft TDH

4.3.1.2 Intake Structure and Pump Station

The intake structure collects raw water from the Marys River through a screened intake. Water flows by gravity to the intake pump station wet well where it is pumped into the treatment facility. Three raw water pumps operate as system demand increases.

The screened intake is equipped with a 200 gallon air tank that stores air to clean the screen. The screen is cleaned by a blast of air to remove debris. A second emergency intake is provided if the screened intake or air cleaning system fails.

Three vertical turbine pumps provide raw water supply to the treatment plant. Two pumps operate in a "lead-lag" sequence with a third pump dedicated to supply high water demands. Each pump is equipped with isolation and check valves. A level switch in the intake structure protects the pumps from low water levels. Level switches in the clearwell also control the raw water pumps. As the water level in the clearwell lowers, the raw water pumps are sequentially turned on and as the water level rises, the pumps are sequentially turned off. The first two raw water pumps are in a "lead-lag" sequence and alternate in operation as the "first-on" raw water pump.

Based on discussions with the City, in recent years sediment is beginning to accumulate around the intake screen. To prevent clogging, City personnel must remove sediment from the area around the screen on an annual basis.

4.3.1.3 Chemical Feed Equipment

Five chemical feed systems are used at the plant:

1. Liquid Alum (Aluminum Sulfate)
2. Sodium Carbonate (Soda Ash)
3. Polyelectrolyte
4. Chlorine (Gas)
5. Fluorosilisic Acid

Each chemical feed system is equipped with an isolation valve, chemical injector, and calibration column. The calibration column is a graduated cylinder used to check the feed rate of each chemical feed pump. All chemicals are added to the raw water at a static mixer before the packaged treatment units. The static mixer is a baffled pipe section that induces turbulence as water flows through. The liquid alum feed system has one pump each, while the soda ash, polyelectrolyte, and fluorosilisic acid have two. Chlorine gas is injected into the water solution and is pumped to the treatment facility. The plant was originally designed to allow for the addition of activated carbon. However, this equipment was not used and has been removed.

4.3.1.4 Adsorption Clarifier/Filter

At the heart of the treatment plant are two large steel tanks, each containing an adsorption clarifier and mixed media filter. The chemically dosed raw water enters the units and flows upward through the adsorption clarifier. The clarifier contains a granular, buoyant media that provides rapid mixing, flocculation, and clarification in a single treatment step. Contact flocculation and clarification occur as the coagulated particles move through the adsorption media.

The effluent from the clarifier flows into a trough and to the mixed-media filters. The filters are composed of materials that are sized form coarse to fine in the direction of flow.

To clean the clarifier, diffused air from an air blower is injected into the bottom of the clarifier. The air reduces the adsorption media's buoyancy, causing an expansion and scouring of the adsorption media. Raw water continues to enter the clarifier and accumulated solids are flushed to waste. Since the majority of solids removal is done in the clarifier, this compartment is normally cleaned two or more times during a filter run.

The mixed media filter is backwashed by reversing the flow direction, expanding the media bed, and flushing solids to waste. A surface wash system is also provided to break-up any layer of accumulated solids on the surface of the media.

Both the clarifier and filter cleaning cycles are automatically controlled in response to flow through the units. The system includes a filter to waste line to waste the high turbidity filtered water spike common after backwash cycles.

4.3.1.5 Clearwell and High Service Pumps

The clearwell is located in the WTP building beneath the high service pump motors. It is approximately 40,000 gallons in total volume and has access through a hatch in the northeast corner of the building. The clearwell contains the level switches controlling the backwash and raw water pumps.

The high service pumps pump water from the clear well into the distribution system. When the original WTP was constructed, 20 hp pumps were installed. These were replaced with 40 hp pumps when the new storage reservoir was constructed. This was done because the new storage reservoir was constructed at a higher overflow elevation than the original reservoir. This changed the head conditions on the high service pumps rendering the 20 horsepower pumps insufficient. The high service pumps are controlled by the water level in the storage reservoir.

The clearwell contains enough water to backwash each filter once before refilling is necessary. However, if the backwash water volume is insufficient to complete one backwash, the level controls will not allow the filters to backwash until the clearwell is sufficiently full.

4.3.1.6 Backwash Waste Ponds

The backwash waste ponds, located just south of the treatment plant, are for settling solids from the backwash wastewater prior to discharging to the river. Each pond has an overflow and isolation valves so each pond can be used separately. The overflow from each pond is routed to an overflow box that has a V-notch weir. The weir allows a varying discharge as the pond rises, but also keeps the pond at a fairly constant level. The ponds are designed to be used for a few weeks at a time before sludge drying and removal is required.

4.3.1.7 Chlorine Contact Chamber

The Oregon Department of Human Resources Health Division – Drinking Water Section evaluated the Water Treatment Plant. The filtration equipment is credited with a 2.5-log Giardia removal credit for treatment thus requiring 0.5-log removal by disinfection. The required 0.5-log removal by disinfection is provided in a chlorine contact chamber downstream of the filter units. The contact chamber was designed to provide 55 minutes contact time at the maximum plant production rate of 1050 gpm. The chamber consists of 10 and 12 inch diameter pipe that provides approximately 7,525 gallons and 24" diameter pipe that provides approximately 52,590 gallons of contact volume. The piping is configured to allow for future expansion.

4.3.1.8 Raw Water Flow Measurement

Flow of raw water into the treatment plant is measured after the raw water pumps. The flow meter is a 6" turbine water meter. A second meter is installed on the backwash line from the filters to record the volume of water used in backwashing.

4.3.1.9 Finish Water Flow Measurement

Flow of finish water into the distribution system is measured after the high service pumps. The flow meter is a Sparling 10" in line turbine water meter.

4.3.1.10 Disinfection

Disinfection is achieved by chlorine injection either downstream of the raw water pumps or directly into the filter discharge piping. The chlorine injection rate is varied depending on the turbidity, with more chlorine used when the turbidity is higher. Typical rates of chlorine injection are near 1 ppm. Injection rates of 3-4 ppm may be used for short periods during heavy rains.

4.3.1.11 Auxiliary Power

The plant does not have auxiliary power.

4.3.1.12 Finished Water Quality

The finished water quality from the treatment plant is generally of good quality. As required by the OHD and under OAR 333-61-036, water from the City water system is tested periodically for bacteriological contamination, organic and inorganic chemical contaminants, disinfection byproducts, and a variety of radioactive compounds.

Based on conversations with City personnel there does not currently appear to be any known problems with water quality under normal conditions. To date, finish water has met all applicable treatment standards. The City has also been able to meet the Lead and Copper rules through pH control at the WTP.

4.3.2 11th Street Well Treatment Facilities

Water from the 11th Street well requires a modest amount of treatment. As previously described, polyphosphates are added to the well water to sequester iron and manganese and to control pipe corrosion. A gas chlorine system is used to disinfect the well water prior to being discharged to the distribution system.

4.4. Existing Distribution System

The major components of the water transmission and distribution system for the City are shown in **Figure 4-1**. Detailed water system maps are included in **Appendix A**. The current transmission system is a mixture of many different pipe materials and ages, with sizes primarily of 6" and 8". Some larger 12" and 16" transmission lines are also included. Water services on the City water system are metered, with the meters being read monthly by the City.

4.4.1 Distribution System Layout

The layout of the existing water system appears to be adequate to deliver the required domestic flowrates to the community. However, large portions of the system do not have the capacity to deliver required fire flows while maintaining the required 20 psi residual pressure at all service connections. This lack of capacity is the result of pipe sizes which are too small and the configuration of the distribution system.

Overall the valve and hydrant arrangement for the system appears to function satisfactorily for the City in most circumstances. The valve arrangement provides the ability to isolate most sections of pipe to a reasonably small area. The hydrants are well distributed around the system providing some level of coverage to nearly all parts of the developed areas. However, in a number of locations hydrant spacing exceeds the current standards calling for hydrants no more than 500 feet apart.

Although all public waterlines within the study area are owned by the City, three entities have jurisdiction over the right-of-ways within which the water mainlines are located. In addition to the City, the Oregon Department of Transportation (ODOT) has jurisdictional oversight for facilities constructed within the right-of-ways along Highway 20/34, while Benton County has jurisdictional oversight for facilities constructed within County right-of-ways. The County typically defers to the City for review of water distribution facilities in County right-of-ways within City Limits.

4.4.2 Service Levels and Pumping Facilities

Water must be supplied to the customers at sufficiently high pressures to prevent contamination and to ensure that water using appliances operate correctly. Excessive pressures must also be avoided to prevent damage to components of the distribution system and private plumbing fixtures. City standards require a range of 40 to 100 psi. Where higher pressures are necessary for an isolated area within a service level, individual pressure reducing valves (PRV) can be installed by the customer on the affected services. If more than a few water services are affected, the installation of a public PRV should be considered.

Due to the difference in elevation and location within the City, there are two pressure service levels that provide service for customers. The Main Philomath Service Level serves the vast majority of the City. Some portions of the City are too high in elevation to be served by the Main Philomath Service Level. These areas are in the Upper Service Level. Individual pump stations boost pressures in these areas. Each pump station serves only a portion of the upper service level. In this way the service area of each pump station further subdivides the upper service area. There are currently two pump stations serving different areas of the upper service level. These pump stations create the Neabeack Hill service area and the Starlight Village service area. The vertical boundary between the Main Philomath Service Level and the Upper Service Level is the 388 foot elevation.

Figure 4-2 is a schematic representation of the water system showing the relationship between the various service levels and the pump stations that provide water to the service levels. **Table 4-3** contains an overview of the basic design criteria for the City's existing pump stations. A brief discussion of the service levels and pumping facilities follows.

TABLE 4-3 EXISTING HIGH SERVICE PUMPING FACILITIES (Based on District Records)					
Pump Station Name (Service Level)	WTP (Main Philomath)	11th Street Well (Main Philomath)	Neabeack Hill Domestic (Neabeack Hill)	Neabeack Hill Fire (Neabeack Hill)	Starlight Village (Starlight Village)
Pump Location Pump Designation	WTP Pumps 1, 2, & 3	11th St. near Quail Glenn Drive Pump 4	Near Storage Reservoir Pump 5 & 6	Benton View Dr. Near Neabeack Hill Dr. Pump 7	Pioneer St. near Canberra Drive Pumps 8, 9, & 10
Flows (Current Capacity)	±375 gpm each ± 1000 gpm combined	±320 gpm	±50 gpm each	±2000 gpm	2 @ ± 150 gpm 1 @ 2000 gpm
Pumps ▸ Type ▸ Number ▸ Motor Size ▸ Motor Speed ▸ Power	▸ Vertical Turbine ▸ 3 ▸ 40 HP ▸ 1750 rpm ▸ 480V, 3ø	▸ Vertical Turb. ▸ 1 ▸ 50 HP ▸ 1760 rpm ▸ 480V, 3ø	▸ Centrifugal ▸ 2 ▸ 1.5 HP ▸ 3500 rpm ▸ 230V, 1ø	▸ Centrifugal ▸ 1 ▸ 75 HP ▸ 3570 rpm ▸ 480V, 3ø	▸ Centrifugal ▸ 3 ▸ 15 & 200 HP ▸ 15 HP VFD 3500 rpm (max) 200 HP 1750 rpm ▸ 480V, 3ø
Discharge Cond. ▸ Intake HGL ▸ Discharge Loc. ▸ Discharge El. ▸ Static Head	▸ ±266.50' ▸ Main Philomath Service Level ▸ ±213.5'	▸ ±260' ▸ Main Philomath Service Level ▸ ±220'	▸ ±445' ▸ Neabeack Hill Service level ▸ NA	▸ ±355' ▸ Neabeack Hill Service level ▸ NA	▸ ±352' ▸ Starlight Village Service level ▸ NA
Pump Control ▸ On ▸ Off	▸ Reservoir call ▸ Reservoir call ▸ Clearwell low	▸ Reservoir call ▸ Reservoir call	▸ Pressure switch ▸ Pressure switch	▸ Pressure switch ▸ Pressure switch	▸ Pressure switch ▸ Pressure switch
Flow Measurement	In-line Turbine Meter	In-line Turbine Meter	None	None	Pump hour meter readings
Telemetry	Leased Line from reservoir	Leased Line from reservoir	None	None	None
Auxiliary Power	None	None	None	None	None

4.4.2.1 Main Philomath Service Level/WTP High Service Pumps

The main Philomath Service Level encompasses the vast majority of the service area. Historically this was the only service level in the City. However, growth in the higher elevations atop Neabeack Hill and in the hills on the west side of town has required the creation of separate service levels served by pump stations.

The high service pumps at the WTP and the 11th Street well pump feed directly into the main Philomath Service Level. These facilities are described above in greater detail. The City's storage reservoir atop Neabeack Hill is connected to this service level and maintains the static pressure. The water level in the reservoir provides the on/off control for the high service pumps at the WTP and the 11th Street well pump.

4.4.2.2 Neabeack Hill service area/Neabeack Hill Pump Stations

The Neabeack Hill service area serves those homes on the top of Neabeack Hill which are above the Main Philomath Service Level. Water is fed into the service area by two pump stations. A small duplex pump station located near the reservoir provides water to meet the domestic demand only. This pump station is known at the Neabeack Hill Domestic Pump Station. Fire flows are provided by a second pump station known as the Neabeack Hill Fire Pump Station. This station is located near the intersection of Neabeack Hill Drive and Benton View Drive. There is no gravity storage tank in this service level. Therefore, the pump stations maintain the system pressure.

The Neabeack Hill Domestic Pump Station includes two 1.5 horsepower constant speed pumps. At least one pump runs at all times. The lag pump turns on when the pressure in the system drops below a set level. The Neabeack Hill Fire Pump Station includes a single 75 horsepower constant speed end suction centrifugal pump that turns on when the pressure in the system drops below a set level.

4.4.2.3 Starlight Village service Area/ Starlight Village Pump Station

The Starlight Village service area generally encompasses that portion of the Starlight Village development that is above the Main Philomath Service Level. This development is located in the northwest corner of town. The Starlight Village Pump Station located on Pioneer Street near the intersection of Canberra Drive feeds water into the service level. There is no gravity storage tank in this service level. Therefore, the pump station maintains the system pressure.

The Starlight Village Pump Station consists of two 15 horsepower vertical in-line centrifugal pumps that are started in a sequential manner as demand increase. A third 200 horsepower horizontal split case centrifugal pump provides fire flows. The two 15 horsepower pumps are controlled by a variable frequency drive that increases the pump speed to maintain system pressure. A constant speed motor drives the fire pump. If the system demand remains low for extended periods, all pumps will shut off. As the pressure drops, the first pump turns on. The variable frequency drive modulates the pump speed to maintain a constant pressure. If the first pump cannot maintain the system pressure at full speed the second pump starts. The speed of the second pump is then modulated to maintain system pressure. If the system pressure continues to drop the fire pump will start and the two domestic pumps will stop. The fire pump stops when the pressure in the system rises above a set pressure. Most of the pressure settings for the system are adjustable at an operator interface.

4.4.3 Distribution System Materials

4.4.3.1 Piping Materials

Most of the City's transmission and distribution piping is constructed of cast iron and ductile iron pipe and is in reasonably good condition. PVC piping serves some areas. Water system leakage is generally low.

It is generally desirable to use as few types of pipe within a water system as practical for the following reasons:

- Fewer types and sizes of repair bands, service saddles, and fittings need to be stocked.
- Fewer tools are required by maintenance personnel.

In July 1998 the City adopted public works design standards which are, in part, aimed at standardizing the type and size of piping materials being used in the expansion or rehabilitation of the distribution system. These new standards specify Class 52 ductile iron pipe conforming to AWWA C-151 as the material of choice for use in the water transmission and distribution system. **Table 4-4** gives a brief summary of the major requirements outlined in these standards, as well as current recommendations.

Many of the older components of the distribution system do not meet the current standards. In many cases the need to upgrade these portions of the distribution system is not critical enough to justify replacement. However, as extensions, repairs or alterations are made to these portions of the distribution system, it is advisable not only that the new components meet the standards, but that the portions of the distribution system which supply these components also be upgraded to conform with the standards.

TABLE 4-4 RECOMMENDED PIPING STANDARDS			
Component	Pipe Diameter	Pipe Material	Class
Transmission main and fire lines supplying more than 1500 gpm.	10-inch minimum	Ductile iron	Class 52 (AWWA-151)
Distribution:			
Private fire line serving single hydrant or building fire suppression system	6-inch minimum	Ductile iron	Class 52 (AWWA-151)
Dead end w/hydrant	8-inch minimum	Ductile iron	Class 52 (AWWA-151)
Looped runs	8-inch minimum	Ductile iron	Class 52 (AWWA-151)
Service Lines (public side of meter):			
Single Residential	1 inch minimum	Type K Seamless Copper	AWWA C-800, 160 psi
Triple Residential (triplexes only)	2 inch minimum	Type K Seamless Copper	AWWA C-800, 160 psi
Commercial/Industrial	1-inch min.	Type K Seamless Copper	AWWA C-800, 160 psi
Other services	Case by Case Basis	Case by Case Basis	Case by Case Basis

4.4.3.2 Fire Hydrants

Review of existing records indicate that the City has approximately 157 fire hydrants. While there are a variety of hydrants (e.g., Clow, Pacific States, Iowa, Waterous) in the system, the majority of the hydrants were manufactured by Pacific States and Clow. The Clow F-2500 with full size inlets was adopted in November 1998 as the City's standard hydrant.

Based on the City's Public Works Design Standards, the desired hydrant configuration is a three port hydrant with two 2½-inch ports and one 4-inch port (with pacific coast thread) fed from a 6-inch hydrant lead.

4.5. Storage Reservoir

The City presently has a single storage reservoir with a capacity of 1.25 million gallons. The reservoir is located atop Neabeack Hill as shown on the collection system maps. Water storage reservoirs provide at least five important functions as follows:

- They provide a reservoir of water to draw upon during short-term peak system consumption.
- They provide a reserve supply of water to meet fire demands.
- They allow water sources to be taken out of service for repairs or maintenance.

- They help in keeping system pressures reasonably constant.
- They add to system reliability generally.

The City's reservoir is a ground level, cylindrical, cast in place reinforced concrete structure. The inside diameter of the tank is 75 feet, and the walls are 39 feet tall. The overflow elevation is 480 feet and is set one foot below the top of the side walls. The tank is covered with a cast in place reinforced concrete roof that is supported by the tank walls and four interior columns. The reservoir is connected to the distribution system by a 16-inch diameter combination inlet/outlet. The reservoir has three floor penetrations; an inlet, an outlet, and an overflow. Check valves located in a valve vault outside of the reservoir control the flow of water into the inlet and out the outlet. The reservoir is drained by opening a valve that connects the overflow pipe and the outlet pipe. This valve is located in the valve vault. The overflow piping is equipped with an overflow sensor that detects the presence of water. The overflow/drain line discharges into a stormwater catch basin located near the intersection of Applegate and 31st Streets.

The reservoir has functioned as designed since construction. Over time, shrinkage cracks have opened causing visible leakage through the above grade tank walls. Periodically, the City has contracted to have the leaks sealed by pressure injecting grout. This work has successfully sealed existing leaks. However, as the tank continues to age new cracks are likely to develop. Therefore, sealing the leaks is likely to be an ongoing maintenance requirement. As part of the master planning effort, permanent solutions to eliminate the leakage problems were investigated. Recommendations are discussed in **Section 6.**

4.6. Telemetry

Telemetry refers to the monitoring and/or control of the system components from a remote location, such as a central control building. An analog signal produced by the instrumentation system components (e.g., pressure gage, flow meter, level transducer, etc.) is transmitted to a receiving station, where the signal is converted back to an instrument reading. Data transmitted to a central receiving station is more (and immediately) useful, as compared to data stored in a remote pumping station or reservoir. Telemetered alarms provide immediate warning of malfunctions and low water levels, reducing the time required to respond to emergency situations.

The Telemetry in the existing City water system is limited to the level control probe mounted in the 1.25 million gallon reservoir and connected via dedicated phone line to the WTP.

The telemetry in the tank controls the operation of the WTP and the 11th Street Well. When the tank water level reaches the low water setting, the WTP high service pumps are started and the reservoir fills. Should the water level in the tank continue to fall, the tank level will eventually reach the "on" setting for the 11th Street Well.

The current telemetry system will likely become outdated and or insufficient by the end of the planning period. Telemetry improvements are discussed in **Section 6.**

4.7. Description of Existing System Deficiencies

The major deficiencies in the City water system are related to storage capacity, and the ability to deliver fire flows. The Water Treatment plant is currently operating satisfactorily, but the required demands will soon exceed the production capacity of the plant.

In general, deficiencies fall into several categories. System elements may be experiencing one or more of these problems at the same time. These categories are provided to clarify concerns with particular elements of the system outlined in the following sections, and present typical solutions for each category of problem.

- Lack of Capacity. This type of problem results from sources, pipes, reservoirs or pumps which are too small to deliver the peak water demands. Many of the pipes installed are too small to deliver the required fire flows. Although the water system may have capacity to deliver the domestic flows, it is unable to convey the flows during major demand periods such as fire flows. In either case, the undersized portions of the existing system need to be addressed, either by increasing the size of the existing system or constructing new waterlines.

- End of Useful Life. This type of problem is the result of old, damaged, or worn out pipes, reservoirs or pump stations that no longer function as designed. The most common example of this type of problem includes leaking pipes, broken fire hydrants, or reservoirs which have reached the end of their design life. The correction of these type of problems requires replacement or reconstruction of the existing system.

- Lack of Facility. Problems in this category are caused by the absence of a component of the water system, either entirely of in a particular area. Examples include areas where there are no existing waterlines, lack of control systems or telemetry, etc.

- Lack of Maintenance. Many components of the water system require periodic maintenance to remain functional. Valves and fire hydrants, in particular, must be exercised on a regular basis (typically once/year at a minimum) to ensure that they remain in operational condition. This type of problem can be prevented or minimized by routine inspection, exercising and maintenance of the water system. At this time it does not appear that routine maintenance issues are involved in any of the deficiencies that have been noted.

Table 4-5 outlines the major known problem areas identified during the preparation of this report or as reported by Public Works, as well as the category which the problem falls under.

TABLE 4-5 KNOWN WATER SYSTEM PROBLEM AREAS	
Condition	Problem Category
Inadequate Storage	Lack of Capacity
Inadequate Fire Flows	Lack of Capacity (insufficient storage) Lack of Capacity (undersized mains) Lack of Facility (lines not looped)

The following is a brief discussion of some of the items outlined above.

4.7.1 Transmission & Distribution System Capacity

Although the City's water transmission and distribution system appears to be adequately sized to deliver the required <u>municipal</u> demands, the current water system is not able to deliver the recommended fire flows to many areas of town. Based on information included in the City's previous Water Master Plan, the long range plan for the distribution system included a reservoir on the west side of town and large diameter transition mains around both the north and south ends of town. Without these facilities, the system lacks the ability to deliver fire flows to the core area of town. These deficiencies are discussed in more detail in the analysis of the hydraulic capacity of the system presented in **Section 6**

Another shortcoming relates to service lines constructed during the 1970's and early 1980's. During that time the City installed a number of services using polybutylene pipe. Over the years, this material has shown a propensity for premature failure. As a result, the City has had to replace these service lines on a fairly regular basis. The City's existing maintenance budget has allowed for this work. Therefore, a large-scale polybutylene service replacement project will not be incorporated into the water system capital improvement plan.

4.7.2 Water Storage Facilities (Reservoirs)

It is important that adequate storage capacity be available to meet peaking demands while simultaneously providing the required fire flows. The current reservoir capacity of 1,250,000 gallons falls short of fulfilling these goals. The required system storage will be discussed in detail in **Section 6**.

<u>4.8. Existing Water System Funding Mechanisms</u>

Funding for the City's existing water system comes from two major sources, user fees and SDCs. Since SDCs can't be used to finance operation, maintenance and replacement costs of a water system, the O&M and repair costs must be financed from user fees.

The City's water fund must provide sufficient revenues to properly operate and maintain the water system and provide reserves for normally anticipated replacement of key system components such as pumps, motors, hydrants, waterlines, valves, etc. Although the City relies exclusively on water fees for operation and maintenance of the water system, the water fund can not typically finance major capital improvements without outside funding sources.

The existing monthly user rates are determined by adding a fixed base charge to a volume charge per unit of water consumed. The base charge and volume charge depend on the user classification and the meter size for commercial and industrial users. The specific rates are listed in **Table 4-5**. Assuming an average per capita consumption rate of 100 gallons per day and an average household size of 2.85 residents per household, the typical monthly user charge is approximately $33.14 for a single family residence.

TABLE 4-6
EXISTING WATER RATES

User Class	Base Charge	Volume Charge (1)
Residential and Duplex	$12.00	$1.85
Multi-Residential	$12.00 x # units x 50%	$1.60
Commercial/Industrial		
5/8" or 3/4" meter	$13.10	(2)
1" meter	$18.65	(2)
1 1/2" meter	$31.60	(2)
2" meter	$50.65	(2)
3" meter	$102.40	(2)

(1) 1 Volume Unit = 100 cubic feet = 748 gallons
(2) Commercial = $2.12, Industrial = $1.45

Section 5

Present and Future Water Demands

SECTION 5
PRESENT AND FUTURE WATER DEMANDS

5.1. General

The required capacity of a municipal water system is dictated by the total amount of water that it must furnish. This is a sum of the water required for domestic, commercial and industrial uses, plus water required for fire protection. For purposes of determining the required system capacity, the water required for domestic, commercial and industrial uses is usually taken as the maximum daily demand. In smaller towns, the requirements for fire protection typically meet or exceed this maximum daily demand.

The City currently obtains virtually all of its municipal drinking water from a surface water treatment plant, with water drawn from the Marys River. The City's maximum day demand in recent years is approximately 700 gpm. The total withdrawal rate permitted under the City's current Marys River water rights is approximately 2,550 gpm (See **Table 4-1**). Therefore, the City's current maximum day demand is approximately 27% of the total water rights controlled by the City. It is also interesting to note what proportion of the total water water rights issued on the Marys River Basin are controlled by the City. As previously stated, the City controls surface water rights in the amount of approximately 2,550 gpm or 5.68 CFS (See **Table 4-1**). Based on a review of the Oregon Water Resources Department Records, the sum of all surface water rights in the Marys River Basin equates to a withdrawal rate of approximately 180 CFS. Therefore, the City controls approximately 3% of the total water rights issued in the basin.

In order to select and size both pumping and distribution facilities for the planning period, projected water demands must be determined. The projected demands were determined based on a number of variables including the following.

- Rate of projected population increases
- Land use zoning within the study area
- Projected per capita flowrates.
- Projected fire flows.

This section develops water demand projections that are used for sizing the pump stations and distribution and storage system components, as well as the treatment plant components. The projected design flowrates were determined based on a number of variables including zoning of land within the service area, anticipated development density at buildout and within the planning period, projected per capita domestic flows, and fire flows.

5.2. Terms and Definitions

For purposes of the following discussions, some useful water system terms include the following.

- **Consumption** - Consumption is the water actually delivered to the system's users through service connections. Consumption is always somewhat less than demand, the difference being system loss. Demand is usually measured by system master meters and consumption is measured at the customer's meter. This report considers residential, public, commercial, industrial and rural consumption, as well as unmetered but quantifiable demands such as recommended fire flows.

- **Demand** - Demand refers to the total amount of water entering the distribution system from water sources and storage facilities to meet various user needs. Demand equals consumption plus system losses and is expressed in gallons per minute (gpm), gallons per day (gpd), or million gallons per day (MGD).

- **System Loss** - System loss is water which cannot be accounted for. It is the difference between the total system demand and the total consumption. System loss is not necessarily the same as leakage. Although the majority of system losses are typically the result of leaks, losses can also be attributed to meter error, as well as unmetered uses such as street flushing, hydrant testing and similar activities.

- **Average Day Demand (ADD)** - The average day demand is the total volume of water that enters the system over a period of one year, divided by 365 days. It is usually expressed in gpm or MGD.

- **Maximum Month Demand** - The maximum monthly demand is the largest total volume of water which enters the system in a one month period, divided by 30 days, expressed in gpm or MGD.

- **Maximum Day Demand (MDD)** - The maximum daily demand is the largest total volume of water that enters the system in a 24-hour period, expressed in gpm or MGD.

- **Peak Hour Demand (PHD)** - The peak hour demand is the greatest flow occurring in any one hour period, expressed in gpm or MGD. Unless the system has accurate records of both the production and the reservoir levels over time, this number may be hard to quantify.

- **Fire Flows** - The recommended fire flow is the flowrate required to fight a fire at a particular location. These fire flows are considered to be met if the system can deliver the required flowrate while maintaining a minimum residual pressure in the distribution system of 20 psi.

5.3. Current Water Demand and Consumption

For the purposes of this study, water consumption was determined by reviewing the system billings for water use. With the exception of tanker filling by the fire department, all service connections in the City are metered, with meters read on a monthly basis. As of January

2003 there were about 1,465 active water service connections in the City. **Table 5-1** shows a summary of the service connections within the City as of January 2003.

TABLE 5-1
WATER USER SUMMARY
(January 2003)

User Classification	No. of Services
Residential/Multi-Residential	1,276
Commercial/Schools	179
Industrial	10
Totals	1,465

Water demand is determined from the finish water flow meter at the WTP. This meter measures the water delivered to the distribution system and does not include water used for filter backwash.

Table 5-2 shows water demand and consumption characteristics for Philomath during the period from 2000 through 2002. It should be noted that neither the user's water meters nor the demand meter at the WTP are necessarily read at exactly the same time each month. Therefore the numbers in **Table 5-2** are most useful for annual averages, and may not accurately reflect month to month variations.

TABLE 5-2
RECORDED WATER DEMAND AND CONSUMPTION
2000 THROUGH 2002

Month	2000 Demand (MG)	2000 Cons. (MG)	2001 Demand (MG)	2001 Cons. (MG)	2002 Demand (MG)	2002 Cons. (MG)	Average Demand (MG)	Average Cons. (MG)
January	13.187	11.154	10.301	10.425	11.655	10.498	11.714	10.692
February	11.601	9.829	9.150	8.268	11.008	9.581	10.586	9.226
March	13.784	11.130	9.922	8.511	11.643	9.594	11.783	9.745
April	13.107	9.471	9.999	8.894	11.074	9.003	11.393	9.123
May	13.755	11.850	14.733	12.865	12.625	12.048	13.704	12.254
June	18.988	17.692	16.815	15.706	17.597	13.648	17.800	15.682
July	22.640	19.630	20.583	16.612	24.307	23.185	22.510	19.809
August	24.144	22.371	20.276	19.524	23.49	20.468	22.637	20.788
September	16.255	14.139	16.878	14.729	18.502	16.558	17.212	15.142
October	13.372	11.007	13.569	13.047	11.621	12.211	12.854	12.088
November	10.643	9.994	11.720	9.277	10.327	8.885	10.897	9.385
December	10.304	8.648	11.309	9.231	10.540	9.348	10.718	9.076
Totals	181.780	156.915	165.255	147.089	174.389	155.027	173.808	153.010
Average	15.148	13.076	13.771	12.257	14.532	12.919	14.484	12.751

Based on the data in **Table 5-2**, several calculated parameters that describe Philomath's water consumption patterns are presented in **Table 5-3.**

TABLE 5-3
WATER CONSUMPTION 2000 THROUGH 2002

Year	Annual Water Consumption (MG)	Est. Pop.	Average Annual Per Capita Consumption (gpcd)	Average Day Consumption (MGD) (gpm)	Max. Month Per Capita Consumption (gpcd)	Max. Month Consumption (MGD) (gpm)
2000	157	3838	112	0.430 299	188	0.722 500
2001	147	4010	100	0.403 280	157	0.630 437
2002	155	4100	103	0.425 295	182	0.748 519

The average per capita consumption for the three years shown is 105 gallons per capita per day, for all uses. For comparison purposes, the statewide average for domestic consumption is in the range of 110-120 gpcd.

Total system demand is shown in **Table 5-4**. The demand is assumed to be equal to the finished water produced at both the WTP and the 11th Street well. The production values do not include filter backwash water.

TABLE 5-4
WATER DEMAND 2000 THROUGH 2002

Year	Annual Water Production (MG)	Est. Pop.	Average Annual Per Capita Demands (gpcd)	Average Day Demand (MGD) (gpm)	Maximum Month Per Capita Demands (gpcd)	Maximum Month Demand (MGD) (gpm)	Maximum Day Per Capita Demands (gpcd)	Maximum Day Demand (MGD) (gpm)
2000	182	3838	130	0.499 346	202	0.779 540	261	1.004 697
2001	165	4010	112	0.452 313	165	0.652 452	215	0.864 600
2002	174	4100	116	0.476 331	191	0.784 544	261	1.074 746

The average annual per capita demand for the three years shown is 119 gallons per capita per day, for all uses. The average maximum month per capita demand is 186 gallons per capita per day. The average maximum day demand per capita is 245 gallons per capita per day. These numbers include both the water sold to users and the water lost in the distribution system.

5.4. Current Water System Losses

By comparing demand versus consumption, the unaccounted for water can readily be determined. The average percent unaccounted for water for Philomath for the years 2000 through 2002 are listed by month in **Table 5-5**. It should be noted that the production values do not include backwash water. It should also be noted, that the water meters at the services as well as at the production facilities are not necessarily read at the same time each month. Therefore, of the values presented in **Table 5-5**, the annual averages are the most useful.

TABLE 5-5
SYSTEM LOSSES

Month	Average Production (MG)	Average Consumption (MG)	Average System Loss (MG)	Average System Loss (gpm)	Average System Loss % Production
January	11.714	10.692	1.022	22.9	8.72%
February	10.586	9.226	1.360	33.7	12.85%
March	11.783	9.745	2.038	45.7	17.30%
April	11.393	9.123	2.271	52.6	19.93%
May	13.704	12.254	1.450	32.5	10.58%
June	17.800	15.682	2.118	49.0	11.90%
July	22.510	19.809	2.701	60.5	12.00%
August	22.637	20.788	1.849	41.4	8.17%
September	17.212	15.142	2.070	47.9	12.02%
October	12.854	12.088	0.766	17.1	5.96%
November	10.897	9.385	1.511	35.0	13.87%
December	10.718	9.076	1.642	36.8	15.32%
Average	14.484	12.751	1.733	39.593	12.38%

From **Table 5-2**, an average of 12.4% of the water produced is unaccounted for. This includes water lost through leaks, water unaccounted for due to unmetered uses such as fire fighting, or it may be the result of inaccurate meters. Given the age of the piping in the distribution system, approximately 12% loss is not surprising nor is it excessive when compared to other communities.

5.5. Projected Future Water Demands

Projected water demands were based on population projections, and typical water demand statistics. As discussed in **Section 2,** the population projection for Philomath is 7,365 residents in 2029.

The projected future industrial demands are based on the assumption that future industrial development will track the population growth. No provision has been made for new industries with heavy water demands such as food processing or beverage production. For purposes of this master plan it is assumed that new commercial and industrial developments will not be large water users (i.e., dry industries).

To project future flows, it is assumed that the long term per capita water demands will reflect the historical City averages. Since hourly data is not readily available, peaking factors were used to estimate peak hour demands. A peaking factor of 5 times ADD was used to estimate the PHD (peak hourly demand). This peaking factor is a commonly found value in the engineering literature and is often used for water system analysis and master planning.

Maximum daily demands have special significance because they can put stress on the water supply capabilities of the system. The water sources should be able to supply the entire water demand during the maximum day of the year in addition to any required fire flows. **Table 5-6** shows the projected water demands based on the peaking factors and population projections.

TABLE 5-6
SUMMARY OF PROJECTED WATER DEMANDS

Category Year	2005	2010	2015	2020	2025	2029	Buildout[5]
Population	4,220	4,739	5,322	5,977	6,712	7,365	15,170
Avg. Day Demand (ADD)[1] mgd (gpm)	0.502 (350)	0.564 (390)	0.633 (440)	0.711 (490)	0.799 (550)	0.876 (510)	1.805 (1,250)
Max. Month Demand (MMD)[2] mgd (gpm)	0.785 (550)	0.881 (610)	0.990 (690)	1.110 (770)	1.250 (870)	1.370 (950)	2.820 (1,960)
Max. Day Demand (MDD)[3] mgd (gpm)	1.034 (720)	1.161 (810)	1.304 (910)	1.464 (1,020)	1.644 (1,140)	1.804 (1,250)	3.720 (2,580)
Peak Hour Demand (PHD)[4] mgd (gpm)	2.510 (1,740)	2.820 (1,960)	3.165 (2,200)	3.555 (2,470)	3.995 (2,770)	4.380 (3,040)	8.025 (6,270)

[1] - Based on 119 gpcd (historical demands)
[2] - Based on 186 gpcd (historical demands)
[3] - Based on 245 gpcd (historical demands)
[4] - Based on peaking factor of 5 x ADD
[5] – Flows at buildout are used to size future transmission mains (see **Section 6**).

5.6. Fire Flows

In general, the water system is a community's primary resource for fighting fires. To assure adequate fire protection, the water system must be capable of supplying required fire flows in addition to maximum daily demands to the system. The Insurance Services Office (ISO) provides guidelines for determining the recommended fire flows for various structures. Large combustible buildings require larger fire flows than smaller or less combustible buildings. Buildings with fire protection systems (automatic sprinklers) generally require smaller fire flows than buildings without these systems. These guidelines are then used for the purpose of establishing insurance rates.

The minimum recommended fire flows from hydrants located in the City are based on two sets of criteria. The first is City or Fire Department standards, if present. The other is the ISO report prepared by the ISO Commercial Risk Services. The typical requirements are that the system in residential areas shall be designed to provide a minimum of 1,000 gpm per hydrant at a residual pressure of 20 psi at the highest water meter. Although flows of 1,000 gpm are normally adequate to provide fire protection in residential areas, much higher flows are required in commercial, industrial and multi-family developments.

To limit the size of the water mains and storage facilities necessary to supply fire flows to large combustible structures, some cities have a policy stating that all buildings requiring fire flows of 2,500 gpm or greater must install an automatic sprinkler system unless otherwise approved by the local fire marshall. If not already in place, it is recommended that the City institute a similar policy. The effect of such a policy would be to limit the City's obligation for providing fire flows to a maximum of 2,500 to 4,000 gpm to any single hydrant, thereby reducing the size and cost of future water system improvements.

As part of the Public Works Design Standards, the City adopted a policy of requiring adequate fire flow capacity as a prerequisite for future development. In addition to the ability of the water system to deliver the required fire flows at a particular location, fire protection rating also requires the capability of the system to deliver the required flowrate for a specified period of time. Section 5.10 of the City's Public Works Design Standards contains recommended fire flow standards. These are listed in **Table 5-7**.

TABLE 5-7
RECOMMENDED FIRE FLOWS

Location		Recommended Fire Flow (gpm)	Duration (hours)	Required Volume (gallons)
All others		1,000	2	120,000
Residential	Single Family	1,000	2	120,000
	Multi-familiy	2,500	2	300,000
Commercial		3,500	3	630,000
Industrial		4,000	4	960,000

CITY OF PHILOMATH
Water System Master Plan,
Philomath, Oregon

Section 6

Water System Evaluation and Recommendations

SECTION 6
WATER SYSTEM EVALUATION AND RECOMMENDATIONS

6.1. Introduction

As the City continues to grow, present and projected water system deficiencies will need to be corrected, including additional or expanded supply sources, expanded distribution system flow capacity, and increased storage capacity. By first formulating long range improvement plans, short term improvement priorities can best be established. Long range planning recommendations for the water supply, distribution, and storage facilities are presented in this chapter. The chapter also includes a prioritization of the recommendations to enable the City to most efficiently utilize available resources.

6.1.1 Basic Design Criteria

The size and location of all water system components including pumping facilities, pipelines and storage facilities determine the ability of the system to meet the water demands under different imposed conditions. Future water demands for various areas in City were estimated based on the land uses shown in the Comprehensive Plan. The criteria used to determine system adequacy are as follows:

- Water production facilities and water rights must be adequate to satisfy peak day demands.
- The system must provide for finish water storage sufficient to provide for equalization, fire flows, and emergency use.
- Peak hour demands for the entire system must be met with system pressures remaining above 20 psi.
- The system must be capable of delivering the required fire flows to all portions of the distribution system in combination with the maximum day demand while maintaining a minimum residual pressure of 20 psi at all service connections.
- The system must be able to refill all storage reservoirs during periods of reduced demand.

6.1.2 Methods of Analysis

The City water system consists of the WTP, the pump stations, reservoir, transmission mains and distribution system piping. Each element of this system can deliver a finite amount of water to the end user. The system as a whole must have the hydraulic capacity to deliver the required flows to the point of use.

The capacity of the water transmission and distribution system was evaluated to determine the improvements that need to be made to meet both the existing and future water demands. Computer modeling was used to assess the ability of the proposed future system to deliver the required flows under different conditions (See **Section 6.6**).

In addition to the hydraulic analysis the reliability of the various system components was examined. Based on this examination, recommendations were developed for the replacement of those components that were judged to be questionable in terms of reliability or serviceability.

It needs to be pointed out that the analyses outlined above were based on the assumptions and projections regarding population growth and community development as outlined in **Section 2** and water use projections in **Section 5**. Any large water using industry could seriously change the conditions predicted by the above analysis. Therefore, if and when plans for large industries are presented, it may be necessary to reanalyze expected flows to the affected area to determine the effect on the water system as a whole.

6.2. Water Supply and Water Rights

An analysis of the City's existing water rights and water supplies identified three areas of work for the next planning period. These include work to solidify the City's existing water rights, development of a Water Management and Conservation Plan, and obtaining additional reliable water supplies. The details of each of these work areas are discussed in the following sections.

6.2.1 Existing Water Rights

A review of the City's current water rights (see **Section 4.2**), showed that some work needs to be done to ensure the rights remain valid through and beyond the planning period. Listed below are the City's existing water rights with the work that must be done in order to strengthen the City's overall water rights position. At the time this plan was written, the City had begun work with a Certified Water Rights Examiner to perform the tasks listed below. As such, it is considered complete for the purposes of this planning effort, and no budgetary provisions are recommended.

Transfer Order 5623 - Marys River 1939 right for 1 CFS - Submit report of beneficial use and work with Water Resources Department to obtain certificate.

Transfer 8527 - Marys River 1952 and 1964 rights for 1 CFS and 0.19 CFS Respectively – Work with Water Resources Department to complete review of transfer application.

Permit S49245 – Marys River 1985 right for 3.5 CFS – Submit extension application.

Permit G9728 – 11th Street Well 1981 right for additional 100 GPM – Submit report of beneficial use and work with Water Resources Department to obtain certificate.

6.2.2 Water Management and Conservation Plan

New Oregon Administrative Rules now require the preparation of Water Management and Conservation Plans (WMCP) in accordance with OAR 690-86 guidelines. It is recommended that the City prepare and obtain approval for such a plan early in the planning period. Completion of a WMCP will likely be a condition of approval for the water rights extension application discussed above. It is recommended that the City implement a formal water conservation program in accordance with State guidelines following the completion of the WMCP. A budget of $20,000 should be established to complete the WMCP.

6.2.3 Obtain Additional Reliable Water Supplies

Though the 11th Street Well is a reliable source throughout the year, it alone cannot meet the City's demands. Therefore, the City's water supply is largely dependent upon the quantity of water that can be reliably withdrawn from the Marys River. During dry periods, flow in the Marys River can become very low. The State owns an in-stream water right for 10 CFS with a priority date of 1964. During extended dry periods, flow in the river often drops below this value. Therefore, the City has historically chosen to obtain early (pre-1964) water rights as a means of providing adequate water supply. These early, or senior, water rights predate the State's minimum flow right for 10 CFS, and may therefore be used to withdraw water when river flows drop below this value. For the purposes of this discussion, the City's early water rights constitute a reliable water source during the low flow summer months.

The total withdrawal allowed under the City's pre-1964 water rights is 1 CFS or 0.645 MGD. Combined with water from the 11th Street well, the total reliable water available to the City is approximately 1.02 MGD. Based on the data presented in **Section 5**, the peak day demand is currently equal to this value. Therefore, while the existing water rights are sufficient through the planning period, the existing reliable water supplies (i.e., sum of City's pre-1964 water rights and the 11th Street Well) are not. As such, alternative water supplies must be obtained. A number of alternatives exist for developing additional water supplies. A few of these include; additional wells, constructing a storage reservoir in the upper reaches of the Marys River Watershed, and obtaining additional early water rights.

6.2.3.1 Develop Additional Wells

Philomath is not in a particularly good groundwater area. Northwest of Philomath the hills are formed by the Siletz River volcanics, an igneous formation which yields small to moderate water quantities. There is some potential for drilling municipal wells in this formation, but such wells would be exploratory in nature and would be drilled without a high likelihood of success. The 11th Street well was drilled through terrace deposits into the Siletz River volcanics bellow. The terrace deposits typically yield small to moderate amounts of poor to moderate quality water. South of the City lie older alluvium deposits which are in most places less than 100 feet thick. Beneath the alluvium deposits is the Spencer Formation, a marine series yielding small quantities of poor quality water. The older alluviums in places do yield fairly large quantities of water, but it is usually of poor quality. The best, and only reliable good aquifer near Philomath, are the younger alluviums lying in the flood plain along the Willamette River. Wells in these materials can yield over 1000 gallons per minute.

The closest younger alluvium deposits suitable for municipal well development are 6.2 miles east of the City, northeast of the Corvallis airport. Developing a well field in the Willamette flood plain alluviums would require two or three good well sites and a long supply pipeline to convey water to town. The supply pipeline would be a relatively large diameter buried pipeline. A rough estimate of the construction costs for the pipeline alone is approximately 2.6 million dollars. This does not include the costs for the development of the wells. The high cost of this alternative, renders it infeasible when compared to the other alternatives.

6.2.3.2 Construct a Dam and Reservoir

The City could store water, most likely in a dam and reservoir, and release that water into the river when it is needed. The released water would be solely the City's and would not be subject to use by others. This scheme might be accomplished best by constructing an adequately sized dam and reservoir on a tributary of the Marys River in a location where a fish ladder would not be required. During periods when there is insufficient water in the river to meet the City's water needs, water from the reservoir would be released into the river and withdrawn at the WTP.

The development of water resources in the Marys River Basin has been studied to various degrees throughout the history of the Willamette Basin Project. The most recent and most thorough evaluation of the Marys River Basin occurred in the mid-1970's. The US Army Corps of Engineers published the results of this work in 1975 in a document titled "Marys River Basin Oregon: Review Report for Water Resources Development." As part of this work, the Corps identified three sites for large multipurpose reservoirs.

These are the Noon Site, Wren Site, and Tumtum Site. These are large multipurpose reservoirs of a much larger scale than that required for the City. The 1975 report, also lists a fourth storage alternative that includes a system of small tributary reservoirs. As part of this alternative, they identified four sites for the smaller reservoirs. These are Shotpouch Creek, Bark Creek, Mulkey Creek, and the East Fork of the Marys River. While still much larger than required, these tributary reservoirs are likely to be closer to the scale required for the City. Therefore, these tributaries are a good starting point for the determination of potential reservoir sites.

In the current regulatory climate, the overall project cost for the construction of a dam and storage reservoir can quickly ascend into the multimillion dollar range. Therefore, this alternative is much more costly than the other alternatives described below. As such, this alternative is not recommended at this time. Nonetheless, as the City continues to grow beyond the planning period the construction of a dam and storage reservoir in the upper reaches of the Marys River may eventually be required.

6.2.3.3 Obtain Additional Early Water Rights

During the summer months, the Marys River has a finite capacity for water withdrawals. Currently, agricultural users consume the majority of this capacity. In an effort to ensure that reliable water supplies are available, the City could purchase additional early water rights from the nearby agricultural users. This would essentially shift a greater portion of the finite capacity of the river from agricultural usage to municipal usage. The City recently acquired an irrigation water right as part of a land purchase. The City has applied to transfer the point of diversion for this right to the WTP and change the use from irrigation to municipal. This right is listed in **Table 4-1**. The diversion allowed under this right is 1 CFS or (0.645 MGD) with a priority date of 1952. Upon approval of the transfer, the City will have a total of 2 CFS (1.29 MGD) of pre-1964 rights. In order to meet the projected peak day demand at the end of the planning period (2.79 CFS or 1.80 MGD) without having to rely on the 11th Street Well, the City should obtain an additional 0.79 CFS (0.51 MGD) of pre-1964 water rights as soon as possible. Currently the City is working to obtain early water rights. As a preliminary goal, the City has elected to obtain enough early water rights to meet peak day demands through buildout. Based on the information presented in **Section 5**, the peak day demand at buildout is approximately 5.77 CFS (3.72 MGD). Therefore the acquisition of an additional 3.77 CFS (2.43 MGD) of early water rights is recommended.

The process of obtaining and transferring existing water rights is complicated. A basic element of state water law is the "use it or loose it" doctrine. This requires that water rights must be regularly exercised in order to remain valid. A certificated water right remains valid forever, so long as it is used. If the water right is not used for a period of five or more years, it then becomes subject to forfeiture and cancellation. The process is not automatic. The state must first prove that the water right has not been used. The law includes a presumption of forfeiture upon a showing of non-use for the five-year period. The water right holder then has an opportunity to show whether the non-use was "excused" for one of a number reasons listed in the statutes. Excuses for non-use include, but are not limited to: economic hardship; other government regulations that prevent water use; or participation in a conservation reserve program.

A review of the Water Resources Department files shows the early (pre-1964) water rights for the Marys River listed in **Appendix F**. Many of the rights listed in **Appendix F** are likely not transferable due to inactivity. Over the years, agricultural practices in the Marys River Basin have shifted from row crops with high irrigation requirements to less consumptive crops such as grass seed and Christmas Trees. As a result of this and other trends, many of the water rights listed in **Appendix F** have likely been unused for more than five years. As described above, such rights are non-transferable and subject to cancellation. Another complicating factor that arises from the "use it or loose it" doctrine is that appropriations allowed under a particular right must continue on a regular basis for the right to remain valid. In other words, water rights cannot simply be purchased and put in storage until needed. A continuous history of use must be demonstrated in order for the right to be transferable.

6.2.3.4 Recommended Water Supply Strategy

Based on the above discussion, it is clear that the most cost-effective strategy for obtaining additional reliable water supplies is to obtain additional early water rights. The City is currently working toward defining a list of target water rights that are transferable and may be obtained at a reasonable cost. The end result of this work should be a plan for obtaining early water rights that targets several water rights as well as a step by step plan for purchasing, and transferring each water right as demand requires. A key element of this plan is the identification of how each right will be exercised from the date of purchase to the date of transfer to municipal use at the WTP. As previously mentioned, this work effort is currently underway. However, due to the importance of this work it is recommended that an additional $50,000 be reserved for the continued development of a water rights acquisition plan as well as for the purchase of the water rights.

6.3. Water Production Facilities

The City owns and operates two water production facilities. These are the Marys River Water Treatment Plant and the 11th Street Well. The 11th Street Well is intended as an emergency backup water supply only. Thus, for long range planning purposes, the Marys River Water Treatment Plant must be able to satisfy essentially all of the City's demands.

Common practice is to size water production facilities to meet or exceed maximum day demands. As discussed in **Section 5**, the existing maximum day demand is approximately 1.07 MGD. The nominal capacity of the Marys River Water Treatment Plant is approximately 1.0 MGD. Therefore, maximum day demands are approaching the capacity of the production facilities. This indicates that during peak days, water in the storage reservoir along with water from the 11th Street Well may be required to satisfy domestic demands leaving little reserve capacity in the event of a major fire. As such, additional water production facilities may be required early in the planning period.

Based on the previous discussion, the Marys River is the recommended water source to meet future demands. A new treatment plant would require the acquisition of a new plant site due to the fact that the existing plant must remain in service during the construction of the new facility. If the new plant were to be constructed near the existing facility, it could use the existing river intake structure. However, if the site were not relatively close to the existing river intake, a new intake would be needed. The construction of a new intake requires and extensive permitting process to perform the in-stream work as well as a water rights transfer for a new "Point of Diversion". This would add considerable expense, and permit acquisition time, to the overall project. As such, the logical alternative for increasing the City's production facility is the expansion of the existing Marys River Water Treatment Plant.

The projected peak day demand at the end of the planning period is approximately 1.80 MGD. The 11th Street well should remain as a backup water source to supply customers when the Marys River Water Treatment Plant must be removed from service. Therefore, the treatment plant expansion should be sized to meet all of the projected peak day demands. The existing plant utilizes two modular treatment units manufactured by Neptune Microfloc. For compatibility purposes, ease of operation, and equipment flexibility, the same treatment units should be used for the expansion. The proposed expansion includes the addition of two new modular treatment units. The addition of two new filter units will increase the production capacity to 2.0 MGD.

The existing treatment plant site can accommodate the proposed plant expansion. The existing river intake screen has a capacity of approximately 1,500 GPM with minimal headloss. Therefore the screen has adequate capacity for the proposed expansion. However, due to the age of the screen, minor repair work may be required and should be budgeted accordingly.

The existing plant has two treatment units with three raw water pumps (one pump being redundant) and a common raw water main to the plant. During recent years of plant operation, the operator has experienced difficulty in maintaining constant flow to each of the treatment units so that efficient dosages of treatment chemicals are obtained. To remedy this situation, the proposed improvements include the installation of four dedicated raw water pumps with four dedicated raw water mains (one pump and water main for each treatment unit). Individual chemical feed pumps for each raw water main would be installed so that flows and chemical dosages can be individually controlled, thus providing a more efficient treatment process.

The chemical storage building that currently houses liquid alum would be expanded to accommodate a new caustic soda storage tank and polymer feed assembly. This would allow the existing chemical feed room to be used to house the fluoride feed assemblies.

Each treatment chemical would have four individual chemical feed pumps for each treatment unit. Therefore, each treatment unit is a separate treatment process that can operate independently of the other units. This allows considerable flexibility meeting water demands and normal maintenance of the overall systems.

The existing clearwell would need to be expanded to accommodate the capacity increase. The new clearwell would be constructed and connected to the existing clearwell. Two finished water pumps would remain in the existing clearwell and two new finished water pumps would be installed in the new clearwell. This would allow the treatment facility to be operated at 50% capacity should repair or maintenance work be required on the remaining 50% of the treatment plant.

The clearwell expansion would be part of an overall building expansion to the north of the existing building that would house two new treatment units. The existing plant would remain in operation during the construction of the two new treatment units. The new treatment units will need to be operational prior to taking the existing units off-line. After the raw water pumps, new units, clearwell, and finished water pumps are operational, the existing units would be connected to the new dedicated raw water lines and chemical treatment processes.

With the treatment plant capacity doubling, the backwash water settling ponds would also need to be expanded. The current area of the backwash water ponds is sufficient to double the size of the ponds by constructing concrete basins in each of the two existing basins. The discharge of the ponds would be directed eastward to the slough area for further settling prior to discharging to the Marys River.

Although the new treatment plant would meet the requirements to provide a 2.5-log removal credit in regards to disinfection, the chlorine contact basin must be expanded to supply adequate detention time to meet the Oregon Health Division 0.5-log removal requirement. Based on a flow of 1,400 gpm and a chlorine residual of 0.6 ppm, the total contact volume required is 77,000 gallons. An additional 724 feet of 24-inch diameter pipeline must be added to the existing contact chamber to provide the required contact volume.

The treatment plant expansion would also require additional parking area, landscaping, fencing, etc. and should be budgeted accordingly.

As described in Section 3, the Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) will be adopted by the OHD in the coming years. Under the LT2ESWTR, systems initially conduct source water monitoring for *Cryptosporidium* to determine their treatment requirements. Filtered systems will be classified in one of four risk bins based on their monitoring results. Systems classified in higher risk bins must provide 1 to 2.5-log additional reduction of *Cryptosporidium* levels. Since the LT2ESWTR has not been adopted, the City has not been required to perform the source water monitoring. Prior to undertaking the treatment plant upgrades, it is recommended that the City complete the required monitoring and design the plant to provide the necessary treatment levels required by the LT2ESWTR. To allow for treatment plant upgrades required by future regulation an allowance of $150,000 is included in the construction budget for the treatment plant expansion project.

The estimated overall project cost of the treatment plant expansion is $3,252,000. A detailed breakdown is included in **Appendix E**.

6.4. Water Storage Facilities

Water system storage serves three purposes: it equalizes daily variations between supply and use; it provides a reserve for fire fighting; it provides a reserve that can be used during an emergency interruption of supply. The total recommended storage in the system is the sum of the operational, fire, and emergency storage.

6.4.1 Equalizing Storage

Equalizing storage must supply the volume of water consumed during periods when system demands exceed supply capabilities. Philomath's present supply capacity is approximately 1 million gallons per day. This does not include the production capacity from the 11th Street Well. The City would like to continue to use the 11th Street Well as an emergency backup water supply only. Therefore, the production from the well was not considered in the analysis of the required equalization storage.

Since demands vary during the course of a day, there are periods when amounts greater than the production capacity (currently 1 MGD) are consumed. Hourly demand data is not readily available for Philomath. However, based on commonly accepted peaking factors, one can estimate peak demands throughout the day. As discussed in **Section 5**, the existing peak hour demand is approximately 2.45 MGD. Short duration peaks above the supply capacity of 1 MGD are met by equalization storage.

Daily demand fluctuations are influenced by weather and the mix of residential, commercial and industrial use. Commercial and industrial use tends to be more constant throughout the day than residential use. Therefore, if the proportion of residential use increases in coming years, the relative value of peak hour use to maximum day can be expected to increase.

The equalization storage volume required is typically determined as either percentage of the maximum day demand (typically 20 to 40%), or by determining the deficit between the peak hour demand and the available supply over a given time period. As previously stated, hourly data is not readily available for Philomath. Therefore, it is difficult to determine the deficit between peak hour demands and supply. As such the former method must be used to estimate the required equalization storage. Since Philomath is a relatively small community, the hourly fluctuations in water usage are likely to be higher than for larger communities. In larger communities, commercial and industrial users tend to dampen hourly variations. Whereas in smaller communities, hourly usage patterns are primarily influenced by residential users. Based on this reasoning, equalization storage in the amount of 40% of the maximum day demand is recommended.

6.4.2 Fire Storage

The required fire storage is determined by the single most severe fire flow demand on the system. As discussed in **Section 5**, industrial areas require the greatest fire flow. Per City standards, the fire flow requirement for industrial areas is 4000 gallons per minute for four hours. This equates to a total fire flow volume of 960,000 gallons.

6.4.3 Emergency Storage

Emergency storage is often provided to supply water from storage during emergencies such as pipeline failures, power outages, or natural disasters. The amount of emergency storage provided can be highly variable depending upon an assessment of risk and the desired degree of system reliability. Provisions for emergency storage in other systems vary from none to a volume equal to the maximum day demand or higher. In short, the criteria for determining the amount emergency storage are somewhat subjective.

Since the City has two sources (the 11th Street Well and the Marys River) there is some redundancy in the supply system. In the event of a treatment plant failure, the 11th Street Well may be used to supply water on an interim basis. The most likely events that could disrupt the City's water supplies include power outages, contamination of the Marys River, or the loss of a pipeline between each source and the distribution system.

The WTP and 11th Street well do not have back up power generation capabilities. Therefore, both are susceptible to service interruption resulting from power outages. In recent years, the City's power supply has been relatively stable with only a few outages of relatively minor duration. It is difficult to predict the future reliability of the power supply to the City's treatment facilities. With the construction of the auxiliary power units discussed above, emergency storage in the event of power outages will become less of an issue.

Contamination of the extent that would interfere with a public water supply system generally means a chemical spill directly into the river. These events are not as rare as one might think as evidenced by the January 2001 diesel spill into the nearby Yaquina River along Highway 20. It is difficult to determine a reasonable duration of such an event without a clear understanding of the nature and volume of the contaminate. Clearly one can envision a scenario where the Marys River is unavailable for several weeks. However planning for such an event is cost prohibitive. Should such an event occur, it is likely that temporary facilities could be constructed to pump water from the City of Corvallis to Philomath. The old intertie between the City of Corvallis' Rock Creek Transmission Main and the City's system could be used for this purpose. A more detailed discussion on refurbishing the intertie is presented in **Section 4.2.4**.

The length of pipelines in which a failure would sever the connection between the two sources and the distribution system is relatively small. Therefore, the risk of such a failure is relatively low. Should such a failure occur, it is likely that repairs could be made within a day or two.

Based on the above discussions, an emergency supply of 48 hours is recommended. In the event of such an emergency, it is likely that customers would respond within 12 hours to a public announcement to reduce water usage. If the emergency occurred during a high demand day, it is expected that usage would be reduced from the maximum day demand MDD to average day demand ADD after a 12-hour period. During an emergency event of the nature proposed herein, it is also likely that the 11th Street Well will be available on a 24-hour basis throughout the emergency. For the relatively short duration of the emergency event envisioned herein, the firm capacity of the 11th Street Well may be increased to 320 gallons per minute or 0.460 MGD. Therefore, the basic emergency scenario is defined as a 48-hour failure of the WTP during the maximum day of water usage. The emergency storage volume is therefore determined by the following equation.

$$\text{Emergency Storage [MGD]} = (0.5 * \text{MDD}) + (1.5 * \text{ADD}) - (2 * 0.460)$$

6.4.4 Storage Analysis

Based upon the criteria discussed above, the storage requirements were determined through the planning period. The results of this analysis is presented in **Table 6-1.**

TABLE 6-1
FINISHED WATER STORAGE ANALYSIS

Year		2003	2005	2010	2015	2020	2025	2029
Population		4100	4220	4739	5322	5977	6712	7365
Avg. Day Demand (ADD)	mgd	0.488	0.502	0.564	0.633	0.711	0.799	0.876
Max. Day Demand (MDD)	mgd	1.005	1.034	1.161	1.304	1.464	1.644	1.804
Equalization Storage Required	mg	0.402	0.414	0.464	0.522	0.586	0.658	0.722
Fire Storage Required	mg	0.960	0.960	0.960	0.960	0.960	0.960	0.960
Emergency Storage Required	mg	0.313	0.349	0.505	0.680	0.877	1.099	1.295
Total Storage Requirement	mg	1.674	1.722	1.929	2.162	2.423	2.716	2.977
Storage Provided	mg	1.250	1.250	1.250	1.250	1.250	1.250	1.250
Storage Deficit	mg	0.424	0.472	0.679	0.912	1.173	1.466	1.727

6.4.5 West Side Reservoir

Based on the storage analysis presented above, a new 1.75 million gallon reservoir is recommended. The City currently has a site identified for this reservoir in the hills west of town. The site is located on the west side of the extension of Dampier Street planned as part of the Starlight Village Phase IIA development. The site is approximately four acres in size. The terrain is sloping and appears to be at a suitable elevation for the construction of a reservoir. The reservoir should be designed so that the floor and overflow elevations are the same as the Neabeack Hill Reservoir. This will result in a wall height of approximately 40 feet. The inside diameter of the new reservoir will be approximately 90 feet. For a reservoir of this size and wall height the most economical structure over the life of the facility is a prestressed concrete tank meeting the requirements of AWWA D110. Prestressed concrete tanks are less susceptible to leakage than conventionally reinforced tanks. Reinforced concrete tanks also do not require recoating and the corrosion control efforts associated with steel tanks. Therefore, reinforced concrete tanks require less maintenance than both conventionally reinforced tanks and steel tanks. In addition, reinforced concrete tanks typically have a longer design life than conventional concrete and steel tanks. As a result, the lifecycle cost for reinforced concrete tanks is typically the lowest of the three alternatives. The total project cost for the reservoir is estimated to be approximately $2,835,000. A detailed cost breakdown is included in **Appendix E**.

6.4.6 Neabeack Hill Storage Reservoir

The existing storage reservoir at Neabeack Hill is in relatively good condition with the exception of some leaks around the exterior of the tank. In a past effort to control leakage, the City has hired a contractor to inject epoxy grout into the cracks. This technique was successful. However, subsequent to this repair new leaks have occurred. Leak repair is likely to be an ongoing maintenance requirement throughout the life of the tank. In recent years, new waterproofing technologies have been developed. One such technology is a surface applied product that generates a non-soluble crystalline formation within the pores and capillary tracts of the concrete. This works to seal the concrete against the penetration of water. One such product is Xypex manufactured by the Xypex Chemical Corporation. For best results this product should be applied to the interior of the tank. This will require draining the tank and removing it from service. Since the Neabeack Hill Reservoir is the only storage reservoir in the City's system, it cannot easily be removed from service until the new tank is constructed.

Some additional minor modifications to the existing tank will be required when the new tank is constructed. The existing check valve on the tank inlet line must be replaced with an altitude valve that includes a check feature. Since water is fed into the distribution system from multiple locations, and the friction losses between the sources and the tanks is not the same, altitude valves are required to enable operators to completely fill both tanks. An altitude valve typically requires a sensing line from the reservoir that initiates closure. A new wall penetration will be required to install the sensing line.

Due to the need to remove the existing reservoir from service, the recommended repairs cannot be made until the new reservoir is online. As such, it is recommended that the modifications to the Neabeack Hill Reservoir be incorporated into the new west side reservoir project. The total estimated construction cost for the Neabeack Hill Reservoir Improvements is approximately $245,000. A detailed cost breakdown is included in **Appendix E**. This includes the construction of an auxiliary power generator to supply power to the Neabeack Hill Domestic Pump Station located at the reservoir site. The need for auxiliary power is discussed below.

6.5. Pumping Facilities

As described in **Section 4**, the City owns and operates three pump stations. These are the Neabeack Hill Domestic Pump Station, the Neabeack Hill Fire Pump Station, and the Starlight Village Pump Station. All three facilities are relatively new, and in good working condition. All have the capacity to meet domestic and fire demands for their current service areas. Only routine maintenance of the mechanical and electrical systems is anticipated during the planning period. The primary shortcoming of each facility is the lack of auxiliary power. In the event of a power failure, domestic and fire demands in the areas served by these facilities cannot be met. Therefore, the installation of a permanent auxiliary power generator with automatic transfer switch is recommended at each facility.

The auxiliary power generator for the Neabeack Hill Domestic Pump Station should be sized to provide backup power for the pump station as well as all facilities located at the Neabeack Hill Reservoir. The two Neabeack Hill Pump Stations are in relatively good working order, and should require only routine maintenance and replacement during the planning period. The estimated project cost for the installation of an auxiliary power generator at the Neabeack Hill Domestic Pump Station is included in the Neabeack Hill Reservoir Project as discussed above. The estimated project cost for the Neabeack Hill Fire Pump Station improvements is $146,000. A detailed cost breakdown is included in **Appendix E**.

The Starlight Village Pump Station is located in a subsurface vault. The vault is a confined space and subject to the corresponding OSHA regulations. The location also does not provide for easy access to the various equipment items. The control panel and variable frequency drives are located in the vault. This is a demanding environment for equipment of this nature. The City has expressed a desire to address these issues. The recommended improvements include the construction of a CMU block building over the existing vault. The vault lid should be removed and the building should be constructed over the vault. Walkways will likely be required to access the vault floor from the building door. The building should be heated and ventilated to protect the piping and electrical equipment from extreme temperatures and to eliminate confined space issues. These improvements should be included with the installation of an auxiliary power generator. Together these two elements will be called the Starlight Village Pump Station Phase 1 Improvements. The estimated project cost for the Starlight Village Pump Station Phase 1 Improvements is $268,000. A Detailed cost breakdown is included in **Appendix E**.

In addition to the Starlight Village Development, the Starlight Village Pump Station will eventually serve the entire contiguous portion of the upper service level on the western edge of the UGB (See **Figure 6-1**). The pump station currently lacks the capacity to serve the entire area. As such, upgrades will become necessary as development continues. It is anticipated that these capacity increases will not be necessary for many years. By the time the upgrades are required, it is likely that the existing pumping facilities will be near the end of their useful life. Therefore, a complete replacement of the pump station is envisioned. Since the need for the upgrades is driven by growth, it is expected that a significant portion of the costs will be borne by private developers. The pump station will feed into a transmission main that generally runs in a northeasterly alignment across the service area. This transmission main is included in the distribution system improvements discussed below. It is envisioned that a new pump station will be constructed adjacent to the original pump station. An above grade structure will house the pump station and controls. The estimated project cost for the Starlight Village Pump Station Phase 2 Improvements is $470,000. A Detailed cost breakdown is included in **Appendix E**.

6.6. Water Distribution Facilities

An analysis of the existing distribution system was performed to assess its ability to maintain adequate pressures under peak domestic and fire demands. A hydraulic network analysis computer program was used for this purpose. WaterCAD software was used to develop a computer model of the City's water system. This software enabled both steady state and extended period simulations. The model was used to simulate peak domestic demand and fire events. These simulations were analyzed to determine if the system was capable of providing the required flows at acceptable pressures. The analysis enabled the identification of system shortcomings. The model was also used to develop proposed collection system improvements to address these shortcomings. Alternatives for Long-range distribution system improvements were simulated and analyzed to develop a recommended set of distribution system improvements.

6.6.1 Model Development

As stated above, WaterCAD software was used to develop a hydraulic network analysis computer model of the City's water system. At the most basic level, the model consists of links and nodes. Nodes represent the various elements of the system including water sources, pumps, pipe connections, and storage tanks. The links define the relationship between each node. In other words, the links are used to depict the way in which the nodes are connected. In water systems, links are almost always used to represent the distribution pipes.

The existing distribution system maps were used as a base to develop the model. The layout of the various nodal elements and the links between each element were based directly on the collection system maps. Data for each node and link (e.g., pipe diameter, pipe length, reservoir size and shape, pump curves, elevations, etc.) was entered into the model based upon available City records and field investigations.

The model was calibrated using flow data collected by Westech personnel during the summer of 2003. Flows and pressures were measured at approximately 18 hydrants throughout town. Model results at these locations were compared to the flow data. The Hazen-Williams roughness coefficients were adjusted and the model was re-run with the new roughness coefficients. This process was continued in an iterative fashion until the model provided reasonable agreement with the data. The error between the model and the field measurements ranged from less than 1% to a maximum of 12% with an average error of less than 6%.

6.6.2 Model Simulations

The calibrated model was used to investigate a number of conditions to determine the adequacy of the existing system. Both steady state and extended period (i.e., dynamic) model simulations were performed. In particular the conditions investigated include the following.

1. Existing peak hour demands.

2. Existing maximum day demands.

3. Fire flows to each model node in combination with the existing maximum day demand.

The model was also used to simulate various improvements to the distribution system to identify the most cost-effective solutions to the system deficiencies. Simulations with several combinations of the improvements listed below were analyzed. The improvements considered are listed as follows.

1. Addition of a storage reservoir on the west side of town.

2. Completion of a large diameter transmission main through the center of town.

3. Increasing WTP production.

4. Completion of a large diameter transmission main around the northern perimeter of town.

5. Completion of a large diameter transmission main around the southern perimeter of town.

6. Miscellaneous waterline size increases in various portions of the existing system.

The results from the previous simulations were used to develop a list of long-range improvements required to address system deficiencies and to serve the City through the planning period. Two timeframes were considered. Since transmission pipelines are not well suited for incremental expansion, it is cost effective to size the pipes for fully built-out conditions. Water production and storage facilities, on the other hand, are more suited for incremental expansion. Therefore, it makes sense to design these facilities based on 20-year projections rather than projections at build-out. Steady state simulations of the future system at buildout were performed to determine the required size of the transmission mains. The following simulations were performed.

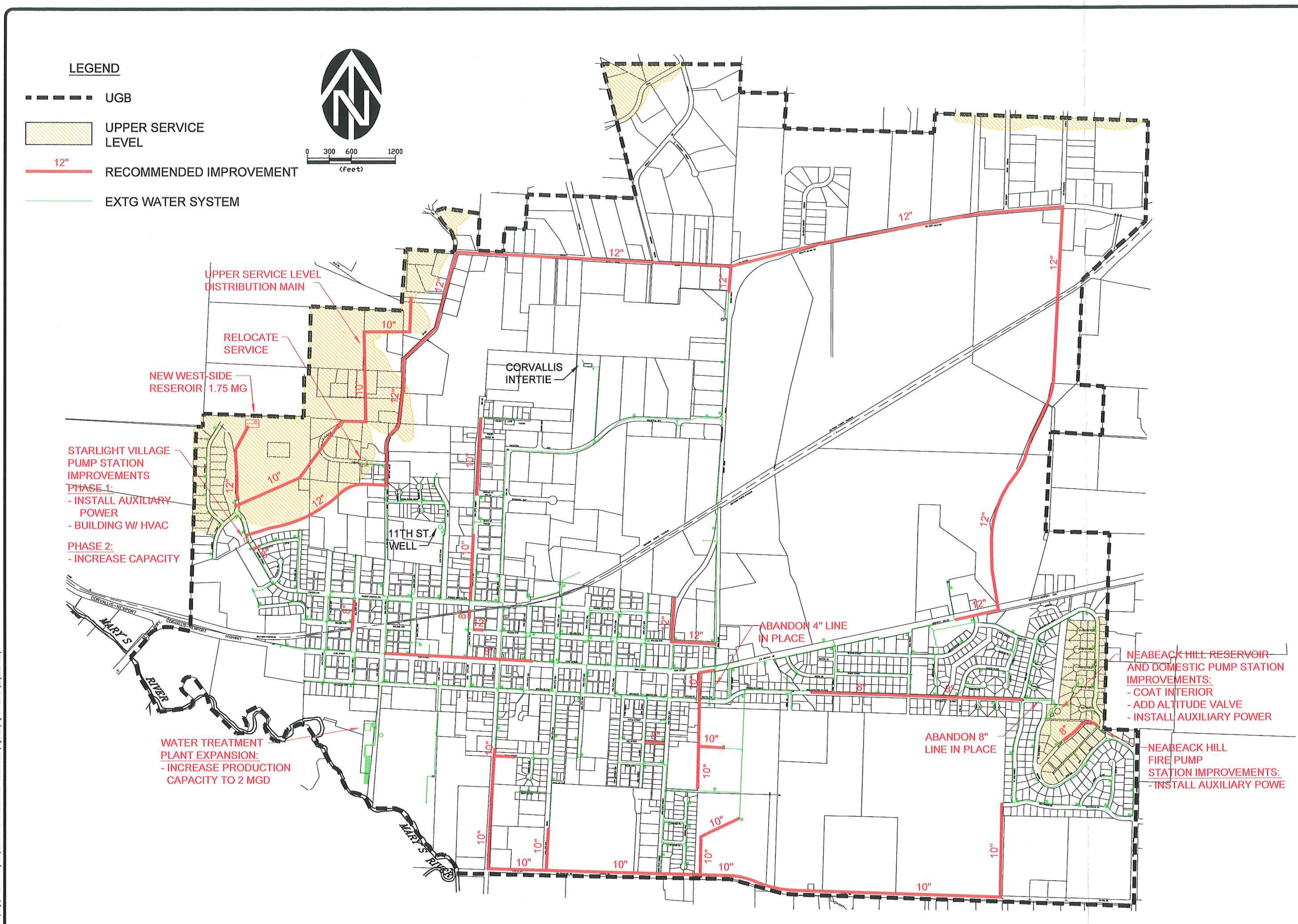
1. Peak hour demands at build-out.

2. Peak day demands at build-out.

3. Fire flows to each model node in combination with the existing maximum day demand at build-out.

6.6.3 Recommended Distribution System Improvements

The primary problem with the exiting distribution system is the inability to deliver adequate fire flows to large portions of the City. OAR 333-61-025 requires public water suppliers maintain a minimum pressure of 20 PSI at all service connections at all times. The current distribution system is incapable of delivering fire flows while maintaining 20 PSI at the highest service connections. The western most water service on Marylin Drive is located above the top of the main Philomath gravity service level. The top of the service level is defined by the 388 foot elevation contour. This particular service is located at an elevation of approximately 400 feet. Since this is the highest connection in the service level it controls the available fire flow to much of the City. This problem may be corrected by moving the service downhill to the east along Marylin Drive. As demonstrated above, the City's system currently lacks adequate storage capacity. Therefore, a primary element of the distribution system plan includes the addition of a storage reservoir on the west side of town. The addition of this reservoir significantly improves the available fire flow through much of the City. The recommended plan also includes the construction of arterial transmission mains around the north and south perimeters of town as well as some miscellaneous line upsizing and extensions. The plan also includes replacing some old waterlines that have a demonstrated history of repeated failures. The recommended distribution system improvements together with the recommended water supply, storage, and pumping improvements are shown in **Figure 6-1**. When completed, the recommended distribution system improvements should result in a system capable of delivering the fire and domestic demands discussed above. The individual projects are listed together with cost estimates in **Table 6-2**. Detailed cost breakdowns are included in **Appendix E**.



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DATE: March 04

WESTECH ENGINEERING, INC.
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CITY OF PHILOMATH
2004 WATER MASTER PLAN

RECOMMENDED WATER SYSTEM IMPROVEMENTS

FIGURE 6-1

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TABLE 6-2 RECOMMENDED DISTRIBUTION SYSTEM IMPROVEMENTS				
Location	Existing Size (inch)	Recommended Size (inch)	Length (feet)	Total Project Cost
Dampier Street (Pioneer Street to West Reservoir)	NA	12	1100	$142,000
Marylin Drive Service Relocation	NA	NA	NA	$4,000
20th Street Waterline Extension (Main to Applegate)	NA	10	640	$74,000
High School Site Waterline Extension (Applegate to end)	NA	10	1580	$183,000
Ash Street Waterline Extension (19th to 18th)	NA	8	280	$29,000
Main Street Waterline Replacement (9th to 14th)	8	8	2020	$234,000
Applegate Street Waterline Replacement (Newton Creek Bridge to 30th Street)	8	8	2860	$292,000
Canberra Street (connect to 12" in Pioneer St.)	NA	8	35	$4,000
College Street (12th to 13th)	NA	12	200	$26,000
12th Street (Pioneer to College)	NA	8	120	$12,000
8th Street (Main to Pioneer)	NA	8	500	$51,000
College Street (19th to 20th)	6	12	620	$80,000
19th Street (College to End)	6	12	600	$78,000
12th Street (Monroe to Houser)	4	10	1050	$121,000
12th Street (Pioneer to Grant)	2	10	900	$104,000
Benton View Drive Waterline Extension	NA	8	600	$61,000
Upper Philomath Service Level Transmission Main (Pioneer Street to end)	NA	10	4600	$532,000
Middle School Site Waterline Extension (From existing FH to Chapel Drive)	NA	10	1120	$129,000
North Arterial Transmission Main				
Pioneer Street to 9th Street	NA	12	2200	$291,000
9th Street to Hills Road	NA	12	3400	$439,000
Hills Road to Existing System in Green Road	NA	12	4200	$543,000
Green Road to Boulevard Street	NA	12	4550	$588,000
Boulevard Street to Corvallis-Newport Highway	NA	12	6050	$861,000
South Arterial Transmission Main				
13th Street to Chapel Drive	NA	10	1950	$225,000
Chapel Drive to 19th Street (Including 15th Street)	NA	10	2450	$283,000
19th Street to Southwood Drive	NA	10	4950	$576,000

6.7. Supervisory Control and Data Acquisition (SCADA) System

A SCADA system is needed to monitor and control the major components of the Water System. At a minimum, the system should monitor the Neabeack Hill Reservoir, the proposed west side reservoir, the 11th Street Well, the Neabeack Hill Domestic Pump Station, the Neabeack Hill Fire Pump Station, and the Starlight Village Pump Station. Recommended conditions/alarms at each facility include the following. This list is preliminary and subject to change. For example, if during the design of the facilities a natural gas powered generator is selected, low fuel alarms are no longer applicable.

Neabeack Hill Reservoir/West Side Reservoir

- Reservoir Level
- Low water Alarm
- High water Alarm
- Overflow Alarm
- Facility Security Alarms

11th Street Well

- Well Pump Run
- Well Pump Fail
- Well Level
- Loss of Control Power
- Low Well Level
- Discharge Rate
- Facility Security Alarms

Neabeack Domestic Pump Station

- Domestic Pump Run (2)
- Domestic Pump Fail (2)
- Loss of Power
- Generator Run
- Generator Fail
- Generator Low Fuel
- Facility Security Alarms

Neabeack Fire Pump Station

- Fire Pump Run
- Fire Pump Fail
- System pressure
- Loss of Power
- Generator Run
- Generator Fail
- Generator Low Fuel
- Facility Security Alarms

Starlight Village Pump Station

- Domestic Pump Run (2)
- Domestic Pump Fail (2)

- Fire Pump Run
- Fire Pump Fail
- System Pressure
- Discharge Rate
- Loss of Power
- Generator Run
- Generator Fail
- Generator Low Fuel
- Facility Security Alarms

Water Treatment Plant

- Raw Water Turbidity
- Finish Turbidity Combined
- Filter Finish Turbidity (4)
- pH Raw
- pH Final
- Raw Water Flow (4)
- High Service Pumps off/on/fail (4)
- Filter Backwash (4)
- Clarifier Flush (4)
- Low Filter Level (4)
- High Filter Level (4)
- Chemical Pump Fail (12)
- Facility Security Alarms

The costs for the new SCADA system are included in the electrical and control estimates for the water treatment plant expansion.

6.8. System Operation and Maintenance

This section discusses the need that exists in all water systems for system maintenance and outlines some of the basic elements necessary for all such maintenance programs. We have found that even for systems with good maintenance programs, providing the following general overview is useful in refining and periodically evaluating the ongoing maintenance program. The following discussion first addresses system-wide preventative maintenance, then outlines some general recommended approaches to system maintenance.

6.8.1 System-Wide Preventative Maintenance

Maintenance of water systems is necessary to insure the proper operation of the facilities and to obtain the full useful life of those facilities. Water systems represent significant investment of public capital. If a water system is allowed to fall into disrepair because of the lack of maintenance, it will not operate efficiently or as designed. Health problems and property damage may result from leaking mains or services, mainline breaks, inoperable valves or fire hydrants, etc. Repair of failed portions of a public water system are costly, quite often equaling or exceeding the original cost of construction. Because of this, it is imperative that municipalities consistently provide adequate maintenance funding to protect their investment in the water system. System maintenance can be separated into two types: preventive and corrective.

Preventive maintenance involves scheduled inspection of the system and data gathering to identify problem areas and analysis of this data so that scheduled maintenance can be targeted at specific problems. As a general rule, as preventative maintenance increases, the amount of corrective maintenance required decreases.

Corrective maintenance, often referred to as emergency maintenance, is typically performed when the water system fails, such as leaking mainlines, inoperable pumps or fire hydrants, etc. Corrective maintenance requires immediate action, and the City will typically pay a premium to have this work performed on an emergency basis.

6.8.2 Operation & Maintenance Recommendations

Overall, the City's current O&M practices are very good. The City normally replaces approximately five hydrants per year. The City also has in place an ongoing water meter replacement program. City crews also have the ability repair mainline and service line breaks as they occur. All of these activities are included in the City's current O&M budget. Listed below are some general recommendations that will further improve the reliability of the water system and assist significantly with future planning efforts. These items do not require much operator time once set up and help a great deal in examining and determining the water system's future needs.

6.8.2.1 Pump Station Monitoring

All pumps should be exercised on a regular basis. This is particularly true for the fire pumps serving the Neabeack Hill and Starlight Village service levels. These pumps perform a critical emergency function. Should these pumps fail to start during a fire, significant property damage may occur. We recommend these pumps be started and put through a rigorous exercise program on a quarterly basis as a minimum.

6.8.2.2 Hydrant and Valve Exercising and Maintenance

Based upon our observations around the water distribution system, it appears that many of the valves and fire hydrants are exercised or operated on a regular basis. However, our experience indicates that water system operators in small communities commonly have more tasks than time available. We have found that a standardized schedule and forms for valve and hydrant operation to be helpful in making sure that the tasks continue to be accomplished on a routine basis. We also find it helpful for the Fire

Department to perform some of the work such as hydrant inspection, maintenance and repair.

6.8.2.3 Record Keeping

Complete record keeping will help assist operators in tracking trends and allow more time for the City to respond to meet the City's growing needs. At a minimum, it is recommended that the City maintain the records listed below. Some of the records listed below are already being maintained by the City. The City may wish to maintain additional records at their discretion.

a) WTP and 11th Street Well Production

The production from the WTP should be recorded on a daily basis including the quantity of water used for backwashing purposes. Upon completion of the new telemetry system, the City should also begin collecting hourly production data from both sources. Due to the volume of hourly data, we recommend collection and storage on an electronic basis.

b) Reservoir Level

Upon the completion of the new telemetry system, the City should begin collecting hourly reservoir level data. This data should be collected at the same time as the production data.

c) Water Consumption

The City should verify the accuracy of consumption records by performing a water audit on at least an annual basis. All meters should be read as close to the same date every month so that the period of record remains as uniform as possible from year to year.

6.9. Master Plan Update

As described in previous sections, water master planning is typically done at 20-year intervals. In the case of Philomath, these intervals have coincided with the need for new facilities. For example, the existing water storage and production facilities are reaching their capacity. This should be expected since these facilities were designed nearly 20 years ago to meet projected demands over a 20-year planning period. This current master planning effort is being undertaken at almost the same time that the new facilities are needed. This creates a cash flow problem since it does not provide sufficient time for the community to build reserve funds. One purpose of the master plan is to identify system needs and recommend capital improvements. This information is used to adjust user rates or to set savings goals for capital improvement budgets. Since in the case of Philomath, major projects are needed relatively soon, there is little time for the City to make spending or rate adjustments. The end result of this timing issue is that the City may be forced to borrow money to pay for the improvements rather than save money for future improvements. The latter alternative is always preferred since it allows for interest to accrue on the money in savings. In an attempt to avoid this situation during the next planning period, it is recommended that the City update this master plan at the halfway point of the current planning period. A budget of approximately $40,000 should be established for this purpose. This should make it easier for the City to adjust user rates, SDC fees, and spending as needed so that sufficient capital reserves are available to fund the necessary improvements at the time they are needed.

Section 7

Recommended Capital Improvement Priorities and Implementation Plan

SECTION 7
RECOMMENDED CAPITAL IMPROVEMENT PRIORITIES & IMPLEMENTATION PLAN

7.1. General Prioritization Criteria

As summarized in the previous sections, the water system has a number of deficiencies which inhibit the City's ability to provide the required flows to many areas. Some of these deficiencies are more critical than others. In order to assist the City in the planning and scheduling the construction of needed improvements, the improvements recommended in previous sections are grouped as Priority 1, Priority 2 and Priority 3 as outlined below.

When prioritizing the improvements a number of factors are considered. These include the severity of the shortcoming, cost, and benefit of each project. This allows the identification of high benefit to cost projects. These projects are scheduled for earlier construction, while less critical, lower value projects are delayed until a later time. This process makes the best use of available construction funds, and identifies areas where improvements may be delayed until they become a necessary component of development thus properly placing construction costs on the benefited development rather than on the whole community.

- **Priority 1** (Near Term Improvements) – These are the projects representing existing system deficiencies (currently needed to resolve compliance issues and to meet existing and near future projected flows) or problem areas needing immediate attention. It is recommended that Priority 1 improvements be accomplished as soon as practical considering financing, construction time and timing associated with other related projects.

- **Priority 2** (Vital Future Improvements) - These are improvements which will be needed in the future to meet anticipated future development conditions and design flows. Although not critical at this time, they should be considered as improvement projects which will be upgraded to Priority 1 at some time in the future.

- **Priority 3** (Long Term Improvements/Possible Future Need) - These improvements are needed to improve system reliability or to convey future design flows if land develops to zone intensities. While important, they are not considered to be critical at the present time. If possible, these improvements should be incorporated into other improvement projects to allow for concurrent construction. Developers may also construct them with the utility construction associated with the development.

Each of the projects was examined and assigned a priority for implementation according to the criteria described hereafter.

7.1.1 Project Prioritization Criteria

The following criteria were used by the City to evaluate individual projects and alternative capital improvement programs for the water system. Each of the projects and alternative capital improvement programs was examined and rated according to the following criteria.

- Existing Size vs. Needed Size/Flows Required. Comparisons were made between the size of the existing components and the proposed replacement components, compared to the need for additional flows which will be provided by the proposed improvements. The relative increase in the size and available flows were compared to needed flows and assigned values of high, medium and low.

- Structural Damage/End of Useful Life/Existing Deficiencies. Projects to replace damaged components or components which have reached the end of their useful life and no longer function as designed were assigned a higher priority.

- City Priority. Projects identified by City engineering and maintenance personnel to be high priority for implementation due to operations or maintenance problems.

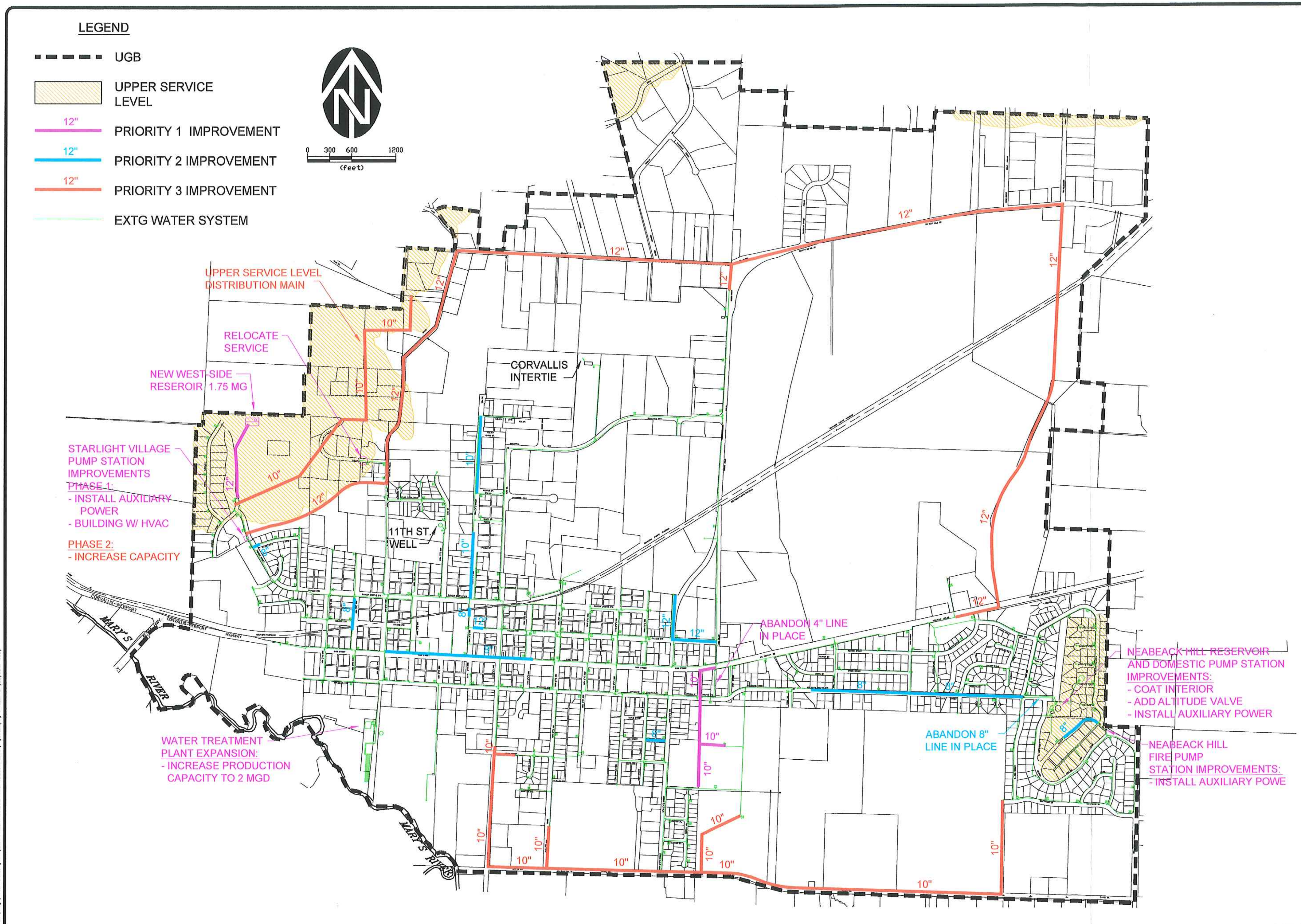
- Anticipated Time Utill Projected Demand Increases. The anticipated timeframe for the development of land within the area served by the proposed improvements was considered. Projects which will be required sooner due to increased demands from anticipated or currently approved developments were given higher priority.

- Capital Costs. Capital costs of the projects were considered, including the costs of implementing a project, such as surveying, design, permitting, construction, legal fees and administration. Costs for acquisition of land and/or easements were not included. Projects which will need to be constructed by developers in conjunction with proposed or currently approved developments were given a lower priority than projects which may be largely the responsibility of the City.

7.1.2 Ranking of Recommended Improvements

Using the above criteria, the projects identified in **Section 6** were ranked. The individual projects are listed together with their priority in **Table 7-1**. Where appropriate the improvements listed in **Table 7-1** are shown in **Figure 7-1**.

TABLE 7-1 RECOMMENDED PROJECT PRIORITIES		
Project	Priority	Recommended Project Budget*
Obtain Additional Early Water Rights	1	$50,000
Water Management and Conservation Plan	1	$20,000
Water Treatment Plant Expansion	1	$3,252,000
1.75 MG West Side Reservoir	1	$2,835,000
Dampier Street Waterline (Pioneer St. to West Side Reservoir)	1	$142,000
Neabeack Hill Reservoir Improvements	1	$245,000
Starlight Village Pump Station Phase I Improvements	1	$268,000
Neabeack Hill Fire Pump Station Aux Power Improvements	1	$146,000
Marylin Drive Service Relocation	1	$4,000
20th Street Waterline Extension (Main to Applegate)	1	$74,000
High School Site Waterline Extension (Applegate to end)	1	$183,000
Priority 1 Subtotal		**$7,001,000**
Ash Street Waterline Extension (19th to 18th)	2	$29,000
Main Street Waterline Replacement (9th to 14th)	2	$234,000
Applegate Street Waterline Replacement (Newton Creek Bridge to 30th Street)	2	$292,000
Canberra Waterline Extension (connect to 12" in Pioneer)	2	$4,000
College Street Waterline Extension (12th to 13th)	2	$26,000
12th Street (Pioneer to College)	2	$12,000
8th Street (Main to Pioneer)	2	$51,000
College Street (19th to 20th)	2	$80,000
19th Street (College to End)	2	$78,000
12th Street (Monroe to Houser)	2	$121,000
12th Street (Pioneer to Grant)	2	$104,000
Benton View Drive Waterline Extension	2	$61,000
Water Master Plan Update	2	$40,000
Priority 2 Subtotal		**$1,132,000**
Starlight Village Pump Station Phase II Improvements	3	$470,000
Upper Service Level Transmission Main (Pioneer Street to end)	3	$532,000
Middle School Site Waterline Extension	3	$129,000
North Arterial Transmission Main		
Pioneer Street to 9th Street	3	$291,000
9th Street to Hills Road	3	$439,000
Hills Road to Existing System in Green Road	3	$543,000
Green Road to Boulevard Street	3	$588,000
Boulevard Street to Corvallis-Newport Highway	3	$861,000
South Arterial Transmission Main		
13th Street to Chapel Drive	3	$225,000
Chapel Drive to 19th Street (Including 15th Street)	3	$283,000
19th Street to Southwood Drive	3	$576,000
Priority 3 Subtotal		**$4,937,000**
GRAND TOTAL		**$13,070,000**
*Costs are 2004 dollars and assume dry weather construction. ENR 20 Cities Index = 6956 (March 2004)		



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NO.	DATE	DESCRIPTION	BY
1		REVISIONS	

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BAR IS ONE INCH ON ORIGINAL DRAWING
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

DSN. CB
DRN. TMT
CKD. CB
DATE: March 04

WESTECH ENGINEERING, INC.
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CITY OF PHILOMATH
2004 WATER MASTER PLAN

RECOMMENDED WATER SYSTEM IMPROVEMENT PRIORITIES

FIGURE 7-1

JOB NUMBER 960.4140.0

7.2. Recommended Capital Improvement Plan

All priority 1 and priority 2 projects should be included in the Water System Capital Improvements Plan. The City should plan on undertaking all of these projects at some point during the planning period. The City should aggressively work toward implementing the priority 1 improvements early in the planning period. A recommended schedule for the priority 1 improvements is included below. The remaining priority 2 improvements may be implemented as funding becomes available. However, the City should plan to complete the projects before the end of the planning period. From **Table 7-1**, the total budget for the priority 1 and priority 2 improvements is $8,133,000.

The priority 3 improvements are largely driven by growth in the community. As such, a significant portion of the costs for these improvements is likely to be borne by private developers.

7.3. Water System Funding Issues

As a general rule, small communities are not able to finance major water system improvements without some form of government funding, such as low interest loans or grants. It is anticipated that the funding for the recommended capital improvement plan outlined herein will be from multiple sources, including systems development charges (SDC's), monthly user fees, as well as state and federal grant and loan programs. The following section outline the major local and State/Federal funding programs which may be available for these projects. A recommended financing strategy will then be presented.

7.3.1 Annual Operation & Maintenance Costs

Annual Operation and Maintenance (O&M) costs are recurring costs typically funded through user rates. **Table 7-2** presents City's annual O&M costs for the 2004-2005 fiscal year.

TABLE 7-2
ANNUAL OPERATION & MAINTENANCE COSTS

Item	2003-04 Budget
Personal Services	$278,583
Materials & Services	$288,081
Capital Improvements	$17,000
Debt Service	$32,511
Transfers	$109,700
Contingency	$25,000
TOTAL	$750,875

It is worthwhile to consider the effects of the recommended improvements on O&M costs. The recommended improvements include treatment plant upgrades, an additional reservoir, upgrades to the City's pumping facilities, and distribution system improvements. The distribution system improvements are likely to have only a minor impact on the operation of the system. On the other hand, the treatment plant, pump station, and reservoir improvements will increase the mechanical complexity of the City's water system. Therefore, the City should anticipate increased operation and maintenance cost as these facilities are constructed.

It is likely that the existing staffing level will be sufficient to operate the recommended priority 1 and priority 2 improvements. Therefore, the need for a dramatic increase in the personal services component of the budget does not seem likely. The new improvements will increase the number of mechanical systems that must be maintained. Therefore equipment maintenance and replacement costs will likely increase. Chemical usage costs will also increase as water production increases. As such, an increase in the materials and services component of the budget should be expected as the recommend improvements are constructed.

7.3.2 Local Funding Sources

To a large degree, the type and amount of local funding used for the water system improvements will depend on the amount of grant funding obtained and the requirements of any loan funding. Local revenue sources for capital improvements include ad valorem taxes (property taxes), various types of bonds, water user fees, connection fees, and system development charges (SDC). Local revenue sources for operating costs include ad valorem taxes and water user fees. The following sections discuss the local funding sources and financing mechanisms that are most commonly used for the type of capital improvements presented in this study.

7.3.2.1 Existing Debt Service

As of January 1, 2005 the Water Fund will have a total of $408,154 in outstanding debt. The debt is comprised of two loans. Both loans are with the Oregon Economic and Community Development Department (OECDD). The first loan was used for the construction of the 1.25 mg water reservoir. This loan was issued in December 1992 and has an unpaid balance of $200,854. The second loan was used for the construction of the chlorine contact chamber at the water treatment plant. This loan was issued in September 1995 and has an unpaid balance of $207,300. **Table 7-3** includes a listing of the remaining repayment schedule for both loans.

TABLE 7-3 WATER FUND DEBT							
Fiscal Year Beginning	Water Reservoir		Contact Chamber		Total Principal	Total Interest	Total
	Principal	Interest	Principal	Interest			
July 2005	20,199	12,313	0	0	20,199	12,313	32,512
July 2006	21,437	11,074	4,969	13,475	26,406	24,549	50,955
July 2007	22,751	9,760	5,293	13,151	28,044	22,911	50,955
July 2008	24,146	8,366	5,637	12,808	29,783	21,174	50,957
July 2009	25,626	6,885	6,003	12,441	31,629	19,326	50,955
July 2010	27,197	5,314	6,393	12,051	33,590	17,365	50,955
July 2011	28,864	3,647	6,809	11,635	35,673	15,282	50,955
July 2012	30,634	1,878	7,251	11,193	37,885	13,071	50,956
July 2013			16,369	10,721	16,369	10,721	27,090
July 2014			17,432	9,658	17,432	9,658	27,090
July 2015			18,566	8,524	18,566	8,524	27,090
July 2016			19,772	7,318	19,772	7,318	27,090
July 2017			21,058	6,032	21,058	6,032	27,090
July 2018			22,426	4,664	22,426	4,664	27,090
July 2019			23,884	3,206	23,884	3,206	27,090
July 2020			25,438	1,653	25,438	1,653	27,091
	200,854	59,237	207,300	138,530	408,154	197,767	605,921

7.3.2.2 User Fees/Connection Fees

User fees are typically the sole source of revenue to finance water system operation and maintenance. User fees are monthly charges to all residences, businesses, and other users that are connected to the water distribution system. These fees are established by the City Council and may be modified as needed to account for changes in O&M costs, need for new improvements, etc. The monthly charges are typically based on a user classification (i.e., single family dwelling, multiple family dwelling, school, commercial, etc.), as well as the amount of water consumed as measured at the water meter. A breakdown of the user fees is presented in **Section 4**. As shown in **Section 4**, the average monthly user charge is approximately $33.14 for a single family residence.

7.3.2.3 System Development Charge (SDC) Revenues

A system development charge (SDC) is a fee collected by the City as each piece of property is developed. SDCs are used to finance necessary capital improvements and municipal services required by the development. SDCs can be used to recover the capital costs of infrastructure required as a result of the development. As established in ORS 223, an SDC has two principal elements, the reimbursement fee and the improvement fee. Fees are collected at issuance of building permits. It is important to note that operation, maintenance, and replacement costs <u>cannot</u> be financed or repaid by SDC revenues.

The reimbursement portion of the SDC is the fee for buying into existing or under construction capital facilities. The reimbursement fee represents a charge for utilizing excess capacity in an existing facility which was paid for by someone else. The revenue from this fee is typically used to pay back existing loans for improvements.

The improvement portion of the SDC is the fee designed to cover the costs of capital improvements which must be constructed to provide an increase in capacity.

The City currently assesses both reimbursement and improvement water SDC fees based on water meter size. Based on the assumption that a standard 3/4-inch meter is used to serve a typical residential unit, the 3/4-inch meter SDC was used as an Equivalent Dwelling Unit (EDU). As of the later part of 2003 the improvement fee was $1,224 per EDU and the reimbursement fee was $525 per EDU.

For the purposes of the funding analysis, it was assumed that SDC collection will be related directly to population growth as projected in **Section 2**. The projected population increase over the next planning period is 3,265 (i.e., 7,365 in 2029). This is approximately 1,205 new EDUs over the planning period. At $1,749 per EDU, SDC fees should generate just over $2,107,000 over the planning period. By comparing this to the projected costs for the recommended capital improvements, it is clear that the current SDC fee structure is insufficient to fund the recommended improvements. Therefore, it is strongly recommended that the City reevaluate their SDC fee schedule.

7.3.2.4 Capital Construction (Sinking) Fund

Sinking funds are often established as a budget line item to set aside money for a particular construction purpose. A set amount from each annual budget is deposited in a sinking fund until sufficient revenues are available to complete the project. Such funds can also be developed from user fee revenues or from SDCs. The City does have a capital reserve fund that is intended to finance certain identified improvements and repairs. The City's existing Capital Improvement Plan (CIP) shows an expenditure of $1,000,000 in the 2008-09 fiscal year for water treatment plant upgrades. Based on the analysis presented herein, the recommended project budget for the treatment plant upgrades is $3,252,000. The CIP also includes an expenditure of $1,250,000 for the West Side Reservoir during the 2015-16 fiscal year. The analysis presented in **Section 6** shows that the City currently lacks adequate storage capacity and that the new reservoir should be constructed as soon as possible. The recommended project budget for the West Side Reservoir is

$2,835,000. Clearly the current CIP is not structured in accordance with the recommendations included herein. Therefore, the City should review and revise the CIP as appropriate. A revision will likely require a substantial increase in appropriations to the Capital Construction Fund if the recommended improvements are to be implemented.

7.3.2.5 General Obligation Bonds

One traditional way to fund municipal water projects is through the sale of municipal general obligation (GO) bonds. These are the most often used form of local financing for large scale utility improvements benefiting a major portion of the City. GO bonds utilize the City's basic taxing authority and are retired with property taxes based on an equitable distribution of the bonded obligation across the City's assessed valuation. General obligation bonds are normally associated with the financing of facilities which benefit an entire community and must be approved by a majority vote of the City's voters.

General obligation bonds are backed by the City's full faith and credit, as the City must pledge to assess property taxes sufficient to pay the annual debt service. This portion of the property tax is outside the State constitutional limits which limit property taxes to a fixed percentage of the assessed value. The City may use other sources of revenue including water user fee revenues to repay the bonds. If it uses other funding sources to repay the bonds, the amount collected as taxes is reduced commensurately.

The general procedure followed when financing water system improvements with GO bonds is typically as follows.

- Determination of the capital costs required for the improvement.
- An election by the voters to authorize the sale of bonds.
- The bonds are offered for sale.
- The revenue from the bond sale is used to pay the capital costs associated with the project(s).

GO bonds can be "revenue supported," wherein a portion of the user fee is pledged toward repayment of the bond debt. The advantage of this method is that the need to collect additional property taxes to retire the bonds is reduced or eliminated. Such revenue supported GO bonds have most of the advantages of revenue bonds, plus lower interest rate and ready marketability.

The primary disadvantage of GO bond debt is that it is often added to the debt ratios of the City, thereby restricting the flexibility of the municipality to issue debt for other purposes.

7.3.2.6 Revenue Bonds

These are similar to GO bonds, except they rely on revenue from the sales of the utility (i.e., user fees) to retire the bonded indebtedness. The primary security for the bonds is the City's pledge to charge user fees sufficient to pay all operating costs and debt service. Because the reliability of the source of revenue is relatively more speculative than for GO bonds, revenue bonds typically have slightly higher interest rates.

The general shift away from ad valorem property taxes makes revenue bonds a frequently used option for payment of long term debt. Many communities prefer revenue bonding, because it insures that no additional taxes are levied. In addition, repayment of the debt obligation is limited to system users since repayment is based on user fees.

One advantage with revenue bonds is that they do not count against a City's direct debt. This feature can be a crucial advantage for a municipality near its debt limit. Rating agencies evaluate closely the amount of direct debt when assigning credit ratings. There are normally no legal limitations on the amount of revenue bonds which can be issued. However, excessive issue amounts are generally unattractive to bond buyers because they represent high investment risks.

Under ORS 288.805-288.945, City's may elect to issue revenue bonds for revenue producing facilities without a vote of the electorate. Certain notice and posting requirements must be met and a sixty (60) day waiting period is mandatory.

The bond lender typically requires the City to provide two additional securities for revenue bonds which are not required for GO bonds. First, the City must set user fees such that the <u>net</u> projected cash flow from user fees plus interest will be at least 125% of the annual debt service (a 1.25 debt coverage ratio). Secondly, the City must establish a bond reserve fund equal to maximum annual debt service or 10% of the bond amount, whichever is less.

7.3.2.7 Improvement (Bancroft) Bonds

Improvement (Bancroft) bonds are an intermediate form of financing that is less than full-fledged GO or revenue bonds. This form of bonding is typically used for so-called Local Improvement Districts, or LIDs.

Improvement bonds are payable from the proceeds of special benefit assessments, not from general tax revenues or user fees. Such bonds are issued only where certain properties are recipients of special benefits not occurring to other properties. For a specific improvement, all property within the designated improvement City is assessed on the same basis, regardless of whether the property is developed or undeveloped. The assessment is designed to divide the cost of the improvements among the benefited property owners. The manner in which it is divided is in proportion to the direct or indirect benefits to each property. The assessment becomes a direct lien against the property, and owners have the option of either paying the assessment in cash or applying for improvement bonds. If the improvement bond option is taken, the City sells Bancroft Improvement Bonds to finance the construction, and the assessment is paid over 20 years in 40 semi-annual installments plus interest.

The assessments against the properties are usually not levied until the actual cost of the project is determined. Since the determination of actual costs cannot normally be determined until the project is completed, funds are not available from assessments for the purpose of paying costs at the time of construction. Therefore, some method of interim financing must be arranged.

The primary disadvantage to this source of revenue is that the development of an assessment District is very cumbersome and expensive when facilities for an entire City are contemplated. Therefore, this method of financing should only be considered for discrete improvements to the distribution system where the benefits are localized and easily quantified.

7.3.2.8 Certificates of Participation

Certificates of Participation are a form of bond financing that is distinct from revenue bonds. While it is more complex and typically has a higher interest rate than revenue bonds, it is a process controlled by the City Council, and it does not have to be referred to the voters, which can result in a significant time savings.

7.3.2.9 Ad Valorem Taxes

Ad valorem property taxes were often used in the past as a revenue source for public utility improvements. Historically, ad valorem taxes were the traditional means of obtaining revenue to support all local governmental functions. Ad valorem taxation provided a means of financing that reached all property owners that benefit or can potentially benefit from the water system, whether the property was developed or not. The construction costs for the project were shared proportionally among all property owners based on the assessed value of each property. Ad valorem taxation, however, is less likely to result in individual users paying their proportionate share of the costs as compared to their benefits.

7.3.3 State & Federal Grant & Loan Programs

Several state and federal grant and loan programs are available to assist municipalities finance water system improvements. Philomath, with a median household income of $41,461 (based on 2000 census), is considered a low/moderate income community and would therefore be eligible for many programs. The primary sources of funding available for water system financing are Rural Development Administration (RDA), Special Public Works Fund (SPWF), the Water/Wastewater (W/W) Financing Program and the Community Development Block Grant (CDBG).

7.3.3.1 Rural Utility Service

The Rural Utility Service (RUS) provides federal loans and grants to rural municipalities, counties, special districts, Indian tribes, and not-for-profit organizations to construct, enlarge, or modify water treatment and distribution systems and wastewater collection and treatment systems. Preference is given to projects in low-income communities with populations below 10,000.

Borrowers of RDA loans must be able to demonstrate the following:

- Monthly user rates must be at or above the "state wide average." of $40-$43 per month.
- They have the legal authority to borrow and repay loans, to pledge security for loans, and to operate and maintain the facilities and services.
- They are financially sound and able to manage the facility effectively.
- They have a financially sound facility based on taxes, assessments, revenues, fees, or other satisfactory sources of income to pay for all facility costs including O&M and to retire indebtedness and maintain a reserve.

The maximum loan term is 40 years but the finance term may not exceed statutory limitations on the agency borrowing the money or the expected useful life of the improvements. The reserve can typically be funded at 10 percent per year over a ten year period. Interest rates for RUS loans vary based on median household income (MHI).

7.3.3.2 Special Public Works Fund

The Oregon Economic and Community Development Department (OECDD) administers the SPWF program. The SPWF is a lottery-funded loan and grant program that provides funding to municipalities, counties, special districts, and public ports for infrastructure improvements to support industrial/manufacturing and eligible commercial economic development. Eligible commercial means commercial activity that is marketed nationally or internationally and attracts business from outside Oregon. Funded projects are usually linked to a specific private sector development and the resulting direct job creation (i.e., firm business commitment), of which 30% of the created jobs must be "family wage" jobs. The program also funds projects build infrastructure capacity to support industrial/manufacturing development where recent interest by eligible business(s) can be documented.

The SPWF is primarily a loan program, although grant funds are available based on economic need of the community. Although the maximum loan term is 25 years, loans are generally made for 20-year terms. The maximum loan amount for projects funded with direct SPWF money is $11 million.

7.3.3.3 Bond Bank Program

The Bond Bank program, administered by OECDD, attempts to lower the cost of issuing debt by pooling small revenue bond issues from many communities into one large revenue bond issue. It uses lottery proceeds to write-down financing costs, and to improve the debt/equity ratio on projects. The interest rate for repayment of funds is typically around 6 percent, with up to a 25 year term.

7.3.3.4 Water/Wastewater Financing Program

OECDD also administers the W/W Financing Program, which gives priority to projects that provide system-wide benefits and help communities meet the Clean Water Act or the Safe Drinking Water Act standards. It is intended to assist local governments which have been hard hit with state and federal mandates for public drinking water systems and wastewater systems. In order to be eligible for this program, the system must be out of compliance with federal or state rules, regulations or permits, as evidenced by issuance of Notice of Non-Compliance by the appropriate regulatory agency. The funded project must be needed to meet state or federal regulations. Priority is given to communities under economic distress.

Similar to the SPWF, the W/W Financing Program is primarily a loan program, although grant funds are available in certain cases based on economic need of the community. Although the maximum loan term is 25 years, loans are generally made for 20-year terms. The maximum loan amount for projects financed with bond funds is $10 million.

7.3.3.5 Community Development Block Grant

The OECDD administers the CDBG, but the funds are from the U.S. Department of Housing and Urban Development (HUD), so all federal grant management rules apply to the program. The federal eligibility standards are strict. There are two subcategories of Public Works projects eligible for funding, "Public Water and Wastewater," and "Public Works for New Housing." Only the former is considered in this discussion.

Based on the 2000 Census 54.5% of the population of Philomath falls into OECDD's Low/Mod income category. Therefore Philomath is eligible for grant funding. One of the requirements to receive CBDG funds is that the monthly user rate is equal to or greater than 1.37% of the median household income. For Philomath this equates to a minimum monthly user rate of $47.33. Therefore in order for Philomath to qualify for grant funds rates must be increased.

Grants are available for critically needed construction, improvement, or expansion of publicly owned water and wastewater systems for the benefit of current residents. Generally, projects must be necessary to resolve regulatory compliance problems identified by state and/or federal agencies.

The program separates projects into three parts. Grants are available for:

- <u>Preliminary Engineering and Planning</u> Projects

  Generally, these grants fund preparation or update of Water System Master Plans and Wastewater Facility Plans, as required by the Oregon Department of Environmental Quality or Oregon Health Division. In addition, funds for grant administration and preparation of a final design funding application can be included in the project budget. All plans produced with grant funds must be approved by the appropriate regulatory agency. Grants of up to $10,000 can also be made for problem identification studies to delineate problems and corrective measures, as required by a regulatory agency.

- <u>Final Design and Engineering Projects</u>

  Final design and engineering, bid specifications, environmental review, financial feasibility, rate analysis, grant administration, and preparing a construction funding application are all eligible project activities. The final design, plans and specifications must be approved by the appropriate regulatory agency before a grant will be awarded.

- <u>Construction Projects</u>

  These grants fund construction and related activities, grant administration and land/permanent easement acquisition.

OECDD has established an evaluation system that gives priority to projects that provide system-wide benefits. The overall maximum grant amount per water or wastewater project is $750,000 (including all planning, final engineering, and construction). The project cannot be divided locally into phases with the expectation of receiving more than one $750,000 grant. In order to qualify for grant funding under this project, the water user rates must be at or above statewide averages.

7.3.3.6 Safe Drinking Water Revolving Loan Fund

The SDWRLF program is administered by OECDD with assistance from OHD and provides loans to cities, counties, special districts, and Indian tribes to construct, expand or rehabilitate water treatment, distribution and storage improvements which are needed to comply with the Safe Drinking Water Act (i.e., to protect the public health).

Interest rates on loans are about 80% of the general obligation bond rate. However, there are additional financing costs and annual service fees which increase the effective rates. The maximum loan amount per project is $4,000,000. The maximum loan term is 20 years except for disadvantaged communities, which may have loan terms up to 30 years, provided the loan term does not exceed the useful life of the facility being constructed.

7.3.3.7 Water Development Loan Fund

The WD Loan Fund is administered by the Oregon Water Resources Department. This program provides loans to municipal water suppliers with under 30,000 population for projects including drinking water systems. These loans are available with up to 30-year terms.

7.3.4 Funding Recommendations

As explained above grant funding will require a user rate to be at least $47.33 per month. The current City water rates are well below the monthly statewide average based on typical flow rates and should be increased as soon as possible. A reevaluation of the City's SDC fee structure is also recommended.

As available grant funding on public works projects has decreased in the last several years, it will be incumbent upon the City to aggressively pursue grant funding. The first step in this process is to schedule a "one stop meeting" with Oregon Economic Development Department (OEDD) and the preparation of applicable funding applications as soon as possible.

However, with or without outside assistance, we believe the improvements recommended as Priority 1 projects are essential to the City. The single most important project is the construction of the West Side Reservoir. A close second, is the water treatment plant expansion. We recommend the City pursue construction of Priority 1 improvements at the earliest possible time.

7.4. Recommended Implementation Schedule

Given the magnitude of the recommended Priority 1improvements, and the number of steps that must precede construction, we recommend the City pursue construction during 2009. This will allow time for preparation and review of a pre-design report, arranging for funding for design and construction drawings, detailed cost estimating, arranging a funding package for construction. We recommend these efforts be timed such that bid opening takes place in late winter-early spring 2009 to take advantage of the more competitive bidding environment usually prevalent at that time of year. Construction should be scheduled to start in late spring to provide the best weather for construction.

TABLE 7-4
PROPOSED IMPLEMENTATION SCHEDULE
(Priority 1 Projects – 2009 Construction)

Milestone	Date
PHASE I	
Submit Draft Water Master Plan to OHD & City	5/15/05
Receive Comments from OHD & City	7/15/05
Submit Final Master Plan to OHD & City	9/01/05
OHD Approval of Final Master Plan	10/01/05
City Adopts Final Master Plan	10/15/05
Perform Rate Study & SDC Analysis	1/01/06
Update CIP	6/01/06
Implement New User Rates and SDC's	7/01/06
Conduct Funding Meeting with OECDD and RUS	1/01/07
Submit Funding Applications	3/01/07
Finalize Funding Package	5/01/07
PHASE II	
Select Design Consultant Prepare Predesign Reports	6/01/07
Submit predesign report to OHD, OEDD & City	9/01/07
OHD, OEDD & City approval of predesign report	11/01/07
Funding for Detailed Design Secured	12/01/07
Start Final Design of Recommended Improvements	1/01/08
Complete Final Design of Recommended Improvements	10/01/08
OHD, OEDD & City Approval of Plans & Specifications	12/01/08
Advertise for Construction Bids	1/01/09
Receive Construction Bids	2/01/09
Award Contracts	2/15/09
Start Construction	4/1/09
Complete Construction of Recommended Improvements	12/31/09

CITY OF PHILOMATH
Water System Master Plan,
Philomath, Oregon

Existing Water System Maps

Appendix A

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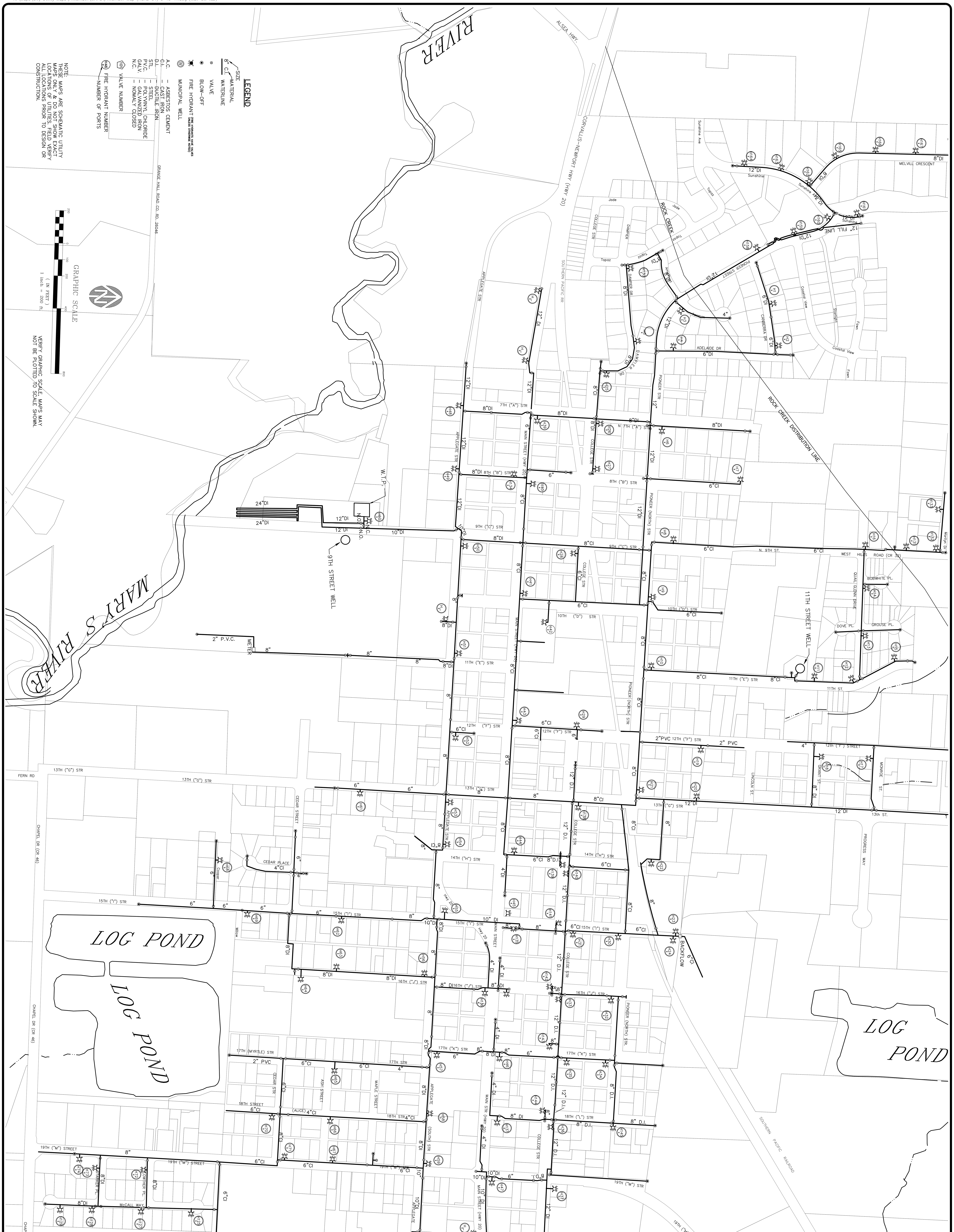

SHEET 1 OF 4	CITY OF PHILOMATH, OREGON	
JOB NUMBER 960.113.0	WATER SYSTEM MAP SW QUADRANT	

WESTECH ENGINEERING, INC.
CONSULTING ENGINEERS AND PLANNERS
3841 Fairview Industrial Dr. S.E., Suite 100, Salem, OR 97302
Phone: (503) 585-2474 Fax: (503) 585-3986
E-mail: westech@westech-eng.com

MAP UPDATED: 6-21-11

SCALE
HORIZ: 1" = 200'
VERT:
DSN. JK
DRN. JK
CKD. DM
DATE: FEB. 1998

NO.	DATE	DESCRIPTION	BY
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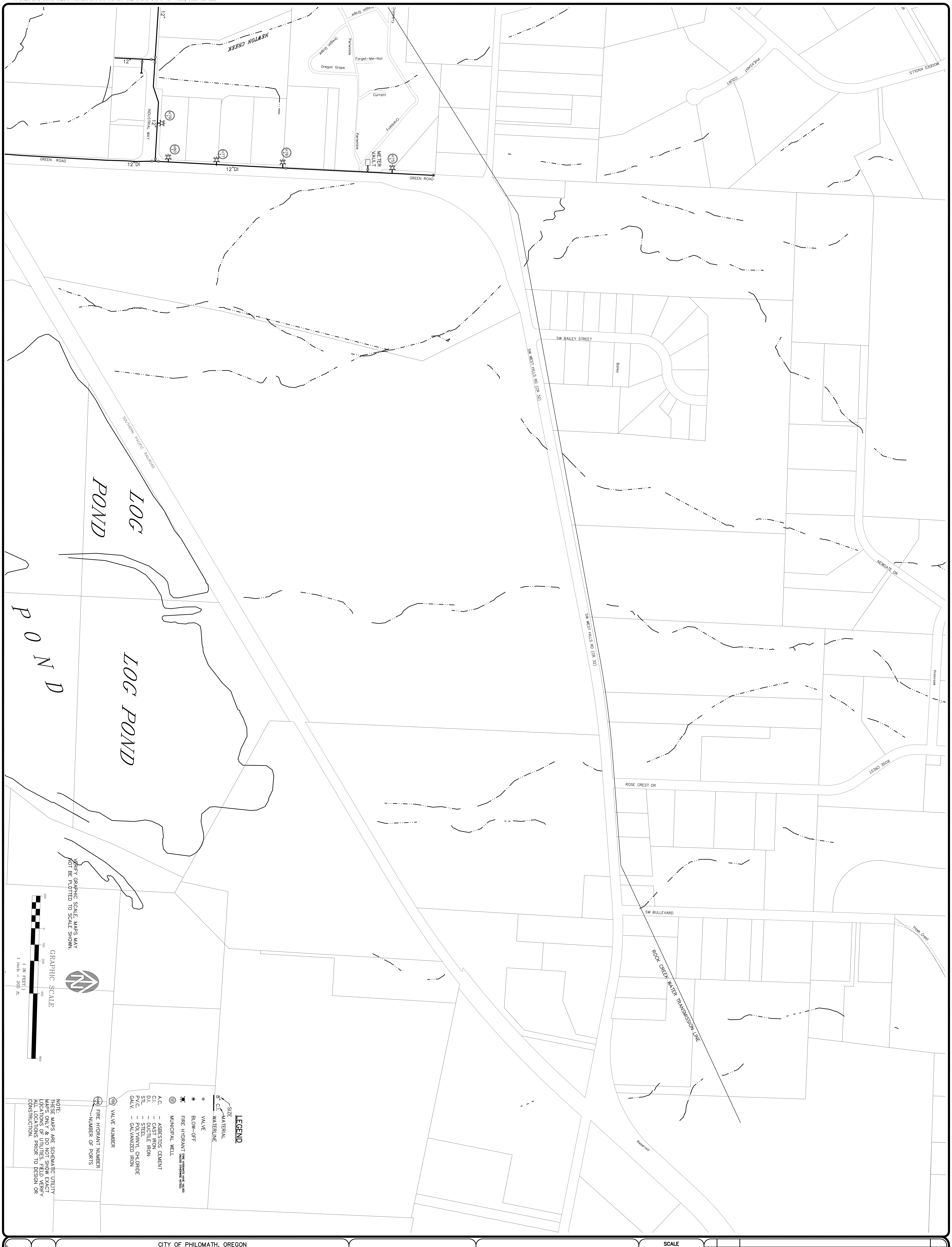

CITY OF PHILOMATH, OREGON

WATER SYSTEM MAP
NE QUADRANT

SHEET 4 OF 4
JOB NUMBER 960.113.0

WESTECH ENGINEERING, INC.
CONSULTING ENGINEERS AND PLANNERS
3841 Fairview Industrial Dr. S.E., Suite 100, Salem, OR 97302
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MAP UPDATED: 6-20-11

SCALE
HORIZ: 1" = 200'
VERT:

DSN. JK
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CKD. DM
DATE: FEB. 1998

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JOB NUMBER 960.113.0	WATER SYSTEM MAP NW QUADRANT	

WESTECH ENGINEERING, INC.
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MAP UPDATED: 6-21-11

SCALE
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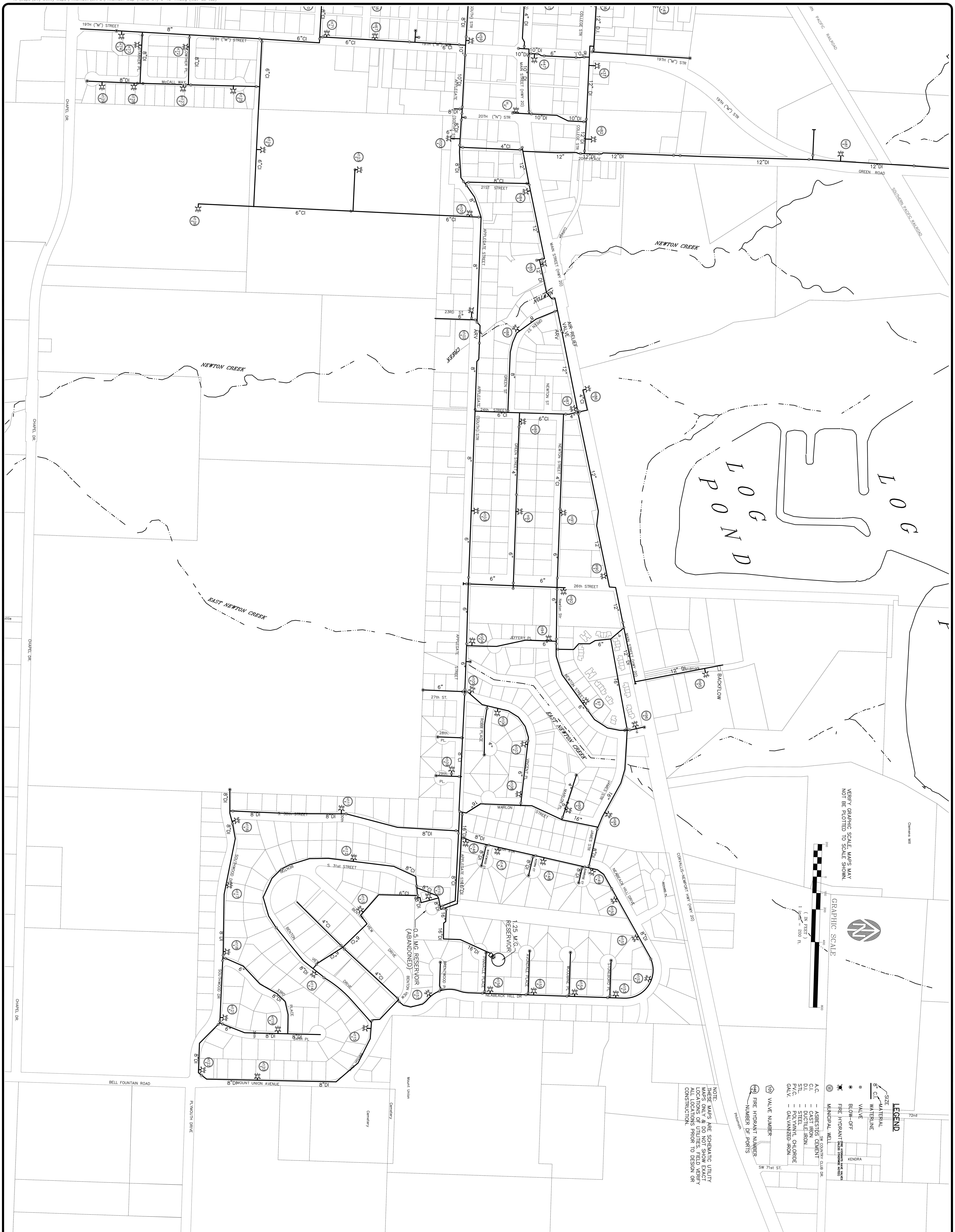

SHEET 2 OF 4	CITY OF PHILOMATH, OREGON	WESTECH ENGINEERING, INC. CONSULTING ENGINEERS AND PLANNERS	MAP UPDATED: 6-20-11
JOB NUMBER 960.113.0	WATER SYSTEM MAP SE QUADRANT	3841 Fairview Industrial Dr. S.E., Suite 100, Salem, OR 97302 Phone: (503) 585-2474 Fax: (503) 585-3986 E-mail: westech@westech-eng.com	

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REVISIONS

CITY OF PHILOMATH
Water System Master Plan,
Philomath, Oregon

OHD Summary of Oregon Drinking Water Quality Standards (Fall 2002)
OHD Pipeline Newsletter (Fall 2003): Includes discussions of upcoming LT2ESWTR and Stage 2 Disinfection Byproducts Rule

Appendix B

Oregon Drinking Water News

PIPELINE

Department of Human Services, Drinking Water Program

Vol.17, Issue 4 • Special Edition, Fall 2002 www.ohd.hr.state.or.us/dwp

OREGON DRINKING WATER QUALITY STANDARDS

Fall 2002

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DHS
Oregon Department of Human Services

OREGON DRINKING WATER QUALITY STANDARDS
Fall, 2002

This summary provides a broad overview of current and future drinking water quality standards which public water systems in Oregon must meet through the year 2010 and beyond. It is organized in two major sections - Section I: Current Standards, and Section II: Future Standards. The summary of current standards is for reference only, and is not a substitute for the actual statutes and regulations that govern public water supply in Oregon. Future standards described here are still under development at the national level, and are subject to change.

Types of Drinking Water Contaminants

The sources of drinking water, both tap water and bottled water, include surface water (rivers, lakes, ponds, reservoirs), and groundwater (wells and springs). As water travels over the surface of the land or through the ground, it dissolves naturally-occurring minerals and in some cases natural radioactive materials, and can pick up substances from the presence of animals or from human activities.

Drinking water contaminants are any substances present in drinking water that could adversely affect human health if present in high enough concentrations. All drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily mean that the water presents a health risk.

There are now drinking water quality standards for 95 different contaminants. They can be grouped into the following general categories:

- **Microbial Contaminants** - such as viruses, bacteria, and parasites which can come from sewage treatment plants, septic systems, agricultural and livestock operations, and wildlife.
- **Disinfectants and Disinfection By-Products** - chemical disinfectants used in water treatment to kill harmful microbes, and the chemical by-products formed from the reaction of disinfection treatment chemicals with natural substances in the water.
- **Inorganic Chemicals** - such as salts or metals, which can be naturally-occurring or can result from urban stormwater runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming. Includes lead and copper leached into the water from household plumbing and fixtures.
- **Organic Chemicals** - Pesticides and herbicides which may come from a variety of sources, such as agriculture, urban stormwater runoff, and residential uses. Also includes synthetic and volatile chemicals which are used in industrial processes and petroleum production and can come from gas stations, urban stormwater runoff, and septic systems.
- **Radiologic Contaminants** - Naturally occurring or resulting from oil and gas production or mining operations.

Every drinking water supply is vulnerable to microbial or chemical contaminants of one type or another from a variety of sources. Disease-causing microorganisms from human or animal feces (bacteria, viruses, parasites) can be present in surface water or from groundwater. Microorganisms can also enter the water system through pipe breaks or cross connections. Organic chemicals (industrial solvents, pesticides) are mainly man-made and can enter drinking water supplies from chemical production, storage, use, or disposal in the water source area. Inorganic chemicals can be introduced by human activities (nitrate from fertilizer) but more often result from natural occurrence in rocks, soils, and mineral deposits (radon, arsenic). Drinking water treatment which is essential to remove microbes and chemicals can also add or form contaminants in drinking water, such as disinfectant chemicals themselves, byproducts of disinfectants reacting with other substances in the water, and treatment chemicals used in filtering water. Finally, water storage tanks, pipes, and household plumbing that are in direct contact with water can contribute contaminants from either the material used in the tanks and pipes or from internal coatings used to protect the materials from contact with the water.

Drinking Water Standards and Health Protection

To protect health, national regulations set by the US Environmental Protection Agency limit the amounts of certain contaminants in tap water provided by public water systems. Other regulations set by the federal Food and Drug Administration establish limits for contaminants in bottled water which must provide the same level of protection of public health.

In order to be regulated under the Safe Drinking Water Act, a drinking water contaminant must meet certain criteria. The contaminant must be one which:

- may have an adverse effect on the health of persons,
- is known or likely to occur in public drinking water systems with frequencies and levels of health concern, and
- where regulation presents a meaningful opportunity for health risk reduction for persons served by public water systems, considering feasibility and cost.

Drinking water standards take several forms:

- **Maximum Contaminant Level Goal (MCLG)** - The level of a contaminant in drinking water below which there is no known or expected risk to health, allowing for a margin of safety. All regulated contaminants must have a MCLG, although the MCLG is not enforceable.
- **Maximum Contaminant Level (MCL)** - The highest level of a contaminant allowed in drinking water, set as close the MCLG as feasible using the best available treatment technology. Most MCLs are expressed in concentration units called "milligrams per liter" (mg/L), which for drinking water is the same as parts per million (ppm). MCLs can be expressed in a variety of other measurement units.
- **Treatment Technique (TT)** - A required treatment process intended to reduce the level of a contaminant in drinking water. For any contaminant that can not be effectively measured or detected in drinking water, the standard may be a treatment technique requirement instead of an MCL. This means that all water systems at risk of the contaminant must provide continuous water treatment to remove the contaminant at all times. Performance Standards (PS) are used to determine whether or not a water system is meeting a specific treatment technique requirement. Performance Standards are measurements of water quality parameters related to specific treatment processes, such as turbidity, disinfectant residual, pH, or alkalinity.
- **Action Level (AL)** - The concentration of a contaminant, which when exceeded, triggers treatment or other requirements which a water supplier must follow.

Public water suppliers and bottled water producers must sample for contaminants routinely to ensure that standards are met, and report the results of that sampling to the regulatory agency. Sampling frequencies for public water systems vary by the type of drinking water contaminant. Contaminants that are associated with immediate health impacts, like bacteria and nitrates, must be sampled as often as every month, quarter, or year. Contaminants that are associated with health effects that could develop from very long-term exposures, like arsenic, are sampled less frequently, such as every three or four years or more.

Some people may be more vulnerable to drinking water contaminants than the general population. Immune-compromised persons, such as persons with cancer and undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from microbial infections. These people should seek advice from their health care provider. USEPA and the federal Centers for Disease Prevention and Control (CDC) developed guidelines on appropriate measures to lessen the risk of infection by *Cryptosporidium* and other microbial contaminants. These are available from the USEPA at http://www.epa.gov/safewater/crypto.html.

Public Drinking Water Regulatory Program

The first national public drinking water standards, called the National Interim Primary Drinking Water Regulations (NIPDWR), were adopted on December 24, 1975, by the US Environmental Protection Agency (USEPA) under the 1974 Safe Drinking Water Act. By 1986, drinking water quality standards were in place for 23 different contaminants. The 1986 Safe Drinking Water Act mandated USEPA to set standards for 83 contaminants within 3 years, and 25 more contaminants every three years thereafter. The 1996 Safe Drinking Water Act significantly redirected this standard-setting schedule to focus on the highest remaining risks to health.

In Oregon, public drinking water systems are subject to the Oregon Drinking Water Quality Act (ORS 448 - Water Systems). The primary purpose of the 1981 Oregon Act is to "assure all Oregonians safe drinking water". According to the Oregon Act, safe drinking water means water which is "sufficiently free from biological, chemical, radiological, or physical impurities such that individuals will not be exposed to disease or harmful physiological effects". Under the Oregon Act, the Department of Human Services has broad authority to set water quality standards necessary to protect public health through insuring safe drinking water within a public water system. To accomplish this, the Department is directed under the Act to require regular water sampling by water suppliers. These samples must be analyzed in laboratories approved by the Department, and the results of laboratory tests on those samples must be reported by the water supplier to the Department. The Department must investigate water systems that fail to submit samples, or whose sample results indicate levels of contaminants that are above maximum allowable levels. Water suppliers who fail to sample the water or report the results, or whose water contains contaminants in excess of allowable levels must take corrective action and notify water users.

Since 1986, the Department has exercised primary responsibility for administering the federal Safe Drinking Water Act in Oregon, an arrangement called Primacy. The Department adopts and enforces standards that are no less stringent than the federal standards, and in return, the USEPA gives the Department the regulatory responsibility for public drinking water systems and partial financial support for the Oregon program operation.

In practice, the Oregon drinking water standards match the national standards established under the Safe Drinking Water Act by the USEPA. This is because setting maximum levels for drinking water contaminants to protect human health involves considerable development of health effects information and other scientific research that is best carried out at the national level. The Department of Human Services concentrates its efforts on implementing the national standards at Oregon public water systems.

Oregon Public Water Systems

Today, there are 2,756 public water systems in Oregon subject to regulation under the federal Safe Drinking Water Act. They serve 25 or more people at least 60 days per year. Of these, 898 are community water systems, which means the systems serve at least 15 connections used by year-round residents. These systems perform the most frequent water sampling for the greatest number of contaminants, because the people served have the most ongoing exposure to the drinking water. **Community water systems** in Oregon serve a total of about three million people and range in size from 15-home subdivisions and mobile home parks up to and including the City of Portland. **Nontransient noncommunity water systems** serve nonresidential populations consisting of the same people every day, such as a school or workplace with its own independent water supply system. There are 345 of these in Oregon.

Transient noncommunity water systems serve transient populations. Examples are campgrounds, parks, or restaurants with their own independent water supply systems, and there are 1,513 of these in Oregon. There are many small water systems in Oregon. About 87% of the public water systems in Oregon serve 500 or fewer people each.

Oregon public water systems get their water either from wells or springs (called groundwater) or from rivers, lakes, or streams (called surface water). Of the 2,756 public water systems in Oregon, 2,459 get their water exclusively from groundwater. 297 water systems get their water in whole or in part from surface water supplies. Generally speaking, surface water requires much more treatment and processing to ensure safety for drinking than does groundwater.

An additional 939 very small systems, serving 10-24 people each, are subject only to the Oregon Act, serving a total of nearly 17,300 people. About 400,000 Oregonians get their drinking water from **individual home wells**, which are not subject to either state or federal public drinking water standards.

For More Information

Visit the Oregon Drinking Water Web Page for drinking water information and publications (http://www.ohd.hr.state.or.us/dwp). Use the "Data Online" feature to look at past and current water sample test results and regulatory compliance status information for any Oregon public water system. In addition, contact names and phone numbers of state and county program staff are listed. You can use "links" at this site to access many other sources of drinking water information. For example, a comprehensive schedule of federal drinking water standards implementation can be found at http://www.epa.gov/safewater/pws/imp_milestones.pdf.

County staffs are responsible for community water systems serving 3,300 people or fewer and using groundwater sources, and all nontransient noncommunity and transient noncommunity systems. Questions about these systems should be directed to the respective county health department.

Department staff are responsible for all community water systems serving more than 3,300 people and all community systems that use surface water sources. In counties without drinking water programs, Department staff are responsible for all public water systems. Department staff also serve as a technical resource for county drinking water programs as needed.

Compliance with drinking water standards is summarized for each calendar year on a statewide basis in the Oregon Annual Compliance Report, which is prepared in June and distributed via the PIPELINE newsletter shortly thereafter. Each community water system must distribute to users an annual Consumer Confidence Report, detailing the levels of contaminants detected in the water system and their significance, listing any violations of standards or sampling requirements that occurred, and providing information on the water sources used by the community.

I. CURRENT STANDARDS

There are now drinking water quality standards for 95 contaminants, including 9 microbials, 8 disinfection by-products and residuals, 18 inorganics (including lead and copper), 53 organics, and 7 radiologic contaminants. These standards either have established MCLs or treatment techniques, and are summarized in this Section.

Microbial Contaminants - Coliform Bacteria

Purpose: Reduce the risk of waterborne illness. Coliforms are bacteria that are naturally present in the environment and normally do not cause illness. Coliforms present in more samples than allowed is, however, a warning of potential problems. Their presence in drinking water is used as an indicator that other organisms that are potentially harmful may be present. Routine samples collected by Oregon public water suppliers are analyzed for total coliform bacteria. Samples that show the presence of total coliforms are further examined for fecal coliforms or *E. coli*, which are more specific indicators of fecal contamination.

Health effects: The presence of total coliforms indicates potential problems with water system operations or maintenance that require attention and correction. Fecal coliforms and *E. coli* are bacteria whose presence indicates that the water may be contaminated with human or animal wastes, and urgent action is required to protect health including advising water users to boil drinking water or use alternate supplies. Microbes in these wastes can cause short-term health effects, such as diarrhea, cramps, nausea, headaches, or other symptoms. They may pose a special health risk for infants, young children, and people with severely compromised immune systems.

Application: All public water systems must regularly test for coliform bacteria from locations in the distribution system, identified in a coliform sampling plan.

Monitoring: All community systems, and non-community systems using surface water sources or serving over 1,000 people, must sample monthly:

Population	Number of Monthly Samples
up to 1,000	1
1,001-2,500	2
2,501-3,300	3
3,301-4,100	4
4,101-4,900	5
>4,900	see rules

All other systems must test for coliform bacteria once per quarter.

Compliance: All coliform sample results are reported as "coliform absent" (negative) or "coliform present" (positive). A set of 3-4 repeat samples is required for each positive coliform sample (so that a total of at least five samples is collected during the month). Repeat sampling continues until the maximum contaminant level is exceeded or a set of repeat samples with negative results is obtained. Small systems (fewer than 40 samples/month) are allowed no more than one positive sample per month. Larger systems are allowed no more than 5% positive samples in any month. Confirmed presence of fecal coliform or *E. coli* is considered an acute health risk and requires immediate notification of the public to take protective actions such as boiling or using bottled water.

Water Treatment/control measures: Use of disinfection processes for source waters, such as chlorination, ozonation, and ultraviolet light. Other control measures include maintaining a disinfectant residual in the distribution system, protecting the source water area, proper well construction, maintaining distribution system pressure, and cross connection control.

Rule history:
- Federal rule - 12/24/75 (National Interim Primary Drinking Water Regulation)
- Oregon rule - 9/24/82
- Federal rule - 6/29/89 (Total Coliform Rule)
- Oregon rule - 1/1/91

Microbial Contaminants - Surface Water Treatment

Purpose: Increase protection of people against gastrointestinal illness from *Cryptosporidium* and other disease-producing (pathogenic) organisms by improving filtration treatment in water systems that use surface water supplies. All surface water supplies are considered at some risk of containing microorganisms at any given time. Requirements are designed to control pathogenic microorganisms and indicators in surface water sources, including *Cryptosporidium, Giardia lamblia,* enteric viruses, and *Legionella.* Requirements also control indicators of microbial contamination including heterotrophic plate count bacteria (HPC), and particulate matter from soil runoff (turbidity). At the same time, water suppliers must assure that actions to limit the levels of disinfection by-products do not increase the risk of waterborne disease.

Health effects: Pathogenic organisms in drinking water can cause acute gastrointestinal disease in humans (see Table 1). These organisms include bacteria, viruses, and parasites that can cause symptoms such as nausea, cramps, diarrhea, and associated headaches. EPA estimates that 334,000 to 1,173,000 cases of waterborne disease per year are avoided in the U.S. in water systems by meeting the surface water treatment requirements. These figures include epidemic illness (large outbreaks) and endemic illness (periodic low numbers of illness).Turbidity performance standards are specified. Turbidity has no direct health effects, however, turbidity can interfere with disinfection treatment and provide a medium for microbial growth. Primarily, turbidity is used to evaluate the effectiveness of filtration treatment processes.

Application: All public water systems using surface water sources. Also all public water systems using groundwater sources determined by the Department to be under the "direct influence of surface water", as indicated by:

- Significant similarities in water characteristics such as turbidity, temperature, conductivity, or pH between the groundwater source and nearby surface water, and if so,
- A significant occurrence of insects or other macroorganisms, algae, organic debris, or large pathogens like *Giardia* and *Cryptosporidium*, as indicated by microscopic particulate analysis.

Compliance: Water systems must provide a total level of treatment to remove/inactivate 99.9% (3-log) of *Giardia lamblia*, and to remove/inactivate 99.99% (4-log) of viruses. In addition, filtered water systems must achieve 99% (2-log) removal of *Cryptosporidium*, and those water systems with exceptions from the filtration requirements must include *Cryptosporidium* control in their watershed control programs. Filtration performance standards for turbidity, and CxT [concentration x time] calculations for disinfection, are used to determine if a water system is meeting the required removal/inactivation levels. Filtered water systems that recycle spent filter backwash water or other waste flows must return those flows through all treatment processes in the filtration plant.

Compliance can be achieved by:

- Filtration plus disinfection treatment meeting performance standards, or
- Disinfection plus "natural filtration" plus wellhead/source water protection (for groundwater sources under the direct influence of surface water), or
- Disinfection treatment plus meeting exception criteria to remain unfiltered.

Filtration treatment performance standards for combined filter effluent for systems using conventional or direct filtration treatment:

- Turbidity measurements of filtered water every four hours by grab sampling or continuous monitoring (1 measurement per day for slow sand filtration, diatomaceous earth filtration, and alternative technologies).
- 95% of turbidity readings less than or equal to 0.3 ntu (1 ntu for slow sand filtration, diatomaceous earth filtration, and alternative technologies).
- All turbidity readings less than or equal to 1 ntu (5 ntu for slow sand filtration, diatomaceous earth filtration, and alternative technologies).
- Minimum 2-log *Cryptosporidium* removal/inactivation, based on meeting turbidity performance standards.

Alternative filtration technologies include membrane filtration and cartidge filtration.

Individual filter effluent monitoring for systems using conventional or direct filtration treatment:

- Continuous turbidity monitoring of individual filters, recorded every 15 minutes.
- Specific follow up actions required if any individual filter has:
  - Turbidity > 1.0 ntu in two consecutive measurements 15 min. apart, or

- Turbidity > 0.5 ntu in two consecutive measurements 15 min. apart after 4 hours of operation following backwash, or
- Turbidity > 1.0 ntu in two consecutive measurements 15 min. apart in each of three consecutive months, or
- Turbidity >2.0 ntu in two consecutive measurements 15 min. apart in two consecutive months.

Specific follow up actions include additional reporting, filter self-assessment, and comprehensive performance evaluations.

Criteria for surface water systems to remain unfiltered:

- Source water quality criteria:
    - Coliform bacteria:
        - Less than or equal to 100 total coliform bacteria per 100 ml in 90% of samples collected for a running 6 month period, or
        - Less than or equal to 20 fecal coliform bacteria per 100 ml in 90% of samples collected for a running 6 month period
    - Turbidity:
        - Continuous monitoring, or test every four hours
        - No exceedence of 5 ntu
        - Collect source water coliform sample on any day where turbidity exceeds 1 ntu
- Site-specific criteria:
    - Adequate disinfection:
        - 99.9% (3-log) *Giardia* inactivation
        - 99.99% (4-log) enteric virus inactivation
        - Continuous recording of disinfectant residual at distribution system entry point
        - Reliable backup equipment
        - Maintain distribution residuals throughout system
    - Control over the watershed area, and a formal Watershed Control Program addressing control of *Cryptosporidium*.
    - Annual sanitary survey showing no source water quality, disinfection treatment, or watershed control deficiencies
    - On-going compliance with total coliform and disinfection by-products standards
    - No history of waterborne disease outbreaks

Disinfection performance standards (all systems):

- Continuous recording of disinfectant residual at the entry point to the distribution system (small systems can substitute 1-4 grab samples per day).
- Daily calculation of CxT (disinfectant concentration x time) at highest flow.
- Provide adequate CxT to meet needed removal/inactivation levels.
- Maintain a continuous minimum 0.2 mg/L disinfectant residual at entry point to the distribution system.
- Maintain a minimum detectable disinfectant residual in 95% of distribution system samples (collected at coliform bacteria monitoring points).

Disinfection profiling and benchmarking:

- All systems must develop four quarters of total trihalomethane (TTHM) and haloacetic acid (HAA5) data.
- If the annual running average for TTHM $\geq$ 0.064 mg/L, or HAA5 $\geq$ 0.048 mg/L, develop disinfection profile reflecting daily inactivation rates for *Giardia* for at least one year.
- Using the profile, calculate a disinfection benchmark (lowest monthly average inactivation) and consult with Department before making significant changes to the disinfection process.

Compliance dates:

12/91 Unfiltered systems meet requirements to remain unfiltered

6/93 Filtration or alternate water source in place.

6/94	Department determines which community groundwater systems are under direct influence of surface water
12/95	Surface-influenced community systems meet treatment performance requirements
2/99	Construction of uncovered finished water reservoirs prohibited
3/99	Large systems (10,000 or more people) begin TTHM, HAA5 quarterly monitoring
6/99	Department determines which non-community groundwater systems are under direct influence of surface water
4/00	Large systems begin to develop disinfection profile, based on TTHM, HAA5 results
12/00	Surface-influenced noncommunity systems meet treatment performance requirements
4/01	Large systems complete disinfection profile
1/02	Large systems start individual filter monitoring and meet turbidity performance standards
12/03	Systems that recycle waste flows within the treatment plant provide notice to the state
7/03	Systems serving 500-9,999 persons report TTHM/HAA5 monitoring data or start disinfection profiling
1/04	Systems serving fewer than 500 persons report TTHM/HAA5 monitoring data or start disinfection profiling
6/04	Systems serving 500-9,999 persons complete disinfection profile
6/04	Systems that recycle waste flows complete collection of technical data on recycling practices and treatment, retain information on-site for state review
6/04	Systems that recycle waste flows comply with filter backwash recycling requirements
12/04	Systems serving fewer than 500 persons complete disinfection profile
1/05	Systems serving fewer than 10,000 people start individual filter monitoring and meet turbidity performance standards
6/06	Compliance date for systems that recycle waste flows, but need capital improvements to meet the rule

Cost: Total US cost estimated to be $870M/yr.

Rule history:

- Federal rule - 12/24/75 (turbidity)
- Oregon rule - 9/24/82 (turbidity)
- Federal rule - 6/29/89 (Surface Water Treatment Rule - SWTR)
- Oregon rule - 1/1/91 (SWTR)
- Federal rule - 12/16/98 (Interim Enhanced Surface Water Treatment Rule- IESWTR)
- Federal rule - 4/14/00, 6/13/00 (revisions)
- Oregon rule - 7/15/00 (IESWTR)
- Federal rule - 1/16/01, 2/12/01 (revisions)
- Federal rule - 6/8/01 (Filter Backwash Recycling Rule-FBRR)
- Oregon rule - 10/31/01 (revisions)
- Federal rule - 1/14/02 (Long Term 1 Enhanced Surface Water Treatment Rule)
- Oregon rule - expected 10/02 (FBRR)
- Oregon rule - expected 4/04 (LT1ESWTR)

Table 1 - Microbial Contaminants

Contaminant	MCL, mg/L	Potential Health Effects	Source of Drinking Water Contamination
Giardia lamblia	TT[1]	Gastrointestinal disease	Human and animal fecal wastes
Cryptosporidium	TT	Gastrointestinal disease	Human and animal fecal wastes
Legionella	TT	Legionnaires disease	Natural waters, can grow in water heating systems
Heterotrophic plate count (HPC)	TT	Indicates water quality, effectiveness of disinfection treatment	Naturally occurring bacteria
Turbidity	PS[2]	Interferes with disinfection, indicator of filtration treatment performance	Particulate matter from soil runoff
Viruses	TT	Gastrointestinal disease	Human fecal wastes
Total coliforms	<5% positive[3]	General indicator of the presence of pathogens	Bacteria naturally present in the environment, human and animal fecal wastes
Fecal coliforms	Confirmed presence	More specific indicator of the presence of pathogens	Human and animal fecal wastes, some natural environmental sources
E. coli	Confirmed presence	Most specific indicator of the presence of pathogens	Human and animal fecal wastes

[1] *Treatment Technique, filtration plus disinfection of surface water, or equivalent*

[2] *Performance Standard, see text*

[3] *No more than one positive routine sample per month (or quarter) for systems collecting fewer than 40 samples/month*

Disinfectants and Disinfection By-products

Purpose: Protect public health by limiting the exposure of people to chemical disinfectant residuals and chemical by-products of disinfection treatment that result from disinfection treatment practices. Disinfection treatment used to kill microorganisms in drinking water can react with naturally occurring organic and inorganic matter in water to form disinfection by-products. The challenge is to apply levels of disinfection treatment needed to kill microorganisms while limiting the levels of disinfection by-products produced. The primary disinfection by-products of concern in Oregon are the trihalomethanes and the haloacetic acids.

Health Effects: See Table 2.

Application: All community and nontransient noncommunity water systems that 1) apply a disinfectant to the drinking water for primary or residual water treatment, or 2) that distribute water that has been disinfected. In addition, transient noncommunity systems that use chlorine dioxide are also affected.

Monitoring: Disinfectant residuals must be monitored at the same locations and frequency as coliform bacteria. Disinfection by-products (DBPs) must be monitored throughout the distribution system at frequencies daily, monthly, quarterly or annually, depending on the population served, type of water source, and the specific disinfectant applied, and in accordance with an approved monitoring plan. Systems using surface water sources and conventional filtration treatment must monitor source water for total organic carbon (TOC) and control with enhanced coagulation if TOC exceeds 2.0 mg/L.

Compliance: Compliance is determined based on meeting maximum levels for disinfectant residual and disinfection by-products over a running 12-month average of the sample results, computed quarterly. See Table 2 for MCLs. Maximum Residual Disinfectant Levels (MRDLs) are:

- Chloramines (total chlorine residual) - 4.0 mg/L (as Cl_2)
- Chlorine (free chlorine residual) - 4.0 mg/L (as Cl_2)
- Chlorine dioxide - 0.8 mg/L (as ClO_2)

Compliance dates:

1/02 - Surface water systems serving 10,000 or more people.

1/04 - Surface water systems serving fewer than 10,000 people, and all groundwater systems.

Water treatment/control measures: Optimize treatment processes to reduce disinfectant residuals. DBPs can be reduced by moving the point of chlorine application from prior to filtration to after filtration, where many of the natural organic compounds in the water have been reduced, and by enhanced coagulation treatment to remove total organic carbon prior to disinfection. Alternative disinfectants such as ozone, or using chlorine combined with ammonia (chloramines), can reduce DBP levels.

Cost: Total cost US is estimated at $684M/yr. Benefits include reduced exposure for 140M people in US, 24% reduction in THM levels across US, and reduction in exposure to bromate and chlorite. Benefits difficult to quantify due to uncertainties in health data. Benefits are believed to exceed costs.

Rule history:

Federal rule - 11/29/79 (Total Trihalomethanes (TTHM), 0.10 mg/L, for water systems serving more than 10,000 people)
Oregon rule - 9/24/82 (TTHM)
Federal rule - 12/16/98 (Stage 1 Disinfectants/ Disinfection By-products Rule - D/DBP)
Federal rule - 4/14/00, 5/30/00, 6/13/00 (revisions)
Oregon rule - 7/15/00 (Stage 1 D/DBP)
Federal rule - 1/16/01, 2/12/01 (revisions)
Oregon rule - 10/31/01 (revisions)

Table 2. Disinfectant Residuals, and Disinfection By-products

Contaminant	MCL, mg/L	Potential Health Effects	Source of Drinking Water Contamination
Bromate	0.010	Cancer	Drinking water ozonation by-product
Bromodichloromethane	(see total trihalomethanes, TTHMs)	Cancer; liver, kidney, and reproductive effects	Drinking water chlorination by-product
Bromoform	(see TTHMs)	Cancer; nervous system, liver and kidney effects	Drinking water chlorination by-product
Chlorite	1.0	Oxidative effects to red blood cells	By-product of disinfection using chlorine dioxide
Chloroform	(see TTHMs)	Cancer; liver, kidney, reproductive effects	Drinking water chlorination by-product
Dibromochloromethane	(see TTHMs)	Nervous system, liver, kidney, reproductive effects	Drinking water chlorination by-product
Dichloroacetic acid	(see HAA5)	Cancer; reproductive, developmental effects	Drinking water chlorination by-product
Haloacetic acids (HAA5) [1]	0.060	Cancer and other effects	Drinking water chlorination by-products
Trichloroacetic acid	(see HAA5)	Liver, kidney, spleen developmental effects	Drinking water chlorination by-product
Total Trihalomethanes (TTHMs)[2]	0.080	Liver, kidney, central nervous system effects, increased risk of cancer	Drinking water chlorination by-products
Total Organic Carbon (TOC)	TT (if source water TOC exceeds 2.0 mg/L)	None, used as a surrogate for DBP formation potential	Natural organic materials present in surface waters

[1] *Sum of the concentrations of mono-, di-, and trichloroacetic acids and mono- and dibromoacetic acids*

[2] *Sum of the concentrations of chloroform, bromoform, dibromochloromethane, and bromodichloromethane*

Lead and Copper

Purpose: Set treatment technique requirements to control lead and copper in drinking water at the customer tap. Although lead and copper are naturally present in geologic deposits, they are rarely present in Oregon at significant levels in surface water or groundwater sources. They are primarily from corrosion of plumbing and plumbing fixtures in homes and buildings. Lead comes from lead solder and brass fixtures, and copper comes from copper tubing and brass fixtures. Copper is also used as a wood preservative.

Health effects-Lead: Infants and young children are typically more vulnerable to lead in drinking water than the general population. Infants and children who drink water containing lead in excess of the action level could experience delays in their physical or mental development. Children could show slight deficits in attention span and learning abilities. Adults who drink this water over many years could develop kidney problems or high blood pressure. EPA considers lead a probable human carcinogen.

Health effects-Copper: Copper is an essential nutrient, but some people who drink water containing copper in excess of the action level over a relatively short period of time could experience gastrointestinal distress. Some people who drink water containing copper in excess of the action level over many years could suffer liver or kidney damage. People with Wilson's Disease should consult their health care provider.

Application: All community and nontransient noncommunity systems

Monitoring: Samples are collected from "high-risk" homes; those with lead-soldered plumbing built prior to the 1985 prohibition of lead solder in Oregon. One-liter samples of standing water (first draw after 6 hours of non-use) are collected at homes identified in the water system sampling plan. The number of samples required for initial and subsequent monitoring is summarized below:

Water System Population	Initial Sample Sites	Reduced Sampling Sites
>100,000	100	50
10,001-100,000	60	30
3,301-10,000	40	20
501-3,300	20	10
101-500	10	5
<101	5	5

Two rounds of initial sampling were required during 1992-94, collected at six-month intervals. Subsequent annual sampling from the reduced number of sites is required after demonstration that lead and copper action levels are met. After three rounds of annual sampling, samples are required every three years. Water systems practicing corrosion control treatment must also monitor for water quality parameters (such as pH, temperature, alkalinity) and comply with target levels as specified by the Department.

Compliance: In each sampling round, 90% of samples from homes must have lead levels less than or equal to the Action Level of 0.015 mg/L, and copper levels less than or equal to the Action Level of 1.3 mg/L. Water systems with lead above the Action Level must conduct periodic public education, and either install treatment, change water sources, or replace plumbing.

Water Treatment/Control Measures: Water systems that can not meet the Action Levels must either install corrosion control treatment or develop alternate sources of water by January, 1998. Water treatment alternatives include adding chemicals to adjust pH, alkalinity, or both (such as soda ash, caustic soda) or adding passivating agents (such as orthophosphates or ortho/polyphosphate blends). If levels are not met even after treatment installation and optimization, then continuing public education efforts are required, along with replacement of any lead service lines. It is possible that lead levels in a particular home may be higher than at other homes in the community as a result of the materials used in that home's plumbing. People who are concerned about elevated lead levels can arrange to test their water and if the results are high, can flush taps for 30 seconds to two minutes before using tap water, especially after periods of extended non-use.

Rule History:
- Federal rule - 12/24/75 (Lead, 0.05 mg/L)
- Oregon rule - 9/24/82
- Oregon rule - 7/1/85 (Lead solder ban)
- Federal rule - 6/7/91 (Lead and Copper)
- Oregon rule - 12/7/92
- Federal rule - 7/15/91, 6/29/92, 6/30/94 (technical corrections)
- Federal rule - 1/12/00 (minor revisions)
- Oregon rule - 10/31/01 (technical corrections, revisions)

Inorganic Contaminants

Purpose: Control levels of metals and minerals in drinking water, both naturally-occurring and resulting from agricultural or industrial use. Inorganic contaminants most often come from the source of water supply, but can also enter water from contact with materials used for pipes and storage tanks. A new and more stringent drinking water standard was recently established for arsenic. See Table 3.

Health effects: For most inorganic contaminants, health concerns are related to long-term or even lifetime exposures (see Table 3). Arsenic is a naturally-occurring mineral known to cause cancer in humans at high concentrations over years of exposure. Nitrate and nitrite, however, can seriously affect infants in short-term exposures by interfering with the transfer of oxygen from the lungs to the bloodstream. Infants below the age of six months who drink water containing nitrate or nitrite in excess of the MCLs could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue-baby syndrome.

Application: All public water systems. The exceptions are the arsenic and asbestos standards which apply only to community and nontransient non-community systems.

Monitoring: Nitrate - community and nontransient noncommunity systems must sample quarterly for surface water sources and annually for groundwater sources. All noncommunity and state-regulated water systems must sample annually. Asbestos - community and nontransient noncommunity systems with asbestos-cement water pipes or with water sources in geologic asbestos deposit areas must sample every nine years. Arsenic - community and nontransient noncommunity systems begin monitoring and comply with the new standard by January, 2006. All other inorganics - community and nontransient noncommunity systems must sample surface water sources annually and groundwater sources every three years. All noncommunity and state-regulated water systems must sample once.

Compliance: Water systems must meet the established maximum contaminant levels (Table 3). Systems that can not meet one or more MCLs must either install water treatment systems or develop alternate sources of water.

Compliance dates for arsenic:

1/06	0.010 mg/L MCL becomes effective, water systems begin monitoring
12/06	Surface water systems complete initial monitoring
12/07	Groundwater systems complete initial monitoring

Water Treatment: A variety of water treatment processes are available for reducing levels of specific inorganic contaminants in drinking water, including ion exchange and reverse osmosis.

Cost (arsenic): EPA estimates the cost of meeting the new arsenic standard is $165M per year in the US. A drinking water research organization estimates the US cost at $605M per year. Benefits include avoiding 16-26 non-fatal bladder and lung cancer cases per year in the US, avoiding 21 to 39 fatal bladder and lung cancer cases per year, and reducing non-cancer diseases.

Rule history:
- Federal rule - 12/24/75 (inorganic chemicals)
- Oregon rule - 9/24/82 (inorganic chemicals)
- Federal rule - 4/2/86 (fluoride)
- Oregon rule - 11/13/89 (fluoride)
- Federal rule - 7/1/91 (Phase II)
- Federal rule - 6/29/92, 7/1/94 (corrections to Phase II)
- Federal rule - 7/19/92 (Phase V)
- Federal rule - 7/1/94 (corrections to Phase V)
- Oregon rule - 6/9/92 (Phase II), and 1/14/94 (Phase V)
- Federal rule - 1/22/01 (arsenic)
- Oregon rule - expected 1/22/05

Table 3. Inorganic Contaminants

Contaminant	MCL, mg/L (or as noted)	Potential Health Effects	Sources of Drinking Water Contamination
Antimony	0.006	Blood cholesterol increases, blood sugar decreases	Discharge from petroleum refineries, fire retardants, ceramics, electronics, solder
Arsenic	0.010	Skin damage, circulatory system effects, increased cancer risk	Erosion of natural deposits of volcanic rocks, runoff from orchards, runoff from glass and electronics production wastes
Asbestos	7 million fibers per liter (>10 um fiber size)	Increased risk of developing benign intestinal polyps	Erosion of natural geologic deposits, decay of asbestos-cement water pipes
Barium	2	Increase in blood pressure	Discharge of drilling wastes, discharge from metal refineries, erosion of natural deposits
Beryllium	0.004	Intestinal lesions	Discharge from metal refineries and coal-burning factories, discharge from electrical, aerospace, and defense industries
Cadmium	0.005	Kidney damage	Corrosion of galvanized pipes, erosion of natural deposits, discharge from metal refineries, runoff from waste batteries and paints
Chromium (total)	0.1	Allergic dermatitis	Discharge from steel and pulp mills, erosion of natural deposits
Cyanide	0.2	Thyroid, nervous system damage	Discharge from steel/metal factories, discharge from plastic and fertilizer factories

Table 3. Inorganic Contaminants (continued)

Fluoride	4[1]	Bone disease, mottled teeth	Erosion of natural deposits, discharge from fertilizer and aluminum industries, drinking water additive promoting strong teeth
Mercury (total inorganic)	0.002	Kidney damage	Erosion of natural deposits, discharges from refineries and factories, runoff from landfills, runoff from cropland
Nickel	0.1[2]	Heart and liver damage	Metal alloys, electroplating, batteries, chemical production
Nitrate (as N)	10	Methemoglobinemia ("blue baby syndrome") in infants below the age of six months	Runoff from fertilizer use, leaching from septic tank/drain fields, erosion of natural deposits
Nitrite	1	Methemoglobinemia ("blue baby syndrome") in infants below the age of six months	Runoff from fertilizer use, leaching from septic tank/drain fields, erosion of natural deposits (rapidly converted to nitrate)
Nitrate + nitrite	10	Methemoglobinemia ("blue baby syndrome") in infants below the age of six months	Runoff from fertilizer use, leaching from septic tank/drain fields, erosion of natural deposits (rapidly converted to nitrate)
Selenium	0.05	Hair and nail loss, numbness in fingers and toes, circulatory problems	Discharge from petroleum and metal refineries, erosion of natural deposits, discharge from mines
Thallium	0.002	Hair loss, blood changes, and kidney, liver, intestinal effects	Leaching from ore processing sites, discharge from electronics, drugs, and glass factories

[1]*Note: a secondary standard for fluoride is set at 2.0 mg/L to control tooth discoloration*

[2]*Oregon regulatory standard only, federal standard withdrawn 2/23/95*

Organic Chemicals

Purpose: Control levels of organic contaminants (see Table 4). Organic contaminants are most often associated with industrial or agricultural activities that affect sources of drinking water supply. Major types of organic contaminants are Volatile Organic Chemicals (VOCs) and Synthetic Organic Chemicals (SOCs). These include industrial and commercial solvents and chemicals, and pesticides used in agriculture and landscaping. Organic contaminants can also enter drinking water from materials in contact with the water such as pipes, valves, and paints and coatings used inside water storage tanks.

Health effects: For organic contaminants, health concerns are related to long-term or even lifetime exposures to low levels of contaminant (see Table 4).

Application: Community and nontransient non-community water systems.

Monitoring: At least one test for each contaminant from each water source is required during every 3-year compliance period. Public water systems serving more than 3,300 people must test twice during each 3-year compliance period for SOCs. Public water systems using surface water sources must test for VOCs annually. Quarterly followup testing is required for any contaminants that are detected. The exceptions are dioxin and acrylamide/epichlorohydrin. Only those systems determined by the Department to be at risk of contamination must monitor for dioxin. Water systems using polymers containing acrylamide or epichlorohydrin in their water treatment processes must keep their dosages below specified levels.

Compliance: Water systems must meet the established maximum contaminant levels (Table 4). Systems that can not meet one or more MCLs must either install or modify water treatment systems or develop alternate sources of water.

Water Treatment: A variety of water treatment processes are available for reducing levels of specific organic contaminants in drinking water, including activated carbon and aeration.

Rule history:

- Federal rule - 12/24/75 (National Interim Primary Drinking Water Regulation)
- Oregon rule - 9/2/82
- Federal rule - 7/8/87 (Phase I Volatile Organic Chemicals)
- Oregon rule - 11/13/89 (Phase I)
- Federal rule - 1/30/91 and 7/1/91(Phase II Synthetic Organic Chemicals)
- Federal rule - 6/29/92, 7/1/94 (corrections to Phase II)
- Federal rule - 7/19/92 (Phase V Synthetic Organic Chemicals)
- Federal rule - 7/1/94 (corrections to Phase V)
- Oregon rule - 6/9/92 (Phase II); and 1/14/94 (Phase V)

Table 4. Organic Contaminants

Contaminant	MCL, mg/L	Potential Health Effects	Sources of Drinking Water Contamination
Acrylamide	TT[1]	Central nervous system and blood effects, increased risk of cancer	Added to water during water and sewage treatment
Alachlor	0.002	Eye, liver, kidney, spleen effects, anemia, increased risk of cancer	Runoff from herbicides used on row crops
Atrazine	0.003	Cardiovascular and reproductive effects	Runoff from herbicides used on row crops
Benzene	0.005	Decreased blood platelets, anemia, increased risk of cancer	Discharge from factories, leaching from landfills and gas storage tanks
Benzo(a)pyrene (Polyaromatic hydrocarbons)	0.0002	Reproductive difficulties and increased risk of cancer	Leaching from linings of water storage tanks and water pipes
Carbofuran	0.04	Blood, nervous system, and reproductive system effects	Leaching of soil fumigant used on rice and alfalfa
Carbon tetrachloride	0.005	Liver effects and increased risk of cancer	Discharge from chemical plants and other industrial activities
Chlordane	0.002	Liver and nervous system effects, increased risk of cancer	Residue of banned termiticide
Chlorobenzene	0.1	Kidney and liver effects	Discharge from chemical and agricultural chemical factories
2,4-D	0.07	Liver, adrenal gland, and kidney damage	Runoff from herbicides used on row crops
Dalapon	0.2	Minor kidney effects	Runoff from herbicides used on rights of way
Dibromo-chloropropane (DBCP)	0.0002	Reproductive difficulties and increased risk of cancer	Runoff from soil fumigant used on soybeans, cotton, pineapples, orchards

Table 4. Organic Contaminants (continued)

o-Dichloro-benzene	0.6	Liver, kidney, circulatory system damage	Discharge from industrial chemical factories
p-Dichlorobenzene	0.075	Liver, kidney, spleen damage, anemia, blood effects	Discharge from industrial chemical factories
1,2-Dichloroethane	0.005	Increased risk of cancer	Discharge from industrial chemical factories
1,1-Dichloroethylene	0.007	Liver damage	Discharge from industrial chemical factories
cis 1,2-Dichloro-ethylene	0.07	Liver damage	Discharge from industrial chemical factories
trans 1,2-Dichloro-ethylene	0.1	Liver damage	Discharge from industrial chemical factories
Dichloromethane (methylene chloride)	0.005	Liver damage and increased risk of cancer	Discharge from pharmaceutical and chemical factories
1,2-Dichloropropane	0.005	Increased risk of cancer	Discharge from industrial chemical factories
Di(2-ethylhexyl) adipate	0.4	General toxic and reproductive effects	Discharge from chemical factories
Di(2-ethylhexyl) phathalate	0.006	Liver effects, reproductive difficulties, increased risk of cancer	Discharge from chemical and rubber factories
Dinoseb	0.007	Reproductive difficulties	Runoff from herbicide used on soybeans and vegetables
Dioxin (2,3,7, 8-TCDD)	3×10^{-8}	Reproductive difficulties and increased risk of cancer	Emissions from waste incineration and other combustion, discharge from chemical factories
Diquat	0.02	Cataracts	Runoff from herbicide use
Endothall	0.1	Stomach, intestine effects	Runoff from herbicide use
Endrin	0.002	Liver damage	Residue of banned insecticide

Table 4. Organic Contaminants (continued)

Epichlorohydrin	TT[1]	Stomach effects and increased risk of cancer	Discharge from industrial chemical factories, impurity in some water treatment chemicals
Ethylbenzene	0.7	Liver, kidney damage	Discharge from petroleum refineries
Ethylene dibromide	0.00005	Liver, stomach, kidney, reproductive system effects, and increased risk of cancer	Discharge from petroleum refineries
Glyphosate	0.7	Kidney, reproductive system effects	Runoff from herbicide use
Heptachlor	0.0004	Liver damage, increased risk of cancer	Residue of banned termiticide
Heptachlor epoxide	0.0002	Liver damage, increased risk of cancer	Breakdown of heptachlor
Hexachlorobenzene	0.001	Liver, kidney, reproductive system effects, and increased risk of cancer	Discharge from metal refineries and agricultural chemical factories
Hexachloro-cyclopentadiene	0.05	Kidney, stomach damage	Discharge from chemical factories
Lindane	0.0002	Liver, kidney effects	Runoff/leaching from insecticide used on lumber, gardens, cattle
Methoxychlor	0.04	Reproductive difficulties	Runoff/leaching from insecticide used on fruits, vegetable, alfalfa, livestock
Oxamyl (Vydate)	0.2	Slight nervous system effects	Runoff/leaching from insecticide used on apples, potatoes, tomatoes
Pentachlorophenol	0.001	Liver and kidney effects, increased risk of cancer	Discharge from wood preserving operations
Picloram	0.5	Liver damage	Herbicide runoff
Polychlorinated biphenyls (PCBs)	0.0005	Skin, thymus gland, reproductive system, and nervous system effects, immune deficiencies, increased risk of cancer	Runoff from landfills, discharge of waste chemicals

Table 4. Organic Contaminants (continued)

Simazene	0.004	Blood effects	Herbicide runoff
Styrene	0.1	Liver, kidney, circulatory system damage	Discharge from rubber and plastic factories, leaching from landfills
Tetrachloroethylene	0.005	Liver damage and increased risk of cancer	Discharge from factories and dry cleaning
Toluene	1	Liver, kidney, nervous system effects	Discharge from petroleum refineries
Toxaphene	0.003	Kidney, liver, thyroid effects, increased risk of cancer	Runoff/leaching from insecticide used on cattle, cotton
2,4,5-TP (Silvex)	0.05	Liver damage	Residue of banned herbicide
1,2,4-Trichloro-benzene	0.07	Adrenal gland changes	Discharge from textile finishing factories
1,1,1-Trichloroethane	0.2	Liver, nervous system, circulatory system effects	Discharge from metal degreasing sites and other factories
1,1,2-Trichloroethane	0.005	Kidney, liver, immune system damage	Discharge from industrial chemical factories
Trichloroethylene	0.005	Liver damage and increased risk of cancer	Discharge from metal degreasing sites and other factories
Vinyl chloride	0.002	Increased risk of cancer	Leaching from PVC pipe, discharge from plastics factories
Xylenes (total)	10	Nervous system damage	Discharge from petroleum factories, discharge from chemical factories

[1] *Treatment technique requirement (limit dosage of polymer treatment chemicals)*

Radiologic Contaminants

Purpose: Limit exposure to radioactive contaminants in drinking water (see Table 5). These contaminants are both natural and man-made. Rules were recently revised to include a new MCL for uranium, and to clarify and modify monitoring requirements.

Health effects: Primarily increased cancer risk from long-term exposure. Reduced uranium exposure for 620,000 persons in the US and protection from toxic kidney effects of uranium.

Application: All community water systems.

Monitoring: Initial tests, quarterly for one year from each source, must be completed prior to December 31, 2007 for gross alpha, radium-226, radium-228 and uranium. Gross alpha may substitute for radium 226 monitoring if the gross alpha result does not exceed 5 pCi/L. Gross alpha may substitute for uranium monitoring if the gross alpha result does not exceed 15 pCi/L. Subsequent monitoring every 3, 6, or 9 years depending on initial results. Only those communities with water supplies potentially impacted by man-made radiation sources, as designated by the Department, must sample for beta/photon radiation, iodine-131, strontium-90, or tritium.

Compliance: Community water systems that can not meet MCLs must install treatment or develop alternate water sources.

Compliance dates:

6/00-12/03	Monitoring data collected is eligible for use as initial data
12/03	Systems begin initial monitoring
12/07	All systems complete initial monitoring

Water treatment: Variety of treatment processes will reduce radiologic contaminants, including ion exchange and reverse osmosis.

Cost: $81M per year in the US. About 800 public water systems in the US will have to install treatment.

Rule history:

Federal rule - 7/9/76
Oregon rule - 9/24/82
Federal rule -12/7/00 (uranium, Ra 226&228)
Oregon rule - expected 10/02

Table 5. Radiologic Contaminants

Contaminant	MCL, pCi/L (picocuries per liter), unless otherwise noted	Potential health effects	Sources of Drinking Water Contamination
Gross alpha	15	Increased risk of cancer	Erosion of natural deposits
Beta and photon emitters[1]	4 mrem/yr	Increased risk of cancer	Decay of natural and man-made deposits
Iodine-131[2]	3	Increased risk of cancer	Power production
Combined Radium 226 & 228[3]	5	Increased risk of cancer	Erosion of natural deposits
Uranium	30 ug/L	Increased risk of cancer, kidney toxicity	Erosion of natural deposits
Strontium 90[2]	8	Increased risk of cancer	Power and weapons production
Tritium[2]	20,000	Increased risk of cancer	Power and weapons production

Sampling required only if designated by the Department - Gross beta + photon emitters not to exceed 4 millirems per year (mrem/yr)

[2]State standards only, sampling required only if designated by the Department. (Based on 4 mrem/yr dose)

[3]Measured separately.

Review and Update of Current Standards

The 1996 Safe Drinking Water Act requires EPA to review and revise as appropriate each current standard at least every six years. On April 17, 2002, EPA announced a preliminary determination that 68 chemical current regulations remain appropriate, and that the Coliform Rule should be revised. A final rule presenting a timetable for proposal and finalizing revisions is scheduled for August, 2002.

Unregulated Contaminant Monitoring

Purpose: Develop occurrence data on contaminants not currently regulated in order to support development of future drinking water standards in 2005 (see Table 6).

Health effects: Not fully characterized at present. Research on health effects is in progress.

Application: All community water systems serving over 10,000 people, plus a statistically representative selection of community water systems serving 10,000 or fewer people.

Monitoring: Surface water systems sample quarterly for one year during 2001-2003. Groundwater systems sample twice in one year during 2001-2003.

Compliance: Large water systems must collect samples, have them analyzed at approved labs, and report results to EPA, all at their own expense. Small systems must collect samples and ship them to EPA approved labs for analysis at EPAs expense. All water systems with unregulated contaminant results must present any contaminant detections in their annual Consumer Confidence Reports.

Compliance dates:

2001-03	Assessment monitoring (List 1-1999), all systems
2001-05	Index monitoring, 30 small systems
2001	Screening surveys - chemicals (List 2-1999), 180 small systems
2002	Screening surveys - chemicals (List 2-1999), 120 large systems
2003	Screening surveys - microbes (List 2-1999), 300 large and small systems

Rule History:

- Federal rule - 7/8/87
- Federal rule - 7/1/88, 7/1/94, 1/8/99, 4/30/99, 6/8/99 (corrections)
- Federal rule - 9/17/99
- Federal rule - 3/2/00, 1/11/01 (revisions)
- Oregon rule - Not applicable, rule to be enforced by EPA

Table 6. Unregulated Contaminants and Their Use/Environmental Source

List 1 - Assessment Monitoring (monitoring methods available)

2,4-dinitrotoluene	Used to produce isocyanate and explosives
2,6-dinitrotoluene	Used as a mixture with 2,4-dinitrotoluene
DCPA mono- and di- acid	Degradation product of DCPA, an herbicide
4,4' -DDE	Degradation product of DDT, an insecticide
EPTC	Herbicide
Molinate	Herbicide
Methyl tertiary butyl ether (MTBE)	Octane enhancer in unleaded gasoline
Nitrobenzene	Used to produce analine
Terbacil	Herbicide
Acetochlor	Herbicide
Perchlorate	Oxygen additive in solid fuel propellant

List 2 - Screening Survey (Methods available soon)

Diuron	Herbicide
Linuron	Herbicide
2,4,6-trichlorophenol	By-product of fuel burning, and used as a bacteriacide and wood and glue preservative
2,4-dichlorophenol	By-product of herbicide production
2,4-dinitrophenol	Released in mining, and in metal, petroleum, and dye processing
2-methylphenol	Released in fuel burning, coal tar and petroleum refining, and wood pulp processing
Alachlor ESA	Degradation product of alachlor, an herbicide
1,2-diphenylhydrazine	Used to make benzidine and anti-inflammatory drugs
Diazinon	Insecticide
Disulfoton	Insecticide
Fonofos	Insecticide
Terbofos	Insecticide
Aeromonas	Microorganism present in all fresh and brackish water
Nitrobenzene	Used to make analine
Prometon	Herbicide
RDX	Used in explosives and ammunition

Table 6. Unregulated Contaminants and Their Use/Environmental Source (continued)

List 3 - Prescreening (monitoring methods to be developed)

Cyanobacter	Blue-green algal bloom in lakes and rivers
Echoviruses	Microoganism from fecal sources
Coxsackieviruses	Microoganism from fecal sources
Heliobacter pylori	Microoganism from fecal sources
Microsporidia	Microorganism found in lakes and rivers
Caliciviruses	Microorganism in contaminated food and water, raw shellfish
Adenoviruses	Microoganism from fecal sources
Lead-210	Uranium-decay isotope
Polonium-210	Uranium-decay isotope

Drinking Water Contaminant Candidate List (DWCCL)

Purpose: Identify chemical and microbiological contaminants known or anticipated to occur in public water systems, for possible future regulation. The first DWCCL was published in March, 1998. In Tables 7 and 8, the list is broken into two groups. The first group includes twenty contaminants that are priorities for regulation. The second group includes forty additional contaminants which require further research on health, treatment, and/or analytical methods, or need further occurrence data collection. For each contaminant, its classification is shown along with the Chemical Abstract System Number (CASN), if applicable, for use in locating additional information on the contaminant. The list must be updated every five years.

In addition, the tables indicate the contaminants on the DWCCL for which EPA Health Advisories have been published. These advisories contain known information on health risks, and specify ranges of concentrations that are acceptable for drinking over different lengths of time. Advisories are generally used to evaluate specific contaminant exposures at specific sites, such as chemical spills.

EPA must publish a decision on whether or not to regulate at least five contaminants (including sulfate) from the DWCCL every five years. On June 3, 2002, EPA announced preliminary decision not to regulate any of nine contaminants from the current DWCCL: *Acanthamoeba*, aldrin, dieldrin, hexachlororbutadiene, manganese, metribuzin, napthalene, sodium, and sulfate. In addition, EPA must publish a new DWCCL every five years.

Federal regulation dates:
- Final DWCCL: 3/2/98
- Preliminary regulatory determinations from CCL list: 6/3/02
- Expected final regulatory determinations: 8/02
- Next DWCCL: 2003

Table 7. 1998 Contaminant Candidate List - Regulatory Determination Priorities (20)

Contaminant	Classification	Chemical Abstract Number	Health Advisory Published
Acanthamoeba	microbiological	————	
1,1,2,2-tetrachloroethane	organic	630-20-6	
1,1-dichloroethane	organic	75-34-3	
1,2,4-trimethylbenzene	organic	95-63-6	
1,3-dichloropropene	pesticide	542-75-6	
2,2-dichloropropane	organic	594-20-7	
Aldrin	pesticide	309-00-2	X
Boron	inorganic	7440-42-8	
Bromobenzene	organic	108-86-1	
Dieldrin	pesticide	60-57-1	X
Hexachlorobutadiene	organic	87-68-3	
p-Isopropyltoluene	organic	99-87-6	
Manganese	inorganic	7439-96-5	
Metolachlor	pesticide	51218-45-2	
Metribuzin	pesticide	21087-64-9	
Naphthalene	organic	91-20-3	
Organotins	organic	————	
Triazines & degradation products (including Cyanazine, Atrazin-desethyl)	pesticide	————	
Sulfate	inorganic	————	
Vanadium	inorganic	7440-62-2	

Table 8. 1998 Contaminant Candidate List - Research and Occurrence Priorities (40)

Contaminant	Classification	Chemical Abstract Number	Health Advisory Published
Adenoviruses	microbiological	————	
Aeromonas hydrophilia	microbiological	————	
Cyanobacteria (Blue-green algae) and their toxins	microbiological	————	
Caliciviruses	microbiological	————	
Coxsackieviruses	microbiological	————	
Echoviruses	microbiological	————	
Helicobacter pylon	microbiological	————	
Microsporidia	microbiological	————	
1,1-dichloropropene	organic	563-58-6	
1,2-diphenylhydrazine	organic	122-66-7	
1,3-dichloropropane	organic	142-28-9	
2,4,6-trichlorophenol	organic	88-06-2	
2,4-dichlorophenol	organic	120-83-2	
2,4-dinitrophenol	organic	51-28-5	
2,4-dinitrotoluene	organic	121-14-2	
2,6-dinitrotoluene	organic	606-20-2	
2-methyl-phenol	organic	95-48-7	
Alachlor ESA	pesticide	————	
Aluminum	inorganic	7429-90-5	
Acetochlor	pesticide	34256-82-1	
DCPA (Dacthal) mono-acid & degradates	pesticide	887-54-7	

Table 8. 1998 Contaminant Candidate List - Research and Occurrence Priorities (40) (continued)

Contaminant	Classification	Chemical Abstract Number	Health Advisory Published
DCPA (Dacthal) di-acid degradates	pesticide	2136-79-0	
DDE	pesticide	72-55-9	
Diazinon	pesticide	333-41-5	X
Disulfoton	pesticide	298-04-4	X
Diuron	pesticide	330-54-1	X
EPTC (s-Ethyl-dipropyl-thiocarbonate)	pesticide	759-94-4	
Fonofos	pesticide	944-22-9	X
Linuron	pesticide	330-55-2	
Methyl bromide	organic	74-83-9	
Molinate	pesticide	2212-67-1	
Mycobacterium avium intercellulare (MAC)	microbiological	————	
MTBE	organic	1634-04-4	X
Nitrobenzene	organic	98-95-3	
Perchlorate	inorganic	————	
Prometon	pesticide	1610-18-0	
RDX	organic	121-82-4	X
Sodium	inorganic	7440-23-5	
Terbacil	pesticide	5902-51-2	X
Terbufos	pesticide	13071-79-9	X

II. FUTURE STANDARDS

New and revised drinking water quality standards are mandated under the 1996 federal Safe Drinking Water Act. This Section is intended to summarize and preview these standards, currently under development by USEPA and not yet final.
The future standards include:

- Microbial standards - Enhanced surface water treatment, groundwater requirements, and revised coliform requirements
- Disinfectants and disinfection by-products
- Radon
- Contaminant candidate list - next five contaminants

USEPA is expected to complete an ambitious adoption schedule for these standards during 2000-2005. Water suppliers should be aware of and familiar with these mandates and deadlines, and plan strategically to meet them. The Department of Human Services, under the Primacy Agreement with USEPA, has up to two years to adopt each federal rule after it is finalized. Water suppliers have at least three years to comply with each federal rule after it is finalized.

A comprehensive schedule of federal drinking water standards implementation can be found at http://www.epa.gov/safewater/pws/imp_milestones.pdf.

Microbial Standards - Enhanced Surface Water Treatment, Groundwater, and Coliform requirements

Purpose: Increase protection of people from disease-producing (pathogenic) organisms in both groundwater and surface water supplies. All surface water supplies are considered at some risk of containing microorganisms at any given time. Future rules will identify those surface water supplies that are at high risk of *Cryptosporidium,* and prescribe additional levels of treatment selected from a matrix of options. Human enteric viruses from human fecal matter is of concern in groundwater supplies. Available data suggests that 8-10% of public wells may be at risk of virus contamination, so requirements will focus on identification of at-risk wells and either reducing the risk or providing adequate levels of disinfection treatment to kill viruses. Current requirements for coliform bacteria will be revised, emphasizing fecal coliforms and *E. coli,* and focusing on protection of water within the distribution system.

To increase microbial occurrence data in US public water systems, larger utilities collected microbiological data under the Information Collection Rule (ICR) during 1998-99. ICR data is being used to design future microbial drinking water standards. A negotiated rulemaking process to outline a Long-term 2 Enhanced Surface Water Treatment Rule was concluded in 2000 in a Federal Advisory Committee Act (FACA) committee agreement. Current microbial standards focus on improvements in health protection that can be achieved by optimizing existing large water system facilities without major capital costs (see Microbial Requirements-Surface Water Treatment, described under Section I- Current Standards). Future standards are likely to require major capital investments for some water systems, based on the public health needs demonstrated by analysis of the ICR data and following the FACA rule outline.

The remaining regulatory "stages" are summarized below:

- Groundwater Rule (GWR) - New disinfection treatment performance standards or alternative practices for groundwater systems at high risk of virus contamination
- Long-term Stage 2 Enhanced Surface Water Treatment (LT2ESWTR) - Further increased filtration and disinfection performance standards for surface water systems at high risk from *Cryptosporidium*
- Revisions to current coliform bacteria standards.

Health effects: Gastrointestinal illness. Actual numbers of illness cases are very difficult to quantify - typically, only large and sudden outbreaks are likely to be recognized. Smaller outbreaks and low constant levels of illness are unlikely to be recognized. EPA estimates that as many as 168,000 cases of gastrointestinal illness per year could be avoided in public water systems using groundwater sources.

Application: All public water systems using groundwater or surface water sources of supply.

Monitoring: Monitoring will be required for specific pathogenic organisms and/or indicator organisms, such as *Cryptosporidium*, enteric viruses, or surrogate organisms. Additional monitoring of and stricter performance standards for surface water treatment processes will be required. Identification and correction of sanitary defects and hazards in water systems and use of best management practices to control coliform bacteria in distribution systems will be required.

Compliance: Compliance is demonstrated by meeting MCLs or treatment technique requirements, correcting sanitary defects, and using best management practices.

Costs: Significant costs to some water systems are expected, depending on the scope and content of the final rules. Some surface water systems will have to install additional treatment processes based on pathogen monitoring results. Some groundwater systems will have to correct sanitary defects or install disinfection treatment. Some water systems will need to improve distribution system protection and practices.

Projected compliance dates:

- Groundwater Rule source monitoring, hydrogeologic sensitivity assessments, sanitary surveys: Complete by 2008 (community systems) and 2010 (noncommunity systems)
- Groundwater Rule, Compliance: 2008-10
- LT2ESWTR: 2004-2011

Federal regulation dates:

- Proposed Groundwater Rule: 5/10/00
- LT2ESWTR/Stage 2 D/DBP rulemaking agreement: 9/29/00
- White papers on coliform bacteria/distribution rule issues: 2002
- Final Groundwater Rule: 2003
- Final LT2ESWTR: 2003
- Final coliform bacteria/distribution rule: 2004-05

Disinfectants and Disinfection By-products

Purpose: Further reduce exposure of people to disinfectant residuals and disinfection by-products (D-DBPs). Disinfection treatment used to kill or inactivate microorganisms in drinking water can react with naturally occurring organic and inorganic matter in water to form disinfection by-products. The challenge is to apply levels of disinfection treatment needed to kill microorganisms while limiting the levels of disinfection by-products produced, so these requirements are linked with development of microbial standards described above. The main goal of the Stage 2 rule is to control peak DBP levels within water distribution systems.

To increase D-DBP occurrence data in US public water systems, larger utilities collected data under the Information Collection Rule (ICR) during 1998-99. ICR data is being used to design future D-DBP drinking water standards. A negotiated rulemaking process to outline a Stage 2 Disinfectants and Disinfection By-products Rule was concluded in 2000 in a Federal Advisory Committee Act (FACA) committee agreement. Current standards focus on improvements in health protection that can be achieved by optimizing existing large water system facilities without major capital costs (see Stage 1 D-DBP Rule, Section I- Current Standards). Future standards will address control of peak levels of DBPs and require major capital investments by some water systems.

Health Effects: Possible chronic and reproductive effects.

Application: All water systems that apply disinfectants or distribute water that has been disinfected.

Monitoring: Monitoring for disinfection byproducts at sample locations where peak levels are expected, as identified in an Initial Distribution System Evaluation (IDSE).

Compliance: Meet Locational Running Annual Average (LRAA) for DBPs at each sampling location in the distribution system in two phases. Phase 1: meet running locational annual average at each sampling point for TTHM (120 ug/L) and HAA5 (100 ug/L) within 3 years of the final rule. Phase 2: meet running locational annual average at each sampling point for TTHM (80 ug/L) and HAA5 (60 ug/L) within 6-8.5 years of the final rule, depending on system size.

Costs: Significant capital costs to some water systems are expected.

Projected Compliance Dates:
- IDSE and monitoring (>10,000 pop.): 2003-04
- IDSE and monitoring (≤10,000 pop.): 2005-06
- Compliance with Phase 1 LRAA (all systems): May, 2005
- Compliance with Phase 2 LRAA (>10,000 pop.): May, 2008
- Compliance with Phase 2 LRAA (≤10,000 pop.): 2009-10

Federal Regulation Dates:
- LT2ESWTR/Stage 2 D/DBP rulemaking agreement: 9/29/00
- Final Stage 2 Disinfectants/Disinfection Byproducts (Stage 2 D/DBP): 2003

Radon

Purpose: Reduce exposure of people to both indoor air radon and radon in drinking water. Radon is a naturally occurring gas formed from the decay of uranium-238. Radon enters indoor air primarily from soil under homes. Tap water from groundwater sources is a relatively small source of radon in air. Surface water supplies of drinking water are unlikely to contain radon.

Health effects: Inhalation of radon and its decay products causes lung cancer, with smokers at particular risk. EPA estimates that 15,000 to 22,000 deaths per year in the US result from indoor air radon, primarily from soil gases. Radon in drinking water can contribute to indoor air radon levels from washing and showering. Ingestion of radon in drinking water presents a small risk of stomach cancer. 168 deaths are likely due to radon in drinking water (149 from inhalation, 19 from ingestion).

Application: All community water systems using groundwater sources.

Monitoring: Quarterly initial sampling at distribution system entry points, for one year. Subsequent sampling once every 3 years.

Compliance: Meet MCL of 300 pCi/L. An alternative MCL (AMCL) of 4,000 pCi/L is proposed, if the Department develops and adopts an EPA-approved statewide Multi-Media Mitigation program (MMM). Elements of the MMM program include public participation in MMM development, quantitative goals for remediation of existing homes and radon-resistant new construction, strategies for achieving goals, and tracking and reporting of results. Finally, local communities have the option of developing an EPA approved local MMM program, in the absence of a statewide MMM program, and meeting the drinking water AMCL.

Occurrence in Oregon: Oregon radon data from 65 deep community wells collected in 1981 showed 23 with radon greater than 300 pCi/L, and none greater than 4,000 pCi/L. Oregon geologic mapping and results of voluntary indoor air testing in homes suggest that a maximum of 4% of Oregon homes may exceed the EPA indoor air action level due to soil radon.

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Water treatment: Aeration, granular activated carbon.

Cost: Estimated national annual costs of radon MCLs: 300 pCi/L, $408M/yr; 4,000 pCi/L, $43M/yr.

Projected Compliance Dates:
- Initial monitoring (without MMM):2004-05
- Compliance with MCL (without MMM): Spring, 2005
- Initial monitoring (with MMM):2006
- Compliance with MCL (with MMM): Winter, 2007

Federal regulation dates:
- Proposed rule: 11/2/99
- Final rule: 2003

PIPELINE is published quarterly free of charge by the staff of the Department of Human Services, Drinking Water Section, 800 NE Oregon St., Portland OR 97232, Phone (503) 731-4010. Periodicals postage paid at Portland OR.
POSTMASTER: Send address changes to
PIPELINE, P.O. Box 14450
Portland OR 97293-0450
ISSN: 1072-4028

Drinking Water Contaminant Candidate List (DWCCL) and Unregulated Contaminant Monitoring Rule (UCMR)

Identify chemical and microbiological contaminants known or anticipated to occur in public water systems, develop monitoring and analytical methods, and generate occurrence data for use in developing future drinking water standards. The first DWCCL was published in March, 1998, and the first UCMR was published in 1999 (see current standards). The second DWCCL is due in 2003, and subsequent lists are due every five years. The UCMR is revised periodically to include DWCCL contaminants in UCMR monitoring requirements. EPA must make regulatory decisions on at least five contaminants from the CCL every five years.

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Oregon Drinking Water News

PIPELINE

Department of Human Services, Drinking Water Program

Protecting Public Health by Assuring Safe Drinking Water

Vol. 18 Issue 4 • FALL 2003

www.dhs.state.or.us/publichealth/dwp

DRINKING WATER PROGRAM UPDATE

by Dave Leland

The end of summer brought new developments in a number of areas. The 2003 Legislature ended a record-length session, finally establishing a state budget for 2003-05. EPA proposed two new drinking water regulations unprecedented in scope and complexity (see article on page 2). The Department of Human Services drinking water program secured new EPA funding for training and certification of operators of small groundwater systems (see article on page 1). Finally, the Department and water supplier organizations began preparations for a Task Force effort this fall and winter to examine the workload of the drinking water program and to recommend future funding levels and funding sources for the drinking water program.

As we collectively work together for safe drinking water during challenging times, it is important to celebrate our successes. In 1992, we identified 165 Oregon public water systems using unfiltered surface water sources that required improvements to meet the 1989 EPA Surface Water Treatment Rule. These water suppliers needed to install adequate filtration and disinfection treatment, develop alternate groundwater sources, or connect to other water systems. During this past summer, the last few of the water suppliers in this group completed construction of needed improvements. We believe that this effort represents the largest single public health benefit to date in the effort to assure safe drinking water in Oregon. Not coincidentally, the last of 15 recognized community waterborne disease outbreaks in Oregon since 1974 occurred in 1992.

We also said farewell to an unusually large number of drinking water professionals across Oregon who retired, and we thank them for their work and wish them well. In the drinking water program, long-term staffers Mike Patterson and Dave Phelps both opted to retire.

Vacancies create opportunities as well. The lifting of the statewide hiring freeze allowed us to fill our vacancies and ing the program to its fill compliment of 33 FTE. We welcome Andy Baker, public health engineer, Dewey Darold, environmental health specialist; Carrie Trachsel,

(Continued on page 5)

SMALL GROUNDWATER OPERATOR CERTIFICATION

by Ron Hall

Community and non-transient, non-community systems serving less than 150 connections and having a groundwater source have been required to have a certified operator since late 2001. This is a special Small Groundwater Operator (SGWO) certification, separate and distinct from the Water Distribution (WD) and Water Treatment (WT) certification that we've been using since 1987.

Those systems which are not yet in compliance received a letter in September advising of their non-compliant status and giving directions as to how to comply.

To summarize, all that is required for the SGWO certification is attendance at our 6 hour Small Water System Training Course (see the schedule for upcoming classes) and submittal of the SGWO application form (available on our web site) along with a copy of the Certificate from the class. The certification is good for approximately 3 years, expiring July 31 of each third year. A system can also come into compliance by contracting with a certified operator.

(Continued on page 5)

Security Advisory System – are you a partner?

If you are a water supplier and have not yet registered for the Oregon State Police Advisory System, be sure to contact Diane Weis of our office for a registration form (503-731-4010). The Advisory System allows law enforcement agencies (and us) to quickly contact you via email to keep you informed about any security threats and advisories related to drinking water. But you have to do your part and register to be part of this statewide system. Register today!

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EPA PROPOSES TWO MAJOR NEW DRINKING WATER RULES

As part of the August 11 Federal Register (68 FR 47639), EPA proposed the Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR). This 157-page rule will be open for public comment through January 9, 2004. As part of the August 18 Federal Register (68 FR 49547), EPA proposed the Stage 2 Disinfectants and Disinfection Byproducts Rule (Stage 2 DBPR). This 134-page rule will be open for comment through January 16, 2004. The following is a brief summary prepared by the Association of State Drinking Water Administrators of both of these proposed EPA drinking water rules.

Long Term 2 Enhanced Surface Water Treatment Rule

The LT2ESWTR will apply to all systems that use surface water or ground water under the direct influence of surface water. EPA is proposing the LT2ESWTR to reduce disease incidence associated with Cryptosporidium and other pathogenic microorganisms in drinking water. The LT2ESWTR will supplement existing regulations by targeting additional Cryptosporidium treatment requirements to higher risk systems. This proposed regulation also contains provisions to mitigate risks from uncovered finished water storage facilities and to ensure that systems maintain microbial protection as they take steps to reduce the formation of disinfection byproducts.

Cryptosporidium Treatment

Under the LT2ESWTR, systems initially conduct source water monitoring for Cryptosporidium to determine their treatment requirements. Filtered systems will be classified in one of four risk bins based on their monitoring results. EPA projects that the majority of systems will be classified in the lowest risk bin, which carries no additional treatment requirements.

Systems classified in higher risk bins must provide 1 to 2.5-log additional reduction of Cryptosporidium levels. The regulation specifies a range of treatment and management strategies, collectively termed the "microbial toolbox," that systems may select from to meet their additional treatment requirements. All unfiltered systems must provide at least 2 or 3-log inactivation of Cryptosporidium, depending on the results of their monitoring.

Monitoring

Cryptosporidium monitoring by large systems (serving at least 10,000 people) will begin six months after the LT2ESWTR is finalized and will last for a duration of two years. Small systems (serving less than 10,000 people) are on a delayed schedule and will start monitoring when the

(Continued on page 3)

Stage 2 Disinfection By-products Rule

This regulation will apply to all systems that add a disinfectant other than ultraviolet light or provide water that has been treated with a disinfectant other than ultraviolet light. This includes water systems that bulk purchase water from another water system (consecutive systems). EPA is proposing the Stage 2 DBPR to reduce disease incidence associated with the disinfection byproducts that form when public water supply systems add disinfectants. The Stage 2 DBPR will supplement existing regulations by requiring water systems to meet maximum contaminant levels (MCLs) for total trihalomethanes (TTHM) and haloacetic acids (HAA5) at each monitoring site in the distribution system. The proposal also contains a risk-targeting approach to better identify monitoring sites where customers are exposed to high levels of disinfection byproducts (DBPs). This proposed regulation will reduce DBP exposure and provide more equitable health protection, and will result in lower cancer and reproductive and developmental risks.

Initial Distribution System Evaluation (IDSE)

Under the Stage 2 DBPR, systems will be required to conduct an IDSE, which is an evaluation of their distribution system to identify the locations with high disinfection byproduct concentrations. These locations will then be used by the systems as the sampling sites for Stage 2 DBPR compliance monitoring. Monitoring under the IDSE will be in addition to routine monitoring under the Stage 1 DBPR and IDSE results will not be used for determining compliance.

Under the IDSE, water systems must take a specified number of TTHM and HAA5 samples over the course of one year and evaluate the results to ensure that optimal monitoring locations are used under the Stage 2 DBPR. The number of samples required and the timing of sampling is dependent on the size and type of water system (large surface water systems begin monitoring as soon as six months after rule promulgation). Consecutive systems are required to perform an IDSE at the same time as the system(s) that provide their water.

(Continued on page 3)

Long Term 2 Enhanced Surface Water Treatment Rule

(Continued from page 2)

required large system monitoring is finished (two and a half years after rule promulgation). To reduce monitoring costs, small filtered systems will initially conduct one year of monitoring for E. coli, which is less expensive to analyze than Cryptosporidium. These systems will be required to monitor for Cryptosporidium for one year only if their E. coli results exceed specified triggering concentrations. Systems may grandfather equivalent previously collected data in lieu of conducting new monitoring, and systems are not required to monitor if they provide the maximum level of treatment required under the rule.

All systems must conduct a second round of monitoring beginning six years after the initial bin classification.

Other Requirements

The LT2ESWTR proposal also contains disinfection profiling requirements to ensure that systems maintain protection against microbial pathogens as they take steps to reduce the formation of DBPs. These requirements are ɜeded because EPA is concurrently developing the Stage 2 DBPR that will establish standards for certain DBPs. Disinfection profiling involves systems assessing the level of disinfection they currently provide and then determining the impact that a proposed change in their disinfection practice would have on this level.

Additionally, the proposed LT2ESWTR has requirements that address risk in uncovered finished water storage facilities, which are subject to contamination if not properly managed or treated.

Stage 2 Disinfection Byproducts Rule

(Continued from page 2)

EPA is also proposing that a water system be allowed to perform a site-specific study in lieu of an IDSE, provided the study will produce the necessary information to enable the system to identify Stage 2 DBPR sample locations. Waivers will also be available for small systems and systems with low Stage 1 DBPR results.

EPA is proposing that Stage 2 DBPR monitoring (and refore IDSE monitoring) for consecutive systems be based upon the population served instead of the number of treatment plants or interconnections. EPA provides rationale for this approach and is requesting comment as to whether all DBP monitoring should be population-based rather than plant-based.

Locational Running Annual Average

Under the Stage 2 DBPR, compliance with the maximum contaminant levels for TTHMs and HAA5s will be calculated for each monitoring location in the distribution system. This approach, referred to as the locational running annual average (LRAA), differs from current requirements that determine compliance by calculating the running annual average (RAA) of samples from all monitoring locations across the system.

Compliance Schedule

EPA is proposing a phased approach to implementing DBP compliance standards Stage 2 DBPR. Stage 2A DBP MCLs would be applicable starting three years after rule promulgation and would be in effect until systems complete their IDSE and identify optimal monitoring sites. Once the sites have been identified, Stage 2B DBP MCLs would be effective.

Under Stage 2A, water systems would need to comply with MCLs of 0.120 mg/L for TTHMs and 0.100 mg/L for HAA5s as LRAAs using the Stage 1 DBPR compliance monitoring sites. In addition, during this time period, all systems must continue to comply with the Stage 1 DBPR MCLs of 0.080 mg/for TTHMs and 0.060 mg/L for HAA5s as RAAs.

Under Stage 2B, all systems, including consecutive systems, must comply with MCLs of 0.080 mg/L for TTHMs and 0.060 mg/L for HAA5s as LRAAs using sampling sites identified under the IDSE.

Other Requirements

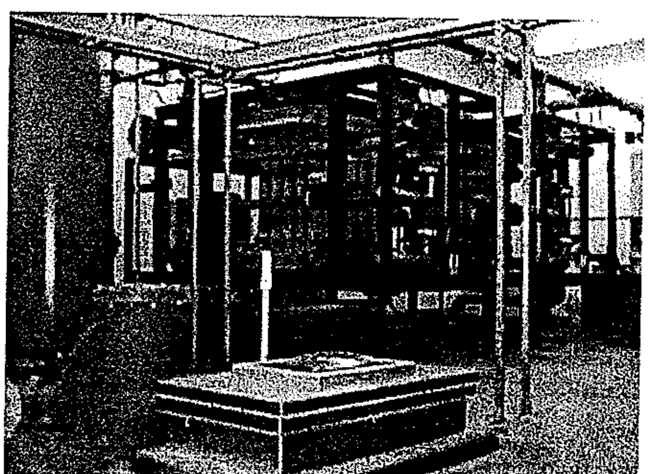
The Stage 2 DBPR would also require systems to determine if they are experiencing short term peaks in DBP levels referred to as "significant excursions." Systems experiencing significant excursions would be required to review their operational practices and work with their state to determine actions that may be taken to prevent future excursions.

MANZANITA AND WHEELER NO LONGER RELY ON UNFILTERED SURFACE WATER SOURCES!

by Kari Salis

Wheeler and Manzanita are bordering towns in coastal Tillamook County. Each had been using unfiltered, chlorinated surface water sources for many years. When the Surface Water Treatment rule came about in 1991, both systems were ordered to filter or seek new sources. At first a regional approach was attempted, to solve drinking water compliance issues of many surrounding towns with one system. After several votes against regionalization, each City had to deal with the issue on their own.

Manzanita, serving an average population of over 3000, many of whom are vacationers and weekenders, chose to build a filter plant. The Anderson Creek sources are now filtered through a membrane filter using microfiltration. The water is also treated with soda ash to control corrosion, and generates sodium hypochlorite on-site for a disinfectant. The City will use both the treated surface water as well as the water from nearby Wheeler as their main sources.



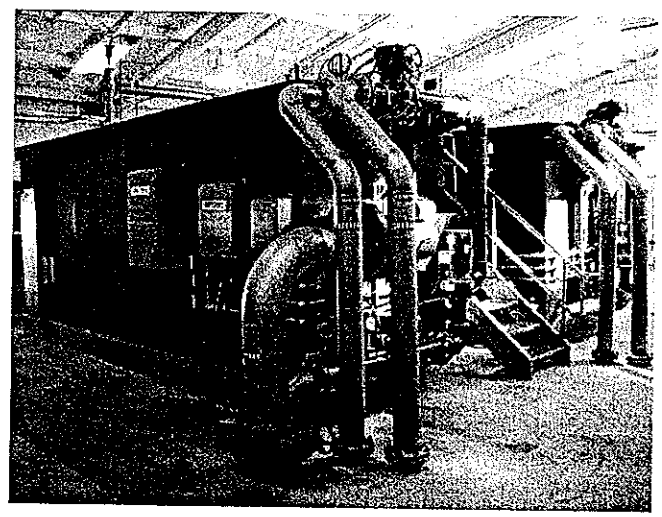
Wheeler, a town of 450 people, with several retirement homes, was able to locate an area where the groundwater supply appeared promising, so they drilled two wells. The wells are located near the Nehalem River and have a capacity of about 1500 total gallons per minute. The City also had to construct a new reservoir and transmission line from the wells to the distribution system. Now that Wheeler had returned to compliance, all Community water systems in Oregon now meet the treatment requirements of the Surface Water Treatment rule!

Kari Salis, PE, is in the Technical Services Unit of the Drinking Water Program / (503) 731-4317 or karyl.l.salis@state.or.us

HECETA WATER DISTRICT INSTALLS FILTRATION PLANT!!

by John Potts

In April, after 37 years as an unfiltered surface water system, the Heceta Water District in Florence completed construction and began operating a 1.2 MGD (million gallons per day) conventional package water treatment plant. The district, which serves approximately 2000 customers, was ordered to install filtration under the Surface Water Treatment Rule (SWTR) in January of 1992. Negotiations with nearby landowners and Lane County as well as litigation in federal court delayed the construction project for many years. Finally, agreements were reached with all parties concerned and construction began in 2002. The construction project consisted of a new raw water transmission line from Clear Lake to the treatment plant, two 0.6 MGD conventional package treatment units, treatment plant building, 0.2 MGD chlorine contact chamber and backwash lagoon.



The $3 million project was financed from existing district funds, a $1 million bond and $1.7 million in Drinking Water State Revolving Loan funds.

John Potts, RS, is in the Technical Services Unit of the Drinking Water Program / (541) 757-4281 or johnpotts5@attbi.com

HAVE YOU SAMPLED THE NEW RADIONUCLIDE CONTAMINANTS YET?

by Kari Salis, PE

All Community systems should sample each entry point by December 8, 2003 to avoid quarterly sampling – which will save you over $1,200!

If you sample each entry point once for Gross-Alpha, Radium-226 & -228, and Uranium between June 2000 and December 8, 2003, this sample will count as initial monitoring. If the sample is not collected by that date, you will have to do 4 consecutive quarters of sampling beginning in 2005. Future sampling frequency will be every 3, 6, or 9 years depending on initial results.

Kari Salis, PE, is in the Technical Services Unit of the Drinking Water Program / (503) 731-4317 or karyl.l.salis@state.or.us

DRINKING WATER PROGRAM UPDATE

(continued from page 1)

office specialist to the drinking water program; and Roberto Reyes-Colon, Safe Drinking Water Revolving oan Fund Coordinator.

The 2003 Legislature considered HB 2255, which originally proposed a water supplier connection fee to match additional available federal EPA funds and increase the drinking water program. The bill was amended in committee to eliminate the fee language and create a Task Force on Drinking Water Program Workload and Funding (see Spring 2003 PIPELINE). The bill expired in Ways and Means at the end of the Legislative session; however, the Department, the League of Oregon Cities, and the Special Districts Association of Oregon remain committed to the Task Force effort. The Task Force will begin meeting in late October, and its work is to conclude by March 1, 2004. We look forward to working with the Task Force to identify the level of effort and funding needed to for the Department to maintain Primacy for implementing the EPA drinking water standards in Oregon, and to have a credible and effective drinking water program. See our website for Task Force meeting announcements, meeting minutes, and information.

Oregon is not the only state lacking the resources to fully carry out current and upcoming federal safe drinking water ındards and assure drinking water safety. In July, the Association of State Drinking Water Administrators released the landmark report "Public Health Threatened by Inadequate Resources for State Drinking Water Programs". This report is based on an unprecedented survey of 50 state drinking water programs, including Oregon. You can view the entire report at www.asdwa.org.

Jean Thorne, Director of the Department of Human Services, visited our public health programs in August. I had the opportunity to brief her on the drinking water program. Director Thorne was struck by the fact that 90% of Oregon public water systems serve fewer than 500 people, recognizing the challenge that presents for the statewide program. After her visit, the Director reflected on the three themes common to all the public health programs: prevention, partnerships, and data. In drinking water, this means that we work with you to prevent illness, we work together as partners in this effort, and we all make sure we all have access to current and accurate data on drinking water quality safety that we need to do our business.

Remember that our collective business is SAFE DRINKING WATER! Keep up the good work!

Dave Leland, PE, is Manager of the Drinking Water Program / (503) 731-4010 or david.e.leland@state.or.us

SMALL GROUNDWATER OPERATOR CERTIFICATION

(Continued from page 1)

Many systems that received the Notice letter were surprised because they thought their operator was certified by virtue of having taken the class. Remember to submit the application form and class certificate to receive certification.

Systems which took advantage of the initial opportunity to certify their operator via the Grandparenting provision that was offered until August 1, 2002, need to be aware that certification expires July 31, 2004. Renewal notices will go out after the first of the year, and operators can renew by having attended the Small Water Operator Training class some time since their initial certification. Now is the time to think ahead and plan on attending one of the classes between now and then. The class schedule for '04 will be out and on our website in early January.

Any questions?...contact Ron Hall at 503-731-4010.

Ron Hall, RS, is in the Monitoring & Compliance Unit of the Drinking Water Program / (503) 731-4010 or ronald.a.hall@state.or.us

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Backflow Management Inc. (B)
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Clackamas Community College (C)
(503) 657-6958 ext. 2388

Backflow Assembly Tester Course

Dec. 8-12	Oregon City (C)
Dec. 13-17	Portland (B)

Backflow Assembly Tester Recertification

Dec. 5	Oregon City (C)

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POSTMASTER: Send address changes to PIPELINE, PO Box 14450, Portland OR 97293-0450
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Water System Master Plan,
Philomath, Oregon

OHD Comprehensive Performance Evaluation

Appendix C

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OMIT

Oregon

DEPARTMENT OF HUMAN RESOURCES

HEALTH DIVISION

CITY549 973700002 1292 07/21/93
FORWARDING TIME EXPIRED
:CITY OF PHILOMATH
PO BOX 400
PHILOMATH OR 97370-0400
RETURN TO SENDER

July 12, 1993

Mr. Beau Vencill
City of Philomath
P.O. Box 549 400
Philomath, Oregon 97370

Dear Mr. Vencill:

Thank you for your help in completing the **Comprehensive Performance Evaluation of the water treatment plant for the City of Philomath (PWS #4100624)**. The treatment is considered to be full treatment (disinfection, flocculation, sedimentation, filtration) and is subject to the requirements of the Surface Water Treatment Rule that becomes effective as of July 1, 1993. The rule requires that the surface water treatment achieve 3-log removal/inactivation of Giardia cysts (also, 4-log inactivation of viruses). This is to be the result of the combination of filtration and disinfection. The filtration efficiency must achieve at least 2-log Giardia removal credit with the disinfection process (CTs) demonstrating the remaining log credit.

The evaluation of the WTP revealed that the current filtration operation is credited with 2-log Giardia removal if flow is maintained at $\leq$ 700 gpm through the WTP. Disinfection must achieve 1-log CT effectiveness for Giardia inactivation and must be demonstrated by daily calculation. The contact time to be used was determined by tracer study to be 37 minutes through the WTP (prechlorination), clearwell and mainline to first user at an operation rate of 1000 gpm. This time may be used in doing the CT calculation or if the rate is changed a new tracer study must be completed to determine contact time. We encourage the City to have a tracer study done through the plant to determine the actual contact time for the various flows.

In general compliance with the Surface Water Treatment Rule requires the following by July 1, 1993:

1. Finished water turbidity (combined from all filters) must be measured every 4 hours and recorded. Results must be submitted to the Health Division each month. Individual sample taps must be installed on

Barbara Roberts
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each filter discharge and sampled once per day or whenever combined flow turbidity changes. Also, each filter must be profiled for turbidity spiking after backwash once per-quarter. Records of individual filter turbidity measurements must be maintained in WTP files. Finished water turbidity readings must be $\leq$ 0.5 ntu in 95% of the readings and never > 5 ntu. It is recommended that finished water never exceed 0.1 ntu.

2. Total treatment must provide 3-log reduction of Giardia cysts. Filtration is credited with 2-log reduction as long as turbidity MCLs are met. Disinfection CTs are required to meet 1-log inactivation of Giardia (4-log virus inactivation). CTactual $\geq$ CTrequired. Results must be calculated and recorded each day and submitted to the State each month.

3. Free chlorine residual leaving WTP must be measured and recorded 2 times per day.

4. Must calculate and record chemical feed dosages each day or whenever feed dosages change.

The following items are recommendations to help optimize the filtration operation:

1. Recommend tracer study through the WTP to determine actual contact times for all flow conditions.

2. Begin or end filter run with a backwash. Never start a filter run with a dirty filter. Avoid start and stop filter operation.

3. Base backwash on turbidity rather than headloss across filters or time.

4. Consider installation of flow to waste piping (after backwash). WTP could possibly achieve 2.5-log credit with some improvements in operation capability.

5. Limit WTP flow ≤ 700 gpm (required to achieve 2 or 2.5 log Giardia removal credit).

6. Test finished water quality for TTHMs. Concern for formation potential with the use of prechlorination.

The water treatment plant is well operated and should meet the requirements of the Surface Water Treatment Rule. We encourage the City to make improvements to the WTP (add flow to waste piping, restrict flow to 700 gpm, eliminate turbidity spiking) that would allow the log reduction credit for the filtration process to achieve 2.5 log.

Please call if there are any questions.

Sincerely,

Tom Charbonneau, P.E.
Regional Manager
Drinking Water Section

cc: Mike Grimm, OHD
John Potts, OHD
Benton County Health Department

COMPREHENSIVE PERFORMANCE EVALUATION (CPE)

Name of Water System: City of Philomath PWS#: 4100 624
Date Conducted: 2-24-93
Persons Conducting CPE: T. Charbonneau, J. Potts, Mike Grimm

Operating Flow: 1050 ~~mgd~~ gpm

Maximum Hydraulic Capacity 700 ~~mgd~~ gpm (designed for 1 MGD)

Narrative:

City of Philomath Phi from the Marys River.
Have capability o Treatment consists of
a WTP (micro idered full treatment.
The city supplies ections with a population
of 3,000 people

The surface wa fective as of July 1, 93.
The following req

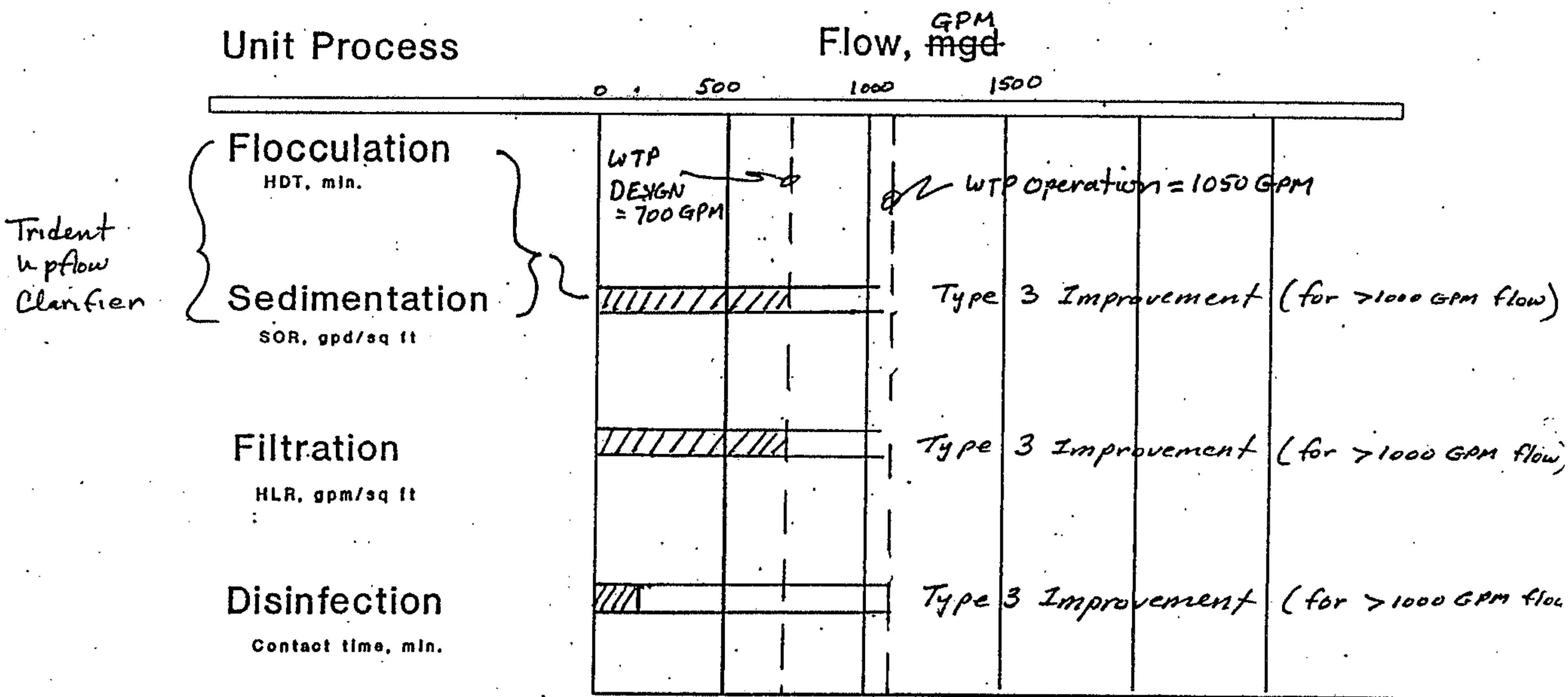
1) Finished w NTU in 95% of readings
& can nev inished water @ 0.1 NTU or less
2) Finished w every 4 Hours of WTP
operation and re onth to OHD. Recordings are
finished water (effluent) - Combine ... from both filters.
3) Filter must achieve a 2-log credit for Giardia removal. Current operation achieves that. 2.5 log credit could be obtained if WTP flow keep ≤ 700 GPM, finished turbidity ≤ 0.1 NTU, & flow to waste following back wash piping is added.
4) Must calculate & record actual CTa each day. Total treatment must achieve 3-log Giardia removal/inactivation at all times. Current filtration achieves 2-log. Therefore, CT actual must achieve at least a 1-log credit. Actual CTa must exceed the Required CT value for 1-log inactivation each day. Values must be recorded & submitted to OHD each month.
5) Total treatment must achieve 4 log virus inactivation. If Giardia 3-log (1-log with disinfection) inactivation being achieved then this value is also being complied with.

The following items are required or recommended to help the WTP (filtration) operation be optimized:

1) Operator must measure each filter turbidity once per day (minimum) or whenever combined (clearwell) turbidity changes. Record data.
2) Operator must profile individual filter effluent turbidity following backwash once per quarter to check for spiking.
3) Operator must calculate & record chemical feed dosages at least once per day or whenever dosages change.
4) Recommend that filter run begin or end with backwash. Never start run with dirty filter.

(over)

Performance Potential Graph



Note: Type 3s are resolved by lowering flow to 700 gpm thru WTP.

To maintain 2-log credit WTP flow must be kept @ ≤ 700 gpm.
If 1000 GPM flow to be continued additional improvements might be required.
Need to prechlorinate to provide for CTs. Need additional tracer study info to determine contact times for ~~addition~~ various flow thru WTP.

5) avoid Start/stop filter operation

6) Base backwash on turbidity instead of Head loss across filters.

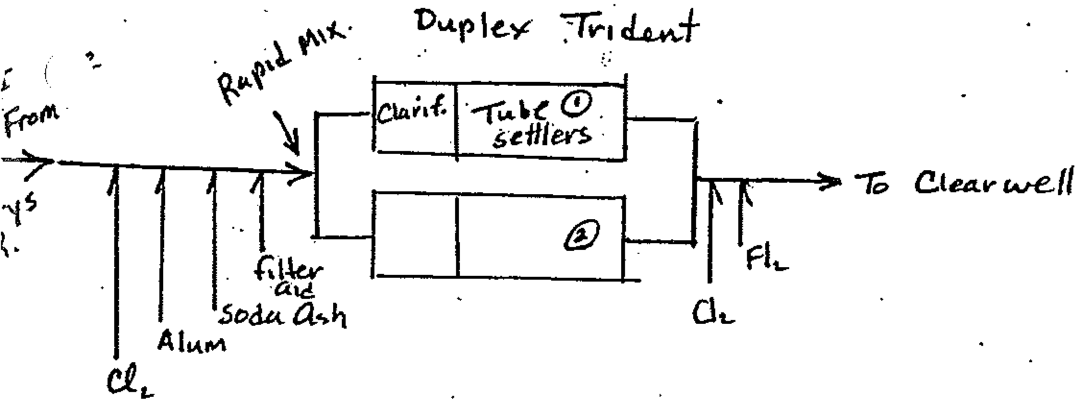
7) Never recycle backwash water (recommended).

The WTP current operation should be able to comply with Surface Water Treatment Rule requirements if pre-Chlorination is practiced in order to obtain the additional contact time for CTs. Strongly recommend that flow rate be kept @ ≤ 700 gpm & that by adding flow to waste piping the WTP operation strive for 2.5 log removal credit.

Reminder that for lower flow rates Tracer study for contact time must be repeated. Also, if pre-chlorination is practiced testing should be done for TTHMs.

DESIGN DATA

A. PLANT FLOW DIAGRAM



B. FLOW DATA

Design Flow

Average Daily Flow 700 ~~mgd~~ gpm
Maximum Hydraulic Capacity 1 mgd

Operating Flow

Peak Instantaneous Operating Flow 1050 ~~mgd~~ gpm

C. UNIT PROCESSES

Flow Stream Measured	Meter Type	Calibration Frequency	Comments
Raw Water:	Rockwell (turbine) mea. total flow & flow rate	2-yrs.	
Finished Water:	Sparling (Propeller) Mea total flow & flow rate		
Backwash:	none		
Backwash Recycle:	none — backwash is not recycled sent to backwash Pond.		
Other (designate):	none		

C. UNIT PROCESSES (con..)

PRESEDIMENTATION

None

resedimentation:

Type (concrete or earthen-sketch below): ____________
Number of Basins ____________ Surface Dimensions ____________
Water Depth (shallowest) ________ ft. (deepest) ________ ft.
Weir Location ____________
Weir Length ________ ft.
Total Surface Area ________ ft2 Total Volume ________ ft3
Total Volume ________ mg

Flow:

Theoretical ____________ mgd Operating ____________ mgd

Detention Time:

Theoretical ____________ hr Operating ____________ hr

Weir Overflow Rate:

Theoretical ____________ gpm/ft Operating ____________ gpm/ft

Surface Settling Rate:

Theoretical ____________ gpm/ft2 Operating ____________ gpm/ft2

Chemical Feed Capability:

Type of Chemicals ____________
Operating Range (describe) ____________

Sketch:

C. UNIT PROCESSES (cont.)

RAPID MIX

apid Mix:

Type
(mechanical, inline mechanical, (inline static))

Number of Mixers 1 Water Depth ____
Number of Basins ____ Surface Dimensions ____
Horsepower ____ Total Volume ____ gallons

Flow:

Theoretical ____ mgd Operating 1050 ~~mgd~~ gpm

Detention Time:

Theoretical ____ mgd Operating ____ mgd

G Value

Theoretical ____ mgd Operating ____ mgd

Operating Problems: ____

COAGULATION / FLOCCULATION

.locculation:

Type (e.g., paddle wheel, turbine, hydraulic) Trident (upward) clarifier
Control (e.g. constant speed or variable speed) ____
High Temp. 47°C Low Temp. 4°C High pH 7.5 Low pH 6.8
Stages (sketch below)

(see Sedimentation Process)

STAGE/BASIN	SURFACE DIMENSIONS	DEPTH	VOLUME	HORSEPOWER	G VALUE
1					
2					
3					
Total					

low:

heoretical ____ MGD Operating ____ MGD

tion Time:

heoretical ____ MGD Operating ____ MGD

alculations/Assumptions: ____

C. UNIT PROCESSES (co...)

SEDIMENTATION

edimentation Basins:

Type: ___ Conventional ___ Tube Settlers ✓ Upflow Clarifiers (absorptior

Number of Basins 2 Surface Dimensions 8'-4" x 4'-2" /unit = 34.7+

Water Depth (shallowest) — ft. (deepest) 6'-6" ft.

Weir Location —

Weir Length 5 ft./filter

Total Surface Area 69.4 ft2 Total Volume ~~415~~ 451 ft3

Total Volume 3377 ~~mg~~ gallons

Flow:

Theoretical 1.0 mgd Operating 1.5 mgd

Detention Time:

Theoretical 4.9 Min. ~~hr~~ Operating 3.2 Min. ~~hr~~

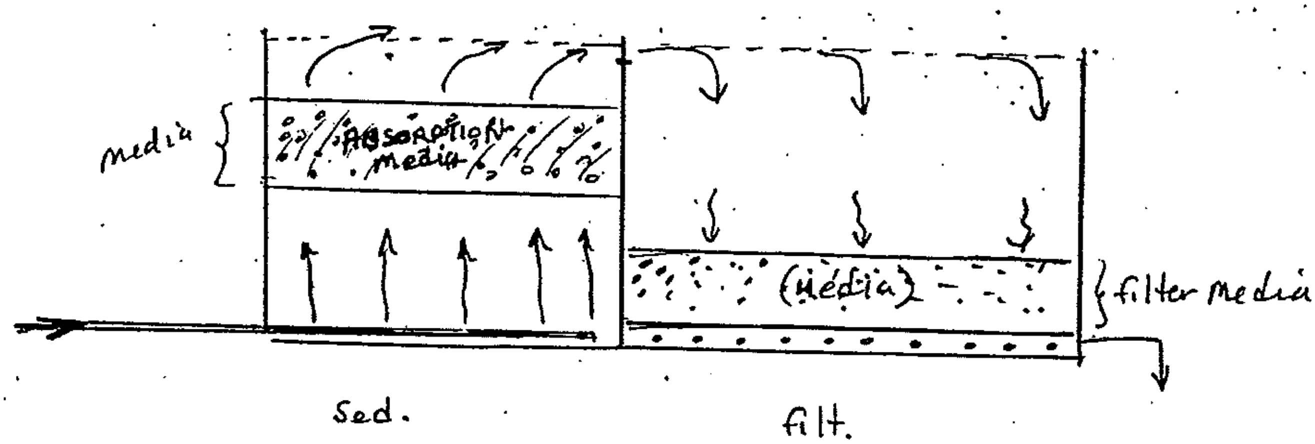
Weir Overflow Rate:

Theoretical 69.4 ≈70 gpm/ft Operating 105 gpm/ft

Surface Settling Rate:

Theoretical 10 gpm/ft2 Operating 15.1 gpm/ft2

Inlet Conditions (Describe and/or sketch)



Operating Problems:

* From Water Treatment Plant Design by ASCE/AWWA pg 141-143

DESIGN DATA

C. UNIT PROCESSES (cont.)

FILTRATION

Type of Filters (sand, (mixed media), dual media, pressure gravity, etc.)

Number of Filters 2 Surface Dimensions 138.9 SF (8'-4" x 8'-4") = 70 SF e

Media Charachteristics:

MEDIA TYPE	DEPTH	EFFECTIVE SIZE	SPECIFIC GRAVITY
Anthracite	9"		
Silica	↕ 21"		
Garnet			
Gravel			

Total Surface Area 138.9 ft2

Filtration Rate: Theoretical Flow = 1 MGD (694 GPM) Operating flow = 1.5 MG 1050 GP

Theoretical 5.0 gpm/ft2 Operating 7.6 gpm/ft2

Filter Control (e.g., constant rate, declining rate, constant level)

Avaliable Headloss 7 ft. (Backwash Initiated at this head)

Surface Wash:

Type (e.g., (rotary), fixed, manual)
Water Flow Rate ______ gpm
Duration (Operating) ______ min
Surface Wash Rate ______ gpm

Backwash:

Water Wash Rate:
Theoretical – gpm/ft2 Operating 17 gpm/ft2

Duration:
Theoretical ______ gpm/ft2 Operating 9 ~~gpm/ft2~~ min.

Air Wash Rate:
Theoretical ______ scfm/ft2 Operating ______ scfm?ft2
→ Used on upward Clarifier. Raw water backwash used on upward Clarifier.

Control/Operating Problems:

	Yes	No
Mud Balls		X
Dirty Media		X
Uneven Media		X
Backwash Rate Gradual	X	
Hydraulic Loading		X
Air Bubbles		X
Surface Wash Control	X	
Filter Rate Control	X	

Comments:

WTP is operating at too high of a flow rate.
Plant designed for 1 MGD.

DESIGN DATA

C. UNIT PROCESSES (cont.)

DISINFECTION

Contact Basin(s) (e.g. clearwell):

BASIN NO.	SURFACE DIMENSIONS	DEPTH	(gallons) VOLUME	CHANNEL LENGTH TO WIDTH	THEORETICAL AVAILABLE EFFECTIVE CONTACT VOLUME
1			40,000		
	Total Volume		40,000		*

* Tracer Study info

Chlorinator(s):
No. of Chlorinators 2 Capacity 20#/day
Flow Proportioned ? yes

Feed Rate:
Design 20#/day Operating ____

Flow:
Design 700 gpm Operating 1050 gpm

Dosage:
Design 2.4 ppm Operating 1 ppm (free residual)

Operating Problems:

____

____

ulating approximate CT:

maximum pH 7.6 minimum temp. 5°

~~maximum~~ Minimum free Cl2 residual 1 ppm expected log removal of plant 2 log

Required CT using above assumptions 60 (1 log Inactivation) (3 log 186)

Has a tracer study been done ? yes

If yes, what was the T10 ? 7 (min.) (thru Clear well) & transmission line to first user.

If no, what is the estimated theoretical contact time ? ____ (min.)

Contact time required = Required CT / ~~Maximum~~ Minimum Chlorine Residual $\frac{60}{1}$

Contact time required = 60 minutes

Theoretical flow = Theoretical volume / Contact time required $\frac{5{,}000 \text{ gallons (from Tracer Study)}}{60}$

Theoretical flow = 83 gpm ____ mgd

CT log inactivation $= \frac{3 \times 7}{186} = 0.1$ log ←

Comments:
Discharge from clearwell Max flow (from Tracer Study) = 1,000 GPM.
Post chlorination only – Contact time = 7 min @ 1,000 GPM, or *10 min (est.) @ 700 gp
With pre-chlorination – contact time = 37 min @ 1,000 GPM, or *53 min (est) @ 700 g
* Need to run additional tracer study to determine actual time.

DESIGN DATA

CHE...ICAL FEED CAPABILITY

Coagulant Aids:

TYPE	DESIGN FEED RANGE	OPERATING FLOW (mgd) min.	OPERATING FLOW (mgd) max.	~~DESIGN~~ DOSAGE (mg/1) min.	~~max.~~
Alum	— 240 GPD		1,050 GPM		13.5 mg/l

Polymers:

TYPE	PURPOSE	DESIGN FEED RANGE (GPH)	OPERATING FLOW (mgd)	~~DESIGN~~ DOSAGE
N-101 P	Filter aid		1,050 gpm	0.61 mg/l
Clarifloc				

Dosage Control (describe):
OMI operation — Jar testing (?).
Must record/calculate dosages daily or whenever changes occur.

Operating Problems:

Conc./Pump Calibration Test:
daily — check calibration —

Stabilization Chemicals:
Chemicals Used: Soda Ash (post feed for pH control)
Dosage Control (describe):

Operating Problems:

Fluoride:
Fluoride Compound Used: hydrofluorosilicic acid
Dosage (Operating) 1 mg/l
Comments:

Softening:
Chemicals Used:
Dosage Control (describe):

Operating Problems:

TEST DATA

A. TURBIDITY CHECKS AFTER BACKWASH:

Run # 1

Elapsed Time	Reading (NTU)
0	0.2
1	—
2	0.5
3	0.35
4	0.30
5	—
6	0.20
7	0.20
8	0.20
9	0.24
11	0.20
17	0.23
20	0.21
25	0.17
30	0.14
43	0.13
60	0.11

Run # 2

Elapsed Time	Reading (NTU)
0	0.09
2	0.094
3	0.10
4	0.14
5	0.~~19~~ .21
6	0.22
7	0.24
8	~~0.24~~
9	0.25
10	0.23
11	0.20
14	0.17
19	0.15
20	0.15
30	0.14
38	0.11
40	0.15
54	0.11

Comments:

Spiking after BW is very minimal. Could be eliminated completely with filter to waste piping. Plant credited with 2-log Giardia removal, but with filter-to-waste & reducing WTP production to 1MGD, it would achieve 2.5 log credit.

OHA T

(503) 731-4381
FAX (503) 731-4077
TDD-Nonvoice (503) 731-4031

Oregon

DEPARTMENT OF HUMAN RESOURCES

HEALTH DIVISION

July 22, 1993

Philomath Water Department
Dick Clark
400 S. 16th, Box 549
Philomath, OR 97370

RE: Fluoride Check Samples

Dear Dick Clark:

Thank you for sending in the fluoride check sample. The results were:

Your reading:	1.0
Health Division reading:	1.0
Difference:	0

Since the difference was ≤ 0.3 ppm, your analysis result is acceptable.

Remember the optimal range for fluoride is 0.8 and 1.2 ppm.

If you have any questions please give me a call.

Sincerely,

Patrick Meyer, MPH, RS
Monitoring & Compliance
Drinking Water Section

H:\Home\Mc\Meyer\Fl\Flrd1.ltr

Barbara Roberts
Governor

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24-26 (Rev. 1-92)

CITY OF PHILOMATH
Water System Master Plan,
Philomath, Oregon

Water System Ordinances

Appendix D

ORDINANCE NO. 625

AN ORDINANCE PROVIDING RULES AND REGULATIONS FOR THE REGULATION AND OPERATION OF THE PHILOMATH WATER UTILITY; DEFINING THE ADMINISTRATIVE RIGHTS AND OBLIGATIONS OF THE CITY OF PHILOMATH AND ITS WATER UTILITY CUSTOMERS IN CONNECTION THEREWITH; PROVIDING A PENALTY FOR A VIOLATION THEREOF; AND REPEALING ORDINANCES NO. 500, 515, 528 AND 598.

THE CITY OF PHILOMATH ORDAINS that the following shall be the rules and regulations for the operation of the Philomath Water Utility.

Section 1. **COMPANION ORDINANCE.** This ordinance is a companion ordinance to the City of Philomath Ordinance(s) that provide for System Development Charges.

Section 2. **DEFINITION OF TERMS.** Unless the context specifically indicates otherwise, the meaning of terms used in this ordinance shall be as follows:

APPLICANT: A person, corporation, association or agency applying for water service.

CITY: City of Philomath, a municipal corporation of the State of Oregon.

COMMERCIAL SERVICE: Provision of water to premises which include mercantile establishments, stores, offices, public buildings, governmental agencies, public and private hospitals, schools, churches and mercantile establishments combined with residences, except those in which each unit is metered separately, but not an industrial user.

COUNCIL: The City Council of the City of Philomath.

CUSTOMER: A property owner of record, agent of the owner or tenant who receives service from the City and is responsible for payment of charges/fees.

CUSTOMER LINE: The piping from the meter to the property served.

DATE OF PRESENTATION: The date upon which a bill or notices mailed or delivered personally to the customer, or his designee.

FIRE PROTECTION SERVICE: Provision of water to premises for automatic fire protection.

INDUSTRIAL SERVICE: The provision of water to a customer for use in manufacturing or processing activities.

MAINS: Distribution pipelines located in streets, highways, public ways or private rights-of-way which are used to serve the general public.

MAIN EXTENSIONS: Extensions of distribution pipelines, exclusive of service connections, beyond existing facilities.

METER RATE SERVICE: Provision for supplying water in measured quantities.

MUNICIPAL USE: Provision for supplying water to departments of the City.

PERSON: Any individual, company, enterprise, partnership, corporation, association, society or group; the singular term shall include the plural.

PREMISES: The integral property or area, including improvements thereon, to which water service is or will be provided.

RATE SCHEDULES: The entire body of effective rates, rentals, charges and fees, as established by the City Council.

RESIDENTIAL SERVICE: Provision of water for household residential purposes, including water for sprinkling lawns, gardens and shrubbery, watering livestock, washing vehicles and other similar and customary purposes.

SERVICE CHARGE (User Charge): A charge on users of the treatment works for the user's proportionate share of the cost of operation and maintenance (including replacement) of such works.

SERVICE CONNECTION: The pipe, valves and other facilities by means of which the City conducts water from its distribution mains to and through the meter, but does not include the piping from the meter to the property, structure or facility served.

TEMPORARY SERVICE: A service for circuses, bazaars, fairs, construction work and other uses that, because of their nature, will not be used steadily or permanently.

Section 3. SERVICE AREA. The area in which service may be furnished at the City's option includes all that territory within the corporate limits of the City and certain areas adjacent to or in reasonable proximity thereto.

Section 4. DESCRIPTION OF SERVICE.

(A) SUPPLY. The City will exercise reasonable diligence and care to deliver a continuous and sufficient supply of water to the Customer in accordance with state and federal standards.

(B) QUALITY. The City will exercise reasonable diligence to supply potable water, in accordance with state and federal standards.

(C) CLASSES OF SERVICE. All services installed by the City will be classified as follows:

1) Single-Family Residential - Single family or multi-family units serviced by separate meters.
2) Multi-Family Residential - Multi-family units serviced by one meter.
3) Commercial.
4) Industrial.
5) Contract service.
6) Fire protection.

(D) SERVICE CHARGES. A service (user) charge shall be set by the City Council upon all customers using the City water system.

(E) FINANCIAL SELF-SUFFICIENCY. The user charges shall be fixed at such amounts to assure the financial self-sufficiency of the sewerage system, and thereafter amended as necessary by resolution of the City Council.

(F) RATE AND FEE SCHEDULE. The rates required by this Ordinance shall be set by the City Council. The City Council may, by resolution, change the fee schedule to reflect changing conditions. In setting the charges and fees, the City Council shall consider the costs necessary for the establishment, operation, maintenance, improvement, extension and repair of the water system addition to any other factors the Council may find relevant.

(G) REVIEW AND REVISION OF RATES. The water user charges established in Section 4(D) of this ordinance shall, as a minimum, be reviewed annually by the City Council of the City of Philomath, and shall be revised periodically to reflect actual costs of operation, maintenance, and replacement of the treatment works, and to maintain the equitability of the user charge with respect to distribution of the costs of operation and maintenance proportional to each user's contribution to the total wastewater loading of the treatment works.

Section 5. APPLICATION FOR SERVICE.

(A) APPLICATION. Each applicant for water service shall be required to complete and sign a form provided by the City.

(B) INDIVIDUAL LIABILITY FOR JOINT SERVICE. Two or more customers who join to make application for service shall be jointly and individually liable and shall be sent a single periodic bill.

(C) SPECIAL CONTRACTS. Contracts, other than applications, may be required prior to service where, in the opinion of the City, special circumstances warrant special consideration.

(D) SECURITY DEPOSITS. A deposit in an amount deemed sufficient by the City Manager may be required of any person desiring service. A security deposit need not be made if the applicant has promptly paid all accounts due the City for a reasonable time in the past.

(E) WATER SERVICE ACCOUNT FEE. Any new application for water shall be charged a non-refundable new account fee in an amount as specified in the rate schedule in effect at the time of the application for service.

Section 6. PUBLIC POLICY.

(A) NO USE OUTSIDE CITY WITHOUT CONTRACT. No use or benefits of the water system or water treatment plant of the City shall be extended to or made available to any property not within the corporate limits of the City, except under a contractual agreement.

1) Charges To Customers Outside The City: Any person having connection to the City water system for property which is outside the corporate boundaries of the City of Phiomath shall, in addition to the fees and charges for service called for in Section 4(D) of this ordinance, be charged monthly fees derived and calculated in accordance with the following standard and fixed by resolution of the City Council:

- Fee In Lieu: A fee in lieu of property tax payments supporting principle and interest for the retirement of indebtedness associated with investment in capital facilities necessary to the water system.

(B) WATER MAIN EXTENSIONS.

1) Service Within The City Limits. Water mains may be extended inside the City limits upon petition to, and acceptance by, the City Council by the following method: Water mains shall be constructed in accordance with the City's standards and specifications, and subject to inspection by the City, with all necessary easements, rights-of-way and permits, as required, obtained in the City of Philomath's name prior to construction. After completion, and if accepted by the City, the water main, free of all liens and encumbrances, shall be transferred, along with all necessary easements, rights-of-way and permits, to the City. The City will then own, operate and maintain the water main. The water mains shall be constructed of pipe not smaller than eight inches in diameter, unless the City finds that engineering considerations determine that a larger or smaller pipe should be installed. Where the City has determined that a water main larger or smaller than eight inches in diameter is required or desirable, the City shall have the right to require the installation of the larger or smaller pipe. The developer or contractor may be required to pay all additional costs for the installation and materials for the increased size of the water main, where the City requires installation of larger pipe.

2) Fire Flow Standards. In the event new construction occurs in the area of an existing water main, and it is determined by the City that fire flow requirements require a larger water main, the City shall the right to reject the new construction or to require installation of a water main to meet fire flow requirements.

3) Service Outside City Limits Outside City Limits. The City is not required to construct or provide service to water mains specifically residential, commercial, industrial or combined residential commercial and industrial uses outside the city limits. Individual service connections may be permitted by option of the City on those mains owned and operated by the City outside the city limits.

a) <u>Discontinuation Of Service And Guarantee Of Supply</u>. All water delivered outside the city limits shall be considered as a special service and not provided by the City as a common utility service. The quantity of water supplied may be reduced or the service entirely discontinued at any time at the discretion of the City and for any reason. The City shall have no liability in any way to customers for failure to provide service or any failure of the system.

b) <u>Application And Rates</u>. The City reserves the right to act on each application for outside-the-city services on its merits without regard to any other past or present application or service. No application for water service will be allowed unless the recipient property owner agrees in writing to the annexation of the subject property to the City at such time as the City shall determine that such annexation is in the best interest of the City, unless the applicant applies in writing to the City Council for a waiver of this requirement and the application is granted. Such consent to annex shall be an irrevocable covenant running with the title to the land and shall be binding upon all heirs and assigns. If service is approved, the charge for service connections and meters will be in accordance with the rate schedule for service connections and meters in effect at the time of the application for outside-the-city services. Water rates will be those in applicable portions of the rate and fee schedule, in effect at the time of application.

c) <u>Rules And Regulations</u>.
- All customers outside the City receiving water from the City shall comply with and be bound by the rules and regulations of the City.
- Individuals shall cooperate to a reasonable and practicable extent with other customers in the extension and/or enlargement of common facilities.
- No customer shall interconnect between water furnished by the City and water from another source. Discovery by the City that such an interconnection has been made, the City may discontinue service and shall assess a penalty in accordance with the rate and fee schedule.

Section 7. <u>BILLS AND PAYMENT</u>.

(A) RESPONSIBILITY FOR PAYMENT OF BILLS. The customer who signed the application for service shall be responsible for payment of all charges prescribed in this ordinance and set in the rate schedule. All water service charges shall be mailed to the premises where water service is furnished unless the customer requests, in writing, that the bill be submitted to another address.

(B) RENDERING OF BILLS.

1) Meters will be read at regular intervals for the preparation of billings and as required for the preparation of opening, closing and special bills.

2) Bills for water service will be rendered at the intervals provided in the rate and fee schedule.

(C) PAYMENT OF BILLS.

1) All bills shall be due and payable on presentation. An account becomes delinquent if unpaid fifteen (15) days after date of billing. Payment may be made at the City's office or to an authorized collector. Interest may be charged and collected on delinquent accounts at a rate set by Council resolution.

2) Closing bills will be collected at the time of discontinuance of service.

3) When bills are delinquent, the City will follow the procedure outlined in Section 8 of this ordinance.

4) Any change in water user shall result in the new user paying the water use charges commencing from the date of change. Any new water service user shall commence paying the water use charges from the time of connection. The water base charges shall be pro-rated on a daily basis.

(D) SEPARATE METER BILLINGS. Each meter on customer's property will be read separately; and the readings of two or more meters will not be combined unless the City's operating convenience requires the use of more than one meter, or of a battery of meters. The minimum monthly charge for such combined meters will be based on the diameter of the total combined discharge areas of the meters.

Section 8. DELINQUENT ACCOUNTS.

(A) NOTICE. All customer charges levied in accordance with this ordinance shall be a debt due the City. A notice of delinquent account shall be sent to each account which has not been paid by the 45th day after presentation of bill. All delinquent accounts may be collected in any lawful manner. Reasonable costs of collection may be added to the delinquent account.

(B) TURN-OFF DATE. Said notice shall state a turn-off date, ten (10) days from the date of the notice of delinquency.

(C) DISPUTED BILLING. If the customer disputes the accuracy of the billing, the customer shall present the objection within fifteen (15) days after the date of presentation of the bill. If the bill is found to be correct, payment must be made by the 15th day after notice to that effect is presented. Failure to file a notice of objection to the billing as specified above shall constitute a waiver of any defects in the bill and of the customer's right to object.

(D) DISCONTINUE SERVICE. On the turn-off date, the meter reader or other agent of the City shall turn off the service and then immediately thereafter deliver a written notice to the customer stating that water service has been turned off until all delinquent amounts have been paid. A delivery to any person residing at the address served by the meter shall be considered a delivery to the customer. If there is no person present at the address served, then a notice may be left on the premises.

Section 9. NOTICES.

(A) NOTICES TO CUSTOMERS. Notices required to be given by the City to a customer will be given in writing and may be either delivered or mailed to the customer personally, or delivered or mailed to the address at which service is rendered unless customer has requested in writing that notices be mailed to a different address.

(B) NOTICE FROM CUSTOMERS. Notice from a customer to the City shall be given by the customer or their authorized representative in writing at the office of the City Finance Department.

Section 10. DISCONTINUANCE OF SERVICE

(A) NONPAYMENT OF BILLS. A customer's water service may be discontinued if the service bill is not paid in accordance with the procedures as listed in Section 8 of this ordinance.

(B) UNSAFE APPARATUS.

1) The City may refuse to furnish water and may discontinue service to any premises where apparatus, appliances or equipment using water are dangerous, unsafe or are in violation of laws, ordinances or legal regulations. The City reserves the right of inspection if there is reason to believe that unsafe or illegal apparatus is in use.

2) Except for cross-connection control, the City does not assume responsibility for inspecting apparatus on customer's property.

(C) SERVICE DETRIMENTAL TO OTHERS. The City may refuse to furnish water and may discontinue service to any premises where excessive demands by one customer will result in inadequate service to others.

(D) FRAUD AND ABUSE. The City shall have the right to refuse or to discontinue water service to any premises to protect itself against fraud and abuse.

(E) NONCOMPLIANCE. The City may, unless otherwise provided, discontinue water service to a customer for noncompliance with any of these regulations if the customer fails to comply with said regulations within seven days after the City delivers written notice of the City's intention to discontinue service. If such noncompliance affects matters of health or safety or other conditions that warrant such action, the City may discontinue service immediately. The expense of such discontinuance, as well as the expense of restoring service, shall be a debt due to the City, and may be recovered by any lawful means.

(F) CUSTOMER'S REQUEST FOR SERVICE DISCONTINUANCE.

1) A customer may have the water service discontinued by notifying the City at least 5 days in advance of the desired date of discontinuance. The customer will be required to pay all water charges until the date of such discontinuance.

2) If notice is not given, the customer will be required to pay for water service until the date the City has learned that the customer has vacated the premises or otherwise has discontinued service.

(G) RECONNECTION CHARGE. In all instances where water has been turned off because of a delinquent account, a reconnection fee shall be charged in accordance with the rate and fee schedule for the restoration of service. In cases of extreme hardship, the City Manager shall have the discretion of waiving the reconnection fee or renewing service to a delinquent account upon receipt of a plan for the payment of back-due amounts in installments, or both.

(H) PENALTY FOR TURNING ON WATER WITHOUT AUTHORITY. Should the water be turned on by any water customer or other person without authority from the City, the water may be turned off by the City. The City shall have the option of locking the meter, shutting the water off at the main, or removing the meter, and shall assess a charge against the owner of the property where the water is supplied in accordance with the rate and fee schedule of the City. If the City locks the meter and the lock is subsequently removed by any person, without authorization from the City, the customer shall be assessed an additional fee as a penalty for replacement of the lock in accordance with the rate and fee schedule. All such charges shall be chargeable to the customer, and water shall not again be furnished to such premises until said charges and the cost of the water used are paid.

Section 11. **SERVICE CONNECTIONS AND METERS.** The City may furnish and install a service of such size and at such location as the applicant requests. The service will be installed from its water distribution main to the curb line or property line of the premises which may abut on the street, on other thoroughfares or on the City right-of-way or easement. Charges for new services shall be paid for in advance and shall be in accordance with the rate and fee schedule in effect at the time the new service is installed. The City Council may , by resolution, change the fee schedule to reflect changing conditions.

(A) METERS.

1) No rent or other charge will be paid by the City for a meter or other facility, including housing and connections, located on a customer's premises.

2) Meters up to 2 inches in size shall be owned by the City and will be maintained at its expense. Two inch meters and larger shall be owned by the property owner, and all repairs and maintenance shall be paid by the customer. If a customer or property owner fails to repair or replace a meter owned by the property owner after having been given notice to make repairs by the City, the City may make the necessary repairs or replace the meter (after 45 days) and all cost of the repair or replacement shall be billed to and paid by the property owner.

3) Two-inch meters or larger furnished by the owner must be acceptable to the City and delivered to the City for testing prior to installation.

4) All meters shall be sealed by the City at the time of installation, and no seal shall be altered or broken except by an authorized employee or agent of the City.

(B) CHANGE IN LOCATION OF METER OR SERVICE. Meters or services moved for the convenience of the customer will be relocated only at the customer's expense.

(C) CHANGE IN SIZE OF METER OR SERVICE. If for any reason a change in size of a meter or service or both is required, the charges shall be paid for in advance and shall be in accordance with the rate and fee schedule in effect at the time the change is made.

(D) OWNERSHIP. The service connection, whether located on public or private property, is the property of the City, and the City reserves the right to repair, replace and maintain it, as well as to remove it upon discontinuance of service.

(E) CHARGES FOR SERVICE PIPES CONNECTED WITHOUT A PERMIT. If premises are connected without the application prescribed in the preceding section, such premises shall be immediately disconnected. Before a new connection is made, the applicant shall pay double the new connection fee. A new connection shall only be made upon compliance with provisions of this ordinance.

(F) CHANGES IN CUSTOMER'S EQUIPMENT. Customers making any material change in the size, character or extent of the equipment or operation utilizing water service shall immediately give the City written notice of the nature of the change.

(G) ABANDONED AND NON-REVENUE PRODUCING SERVICES. Where a service connection to any premises has been abandoned or not used for a period of 3 months or more, the City may remove said service connection. New service shall be placed only upon an application being made for service and payment for a new connection at the rate in effect at the time the new connection is made. If the service connection has not been removed, it may be reconnected upon application and payment of the fee set forth in the rate and fee schedule.

(H) LEAKING SERVICES. Where there is a leak between the main and the meter, the City shall make all repairs free of charge. When a service pipe at the proper grade is damaged or destroyed by contractors or others, the person responsible for such damage or destruction shall pay the City for the cost of repairing or replacing such pipes on the basis of the rate and fee schedule.

Section 12. <u>MULTIPLE UNITS</u>.

(A) NUMBER OF SERVICES TO SEPARATE PREMISES. Separate premises under single control or management will each be supplied through individual service connections, unless the City elects otherwise.

(B) SERVICE TO MULTIPLE UNITS. Separate houses, buildings, living or business quarters on the same premises, under a single control or management, may be served at the option of the customer by either of the following methods:

1) Through a separate service connection to each or any unit, provided the pipeline system from each service is independent of the others and is not interconnected.
2) Through a single service connection to the entire premises on which only one minimum charge will be applied. The responsibility for payment of charges for all water furnished to combined units supplied through a single service connection of approved capacity must be assumed by the customer.

Section 13. METER ERROR.

(A) METER TEST

1) Prior to installation, each meter will be tested and no meter found to register more than 2 percent fast or slow, under conditions of normal operation, will be placed in service.
2) On customer request:
    a) a customer may, giving not less than one week's notice, request the City to test the meter serving the premises.
    b) the City may require the customer to deposit an amount as set forth in the rate and fee schedule to cover the reasonable cost of the test.
    c) if the City owns the meter, the test deposit will be returned if the meter is found to register more than 2 per cent fast. The customer will be notified not less than five days in advance of the time and place of the test.
    d) a customer or his representative shall have the right to be present when the test is made.
    e) a written report giving the results of the test shall be available to the customer within 10 days after completion of the test.

(B) ADJUSTMENT OF BILLS FOR METER ERROR.

i) Fast Meters. When, upon test, a meter is found to be registering more than 2 per cent fast under conditions of normal operation, the City will refund to the customer the full amount of the overcharge based on corrected meter readings for a period of not exceeding three months that the meter was in use.

ii) <u>Slow Meters</u>

a) When, upon test, a meter used for domestic or residential service is found to be registering more than 25 per cent slow, the City may bill the customer for the amount of the undercharge based upon corrected meter readings for a period not exceeding three months that the meter was in use.

b) When, upon test, a meter used for other than domestic service is found to be registering more than 5 per cent slow, the City may bill the customer for the amount of the undercharge based upon correct meter readings for a period not exceeding six months that the meter was in use.

iii) <u>Non-Registering Meter</u>. The City may bill the customer for water consumed while the meter was not registering. The bill will be at a minimum monthly meter rate or will be computed upon an estimate of consumption based either upon the customer's prior use during the same season of the year, or upon a reasonable comparison with the use of other customers receiving the same class of service during the same period and under similar circumstances and conditions.

iv) <u>Adjustment of Bills for Underground Leaks</u>. Where a leak exists underground between the meter and the building and the same is repaired within 10 days after the customer, agent or the occupant of the premises discovers or has been notified of the possibility of such leakage, the City may allow an adjustment of up to 50 per cent of the estimated excess consumption.

Section 14. <u>FIRE PROTECTION SERVICE</u>. Fire protection connections will be allowed inside and outside buildings under the following conditions.

(A) SERVICE METER. The City shall require a service meter of approved pattern to be furnished and maintained by the owner of any service system. The connection with the city main and the setting of the meter and the construction of a meter chamber shall be made by the City upon the payment of the charges prescribed in the rate and fee schedule.

(B) PIPES FOR FIRE SPRINKLER SYSTEM. When the owner of a building desires, or when the building code calls for a certain size pipe to supply water to a wet or dry sprinkler system without hose connections, such pipe or pipes may be covered by an approved proportional meter or a detector check. The owner or agent of such building shall agree in writing that water supplied through this service will not be used for any purpose except extinguishing a fire. If at any time it is found that hose connections have been added to the system or that registration is recorded on the meter or detector check, the immediate installation of an approved meter, as mentioned in Section 11, or the removal of the service may be required by the City. Such water registered shall be charged for at double the regular meter rates.

(C) EXTINGUISHING CHARGE. No charge shall be made for water used in the extinguishing of fires if the owner or agent reports such use to the City in writing within 10 days of such usage.

(D) STANDBY CHARGES FOR AUTOMATIC FIRE SERVICE. The standby charges for automatic fire service are based on wet or dry sprinkling systems without hose or other connections and are set forth in the rate and fee schedule. Combined systems will pay the regular service meter minimums and the regular meter rates.

(E) WATER FOR FIRE STORAGE TANKS. Water may be obtained from a fire service for filling a tank connected with the fire service, but only if written permission is secured from the City in advance and an approved means of measurement is available. The rates for general use will apply.

(F) OWNERSHIP OF SERVICE CONNECTIONS AND EQUIPMENT. Ownership of service connection and all equipment appurtenant thereto, exclusive of the meter, shall be the sole property of the City, and no part of the cost thereof will be refunded to the applicant.

(G) PRESSURE AND SUPPLY. The City assumes no responsibility for loss or damage because of lack of water pressure and merely agrees to furnish such quantities and pressures as are available in its general distribution system. The service is subject to shutdowns and variations required by the operation of the system.

Section 15. TEMPORARY SERVICE.

(A) TIME LIMIT. Temporary service connections shall be disconnected and terminated within six months after installation unless an extension of time is granted in writing by the City.

(B) CHARGES FOR WATER SERVED. Charges for water furnished through a temporary service connection shall be at the established rates for other customers.

(C) INSTALLATION CHARGES AND DEPOSITS. The applicant for temporary service will be required:

1) To pay the City, in advance, the estimated cost of installing and removing all facilities necessary to furnish such service, or, at the City's option, if service is supplied through a fire hydrant, the applicant will be charged the applicable fee set forth in the rate and fee schedule.

2) To deposit an amount sufficient to cover estimated bills for water during the entire period such temporary service may be used or establish credit approved by the City.

3) To deposit with the City an amount equal to the value of any equipment loaned by the City to such applicant for use on temporary service. This deposit is refundable under terms of Section 15(D) below.

(D) RESPONSIBILITY FOR METERS & INSTALLATION. The customer shall use all possible care to prevent damage to the meter or any loaned facilities of the City which are involved in furnishing the temporary service from the time of installation until removal. If the meter or other facilities are damaged, the cost of making repairs shall be paid by the customer.

Section 16. **<u>POOLS AND TANKS</u>.** When an abnormally large quantity of water is desired for filling a swimming pool, log pond or for other purposes, arrangements must be made with the City prior to taking such water. Permission to take water in unusual quantities will be given only if it can be delivered safely through the City's facilities and if other consumers are not inconvenienced.

Section 17. **<u>FIRE HYDRANTS</u>**

(A) USE OF AND DAMAGE TO FIRE HYDRANTS. No person or persons, other than those designated and authorized by the proper authority, or by the City, shall open any fire hydrant; attempt to draw water from it or in any manner damage or tamper with it. Any violation of this regulation will be prosecuted.

(B) MOVING OF FIRE HYDRANTS. When a fire hydrant has been installed in the location specified by the proper authority, the City has fulfilled its obligation. If a property owner or other party desires a change in the size, type or location of the hydrant, he shall bear all costs of such changes. Any change in the location of a fire hydrant must be approved by the City.

Section 18. **RESPONSIBILITY FOR EQUIPMENT.** The customer shall, at their own risk and expense, furnish, install and keep in good and safe condition all equipment which may be required for receiving, controlling, applying and utilizing water. The City shall not be responsible for any loss or damage caused by the improper installation of such water equipment, or the negligence, want of proper care or wrongful act of the customer, property owner, agents or any tenants in installing maintaining, using, operating or interfering with such equipment.

The City shall not be responsible for damage to property caused by spigots, faucets, valves or other equipment which are open when water is turned on at the meter, either when turned on originally or when turned on after a temporary shutdown.

Section 19. **DAMAGE TO CITY'S PROPERTY.** The customer shall be liable for any damage to a meter or other equipment or property owned by the City which is caused by an act of the customer, their tenants or agents. Such damage shall include the breaking or destruction of locks by the customer or others on or near a meter and any damage to a meter which may result from hot water or steam from a boiler or heater on the customer's premises. The City shall be reimbursed by the customer for any such damage promptly on presentation of a bill.

Section 20. **CONTROL VALVES.** The customer shall install a suitable valve, as close to the meter location as practicable, the operation of which will control the entire water supply from the service. The customer is not permitted to operate the curb stop on the meter box.

Section 21. **CROSS CONNECTION**

(A) HEALTH REGULATIONS. Unprotected cross connections between the public water supply and any unapproved source of water are prohibited.

(B) DEFINITION. A cross-connection is an interconnection between the City water supply and any unapproved water supply, or a connection between a water distribution pipe and any fixture installed in such a manner that unsafe water, waste or sewage may be drawn into the City water system. Cross connections may be divided into two classifications as follows:

1) Connections in which pure and impure water are separated by gate valves, check valves or both.

2) Connections which permit pollution to enter when the pressure in the City water system falls below atmospheric pressure, thus creating a vacuum. This process of water pollution is known as back-siphonage.

(C) USE OF PRIVATE WATER AND CITY WATER. Customers desiring to use both a City water supply and a supply of water other than that furnished by the City may obtain water at meter rates upon the following conditions and not otherwise. Under no circumstances shall a physical connection exist, direct or in any manner, even temporarily, between the City water supply and that of a private water supply. Where there is such a connection, or where provision is made to connect the two systems by means of a spacer or otherwise, the City water supply shall be shut off from the premises without notice. In case of such discontinuance, service shall not be re-established until satisfactory proof is furnished that the cross-connection has been completely and permanently severed.

Section 22. <u>WATER WASTE.</u> Where water is wastefully or negligently used on a customer's premises, seriously affecting the general service, the City may discontinue the service if such conditions are not corrected within five days after giving the customer written notice.

Section 23. <u>INSPECTIONS.</u> Any inspection or recommendations made by the City or its agents, on plumbing or appliances, or use of water on the customer's premises, either as the result of a complaint or otherwise, will be made or offered without charge.

Section 24. <u>INTERRUPTIONS IN SERVICE</u>. The City shall not be liable for damage resulting from an interruption in service. Temporary shutdowns may be resorted to by the City for improvements and repairs. Whenever possible, as time permits, all customers affected will be notified prior to such shutdowns. The City will not be liable for interruption, shortage or insufficiency of supply, or for any loss or damage occasioned thereby, if caused by accident, act of God, fire, strikes, riots, war or any other cause not within its control.

Section 25. <u>RESALE OF WATER</u>. Except by special agreement with the City, no customer shall resell any of the water received from the City, nor shall water be delivered to premises other than those specified in the application for service.

Section 26. <u>PENALTY</u>. Any person violating any of provisions of this ordinance shall, upon conviction thereof, be punished by a fine not exceeding $500.00, or by imprisonment in jail for a period not exceeding 100 days, or by both such fine and imprisonment.

Section 27. SEVERABILITY. If any section, subsection, sentence, clause or provision of this ordinance is for any reason held invalid or declared unconstitutional or in conflict with any law of the State of Oregon, by any court of competent jurisdiction, such portion shall be deemed a separate, distinct and independent provision and such holding shall not affect the validity of the remaining portions of this ordinance.

Section 28. REPEAL. Ordinances No. 500, 515, 528 and 598 are repealed.

Section 29. SAVING CLAUSE. The repeal of ordinances by Section 28 of this ordinance shall not preclude collection of costs or fees charged under those ordinances, nor shall it preclude any action against a person who violated those ordinances prior to the effective date of this ordinance.

PASSED by the Council this 8th day of August, 1994.

APPROVED by the Mayor this 8th day of August, 1994.

Van O. Hunsaker

Van O. Hunsaker, Mayor

ATTEST: Terri J. Phillips

Terri J. Phillips, City Recorder

CITY OF PHILOMATH
Water System Master Plan,
Philomath, Oregon

Preliminary Cost Estimates
Appendix E

Table E-1

Water System Improvements Preliminary Project Cost Estimates

Philomath Water Master Plan

960.4140.0

1= priority 1A
1.5= priority 1B
2= priority 2
3= priority 3

11/29/2004

Priority	Project Number	Project & Location(s)	Size (in)	Length (ft)	Unit Cost ($/foot)	($/ft) $180 Bore Length (ft)	Other Costs	Constr Cost	15% 10% Constr Contingency	20% 16% Eng Cost	10% Legal, Permits Easement, Admin	Total Project	Rounded Total	Prior 1	Prior 2	Prior 3
Recommended Water System Improvements																
1		**WTP Expansion**					$ 2,243,000.00	$2,243,000.00	$336,450	$448,600	$224,300	$3,252,350	$3,252,000	$3,252,000	$0	$0
1		**1.75 Million Gallon West Side Reservoir**					$ 1,955,000.00	$1,955,000.00	$293,250	$391,000	$195,500	$2,834,750	$2,835,000	$2,835,000	$0	$0
1		**Neabeack Hill Reservoir Improvements (interior coating, altitude valve, & aux power)**					$ 169,000.00	$169,000.00	$25,350	$33,800	$16,900	$245,050	$245,000	$245,000	$0	$0
1		**Starlight Village Pump Station Phase 1 Improvements (building with HVAC & aux power)**					$ 185,000.00	$185,000.00	$27,750	$37,000	$18,500	$268,250	$268,000	$268,000	$0	$0
1		**Neabeack Hill Fire Pump Station Aux Power Imps**					$ 101,000.00	$101,000.00	$15,150	$20,200	$10,100	$146,450	$146,000	$146,000	$0	$0
1		**Marylin Drive Service Relocation**					$ 3,000.00	$3,000.00	$300	$480	$300	$4,080	$4,000	$4,000	$0	$0
1		**Dampier Street Waterline (Pioneer Street to West Reservoir)**	12	1100	$ 95.00		$ -	$104,500.00	$10,450	$16,720	$10,450	$142,120	$142,000	$142,000	$0	$0
1		**20th Street Waterline Extension (Main to Applegate)**	10	640	$ 85.00		$ -	$54,400.00	$5,440	$8,704	$5,440	$73,984	$74,000	$74,000	$0	$0
1		**High School Site Waterline Extension (Applegate to end)**	10	1580	$ 85.00		$ -	$134,300.00	$13,430	$21,488	$13,430	$182,648	$183,000	$183,000	$0	$0
2		**Ash Street Waterline Extension (19th to 18th)**	8	280	$ 75.00		$ -	$21,000.00	$2,100	$3,360	$2,100	$28,560	$29,000	$0	$29,000	$0
2		**Main Street Waterline Replacement (9th to 14th)**	8	2020	$ 85.00		$ -	$171,700.00	$17,170	$27,472	$17,170	$233,512	$234,000	$0	$234,000	$0
2		**Applegate Street Waterline Replacement (Newton Creek Bridge to 30th Street)**	8	2860	$ 75.00		$ -	$214,500.00	$21,450	$34,320	$21,450	$291,720	$292,000	$0	$292,000	$0
2		**Canberra Waterline Extension (connect to 12" in Pioneer St.)**	8	35	$ 75.00		$ -	$2,625.00	$263	$420	$263	$3,570	$4,000	$0	$4,000	$0
2		**College Street Waterline Extension (from 12th to 13th)**	12	200	$ 95.00		$ -	$19,000.00	$1,900	$3,040	$1,900	$25,840	$26,000	$0	$26,000	$0
2		**12th Street Waterline Extension (Pioneer to College)**	8	120	$ 75.00		$ -	$9,000.00	$900	$1,440	$900	$12,240	$12,000	$0	$12,000	$0
2		**8th Street Waterline Extensions (Main to Pioneer)**	8	500	$ 75.00		$ -	$37,500.00	$3,750	$6,000	$3,750	$51,000	$51,000	$0	$51,000	$0
2		**College Street Waterline Replacement (19th to 20th)**	12	620	$ 95.00		$ -	$58,900.00	$5,890	$9,424	$5,890	$80,104	$80,000	$0	$80,000	$0
2		**19th Street Waterline Replacement (College to End)**	12	600	$ 95.00		$ -	$57,000.00	$5,700	$9,120	$5,700	$77,520	$78,000	$0	$78,000	$0
2		**12th Street Waterline Replacement (Monroe to Houser)**	10	1050	$ 85.00		$ -	$89,250.00	$8,925	$14,280	$8,925	$121,380	$121,000	$0	$121,000	$0
2		**12th Street Waterline Replacement (Pioneer to Grant)**	10	900	$ 85.00		$ -	$76,500.00	$7,650	$12,240	$7,650	$104,040	$104,000	$0	$104,000	$0
2		**Benton View Drive Waterline Extension**	8	600	$ 75.00		$ -	$45,000.00	$4,500	$7,200	$4,500	$61,200	$61,000	$0	$61,000	$0
3		**Starlight Village Pump Station Phase 2 Improvements (Capacity Increase)**					$ 324,000.00	$324,000.00	$48,600	$64,800	$32,400	$469,800	$470,000	$0	$0	$470,000
3		**Upper Philomath Service Level Transmission Main (Pioneer Street to End)**	10	4600	$ 85.00		$ -	$391,000.00	$39,100	$62,560	$39,100	$531,760	$532,000	$0	$0	$532,000
3		**Middle School Site Waterline Extension (From existing FH to Chapel Drive)**	10	1120	$ 85.00		$ -	$95,200.00	$9,520	$15,232	$9,520	$129,472	$129,000	$0	$0	$129,000
		North Arterial Transmission Main														
3		Pioneer Street to 9th Street	12	2200	$ 95.00		$ 5,000.00	$214,000.00	$21,400	$34,240	$21,400	$291,040	$291,000	$0	$0	$291,000
3		9th Street to Hills Road	12	3400	$ 95.00		$ -	$323,000.00	$32,300	$51,680	$32,300	$439,280	$439,000	$0	$0	$439,000
3		Hills Road to Existing System in Green Road	12	4200	$ 95.00		$ -	$399,000.00	$39,900	$63,840	$39,900	$542,640	$543,000	$0	$0	$543,000
3		Green Road to Boulevard Street	12	4550	$ 95.00		$ -	$432,250.00	$43,225	$69,160	$43,225	$587,860	$588,000	$0	$0	$588,000
3		Boulevard Street to Corvallis-Newport Highway	12	6050	$ 95.00	240	$ 15,000.00	$632,950.00	$63,295	$101,272	$63,295	$860,812	$861,000	$0	$0	$861,000
		South Arterial Transmission Main														
3		13th Street to Chapel Drive	10	1950	$ 85.00		$ -	$165,750.00	$16,575	$26,520	$16,575	$225,420	$225,000	$0	$0	$225,000
3		Chapel Drive to 19th Street (Including 15th Street)	10	2450	$ 85.00		$ -	$208,250.00	$20,825	$33,320	$20,825	$283,220	$283,000	$0	$0	$283,000
3		19th Street to Southwood Drive	10	4950	$ 85.00		$ 2,500.00	$423,250.00	$42,325	$67,720	$42,325	$575,620	$576,000	$0	$0	$576,000
								$9,359,825	$1,184,833	$1,696,652	$935,983	$13,177,292	$13,178,000	$7,149,000	$1,092,000	$4,937,000

Table E-2
Water Treatment Plant - Preliminary Construction Cost Estimates
Philomath Water Master Plan
960.4140.0

Item No.	Description	Estimated Quantity	Unit	Unit Price	Total Price
1.	Mobilization, Bonds, Permits and Insurance	ALL	L.S.	Lump Sum	$165,000.00
2.	Intake				
	a. Intake Equipment Upgrade	All	L.S.	Lump Sum	$20,000.00
	b. New Intake Pump Installation	4	Each	20,000.00	$80,000.00
	c. New Pump Building	All	L.S.	Lump Sum	$15,000.00
3.	6" Raw Water Lines				
	a. 6" Ductile Iron Waterline	2755	L.F.	30.00	$82,650.00
	b. Excavation and Backfill (stacked)	540	L.F.	25.00	$13,500.00
	c. Excavation and Backfill (parallel)	120	L.F.	35.00	$4,200.00
	d. Excavation and Backfill (single)	115	L.F.	15.00	$1,725.00
	e. Surface Restoration	775	L.F.	5.00	$3,875.00
4.	Chemical Injection				
	a. Alum	4	Each	4,500.00	$18,000.00
	b. Caustic	4	Each	4,500.00	$18,000.00
	c. Polymer	4	Each	4,500.00	$18,000.00
	d. Fluoride	4	Each	4,500.00	$18,000.00
	e. Caustic Soda Tank	1	Each	30,000.00	$30,000.00
	f. Static Mixer	4	Each	4,200.00	$16,800.00
	g. High Range Turbidimeter	1	Each	5,000.00	$5,000.00
	h. Low Range Turbidimeter	2	Each	3,000.00	$6,000.00
	I. Flow Meters	4	Each	1,500.00	$6,000.00
	j. Building Expansion	700	S.F.	150.00	$105,000.00
5.	New Treatment Units				
	a. Treatment Unit - 210A double tank	All	L.S.	Lump Sum	$360,000.00
	b. Controls	All	L.S.	Lump Sum	$75,000.00
	c. Piping	All	L.S.	Lump Sum	$100,000.00
	d. Concrete (elevated slab)	20	C.Y.	300.00	$6,000.00
6.	Clearwell and Building Expansion				
	a. Excavation	283	C.Y.	15.00	$4,245.00
	b. Structural Concrete (footings and slab)	135	C.Y.	300.00	$40,500.00
	c. 2" Fill Material	252	TONS	17.00	$4,284.00
	d. 3/4" Crushed Rock	50	TONS	12.00	$600.00
	e. New Clearwell Pump	2	Each	20,000.00	$40,000.00
	g. 12" D.I. Spool W/ Gate Valve	2	Each	2,000.00	$4,000.00
	h. Building Expansion	1292	S.F.	125.00	$161,500.00
	I. Equipment Door	1	Each	10,000.00	$10,000.00
7.	Sewage Pump Replacement	All	L.S.	Lump Sum	$6,000.00

Table E-2
Water Treatment Plant - Preliminary Construction Cost Estimates
Philomath Water Master Plan
960.4140.0

Item No.	Description	Estimated Quantity	Unit	Unit Price	Total Price
8.	Backwash Pond Upgrade				
	a. Excavation	1,110	C.Y.	15.00	$16,650.00
	b. Base Rock	325	TONS	17.00	$5,525.00
	c. Structural Concrete (10" walls)	100	C.Y.	400.00	$40,000.00
	d. Structural Concrete (6" base)	175	C.Y.	300.00	$52,500.00
	e. Piping	All	L.S.	Lump Sum	$25,000.00
9.	Parking Lot Extension				
	a. Excavation	110	C.Y.	12.00	$1,320.00
	b. Base Rock	90	TON	14.00	$1,260.00
	c. Asphalt	37	TON	55.00	$2,035.00
	d. Curb	125	L.F.	$15.00	$1,875.00
	e. Storm Drainage	All	L.S.	Lump Sum	$5,000.00
10.	Chlorine Contact Piping	All	L.S.	Lump Sum	$100,000.00
11.	Fence construction/relocation	250	L.F.	$50.00	$12,500.00
12.	Landscaping	All	L.S.	Lump Sum	$15,000.00
13.	Electrical & Controls	All	L.S.	Lump Sum	$375,000.00
14.	Upgrades Resulting from Future Regulations	All	L.S.	Lump Sum	$150,000.00

Rounded Total **$2,243,000**

Note: The above estimate is for construction costs only. See table E-1 for total project costs.

Table E-3
1.75 Million Gallon West Side Reservoir - Preliminary Construction Cost Estimates
Philomath Water Master Plan
960.4140.0

Item No.	Description	Estimated Quantity	Unit	Unit Price	Total Price
1.	Mobilization, Bonds, Permits and Insurance	ALL	L.S.	Lump Sum	$125,000
2.	Reservoir Structure (Prestressed Concrete AWWA D110)	ALL	L.S.	Lump Sum	$1,250,000
3.	Site Work/Landscaping/Fencing/Yard Piping (Assumes no rock excavation)	87,000	S.F.	$5.00	$435,000
4.	Valve Vault and Electrical Building	ALL	L.S.	Lump Sum	$100,000
5.	Electrical and Controls	ALL	L.S.	Lump Sum	$45,000
	Rounded Total				**$1,955,000**

Note: The above estimate is for construction costs only. See table E-1 for total project costs.

ble E-4

Neabeack Hill Reservoir Improvements - Preliminary Construction Cost Estimates
Philomath Water Master Plan
960.4140.0

Item No.	Description	Estimated Quantity	Unit	Unit Price	Total Price
1.	Mobilization, Bonds, Permits and Insurance	ALL	L.S.	Lump Sum	$8,000
2.	Drain and Clean Existing Tank	ALL	L.S.	Lump Sum	$3,500
3.	Coat tank interior (Xypex)	ALL	L.S.	Lump Sum	$35,000
4.	Install Altitude Valve and Sensing Line	ALL	L.S.	Lump Sum	$25,000
5.	Disinfect Tank and Place Back Into Service	ALL	L.S.	Lump Sum	$2,500
6.	Install Auxilliary Power Generator w/Automatic Transfer Switch (Neabeack Hill Domestic P.S. & Reservoir)	ALL	L.S.	Lump Sum	$65,000
7.	Electrical and Controls	ALL	L.S.	Lump Sum	$30,000
	Rounded Total				**$169,000**

Note: The above estimate is for construction costs only. See table E-1 for total project costs.

able E-5

Starlight Village Pump Station Phase I Improvements - Preliminary Construction Cost Estimates
Philomath Water Master Plan
960.4140.0

Item No.	Description	Estimated Quantity	Unit	Unit Price	Total Price
1.	Mobilization, Bonds, Permits and Insurance	ALL	L.S.	Lump Sum	$10,000
2.	Remove Vault Lid and Construct CMU Block Building w/HVAC	ALL	L.S.	Lump Sum	$50,000
3.	Stairs and Catwalks	ALL	L.S.	Lump Sum	$10,000
4.	Install Auxilliary Power Generator w/Automatic Transfer Switch	ALL	L.S.	Lump Sum	$85,000
5.	Electrical and Controls	ALL	L.S.	Lump Sum	$30,000
	Rounded Total				**$185,000**

Note: The above estimate is for construction costs only. See table E-1 for total project costs.

ıble E-6

ıNeabeack Fire Pump Station Improvements - Preliminary Construction Cost Estimates

Philomath Water Master Plan

960.4140.0

Item No.	Description	Estimated Quantity	Unit	Unit Price	Total Price
1.	Mobilization, Bonds, Permits and Insurance	ALL	L.S.	Lump Sum	$5,500
2.	Install Auxiliary Power Generator w/Automatic Transfer Switch	ALL	L.S.	Lump Sum	$85,000
3.	Electrical and Controls	ALL	L.S.	Lump Sum	$10,000
	Rounded Total				**$101,000**

Note: The above estimate is for construction costs only. See table E-1 for total project costs.

Table E-7

Starlight Village Pump Station Phase II Improvements - Preliminary Construction Cost Estimates
Philomath Water Master Plan
960.4140.0

Item No.	Description	Estimated Quantity	Unit	Unit Price	Total Price
1.	Mobilization, Bonds, Permits and Insurance	ALL	L.S.	Lump Sum	$24,000
2.	Sitework	ALL	L.S.	Lump Sum	$10,000.00
3.	Control Building	ALL	L.S.	Lump Sum	$40,000
4.	Yard Piping	ALL	L.S.	Lump Sum	$25,000
5.	Pumping Equipment	ALL	L.S.	Lump Sum	$100,000
6.	Electrical & Controls	ALL	L.S.	Lump Sum	$40,000
7.	Auxilliary Power Generator w/Automatic Transfer Switch	ALL	L.S.	Lump Sum	$70,000.00
8.	Landscape & Fencing	ALL	L.S.	Lump Sum	$15,000
	Rounded Total				**$324,000**

Note: The above estimate is for construction costs only. See table E-1 for total project costs.

CITY OF PHILOMATH
Water System Master Plan,
Philomath, Oregon

Marys River Basin Pre-1964 Water Rights Summary

Appendix F

Table F-1
Marys River Basin Pre-1964 Water Rights
Philomath Water Master Plan
960.4140.0

Mainstem Marys River and Tributaries above USGS gauge at Belfountain Road

WaterRightID	Stream Name	Application	Permit	Certificate	Decree	Claim	Location	Use	StartSeason	EndSeason	Priority	Source	RateCFS	Est	RateAFT	Est	Supplemental	Status	Origin	DownloadDate
66714	MARYS R > WILLAMETTE R	S 19062	S 14661	14325			12.00S 05.00W 02 NWSE	IM	1-Jan	31-Dec	10/29/1940	MARYS R	6.69	E			P	NC	CT	10/29/2003
63131	GELLATLY CR > MARYS R	S 13444	S 9653	10742			11.00S 06.00W 20 NWSW	DO	1-Jan	31-Dec	5/17/1930	GELLATLY CR	2	E			P	NC	CT	10/29/2003
79251	MARYS R > WILLAMETTE R	S 29884	S 23534	26860			12.00S 05.00W 15 NWNW	IR	1-Jan	31-Dec	4/8/1955	MARYS R	1.17	E			P	NC	CT	10/29/2003
87685	MARYS R > WILLAMETTE R	S 33020	S 26125	35289			12.00S 05.00W 35 NESW	IR	1-Jan	31-Dec	4/7/1959	BOONEVILLE CH	1.08	E			P	NC	CT	10/29/2003
74687	BARK CR > TUMTUM R	S 30366	S 23974	22297			12.00S 07.00W 06 NESW	RC	1-Jan	31-Dec	10/14/1955	BARK CR/THOMPSON RS	1	E			P	NC	CT	10/29/2003
18163	MARYS R > WILLAMETTE R		S 13556				12.00S 06.00W 11 SESE	MU	1-Jan	31-Dec	3/11/1939	MARY'S R	1	E			P	NC	TR	10/29/2003
100512	MARYS R > WILLAMETTE R		S 21973	48112			12.00S 05.00W 18 NWSW	IR	1-Jan	31-Dec	12/8/1952	MARYS R	1	E			P	NC	CT	10/29/2003
63620	BLAKESLY CR > MARYS R	S 13319	S 9588	11231			11.00S 06.00W 14 NWNE	IR	1-Jan	31-Dec	3/13/1930	BLAKESLY CR	0.98	E			P	NC	CT	10/29/2003
77133	ROCK CR > GREASY CR	S 26911	S 21146	24743			12.00S 06.00W 29 SENE	IR	1-Jan	31-Dec	2/28/1952	ROCK CR	0.89	E			P	NC	CT	10/29/2003
82337	MARYS R > WILLAMETTE R	S 31900	S 25133	29943			12.00S 05.00W 10 NESW	IR	1-Jan	31-Dec	9/25/1957	MARYS R	0.75	E			P	NC	CT	10/29/2003
78696	MARYS R > WILLAMETTE R	S 27685	S 21797	26305			12.00S 05.00W 03 SENW	IR	1-Jan	31-Dec	9/24/1952	MARYS R	0.68	E			P	NC	CT	10/29/2003
62418	MARYS R > WILLAMETTE R	S 12839	S 9107	10035			12.00S 05.00W 10 NENE	IR	1-Jan	31-Dec	7/10/1929	MARYS R	0.67	E			P	NC	CT	10/29/2003
86085	MARYS R > WILLAMETTE R	S 38482	S 28656	33690			12.00S 06.00W 13 NESW	IR	1-Jan	31-Dec	3/7/1963	MARYS R	0.57	E			P	NC	CT	10/29/2003
109948	TUMTUM R > MARYS R	S 30689	S 24182	57546			11.00S 08.00W 23 SENE	IR	1-Jan	31-Dec	5/1/1956	TUMTUM R	0.54	E			P	NC	CT	10/29/2003
80926	MARYS R > WILLAMETTE R	S 30451	S 23988	28535			12.00S 05.00W 10 NESW	IR	1-Jan	31-Dec	11/28/1955	MARYS R	0.53	E			P	NC	CT	10/29/2003
66788	TUMTUM R > MARYS R	S 16896	S 12658	14399			11.00S 07.00W 21 SWSW	IR	1-Jan	31-Dec	5/20/1937	TUMTUM R	0.52	E			P	NC	CT	10/29/2003
89464	MARYS R > WILLAMETTE R	S 39968	S 29680	37067			12.00S 06.00W 13 NESW	IM	1-Jan	31-Dec	6/16/1964	MARYS R	0.5	E			P	NC	CT	10/29/2003
83946	MARYS R > WILLAMETTE R	S 38817	S 28887	31551			12.00S 05.00W 16 SWNE	IR	1-Jan	31-Dec	6/7/1963	MARYS R	0.48	E			P	NC	CT	10/29/2003
66825	MARYS R > WILLAMETTE R	S 17502	S 13207	14436			12.00S 06.00W 11 SENW	IR	1-Jan	31-Dec	8/11/1938	MARYS R	0.46	E			P	NC	CT	10/29/2003
78635	MARYS R > WILLAMETTE R	S 29850	S 23680	26244			12.00S 06.00W 13 NWSE	IR	1-Jan	31-Dec	3/29/1955	MARYS R	0.45	E			P	NC	CT	10/29/2003
79152	MARYS R > WILLAMETTE R	S 29175	S 22941	26761			11.00S 07.00W 08 NWSW	IR	1-Jan	31-Dec	5/17/1954	MARYS R	0.4	E			P	NC	CT	10/29/2003
72907	MARYS R > WILLAMETTE R	S 24178	S 19014	20517			12.00S 05.00W 16 SWNE	IR	1-Jan	31-Dec	9/30/1949	MARYS R	0.375	E			P	NC	CT	10/29/2003
72937	MARYS R > WILLAMETTE R	S 25169	S 19793	20547			12.00S 05.00W 18 SENE	IR	1-Jan	31-Dec	8/23/1950	MARYS R	0.375	E			P	NC	CT	10/29/2003
66573	GREASY CR > MARYS R	S 17395	S 13095	14184			12.00S 06.00W 29 SENW	IR	1-Jan	31-Dec	6/30/1938	GREASY CR	0.35	E			P	NC	CT	10/29/2003
120718	GREASY CR > MARYS R		S 14311	68385			12.00S 06.00W 29 SESE	IR	1-Jan	31-Dec	4/23/1940	GREASY CR	0.34	E			P	NC	CT	10/29/2003
72794	MARYS R > WILLAMETTE R	S 21566	S 16906	20404			11.00S 06.00W 28 SWSW	IR	1-Jan	31-Dec	4/18/1946	MARYS R	0.34	E			P	NC	CT	10/29/2003
78616	MARYS R > WILLAMETTE R	S 27844	S 22104	26225			12.00S 05.00W 10 SWSW	IR	1-Jan	31-Dec	11/21/1952	MARYS R	0.34	E			P	NC	CT	10/29/2003
66541	GREASY CR > MARYS R	S 17004	S 12748	14152			12.00S 06.00W 15	IR	1-Jan	31-Dec	7/27/1937	GREASY CR	0.33	E			P	NC	CT	10/29/2003
76573	MARYS R > WILLAMETTE R	S 20627	S 16134	24183			12.00S 06.00W 11 SESE	IR	1-Jan	31-Dec	1/4/1945	MARYS R	0.32	E			P	NC	CT	10/29/2003
85968	MARYS R > WILLAMETTE R	S 37455	S 27885	33573			12.00S 06.00W 13 NESE	IR	1-Jan	31-Dec	3/6/1962	MARYS R	0.31	E			P	NC	CT	10/29/2003
63184	MARYS R > WILLAMETTE R	S 13385	S 9610	10795			11.00S 06.00W 22 SESW	IR	1-Jan	31-Dec	4/19/1930	MARYS R	0.3	E			P	NC	CT	10/29/2003
81034	MARYS R > WILLAMETTE R	S 26381	S 20770	28643			11.00S 06.00W 30 SESE	IR	1-Jan	31-Dec	8/30/1951	MARYS R	0.3	E			P	NC	CT	10/29/2003
64008	MULKEY CR > TUMTUM R	S 15074	S 11010	11619			11.00S 07.00W 27 SWSE	ID	1-Jan	31-Dec	8/8/1933	MULKEY CR	0.3	E			P	NC	CT	10/29/2003
89559	MARYS R > WILLAMETTE R	S 39174	S 29220	37162			11.00S 06.00W 26 NWNW	IR	1-Jan	31-Dec	10/16/1963	MARYS R	0.29	E			P	NC	CT	10/29/2003
85009	MARYS R > WILLAMETTE R	S 37798	S 28154	32614			10.00S 07.00W 32 SESE	IR	1-Jan	31-Dec	7/11/1962	MARYS R	0.28	E			P	NC	CT	10/29/2003
69249	MARYS R > WILLAMETTE R	S 19092	S 14683	16859			11.00S 07.00W 17 NENE	IR	1-Jan	31-Dec	11/19/1940	MARYS R	0.263	E			P	NC	CT	10/29/2003
73102	BARK CR > TUMTUM R	S 17546	S 13250	20712			11.00S 07.00W 30 NWSE	IR	1-Jan	31-Dec	8/27/1938	BARK CR	0.25	E			P	NC	CT	10/29/2003
73102	TUMTUM R > MARYS R	S 17546	S 13250	20712			11.00S 07.00W 30 NWNE	IR	1-Jan	31-Dec	8/27/1938	TUMTUM R	0.25	E			P	NC	CT	10/29/2003
82382	TUMTUM R > MARYS R	S 26346	S 20671	29988			11.00S 08.00W 24 SENW	IR	1-Jan	31-Dec	8/22/1951	TUMTUM R	0.25	E			P	NC	CT	10/29/2003
80924	GREASY CR > MARYS R	S 28743	S 22615	28533			12.00S 06.00W 32 NWSE	IR	1-Jan	31-Dec	8/27/1953	GREASY CR	0.24	E			P	NC	CT	10/29/2003
80967	SHOTPOUCH CR > TUMTUM R	S 26620	S 20845	28576			11.00S 08.00W 23 NESE	IR	1-Jan	31-Dec	11/5/1951	SHOTPOUCH CR	0.23	E			P	NC	CT	10/29/2003
73221	TUMTUM R > MARYS R	S 20164	S 15734	20831			11.00S 07.00W 20 SWNE	IR	1-Jan	31-Dec	3/17/1944	TUMTUM R	0.224	E			P	NC	CT	10/29/2003
66825	GREASY CR > MARYS R	S 17502	S 13207	14436			12.00S 06.00W 11 SWSE	IR	1-Jan	31-Dec	8/11/1938	GREASY CR	0.22	E			P	NC	CT	10/29/2003
66895	MARYS R > WILLAMETTE R	S 18893	S 14508	14506			12.00S 06.00W 13 NWNE	IR	1-Jan	31-Dec	7/29/1940	MARYS R	0.22	E			P	NC	CT	10/29/2003
78678	MARYS R > WILLAMETTE R	S 24291	S 19054	26287			12.00S 05.00W 16 SWNE	IR	1-Jan	31-Dec	11/25/1949	MARYS R	0.22	E			P	NC	CT	10/29/2003
75065	MARYS R > WILLAMETTE R	S 24719	S 19497	22675			11.00S 06.00W 29 SWNE	IR	1-Jan	31-Dec	5/16/1950	MARYS R	0.22	E			P	NC	CT	10/29/2003
72774	TUMTUM R > MARYS R	S 20667	S 16168	20384			11.00S 07.00W 19 SESE	IR	1-Jan	31-Dec	2/2/1945	TUMTUM R	0.218	E			P	NC	CT	10/29/2003
72918	W FK MARYS R > MARYS R	S 24689	S 19660	20528			10.00S 07.00W 32 NENW	IR	1-Jan	31-Dec	5/9/1950	W FK MARYS CR	0.216	E			P	NC	CT	10/29/2003
74916	MARYS R > WILLAMETTE R	S 27002	S 21208	22526			11.00S 07.00W 08 NWNE	IR	1-Jan	31-Dec	3/21/1952	MARYS R	0.21	E			P	NC	CT	10/29/2003
86087	MARYS R > WILLAMETTE R	S 35049	S 27446	33692			12.00S 06.00W 11 SENE	IR	1-Jan	31-Dec	6/19/1961	MARYS R	0.2	E			P	NC	CT	10/29/2003
60559	CEDAR CR > GREASY CR	S 8398	S 5455	8177			12.00S 06.00W 31 SWSE	ID	1-Jan	31-Dec	5/24/1922	CEDAR CR	0.18	E			P	NC	CT	10/29/2003
64470	GREASY CR > MARYS R	S 13962	S 10060	12081			12.00S 06.00W 11 SWSW	IR	1-Jan	31-Dec	2/18/1931	GREASY CR	0.175	E			P	NC	CT	10/29/2003
69300	MARYS R > WILLAMETTE R	S 20824	S 16295	16910			11.00S 07.00W 16 NWNE	IR	1-Jan	31-Dec	5/4/1945	MARYS R	0.17	E			P	NC	CT	10/29/2003
94311	TUMTUM R > MARYS R	S 27028	S 21270	41914			11.00S 07.00W 28 NWSW	IR	1-Jan	31-Dec	3/28/1952	TUMTUM R	0.17	E			P	NC	CT	10/29/2003
72822	MARYS R > WILLAMETTE R	S 22998	S 18135	20432			11.00S 07.00W 15 SWSE	IR	1-Jan	31-Dec	4/21/1948	MARYS R	0.169	E			P	NC	CT	10/29/2003
73053	MARYS R > WILLAMETTE R	S 24348	S 19228	20663			12.00S 06.00W 13 NWSW	IR	1-Jan	31-Dec	12/15/1949	MARYS R	0.163	E			P	NC	CT	10/29/2003

Table F-1
Marys River Basin Pre-1964 Water Rights
Philomath Water Master Plan
960.4140.0

Mainstem Marys River and Tributaries above USGS gauge at Belfountain Road

72888	HORTON CR > MARYS R	S 23728	S 18876	20498			11.00S 07.00W 11 NWNE	IR	1-Jan	31-Dec	4/21/1949	HORTON CR	0.16	E			P	NC	CT	10/29/2003
83828	MARYS R > WILLAMETTE R	S 30523	S 24033	31433			12.00S 05.00W 10 NESW	IR	1-Jan	31-Dec	1/25/1956	MARYS R	0.16	E			P	NC	CT	10/29/2003
69018	MARYS R > WILLAMETTE R	S 17662	S 13356	16628			10.00S 07.00W 33 NESE	IR	1-Jan	31-Dec	11/16/1938	MARYS R	0.15	E			P	NC	CT	10/29/2003
66869	MARYS R > WILLAMETTE R	S 18156	S 13798	14480			11.00S 06.00W 29 SWNE	IR	1-Jan	31-Dec	6/5/1939	MARYS R	0.15	E			P	NC	CT	10/29/2003
82388	TUMTUM R > MARYS R	S 32244	S 25479	29994			11.00S 08.00W 24 SESE	IR	1-Jan	31-Dec	4/8/1958	TUMTUM R	0.15	E			P	NC	CT	10/29/2003
113341	MARYS R > WILLAMETTE R	S 38557	S 29197	60977			12.00S 05.00W 10 NESW	IR	1-Jan	31-Dec	3/29/1963	MARYS R	0.145	E			P	NC	CT	10/29/2003
63356	WESTWOOD CR > GREASY CR	S 13293	S 9536	10967			12.00S 06.00W 29 SWNE	IR	1-Jan	31-Dec	2/27/1930	WESTWOOD CR	0.14	E			P	NC	CT	10/29/2003
82388	HYMES CR > TUMTUM R	S 32244	S 25479	29994			11.00S 08.00W 24 SESE	IR	1-Jan	31-Dec	4/8/1958	HYMES CR	0.13	E			P	NC	CT	10/29/2003
69143	MARYS R > WILLAMETTE R	S 20699	S 16222	16753			12.00S 06.00W 11 SENW	IR	1-Jan	31-Dec	2/20/1945	MARYS R	0.13	E			P	NC	CT	10/29/2003
81982	MARYS R > WILLAMETTE R	S 31905	S 25158	29588			12.00S 05.00W 10 SESW	IR	1-Jan	31-Dec	9/27/1957	MARYS R	0.13	E			P	NC	CT	10/29/2003
63141	BOUNDS CR > GREASY CR	S 13928	S 10021	10752			12.00S 06.00W 15 NWNW	ID	1-Jan	31-Dec	1/22/1931	BOUNDS CR	0.12	E			P	NC	CT	10/29/2003
72990	GREASY CR > MARYS R	S 24518	S 19308	20600			12.00S 06.00W 32 NESW	IR	1-Jan	31-Dec	3/17/1950	GREASY CR	0.12	E			P	NC	CT	10/29/2003
72067	MARYS R > WILLAMETTE R	S 20825	S 16296	19677			11.00S 07.00W 09 SWSW	IR	1-Jan	31-Dec	5/4/1945	MARYS R	0.12	E			P	NC	CT	10/29/2003
64713	TUMTUM R > MARYS R	S 14821	S 10774	12324			11.00S 07.00W 26	IR	1-Jan	31-Dec	12/1/1932	TUMTUM R	0.12	E			P	NC	CT	10/29/2003
97246	UNN STR > TUMTUM R	S 33872	S 26807	44847			11.00S 08.00W 24 NESW	IR	1-Jan	31-Dec	4/13/1960	UNN STR	0.12	E			P	NC	CT	10/29/2003
97326	GREASY CR > MARYS R		S 22324	44927			12.00S 06.00W 32 SWNW	IR	1-Jan	31-Dec	6/10/1953	GREASY CR	0.116	E			P	NC	CT	10/29/2003

CITY OF PHILOMATH
Water System Master Plan,
Philomath, Oregon

Water System Budget

Appendix G