ORDINANCE NO. 1359-13

AN ORDINANCE AMENDING THE TUALATIN DEVELOPMENT CODE (TDC) CHAPTER 12-WATER SERVICE-INCORPORATING THE JULY 2013 WATER MASTER PLAN AND AMENDING TDC 12.010-12.140. PLAN TEXT AMENDMENT (PTA-13-01) corrected AMD

WHEREAS, upon the application of Community Development Department, a public hearing was held before the City Council of the City of Tualatin on September 9, 2013, related to a Plan Text Amendment of the Tualatin Development Code (TDC); and amending TDC 12.010-12.140 (PTA-13-01); and

WHEREAS, the City provided notice of PTA-13-01 to the Oregon Department of Land Conservation and Development as provided under ORS 197.610; and

WHEREAS, notice of public hearing was given as required by Tualatin Development Code 1.031; and

WHEREAS, the Council conducted a public hearing on September 9, 2013, and heard and considered the testimony and evidence presented by the City staff and those appearing at the public hearing; and

WHEREAS, after the conclusion of the public hearing, the Council voted unanimously; with Councilor Bubenik absent, to approve the application.

THE CITY OF TUALATIN ORDAINS AS FOLLOWS:

Section 1. TDC 12.010 is amended to read as follows:

(1) In 1979, the City of Tualatin adopted the Tualatin Community Plan. R. A. Wright Engineering Company prepared the water service element. In 1982, the Tualatin Community Plan was reviewed due to the annexation of approximately 900 acres west of the city limits. City staff reviewed the water sewer service element. In 1983 the City Council amended the Plan, including the water service element. The Plan was changed from covering only the city limits to covering the city limits and the area out to the Urban Growth Boundary (UGB)(an "Active Plan").

(2) In accordance with the Urban Planning Area Agreement between the City and Washington County and an Intergovernmental Agreement between the City and the City of Portland, the City of Tualatin is responsible for providing water service in the City of Tualatin. The City of Tualatin obtains its water from the City of Portland.

(3) In 1990 and 1999 minor amendments to TDC Chapter 12 were adopted. In 2000 and 2002 the City contracted with CH2M Hill to update the City's water master plan. The 2000 update reflected Tualatin's growth and refined the 1983 plan.

(4) The 2003 "Report, Tualatin Water Master Plan Update," (the "Master Plan") was the basis for amending the Tualatin Development Code (TDC), Chapter 12, in 2003. The purpose of the 2003 Master Plan was to provide the City with a comprehensive water master plan for future development of the water system. The 2003 Master Plan included a description of the existing water system, the planning criteria, a water system analysis and a capital improvement plan.

~~(4)~~ The 2003 Master Plan study area was the same as the Tualatin Community Plan, plus it included the Southwest Manufacturing Business Park and the Northwest Tualatin Concept Plan 2005.

(5) ~~Northwest Tualatin Concept Plan 2005 identifies water service needs for the study area. This information is new and updates the 2003 Master Plan.~~ The July 2013 Water Master Plan report was prepared as an update to the 2003 Master Plan. Its purpose is to be a comprehensive analysis of the City's water system, to identify system deficiencies, determine future water distribution system supply requirements and recommend water system facility improvements that correct system deficiencies and provide for future system expansion.

(6) The July 2013 Water Master Plan anticipates demand as residential growth from redevelopment and infill, within the Town Center area, and industrial and employment growth in the Southwest Concept Plan Area.

~~(6)~~ (7) The purpose of Chapter 12 is to provide for:

(a) Reinforcement of the existing water system to provide adequate peak and fire-flow capabilities;

(b) Expansion of the distribution system as areas inside the Urban Growth Boundary are annexed to the City and are developed;

(c) Expansion of supply and storage facilities for present and future needs; and

(d) Financing the construction of the foregoing facilities.

Section 2. TDC 12.020 is amended to read as follows:

City of Tualatin water service policies are to:

(1) Plan and construct a City water system that protects the public health, provides cost-effective water service, meets the demands of users, addresses regulatory requirements and supports the land uses designated in the Tualatin Community Plan.

(2) Require developers to aid in improving the water system by constructing facilities to serve new development and extend lines to adjacent properties.

(3) Water lines should be looped whenever possible to prevent dead-ends, to maintain high water quality and to increase reliability in the system.

(4) Improve the water system to provide adequate service during peak demand periods and to provide adequate fire flows during all demand periods.

(5) Review and update the water system capital improvement program and funding sources as needed or during periodic review.

(6) Prohibit the extension of City water services outside the City's municipal boundaries, unless the water service is provided to an area inside an adjacent city.

(7) ~~The Report, Tualatin Water Master Plan Update, August 2003,~~ The July 2013 Water Master Plan is accepted by reference as a supporting technical document to the Tualatin Community Plan.

~~(8) The Northwest Tualatin Concept Plan 2005 is adopted by reference as a supporting technical document to the Tualatin Community Plan.~~

~~(9) The Southwest Tualatin Concept Plan 2010 is adopted by reference as a supporting technical document to the Tualatin Community Plan.~~

~~(10) Continue the work started in 2001 and select one or more additional water sources.~~

Section 3. TDC 12.040 is amended to read as follows:

~~The 2003 Master Plan used a buildout population of 29,500 in 2010 which is an annual increase of about 2.5 percent per year from 2000 to 2010.~~ The July 2013 Water Master Plan projected a "build out population" of 29396 residents including estimates of 2,288 for redevelopment and infill and 1,048 for Town Center residential growth.

Section 4. TDC 12.050 is amended to read as follows:

(1) Population projections, commercial and industrial zoning acreage, and historical water use data formed the basis for the ~~2003 Master Plan's~~ July 2013 Water Master Plan's future water demand projection.

(a) The future per capita residential average day demand was assumed to be ~~100 gallons per capita~~ 90 gallons per capita per day.

(b) The relationship between the average day demand and other flow rate demands in the system is called the peaking factor. A peaking factor of ~~3.0~~ 2.2 was used in the ~~2003 Master Plan's~~ July 2013 Water Master Plan's

calculation of combined residential, ~~maximum day demand and a factor of 2.0 was used for~~ commercial and industrial maximum day demand.

(c) Large volume users are typically large multi-family projects and specialized industrial uses. The 2003 Master Plan identified 16 large water uses and they represent about 30% of the total system demand.

(d) Unaccounted-for water is the difference between the total amount purchased wholesale from the Portland Water Bureau and the total amount billed to customers. It includes leakage losses, meter discrepancies, hydrant and main flushing, operation and maintenance uses, fire flow uses, unauthorized connections and unmetered miscellaneous uses.

(2) The ~~2003 Master Plan's~~ July 2013 Master Plan's projected average day demand at buildout ~~in 2010~~ beyond 2031 for residential uses was ~~2.95~~ 2.65 million gallons per day ~~and with a 3.0 peaking factor the maximum day demand was 8.85 million gallons per day. The 2003 Master Plan's~~ The July 2013 Master Plan's projected average day demand at buildout ~~in 2010~~ beyond 2031 for commercial and industrial uses was ~~3.41~~3.61 million gallons per day ~~and with a 2.0 peaking factor the maximum day demand was 6.82 million gallons per day~~. The total system average day demand and maximum day demand were ~~6.36 and 17.2~~ 6.47 and 14.24 million gallons per day, respectively.

Section 5. TDC 12.060 is amended to read as follows:

(1) Fire flow is the amount of water required to fight a fire for a specified period. The Insurance Services Office (ISO) Commercial Risk Services, Inc., classifies a city for insurance rating purposes on the basis of a maximum fire flow requirement of 3,500 gallons per minute (gpm). Fire flow requirements greater than 3,500 gpm are evaluated individually and are not used by the ISO to determine the public protection classification of a municipality. For fire flow analysis the total fire flow requirement is a combination of building fire flow requirements plus system maximum day demand.

(2) Fire protection for the City's service area is provided by Tualatin Valley Fire & Rescue. The fire district has adopted fire flow requirements as defined in the 2010 State of Oregon Fire Code. A summary of fire flow recommendations based on the state fire code, fire flow criteria adopted by similar communities and fire flow guidelines as developed by the American Water Works Association is presented in Table 4-2 of the 2013 Master Plan.

(3) Fire protection is not dependent on the water distribution system alone. Fire flows greater than 3,500 gpm can be reduced with individual fire suppression systems such as sprinklers, chemical and alarm systems and fire-resistant construction, onsite supply and other methods. Developments with fire flows greater than 3,500 gpm will need to supplement public water system flows through private systems such as those noted in the prior sentence. The ~~2003 Master Plan's~~ July 2013 Master Plan's recommended minimum criteria for fire suppression flows for single family residential

~~was 1,500 gpm and~~ is 1,000 gpm, for multi-family is 2,000 gpm and commercial, industrial and institutional uses ~~was~~ is 3,500 gpm for a 3-hour duration.

Section 6. TDC 12.070 is amended to read as follows:

~~The 2003 Master Plan analyzed the source, pumping, storage, pipeline and fire flow components under 2002 and 2010 demand conditions in accordance with the Oregon Public Health Services Drinking Water Program and the Oregon Water Resources Department accepted standards for master plan studies. The H2OMap network analysis software was used to simulate the system's hydraulics. The model contained about 1,000 nodes and 1,200 pipes. The modeling was verified by field data collected at 22 stations throughout the system. The overall absolute variation for the 22 stations was less than 5% which is more than adequate for master planning and capital improvement purposes.~~

The July 2013 Water Master Plan analyzed the water system based on criteria for water supply, source, distribution system piping, service pressures, storage and pumping facilities in conjunction with the water demand forecasts for 2031 and beyond in Section 3 of the Master Plan.

The analysis and recommendations in Section 4 of the Master Plan are based on performance guidelines developed in a review of State of Oregon requirements, American Water Works Association (AWWA) acceptable practice guidelines, Insurance Services Office, Inc. (ISO) guidelines and the operational practices of similar water providers. The distribution system analysis was performed using Innovyze's InfoWater hydraulic network analysis software and an updated system model that relied on geographical information system, updated reservoir and pump station data, and current control valve setting information.

Section 7. TDC 12.080 is amended to read as follows:

(1) The City of Tualatin entered into an agreement with the City of Portland in the early 1980's to obtain water from the Bull Run watershed via the Washington County Water Supply Line. In emergencies the City can obtain small quantities through interties with the cities of Tigard, Lake Oswego, Sherwood and Wilsonville. Water from the Willamette River can be used for domestic purposes if Tualatin's voters approve of its use. Water quality from the Bull Run Reservoir, the Portland Water Bureau Columbia South Shore wellfield and the Tualatin distribution system meets or exceeds all U.S. Environmental Protection Agency water quality requirements. ~~Tualatin can obtain up to about 10.8 million gallons per day (mgd), but will need about 17.2 mgd in 2010, thus additional capacity of 6.4 mgd is needed. Reservoir capacity in 2003 is deficient 5.4 million gallons for Level A and will be deficient 1.9 million gallons for Level B and 0.6 million gallons for Level C in 2010. The pipelines are adequate overall and with new reservoir capacity and pipeline improvements will provide adequate peak hour demand conditions to 2010. Fire flows are adequate in 2003 in most areas and with new pipe in~~

~~several areas to increase looping and new reservoirs future fire flows will be adequate while maintaining system pressure.~~

(2) The City's water system is composed of three service levels (Levels A, B, and C) supplied by gravity and pumps and storage reservoirs. The system is primarily within public rights-of-way, is looped and is monitored and controlled by a central telemetry system.

(3) Service Level A is the lowest in elevation and is supplied directly from the Supply Line and by gravity from the 1971 2.2 million gallon enclosed steel tank Avery Reservoir. A new reservoir site was acquired in 2003 southwest of the SW Tualatin-Sherwood Road/SW Cipole Road intersection. Service Level B is the second lowest in elevation and is supplied by gravity from the 1971 and 1989 2.2 and 2.8 million gallon enclosed steel tank reservoirs on SW Norwood Road. A new reservoir site was acquired in the 1990's southwest of the SW 108th Avenue/SW Cottonwood Street intersection Service Level C is the highest in elevation and is supplied by gravity from the 1981 0.8 million gallon enclosed steel tank reservoir southeast of the Norwood Road overpass over I-5.

(4) The City has three pump stations. Stations one and two pump a back-up supply from Level A to Level B. Station three pumps from Level B to the C reservoir.

(5) The ~~8.8~~ July 2013 Water Master Plan identifies 13.0 million gallons of water storage capacity in ~~four~~ five reservoirs ~~is inadequate~~. The ~~2003 Master Plan~~2013 Master Plan recommends ~~a new reservoir in each Service Level which will provide adequate storage to 2010~~increased storage capacity in Service Areas A and B in the future.

Section 8. TDC 12.090 is amended to read as follows:

The ~~proposed~~ water distribution and storage system with existing and proposed waterlines and reservoirs ~~for the year 2010~~ is illustrated in Map 12-1. ~~The phased construction of this system will be dictated by identified deficiencies and actual growth patterns. Growth to 2010 can be projected with reasonable accuracy because the vacant and redevelopment areas are known.~~ The proposed short-term, medium-term and long-term capital improvements for the system recommended in the July 2013 Water Master Plan are ~~in Table 12-1 and~~ in Master Plan Table 7-1 and shown mapped on Plate-1 in Appendix A of the Master Plan.

Section 9. TDC 12.100 is amended to read as follows:

~~The City's agreement with the City of Portland allows Tualatin to purchase 18% of the total capacity of the Portland Water Bureau's Washington County Supply Line which is about 10.8 million gallons per day. This source is insufficient to meet the expected 17.2 million gallons per day demand in 2010. The City began a process in~~

~~2001 to identify potential new sources, including aquifer storage and recovery. The City's process will continue and one or more new sources will be selected.~~

The City's sole water supply is purchased wholesale from the Portland Water Bureau (PWB) through a 10-year wholesale water supply contract signed in 2006. Under the terms of the agreement, the City is obligated to purchase a minimum annual volume of water equal to 4.4 million gallons per day (mgd).

The City operates a single aquifer storage and recovery (ASR) facility. ASR operations allow the City to store surplus drinking water in a groundwater aquifer during low demand periods (fall through spring) and then recover the water from a groundwater well during high demand periods (summer). The aquifer has an effective recovery capacity of approximately 90 mg and is connected to Service Area B for both injection and recovery.

As a member of the Willamette River Water Coalition (WRWC), the City has access to surface water supply capacity from the Willamette River under OWRD Permit S-49240. In May 2002 the City Charter was amended to require that before Willamette River water is used for drinking purposes, a vote must approve such use.

Section 10. TDC 12.110 is amended to read as follows:

(1) The City of Tualatin has three service levels designated as A, B, and C on Map 12-1. The Bridgeport Service Area serves commercial customers in the Bridgeport Village shopping center.

(2) Service Level A includes approximately the northern 50% of the City extending east and west covering elevations from 110 feet to about 200 feet. Service Level B includes approximately the middle 40% of the City extending east and west covering elevations from about 180 feet to 280 feet. Its southern extent is Ibach Street and Ibach Street extended west to the railroad tracks and extended east to I-5. There are isolated areas above 280 feet, but these contain a very limited number of houses. The boundaries of Service Level C are Ibach Street on the north, I-5 on the east, the UGB on the south and the railroad tracks on the west.

(3) Substantial development has occurred over the years. Future development is expected to occur in Level A on the remaining vacant manufacturing lands, in the Town Center ~~downtown~~ area (redevelopment), in the Durham Quarry area and east of I-5 (~~Nyberg property and r~~Redevelopment of the Trailer Park of Portland). Future development in Level B is expected in the area of Legacy Meridian Park Hospital and the SW Concept Plan Area. Future development in Level C is expected in the SW Grahams Ferry and SW 108th Avenue residential areas. ~~Future development will occur in the area southwest of the City that was added to the Urban Growth Boundary by Metro in 2002 (approximately 300 acres).~~

Section 11. TDC 12.111 is amended to read as follows:

~~(1) In 2003 Service Level A was deficient in storage by 5.4 million gallons. The City acquired ownership of a new reservoir site in 2003 and a 10-million gallon reservoir is being designed with construction expected to being in 2004. The reservoir will provide adequate storage through 2010.~~

~~(2) In 2003 Service Level A included some locations that drop below 35 pounds per square inch (psi) of pressure under peak hour demand conditions. All low pressure areas will be improved by the new reservoir and by new pipelines.~~

~~(3) In 2003 there were three areas where the system had difficulty providing 3,500 gallon per minute fire flows. The difficulties will be remedied by the new Level A reservoir, by new pipelines and by increasing the pressure setting in pressure reducing valves.~~

(1) Service Level A has adequate existing storage capacity but will require additional storage in the future. Increased storage volume needs in Service Area A are associated with the Town Center redevelopment and other redevelopment and infill.

Section 12. TDC 12.112 is amended to read as follows:

~~(1) In 2003 storage was adequate in Service Level B, but will be deficient by 2010. A new 1.9 million gallon reservoir is planned at the City owned site on SW 108th Avenue which will provide adequate storage for future growth.~~

~~(2) In 2003 some areas would drop below 35 pounds per square inch (psi) of pressure under peak hour demand conditions. All low pressure areas will be improved by the new reservoir and by new pipelines.~~

~~(3) In 2003 the system had difficulty providing 3,500 gallon per minute fire flows in the eastern portion of Level B. The difficulties will be remedied by the new Level B reservoir and by new pipelines that will improve looping.~~

(1) Service Level B has adequate existing storage capacity but will require additional storage in the future. Increased storage volume needs in Service Area B are associated with expansion and development in the SW Concept Plan Area which is located largely in Service Area B.

Section 13. TDC 12.113 is amended to read as follows:

~~(1) In 2003 storage was adequate in Service Level C, but will be deficient by 2010. A new 1.0 million gallon reservoir is planned next to the existing Level C reservoir which will provide adequate storage for future growth.~~ The 2013 Water Master Plan identifies the pending construction of the 1.0 mg C-2 Reservoir to serve Service Area C.

Section 14. TDC 12.120 is amended to read as follows:

(1) ~~Additional storage is needed in Service Levels A, B and C. One new reservoir is planned for each Level. The new Level A reservoir will be constructed in 2004. The Level B and C reservoirs are planned for 2010 and 2005, respectively.~~ The City's Water System consists of five (5) storage reservoirs with a combined storage capacity of 13.0 million gallons. The reservoirs are supplied both directly from the Portland Supply Main and from pump stations.

(2) Service Areas A and B have adequate existing storage capacity but will require additional storage in the future associated with expansions and development in the Southwest Concept Plan area. Service Area C will be served by a new C-2 Reservoir and with the uncertainty of actual future development characteristics in the Service Area, the 2013 Master Plan does not recommend construction of additional storage within the planning period.

Section 15. TDC 12.130 is deleted in its entirety.

Section 16. TDC 12.140 is amended to read as follows:

~~(1) The 2003 Master Plan estimated rate and system development charge (SDC) impacts for the next 10 years. Three water supply scenarios were developed. The Base Case (Scenario 1) assumed that Aquifer Storage and Recovery (ASR) would be used to meet future supply needs. Because the City was still testing the feasibility of ASR, alternative supply sources were considered. Scenario 2 was the Wilsonville-Willamette River. Scenario 3 was the Joint Water Commission-Tualatin/Trask River option.~~

~~(2) All three scenarios would have significant rate impacts, particularly over the next five years, to fund the needed source and other improvements. All three scenarios assume the City would increase rates in FY 2003/04 by about 12 percent system wide. Additional rate increases for FY 2004/05 and FY 2005/06 range from 15 percent for Scenario 1 to 46 percent for Scenario 3. The projected annual rate increases moderate after FY 2005/06 for all scenarios, to less than 5 percent.~~

~~(3) Because the capital improvement plan was driven primarily by the need to expand capacity for anticipated growth, the revised SDC's for each scenario are significantly higher than the current SDC. The revised SDC's range from $2,758 for Scenario 1 to $6,225 for Scenario 3. The SDC's for Scenarios 1 and 2 are well within the range charged by comparable communities ($2,000 - $4,000).~~

~~(4)~~ (1) The financial plan was based on assumptions related to system revenue and cost growth and the capital improvement plan in the Master Plan. The City should review the funding possibilities for the proposed water system improvements in ~~Table 12-1.~~ Table 7-1 of the July 2013 Water Master Plan.

Section 17. Table 12-1 is deleted in its entirety.

Section 18. The City adopts as its findings the Findings and Analysis attached as Attachment A and incorporated herein.

Section 19. The July 2013 Water Master Plan is as set forth in Attachment B and is incorporated herein.

Section 20. Severability. Each section of this ordinance, and any part thereof, is severable. If any part of this ordinance is held invalid by a court of competent jurisdiction, the remainder of this ordinance shall remain in full force and effect.

INTRODUCED AND ADOPTED this 23rd Day of September, 2013.

CITY OF TUALATIN, OREGON

_____
Mayor

APPROVED AS TO LEGAL FORM

BY _____
City Attorney

ATTEST:

BY _____
Acting City Recorder

ANALYSIS AND FINDINGS

The proposed amendment to the Tualatin Development Code (TDC) Chapter 12-Water Service-, is an application by the Community Development Department to incorporate the evaluation, analysis and recommendations of the July 2013 Water Master Plan accepted by the Council on March 11, 2013 and updated July 2013 for inclusion into the Tualatin Community Plan.

The approval criteria of the Tualatin Development Code (TDC), Section 1.032, must be met if the proposed PTA is to be granted. The plan amendment criteria are addressed below:

1. Granting the amendment is in the public interest.

The public interest is:

1) For the Tualatin Community Plan's water system plan to be up to date for the long term viability of the system and for compliance with the Oregon Public Water System requirements in the Oregon Administrative Rules (OAR).
2) To have a plan for water system improvements that will ensure the continuing and long term viability of the City's water system.

Public Interest #1. The City of Tualatin is the public water service provider to the residences and businesses in the City. The City has built and maintains an extensive system of water supply, water storage and water distribution facilities that was planned to safely, efficiently and effectively serve the community. The water system is primarily supported by revenues from water users and from water system development charges applied to new development.

Tualatin Development Code (TDC) Chapter 12 is the water service element of the Tualatin Community Plan that in 1983 was brought as a water system plan into Chapter 12. In 2003, Chapter 12 was amended to update the water master plan based on the 2003 "Report, Tualatin Master Plan Update". The 2003 Master Plan is the basis for the City's current water system plan in Chapter 12.

OAR Chapter 333 Division 61 requires Public Water Systems to have current water master plans, meaning that the City can expect to update its 20-year water system plan every 8-10 years.

In June 2011, the City started the update to the 2003 Water Master Plan to be prepared by Murray Smith & Associates, Inc. The purpose of the Water Master Plan update was to perform a comprehensive analysis of the City's water system, to identify deficiencies, to determine future supply requirements, and to recommend facility improvements that correct existing deficiencies and provide for future

expansion. The product of the update is the "July 2013 Water Master Plan" that examines current and projected water supply and demand information, system capacity, cost and revenue projections and provides recommendations for short to long term capital projects to ensure adequate domestic water service into the 20-year plan horizon. The 2013 Water Master Plan was accepted by the Council on March 11, 2013 and staff was directed to begin the plan text amendments process to adopt the Water Master Plan into the Code.

The July 2013 Water Master Plan will be incorporated into the Tualatin Community Plan Chapter 12-Water Service- as an up-to-date water system plan that provides a 20 year plan for Tualatin's water service. The recommendation to revisit water demand projections in three years (2016) was accepted by Council. These actions will provide information to the City about the current and future needs and constraints of the system that are necessary for operating and improving the water system in an effective and timely manner.

The proposed TDC amendment incorporates a current, updated water system master plan into the Tualatin Community Plan that will be useful for the next 8-10 year plan cycle and will be consistent with the Oregon Administrative Rules for Public Water Systems. Public Interest #1 is satisfied.

Public Interest #2. The July 2013 Water Master Plan recommends water line, pumping capacity and storage reservoir improvements to correct system deficiencies and to serve the City from the present through Build-out development. The recommended improvements are presented as a Capital Improvement Program with estimated project costs and short, medium and long term schedules. The improvement program recommendations will be referenced in the proposed amendments to Chapter 12.

The Water System Capital Improvement Program schedule and project summary proposed in the Water Master Plan will provide information for the City to consider in budgeting for water system improvements as part of the City's on-going Capital Improvement Program.

The proposed amendment PTA-13-01 incorporates a plan for water system improvements that will ensure the continuing and long term viability of the City's water system. This satisfies Public Interest #2.

Granting the amendment is in the public interest. Criterion "A" is met.

2. The public interest is best protected by granting the amendment at this time.

This Water Master Plan is a 20-year planning document and projects water system needs through 2031. By State law, water master plans must be kept current. This means that the City can expect to update its 20-year plan every eight to ten years. Now is the time to update the Water Service element of the Tualatin Community Plan. The 2013 Water Master Plan is completed and was accepted by the Council on March 11, 2013 and updated July 2013. The Oregon Public Water Systems rules require the Tualatin Water Plan be kept current. Given that the last update was in 2003, it is time to update the TDC Chapter 12 to reflect the new Water Master Plan.

Granting the amendment at this time best protects the public interest.

3. The proposed amendment is in conformity with the applicable objectives of the Tualatin Community Plan.

The applicable objectives of the Tualatin Community Plan relating to the amendment Tualatin Development Code (TDC) Chapter 12 are discussed below:

Chapter 4. Community Growth
Section 4.050. General Growth Objectives
(1) Provide a plan that will accommodate a population range of 22,000 to 29,000 people.
The proposed amendments are consistent with this objective because they update the City's Water Master Plan so a projected population of 28,565 in 2031 can be served. The analysis and recommended water system improvements will accommodate existing and future development in this population range. The objective is met.

Criterion "C" is met.

4. The following factors were consciously considered:

The various characteristics of the areas in the City.

The characteristics of all areas of the City and inside the UGB were considered in the 2013 Master Plan's evaluation and modeling. Data for existing and planned uses were used in the modeling.

The suitability of the area for particular land uses and improvements.

Not applicable

Trends in land improvement and development.

Trends in per capita water usage, water conservation, and industrial water usage were considered in the 2013 Water Master Plan evaluations and modeling. Recommendations for system improvements were based on the needs of industry and future development.

Property Values.

Property values will be maintained and enhanced with a water master plan that calls for adequate storage and water lines that will adequately serve existing and future development.

The needs of economic enterprises and the future development of the area.

The 2013 Master Plan modeling accounted for residential, commercial and industrial water system demands for the present and the future. Recommendations for system improvements were based on the needs of industry and future development.

Needed right-of-way and access for and to particular sites in the area.

Not Applicable.

Natural resources of the City and the protection and conservation of said resources.

Not Applicable.

Prospective requirements for the development of natural resources in the City.

Not Applicable.

And the public need for healthful, safe, aesthetic surroundings and conditions.

In general, the water system will continue to provide potable water that can be used for drinking, washing, or irrigating crops, vegetable gardens, and landscaping, activities that create and maintain healthful, safe and aesthetic surroundings and conditions. As a specific example, under Distribution System notes that the minimum water system fire flow pressure would be as required by the State of Oregon Health Authority, contributing to healthful and safe conditions. The existing and improved water system will provide water that meets water quality standards in sufficient quantity to provide for healthful, safe and aesthetic surroundings and conditions.

Proof of change in a neighborhood or area.
Staff does not assert proof of change in a neighborhood or area.

Mistake in the Plan Text or Plan Map.
There is no mistake in the Plan Text or Plan Map.

5. The criteria in the Tigard-Tualatin School District Facility Plan for school facility capacity have been considered when evaluating applications for a comprehensive plan amendment or for a residential land use regulation amendment.

Because the amendment does not result in a change to plans or development regulations that would impact school facility capacity, the criterion is not applicable.

6. Granting the amendment is consistent with the applicable State of Oregon Planning Goals and applicable Oregon Administrative Rules.

Of the 19 statewide planning goals, staff determined one Goal is applicable, Goal 11 "Public Facilities and Services," which is, "To plan and develop a timely, orderly and efficient arrangement of public facilities and services to serve as a framework for urban and rural development." Oregon Administrative Rules (OAR) 660-015-0000(11) explains that "timely, orderly, and efficient arrangement" refers to "a system or plan that coordinates the type, locations, and delivery of public facilities and services in a manner that best supports the existing and proposed land uses."

Goal 11 and the related OARs require cities to adopt a Public Facilities Plan that includes water system facilities. The City's Water System Plan is Chapter 12 of the Tualatin Community Plan and the July 2013 Water System Master Plan and implementing amendments in PTA-13-01 fulfill water system plan requirements and are a timely update to the plan.

The amendment complies with Goal 11.

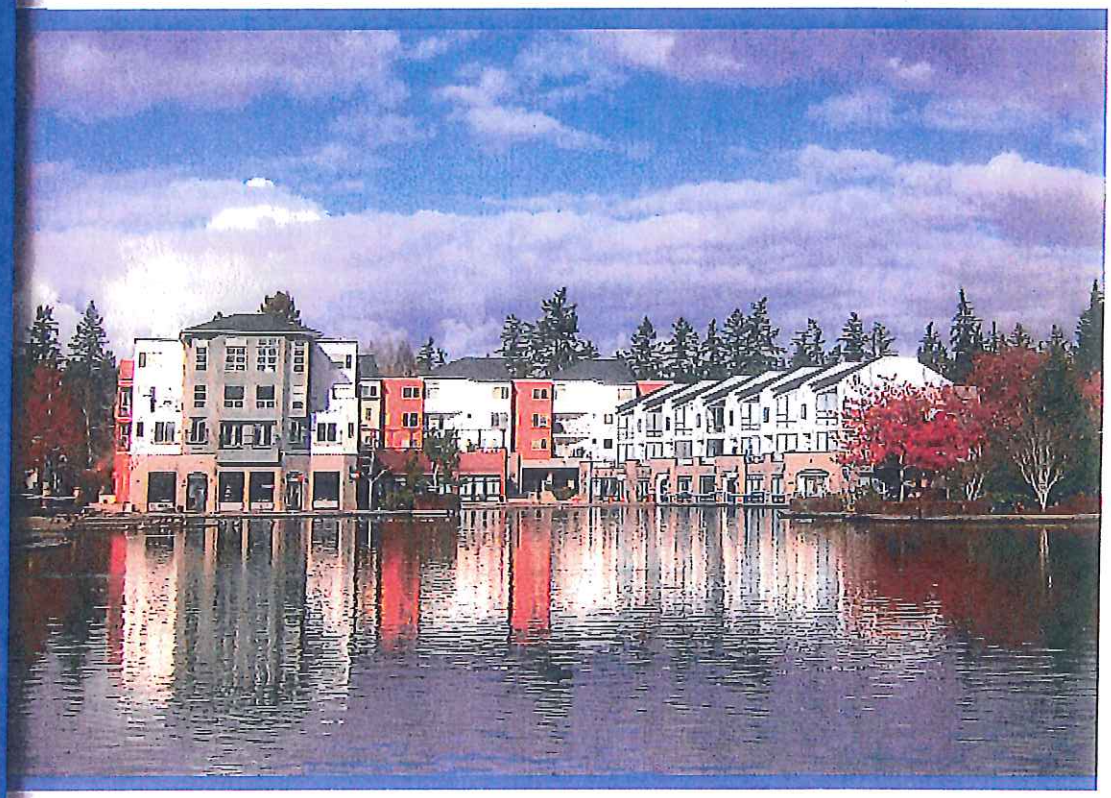
7. Granting the amendment is consistent with the Metropolitan Service District's Urban Growth Management Functional Plan.

The Metro Urban Growth Management Functional Plan (MUGMFP) does not address water systems. The criterion does not apply.

8. Granting the amendment is consistent with Level of Service F for the p.m. peak hour and E for the one-half hour before and after the p.m. peak hour for the Town Center 2040 Design Type (TDC Map 9-4), and E/E for the rest of the 2040 Design Types in the City's planning area.

Because the amendment does not relate to vehicle trip generation, the criterion is not applicable.

City of Tualatin, Oregon



Water Master Plan

January 2013

Amended July 2013

MSA
Murray, Smith & Associates, Inc.
Engineers/Planners

FCS GROUP

Prepared For:

CITY OF TUALATIN, OREGON

Water Master Plan

January 2013
Amended July 2013

RENEWS: 6-30-2013

RENEWS 12-31-14

Prepared By:

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Page

EXECUTIVE SUMMARY

1. INTRODUCTION

2. EXISTING WATER SYSTEM

3. WATER REQUIREMENTS

4. PLANNING & ANALYSIS CRITERIA

5. WATER SYSTEM ANALYSIS

6. WATER QUALITY & WATER CONSERVATION

7. CAPITAL IMPROVEMENTS PROGRAM

8. FINANCIAL ANALYSIS

APPENDICES

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

PURPOSE

The purpose of this Water Master Plan (WMP) is to perform a comprehensive analysis of the City of Tualatin's (City) water system, to identify system deficiencies, to determine future water distribution system supply requirements, and to recommend water system facility improvements that correct existing deficiencies and that provide for future system expansion. This WMP complies with water system master planning requirements established under Oregon Administrative Rules (OAR) for Public Water Systems, Chapter 333, Division 61. The City's existing WMP was completed in 2003. This updated WMP meets the OAR requirement for the City to maintain a current WMP.

WATER SYSTEM CHARACTERIZATION

The City's current water service area includes all areas within the current city limits and Urban Growth Boundary (UGB). The City provides potable water to approximately 26,000 people through approximately 6,700 residential, commercial, industrial and municipal service connections.

The City purchases wholesale water from the City of Portland Water Bureau (PWB) as its sole supply. The City's water distribution system currently consists of four service zones supplied by five (5) steel storage facilities with a total combined storage capacity of approximately 13.0 million gallons (MG) and three (3) pump stations with a combined pumping capacity of approximately 5,800 gallons per minute (gpm).

The City is currently pilot testing a single Aquifer Storage and Recovery (ASR) facility. ASR operations allow the City to store surplus drinking water in a groundwater aquifer during low demand periods (fall through spring) and then recover the water from a groundwater well during high demand periods (summer). The aquifer has an effective recovery capacity of approximately 90 MG (1 mgd for 90 days) and is connected to Service Area B for both injection and recovery. A single 150 horsepower vertical turbine pump recovers the water at a capacity of approximately 400 to 500 gallons per minute (gpm), depending upon aquifer level and hydraulic conditions.

WATER SYSTEM SUPPLY & DEMAND PROJECTIONS & ASSESSMENT

This WMP is a 20-year planning document. The WMP projects water system needs through 2031. By State law, water master plans must be kept current. This means that the City can expect to update its 20-year plan every eight to ten years.

Population Projection

The projected build-out population is estimated as the current population of 26,060, plus the following growth elements identified by other planning studies for a total of 29,396 residents, projected at build-out (beyond the 20-year planning horizon).:

- ☐ 2,288 residents due to redevelopment and infill,
- ☐ 1,048 residents added to the Town Center,

Water Demand Projections

The City's current average daily water demand is approximately 4.3 million gallons per day (mgd) with a maximum day demand (MDD) of approximately 9.5 mgd. At build-out development, the anticipated average daily water demand is approximately 6.5 mgd and with a MDD of approximately 14.2 mgd within the City's current UGB.

Water Supply Capacity & Wholesale Water Purchases

Currently, the City's water supply is purchased wholesale from the PWB through a 20-year wholesale water supply contract signed in 2006. The contract extends through 2026. Under the terms of the agreement, the City is obligated to purchase a minimum annual volume of water equal to 4.4 mgd. The wholesale water rate paid by the City is based on three factors: 1) the guaranteed minimum purchase, 2) the City's peak seasonal factor, and 3) the City's peak daily factor.

The City receives water supply through the Washington County Supply Line (WCSL) which conveys water by gravity from the PWB's Powell Butte Reservoir to the City, along with other Washington County wholesale customers (Tualatin Valley Water District (TVWD) and Raleigh Water District). The WCSL is an 84-inch to 60-inch diameter transmission line that reduces to 48-inch diameter after the supply connection to the TVWD Wolf Creek Main. The WCSL continues south as a 48-inch diameter supply main ending at the Florence Lane Master Meter. A 36-inch diameter City-owned pipe conveys water from the Florence Lane Master Meter to the City, referred to as the Portland Supply Main in this plan.

The Portland Supply Main has a maximum capacity of 20 mgd; however, this supply capacity is limited by the available capacity of the WCSL system. The WCSL has a nominal capacity of 60 mgd and the City has rights to 18 percent of the capacity, or 10.8 mgd. The 60 mgd nominal capacity is based on the WCSL operating with all the owners of the line using their full capacity and maintaining adequate supply pressure. Within the 20-year planning period, the City's peak water supply needs are projected to exceed the City's 10.8 mgd capacity in the WCSL transmission system. The City's 2003 Water System Plan projected water demands to exceed this capacity by 2010, but several factors including conservation and slower population and economic growth have resulted in lower demands.

The City currently has a planning level MDD of approximately 9.5 mgd and experienced an actual peak demand of 9.3 mgd in 2007. The largest single source of increased demand within the study area is the large water users anticipated in the SW Concept Area Plan. The WMP projects that with continued conservation and slower economic growth, water supply expansion will not be required until 2023. **It is recommended that the City review the projected water demand in three years to determine if current conditions warrant action to begin acquiring additional supply capacity. This will allow the City time to evaluate changes in WCSL usage that may result in additional available capacity for acquisition by the City. The City can also evaluate the addition of any significant new customer water demands to the system. The current plan does not budget funds for any supply expansion projects.**

Water System Analysis & Improvements Summary

The City's hydraulic model was updated for recent improvements and calibrated to current water system demands. The model was used to evaluate the current and future water system for deficiencies which were evaluated for inclusion in the City's Capital Improvement Projects (CIP) list. In general, the City's water system is adequate to supply domestic water service and fire suppression capacity within the service area.

The majority of the recommended CIPs are associated with growth related development primarily in the expansion areas. Growth related infrastructure improvements include approximately 48,000 feet of transmission piping, 5.4 MG in new storage facilities, and a new 3,600 gpm pump station. There are several smaller non-growth related improvements associated with improving fire flow capacities, continuation of the asbestos cement pipe replacement program, and upgrades to the existing telemetry system.

The total estimated project cost of these improvements is approximately $24.4 million for the 20-year planning horizon and beyond to the ultimate full development of the City's existing UGB. Of the improvements required in the 20-year planning horizon, approximately $11.8 million of these improvements are required in the next 10 years. Approximately $1.2 million per year should be budgeted over the next 20 years for the completion of these projects.

FINANCIAL SUMMARY

A financial evaluation of the City's water system was performed and included recommendations for updating the System Development Charge (SDC) and recommendations for water system rate adjustments to maintain adequate funds for system operation, maintenance, capital improvements and water system bond coverage.

Water Rate Adjustment

The Plan does not include a recommended rate increase for fiscal year 2012-13. If, during that year, earned rate revenues equal or exceed budgeted rate revenues, then a rate increase can be avoided for fiscal year 2013-14. If, however, revenues for fiscal year 2012-13 are flat, a rate increase of 4.25 percent in fiscal year 2013-14 with a series of similar increases in subsequent years through fiscal year 2021-22 is recommended.

System Development Charge Update

A SDC can include three components: 1) a reimbursement fee based on existing capacity to be used by new development, 2) an improvement fee based on needed new infrastructure to serve development, and 3) compliance costs to develop and administer SDCs. Table ES-1 summarizes the components of the proposed water SDC of $4,428 per Equivalent Dwelling Unit (EDU).

Table ES-1 | SDC Components

Component	Per EDU
Reimbursement fee	$1,602
Improvement fee	2,821
Compliance costs	5
Total water SDC	$4,428

Source: FCS GROUP

The City's current total water SDC (indexed as of February, 2012) is $3,266 per EDU. The proposed SDC is 35.6 percent higher than the current SDC. The City may choose to adopt a new SDC equal to the proposed amount immediately, phase in the SDC increase over multiple years or not adopt the new proposed SDC. Both of the latter options would result in the City forgoing SDC revenue scheduled to fund required system expansion projects identified in the CIP.

CIP Funding

In general, the sources for funding growth and non-growth related Capital Improvement Projects include 1) cash resources and revenues; 2) publicly issued debt; and 3) governmental grant and loan programs.

Water Fund Cash Resources and Revenues

The City's financial resources available for capital funding include rate funding, cash reserves, and SDCs. Generally, the proposed water rate adjustment includes consideration of SDC charges for growth related projects and rate funding for the non-growth related Capital Improvement Projects, which are not SDC eligible.

Public Debt

Revenue bonds are commonly used to fund utility capital improvements. The bond debt is secured by the revenues of the issuing utility and the debt obligation does not extend to other City resources. With this limited commitment, revenue bonds typically require security conditions related to the maintenance of dedicated reserves referenced as bond reserves and financial performance measures which are added to the bond debt as service coverage. There is no bonding limit, except the practical limit of the utility's ability to generate sufficient revenue to repay the debt and meet other security conditions. Revenue bonds incur relatively higher interest rates than government programs, but due to the highly competitive nature of the low- interest government loans, revenue bonds are assumed to be a more reliable source of funding as they typically can be obtained by most communities.

Government Programs

Government programs include low rate loan programs and some grants for eligible projects and loan recipients. The major water system programs include the Oregon State Safe Drinking Water Financing Program, the Special Public Works Fund, and the Water/Wastewater Fund. The WMP financial analysis does not assume use of any lower rate government assistance programs.

AUTHORIZATION

In June 2011, the firm of Murray, Smith & Associates, Inc. was authorized by the City of Tualatin (City) to prepare this Water Master Plan (WMP).

PURPOSE

The purpose of this study is to perform a comprehensive analysis of the City's water system, to identify system deficiencies, to determine future water distribution system supply requirements, and to recommend water system facility improvements that correct existing deficiencies and that provide for future system expansion.

COMPLIANCE

This plan complies with water system master planning requirements established under Oregon Administrative Rules (OAR) for Public Water Systems, Chapter 333, Division 61.

PLAN ELEMENTS

This study includes the following elements:

- ***Water System Description.*** Prepare an inventory of existing water system facilities including supply, transmission and distribution piping, storage reservoirs, pumping stations, and control systems.
- ***Water Requirements.*** Review information related to service area, land use, population distribution, and historical water demands. Develop water demand forecasts for existing and undeveloped areas within the City's water service area.
- ***System Analysis Criteria.*** Develop system performance criteria for distribution and transmission systems and storage and pumping facilities. Develop analysis and planning criteria for pressure zone service pressure limits, for emergency fire suppression water needs, and for other system performance parameters.
- ***Water System Analysis.*** Perform a detailed analysis of the City's transmission and distribution system, storage and pumping capacity needs, and pressure zone limits.
- ***Water Quality and Regulations.*** Describe the City's compliance status with respect to current and anticipated future State and Federal drinking water regulations.
- ***Water Conservation.*** Provide the City with information on potential conservation measures that could be implemented.
- ***Prepare Capital Improvement Plan.*** Develop estimated project costs for recommended improvements, recommend project sequencing and develop a Capital Improvement Program (CIP).

- ***Financial Evaluation.*** Develop an overall financing strategy using costs associated with capital improvements, based on the planning horizons. Review options for alternative rate structures.
- Update existing Rate and System Development Charges models will be updated based on the newly generated CIP.
- ***Prepare Water Master Plan.*** Prepare a WMP that documents and describes the planning and analysis work efforts, including a color map identifying all existing and proposed water system facilities.

GENERAL

This section describes and inventories the City of Tualatin's (City) water service area and water distribution system facilities. Included in this section is a discussion of existing supply and transmission facilities, water rights, pressure zones, storage and pumping facilities and distribution system piping.

BACKGROUND AND STUDY AREA

The City's current water service area includes all areas within the current city limits and Urban Growth Boundary (UGB). The City provides potable water to approximately 26,000 people through approximately 6,700 residential, commercial, industrial and municipal service connections. The study area of this planning effort is the entire area within the UGB. Plate 1 in Appendix A illustrates the City's water system service area limits, water system facilities and distribution system piping.

The City purchases wholesale water from the Portland Water Bureau (PWB) as it sole supply. The City's water distribution system currently consists of four (4) service zones supplied by five (5) steel storage facilities and three (3) booster pumping stations. Figure 2-1, included at the end of this section, presents a hydraulic schematic of the City's water system.

SUPPLY SOURCES

Wholesale Water Purchase

Currently, the City's water supply is purchased wholesale from the PWB through a 20-year wholesale water supply contract signed in 2006. The contract extends through 2026. Under the terms of the agreement, the City is obligated to purchase a minimum annual volume of water equal to 4.4 million gallons per day (mgd). The wholesale water rate paid by the City is based on three (3) factors: 1) the guaranteed minimum purchase, 2) the City's peak seasonal factor, and 3) the City's peak daily factor. Items 2 and 3 are the ratio of use during the 90 days of the summer season and the three (3) consecutive highest water use days, respectively, to the guaranteed minimum purchase. The higher these peaking factors are, the higher the City's wholesale water rate will be.

The supply is metered through the Florence Lane master meter in the City of Portland. The PWB source is the Bull Run watershed located near Mt. Hood. Two (2) surface water impoundments, Bull Run Reservoir No 1 and No. 2, store up to approximately 9.9 billion gallons of usable storage in the protected watershed. This surface water supply is disinfected with chloramines and pH-adjusted to decrease the corrosive qualities in the water. Currently, the source is unfiltered. The PWB designed a water treatment facility to comply with the Environmental Protection Agency (EPA) requirement to address the potential for cryptosporidium contamination under the Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR). Construction of the ultraviolet treatment facility has been delayed indefinitely following a State of Oregon Drinking Water Program variance for the unfiltered Bull Run source. The PWB operates a secondary groundwater supply, the Columbia South Shore

Wellfield, to supplement the Bull Run surface water storage in the summer and to provide source redundancy. The wellfield has a total capacity of approximately 90 million gallons per day (mgd).

The Washington County Supply Line (WCSL) conveys water by gravity from the PWB's Powell Butte Reservoir to the City of Tualatin, along with other Washington County wholesale customers (Tualatin Valley Water District (TVWD) and Raleigh Water District (RWD)). The WCSL is an 84-inch to 60-inch diameter transmission line that reduces to 48-inch diameter after the supply connection to the TVWD Wolf Creek Main, near the intersection of SW Beaverton-Hillsdale Highway and SW Oleson Road. The WCSL continues south as a 48-inch diameter supply main ending at the Florence Lane Master Meter. The City owns 1.5 percent of the 60-inch diameter pipe nominal capacity and approximately 58 percent of the 48-inch diameter pipe nominal capacity. The City also owns a 36-inch diameter pipe which conveys water from the Florence Lane Master Meter to the City of Tualatin. For the purposes of this plan, this pipe is referred to as the Portland Supply Main. Historically, the City of Sherwood has purchased water from the City of Tualatin through the Portland Supply Main.

Emergency Interties

The City maintains Intergovernmental Agreements (IGAs) with neighboring water providers for emergency supply. Existing emergency interties with their providers include connections with the City of Tigard, the Rivergrove Water District, the City of Lake Oswego, the City of Sherwood and the City of Wilsonville. Plate 1 shows the location of these emergency interties. Table 2-1 summarizes the interties characteristics to include the nominal hydraulic grades and estimated nominal intertie capacities to supply the City. The intertie capacities are estimated nominal capacities and assume that the neighboring water provider has excess supply available. Determination of intertie capacities is best made through field testing.

Table 2-1 | Emergency Intertie Summary

Intertie	Hydraulic Grade (Tualatin)	Hydraulic Grade (Other)	Meter size (in)	Nominal Intertie Capacity (gpm)
Lake Oswego	295	320	10	300
Tigard (SW Boones Ferry & Lower Boones Ferry)	295	410	8	700
Tigard (72nd & Bridgeport Rd)	295	410	10	1,000
Rivergrove	295	315	8	600
Sherwood – Supply Main (City Park)	295[1]	380	12	6,600
Sherwood – Distribution System (SW Cipole Road)	295	380	12	1,600
Wilsonville	506[2]	506	n/a	300

Notes:

1) The Sherwood Supply Main could be used to supply the City of Tualatin from the City of Sherwood under emergency conditions when the PWB supply is not available. The normal hydraulic grade of 530 feet would be reduced to the Service Area A grade of 295 feet.
2) Transferring water from the City of Wilsonville would require that the City of Tualatin reservoir be drawn down to induce flow.

Aquifer Storage and Recovery

The City operates a single aquifer storage and recovery (ASR) facility. ASR operations allow the City to store surplus drinking water in a groundwater aquifer during low demand periods (fall through spring) and then recover the water from a groundwater well during high demand periods (summer). The facility is located on SW 108th Avenue near the intersection with SW Dogwood Street. The aquifer has an effective recovery capacity of approximately 90 mg and is connected to Service Area B for both injection and recovery. A single 150 horsepower (hp) vertical turbine pump recovers the water to Service Area B from a pump setting of 470 feet below ground surface at a capacity of approximately 400 to 500 gallons per minute (gpm), depending upon aquifer level and hydraulic conditions. The City is currently pilot testing the ASR facility.

WATER RIGHTS

As a wholesale water customer of the PWB, the City does not hold water rights related to that supply. The City's single ASR facility operates under Oregon Water Resources Department (OWRD) ASR Limited License No. 010. This Limited License authorizes the City to operate an ASR system of up to five (5) wells storing 475 million gallons of water for recovery of up to 3,500 gpm during the summer season.

As a member of the Willamette River Water Coalition (WRWC), the City has access to surface water supply capacity from the Willamette River under OWRD Permit S-49240. A charter amendment adopted May 21, 2002, limits the City's ability to make use of the WRWC water right on the Willamette River. Specifically, the City shall not use Willamette River water as a drinking water source for its citizens unless approved through a majority vote.

SERVICE AREAS (PRESSURE ZONES)

General

The City's existing distribution system is divided into four existing service areas or pressure zones. Pressure zones are usually defined by ground topography and designated by overflow elevations of water storage facilities or outlet settings of pressure reducing facilities serving the zone. Pressure zone boundaries are further refined by street layout and specific development projects. A description of each of the City's pressure zones is presented below and includes a description of the service area, storage facilities, pumping facilities and groundwater sources serving the zone.

Service Area A

Service Area A is the largest pressure zone in the City and it serves customers between an approximate ground elevation of 88 feet and 202 feet above mean sea level (msl). The zone operates at an approximate hydraulic grade line (HGL) of 295 feet. The zone is composed of residential, commercial and manufacturing land uses. Service Area A is served directly from the Portland Supply Main through control valves. The A-1 and A-2 Reservoirs provides operational, emergency, and fire suppression storage to Service Area A.

Service Area B

Service Area B is the second largest pressure zone in the City and it serves customers between an approximate ground elevation of 192 feet and 306 feet above msl and above Service Area A. The zone operates at an approximate HGL of 399 feet. The zone is composed of residential, commercial and manufacturing land uses. Service Area B is served directly from the Portland Supply Main through a control valve. The Norwood Reservoirs provides operational, emergency, and fire suppression storage to Service Area B.

Service Area C

Service Area C is the second smallest pressure zone in the City, and it serves customers between an approximate ground elevation of 260 feet and 360 feet above msl. The zone operates at an approximate HGL of 506 feet. The zone is composed of residential and institutional land uses. Service Area C is served directly from the Norwood Pump Station and the C-1 Reservoir which provides operational, emergency, and fire-suppression storage to Service Area C.

Bridgeport Service Area

The Bridgeport Service Area is the smallest pressure zone in the City, and it serves commercial customers in the Bridgeport Village shopping complex between an approximate ground elevation of 185 feet and 200 feet above msl. The zone operates at an approximate HGL of 360 feet. The zone is composed of commercial land uses. The Bridgeport Service Area is supplied directly from the Portland Supply Main through the SW 72nd Avenue pressure reducing valve (PRV). The zone is isolated from Service Area A by normally closed valves on SW Bridgeport Road. The zone does not contain any gravity storage. A backup connection to the City of Tigard water system is located near the PRV. Fire suppression capacity is provided through both connections.

STORAGE RESERVOIRS

The City's water system contains five (5) reservoirs with a total combined storage capacity of approximately 13.0 mg. Table 2-2 presents a summary of the City's existing storage reservoirs, including capacity, overflow elevations, and pressure zones served.

Table 2-2 | Reservoir Summary

Reservoir Name	Service Area	Capacity (mg)	Overflow Elevation (ft)	Floor Elevation (ft)	Height (ft)[1]	Year Built	Type	Diameter (ft)
Avery (A-1)	A	2.2	295	248	47.0	1971	Steel	90
(A-2)	A	5.0	295	248	47.0	2006	Steel	135
Norwood 1 (B-1)	B	2.2	399	352	47.0	1971	Steel	90
Norwood 2 (B-2)	B	2.8	399	352	47.0	1989	Steel	100
Frobase (C-1)	C	0.8	506	458.5	47.5	1981	Steel	54

Note: 1) Maximum height of water column as measured from floor to overflow elevation.

The Avery Reservoir, also referred to as the A-1 Reservoir, provides gravity storage to Service Area A. The reservoir is located east of SW Teton Avenue and south of SW Avery Street. The reservoir is supplied directly from the Portland Supply Main and subsequently through five (5) PRVs to the Service Area A distribution system. The A-1 Reservoir fills when supply exceeds demand in Service Area A.

A second reservoir, referred to as the A-2 Reservoir, also provides gravity storage to Service Area A. The reservoir is located west of the City and southeast of the intersection of Tualatin-Sherwood Road and SW Oregon Street. Access is from SW Dahlke Lane. As with the Avery Reservoir, the A-2 Reservoir is supplied directly from the Portland Supply Main through the same five (5) PRVs feeding the Service Area A distribution system. The A-2 Reservoir fills when supply exceeds demand in Service Area A.

The Norwood Reservoirs, also referred to as the B-1 and B-2 Reservoirs, provide gravity storage to Service Area B. The reservoirs are located off SW Norwood Road, west of Interstate Highway 5 and are connected to the Service Area B distribution system by approximately 4,800 feet of transmission piping. The reservoirs are supplied from the Portland Supply Main through a control valve directly supplying the Service Area B distribution system. The Martinazzi and Boones Ferry Pump Stations provide backup supply from Service Area A in the event that the control valve is out of service. The Norwood Reservoirs also provide backup emergency and fire suppression storage for Service Area A. The Norwood Reservoirs fill when supply exceeds demand in Service Area B. The Norwood Reservoirs provide suction supply for the Norwood Pump Station.

The Frobase Reservoir, also referred to as the C-1 Reservoir, provides gravity storage to Service Area C. The reservoir is located outside the city limits in Washington County near the intersection of SW Frobase Road and SW 82nd Avenue. The reservoir is supplied from the Norwood Pump Station which boosts water from Service Area B through the Service Area C distribution system to the reservoir.

PUMP STATIONS

General

The City's water system contains three (3) pump stations. A description of each station is presented below and key parameters are summarized in Table 2-3, including the service zone supplied, station capacities and number, type and horsepower (hp) rating of existing pump units.

Table 2-3 | Pump Station Summary						
Pump Station	Unit	HP	Nominal Capacity (gpm)	Suction Service Area	Discharge Service Area	Function
Martinazzi	1	50	1,000	A	B	Backup
	2	50	1,000			
Boones Ferry	1	25	500	A	B	Backup
	2	25	500			
Norwood	1	75	1,400	B	C	Primary Supply
	2	75	1,400			

Martinazzi Pump Station

The Martinazzi Pump Station is located near the intersection of SW Martinazzi Avenue and SW Warm Springs Street in a below grade, cast-in-place, concrete vault. The pump station houses two (2) centrifugal pumps. The two (2) 50-hp pumps provide backup water supply from Service Area A to Service Area B when the City's Boones Ferry control valve connection to the Portland Supply Main is out of service. Each of these pumps has a nominal capacity of approximately 1,000 gpm. A portable power generator connection is provided at the pump station.

Boones Ferry Pump Station

The Boones Ferry Pump Station is located near the intersection of SW Boones Ferry Road and SW Mohawk Street in a below-grade, cast-in-place, concrete vault. The pump station houses two (2) centrifugal pumps. The two (2) 25-hp pumps provide backup water supply from Service Area A to Service Area B when the Boones Ferry control valve connection is out of service. Each of these pumps has a nominal capacity of approximately 500 gpm. A portable power generator connection is provided at the pump station.

Norwood Pump Station

The Norwood Pump Station is located near the Norwood Reservoirs and houses two (2) end-suction centrifugal pumps. Two (2) 75-hp pumps with variable frequency drives supply water from Service Area B to Area C from the transmission line that connects the Norwood Reservoirs to Service Area B. Each of these pumps has a nominal capacity of approximately 1,400 gpm. A portable power generator connection is provided at the pump station.

CONTROL VALVES

Automatic control valves are critical to the normal operation of the City's water system. The City's source water is at a higher hydraulic grade than the distribution system, although Service Area C is not able to be supplied by gravity.

Flow from the Portland Supply Main into Service Areas A and B is regulated by flow control valves (FCV) and PRVs. The Bridgeport Service area is supplied by PRVs from the Portland Supply Main and a backup supply from the City of Tigard. A summary of the City's supply

control valves is presented in Table 2-4. Service Area C is supplied from Service Area B through booster pumping at the Norwood Pump Station. Combination pressure reducing/pressure sustaining (PRPS) valves are located between service areas to help maintain adequate service pressure throughout the distribution system and are summarized in Table 2-5. All control valve locations are shown on Figure 2-1.

Table 2-4 | Supply Control Valves Summary

Valve ID	Type	Upper Zone	Lower Zone	Ground Elev. (ft)	Low Flow		High Flow	
					Size	HGL	Size	HGL
72nd Ave	FCV-PRV	PSM	A	175	6"	175	12"	288
City Park	FCV-PRV	PSM	A	113	3"	113	12"	260
108th Operations	FCV-PRV	PSM	A	124	8"	123	--	123
Leveton	FCV-PRV	PSM	A	141	4"	141	12"	256
Bridgeport (Tualatin)	PRV	PSM	BP	175	3"	117.5	8"	--
Bridgeport (Tigard)	PRV	PSM	BP	175	3"	117.5	8"	--
Boones Ferry	FCV-PRV	PSM	B	168	--	--	10"	422

Notes:
HGL = Hydraulic Grade Line, reported in feet
FCV = Flow Control Valve
PRV = Pressure Reducing Valve
PSM = Portland Supply Main
BP = Bridgeport Service Area

Table 2-5 | Distribution Control Valves Summary

Valve ID	Type	Area A Full Pressure	Area B Full Pressure	Area A ON/OFF Sustaining Minimum Pressure	Area B OFF Override Minimum Pressure
Avery Street	PRPS	56	101	35	84
65th Avenue	PRPS	70	116	50	99
Chesapeake Drive	PRPS	49	94	28	78
Mohawk Street	PRPS	62	107	41	91
57th Avenue	PRPS	55	100	34	84
Valve ID	**Type**	**Area B Full Pressure**	**Area C Full Pressure**	**Area B ON/OFF Sustaining Minimum Pressure**	**Area C OFF Override Minimum Pressure**
Dakota Drive	PRPS	54	100	33	84
Osage Street	PRPS	54	101	33	84

Notes:
Pressures are reported in pounds per square inch (psi)
PRPS = combination pressure-relief and pressure-sustaining valve

DISTRIBUTION SYSTEM

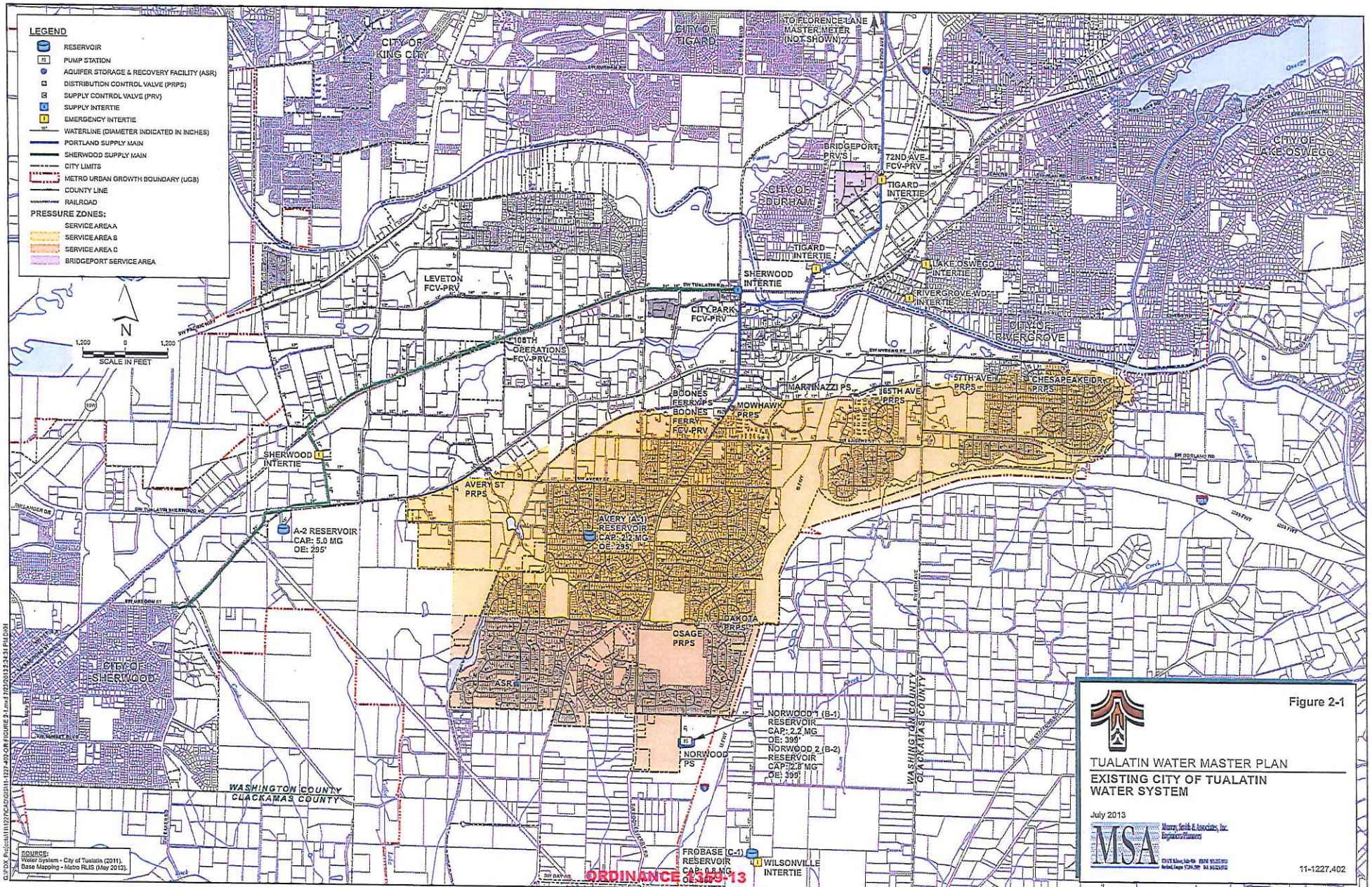
The water service area water distribution system is composed of various pipe types in sizes up to 36 inches in diameter. The total length of piping in the service area is approximately 115 miles. The distribution piping materials include asbestos cement, cast iron, and ductile iron. Transmission piping also includes 36-inch diameter Ameron concrete cylinder pipe and coal tar coated cement lined steel pipe. The majority of the piping in the system is ductile iron piping. Table 2-6 presents a summary of pipe lengths by diameter.

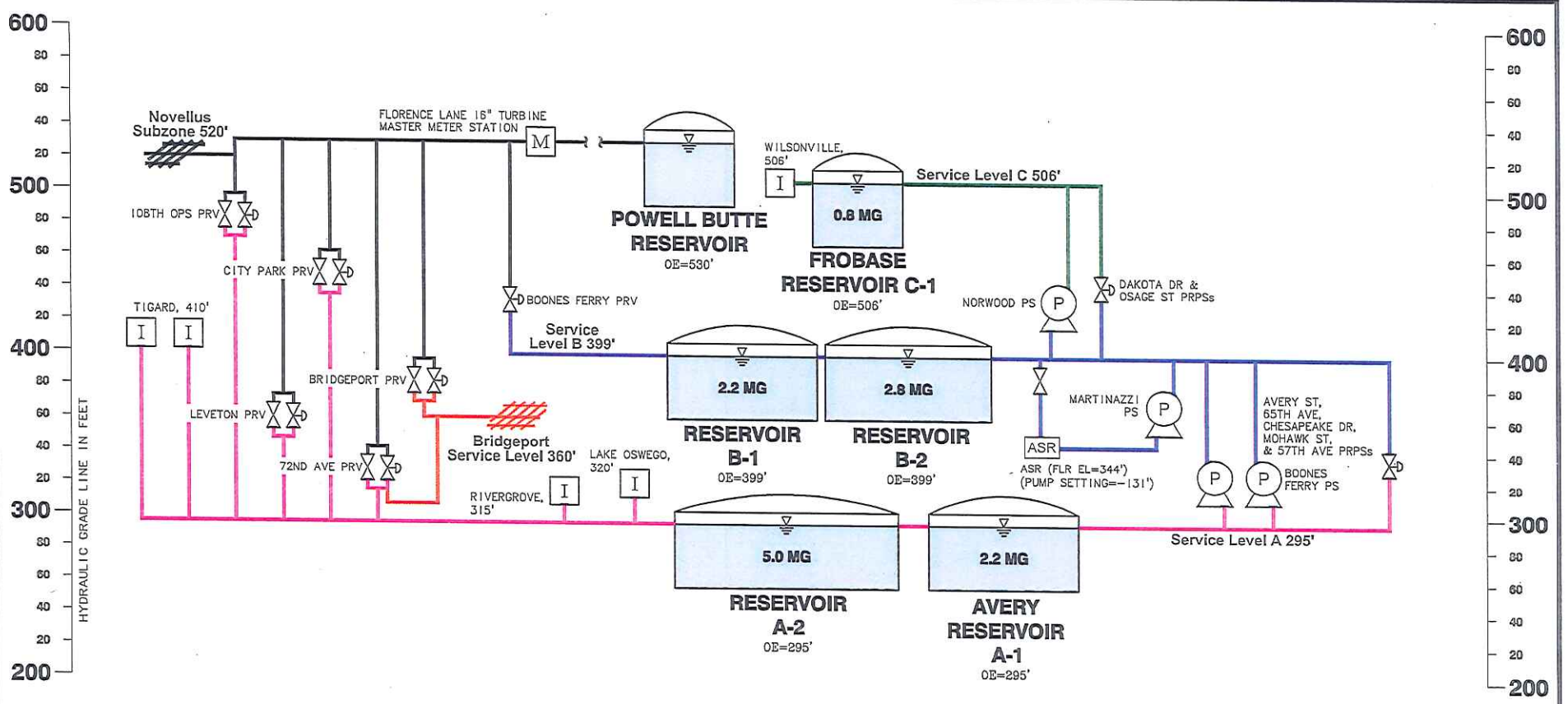
Table 2-6 | Transmission and Distribution System Pipe Summary

Size (in)	Pipe Length (miles) by Pipe Material					
	AC	CI	DI	CCP	STL	Total
≤ 4	0.06		3.46			3.52
6	0.47	2.84	10.14			13.45
8	0.11	2.43	33.81			36.35
10	0.57	0.35	7.78			8.70
12	0.48	9.34	25.16			34.98
16			5.28			5.28
18			2.16			2.16
24[1]			4.96			4.96
36[2]				4.76	1.26	6.02
Total	1.69	14.96	92.75	4.76	1.26	115.42

Notes:

1) Does not include the 24-inch diameter transmission pipe owned by the City of Sherwood.
2) Includes the 36-inch diameter transmission pipe from the Florence Lane Master Meter south (Portland Supply Main).
3) Pipe materials are: AC: asbestos concrete, CI: cast iron, DI: ductile iron, CCP: concrete cylinder pipe, STL: coal tar coated steel pipe





LEGEND

- SERVICE LEVEL A – 295'
- SERVICE LEVEL B – 399'
- SERVICE LEVEL C – 506'
- BRIDGEPORT SERVICE LEVEL – 360'
- FLOW CONTROL VALVE (FCV)
- PRESSURE REDUCING VALVE (PRV) OR PRESSURE RELIEF/PRESSURE SUSTAINING VALVE (PRPS)
- ASR — AQUIFER STORAGE & RECOVERY (ASR) WELL
- I — EMERGENCY INTERTIE
- M — METER STATION
- P — PUMP STATION (PS)
- 1.0 MG — STORAGE TANK
  - CAPACITY
  - OE=1240' — OVERFLOW ELEVATION

Figure 2-2

TUALATIN WATER MASTER PLAN

EXISTING CITY OF TUALATIN WATER SYSTEM HYDRAULIC SCHEMATIC

July 2013

MSA Murray, Smith & Associates, Inc. Engineers/Planners

11-1227.402

GENERAL

This section presents population projections and the development of water demand forecasts for the City of Tualatin's (City) water service area. Population and water demand forecasts are developed from regional and City planning data, current land use designations, historical water demand records, and previous City water supply planning efforts. Also included in this section is a description of the water service area limits.

PLANNING AND SERVICE AREAS

The current water service area is the area within the existing city limits plus two (2) small areas that are served by the City that are outside the city limits. All of the Bridgeport Village commercial area in the northeast area of the City is served by the City including the movie theatre which is in the City of Tigard. East of the freeway, the residential lots between the Tualatin River and the City's service area along SW Childs Road in the City of Rivergrove are also served by the City of Tualatin. These areas are illustrated in Figure 3-1.

There are two (2) planning areas which have been previously developed and characterized. These include the Town Center Planning Area, the Southwest Concept Plan Area. The City's Urban Growth Boundary (UGB), which includes the 5,198 acres within the city limits, encompasses a 6,023 acre planning area. Figure 3-1 at the end of this section illustrates the City's service area.

The Basalt Creek Planning Area is located between the Cities of Tualatin and Wilsonville. Approximately half of the planning are is anticipated to ultimately be incorporated and developed by each city. Since concept planning has not been completed, the Basalt Creek Planning Area is not considered as part of this plan. After the concept plan is adopted, the City will update this Master Plan to include the Basalt Creek Planning Area.

Town Center Planning Area

Located within the city limits, the approximately 426 gross acres Town Center planning area is intended for long-range planning redevelopment to include a higher density of jobs, business floor space, and residences in the downtown Tualatin business area. Current planning anticipates a population increase from 131 to 1,048 residents over the next 20 years (Memorandum, "Urban and Rural Reserves Local Aspirations-Town Center, Commercial, Industrial and Stafford Basin, Prepared by City of Tualatin, April 13, 2009). Increased business space may result in the need for additional fire flow capacity to the Town Center, depending upon the actual specific development. Some additional demand is associated with the increase in developed commercial space. As the Town Center Planning Area is within the planning area, the projected population and water demand growth is incorporated in the respective forecasts.

Southwest Tualatin Concept Area

The Southwest Tualatin Concept Area, as considered in this study, includes the 431 gross acres with the existing UGB to include approximately nine (9) acres within the city limits west of SW Tonquin Road. The area is anticipated to be zoned a mix of industrial and commercial with significant large water users. No residential zoning is anticipated. The 2011 Southwest Tualatin Concept Plan (Prepared by CH2M-Hill, August 3, 2005) identified 352 acres of developable land for industrial and business park land uses. In 2010, Area 1 was added to the SW Concept Plan (2010 Update, Southwest Tualatin Concept Plan, prepared by the City of Tualatin, accepted by City Council October 11, 2010). Area 1 included 19 acres of industrial land.

PLANNING PERIOD

The planning period for this master plan is approximately 20 years. Certain planning and facility sizing efforts will use estimated water demands at build-out development. Build-out development occurs when all existing developable land within the planning area has been developed to its ultimate capacity according to current land use and zoning designations. Planning and analysis for transmission and distribution facilities is based on build-out development of the City's water system planning area. This assumption allows for a determination of the ultimate size of facilities. Typically, if substantial improvements are required beyond the planning period in order to accommodate water demands at build-out development, staging is often recommended for certain facilities where incremental expansion is feasible and practical. Unless otherwise noted, recommended improvements identified in this plan are sized for build-out development within the water system planning area.

HISTORICAL POPULATION

The existing population and total number of dwelling units within the City's water service area were derived from current City planning data supported by estimates from the United States 2010 Census and Portland State University Population Research Center (PRC) which provides current and historical population estimates for incorporated areas within the State of Oregon. Estimates of the City's historical population are taken from the 2010 Oregon Population Report (PRC, March 2011) and 2011 certified population estimates (PRC, December 2011) and are summarized in Table 3-1. The historical population estimates show a decrease from 2009 to 2010 when the estimate method was updated to reflect the 2010 Census value. Table 3-1 also includes a historical summary of total water service connections per City records.

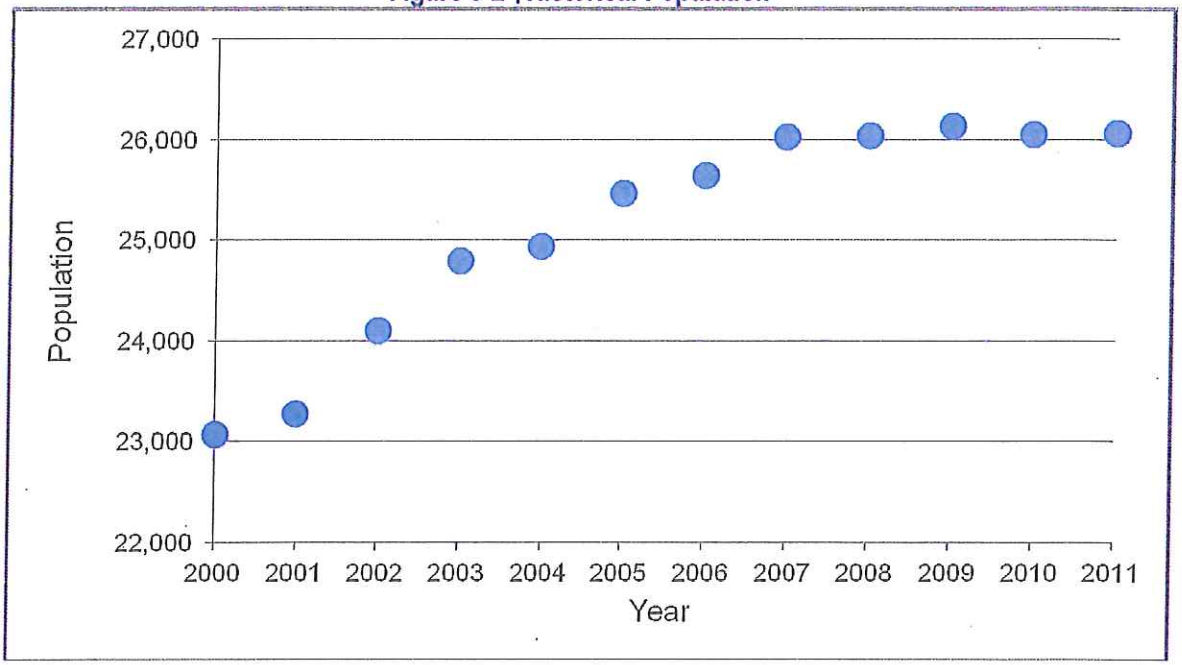
Table 3-1 | Historical Population and Water Services Summary

Year	City of Tualatin Population	Number of Water Services		
		Residential	Non-Residential	Total
2006	25,650	5,779	725	6,504
2007	26,025	5,852	736	6,588
2008	26,040	5,883	748	6,631
2009	26,130	5,877	770	6,647
2010	26,054	5,882	778	6,659
2011	26,060	5,897	773	6,660

The City supplied water to approximately 26,060 people in the water service area through approximately 773 commercial/industrial/institutional and 5,897 residential service connections, during 2011.

The historical annual population growth in the City over the 2000 through 2010 period was approximately 1.3 percent with a maximum annual rate of 3.6 percent between 2001 and 2002. The historical city population is illustrated in Figure 3-2.

Figure 3-2 | Historical Population



POPULATION FORECASTS

Build-out Population Estimate

A useful planning condition is the ultimate, or build-out, population. The build-out condition is commonly used to size the future capacity of water system infrastructure. The forecasted population at build-out development for the City's water system planning area was taken from City planning data as discussed below.

Redevelopment and Infill. For areas within the city limits, the City completed an estimate of ultimate population capacity using City and Metro planning data for vacant and developable lands and current residential densities to determine the number of potential dwelling units within the existing city limits and selected portions of the Metro UGB (Memorandum, "Tualatin Residential and Nonresidential Capacity Estimate 2011", Prepared by Colin Cortes, City of Tualatin, September 1, 2011). The analysis concluded that 2,288 additional residents can be accommodated by redevelopment and development of vacant lands in the city.

Town Center Planning Area. The planning for the city's Town Center, (Memorandum, "Urban and Rural Reserves Local Aspirations- Town Center, Commercial, Industrial and

Stafford Basin," prepared by City of Tualatin, April 13, 2009), envisions an increased residential population as well as an increase in office space through construction of more multistory buildings. By 2030, the plan anticipates an increased residential population of 131 to 1,048.

Build-out Population Estimate. No residential zoning is anticipated within the Southwest Concept Area, so it does not contribute to the build-out population. The projected build-out population is estimated as the current population of 26,060, plus the following growth elements for a total of 29,396 residents.

- 2,288 residents due to redevelopment and infill,
- 1,048 residents added to the Town Center.

Future Population Estimates

An estimate of the annual population growth rate for the short-term planning horizon needs to be consistent with other planning data, be consistent with historical trends and known population drivers, and be somewhat conservative when the population forecast will be used to determine the needed water supply capacity. The City's historical annual growth rate over the last 5-year period is 0.46 percent per year. Given that the City has seen the development of most of its large, residentially-zoned areas, this rate was assumed for projecting further population growth. The 5-year, 10-year and 20-year projected population forecasts are presented in Table 3-2.

Table 3-2 | Population Forecast Summary

Year	Population
Current (2011)	26,060
2016	26,665
2021	27,284
2031	28,565
Build-out (~2039)	29,396

HISTORICAL WATER USAGE

Terminology used in this section to describe uses of drinking water supplied by the municipal water system is defined below:

- ***Water demand*** refers to all of the water requirements of the system including domestic, commercial, municipal, institutional, industrial and unaccounted-for water.
- ***Water production*** is the amount of water produced and delivered to the distribution system. The City of Tualatin does not produce water, but purchases wholesale water from the Portland Water Bureau (PWB). For the purposes of this study, water production is equivalent to water purchases.
- ***Water consumption*** is the amount of metered water usage billed to customers by the City. Consumption is also commonly referred to as customer usage.

- ***Unaccounted-for water*** includes system leakage, or water loss, and unmetered uses. Unaccounted-for water is the difference between water demand and water consumption.
- ***Peaking factor*** is the ratio of maximum day demand (MDD) to average daily demand (ADD). It is a useful tool for characterizing the total water system demands.

Water usage is discussed in terms of volume (gallons) per unit of time such as gallons per day (gpd), million gallons per day (mgd) or gallons per minute (gpm). Demands are also related to per capita use as gallons per capita per day (gpcd). The City maintains daily water purchase records which are used to estimate water demands. Table 3-3 summarizes this data for the years 2006 through 2011.

Table 3-3 also shows the historical purchase of water by the City of Sherwood from the PWB and wheeled through the City of Tualatin infrastructure. The City of Sherwood is currently completing improvements to begin supply of water from the Willamette River Water Treatment Plant in Wilsonville. For water system infrastructure planning purposes, it is assumed that the City of Sherwood will not continue to purchase water from the PWB through City of Tualatin facilities for non-emergency water supply.

Table 3-3 | Historical Water Consumption

Year	Total Purchases (mgd)	Consumption (mgd)			
		City of Tualatin	City of Sherwood	Combined	Unaccounted-for Water
2006	5.03	4.25	0.58	4.83	4.0%
2007	5.48	4.26	0.97	5.23	4.6%
2008	5.81	4.16	1.44	5.60	3.6%
2009	5.29	3.81	1.46	5.27	0.4%
2010	4.62	3.63	0.99	4.62	0.0%
2011	4.85	3.60	1.16	4.76	1.8%
Average	*5.18*	*3.95*	*1.10*	*5.05*	*2.4%*

Table 3-4 presents water consumption by customer class. The City has significant commercial and industrial water consumption. Approximately 40 percent of the total annual water consumption is by commercial and industrial customers.

Historically, ADD within the City has been approximately 3.6 to 4.5 mgd and per capita consumption has ranged from approximately 139 to 174 gpcd. Recent MDD has been as high as approximately 9.0 mgd, with a MDD per capita demand range of approximately 275 to 360 gpcd. MDD to ADD peaking factors varied from 1.9 to 2.2. Table 3-5 summarizes this data for the years 2006 through 2011 to include residential and commercial/industrial usage rates. As illustrated in Figure 3-3 at the end this section, it should be noted that the trend in water use appears to be decreasing for all customer classes. Possible contributing influences include weather temperatures, conservation efforts and increased water efficiency appliances, and economic considerations.

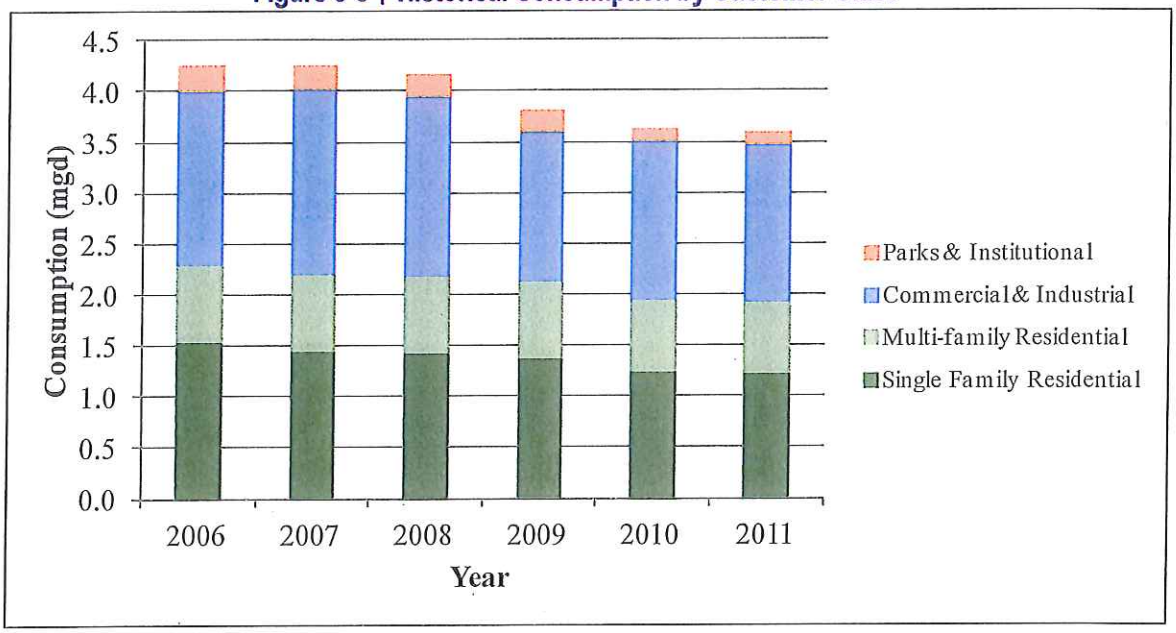
Table 3-4 | Historical Water Consumption by Customer Class							
Year	Water Consumption (mgd)					Residential Use (gpcd)	Commercial/ Industrial Use (gpad)
	SFR	MFR	Commercial/ Industrial	Other[1]	Total		
2006	1.53	0.76	1.71	0.25	4.25	89	648
2007	1.44	0.76	1.81	0.24	4.26	85	686
2008	1.42	0.75	1.78	0.21	4.16	83	672
2009	1.37	0.75	1.49	0.21	3.81	81	561
2010	1.23	0.71	1.55	0.14	3.63	75	586
2011	1.22	0.70	1.55	0.13	3.60	74	585
Average	*1.37*	*0.74*	*1.65*	*0.20*	*3.95*	*81*	*623*

Notes:
1) "Other" class includes institutional and city government uses.
2) Abbreviations: single family residential (SFR); multifamily residential (MFR); gallons per capita per day (gpcd); gallons per acre per day (gpad)

Table 3-5 | Historical Water Demand Trends										
Year	Population	Average Day		Peak Season[1]		Max. Month[2]		Max. Day		Peaking Factor[3]
		(mgd)	(gpcd)	(mgd)	(gpcd)	(mgd)	(gpcd)	(mgd)	(gpcd)	
2006	25,650	4.45	174	6.89	268	7.92	309	9.03	352	2.03
2007	26,025	4.51	173	6.46	248	7.05	271	9.34	359	2.07
2008	26,040	4.38	168	6.72	258	7.88	303	8.98	345	2.05
2009	26,130	3.83	146	6.04	231	7.09	271	8.49	325	2.22
2010	26,054	3.63	139	5.68	218	6.79	261	7.79	299	2.14
2011	26,060	3.69	142	5.38	206	6.38	245	7.12	273	1.93

Notes:
1) Peak Season Demand is the average daily demand for the 92 days of the peak water use season; defined as July 1st to September 30th.
2) Peak Month Demand is the average daily demand for the 31 days of the peak water use month based on available data.
3) The peaking factor is the ratio of the maximum day demand to the average day demand.

Figure 3-3 | Historical Consumption by Customer Class



WATER DEMAND PROJECTIONS

Estimates of future water demands were developed separately for three customer classes - residential, commercial/industrial, and institutional/other – based on City water demand and planning data to estimate the total future water demand forecast. Institutional water use was a small component and assumed to be constant. The historical average residential water consumption rate was approximately 81 gallons per capita per day (gpcd) with a peak of approximately 89 gpcd in 2006. A per capita residential ADD of 90 gpcd is estimated for planning purposes.

The historical commercial and industrial 6-year average water use is approximately 825 gallons per acre per day (gpad) with a peak use of 907 gpad in 2007. Commercial and industrial billing records were used to determine annual consumption and the City's vacant land information was applied to the zoning information to determine the total acreage of active commercial and industrial land. A per acre commercial and industrial demand of 870 gpad for existing areas is estimated for planning purposes. The historical peaking factors are shown in Table 3-5 and ranged from 1.9 to 2.2. A MDD peaking factor value of 2.2 is assumed for water system planning purposes.

The water demands associated with the major planning areas are discussed below.

Town Center Planning Area

The approximately 426 gross acres Town Center planning area, as shown in Figure 3-1, is intended for long-range planning redevelopment to include a higher density of jobs, business floor space, and residences. Current planning anticipates a population increase from 131 to 1,048 residents over the next 20 years (Memorandum, "Urban and Rural Reserves Local

Aspirations - Town Center, Commercial, Industrial and Stafford Basin, Prepared by City of Tualatin, April 13, 2009). Increased business space may result in the need for additional fire flow capacity to the Town Center, depending upon the actual specific development. Some additional demand is associated with the increase in developed commercial space. As the Town Center Planning Area is within the planning area, the projected population increase is used to forecast the water demand growth.

Southwest Tualatin Concept Area

The Southwest Tualatin Concept Area includes 352 acres identified as developable land for industrial and business park land uses outside the existing service area and further identified an additional 88 acres of "wet" industry, or large water users, with an ADD of approximately 1 mgd. The existing ADD rate of 720 gpad is allocated to these areas resulting in a total increased ADD of 1.25 mgd.

Water Demands

Using the per capita residential water demand rate of 90 gpcd and the commercial/industrial per acre demand rate of 870 gpad, as well as planning area specific forecasts reported by others, water demand forecasts were made. Institutional water demand was assumed to remain constant. Table 3-6 presents the average daily water demand projections by customer class and the forecasted of 5.9 mgd in 2031. Table 3-7 summarizes the projected total system water demands to include a current MDD of 9.5 mgd and a 2031 MDD of 13 mgd. Peak season, peak month, and maximum day and peak hour demands are estimated from the average day demand using constant multipliers of 1.6, 1.9, .2.2 and 3.74, respectively. These factors were determined from historical records, except for the peak hour demand. Information is not available to estimate peak hour demand, so a typical value of 1.7 times MDD was assumed.

Table 3-6 | Average Daily Water Demand Projection by Customer Class Summary

Year	Population	Forecasted ADD (mgd)			
		Total	Combined Residential	Commercial/ Industrial	Institutional/ Other
Current	26,060	4.31	2.35	1.75	0.21
2016	26,665	4.70	2.40	2.09	0.21
2021	27,284	5.10	2.46	2.44	0.21
2031	28,565	5.93	2.57	3.15	0.21
Build-out	29,396	6.47	2.65	3.61	0.21

Table 3-7 | Water Demand Projection Summary						
Year	Population	Water Demand (mgd)				
		Average Day Demand	Peak Season Demand[1]	Peak Month Demand[2]	Maximum Day Demand	Peak Hour Demand
Current	26,060	4.31	6.90	8.19	9.48	16.12
2016	26,665	4.70	7.52	8.93	10.34	17.58
2021	27,284	5.10	8.16	9.69	11.22	19.08
2031	28,565	5.93	9.49	11.27	13.05	22.19
Build-out	29,396	6.47	10.35	12.29	14.24	24.20

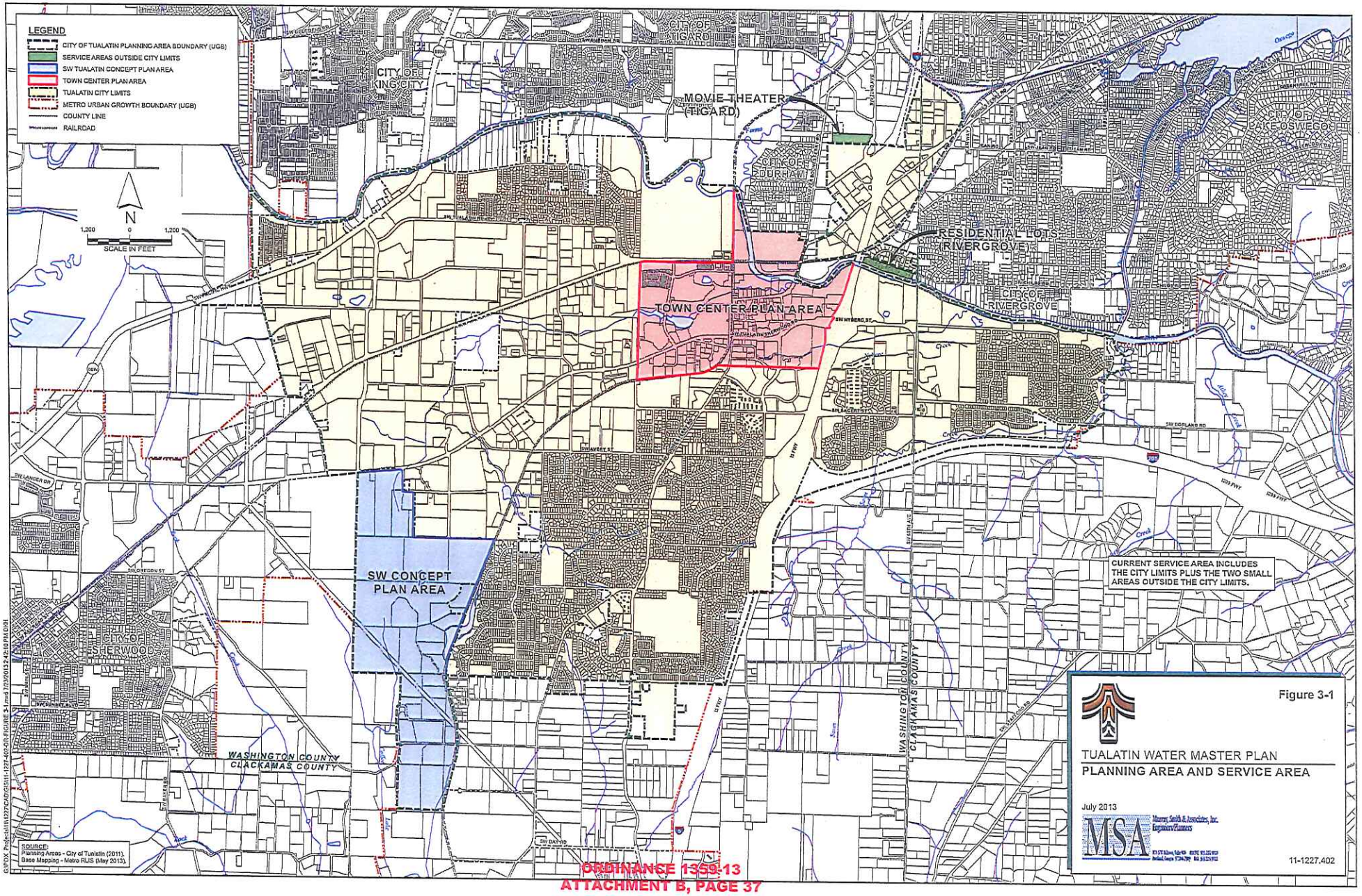
Notes:

1) Peak Season Demand is the average daily demand for the 92 days of the peak water use season; defined as July 1st to September 30th.
2) Peak Month Demand is the average daily demand for the 31 days of the peak water use month based on available data. The peak month in the Pacific Northwest is usually either July or August.

SUMMARY

The City's water system planning area, which includes all developable land within the current UGB, encompasses approximately 6,668 acres. Land use analysis and growth rates developed by the City anticipate an ultimate population within the planning area of approximately 31,972 residents.

The City's current average daily demand is approximately 4.3 mgd with a maximum day water demand of approximately 9.5 mgd. At build-out development, the anticipated ADD demand is approximately 6.5 mgd and the MDD is approximately 14 mgd within the City's planning area.



SECTION 4

GENERAL

This section presents the planning and analysis criteria used for the City of Tualatin's (City) water system analysis. Criteria are presented for water supply source, distribution system piping, service pressures, storage and pumping facilities. Recommended water needs for emergency fire suppression are also presented. These criteria are used in conjunction with the water demand forecasts presented in Section 3 to complete the analysis of the City's water distribution system presented in Section 5.

WATER SUPPLY SOURCE

As described in Section 2, the City's sole water supply is wholesale water purchased from the Portland Water Bureau (PWB). The transmission system delivering water from the Florence Lane Master Meter to the City must be adequate to supply the city-wide maximum day demand (MDD). As the City water demand increases with growth, the City intends to operate one aquifer storage and recovery (ASR) facility to manage peak season water purchases and alleviate transmission capacity improvements.

DISTRIBUTION SYSTEM

The water distribution system should be capable of operating within certain system performance limits, or guidelines, under several varying demand and operational conditions. The recommendations of this plan are based on the following performance guidelines, which have been developed through a review of State of Oregon requirements, American Water Works Association (AWWA) acceptable practice guidelines, Insurance Services Office, Inc. (ISO) guidelines and operational practices of similar water providers. The recommendations are as follows:

- The distribution system should be capable of supplying the peak hourly demand while maintaining minimum service pressures of not less than approximately 75 percent of normal system pressures. The system should meet this criterion with the reservoirs approximately one-half full.
- The distribution system should be capable of providing the recommended fire flow to a given location while, at the same time, supplying the MDD and maintaining a minimum residual service pressure at any meter in the system of 20 pounds per square inch (psi). This is the minimum water system pressure required by the State of Oregon Health Authority, Drinking Water Program. The system should meet this criterion with the reservoirs approximately one-half full.

Typically, proposed or new water mains should be at least 8 inches in diameter in order to supply minimum fire flows. In special cases, 6-inch diameter mains are acceptable if no fire hydrant connection is required, there are limited services on the main, the main is dead-ended, and looping or future extension of the main is not anticipated.

SERVICE AREA PRESSURE

As discussed in Section 2, water distribution systems are typically separated into pressure zones or service areas to provide service pressures within an acceptable range to all customers. The existing water service area distribution system is divided into four (4) service areas or pressure zones. Pressure zones are usually defined by ground topography and designated by overflow elevations of water storage facilities or outlet settings (discharge pressure) of pressure reducing facilities or pump stations serving the zone. Typically, water from a reservoir will serve customers by gravity within a specified range of ground elevations so as to maintain acceptable minimum and maximum water pressures at individual service connections. When it is not feasible or practical to have a separate reservoir serving each pressure zone, pumping facilities or pressure reducing facilities are used to serve customers in different pressure zones from a single reservoir.

Generally, 80 psi is considered the desirable upper pressure limit and 35 psi the lower limit. Whenever feasible, it is desirable to achieve the 35 psi lower limit at the point of the highest fixture within a given building being served. Conformance to this pressure range may not always be possible or practical due to topographical relief, existing system configurations and economic considerations. In the case of the upper pressure limit, while pressures in excess of 100 psi may be acceptable in water mains, services must be equipped with individual pressure reducing valves (PRVs) to maintain their static pressures at no more than 80 psi. Table 4-1 summarizes the service pressure criteria used in the analysis of the water system.

Table 4-1 | Recommended Service Pressure Criteria

Condition	Pressure(psi)
Minimum Service Pressure Under Fire Flow Conditions	20
Minimum Normal Service Pressure	35
Maximum Service Pressure	80

STORAGE VOLUME

General

Water storage facilities are typically provided for three purposes: equalization storage, fire storage, and emergency storage. A brief discussion of each storage element is provided below. This three-component criterion for storage volume is commonly used by other water providers and by the AWWA.

Equalization Storage

Equalization storage is required to meet water system demands in excess of delivery capacity from the supply source to system reservoirs. Equalization storage volume should be sufficient to supply demand fluctuations throughout the day resulting from typical customer water use patterns and is generally considered as the difference between peak hour demand and MDD on a

24-hour duration basis. In other words, equalization storage is the volume of water available to meet system demands when demands exceed the capacity of the supply source. Standard industry practice indicates that equalization storage equal to approximately 25 percent of a system's MDD is typically sufficient for analysis and planning purposes.

Fire Storage

Fire storage should be provided to meet the single most severe fire flow demand within each pressure zone. The fire storage volume is determined by multiplying the recommended fire flow rate by the expected duration of that flow. Specific fire flow and duration recommendations are discussed later in this section.

Emergency Storage

Emergency storage is often provided to supply water from storage during emergencies such as pipeline failures, equipment 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 that would supply a maximum day's flow or higher. A reasonable volume for emergency storage for the water service area is approximately two (2) days of average demand. This amount of storage volume for emergency purposes is consistent with accepted water industry practices and guidelines for systems with interties with other providers for emergency supply.

Summary

The recommended system-wide storage volume is the sum of the equalization, fire and emergency storage volume components.

PUMPING STATION CAPACITY

Pumping capacity requirements vary depending on available storage and the number of pumping facilities serving a particular pressure zone. Firm pumping capacity is defined as a station's pumping capacity with the largest pump out of service. Back-up power is recommended for all stations in the event of power failure. When pumping to storage facilities, a firm pumping capacity equal to the pressure zone's MDD is recommended.

FIRE FLOW RECOMMENDATIONS

While the water distribution system provides water for domestic, commercial, industrial and other uses, it is also expected to provide water for fire suppression. The rate of flow of water recommended for fire suppression purposes is typically associated with the local building type or land use of a specific location within the distribution system. Fire flow recommendations are typically much greater in magnitude than the normal MDD present in any local area. Adequate hydraulic capacity must be provided for these potential large fire flow demands.

Fire protection for the City's service area is provided by Tualatin Valley Fire & Rescue. The fire district has adopted fire flow requirements as defined in the 2010 State of Oregon Fire Code. A

summary of fire flow recommendations based on the state fire code, fire flow criteria adopted by similar communities and fire flow guidelines as developed by the AWWA is presented in Table 4-2. Water stored for fire suppression is typically provided to meet the single most severe fire flow demand within each zone. The recommended fire storage volume is determined by multiplying the fire flow rate by the duration of that flow. Table 4-3 summarizes fire flow durations recommended by the AWWA.

Table 4-2 | Summary of Recommended Fire Flows

Land Use Type	Applicable Zoning	Recommended Fire Flow (gpm)
Single-family Residential	RL, RML	1,000
Multi-family Residential	RMH, RH, RH-HR	2,000
Commercial/ Institutional/ Industrial	CO, CN, CR, CC, CG, ML MG, IN	3,500

Table 4-3 | Fire Flow Duration Summary

Recommended Fire Flow (gpm)	Duration (hours)
Up to 3,000	2
3,000 to 3,500	3
Greater than 3,500	4

SUMMARY

The criteria developed in this section are used in Section 5 to assess the system's ability to provide adequate water service under existing conditions and to guide improvements needed to provide service for future water needs. Recommended planning criteria for the City's source, pumping stations, distribution system, pressure zones, and storage facilities are summarized as follows:

- ***Source Capacity:*** Transmission capacity should deliver MDD.
- ***Pumping Station Capacity:*** When pumping to storage facilities, pumping stations should have a firm pumping capacity equal to the pressure zone's MDD.
- ***Distribution System Criteria:*** The distribution system should be capable of supplying the peak hourly demand while maintaining minimum service pressures of not less than approximately 75 percent of normal system pressures.
- ***Service Pressure Criteria:*** Minimum static system service pressures within each pressure zone should be at least 35 psi at the highest fixture in any building being served. Maximum static service pressure should not exceed approximately 80 psi.
- ***Storage Volume Criteria:*** Total storage volume should be the sum of the operational, fire and emergency storage volume components.

- *Fire Flow Criteria:* The distribution system should be capable of supplying the recommended fire flows while maintaining minimum residual pressures everywhere in the system of not less than 20 psi.

SECTION 5

GENERAL

This section describes the analysis of the City of Tualatin's (City) water distribution system and water supply needs. The analysis is based on water demands presented in Section 3 and the planning and analysis criteria outlined in Section 4. This section includes a detailed evaluation of the City's distribution system and presents findings of a computerized hydraulic network analysis of the system. Included in the analysis is an evaluation of the system's existing pressure zones, pump stations and storage facilities. The findings and recommendations of this water system analysis are developed into a capital improvement program (CIP) which is summarized in Section 7.

DISTRIBUTION SYSTEM ANALYSIS

General

A hydraulic network analysis computer program was used to evaluate the performance of the existing distribution system and to aid in the development of proposed system improvements. The computerized model of the City's water system uses a digital base map of the distribution system and the InfoWater hydraulic network analysis software. The purpose of the model is to determine pressure and flow relationships throughout the distribution system for a variety of critical water demand and hydraulic conditions. System performance and adequacy is then evaluated on the basis of planning criteria presented in Section 4.

Computerized Hydraulic Network Analysis Model

The City's previous hydraulic model was developed using the H20-Map software. This model was converted to Innovyze's InfoWater software and the model was updated. Updates included comparison of the model to geographical information systems (GIS) data provided by the City, updated reservoir and pump station data, and current control valve setting information. Portions of the distribution system that had developed since the previous model development were added to the model network. The updated model files and supporting database were then used to perform the system analysis and to illustrate recommended improvements. A map of the water system and the recommended capital improvements is presented as "Water System Improvements", Plate 1 in Appendix A.

All pipes are shown as links between nodes which represent pipeline junctions or pipe size changes. Pipes and nodes are numbered to allow for easy system updating and revision. These numbers have not been shown on Plate 1 for drawing clarity but are available within the computer model for future use. Diameter and length are specified for each pipe although only pipe diameters are illustrated for drawing clarity. Pipe lengths are drawn to approximate scale. An approximate ground elevation is specified for each node. Ground elevations with 10-foot contours for the City's Urban Growth Boundary (UGB) and surrounding area were assigned to nodes using available United States Geological Survey (USGS) topographic data. Hydraulic elements, such as pressure reducing valves, pump stations and reservoirs, are also illustrated and operating parameters are incorporated into the model database.

Modeling Conditions

The analysis of the existing and proposed system was performed to assess the distribution system's ability to provide recommended fire flows throughout the system during maximum day demand (MDD) conditions. The system's adequacy under existing demand conditions was evaluated first. Existing current water demands as presented in Section 3 were applied to the existing system. The analysis was then extended to evaluate system performance under water demands at build-out development.

All hydraulic analyses assume that the City's storage reservoirs are approximately one-half full and that the pump stations are not operating. Fire flow scenarios test system performance in providing the recommended fire flow to a given location while at the same time supplying the MDD and maintaining a minimum residual service pressure of 20 pounds per square inch (psi) at all service meters in the system.

Demand Allocation

The water system demands were allocated to each service area as shown in Table 5-1. Within each service area, the total residential and total commercial/industrial/institutional demands were allocated uniformly amongst the model nodes. Service Area A includes the Bridgeport Service Area water demand. Service Area B includes the future demand associated with the SW Concept Plan Area at build-out development.

Table 5-1 | Demand Allocation Summary

Service Area	Maximum Day Demand (mgd)		
	2010	2030	Build-out
Area A[1]	5.3	6.2	6.7
Area B[2]	3.2	5.8	6.4
Area C	1.0	1.0	1.1
Total	9.5	13.0	14.2

Notes: 1) Includes the Bridgeport Service Area water demand.
2) Includes the SW Concept Plan Area

Model Calibration

For a hydraulic network model to provide accurate results under test conditions, the model is calibrated with field-measured data to ensure that modeled conditions reflect actual system operation. Data from fire hydrant flow tests are compared to pressure and flow results obtained from modeled demands placed at the same location. Calibration is generally considered successful when pressures measured during hydrant flow tests are within five (5) to 10 percent of the hydraulic model.

The previous H2O-Map model had been calibrated using fire hydrant flow test data. As the system updates were minor, the calibration was not repeated; however, the updated hydraulic model was verified using September 2011 fire hydrant flow test data to confirm the model is accurately predicting system performance at a number of locations.

Hydraulic Analysis Findings

Peak Hour Demand. The results of the peak hour demand analysis showed that the water distribution system is generally able to provide for peak hour demands meeting the pressure criterion presented in Section 4 under existing and build-out conditions. No specific deficiencies are observed under these conditions.

Maximum Day Demand. The results of the MDD analysis showed that the water distribution system is generally able to provide for MDD meeting the pressure criterion presented in Section 4 under existing and build-out conditions. It was observed that the flow from the Portland Supply Main was generally equal to the MDD under existing conditions, but was much less than the build-out MDD which includes significant increases in demand associated with the SW Concept Area. Adjustments to the City Park 12-inch PRV and 10-inch Boones Ferry PRV settings allowed the Portland Supply Main to supply demands in excess of the nominal capacity of 10.8 mgd. The City will need to evaluate the long-term capacity of the Portland Supply Main as discussed later in this section.

Fire Flow Analysis. The results of the fire flow analysis indicate that the City's water distribution system is currently generally able to supply the required fire flows presented in Section 4 while providing for existing MDD and maintaining minimum service pressures throughout the system. There are some areas where the required flow was not available while meeting the minimum service pressure requirements. Figures 5-1 and 5-2 illustrate system fire hydrant locations where the minimum service pressure requirements were not met under existing conditions and future build-out conditions with the existing infrastructure, respectively. Improvements for all deficiencies are not recommended, as discussed below. Recommended distribution system piping improvements are shown on Plate 1. Further descriptions of recommended distribution system improvements and cost estimates for these improvements may be found in Section 7.

Several areas were found to have deficient fire flow capacities for the land use zoning and existing conditions, but improvements were not recommended. The most common case is a fire hydrant located in a developed area that is able to provide 70 to 90 percent of the required fire flow that is also located within 500 feet of another hydrant that is able to provide the adequate capacity. The fire hydrants not meeting this condition are identified and illustrated in Figure 5-1 and discussed below:

NA-1: Several industrially-zoned and developed properties north of SW Herman Road are provided fire suppression water through several fire hydrants along 8-inch diameter dead end mains. These mains are inadequate to provide the full recommended industrial fire flow per the land use zoning. However, it is assumed that the buildings are equipped with fire suppression sprinklers and other fire suppression improvements which reduce the required water system fire flow capacity. As the land is already developed, no improvements are recommended. Should these areas redevelop, the City and Fire Marshall will review the fire flow capacity requirements of the new structures.

NA-2: An industrially-zoned and developed area at the end of SW 90th Court, south from SW Tualatin-Sherwood Road, is provided fire suppression water through several fire hydrants along a 10-inch diameter dead end main. The main is inadequate to provide the full recommended

industrial fire flow per the land use zoning; however, it is assumed that the buildings are equipped with fire suppression sprinklers and other fire suppression improvements which reduce the required water system fire flow capacity. As the land is already developed, no improvements are recommended. Should these areas redevelop, the City and Fire Marshall will review the fire flow capacity requirements of the new structures.

NA-3: The commercially-zoned property north of SW Nyberg Road occupied by the Kmart building and the buildings to the east are provided fire suppression water through several fire hydrants along an 8-inch diameter looped main. The main is inadequate to provide the full recommended industrial fire flow for the land use zoning; however, it is assumed that the buildings are equipped with fire suppression which reduces the required water system fire flow capacity. As the land is already developed, no improvements are recommended. Should these areas redevelop, the City and Fire Marshall will review the fire flow capacity requirements of the new structures.

NA-4: The residentially-zoned property along SW Mandan Drive is provided fire suppression water from 8-inch diameter mains. Where Service Areas B and C meet, the 8-inch diameter dead end mains are inadequate to provide the full recommended residential fire flow for the land use zoning; however, because the deficient hydrants are within 500 feet of one another and supplied from separate service areas, adequate fire suppression flow can be achieved from multiple hydrants and no improvements are recommended to address this deficiency.

NA-5: The residentially-zoned and developed area at the end of SW 103rd Court, north of SW Ibach Street, is provided fire suppression water through a fire hydrant along a 6-inch diameter dead end main. The main is inadequate to provide the full recommended residential fire flow per the land use zoning. The closest fire hydrant is 650 feet away near the intersection with SW Ibach Street. The developed residential lots, occupied by relatively new homes smaller than 3,600 square foot, are located between a city park to the west and a stormwater green space to the east. As such, a reduced fire flow availability of 1,000 gpm is acceptable for this development.

NA-6: The residentially-zoned and developed area at the end of SW Elk Horn Court, south of SW Avery Street, is provided fire suppression water through a fire hydrant along a 6-inch diameter dead end main. The main is inadequate to provide the full recommended residential fire flow for the land use zoning. The closest fire hydrant is approximately 700 feet away near the intersection with SW Avery Street. The developed residential lots are occupied by homes smaller than 2,300 square foot. As such, a reduced fire flow availability of 1,000 gpm is acceptable for this development.

Pressure Zone Analysis

As discussed in Section 2, the City is currently divided into three pressure zones. Typically, municipal water systems are designed to operate at static pressures ranging from 35 to 100 psi. The City's existing pressure zone configuration supplies water effectively within these pressure ranges. A summary of existing service areas and their static pressure ranges is shown in Table 5-2.

Table 5-2 | Pressure Zone Summary			
Service Area	Static Hydraulic Grade (ft)	Approximate Ground Elevation (ft)	Approximate Existing Static Pressure (psi)
A	295	88 - 202	40 - 90
B	399	192 - 306	40 - 90
C	506	260 - 360	63 - 106[1]
Bridgeport	360	185 - 200	69 - 76

Note: 1) Services in Service Area C with a pressure greater than 80 psi have individual service PRVs installed.

The Bridgeport Service Area is a commercial pressure zone with less than 20 feet of variation in ground elevation. During development of the commercial area, higher minimum service pressures, than were available from Service Area A, were desired which resulted in the Bridgeport Service Area being created and supplied independently from the Portland Supply Main.

Ground elevations in the SW Concept Area vary between 170 and 300 feet with most of the elevations between 190 and 260 feet; consequently, the SW Concept Area will largely be an extension of Service Area B. Some low elevation individual tax lots along SW Tualatin-Sherwood Road may be serviced from Service Area A. Some customers in the low elevations in the southeast portion of the expansion area may be served by pressure reducing valves either on individual services or as a pressure subzone from a common pressure reducing valve station.

PUMP STATION CAPACITY ANALYSIS

The City's existing water system contains three (3) pumps stations. The Norwood Pump Station supplies Service Area C from the Norwood Reservoirs. The Martinazzi and Boones Ferry Pump Stations serve as backup supply to Service Area B, boosting water from Service Area A, in the event that the Boones Ferry PRV is out of service.

As outlined in Section 4, firm pumping capacity is defined as a pump station's capacity with the largest pump out of service, or in the case of multiple pump stations serving the same service area, the largest single supply serving the zone is out of service. A firm pumping capacity equal to the MDD of Service Area C is recommended for the Norwood Pump Station. As the Martinazzi and Boones Ferry Pump Stations provide back-up supply to Service Area B., it is recommended that the total combined capacity of these pump stations be adequate to deliver MDD in the event of failure of the Service Area B primary supply from the Boones Ferry PRV.

Recommended pump station capacities are summarized in Table 5-3. The City's pump stations are adequate to meet existing recommended pumping capacities and future pumping capacities for Service Area C. In the future, improvements to the back-up capacity for Service Area B associated with growth in the SW Concept Area should be accomplished as the existing Service Area B pump station lacks the recommended future pumping capacity. Further discussion of pumping capacity improvement recommendations are presented in Section 7.

Table 5-3 | Pumping Capacity Recommendation Summary						
Pump Station	Estimated Total Station Capacity (mgd)		Service Area Supplied	Existing MDD (mgd)	2030 MDD (mgd)	Build-out MDD (mgd)
Boones Ferry Station	1.44	4.32 Total	B+C[1]	4.2	6.3	7.5
Martinazzi Station	2.88					
Norwood Station	2.02		C	1.0	1.0	1.1

Note: 1) Service Area C is supplied through Service Area B, therefore pumping capacity to Service Area B must be adequate to meet the MDD of both Service Area B and C.

STORAGE VOLUME ANALYSIS

Table 5-4 illustrates the individual storage components and combined storage needs recommended for operational, fire and emergency purposes for each service area under existing demand conditions and projected demands in the year 2031 and at build-out conditions. Further discussion of storage improvement needs and recommendations are presented in Section 7. The storage volume criteria developed in Section 4 are summarized below:

- Equalization Storage: 25 percent of MDD
- Fire Flow Storage: 2010 State of Oregon Fire Code:
  - Residential: 1500 gpm for 2 hours
  - Commercial/Industrial: 3500 gpm for 3 hours.
- Emergency Storage: Two times ADD

Service Area C has an existing storage volume deficit of approximately 0.5 mg. The City had already identified the Frobase Reservoir site for a second Service Area C reservoir (C-2) and has completed designs for a 1.0 mg reservoir. Project funding is being secured for construction. While Service Area C has a forecasted deficit of 0.1 mg after construction of the proposed C-2 reservoir, it is not recommended that additional storage be constructed within the planning period to address this deficiency given the uncertainty of actual development characteristics within this water service area

Service Areas A and B have adequate existing storage capacity but will require additional storage in the future. Most of this increased storage need is associated with expansion and development in the SW Concept Area which is located largely in Service Area B. Increased storage volume needs in Service Area A are associated with the Town Center redevelopment and other infill and redevelopment.

Table 5-4 | Storage Volume Recommendation Summary						
Existing (2011) Development Conditions Storage (mg)						
Service Area	Equalization	Emergency	Fire Flow	Total	Available Storage	Deficit
A	1.30	4.80	0.63	6.70	7.2	
B	0.80	2.90	0.63	4.30	5.0	
C	0.30	0.90	0.18	1.40	0.8	0.6
Total	2.40	8.60	1.44	12.40	13.0	
20-year (2031) Development Conditions Storage (mg)						
Service Area	Equalization	Emergency	Fire Flow	Total	Available Storage	Deficit
A	1.60	6.10	0.63	8.30	7.2	1.1
B	1.50	5.90	0.63	8.00	5.0	3.0
C	0.30	1.40	0.18	1.90	0.8	1.1
Total	3.40	13.40	1.44	18.20	13.0	5.2
Build-out Development Conditions Storage (mg)						
Service Area	Equalization	Emergency	Fire Flow	Total	Available Storage	Deficit
A	1.70	6.10	0.63	8.40	7.2	1.2
B	1.60	5.90	0.63	8.10	5.0	3.1
C	0.30	1.00	0.18	1.40	0.8	0.7
Total	3.60	13.00	1.44	18.00	13.0	5.0

Notes: 1) Service Area A includes the Bridgeport Service Area.
2) Service Area B includes the SW Concept Plan Area.

WATER SUPPLY CAPACITY

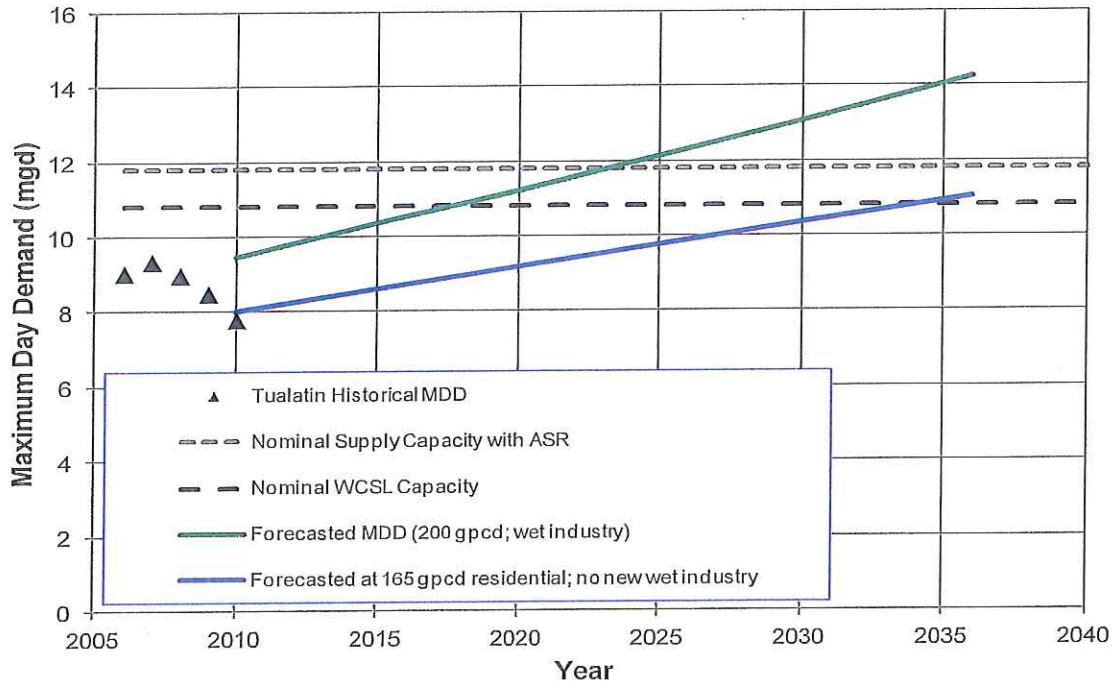
As noted in Section 3, the City currently has a planning level MDD of approximately 9.5 mgd and experienced an actual peak demand of 9.3 mgd in 2007. The 36-inch diameter Portland Supply Main owned by the City has a minimum capacity of 20 mgd; however, supply capacity is limited by the available capacity of the overall Washington County Supply Line (WCSL) system. The WCSL has a nominal capacity of 60 mgd and the City has rights to 18 percent of the capacity, or 10.8 mgd. The 60 mgd nominal capacity is based on the WCSL operating with all the owners of the line using their full capacity and maintaining adequate supply pressure. Within the 20-year planning period, the City's peak water supply needs will exceed the City's 10.8 mgd capacity in the transmission system. The largest single source of increased demand within the study area is the large water users anticipated in the SW Concept Area Plan.

Figure 5-4 illustrates the forecasted supply capacity needs compared to the existing nominal WCSL transmission capacity with and without consideration of supply from the City's ASR facilities. The plot includes a forecasted MDD growth at both a conservative planning rate and a smaller rate reflecting the low residential water use over the last five years (75 gpcd ADD; 165 gpcd MDD versus 90 gpcd ADD; 198 gpcd MDD) and a smaller industrial water use growth that does not included the anticipated 1 mgd ADD identified as "wet industry" in the SW Concept Plan (8.4 versus 6.2 mgd of commercial MDD). It should be noted that the MDD growth rates

illustrated reflect a likely growth rate, but future MDD for specific years could be higher or lower. Also, the growth rates do not include the future addition of UGB areas not currently identified for incorporation by Metro.

It is recommended that the City review the projected water demand in three years to determine if current conditions require that study and action are needed to begin acquiring additional supply capacity. This will allow the City time to evaluate changes in WCSL usage that may result in additional available capacity for acquisition by the City. The City can also evaluate the addition of significant new customer water demands to the system.

Figure 5-4 | Source Capacity Needs Summary



SUMMARY

This section presents the analysis of the City's water distribution system. Recommended system improvements are discussed in Section 7 and are illustrated on Plate 1. Plate 1 illustrates recommended piping, pumping, and reservoir improvements needed to correct existing system deficiencies and to serve the City at build-out development. Section 7 presents recommended capital improvements and estimates of project costs for the proposed improvements.

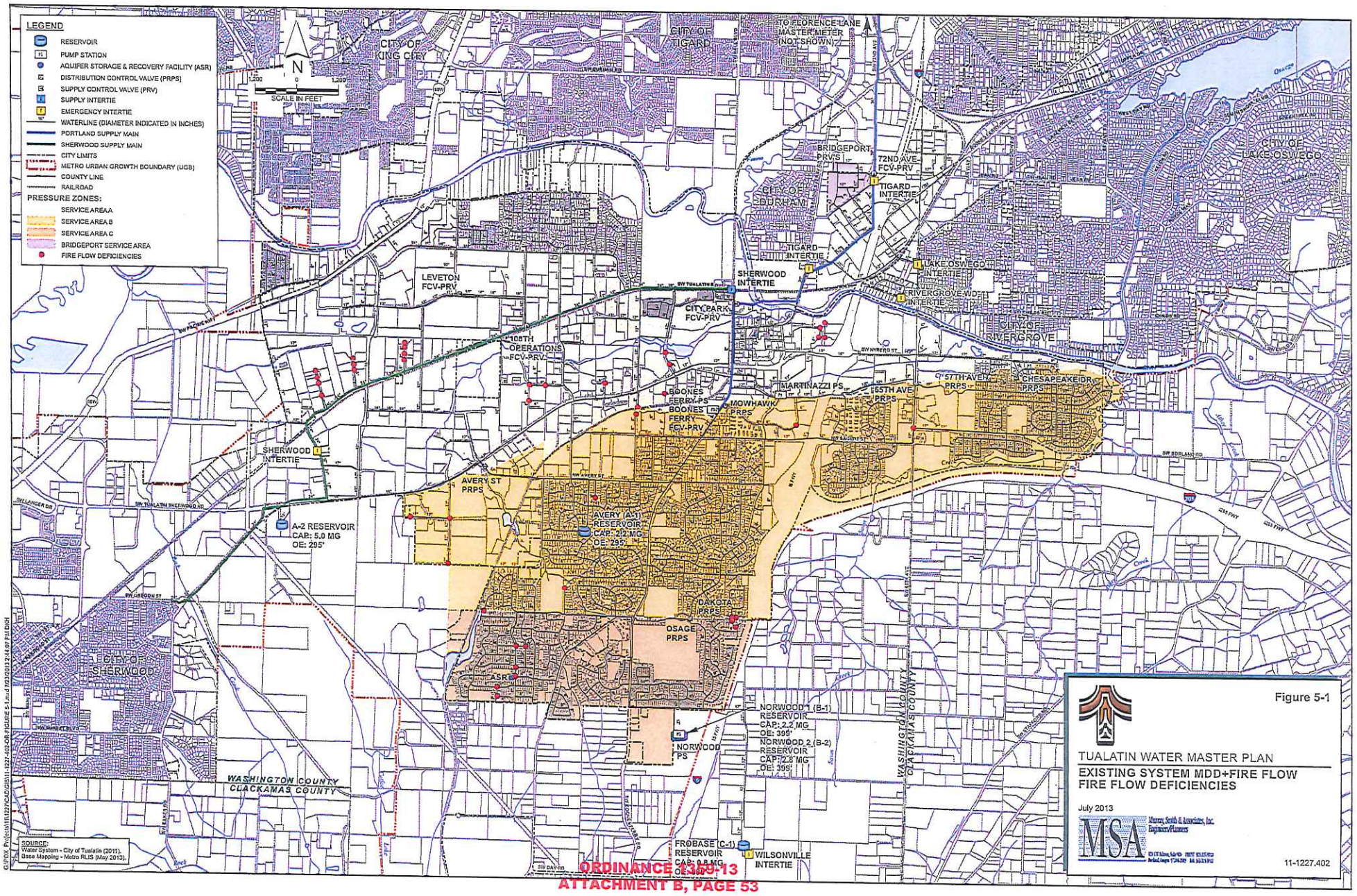


Figure 5-1

TUALATIN WATER MASTER PLAN

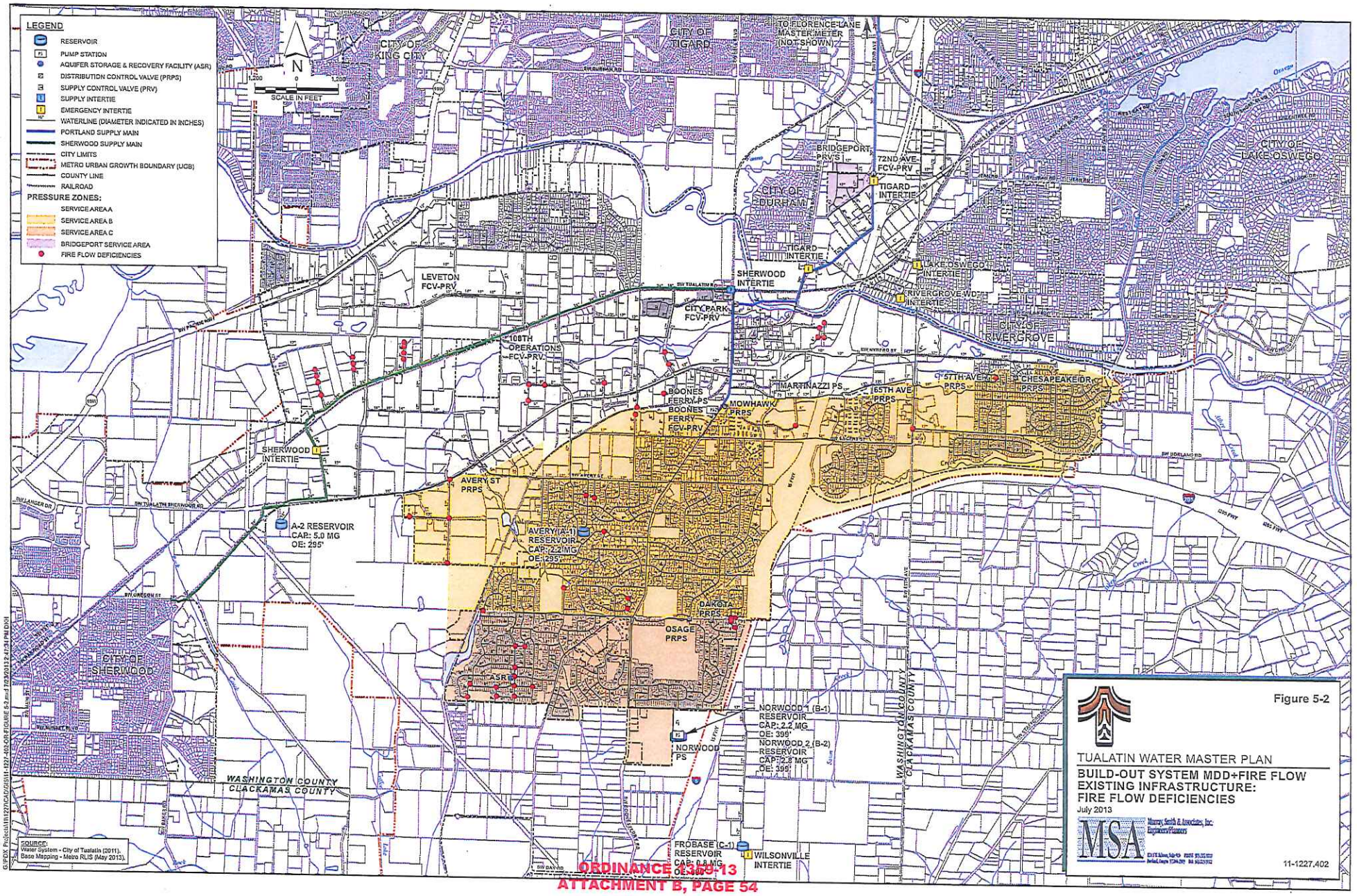
EXISTING SYSTEM MDD+FIRE FLOW
FIRE FLOW DEFICIENCIES

July 2013

Murray, Smith & Associates, Inc.
Engineers/Planners

11-1227.402

G:\PDX Projects\11\1227\CAD\GIS\11-1227-402-OR-FIGURE 5-1.mxd 7/23/2013 2:14:07 PM DKH



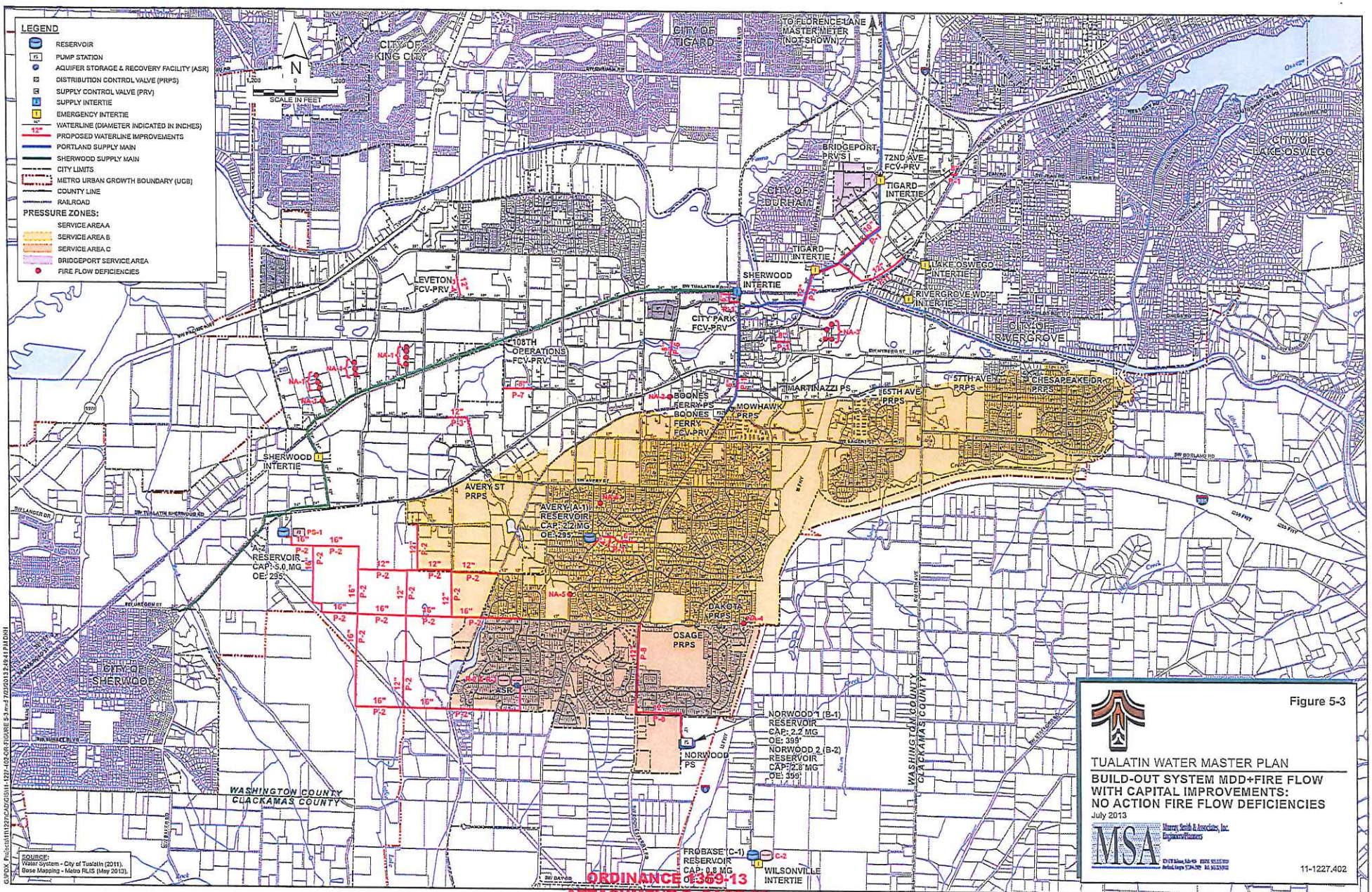


Figure 5-3

TUALATIN WATER MASTER PLAN

BUILD-OUT SYSTEM MDD+FIRE FLOW WITH CAPITAL IMPROVEMENTS: NO ACTION FIRE FLOW DEFICIENCIES

July 2013

MSA Murray, Smith & Associates, Inc. Engineers/Planners

11-1227.402

G:\PDX Projects\11227\CAD\GIS\11-1227-403-06 FIGURE 5-3.mxd 7/26/2013 2:45:41 PM DKH

GENERAL

This section describes water quality regulations affecting the City of Tualatin's (City) water system. This section also presents an overview of potential water conservation measures the City could consider implementing and provides guidance for future conservation efforts.

WATER QUALITY REGULATIONS

Introduction

Both state and federal agencies regulate public drinking water systems. For the federal government, the U.S. Environmental Protection Agency (EPA) establishes standards for water quality, monitoring requirements, and procedures for enforcement. Oregon, as a primacy state, has been given the primary authority for implementing EPA's rules within the state. The State of Oregon agency that administers most of EPA's drinking water rules is the Oregon Health Authority, Drinking Water Program (DWP). DWP rules for water quality standards and monitoring are adopted directly from EPA. The DWP is required to adopt rules at least as stringent as federal rules. To date, the DWP has elected not to implement more stringent water quality or monitoring requirements to date.

In some areas not directly related to water quality, DWP rules cover a broader scope than EPA rules. These areas include general construction standards, cross connection control, backflow installation standards, and other water system operation and maintenance standards. The City's activities are also governed by the Oregon Department of Environmental Quality (DEQ). The complete rules governing the DWP in the State of Oregon are contained in Oregon Administrative Rules Chapter 333, Division 61, Public Water Systems.

Status of Drinking Water Regulations

General. The Safe Drinking Water Act (SDWA) was originally enacted in 1974 by Congress to ensure the quality of America's drinking water. In 1986, the SDWA was reauthorized and changed significantly. In 1996, Congress reauthorized the SDWA and made further changes. The SDWA contains the following assignment and programs for the EPA and the states to administer including:

- State revolving loan fund for water system construction
- Public notification reports
- Source water assessment and protection
- Monitoring reductions based on source water protection
- Mandatory certification of operators

All of these assignments have been implemented by the EPA and the individual states. Progress on evaluation of potential contaminants continues with the unregulated contaminant sampling

requirements and health effects research. Implementation of the Unregulated Contaminants Monitoring Rule 3 (UCMR3) will result in additional water quality sampling in 2013.

Disinfectants/Disinfection By-Products Rule

General. The Disinfectants/Disinfection By-Products (D/DBPs) rule and the Stage 1 D/DBP rule apply to all Community Water Systems and Non-Transient Non-Community Water Systems that treat water with a chemical disinfectant for primary or residual treatment. This rule is currently in effect and regulates Total Trihalomethanes (TTHMs) and Haloacetic Acids (HAA5s), which include:

TTHMs

- Trichloromethane (chloroform)
- Tribromomethane (bromoform)
- Bromodichloromethane
- Dibromochloromethane

HAA5s

- Monochloroacetic acid
- Dichloroacetic acid
- Trichloroacetic acid
- Monobromoacetic acid
- Dibromoacetic acid

The Maximum Contaminant Levels (MCL) for TTHMs and HAA5s in the Stage 1 D/DBP rule are calculated as the running annual average of quarterly samples at four distribution system sites per plant or entry point. The MCLs for several constituents are listed in Table 6-1.

Table 6-1 | Constituents Listed by the Disinfectants/ Disinfection By-Products Rule

Constituent	MCL/Requirement
Chlorine	4 mg/L
Total Organic Carbon (TOC)	Treatment Technique
TTHMs	0.080 mg/L
HAA5s	0.060 mg/L

The Stage 2 D/DBPs rule is currently being implemented. This rule maintains the MCL levels established in Stage 1 D/DBP rule and added Maximum Contaminant Level Goals (MCLGs) for four TTHMs and three HAA5s. The most significant change in the Stage 2 D/DBP is the requirement that the MCL be calculated on the locational running annual average of quarterly samples taken at locations to be determined by an Initial Distribution System Evaluation (IDSE). The compliance sites consist of locations where high TTHMs are found, locations where high HAA5s are found and average detention time sites within the distribution system. The number

of sites is based on the type of source water and population served. The rule provides for reduced monitoring for systems with very low disinfection by-products based on two (2) years of existing data.

City Compliance. The City prepared an IDSE in September, 2006 using the System Specific Study (SSS) method. The City is currently monitoring DBPs and is meeting all D/DBPs Rule requirements. The City is currently sampling quarterly at four (4) sites for the Stage 2 requirements.

Statistics for the sampling results from 2003 through 2010 for the Stage 1 D/DBP Rule are shown in Table 6-2, which show that the City is meeting the MCL for trihalomethanes and haloacetic acids.

Table 6-2 | Quarterly Disinfection Byproduct Monitoring Results

Quarterly Average Value, 2003 - 2010	Trihalomethanes (TTHM) (mg/l)	Haloacetic Acids (HAA5) (mg/l)
Minimum	0.017	0.004
Average	0.029	0.023
Maximum	0.063	0.039
MCL	0.080	0.060

Total Coliform Rule

General. The Total Coliform Rule applies to all surface water and groundwater systems. Total coliforms include both fecal coliforms and *E. coli*. The MCLG for total coliforms is zero. Compliance with the MCL is based on the presence or absence of total coliforms in a sample. The MCL for systems analyzing at least 40 samples per month is that no more than five (5) percent of the monthly samples may have total coliforms present.

Monthly monitoring requirements are based on the population served. A system must collect a set of repeat samples for each positive total coliform result and have it analyzed for total coliforms. The total coliform sampling requirements vary according to population served.

City Compliance. The City is currently meeting all applicable requirements for the Total Coliform Rule. It is important to maintain active circulation of water throughout the distribution system, in both pipes and reservoirs so as to retain a chlorine residual. The absence of chlorine residual and accumulation of sediments contribute to bacterial growth, which in turn can result in failure to comply with the Rule.

These factors should be considered as new pipelines and reservoirs are being added. Large dead-end pipes should be avoided. Where they are installed, it is important for the City to continue the existing program of regular flushing of these lines. Flushing programs must be regular and not just in response to loss of chlorine residuals, because by that time the system may test positive for coliforms.

Reservoirs should be designed and operated to ensure adequate mixing and reservoir turnover to promote good water quality. The City's reservoirs include inlet mixing systems on most reservoirs, and reservoirs are operated at reduced capacity to ensure adequate turnover during low water use periods.

EPA standards for the residual disinfectant concentration in the water entering the distribution system cannot be less than 0.2 mg/L for more than 4 hours (40 CFR 141.72(a)(3) and (b)(2)). The residual disinfectant concentration in the distribution system cannot be undetectable in more than five (5) percent of the samples each month for any two (2) consecutive months that the system serves water to the public (40 CFR 141.72(a)(4) and (b)(3)). The City samples monthly for chlorine residual at approximately 25 to 30 points in the distribution system. Most monthly samples have a residual in the range of 1.0 to 1.5 parts per million (ppm). Annual average system-wide chlorine residual levels range from 1.2 to 1.5 ppm. The sites with the lowest annual average vary in location and have a residual annual average from 0.3 to 1.0 ppm. The City has not reported any compliance problems.

Lead and Copper Rule

General. On June 7, 1991, the EPA published maximum contaminant level goals and regulations for lead and copper. In April 2000, the EPA Lead and Copper Rule Minor Revisions (LCRMR) took effect. The Lead and Copper Rule (LCR) regulation requires lead and copper to be monitored at consumers' taps every 6 months. One (1) monitoring period is equivalent to six (6) months, and two (2) monitoring periods are required per calendar year (that is, January to June and July to December). The LCRMR did not change the Action Levels (AL) and they did not change the basic requirements to optimize corrosion control and, if needed, treat source water, deliver public education, and replace lead service lines. In October 2007, the EPA published the Short-term Revisions which added criteria for reduced sampling frequency for systems in compliance.

Water samples at the customer's tap are required to be taken at high-risk locations, which are defined as homes with the following conditions:

- Lead solder installed after 1982
- Lead service lines
- Lead interior piping

For a water system to comply with the Lead and Copper Rule (LCR), the samples at the customer's tap must not exceed the following action levels:

- Lead - 0.015 mg/L detected in the 90th percentile of all samples
- Copper -1.3 mg/L detected in the 90th percentile of all samples

If the action levels are exceeded for either lead or copper, the water system is required to collect source water samples and submit the data with a treatment recommendation to the State. Additionally, if the action level is exceeded, the water system is required to present a public education program to its customers within 60 days of learning the results. The public education program must be continued as long as the water system exceeds the action levels.

All systems that exceed the lead or copper action level and all systems serving more than 50,000 persons are required to conduct corrosion control studies and optimize corrosion control at the customer tap. Corrosion control studies must compare the effectiveness of pH and alkalinity adjustment, calcium adjustment, and addition of a phosphate or silica-based corrosion inhibitor. In addition to lead and copper, systems that exceed the lead or copper action levels are required to monitor other water quality parameters.

After performing a corrosion control study, water systems are required to develop a corrosion control treatment plan based on study results and monitoring data and submit this plan to the DWP for approval. Once the treatment plan is approved by the State, the purveyor will have 24 months to install the optimal corrosion control treatment and 12 months to collect follow-up samples. Once monitoring has shown that corrosion control is effective, the regulatory agency will assign values for water quality parameters that will be used to ensure that corrosion treatment is effective.

City Compliance. The City is currently monitoring for lead and copper at customer taps and is meeting all applicable requirements of the Lead and Copper Rule. To control leaching of lead and copper, the Portland Water Bureau (PWB), the City's water supplier, adds sodium hydroxide during water treatment to condition the water to a target pH of 8.

Per the agreement with the DWP, of April 2003, the City, along with 15 other water providers, is sampled as part of the PWB Bull Run system for Lead and Copper Rule monitoring. A minimum of three (3) samples are required in the City, and four (4) samples are typically collected to ensure the minimum is met. A summary of the lead and copper monitoring is presented in Table 6-3. The PWB continues the monitoring program established in 2003 and has elected not to reduce the monitoring frequency established in the 2007 Rule revisions based on an agreement with the DWP.

Table 6-3 | Lead and Copper Rule Monitoring Results

	Lead	Copper
Action Level (mg/l)	0.150	1.30
PWB system 90th Percentile, 2006	0.009	0.31
City of Tualatin, maximum value		
2007	0.011	0.31
2008	0.012	0.35
2009	0.013	0.51
2010	0.020	0.47

Unregulated Contaminant Monitoring Rule

General. The 1996 SDWA amendments require that once every five (5) years, EPA issue a new list of no more than 30 unregulated contaminants to be monitored by public water systems. The EPA uses the Unregulated Contaminant Monitoring program to collect data for contaminants suspected to be present in drinking water, but that do not heave health-based standards set under the SDWA. The Unregulated Contaminant Monitoring Rule 3 (UCMR 3) was enacted by the EPA in May 2012, requiring monitoring for 30 contaminants between 2013 and 2015.

City Compliance. The City will be required to perform Assessment Monitoring for 21 chemicals (List 1) during a 12-month period. The 21 chemicals, listed below, will be sampled at distribution system entry points for all chemicals and distribution system maximum residence time for seven of the chemicals.

UCMR 3 List 1 Contaminants

- 1,2,3-trichloropropane
- 1,3-butadiene
- Chloromethane
- 1,1-dichloroethane
- Bromomethane
- Chlorodifluoromethane
- Bromochloromethane
- 1,4-dioxane
- Vanadium
- Molybdenum
- Cobalt
- Strontium
- Chromium
- Chromium-6
- Chlorate
- Perfluorooctanesulfonic acid
- Perfluorooctanoic acid
- Perfluorononanoic acid
- Perfluorohexanesulfonic acid
- Perfluoroheptanoic acid
- Perfluorobutanesulfonic acid

Aquifer Storage and Recovery Sampling

The City operates a single aquifer storage and recovery (ASR) facility under Limited License #010. Licensing requirements include additional water quality sampling and reporting to the DWP. Since the ASR facility began operation in 2010, only the initial rounds of sampling have been conducted. Ongoing sampling and reporting will be required for the ASR well, including compliance with a number of source water sampling requirements described below. Based on a DWP classification as groundwater, the ASR monitoring requirements for recovered water are presented in Table 6-4. No additional sampling is required to meet Stage 2 D/DBP compliance.

Table 6-4 | ASR Monitoring Requirements per Drinking Water Program Groundwater Classification

Constituent	Initial Sampling/Reporting	Anticipated Monitoring Reduction
Nitrate (NO3)	Annual	--
Nitrite (NO2)	1 per 3 years	If non-detect in 2014, reduce to 1 per 9 years
Inorganic Compounds (IOCs)	1 per 3 years	If non-detect in 2014, reduce to 1 per 9 years
Arsenic (As)	1 per 3 years	If non-detect in 2014, reduce to 1 per 9 years
Sodium (Na)	1 per 3 years	--
Soluble Organic Compounds (SOCs)	Annual	If non-detect through 2012, sample 2 consecutive quarters every 3 years
Volatile Organic Compounds (VOCs)	Annual	If non-detect through 2012, 1 sample every 3 years
Radionuclides (Gross Alpha)	Quarterly	Reduction possible based on initial testing results
Coliform	Annual (at wellhead)	--
Disinfection By-Products (DBPs)	No additional sampling beyond Stage 2 compliance monitoring sites	--

Additional Wholesale Provider Regulatory Issues

General. The PWB, as the source water provider, is responsible for sampling, monitoring and compliance with numerous water quality regulations that do not need to be addressed directly by the City. These include:

- Synthetic Organic Chemicals and Inorganic Chemicals
- Volatile Organic Compounds
- Arsenic
- Sulfate
- Fluoride
- Radon/Radionuclides
- Groundwater Rule
- Surface Water Treatment Rule and Supplementary Rules:
  - Interim Enhanced Surface Water Treatment Rule
  - Long Term 1 Enhanced Surface Water Treatment Rule
  - Long Term 2 Enhanced Surface Water Treatment Rule

City Compliance. While the City is not directly responsible for meeting these regulatory requirements, as a wholesale water purchaser from the PWB, the City is directly impacted by these regulatory requirements through wholesale water rates. The Bull Run Watershed drinking water supply is generally considered a high quality protected source with very low vulnerability to the regulated contaminants listed above. The PWB designed a water treatment facility to comply with the EPA requirement to address the potential for cryptosporidium contamination under the Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR). Construction of the ultraviolet treatment facility has been delayed indefinitely following a State of Oregon Drinking Water Program variance for the unfiltered Bull Run source.

With the addition of an ASR well to the City's system, the City will need to initiate compliance monitoring and reporting for a number of the constituents listed above. The City is already performing the sampling for all of these potential contaminants as part of the ASR pilot testing program and has not observed levels of concern for any of the regulated contaminants.

Water Conservation

Introduction

The City is required to meet certain water conservation goals under the wholesale water supply agreement with the Portland Water Bureau. As the City is not an active municipal water rights holder, it is not required to develop a formal Water Management and Conservation Plan, but may consider establishing a formal program to implement the following conservation measures to reduce water usage, particularly peak water usage. The following are examples of water conservation efforts that water utilities are required to consider under the Oregon Administration Rules Chapter 690, Division 86, Water Management and Conservation Plans.

Public Education and Outreach

Water conservation can be promoted through a variety of programs and activities in the public school system, higher education system, community events and regional partnerships. Conservation information can be provided with billing statements and at the City's front lobby. In addition, specific conservation messages are often included with the billing statements to provide tips to use water wisely. These tips, in conjunction with the other elements of the City's public education program, provide a clear link between water conservation and financial savings for the individual customer.

As a member of the Regional Water Providers Consortium (RWPC), the City actively participates in regional water conservation program development and implementation. Comprised of 23 water providers and the Metro Regional Government, the RWPC provides a forum for collaboration on water supply, resource management and conservation issues affecting the region. The RWPC was formed in 1996 by an Intergovernmental Agreement to coordinate the implementation of the Regional Water Supply Plan for the Portland Metropolitan Area. The Regional Water Supply Plan is the region's water supply strategy and recognizes that water conservation plays a key role in meeting future water needs. In December 2004, the RWPC completed the Regional Water Supply Plan Update. The updated plan evaluated regional source options while reflecting the actions and plans of the individual members. The plan also updated water demand forecasts and continued to emphasize opportunities for regional conservation programs where economies of scale and regionally-consistent conservation messages and benefits can be achieved. The RWPC's conservation objectives are to:

- Plan and implement regional programs and events focused on reducing peak summer water use.
- Effectively encourage customers to visit and utilize the web site at www.conserveh2o.org
- Integrate consistent conservation messages into the daily lives of customers.
- Develop and implement effective monitoring and reporting techniques to verify program effectiveness.
- Invite stakeholder participation in conservation program development.
- Seek economies of scale by working together.
- Foster public awareness of the RWPC's collaborative efforts.

The RWPC's conservation plan contains a variety of programs and outreach opportunities which include:

- Summer marketing campaign
- Education programs
- Regional events
- Landscape industry partnerships
- A web site (www.conserveh2o.org)
- Informational materials (brochures, kits and water-saving devices)

Given the City's participation in RWPC, further City-specific public education and outreach programs are not likely to offer cost-effective water conservation results. The commitment of up to a 1/4 full time employee (FTE) would be required to implement a City-specific program.

Technical and Financial Assistance Programs

There are existing State of Oregon and federal water conservation programs that the City can promote through awareness. Examples include the Oregon Energy Trust and federal rebate programs. The City can also take an active role in promoting conservation through technical and financial assistance programs. For example, the Tualatin Valley Water District (TVWD) distributes three residential "kits" to homeowners upon request to help them detect leaks and reduce water usage.

Due to the cost of hiring staff, potentially up to 1/4 FTE , and implementing such programs, including the purchase and distribution of household water use reduction "kits" implementation of such programs should be re-evaluated as part of future WMP updates.

Retrofit/Replacement of Inefficient Fixtures

The City can offer commercial and residential rebates for replacement of high-water use appliances and fixtures and, as described above, provides kits to help identify leaks and other potential reasons for high water bills, such as inefficient fixtures. These programs can be effective where a water system service area contains a high number of older homes that likely still contain aging, inefficient fixtures.

The cost of hiring staff, estimated at 1/2 FTE, to implement and manage rebate and exchange programs is not recommended at this time given the high cost of rebates to the City and a fairly low return on investment that would be expected.

Leak Detection Program

Water loss prevention and leak detection programs are typically economical when annual water losses regularly exceed 10 percent. Given that the estimated percentage of unaccounted-for water is below this level, the City does not currently have and is not planning for implementation of a comprehensive on-going leak detection program within the distribution system.

The City is actively implementing a water main replacement program that is systematically replacing aging mains with a focus on existing asbestos cement pipe and associated service lines to reduce water loss and excessive main breaks. The continuation of this program as a key element of the City's water system capital budget is recommended to maintain current low levels of water loss.

Water Conservation Recommendations

As a member of the RWPC, the City contributes funds to the promotion of water conservation throughout the Portland Metropolitan area and realizes significant benefit from the conservation program of this organization. It is recommended that the City continue to invest its water conservation funds in the larger RWPC conservation program. No further investment in City-specific water conservation measures is recommended at this time; however, as the City continues to grow and develop, future efforts to encourage and support water conservation efforts may help to delay the need to make substantial capital improvements to meet increased water demands. The City should continue to evaluate potential conservation-encouraging programs with future Water Master Plan updates.

GENERAL

This section presents recommended water system improvements based on the analysis and findings presented in Section 5. These improvements include proposed storage reservoir, pumping capacity and water line improvements. Also presented is a capital improvement program (CIP) schedule for all recommended improvements. All proposed system improvements are illustrated on Plate 1 in Appendix A.

COST ESTIMATING DATA

An estimated project cost has been developed for each improvement project recommendation presented in this section. Cost estimates represent opinions of cost only, acknowledging that final costs of individual projects will vary depending on actual labor and material costs, market conditions for construction, regulatory factors, final project scope, project schedule and other factors. The Association for the Advancement of Cost Engineering (AACE) classifies cost estimates depending on project definition, end usage and other factors. The cost estimates presented here are considered Class 4 with an end usage being a study or feasibility evaluation and an expected accuracy range of -30 percent to +50 percent. As the project is better defined the accuracy level of the estimates can be narrowed. Itemized project cost estimate summaries are presented in Appendix C. This appendix also includes a cost data summary for recommended water main improvements developed on a unit cost basis. Estimated project costs include approximate construction costs and an allowance for administrative, engineering and other project-related costs.

The estimated costs included in this plan are planning-level budget estimates presented in 2012 dollars. Since construction costs change periodically, an indexing method to adjust present estimates in the future is useful. The Engineering News Record (ENR) Construction Cost Index (CCI) is a commonly used index for this purpose. For future cost estimate updating, the recent Seattle, Washington, ENR CCI is 9075 (May 2012).

WATER SYSTEM CAPITAL IMPROVEMENT PROGRAM

A summary of all the recommended improvements is presented in Table 7-1 which provides for project sequencing by showing prioritized short-, medium- and long-term recommendations. Short-range recommendations are those suggested to be completed in the next one (1) to five (5) years, medium-term in the next six (6) to 10 years, and long-term in the next 11 to 20 years. Estimated project costs are also summarized in Table 7-1 and discussed in this section.

Table 7-1 | Capital Improvement Program Summary

Category	Project ID	Project Description	CIP Schedule and Project Cost Summary				Percent SDC Eligible
			Short 2013-2016	Medium 2017-2021	Long 2022-2031	Estimated Project Cost	
Distribution Piping	P-1	Continuation of AC pipe replacement.	$575,000	$500,000	$425,000	$1,500,000	36%
	P-2	Development of SW Concept Area. 20,000 ft of 16-inch diameter piping and 11,000 ft of 12-inch diameter piping.			$8,200,000	$8,200,000	100%
	P-3	1,100 ft of 12-inch diameter piping to complete system looping along SW Myslony St. and SW 112th Ave. to improve fire flow capacity.		$240,000		$240,000	36%
	P-4	700 ft of 12-inch diameter piping to complete system looping near the Leveton PRV site to improve fire flow capacity.		$150,000		$150,000	36%
	P-5	Installation of 3 fire hydrants on SW Boones Ferry Road to improve fire flow capacity at the Tualatin High School site.	$100,000			$100,000	36%
	P-6	450 ft of 8-inch diameter piping to complete system looping near SW 90th Ave. to improve fire flow capacity.			$70,000	$70,000	36%
	P-7	850 ft of 8-inch diameter piping to complete system looping near SW Manhasset Dr. to improve fire flow capacity.			$130,000	$130,000	36%
	P-8	4,700 ft of 12-inch diameter piping to improve Norwood Reservoirs outlet transmission capacity to provide for fire flow capacity and improve reservoir water quality when proposed B-Level reservoir near ASR site is constructed.		$1,010,000		$1,010,000	36%
		Subtotal	**$675,000**	**$1,900,000**	**$8,825,000**	**$11,400,00**	

Table 7-1 | Capital Improvement Program Summary (continued)

Category	Project ID	Project Description	CIP Schedule and Project Cost Summary				Percent SDC Eligible
			Short 2013-2016	Medium 2017-2021	Long 2022-2031	Estimated Project Cost	
Storage Facilities	R-1	New 1.0 MG storage reservoir in Service Area C adjacent to Reservoir C-1.	$1,500,000			$1,500,000	50%
	R-2	New 2.2 MG storage reservoir in Service Area B at ASR site to accommodate SW Concept Area growth.		$3,700,000		$3,700,000	100%
	R-3	New 2.2 MG storage reservoir in Service Area B at ASR site to accommodate SW Concept Area growth and Service Area B infill.			$2,600,000	$2,600,000	100%
		Subtotal	**$1,500,000**	**$3,700,000**	**$2,600,000**	**$7,800,000**	
Pumping	PS-1	New 3,600 gpm pump station near the A-2 Reservoir to provide primary and back-up supply to Service Area B.			$950,000	$950,000	100%
		Subtotal	**$0**	**$0**	**$950,000**	**$950,000**	
Other	M-1	SCADA Improvements.	$100,000	$25,000	$50,000	$175,000	36%
	M-2	Water Rate and SDC Study Update.			$25,000	$25,000	36%
	M-3	Water System Master Plan Update.			$150,000	$150,000	36%
		Subtotal	**$100,000**	**$25,000**	**$225,000**	**$350,000**	
			$2,275,000	**$5,625,000**	**$12,600,000**	**$20,500,000**	
			$455,000	$790,000	$1,025,000		
			5-year annual average	10-year annual average	20-year annual average		

Note: The improvement R-1 is not included in the financial analysis and SDC calculation.

As discussed in Section 8, the City of Tualatin (City) collects System Development Charges (SDCs) to fund capital improvements that are associated with future development, or growth, as allowed under Oregon Revised Statute 223.297 through 223.314. For improvements that benefit both current and new customers, a fraction of the project cost is allocated to SDCs proportional to the benefits. Table 7-1 includes the percent of the project cost eligible to be allocated to SDCs for each CIP project.

RECOMMENDED DISTRIBUTION SYSTEM IMPROVEMENTS

General

Presented below are recommended water distribution system improvements for pump stations, storage reservoirs, pressure reducing facilities and distribution system piping. Project cost estimates are presented for all recommended improvements in Appendix C and summarized herein. The recommendations are presented by project type and discussed in order of need.

Piping Improvements

The system analysis found that some distribution water main improvements are needed to provide sufficient fire flow capacities under both existing and future demand conditions. Transmission piping improvements are necessary to extend the water system to serve future growth areas. Improvements that involve construction of new waterlines to expand the distribution system capacity are considered 100 percent eligible for SDCs.

Improvement P-1 is an allocation for continued replacement of asbestos concrete (AC) pipe. AC pipe is commonly associated with increased water line breaks and costly emergency repairs. Approximately 9,000 feet of AC pipe remains in the City's distribution system ranging from 4-inch to 12-inch diameter pipe. It is anticipated that the City will complete AC pipe replacement within the next five (5) years.

Improvement P-2 includes transmission piping improvements associated with growth in the SW Concept Area. The recommended 12-inch and 16-inch diameter piping size and alignments are presented at the conceptual level. Further review and analysis will be required during infrastructure planning as development plans are prepared.

Improvements P-3 and P-4 are completion of 12-inch diameter distribution system looping to improve capacity to address existing fire flow deficiencies. Improvement P-3 is located near SW Myslony Street. Improvement P-4 is located near the Leveton pressure reducing valve (PRV) vault.

Improvement P-5 improves fire flow capacity at the Tualatin High School through the installation of three additional fire hydrants along SW Boones Ferry Road off the 12-inch diameter main of Service Area B. The existing fire hydrants are supplied from the Service Area C main that runs parallel to the Service Area B main.

Improvement P-6 includes completion of 8-inch diameter distribution system looping along SW 90th Avenue to improve capacity to address existing and future fire flow deficiencies.

Improvement P-7 includes completion of 8-inch diameter distribution system looping along SW Manhasset Drive to improve capacity to address existing and future fire flow deficiencies.

Improvement P-8 includes approximately 4,700 ft of parallel 12-inch diameter outlet piping from the Norwood Reservoirs to the Service Area B distribution system at SW Ibach Road. Reservoir outlet capacity improvements are necessary when the future Service Area B reservoirs are constructed to promote turnover in the Norwood Reservoirs.

The proposed piping improvements described above are listed and summarized in Table 7-1 and illustrated in Plate 1 in the Appendix.

Storage Reservoirs Improvements

The storage volume analysis in Section 5 identified a current storage volume deficit in Service Area C and a future storage volume deficit in all service areas. The recommended improvements associated with these deficits include construction of two new reservoirs as previously identified and anticipated.

The primary cause of future anticipated storage deficiencies in Service Area B is growth in the SW Concept Area. The existing ASR site has adequate space to accommodate new storage and is one of the few locations within the City with appropriate elevation to serve Service Area B by gravity. This site should be used to provide future storage capacity for Service Area B, especially to serve the anticipated growth in the SW Concept Area.

Service Area A has adequate current storage volume capacity, but is anticipated to have a small deficiency in the future as increased density from redevelopment occurs. It is recommended that the future storage volume needs for Service Area A, which are small (~1.1 million gallon (MG)), be supplied from the new storage in Service Area B. As the bulk of the future storage needs are for emergency storage, the new storage at a higher elevation is still available to serve Service Area A by gravity in the event of an emergency. Use of the planned reservoir site in Service Area B will avoid costly property acquisition and provide economy of scale in storage construction costs. It is recommended that two (2) 2.2 MG reservoirs be planned. The first of these reservoirs is a medium-term improvement to coincide with infill development in Service Area B. The second reservoir is a long-term improvement for build-out of the service area to include the SW Concept Area. Project cost estimating data for the storage capacity improvements are included in Appendix C.

The Frobase Reservoir site, supplying Service Area C, has adequate existing space to accommodate a second small reservoir. This second reservoir, with a volume of 1 million gallons, will be constructed as an at-grade welded steel reservoir consistent with the City's other reservoirs. Transmission piping is largely in place and no further property acquisition is required. This project has been designed and is awaiting construction funding. This project has been identified as a high priority improvement to meet an existing deficiency and is

recommended as an immediate priority improvement. Approximately half of the storage volume of the second reservoir is associated with an existing storage deficit. The other half is allocated for future growth and emergency storage at the highest level in the water system. This project is currently not included in the financial analysis in Section 8.

Pump Station Capacity Improvements

With development of the SW Concept Area, it is recommended that the City construct a new back-up pump station located near the A-2 reservoir. This new station will provide for future pumping capacity needs to Service Area B in the event of PRV failure. The pump station will also provide for improved service pressures under high demand conditions and improve turnover for water quality in the A-2 reservoir.

The City anticipates future transportation improvements will include the widening of SW Boones Ferry Road. Widening of the road would require the relocation of the existing Boones Ferry Pump Station. It is recommended that the new pump station near the A-2 reservoir site be sized such that the new station (5.22 million gallons per day (mgd)) and the existing Martinazzi Pump Station (2.88 mgd) have a combined capacity equal to the future Service Area B and C maximum day demand of 8.1 mgd. This will allow for the abandonment of the Boones Ferry Pump Station. Cost data for the pumping capacity and site improvements is included in Appendix C.

Pressure Reducing Facilities Improvements

The existing pressure reducing facility capacities are adequate to meet existing and future conditions. Hydraulic analysis found that the existing PRV settings at the City Park facilities will need to be operationally adjusted to meet large increases in maximum day demand associated with the Service Area A demands from the SW Concept Area. No recommendations are made for pressure reducing facility capital improvements.

SCADA System Improvements

The existing System Control and Data Acquisition (SCADA) system is reaching the end of its useful service life and will require significant investment to continue to maintain outdated equipment. An assessment of needed system upgrades to the software and hardware should be made and compared to the costs and benefits of a full system replacement. It is recommended that the City budget approximately $100,000 in the immediate term for completion of system assessments and implementation of replacement or improvements. An ongoing system renewal budget of $25,000 every five (5) years is further recommended.

Capital Improvement Program Funding

It is recommended that the City's water system capital improvement program be funded at approximately $1 million annually. While the funding for certain water system improvements may exceed this amount, the proposed improvements listed in Table 7-1 are phased and sequenced so that the average annual capital requirement for water system improvements is

approximately $1 million over the 20-year planning horizon. Further financial analysis is presented in Section 8.

SHERWOOD SUPPLY MAIN EVALUATION

The City of Sherwood is currently in the process of changing supply sources and it is anticipated that the existing 24-inch diameter main will not be required to serve the City of Sherwood in the future. A scenario where the City of Tualatin acquires rights and/or ownership to this main is examined under a separate memorandum ("Evaluation of Sherwood Main Use Options", prepared by MSA for Kaaren Hofmann, April 30, 2012). This scenario would affect the pumping capacity improvements recommended in the CIP. Use of the Sherwood Supply Main to transmit water to the western portion of the City's Service Area B would allow for a reduction in the required new station capacity and also reduce pumping costs associated with serving the higher elevation service areas.

SUMMARY

This section presents recommendations for improvements to the City's storage reservoirs, pumping stations, control valves, supply transmission capacities and distribution system. The total estimated project cost of these improvements is approximately $20.5 million for the 20-year planning horizon and beyond to the ultimate full development of the City's existing UGB. Of the improvements required in the 20-year planning horizon, approximately $5.6 million of these improvements are required in the next 10 years. Approximately $1.02 million per year should be budgeted over the next 20 years for the completion of these projects.

GENERAL

This section provides a financial plan that will allow the City of Tualatin (City) to implement its capital improvement plan while meeting its other financial obligations, including policy objectives. The two (2) components of this plan are 1) the computation of a system development charge and 2) a revenue requirement analysis that includes a set of fiscal policy recommendations.

SYSTEM DEVELOPMENT CHARGES

System development charges (SDCs) are one-time fees imposed on new and increased development to recover the cost of system facilities needed to serve that growth. This section provides the rationale and calculations for proposed water SDCs.

Methodology

An SDC can include three (3) components: 1) a reimbursement fee, 2) an improvement fee, and 3) compliance costs.

Reimbursement Fee. The reimbursement fee is the cost of available capacity per unit of growth that such available capacity will serve. In order for a reimbursement fee to be calculated, unused capacity must be available to serve future growth. For facility types that do not have excess capacity, no reimbursement fee may be charged.

Improvement Fee. The improvement fee is the cost of capacity-increasing capital projects per unit of growth that those projects will serve. In reality, the capacity added by many projects serves a dual purpose of both meeting existing demand and serving future growth. To compute a compliant SDC rate, growth-related costs must be isolated, and costs related to current demand must be excluded.

We have used the "capacity approach" to allocate costs to the improvement fee basis. Under this approach, the cost of a given project is allocated to growth in proportion to the growth-related capacity that projects of a similar type will create.

Growth should be measured in units that most directly reflect the source of demand. In the case of water, growth is measured in the number and size of water meters. The smallest meters are those typically used by households are therefore designated one "equivalent dwelling unit" (EDU). A larger meter with, for example, five (5) times the flow capacity is considered five (5) EDUs.

Compliance Costs. ORS 223.307(5) authorizes the expenditure of SDCs on "the costs of complying with the provisions of ORS 223.297 to 223.314, including the costs of developing system development charge methodologies and providing an annual accounting of system development charge expenditures." To avoid spending monies for compliance that might

otherwise have been spent on growth-related projects, this report includes an estimate of compliance costs in its SDC rates.

Growth

Based on information provided by City staff, the City currently has approximately 6,660 water connections, representing 11,244 EDUs. For this analysis, one EDU is defined as the flow equivalent of a 5/8-inch by 3/4-inch water meter. Maximum day demand is expected to grow from the current 9.48 million gallons per day to 14.26 million gallons per day at buildout, and the facilities planned for construction in the next twenty years are sized to meet that buildout demand. We therefore assume that the customer base will grow similarly, resulting in our estimate of 16,913 EDUs at buildout. The difference between buildout and current EDUs is the projected growth associated with the capital projects listed in this plan, 5,669 EDUs. This increase in EDUs is used in the SDC calculation.

Eligible Costs

The City has SDC-eligible costs in both its existing water facilities and its planned capital projects.

Existing Facilities. Because the City's water infrastructure has excess capacity that is available to serve growth, the City can charge a reimbursement fee as part of its water SDC. Table 8-1 summarizes the cost of excess capacity that can be included in a reimbursement fee. Note that water-related debt principal outstanding is deducted from these costs to avoid double collection.

Table 8-1 | Reimbursement Fee Cost Basis

Asset Class	Estimated Historical Cost	Available Portion	SDC-Eligible Cost
Storage	$12,636,627	5.38%	$680,434
Pumping	388,819	6.53%	25,403
Transmission	6,304,849	12.04%	758,917
Distribution	21,876,918	36.24%	7,928,548
Construction work in process	4,315,292	22.80%	983,683
Utility debt principal outstanding	(5,685,000)	22.80%	(1,295,912)
Total	39,837,506		9,081,072

Source: City staff (total historical cost) and MSA (asset functionalization and capacity analysis)

When the total eligible cost of $9,081,072 is divided by the expected growth of 5,669 EDUs, the resulting reimbursement fee is $1,602 per EDU.

Planned Capital Projects. Based on the capital improvement plan developed by Murray, Smith & Associates, Inc., the City will construct water facilities with an estimated cost of $18,415,000 over the planning period. However, most of these projects will not serve growth exclusively. Only the growth-related portion of each project can be collected as the improvement fee component of an SDC. Table 8-2 shows the growth-related portion of the planned water projects.

Table 8-2 | Planned Water Projects					
ID	Description	Timing	Total Cost	Portion Serving Growth	SDC Eligible Cost
P-1	Continuation of AC pipe replacement (reduced for already budgeted funds)	2013-32	$915,000	36%	$331,620
P-2	Development of SW Concept Area. 20,000 ft of 16-inch diameter piping and 11,000 ft of 12-inch diameter piping.	2023-32	8,200,000	100%	8,200,000
P-3	1,100 ft of 12-inch diameter piping to complete system looping along SW Myslony St and SW 112th Ave to improve fire flow capacity.	2018-22	240,000	36%	86,982
P-4	700 ft of 12-inch diameter piping to complete system looping near the Leveton PRV site to improve fire flow capacity.	2018-22	150,000	36%	54,364
P-5	Installation of 3 fire hydrants on Boones Ferry Road to improve fire flow capacity at the High School site.	2013-17	100,000	36%	36,243
P-6	450 ft of 8-inch diameter piping to complete system looping near W 90th Ave to improve fire flow capacity.	2023-32	70,000	36%	25,370
P-7	850 ft of 8-inch diameter piping to complete system looping near SW Manhasset Dr to improve fire flow capacity.	2023-32	130,000	36%	47,115
P-8	4,700 ft of 12-inch diameter piping to improve Norwood Reservoirs outlet transmission capacity to provide for fire flow capacity and improve reservoir water quality when proposed B-Level reservoir near ASR site is constructed.	2018-22	1,010,000	36%	366,050
R-2	New 2.2 MG storage reservoir in Service Area B at ASR site to accommodate SW Concept Area growth.	2018-22	3,700,000	100%	3,700,000
R-3	New 2.2 MG storage reservoir in Service Area B at ASR site to accommodate SW Concept Area growth and Service Area B infill.	2023-32	2,600,000	100%	2,600,000
PS-1	New 3,300 gpm pump station near the A-2 Reservoir to provide primary and back-up supply to Service Area B.	2023-32	950,000	100%	950,000
M-1	SCADA Improvements.	2013-32	175,000	36%	63,425
M-2	Water Rate and SDC Study Update.	2023-32	25,000	36%	9,061
M-3	Water System Master Plan Update.	2023-32	150,000	36%	54,364
			$18,415,000		16,524,593
	Less current SDC fund balance				(533,831)
	Cost basis for improvement fee				$15,990,763

Source: MSA

When the SDC-eligible cost of $15,990,763 is divided by the expected growth of 5,669 EDUs, the resulting improvement fee is $2,821 per EDU.

Compliance Costs. Based on data provided by the City, we estimate that the annual cost of compliance with Oregon's SDC law (in excess of projects M-2 and M-3 in the capital improvement plan) will be 0.09 percent of the reimbursement and improvement fees collected.

Summary of Costs. Table 8-3 summarizes the components of the water SDC of $4,428 per EDU.

Table 8-3 | SDC Components	
Component	**Per EDU**
Reimbursement fee	$1,602
Improvement fee	2,821
Compliance costs	5
Total water SDC	$4,428

Source: FCS GROUP

Fee Basis. For the purpose of imposing a water SDC on an individual property, the number of EDUs will be determined by the size of the property's water meter, as shown in Table 8-4.

Table 8-4 | SDC by Meter Size		
Meter Size	**Flow Factor**	**SDC**
5/8" x 3/4"	1.0	$ 4,428
3/4"	1.5	6,641
1"	2.5	11,069
1 ½"	5.0	22,138
2"	8.0	35,421
3"	16.0	70,841
4"	25.0	110,690
6"	50.0	221,379
8"	80.0	354,207
10"	115.0	509,173

Source: FCS GROUP

Comparison

Resolution No. 4819-08 contains the City's most recently published schedule of water SDCs and is further indexed each year for inflation. The indexed SDC as of February, 2012, for one EDU (i.e., the smallest meter) is $3,266. The proposed SDC of $4,428 per EDU is 35.6 percent higher than then current SDC. One way to mitigate the immediate impact of the recommended increase is to phase it in. For example, the City could choose to adopt an SDC of $3,500 for year 1, $4,000 for year 2, and the full $4,428 for year 3 and beyond. If growth were to occur as forecasted (assuming 20 years to build-out), the City would forego SDC revenue of $215,185 in year 1 and $101,292 in year 2, if the rates are phased in.

An area-specific SDC was also calculated for consideration by identifying and allocating the associated costs of projects intended to serve specific sub-areas within the City service area. For the purposes of comparison, that calculation resulted in a citywide charge of $2,661 and a SW Concept Area sub-area surcharge of $2,952, for a total SDC of $5,613 in the sub-area.

REVENUE REQUIREMENT ANALYSIS

The revenue requirement analysis is the determination of annual rate revenue needed to meet all of the utility's financial obligations. Prudent fiscal management requires that utility rates should be set as low as possible, yet sufficient to provide for the long-term sustainability of the water utility. The following framework of reliable, reasonable policies is provided to guide future financial decisions.

Self-Sufficient Enterprise Fund

Rates and charges were developed for this study based on the understanding that the water utility operates as a self-supporting enterprise fund. The utility receives revenues for payment of services on a user fee basis as opposed to property taxes or other non-utility revenue sources. By utilizing an enterprise fund concept of accounting, reporting, and management, subsidies among various City-provided services are avoided. The City's budgeting process includes a balanced and controlled annual budget for the utility. For this study, utility rates are established such that the utility recovers the full cost of operating & maintenance expenses, applicable debt service and related coverage requirements, planned capital, and agreed-upon levels of system reinvestment and reserves.

System Reinvestment Funding

The purpose of system reinvestment funding is to provide for the replacement of aging system facilities to ensure sustainability of the system for ongoing operations. Providing such funding through rates helps to ensure that existing ratepayers pay for the use of the assets serving them (rate equity), with the proceeds funding at least a portion of the eventual replacement of those assets.

The City has not historically set water rates at a level sufficient to provide funding for system replacement. To mitigate near-term rate increases, this study does not include annual system reinvestment funding over and above the cost of replacement projects identified in the capital improvement plan.

Reserve Levels

Cash reserves are a necessary and appropriate part of prudent utility management practices. We recommend that the City maintain its existing reserve levels, as described below.

- Operating Contingency – Operating contingencies, or reserves, are designed to provide a liquidity cushion to ensure that adequate cash working capital will be maintained to deal with significant cash balance fluctuations, such as seasonal billings and receipts, unanticipated cash operating expenses, or lower than expected revenue collections. Target funding levels are generally expressed in the number of days' cash operating expenses with the minimum requirement varying with the expected risk of unanticipated needs or revenue volatility. This study incorporates a target of 60 days of operating expenses (16.4 percent) for the water utility.

In any year where cash reserves exceed the target, we recommend using the excess to help pay for capital projects. This can be accomplished by calculating a target maximum balance at year end (e.g., 120/365 x actual operating expenses for the year) and comparing it against the actual ending cash balance. If the actual balance is greater than the target, the City may transfer the difference to the capital reserve fund.

- Capital Reserve – The capital (construction) fund typically holds any transfers of cash reserves and additional rate revenues from the operating fund. A minimum capital reserve is intended to provide a cushion against unanticipated capital project needs and capital cost overruns, as well as to meet any minimum capital reserve requirements. We recommend that the City establish such an account separate from the operating contingency, and maintain a minimum balance target of one (1) percent of total plant-in-service (utility physical assets), or $459,225 in fiscal year 2011-12.
- Enterprise Bond Fund – When issuing revenue bonds, bond underwriters require that a utility establish a restricted cash reserve, typically equal to one (1) year's debt service payment (principal and interest) for each bond issue. The reserve can be used to fund the final year's debt service payment for each issue. This study incorporates reserve funding of $438,616 for existing revenue bond debt throughout the study period.
- Rate Stabilization Account – The City's existing water revenue bond resolution further provides for a "Rate Stabilization Account within the Water Operating Fund as long as the Bonds are Outstanding." Revenue may be transferred to the Rate Stabilization Account as allowed, and money may be withdrawn "at any time and used for any purpose for which the Gross Revenues may be used," including meeting debt service and associated requirements (such as coverage). The City forecasts an account balance of almost $3 million at the end of fiscal year 2011-12. Due to uncertainty about budgeted revenues, this study does not draw upon Rate Stabilization Account funds to mitigate forecasted rate increases. It instead assumes that the utility will be self-sufficient from year to year.

Summary of Revenue Requirements Analysis

The following financial analysis reveals how much rate revenue will be required to meet operational and capital needs within contractual and policy constraints over the next 10 years.

Criteria

At least two (2) separate conditions must be satisfied in order for rates to be sufficient. First, the water utility must generate revenues adequate to meet cash needs. Second, revenues must satisfy bond coverage requirements. Revenues should be sufficient to satisfy both tests. If revenues are found to be deficient by one or more of the tests, then the greater deficiency drives the rate increase.

Cash Flow. The cash flow test identifies all cash requirements as projected in each given year. Cash requirements include operations and maintenance expenses, debt service payments, policy-driven additions to working capital, and capital improvement costs. If the water service collected replacement funding, it would also be included in the test as an expense. These expenses are compared to the total projected revenues, including interest on

fund balances. Shortfalls are then used to estimate the necessary rate increases.

Bond Coverage. The bond coverage test measures the ability of rate revenues to meet contractual obligations. The master declaration for the City's outstanding Water System Revenue Bonds, Series 2005, specifies three separate requirements.

First, net revenues (as defined in Section 2) excluding SDC revenue must equal or exceed 115 percent of annual bond debt service (as defined in Section 2). Second, net revenues including SDC revenue must equal or exceed 125 percent of annual bond debt service. Both of these requirements are found in Section 6 of the master declaration and apply over the life of the bonds. However, since SDCs are not a reliable source of income, we recommend that the City continue its practice of ignoring SDC revenues in bond coverage tests.

The third requirement is found in Section 7 of the master resolution and is commonly known as an "additional bonds test." It applies only if the City intends to issue additional revenue bonds with the same seniority as its outstanding revenue bonds. This test is identical to the second test (125 percent of annual bond debt service) with the inclusion of the new bonds in the debt service calculation. Although the City does not anticipate issuing new bonds at this time, it currently has some capacity to do so. However, that capacity can be maintained in future years only by adequate rate increases.

For modeling purposes, we have combined these three requirements into a single test for 125 percent of annual bond debt service. Since our modeled net revenues do not include SDC revenue, our test is slightly more stringent than the requirements of the master declaration.

Assumptions

The financial analysis measures the interaction of multiple assumptions over time, and is therefore only as good as those assumptions. Table 8-5 shows the key assumptions used in the revenue requirement analysis.

Note that estimates of water demand used here for financial purposes are lower than those used elsewhere in this report for engineering purposes. Also note that, for fiscal year 2012-13, revenue and expenditure projections have been updated to incorporate fiscal year 2011-12 actual performance. As a result, these projections do not necessarily agree with budgeted revenues and expenditures.

Table 8-5 | Modeling Assumptions		
Variable	**Value in FY 2011-12**	**Average Annual Change**
Demand:		
Customers in EDUs	11,244	0.46%
Water demand per customer		-0.46%
Total water demand		0.00%
Operating revenues:		
Rate revenue	$4,622,735	Determined by model
Sherwood contract	520,000	Discontinued
Other non-rate revenue	189,670	0.00%
Operating expenditures:		
Personal services	$1,777,132	3.52%
M&S and operating transfers	2,138,718	3.69%
Capital outlay (operating)	-	2.94%
Capital project expenditures	Per CIP plus annual escalation of 2.94%	
Debt service	$ 539,531	Per debt service schedule

Sources: City staff (FY 2011-12 budget and customer statistics, MSA (CIP), and FCS GROUP (other escalation rates)

We further assume that there will be neither any draws upon nor additions to the rate stabilization reserve, which was $2.7 million at the end of fiscal year 2010-11. We recommend drawing upon this reserve only at the end of fiscal years when (and to the extent that) actual revenues fall short enough of forecasted revenues to threaten compliance with bond coverage. Over time, actual revenues will naturally vary from projected revenues. The variations will be both positive and negative. They will usually be small, but they will sometimes be large. When actual revenues reflect a large, negative variation from projected revenues, some type of additional revenue may be needed to ensure compliance with bond coverage. Under the terms of the master declaration, the rate stabilization reserve is the only type of reserve that can be counted as revenue in the year that it is used (as opposed to the year that it is reserved). Therefore, its use should be limited to cases in which bond coverage is threatened.

Projections

The following two (2) tables summarize the results of the analysis for a 10-year forecast period. Table 8-6 shows the minimum rate increases that are needed each year. Table 8-7 shows a program of constant annual rate increases (4.25 percent per year starting in fiscal year 2013-14) that achieves the same results.

Table 8-6 shows that annual rate increases starting in fiscal year 2013-14 are required to ensure bond coverage. Starting in fiscal year 2017-18, rate increases are driven by capital improvement needs as the capital improvement program moves into a second, more intensive phase of spending.

Some of these planned project costs are growth-related and will be recovered in the system development charge. Unfortunately, the projects are needed before the SDCs will generate enough cash flow to cover the costs. As SDCs are collected and spent over time, they will ultimately offset the ratepayer burden by being spent on other needed projects. In fact, reimbursement fee proceeds can be spent on any capital projects – not just those that are growth-related. We therefore recommend that the City maintain separate accounts for the receipt and expenditure of both improvement fees and reimbursement fees. In addition, the City's accounting for SDCs must comply with ORS 223.311.

If growth does not occur as projected, SDC receipts also fall short of projections. The City may choose to delay associated capital project construction as a result.

It is important to note that the City's proposed fiscal year 2012-13 budget includes budgeted water rate revenues of $5,490,445 (which do not include miscellaneous fees and are therefore less than total revenues). This is an increase of almost 19 percent over the estimated fiscal year 2011-12 rate revenues of $4,622,735 used in this financial analysis. Recent revenue performance does not appear to support the budgeted water rate revenues for fiscal year 2012-13. If the City generates and sustains rate revenues at budgeted levels, then future increases will not be necessary for at least five (5) years.

Recommendations

We recommend no rate increase for fiscal year 2012-13. If, during that year, earned rate revenues equal or exceed budgeted rate revenues, then a rate increase can be avoided for fiscal year 2013-14. If, however, revenues for fiscal year 2012-13 are flat as we project, we recommend a rate increase of 4.25 percent in fiscal year 2013-14 with a series of similar increases in subsequent years.

Table 8-6 | Projection Summary – Minimum Annual Rate Increase										
Revenue Requirements	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Revenues										
Rate Revenues Under Existing Rates	$4,622,735	$4,622,735	$4,622,735	$4,622,735	$4,622,735	$4,622,735	$4,622,735	$4,622,735	$4,622,735	$4,622,735
Non-Rate Revenues	716,530	261,920	198,669	198,914	199,169	199,432	199,705	199,705	199,705	199,705
Total Revenues	**$5,339,265**	**$4,884,655**	**$4,821,404**	**$4,821,649**	**$4,821,904**	**$4,822,167**	**$4,822,440**	**$4,822,440**	**$4,822,440**	**$4,822,440**
Expenses										
Cash O&M Expenses	$3,915,850	$4,065,510	$4,212,660	$4,365,139	$4,523,140	$4,686,863	$4,856,515	$5,032,312	$5,214,476	$5,403,234
Existing Debt Service	539,531	538,281	536,263	538,363	539,863	540,763	541,063	540,519	538,869	541,125
Rate Funded CIP[1]	-	-	-	-	-	-	266,693	1,077,809	1,117,855	1,155,069
Total Expenses	**$4,455,381**	**$4,603,791**	**$4,748,923**	**$4,903,502**	**$5,063,003**	**$5,227,626**	**$5,664,271**	**$6,650,640**	**$6,871,201**	**$7,099,428**
Annual Rate Adjustment	**0.00%**	**0.00%**	**1.23%**	**3.30%**	**3.28%**	**3.26%**	**5.88%**	**17.97%**	**3.28%**	**3.28%**
Rate Revenues After Rate Increase	$4,622,735	$4,622,735	$4,679,643	$4,834,405	$4,993,967	$5,158,532	$5,464,567	$6,450,936	$6,671,496	$6,899,723
Net Cash Flow After Rate Increase	883,884	280,864	129,389	129,817	130,133	130,338	-	-	-	-
Coverage After Rate Increases	2.64	1.53	1.25	1.25	1.25	1.25	1.50	3.00	3.08	3.14

Note: 1) "Rate Funded CIP" represents same-year revenue that must be used for capital projects when previous operating surpluses (not shown in this table) have been exhausted.

Table 8-7 | Projection Summary – Constant Annual Rate Increase										
Revenue Requirements	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Revenues										
Rate Revenues Under Existing Rates	$4,622,735	$4,622,735	$4,622,735	$4,622,735	$4,622,735	$4,622,735	$4,622,735	$4,622,735	$4,622,735	$4,622,735
Non-Rate Revenues	716,530	261,920	198,669	198,914	199,169	199,432	199,705	199,987	200,280	200,565
Total Revenues	**$5,339,265**	**$4,884,655**	**$4,821,404**	**$4,821,649**	**$4,821,904**	**$4,822,167**	**$4,822,440**	**$4,822,722**	**$4,823,015**	**$4,823,300**
Expenses										
Cash O&M Expenses	$3,915,850	$4,065,510	$4,212,660	$4,365,139	$4,523,140	$4,686,863	$4,856,515	$5,032,312	$5,214,476	$5,403,234
Existing Debt Service	539,531	538,281	536,263	538,363	539,863	540,763	541,063	540,519	538,869	541,125
Rate Funded CIP[1]	-	-	-	-	-	-	-	4,323	598,536	1,152,436
Total Expenses	**$4,455,381**	**$4,603,791**	**$4,748,923**	**$4,903,502**	**$5,063,003**	**$5,227,626**	**$5,397,578**	**$5,577,155**	**$6,351,882**	**$7,096,795**
Annual Rate Adjustment	**0.00%**	**0.00%**	**4.25%**	**4.25%**	**4.25%**	**4.25%**	**4.25%**	**4.25%**	**4.25%**	**4.25%**
Rate Revenues After Rate Increase	$4,622,735	$4,622,735	$4,819,044	$5,024,630	$5,239,933	$5,465,411	$5,701,546	$5,948,841	$6,207,823	$6,479,043
Net Cash Flow After Rate Increase	883,884	280,864	268,790	320,042	376,099	437,217	503,672	571,674	56,222	(417,187)
Coverage After Rate Increases	2.64	1.53	1.51	1.60	1.71	1.82	1.95	2.08	2.22	2.36

Note: 1) "Rate Funded CIP" represents same-year revenue that must be used for capital projects when previous operating surpluses (not shown in this table) have been exhausted.

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APPENDIX

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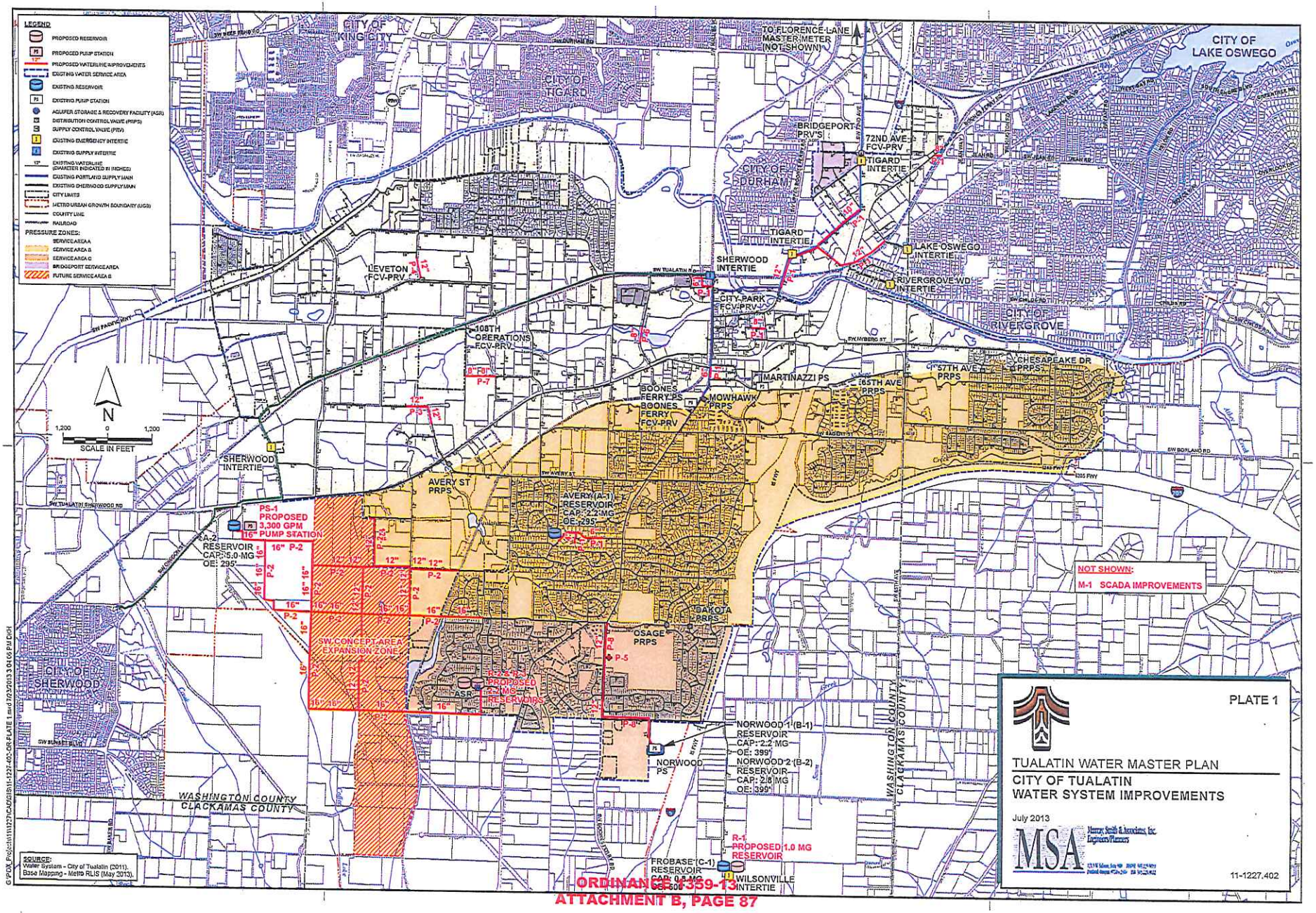
APPENDIX A



ORDINANCE 1359-13
ATTACHMENT B, PAGE 87

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APPENDIX B

APPENDIX B
REFERENCES

1. Memorandum, "Evaluation of Sherwood Main Use Options," prepared by Murray, Smith & Associates, Inc., for the City of Tualatin, April 30, 2012.

2. Memorandum, "Tualatin Residential and Non-Residential Capacity Estimate 2011", prepared by Colin Cortes, City of Tualatin, September 1, 2011.

3. "2010 Update, Southwest Tualatin Concept Plan," prepared by the City of Tualatin, accepted by City Council October 11, 2010.

4. Memorandum, "SW Tualatin Concept Plan Update – Estimate Revisions," prepared by CH2M-Hill, July 27, 2010 for the City of Tualatin.

5. Memorandum, "Urban and Rural Reserves Local Aspirations - Town Center, Commercial, Industrial and Stafford Basin," prepared by City of Tualatin, April 13, 2009.

6. "2005 Southwest Tualatin Concept Plan," prepared by CH2M-Hill, August 3, 2005.

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APPENDIX C

APPENDIX C
COST ALLOCATION FOR FACILITIES AND PIPING IMPROVEMENTS

Appendix C contains cost data for recommended improvements to reservoirs, pressure reducing valves, pump stations, and system piping. Improvement project cost estimates presented in this appendix are based upon recent experience with construction costs for similar work in the area and assume improvements will be accomplished by private contractors. Estimates include provisions for approximate construction costs plus an aggregate 45 percent allowance for contingencies, engineering, administration and other project-related costs. Since construction costs change periodically, an indexing method to adjust present estimates in the future is useful. The Engineering News-Record (ENR) Construction Cost Index (CCI) is a commonly used index for this purpose. For purposes of future cost estimate updating; the current ENR CCI for Seattle, Washington is 9075 (May 2012).

Table C-1
Reservoir Project Cost Estimate Summary
Frobase (C-2) Storage Reservoir (1.0 MG)

This project has been designed and is awaiting construction project funding. The design engineer's construction cost estimate is $1,148,950 as of January 2012.

Item No.	Description	Estimated Project Cost[1]
	Design Engineer's Construction Cost Estimate	$1,148,950.
	35% Contingency, Administration & Construction Engineering	$402,000
	Total Estimated Project Cost	$1,550,950
	SAY	$1,560,000

[1] The cost estimates presented are opinions of cost based on the assumptions stated and developed from information available at the time of the estimate. Final costs for all projects will depend on actual field conditions, on actual material and labor costs, final project scope, project implementation and other variables.

Table C-2
Reservoir Project Cost Estimate Summary
New Service Level B (B-3) Storage Reservoir (2.2 MG)

The reservoir project cost estimate is based on the following assumptions:

- No rock excavation included.
- No property acquisition costs included (current planned site is City-owned)
- Construction by private contractors.
- An Engineering News-Record (ENR) Construction Cost Index (CCI) of 9075 for Seattle, Washington (May 2012).

Reservoir B-3 will be constructed first and will include most of the site improvements. Consequently, Reservoir B-4 will be a smaller project.

Item No.	Description	Estimated Project Cost[1]
1.	Reservoir Structure (Welded Steel)	$1,650,000
2.	Site Work	$500,000
3.	Access/Parking	$100,000
4.	Yard Piping	$200,000
5.	Electrical & Instrumentation	$50,000
8.	Landscaping/Fencing	$50,000
	Total Estimated Construction Cost	$2,550,000
	45% Contingency, Administration & Engineering	$1,147,000
	Total Estimated Project Cost	$3,697,000
	SAY	$3,700,000

[1] The cost estimates presented are opinions of cost based on the assumptions stated and developed from information available at the time of the estimate. Final costs for all projects will depend on actual field conditions, on actual material and labor costs, final project scope, project implementation and other variables.

Table C-3
Reservoir Project Cost Estimate Summary
New Service Level B (B-4) Storage Reservoir (2.2 MG)

The reservoir project cost estimates is based on the following assumptions:

- No rock excavation included.
- No property acquisition costs included (current planned site is City-owned)
- Construction by private contractors.
- An Engineering News-Record (ENR) Construction Cost Index (CCI) of 9075 for Seattle, Washington (May 2012).

Reservoir B-3 will be constructed first and will include most of the site improvements. Consequently, Reservoir B-4 will be a smaller project.

Item No.	Description	Estimated Project Cost[1]
1.	Reservoir Structure (Welded Steel)	$1,650,000
2.	Site Work	$100,000
3.	Yard Piping	$25,000
4.	Electrical & Instrumentation	$10,000
	Total Estimated Construction Cost	$1,785,000
	45% Contingency, Administration & Engineering	$803,000
	Total Estimated Project Cost	$2,588,000
	SAY	$2,600,000

[1] The cost estimates presented are opinions of cost based on the assumptions stated and developed from information available at the time of the estimate. Final costs for all projects will depend on actual field conditions, on actual material and labor costs, final project scope, project implementation and other variables.

Table C-4
Pump Station Project Cost Estimate Summary
New Pump Station (PS-1)

The pump station project cost estimates is based on the following assumptions:

- No rock excavation included.
- No property acquisition costs included.
- Construction by private contractors.
- 3,600 gpm nominal pumping capacity (~100 HP)
- An Engineering News-Record (ENR) Construction Cost Index (CCI) of 9075 for Seattle, Washington (May 2012).

Item No.	Description	Estimated Project Cost[1]
1.	Structure	$100,000
2.	Site Work	$75,000
3.	Yard Piping	$50,000
4.	Pumps and Mechanical	$200,000
5.	Electrical & Instrumentation	$100,000
6.	Landscaping	$25,000
7.	Standby Power Generator	$100,000
	Total Estimated Construction Cost	$650,000
	45% Contingency, Administration & Engineering	$292,500
	Total Estimated Project Cost	$942,500
	SAY	$950,000

[1] The cost estimates presented are opinions of cost based on the assumptions stated and developed from information available at the time of the estimate. Final costs for all projects will depend on actual field conditions, on actual material and labor costs, final project scope, project implementation and other variables.

Table C-5
Piping Unit Project Cost Summary

Pipeline cost estimates are based on the following assumptions:

- No rock excavation included.
- No excessive dewatering included.
- No property or easement acquisitions costs included.
- No specialty construction included.
- A 45% contingency, administration and engineering allowance included.
- Construction by private contractors.
  An Engineering News-Record (ENR) Construction Cost Index (CCI) of 9075 for Seattle, Washington (May 2012).
- An additional 60 percent allowance is included for construction with rock excavation the entire depth of trench.

The following table summarizes the estimated project cost per linear foot by pipe size for water pipelines.

Pipe Diameter	Estimated Project Cost per Linear Foot
8-inch	$145
12-inch	$215
16-inch	$290

[1] The cost estimates presented are opinions of cost based on the assumptions stated and developed from information available at the time of the estimate. Final costs for all projects will depend on actual field conditions, on actual material and labor costs, final project scope, project implementation and other variables.