2015 - 2020 Water System Plan

DRAFT

February 2015 **DRAFT**

McAllister Wellfield initial pumping test
February 2013

City of Olympia | Capital of Washington State

Executive Summary

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EXECUTIVE SUMMARY

Every day, the City of Olympia delivers affordable, high-quality drinking water to over 60,000 people through approximately 20,000 connections. This water consistently meets 100 percent of US Environmental Protection Agency (USEPA) standards for safe drinking water, and it is pumped to everyone's homes at a fraction of the cost some will pay for bottled water.

This Water System Plan serves as a guide for Utility staff to use in achieving objectives and implementing strategies over the next six years, and provides benchmarks against which progress toward the Utility's goals can be measured.

This Plan has been prepared in accordance with WAC 246-290-100, which requires public water systems with more than 1,000 connections to submit a water system plan every six years for review and approval by the Washington State Department of Health (DOH). The Plan demonstrates the Drinking Water Utility's operational, technical, managerial and financial capability to achieve and maintain compliance with relevant local, state and federal regulations, and how the Utility will address present and future needs.

Overall Vision

The Utility's mission is to provide and protect healthy drinking water for the community, with a long-term vision that Olympia's Drinking Water Utility sustains present and future water supplies for our community while protecting the environment. This mission and vision have been developed in the context of the City's commitment to sustainability.

This Plan evaluates the City of Olympia's water system from the perspective of the full hydrologic cycle, not solely from the traditional perspective of source, storage and distribution. It recognizes the connection between groundwater and surface water, and the effect that Olympia's groundwater-dependent water system may have on surrounding surface water bodies.

Additionally, this Plan helps carry out the vision and goals stated in the Olympia Comprehensive Plan. In particular, the following chapters of the Comprehensive Plan give guidance to this strategic management plan for the Utility:

- Community Vision and Values
- Public Participation and Partners
- Utilities
- Natural Environment
- Capital Facilities Plan

Challenges

The years 2015-2020 will be less capital intensive than the previous planning cycle. The Utility achieved its goal of reserving water rights for a 50+ year water supply, replaced the primary source at McAllister Springs with the McAllister Wellfield, and achieved significant water conservation targets.

The following challenges face the Drinking Water Utility for 2015-2020:

1. **Aging infrastructure.** Assessment, repair and replacement of existing infrastructure will continue to be a challenge for the Utility.
2. **Changing water quality regulations.** The Utility must be ready to respond to any changes in water quality regulations and treatment requirements imposed by state and federal agencies.
3. **Keeping pace with development.** Fast or slow, the rate of growth will determine how new water sources are developed and when they come online.
4. **Protecting groundwater from contamination.** Risks to groundwater will increase with a growing population, and will require the City to regularly evaluate, monitor, and take action to control sources of pollution.
5. **Equitable and predictable rates and fees.** Creating predictability for customers and developers is difficult in a complex economic and regulatory environment.
6. **Public education and involvement.** Keeping customers and the community involved and informed about challenges, needs, plans and proposals can help ensure that programs and projects are responsive to customer needs and community values.

2015-2020 Drinking Water Utility Goals

The primary framework for this Plan is the Utility's long-term vision that Olympia's Drinking Water Utility sustains present and future water supplies for our community while protecting the environment. The Utility sees itself as a steward of water resources and therefore takes a broad view of the entire hydrologic cycle, rather than focusing narrowly on system infrastructure.

Table S1 defines the key planning terms used in this Plan. Understanding them will make it easier to see how specific elements of this Plan relate to each other.

Table S1 Key Planning Terms

Goals[1]	Broad, qualitative statements of what the Drinking Water Utility intends to achieve.
Objectives	Specific, measurable statements of what will be done to achieve the Goals within a particular time frame.
Strategies	General approaches or methods for achieving Objectives and resolving specific issues. Strategies speak to the question "How will we go about accomplishing our Objectives?"

1. Definitions are adapted from EPA's Planning for Sustainability: A Handbook for Water and Wastewater Utilities, EPA-823-R-12-001, February 2012.

The goals, objectives and strategies presented in Table S2 offer a roadmap for the Utility's direction over the next six years. Further information and discussion regarding the goals, objectives and strategies are in Chapters 4-14.

The Utility will focus on a number of programs over the next six years:

- Asset Management. This program will enable staff to manage the condition of infrastructure assets, evaluate life cycles, and track ongoing costs of repair and replacement, in order to optimize management of the Utility's infrastructure.
- McAllister Wellfield Mitigation. The Utility will continue to fulfill the requirements of our water rights mitigation plan, often in coordination with other jurisdictions and local tribes.
- Water Conservation. Having exceeded previously established goals for water use efficiency, the Utility has set new, achievable water use efficiency goals to build on past program success.

The Utility has a strong foundation of well-developed, ongoing programs and will continue to refine and strengthen these programs in 2015-2020, guided by the goals, objectives and strategies compiled in Table S2.

Table S2 2015-2020 Goals, Objectives and Strategies

Goal 1. Adequate supplies of water are available for the Olympia community while protecting in-stream flows and sustaining long-term capacity of aquifers. (Chapter 4)
Objective 1A. Maintain water rights that ensure adequate supply for at least 50 years, so sources can be protected from contamination or commitment to lower priority uses.
Strategies 1. Evaluate existing water rights and forecasted demand every six years. 2. Continue implementing required mitigation actions associated with McAllister Wellfield water rights.
Objective 1B. Encourage multi-jurisdictional approaches to water rights and source development.
Strategies 1. Through agreements and in consultation with neighboring tribes and cities, take a cooperative, regional approach to mitigating aquifer pumping impacts on water bodies in the Deschutes and Nisqually WRIAs (11 and 13, respectively). 2. Continue to evaluate future operational strategies for development of the former Olympia Brewery water rights.
Objective 1C. Monitor water levels in all pumped aquifers and maintain numerical groundwater models to better understand aquifer characteristics and evaluate the impacts of the City's withdrawals.
Strategies 1. Continue to monitor water level data and update numerical models as needed for all water sources. 2. Continue to expand the long-term water level monitoring protocol for implementation in all water supply areas to better understand impacts of the City's withdrawal on the aquifers used for water supply. 3. Evaluate whether aquifer pumping tests are needed in certain water supply aquifers and conduct tests as needed. 4. Maintain numerical models for all water sources. Use these models to predict future water supply impacts from climate, development, and additional withdrawals.

Goal 2. Water is delivered at useful pressures and meets Safe Drinking Water Act standards – and it looks and tastes great. (Chapter 11)

Objective 2A. Maintain 100 percent compliance with all state and federal monitoring requirements.

Strategies

1. Continue compliance monitoring for source, distribution and tap locations according to required timelines, with analysis performed by accredited laboratories.
2. Continue groundwater protection monitoring to alert staff about contamination that may be migrating toward drinking water sources.
3. Continue tracking developments associated with future state and federal monitoring requirements.
4. Continue close monitoring of nitrate levels in Shana Park Well 11 (S10). If levels begin to increase, evaluate treatment or development of a new source.

Objective 2B. Maintain 100 percent compliance with all state and federal treatment requirements.

Strategies

1. Maintain a minimum free chlorine residual of 1.07 mg/L at Shana Park Well 11 (S10) in order to maintain compliance with CT6.
2. Maintain a minimum pH of 7.0 at Shana Park Well 11 (S10), Allison Springs Well 13 (S09) and Allison Springs Well 19 (S11); and a minimum 7.5 at McAllister Wellfield (S16) and Indian Summer Well 20 (S12).
3. Verify minimum chlorine residual of 0.2 mg/L in the distribution system through measurement of residual chlorine levels, as part of monthly system coliform sampling.

Objective 2C. Respond to customer water quality concerns promptly and maintain accurate reporting.

Strategies

1. Investigate, validate and respond to water quality complaints by way of phone calls, emails and/or site visits.
2. Meet all reporting and record retention deadlines.

Objective 2D. Support the groundwater protection network with monitoring and data collection.

Strategies

1. Continue sampling groundwater protection monitoring wells in all Drinking Water Protection Areas.
2. Continue maintaining data loggers in all Drinking Water Protection Areas.

Goal 3. Olympia's water supplies are used efficiently to meet the present and future needs of the community and natural environment. (Chapters 5 & 6)

Objective 3A. Reduce indoor use by an additional 100,000 gallons per day (gpd) over past program savings.(Chapter 5)

Strategies

1. Continue to implement flow reduction programs through partnership with the LOTT Clean Water Alliance and Cities of Lacey and Tumwater for single-family, multi-family and industrial/commercial/institutional (ICI) customers who receive LOTT sewer service.
2. Continue to implement water-saving programs for residential City water customers who are on septic systems and therefore cannot participate in the LOTT programs.
3. Continue outreach to raise awareness of the importance of water use efficiency.

Objective 3B. Reduce outdoor use by an additional 5 percent over past program savings. (Chapter 5)

Strategies

1. Continue to implement outdoor water use reduction programs for residential customers.
2. Continue to implement the Efficient Irrigation Hardware Rebate Program for ICI customers.
3. Continue outreach to raise awareness of the importance of water use efficiency.

Objective 3C. Maintain water loss below 10 percent of production. (Chapter 5)

Strategies

1. Continue to monitor water loss in the system annually, as required by the DOH, by evaluating production, authorized consumption (both metered and unmetered) and resulting Distribution System Leakage (DSL).
2. Continue to work closely with the Olympia Fire Department and surrounding fire districts to get accurate estimates of water used for fire suppression, fire flow testing, sprinkler flushing and training conducted off-site.
3. Continue to work closely with the Utility's Operations & Maintenance section to monitor water loss due to field use, main breaks and leaks, as well as expanding leak detection efforts.
4. If the water system exceeds the DSL standard, develop and implement a Water Loss Control Action Plan as required by DOH.

Objective 3D. Meet the needs of current and future City reclaimed water customers. (Chapter 6)

Strategies

1. Continue to respond to inquiries about reclaimed water use, regulations, availability, capacity, opportunities, and requests for assistance with existing infrastructure.
2. Continue to support development-driven advancement of reclaimed water for direct beneficial use, using the *Reclaimed Water System Expansion Plan* to guide placement of infrastructure.
3. Continue to implement and enforce the City's reclaimed water ordinance, engineering design and development standards and End User Agreements to ensure compliance.

Objective 3E. Direct reclaimed water towards meeting the regional wastewater management goal of reducing the amount of treated wastewater discharged into Puget Sound. (Chapter 6)

Strategies

1. Seek opportunities to increase infiltration of reclaimed water to recharge groundwater and enhance in-stream flows.
2. Participate as a LOTT partner in state and local reclaimed water regulation development activities, including presence on technical and advisory groups.
3. Support efforts to expand infrastructure for partnered or regional uses.

Objective 3F. Enhance Reclaimed Water Program efficiency and effectiveness (Chapter 6)

Strategies

1. Engage in a reclaimed water project or effort involving direct beneficial reuse when it:
    - Benefits implementation of the City's Reclaimed Water Program
    - Results in the use of significant volumes of reclaimed water
    - Involves a high-profile or model use or user
    - Aligns with implementing the *Reclaimed Water System Expansion Plan*
2. Pursue grants and other funding sources that support the Reclaimed Water Program's objectives and strategies.

Goal 4. Customers have access to the information they need, have a role in accomplishing Utility goals, and participate in Utility decision making. (Chapter 1)

Objective 4A. Engage with drinking water customers regularly.

Strategies

1. Work with Olympia's Utility Advisory Committee to develop and review drinking water policies, projects, programs and rates.
2. Provide useful information to customers through the Utility bill insert that accompanies each water bill.
3. Maintain the Utility's web pages with current information that is easy to find and understand.

Objective 4B. Coordinate customer service and education with the City's other water resource utilities and LOTT.

Strategies

1. Cooperate with the Wastewater Management Utility, Storm and Surface Water Utility and LOTT in educational/promotional activities.

Goal 5. Groundwater quality is protected to ensure clean drinking water for present and future generations and to avoid the need for expensive replacement or treatment facilities. (Chapter 7)

Objective 5A. Prevent contamination of groundwater through surveillance and response.

Strategies

1. Continue to monitor groundwater quality to understand risks to groundwater, detect contamination and evaluate pollution reduction efforts.
2. Continue to improve spill prevention actions and implement spill response procedures.

Objective 5B. Strengthen and exercise partnerships with citizens and state/local agencies.

Strategies

1. Raise awareness about the need to protect groundwater and change human behaviors that place groundwater at risk.
2. Collaborate on groundwater protection efforts with state, county and neighboring city agencies.

Objective 5C. Improve program policies, procedures and tools.

Strategies

1. Continue to clarify the City's groundwater protection policies and simplify the development review process.
2. Streamline program processes and procedures.
3. Ensure that groundwater protection-related capital projects and major equipment are included in the Utility's Asset Management Program.

Goal 6. Infrastructure is prudently financed, and sustainably constructed, maintained and operated to ensure reliable delivery of high quality water to a growing community. (Chapters 8-13)

Objective 6A. Design and construct infrastructure to ensure reliable delivery of water. (Chapters 8, 9, 10)

Strategies

1. Develop and maintain multiple, geographically dispersed sources of water supply to enhance the reliability of the system. (Chapter 8)
2. Develop and maintain storage and transmission/distribution infrastructure to ensure delivery of water at adequate pressure throughout the system and maintain required fire flow (Chapters 9 & 10)

Objective 6B. Continue to improve maintenance management, including preventive maintenance, repairs and replacements. (Chapter 12)

Strategies

1. Document and report on equipment efficiency and capacity annually.
2. Maintain, clean and exercise equipment per manufacturer recommendations.
3. Maintain buildings and grounds in a park-like manner.

Objective 6C. Continue to improve the Utility's emergency response program and maintain facility security. (Chapter 12)

Strategies

1. Plan for the anticipated impacts of sea level rise.
2. Continue to maintain and be prepared to implement the water system emergency response plan.
3. Store emergency supplies at several strategic locations and replenish before expiration dates
4. Conduct tabletop and/or field exercises periodically.
5. Maintain existing security equipment at critical facilities.
6. Update or replace pump station telemetry system hardware and software as needed.

Objective 6D. Continue to improve O&M program management, including safety and asset management. (Chapter 12)

Strategies

1. Continue scheduling and documenting all water system maintenance in VueWorks.
2. Continue employee safety program, including safety committee review of accidents, review of new regulations and available training, and monthly staff training sessions.
3. Ensure that all Utility infrastructure is accurately depicted on maps and related databases.
4. Develop and implement an asset management program, in coordination with Public Works and City-wide efforts, to prioritize future capital improvement projects.

Goal 7. Drinking Water Utility finances are managed responsibly, and costs are recovered equitably based on customer use. (Chapter 13)

Objective 7A. Set rates that reflect financial policies and recover the cost of providing services to each customer class.

Strategies

1. Increase annual depreciation funding to 75 percent of depreciation by 2020 in order to equitably charge current customers for the use and decline in value of the system.
2. Analyze how the tiered and seasonal rate structure is affecting consumption patterns/ revenue, and propose changes to the rate structure as appropriate.
3. Conduct a cost-of-service study for wholesale and retail customers on a six-year cycle or more often as needed.
4. Coordinate regular rate studies with the City's other water resources utilities, so that the full impact of utility rate increases on customers is considered.

Objective 7B. Manage Utility rates and connection fees consistent with the City's guiding principle of growth paying for growth.

Strategies

1. Increase the General Facility Charges to reflect the current pro rata share of system costs.
2. Review General Facilities Charges regularly to ensure that they accurately and equitably distribute system costs to new development and are adjusted for inflation.

Objective 7C. Use debt financing responsibly to support needed capital facility investments and "smooth" rate impacts.

Strategies

1. Continue the capital funding strategy that utilizes existing resources from reserves and general facility charges first before relying upon debt financing.
2. Maintain the required debt coverage ratio and a solid bond rating
3. Pursue grants and state low-interest loans when available.

Summary of Capital Projects

Table S3 lists Capital Projects scheduled for construction in the next six years. Developer-contributed projects are not included in this table, as they will not require City funding. For a complete list of projects for the 20-year planning period, see **Chapter 13, Table 13.2**.

Table S3 2015-2020 Recommended Capital Improvement Projects

Project Schedule and Costs (in thousands of dollars) [1]							
Code	**Project Name**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Water Source (WS)							
WS-1	Briggs Well Construction [2]						
WS-2	McAllister Wellfield Corrosion Treatment		2,475	825			
WS-3	McAllister Wellfield Mitigation - Deschutes River	200	142	100	100	100	100
WS-4	Groundwater Protection (Easements, Appraisals, etc.)		11	4	11	4	11
WS-5	Wellhead Protection Program			188	175	38	
WS-6	Groundwater Monitoring Wells	75	138	188	200	50	
WS-7	Olympia Brewery Water Engineering Analysis	38	13				38
WS-8	Indian Summer Well Chlorination		113	38			
WS-9	Hoffman Well Treatment [2]						
WS-10	Shana Park Well Water Quality Study		113	38			
Water Storage (ST)							
ST-1	New Log Cabin Tank Construction	6,750	2,250				
ST-2	Fir Street Tank #1 and #2 Seismic Retrofit			750	250		
ST-3	Elliott Tank Seismic Retrofit			938	313		
ST-4	Hoffman Tank Interior Coating Replacement			434	145		
Transmission and Distribution (TD)							
TD-1	Distribution System Oversizing	27	27	27	27	27	27
TD-2	Morse-Merryman Extension to New Log Cabin Tank	900	300				
TD-3	PRVs - East Bay Drive					185	62
TD-4	AC Pipe - Blvd Road Roundabout - Morse-Merryman		585	195			
TD-5	Fones Road Water Main Construction						1,725
TD-6	Fones Road Booster Rehabilitation Design/Construction	813	273				
TD-7	Kaiser Road Water Main Extension to Evergreen Park			570	190		
TD-8	Indian Summer Extension to Rich Road [2]						
TD-9	McCormick Valve House		113	38			
TD-10	Percival Creek Water Main	75	325	100			

TD-11	West Bay Booster Station Pump and Electrical Upgrade	113	38				
TD-12	Meridian Overflow and 36-inch Water Main	113	38				
TD-13	Eastside Street and Henderson Boulevard Water Main Extension [2]						
Operations and Maintenance (OM)							
OM-1	Small Diameter Water Main Replacement	488	500	500	500	500	500
OM-2	Asphalt Overlay Adjustments	11	11	11	11	11	11
OM-3	Storage Tank Coatings (Interior/Exterior)				225	75	225
OM-4	Booster Station Upgrade/Rehabilitation			113	150	150	150
OM-5	AC and Aging Pipe Replacement	375	500	500	500	500	500
OM-6	PRV Telemetry (Radio-Based) [2]						
OM-7	Distribution Main Condition Assessment	19	25	25	25	25	25
OM-8	Cross Country Mains	19	25	25	25	25	25
OM-9	On-site Generator Replacement Plan		56	19	56	19	56
OM-10	Asset Management Program	38	50	50	50	50	50
OM-11	Corrosion Control (Aeration) Tower Condition Assessment & Upgrades		19	25	25	25	25
OM-12	Water Filling Stations						75
OM-13	Water Meter Replacement [2]						
OM-14	Water Meter AMR Radio Replacement [2]						
OM-15	McAllister Wellfield Mitigation - Woodland Creek	38	50	50	50	50	50
Reclaimed Water (RW)							
RW-1	Reclaimed Water Infrastructure						188
RW-2	Port of Olympia - Eliminate Northern Dead End		38	13			
Planning (PL)							
PL-1	Water System Plan						225
PL-2	Infrastructure Pre-Design and Planning	16	21	21	21	21	21
TOTAL		**10,104**	**8,244**	**5,780**	**3,048**	**1,854**	**4,088**

1. Costs are in September 2014 dollars. Totals of individual years may not equal subtotals, due to rounding.
2. Some projects are not scheduled in the six year planning period, only for the 7-20 year planning period (see **Table 13.2**).

Planning Process

This Plan has been prepared by Drinking Water Utility staff, with technical assistance from HDR Engineering, Inc. and financial analysis by Financial Consulting Services Group. The Plan has been reviewed by the City's Utility Advisory Committee and the City Council's Land Use and Environment Committee.

The Utility Advisory Committee (UAC) serves as the principal public advisor on utility policy matters for the City's four public utilities: Drinking Water, Wastewater, Storm and Surface Water, and Waste ReSources. Committee members played a key role in reviewing this Plan and providing recommendations to clarify and improve it.

SEPA Review

The State Environmental Policy Act (SEPA) requires the City to consider the potential environmental impacts of a proposal before making any final decisions.

After reviewing the SEPA Checklist and attachments (Appendix S1) the City's environmental review officer issued a Determination of Non-significance (DNS) on [date to be added] 2015. This means that no significant adverse impacts were identified. No comments were received from the public nor were any appeals filed. [placeholder language]

Potential impacts of construction projects planned for 2015-2020 were not specifically evaluated; they will be evaluated in a separate SEPA process when each is designed.

Public Hearing

As part of the Water System Plan process, DOH requires utilities to hold public hearings to give the community an opportunity to comment on the Plan. As follow-up to the [date to be added], 2015 City Council study session on the Plan, a public hearing was held during a Council meeting on [date to be added], 2015. A copy of the minutes is attached in Appendix S2. The Council Resolution adopting the DOH-approved Plan will be attached as Appendix S3.

Notice about the public hearing was mailed to community members at least 10 days prior to the public hearing. The complete 2015-2020 Water System Plan is available for downloading from the City website, and a printed copy can be viewed at Olympia City Hall, 601 4th Avenue East, Olympia, Washington 98501.

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1-1 Amendment to Extend Service Area (2006 Water System Plan update)

1-2 Intergovernmental agreement with City of Lacey. *Intergovernmental Agreement for Sale of Water* (2007 and 2010 Amendment No. 1)

1-3 Intergovernmental agreement with City of Lacey. *Draft Mutual Aid Agreement (being negotiated).*

1-4 Intergovernmental agreement with City of Tumwater. *Mutual Aid Agreement Between the Cities of Tumwater and Olympia For the Use of Emergency Water System Interties (2001)*

1-5 Intergovernmental agreement with Thurston PUD No. 1. *Intergovernmental Agreement for Sale of Water, Assignment of Water System Accounts, and Management of Water System* (2014)

1-6 Intergovernmental agreement with U.S. Army (Fort Lewis). Department of the Army Mutual Aid Agreement (2005)

1-7 Water Facilities Inventory Form (DOH WF1 Form)

CHAPTER 1 - SYSTEM OVERVIEW

This chapter gives an overview of Olympia's water system, including ownership and management, customers, history, service area environment and land use, boundaries, neighboring purveyors and related policies. It also generally describes the system infrastructure: supply, storage and transmission/distribution.

Olympia is located in Thurston County, at the southern tip of Puget Sound. It is approximately 65 miles south of Seattle, 105 miles north of Portland, and 45 miles east of Aberdeen. As the state capitol as well as the county seat, its economic activity is fueled to a great extent by government activity. The adjacent cities of Lacey and Tumwater contribute to the metropolitan nature of the area.

1.1 Ownership and Management

The City of Olympia owns and operates a public water supply system that serves customers within its Water Service Area. Key facts about the Utility are shown in Table 1.1. The City does not own or manage more than one public water system and therefore is not a satellite management agency.

Table 1.1 System Profile

Water system name	City of Olympia
Water system identification number	634506
Water system classification	Group A – Community Type
Type of ownership	Local government
System contact person	Mike Vessey, Pump Stations Supervisor
Service area population (2013)	60,710
Number of metered service connections (Sept 2014)	19,699
Capacity of distribution storage tanks	30.88 million gallons
Supply sources	McAllister Wellfield and six supply wells

Management and Staffing

Olympia's public utilities are managed within the Public Works Department, which is organized into five lines of business (Water Resources, Waste Resources, Transportation, Engineering and General Services). The three water-related utilities (Drinking Water, Wastewater, and Storm and Surface Water) are managed under the leadership of the Water Resources Director.

The Drinking Water Utility encompasses Engineering and Planning, Drinking Water Operations, Pump Stations Operations and Drinking Water Quality. The Utility is supported by Public Works Engineering, Facilities and Fleet services. The Utility develops its own annual operating budget and capital facilities program.

The Utility has a total of approximately 29 FTE staff, as shown in Table 1.2.

Table 1.2 Drinking Water Utility Staffing Overview

Drinking Water Utility Section	Number of Full-time Employees (FTE)	Associated Chapter
Drinking Water Operations		
Drinking Water	16.5 FTE	Chapter 12
Pump Stations	3.75 FTE	Chapter 12
Drinking Water Quality		
Water Quality	3.0 FTE	Chapter 11
Water Conservation	1.75 FTE	Chapter 5
Reclaimed Water	0.5 FTE	Chapter 6
Groundwater Protection	0.5 FTE	Chapter 7
Engineering and Planning		
Engineering	1.5 FTE	Chapters 8, 9, 10, 13
Planning	1.0 FTE	Chapters 1, 2, 4, 14
Administrative Support	0.6 FTE	N/A
Total	29.1 FTE	

Customers

Olympia provides retail water service within the incorporated City limits and its Urban Growth Area (UGA), with a few exceptions noted below in Section 1.3, and wholesale water to the City of Lacey and Thurston PUD No. 1.

As of 2014, the Utility had 19,699 metered customers within its service area, which includes the incorporated City limits and its Urban Growth Area (Map 1.1). The Utility provides potable water to residential, commercial and industrial customers, and reclaimed water to a few customers in downtown Olympia. See Chapter 3 for details.

Providing high quality service to customers is a priority for the Drinking Water Utility. Drinking Water Goal 4 states:

> **Customers have access to the information they need, have a role in accomplishing Utility goals, and participate in Utility decision making.**

Customer service is a recurring theme in this Water System Plan. In particular, the Utility uses the objectives and strategies below to implement Goal 4.

Objective 4A Engage with drinking water customers regularly.

Strategy 4A1 -- Utilize Olympia's Utility Advisory Committee to develop and review drinking water policies, projects, programs and rates.

Strategy 4A2 -- Provide useful information to customers through the Utility bill insert that accompanies each water bill.

Strategy 4A3 -- Maintain the drinking water utility's web pages with current information that is easy to find and understand.

Objective 4B Coordinate customer service and education with the City's other water resource utilities and LOTT.

Strategy 4B1 -- Cooperate with the Wastewater Management Utility, Storm and Surface Water Utility and LOTT in educational/promotional activities.

Levels of Service

Municipal utilities in the United States and elsewhere commonly use Level of Service (LOS) standards to evaluate whether the physical system and operations are functioning to an adequate level. LOS can be defined in terms of the customer's experience of utility service and/or technical standards based on professional expertise of utility staff.

The Utility complies with all regulatory standards for water quality and system design and operation. In addition to these minimum standards, the LOS standards address issues of concern for customers that influence decisions on infrastructure investments.

LOS standards can help guide investments in maintenance, repair and replacement. For new assets, LOS can be used to establish design criteria and prioritize needs. Using a structured decision process that incorporates LOS can help a utility achieve desired service outcomes while minimizing life-cycle costs.

The Utility has refined its LOS standards using the following criteria:

- Specific goal or expectation identified.
- Focused on customer and community.
- Quantifiable and measurable.
- Relatively simple to understand and apply.
- Constrained by available budgets for maintenance, repair and replacement.

The Utility's LOS standards are in these areas:

- System performance (including service interruption due to breakage, pressure and system reliability).
- Sustainability (energy efficiency).
- Customer service (response to water quality and service-related complaints).

1.2 History

Historical accounts of water service to Smithville, as Olympia was originally known, are vague. The earliest accounts describe a combined creek and groundwater source emanating from the Moxlie Creek watershed. In 1941, when peak system demands began to exceed the supply capacity in this watershed, the City purchased the McAllister Springs property at the headwaters of McAllister Creek.

McAllister Springs and Creek have great cultural and historical significance to the Nisqually Indian Tribe. The Springs are within the aboriginal territory of the Nisqually, a Salish-speaking group that lived in villages along the banks of the Nisqually River and its tributaries, including McAllister Creek. McAllister Creek was also known as Medicine Creek, in reference to its spiritual importance for the Nisqually, and was the place where the 1854 Treaty of Medicine Creek was signed.

The City developed the Springs in 1945, and constructed the pump house and pipeline in 1946 and 1947. In 1949, Olympia began pumping water from McAllister Springs, which provided the majority of Olympia's water supply for the next 65 years. In 1995, due to concerns over the vulnerability of McAllister Springs and costly water quality treatment requirements, the City formally requested a transfer of its water rights from McAllister Springs (and nearby Abbott Springs) to the McAllister Wellfield.

In 1998, the City purchased a 20-acre site (hereafter McAllister Wellfield), along with the development rights for an additional 100 acres adjacent to the Wellfield. The agreement relating to development rights carries certain restrictions on the use of the land. To provide access, the City also purchased a 66-acre parcel of property south of the Wellfield property.

In 2008, the City entered into a Memorandum of Agreement with the Nisqually Indian Tribe to replace McAllister Springs with an up-gradient wellfield to avoid the need for ultra-violet treatment at the Springs, reduce the risk of contamination from transportation spills, and eliminate the potential effects of saltwater intrusion due to sea level rise.

In support of the water right application, the City subsequently conducted an extensive study on groundwater pumping, worked with regional partners on mitigation strategies across two watersheds, and reached two groundbreaking agreements with neighboring Tribes. Nearly 17 years later, in early January 2012, the Department of Ecology (Ecology) issued water rights for the McAllister Wellfield, marking a historic moment for the City and the Nisqually Tribe.

The Wellfield began operations in November 2014 and is now the City's primary source of water supply, supplemented seasonally by six additional wells. (See also Chapter 4 and Chapter 8 for development of McAllister Wellfield and details on other sources.)

1.3 Service Area

This section gives an overview of the natural environment, particularly climate and impacts of climate change; land use; and system information including boundaries, neighboring purveyors, interties and service area agreements.

Environment and Land Use

The following sections describe the climate and land use of the service area. Chapter 7 describes the topography, geology and groundwater conditions, as well as land use and zoning, of the designated Drinking Water Protection Areas (DWPAs) around supply sources.

Climate

Due to its elevation and location on Puget Sound, Olympia's climate is characterized by warm, dry summers and cool, wet winters.

Winter weather in Olympia is temperate, wet and generally overcast. Summer weather is moderate and comparatively dry. The average annual range in temperature is relatively narrow, from an average low of 39 degrees Fahrenheit (F) to an average high of 60 degrees F.

During the wet season, generally from October to May, storms usually arrive from the southwest and continue toward the Olympic Peninsula. An occasional Arctic storm from the northwest brings freezing temperatures, hail or sleet, freezing rain or snow.

The coast range and Olympic Mountains protect the area from strong Pacific storms during the fall and winter. An average annual rainfall of about 51 inches in the Olympia area can be attributed to the onshore effects of maritime disturbances originating in the Pacific Ocean.

Climate Change Trends

The warming climate is projected to cause changes in weather patterns. In general, Ecology expects western Washington to experience milder, wetter winters and hotter, drier summers. The water system will potentially be affected by changing levels of precipitation and rising sea level in Puget Sound. For details, see Ecology's climate change website.

The University of Washington Climate Impacts Group (CIG) has measured observed effects of global climate change in the Pacific Northwest and Puget Sound, and projected potential future trends. The CIG's findings as of 2013 are summarized below, as cited in *Climate Change Impacts and Adaptation in Washington State: Technical Summaries for Decision Makers (2013)* and previous CIG publications.

Rising Temperature. Since 1895, the average annual temperature in the Pacific Northwest has increased 1.3 degrees F. Significant warming has occurred in all seasons except for spring, with the largest changes having occurred during the winter months. The rate of warming is expected to accelerate; the best estimate is a rate of over three times the increase of 0.15 percent per decade observed during the 20th century. Estimates range from increases of 0.7 to 3.2 degrees by the 2020s, 1.4 to 4.6 degrees by the 2040s, and 2.9 to 8.8 degrees by the 2080s. Olympia's water demand forecast more conservatively assumes temperature changes of 1.8 to 5.4 degrees F above historic levels by 2020 and 2.4 to 7.2 degrees higher by 2040, based on the CIG's 2002 forecasts for the Portland (OR) Water Bureau.

Precipitation uncertainty. No significant trends toward wetter or drier conditions in Pacific Northwest precipitation have been observed since 1985. This recent finding may contradict previously reported information documenting an increase in precipitation. Natural variability in precipitation is high. Similarly, the evidence of heavier downpours is ambiguous.

Spring snowpack fluctuates widely from year to year, but has declined in the Washington Cascades since the mid-20th century. Glaciers are in decline. Snow melt and associated streamflow timing is occurring earlier in the year for many rivers and streams. These trends can be expected to continue.

Sea level rise. A 1993 City of Olympia report found that sea level is already rising in Olympia by about one foot per century due to post-ice age warming of the oceans and subsidence of the land (City of Olympia, 1993). This rate is expected to increase with rising global temperatures. However, sea level in Washington is also influenced by coastlines both rising and falling due to plate techtonics. Unlike areas to the north, Olympia's shoreline may be lowering in elevation, thereby exacerbating the impacts of sea level rise.

In a January 2008 report, the University of Washington Climate Impact Group (CIG) recommended that for decisions with long timelines and low risk tolerance, such as coastal development and public infrastructure, policymakers should use low-probability, high-impact estimates of sea level rise.

Overall, although sea level rise scenarios and estimates for Puget Sound vary, most studies anticipate a steady increase in sea levels.

Potential Climate Change Impacts

Direct impacts on the Utility could result from projected increases in summer temperatures and saltwater intrusion from rising sea level.

Increased demand due to rising summer temperatures. Under current climate conditions, water use increases as summer temperatures rise. If summers in Olympia become hotter and drier, demand for water may increase correspondingly. The Utility believed it prudent to anticipate this potential trend in developing its 50-year demand forecast for the 2009–2014 Water System Plan, and has done the same for this 2015-2020 Plan (Chapter 3). Therefore, water demand was analyzed under two climate scenarios: the first assumed a five percent increase in maximum day demand; the second assumed a ten percent increase.

Climate change effects are anticipated to occur gradually, allowing time for the community and water system to adapt over periods of years and decades. The Utility's focus on water conservation should help counteract increases in demand for potable water.

Saltwater intrusion from rising sea level. Prior to development of the McAllister Wellfield, the City's primary drinking water source at McAllister Springs was at risk of saltwater intrusion from rising sea levels. The City developed the McAllister Wellfield to provide an upgradient water supply and largely mitigate this risk. Currently the Allison Springs supply wells are the City's only drinking water sources considered at risk of saltwater intrusion. However, despite their proximity to the Puget Sound and screening near sea level, these wells are considered to be at low risk for saltwater intrusion. Utility staff regularly monitors Allison Springs groundwater, looking for changes in conductivity and chloride concentration that may indicate an influence of salt water.

Land Use and Zoning

This section characterizes the current land use and future zoning of the Utility's service area. See Chapter 7 for land use and zoning in designated DWPAs.

Development of residential and commercial properties in the area has slowed since the 2008 recession. In general, most residential development in Olympia has shifted to large apartment complexes of 100 units or more with densities up to about 20 units per acre. Most single family and commercial development is occurring as "infill" in already developed areas. As a result, most development is occurring on the Westside where large multi-family tracts remain available. Map 1.2 shows current zoning.

The best projection of future land use is in the designations given by Olympia's Comprehensive Plan, as updated in 2014 (Map 1.3). The Plan is designed to accommodate 20-year projected growth as required by the Growth Management Act. Generally, the City is moving toward infilling areas already characterized by urban development, phasing urban development facilities outward from core areas, and requiring new development to be configured to allow for future infill. The Plan aims to bolster the downtown area as the city center, and create two other high density neighborhoods – one in the vicinity of the Capital Mall and another along Martin Way west of Lilly Road.

Service Area System Information

Within Olympia's service area, water is available to all new retail customers through main extensions or by connecting to existing mains. As of 2013, the service area population was approximately 60,710, and the Utility had 19,699 metered service connections.

Water service consists of the sale of potable water to residential, commercial, industrial, and institutional customers, as well as the use of water for fire protection. The service area is divided into seven pressure zones. Water demand calculations for each pressure zone, as shown in Chapter 3, take into account population growth and development as well as uncertainties such as the impacts of climate change. The infrastructure improvements described in this Plan (Chapters 8-10) will ensure that the City has sufficient capacity to provide safe and reliable water service.

The City also distributes reclaimed water to a few customers in downtown Olympia, within a small reclaimed water service area that is entirely within the water service area (Chapter 6).

This section describes other system information including boundaries, neighboring purveyors, interties and service agreements. Service area policies are in Chapter 2, Section 2.2.

Service Area Boundaries

The public utility service areas for Olympia, Lacey and Tumwater are generally contiguous with the Urban Growth Area boundary**.**

The service area boundary establishes the limits of City water service responsibilities through direct connection. Olympia's water service area generally includes the incorporated City limits and its Urban Growth Area (UGA), as shown in Map 1.1.

Over the years, the service area has been amended to include these parcels outside the UGA that are served by Olympia:

- The Evergreen State College (1969)
- Small areas around 11th Avenue Northwest and Overhulse Road Northwest in West Olympia
- A few parcels north of 26th Avenue Northeast
- Some locations in Lacey and Tumwater where Olympia is serving accounts that were connected prior to adoption of the Coordinated Water System Plan
- McLane Fire District 9 facility and McLane Elementary School near the intersection of Delphi and Mud Bay Roads (2006)

The most recent extension was the 2006 amendment to the 2004 Water System Plan to support water service to the new McLane Fire District 9. Thurston County signed the required local government consistency statement and the Washington State Department of Health (DOH) approved this amendment in August 2006. The service area was also updated and approved as part of the 2006 Plan update (Appendix 1-1).

In addition, there are 21 direct service connections off the 36-inch main that lies outside Olympia's service area. These are historic connections, which pre-date the Coordinated Water System Act of 1977. Olympia has discussed with Lacey and Thurston PUD No.1 about moving these connections off the 36-inch main and into their systems as appropriate.

Retail Water Service

Map 1.1 shows the existing/retail and future zones within Olympia's water service area. The existing/retail zone generally includes areas where the Utility currently provides service, or where service is immediately available. The future zone includes areas within Olympia's water service area where the City does not yet provide services.

Wholesale Customers

Thurston PUD No. 1 includes the Tanglewilde and Thompson Place subdivisions in the City of Lacey. The City operated and maintained the PUD's water system from 1964 until June 2005, when the PUD assumed operation and maintenance responsibilities and became a wholesale customer of Olympia's Water Utility.

Olympia also provides wholesale water service to the City of Lacey to supplement its own sources.

Olympia's wholesale agreement with the PUD is scheduled to end in early 2015, and the agreement with the City of Lacey by the end of 2016. Thus, by 2017 Olympia will not be supplying wholesale water to either Lacey or the PUD. This planned change is reflected in Olympia's water demand forecast, Chapter 3, and rate structure analysis, Chapter 14.

Neighboring Purveyors

Olympia's service area is bordered to the east and south by the water service areas of Lacey and Tumwater. Map 1.1 depicts the service areas. Within the boundaries of Olympia's service area there are approximately 16 Group A Water Systems with a total of 372 connections and 29 Group B Water Systems, serving 121 connections.

Interties

Olympia sells water wholesale to the City of Lacey through a booster pump station from the 36-inch main located west of Marvin Road, at Pacific Avenue and Mountainaire Road. There are also two emergency interties with the Lacey system: one on Sleater-Kinney Road Southeast near McDonald's Restaurant; and another off Sleater-Kinney Road Northeast and Sixth Avenue Northeast near North Thurston High School.

Olympia has two emergency interties with the City of Tumwater: one at the intersection of Capitol Boulevard and Carlyon Avenue Southeast; the other at the intersection of Mottman Road and Crosby Boulevard Southwest.

Two interties provide wholesale water to Thurston PUD No. 1: one at Pacific Avenue and Seahawk Street Southeast; and the other at Pacific Avenue and Steilacoom Road.

For details on the emergency interties with Lacey and Tumwater see Chapter 10, Table 10.4 and the Emergency Response Plan (Chapter 12, Section 12.2 and Appendix 12-2). Map 1.4 shows the general location of these interties, which are included in the Water Facilities Inventory Form in Appendix 1-7.

Service Area Agreements

Water service areas in North Thurston County are designated in the 1986 Coordinated Water System Plan (CWSP) and 1996 Area Wide Supplement. The CWSP has not been updated to reflect the 2005 agreement under which the City no longer provides retail service to the Tanglewilde and Thompson Place areas within Thurston PUD No. 1; or the 2006 agreement extending City water service to the McLane Fire District 9 facility. Olympia also has intergovernmental agreements with the Cities of Lacey and Tumwater, Thurston PUD No. 1, and Fort Lewis (now Joint Base Lewis McChord):

- **City of Lacey**. Under the 2007 *Intergovernmental Agreement for Sale of Water* (Appendix *1*-2), Olympia agrees to sell Lacey up to two million gallons per day during November through June and up to 1 million gallons per day during July through October. Olympia may temporarily interrupt or reduce delivery of water to Lacey in event of emergency or need for maintenance or repair. The original two-year agreement has been extended to expire after 2016, with no further continuation. A mutual aid emergency agreement is being negotiated with City of Lacey (Appendix 1-3).
- **City of Tumwater**. *Under the 2001 Mutual Aid Agreement Between the Cities of Tumwater and Olympia For the Use of Emergency Water System Interties* (Appendix 1-4), each City agrees to provide potable water service to the other for use in firefighting, and for drinking water and personal hygiene. It will be activated only in the event of an emergency proclamation by the city requesting assistance.
- **Thurston PUD No. 1.** In 2005, Olympia signed a 20-year agreement with Thurston PUD No. 1, *Intergovernmental Agreement for Sale of Water, Assignment of Water System Accounts, and Management of Water System.* This terminated the 1996 agreement under which Olympia had operated the PUD system. Since then Olympia has continued providing water but the PUD operates its own system. The agreement was amended in 2007, specifying the quantity and price of water to be supplied, and committing the City to provide sufficient water for ultimate build-out of the (PUD's) service area. In 2014, the City of Olympia and the PUD entered into a new agreement for the sale of water in anticipation of the PUD no longer needing to buy wholesale water from Olympia. This 2014 agreement (Appendix 1-5) supercedes the previous intergovernmental agreements between the PUD and City for sale of water.

- **Joint Base Lewis McChord (JBLM, formerly Fort Lewis).** Under this 2005 mutual aid agreement, the US Army at JBLM and the City of Olympia agree to assist each other in fire prevention and the protection of life and property from fire and firefighting and other emergencies, including response to hazardous materials spills (Appendix 1-6). The JBLM Fire Department staff is fully trained and equipped to respond to any size of spill. (See Chapter 12, Section 12.2.)

Emergency supply agreements are authorized under Chapter 38.52 RCW, Emergency Management. Sale of water to another municipality is authorized by Chapter 29.34 RCW, RCW 35.92.170 and RCW 35.92.200.

Service Area Policies

Under RCW 43.20.260, municipal water suppliers have a duty to provide service to all new connections within their retail service area when the circumstances meet four threshold factors:

- The supplier has sufficient capacity to serve water in a safe and reliable manner.
- The service request is consistent with adopted local plans and development regulations.
- The supplier has sufficient water rights to provide service.
- The supplier can provide service in a timely and reasonable fashion.

The City of Olympia anticipates having adequate capacity to supply customers in its service area with drinking water throughout the planning period for this water system plan.

Local and regional ordinances and policies regulating Utility operations are in Chapter 2, Section 2.2.

1.4 Facilities Inventory

This section is an overview of Olympia's water system facilities -- wells, pumps, storage tanks, and transmission and distribution lines described more fully in Chapters 8-10. The Water Facilities Inventory form submitted to DOH is in Appendix 1-7.

Map 1.4 shows the location of the major water system components; elevations are shown on Figure 1.1, a profile schematic of the system.

Source of Supply

Olympia depends solely on groundwater to meet its drinking water needs. The McAllister Wellfield is the primary source of water for all City customers. From May through October, daily water use doubles and sometimes nearly triples, mostly due to outdoor water use. During these months, the City uses up to six additional wells to supplement the McAllister Wellfield.

Drinking Water Protection Areas are designated for each source. See Chapter 7 for information regarding hydrogeology, boundary delineations, and land use and zoning for each area.

The McAllister Wellfield provides approximately 69 percent of the total source capacity for the City. It is located about 10 miles east of the City off Washington Highway 510. Water from the Wellfield is pumped to the Meridian Storage Tanks, which are just over a mile to the northwest of the Wellfield. A 36-inch transmission main takes the water on a nine-mile journey, mostly beneath Pacific Avenue, into the storage tanks on Fir Street at Seventh Avenue. From there, water is pumped and piped throughout the City.

The balance of the City water is provided seasonally by up to six wells. East Olympia is served by Shana Park Well 11 (S10), Hoffman Well 3 (S08) and Indian Summer Well 20 (S12). West Olympia is served by Allison Springs Well 13 (S09) and Well 19 (S11), and Kaiser Road Well 1 (S03). Table 1.2 summarizes basic information about each source. For details, see Chapter 4 and Chapter 8.

Table 1.2 City of Olympia Water Supply Sources

Source	Location & Approximate Area of Drinking Water Protection Area	Percent of Current Capacity
McAllister Wellfield (S16)	North Thurston County south of Nisqually Delta	68.8%
Hoffman Well 3 (S08) Shana Park Well 11 (S10) Indian Summer Well 20 (S12)	Southeast Olympia, Lacey urban growth area and Thurston County	18.7%
Allison Springs Well 13 (S09) and Well 19 (S11) Kaiser Well 1 (S03)	West Olympia and Thurston County	12.5%

Storage

Eleven storage tanks serve seven pressure zones throughout the City, with a total capacity of 30.88 million gallons. Five tanks are steel and six are concrete. The Meridian storage tanks, located northwest of the McAllister Wellfield, provide eight million gallons of storage. (See Chapter 9 for details.)

Transmission and Distribution

The transmission and distribution system is a network of over 360 miles of pipe, ranging from ¾-inch to 36 inches in diameter and ranging in age from new to nearly 80 years old. The pipes are made of various materials, including galvanized steel, polyvinyl chloride (PVC), asbestos cement (AC), concrete, ductile iron, steel, high-density polyethylene and plastic.

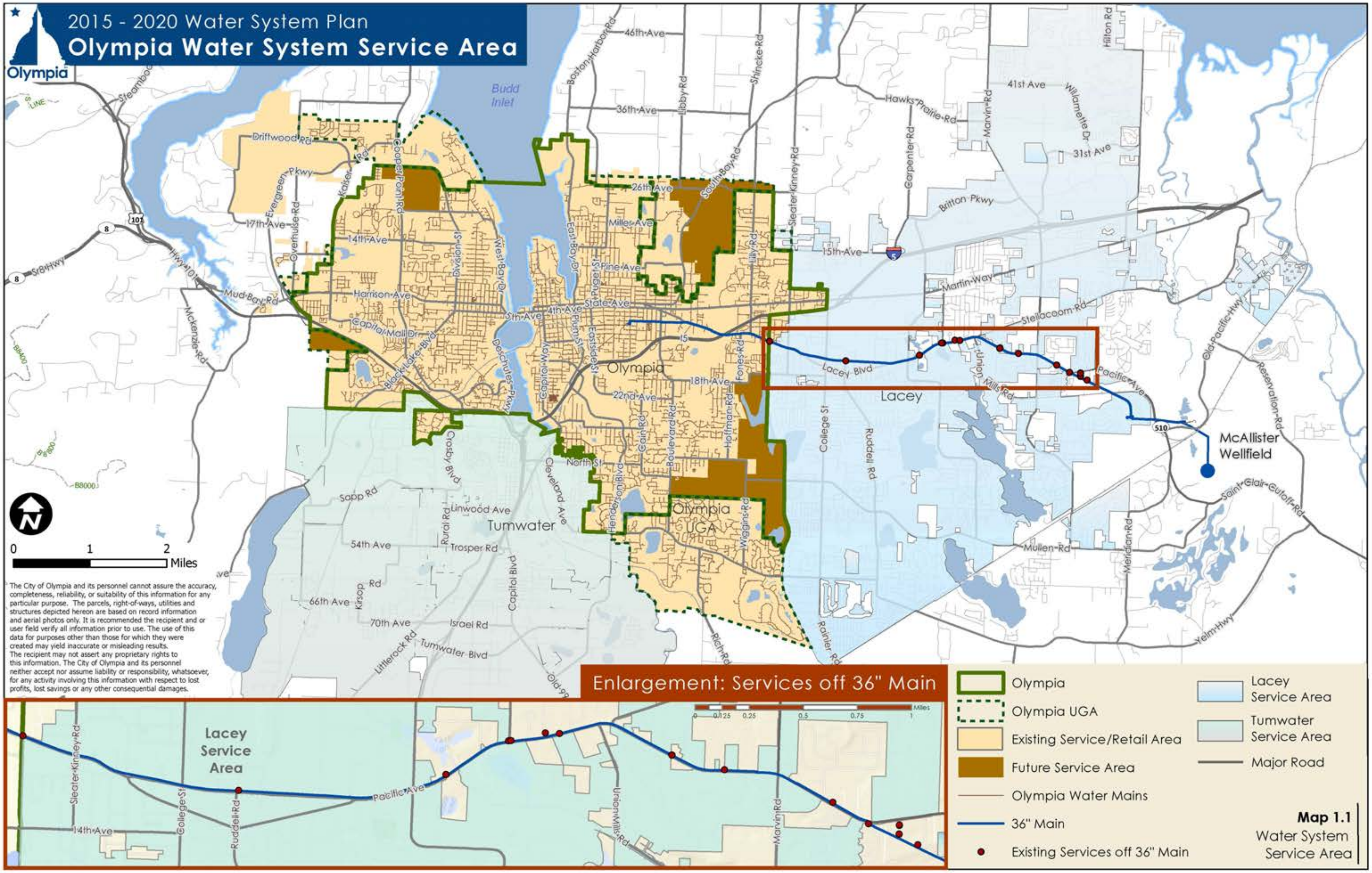
Because of the topography and extent of the service area, as well as the arrangement of storage tanks and other facilities, Olympia's water distribution system has been divided into seven pressure zones, listed in Table 1.3. Five booster pump stations pump water throughout the system. For details, see Chapter 10.

Map 1.4 shows the pressure zone boundaries. The pressure zones are designated with numbers corresponding to the overflow elevation of the reservoirs that feed a particular zone; that is, the highest water level in the reservoir as measured from mean sea level. For example, Zone 417 is served by the Hoffman Storage Tank, which has a maximum water level of 417 feet above mean sea level. For details on pressure zones, see Chapter 9 and Chapter 10.

Table 1.3 Olympia Water Distribution System Pressure Zones

Zone	Pressure Control Facility	Maximum HGL[1]
417	Fones Road & South Sound Booster Pump Stations/Shana Park, Hoffman and Indian Summer wells	417
338	Boulevard Storage Tank /pressure-reducing valve from Zone 417	338
347	Eastside Booster Pump Station	347
264	36-inch gravity line from Meridian Storage Tanks	264
226	Fir Street Storage Tanks	226
298	Allison Springs Wells / Percival Booster Pump Station	298
380	West Bay Booster Pump Station	380

1. Maximum hydraulic grade line (HGL) is the overflow elevation of the tank(s) serving the zone.


2015 - 2020 Water System Plan
Olympia Water System Service Area
Olympia
Budd Inlet
Olympia
Lacey
Tumwater
Olympia UGA
McAllister Wellfield
Harrison Ave
Capital Mall Dr
Black Lake Blvd
4th Ave
State Ave
5th Ave
Pacific Ave
Lacey Blvd
Martin Way
Stellacoom Rd
Union Mills Rd
College St
Ruddell Rd
Mullen Rd
Yelm Hwy
Rainier Rd
Rich Rd
Capitol Blvd
Tumwater Blvd
Israel Rd
Littlerock Rd
0
1
2
Miles
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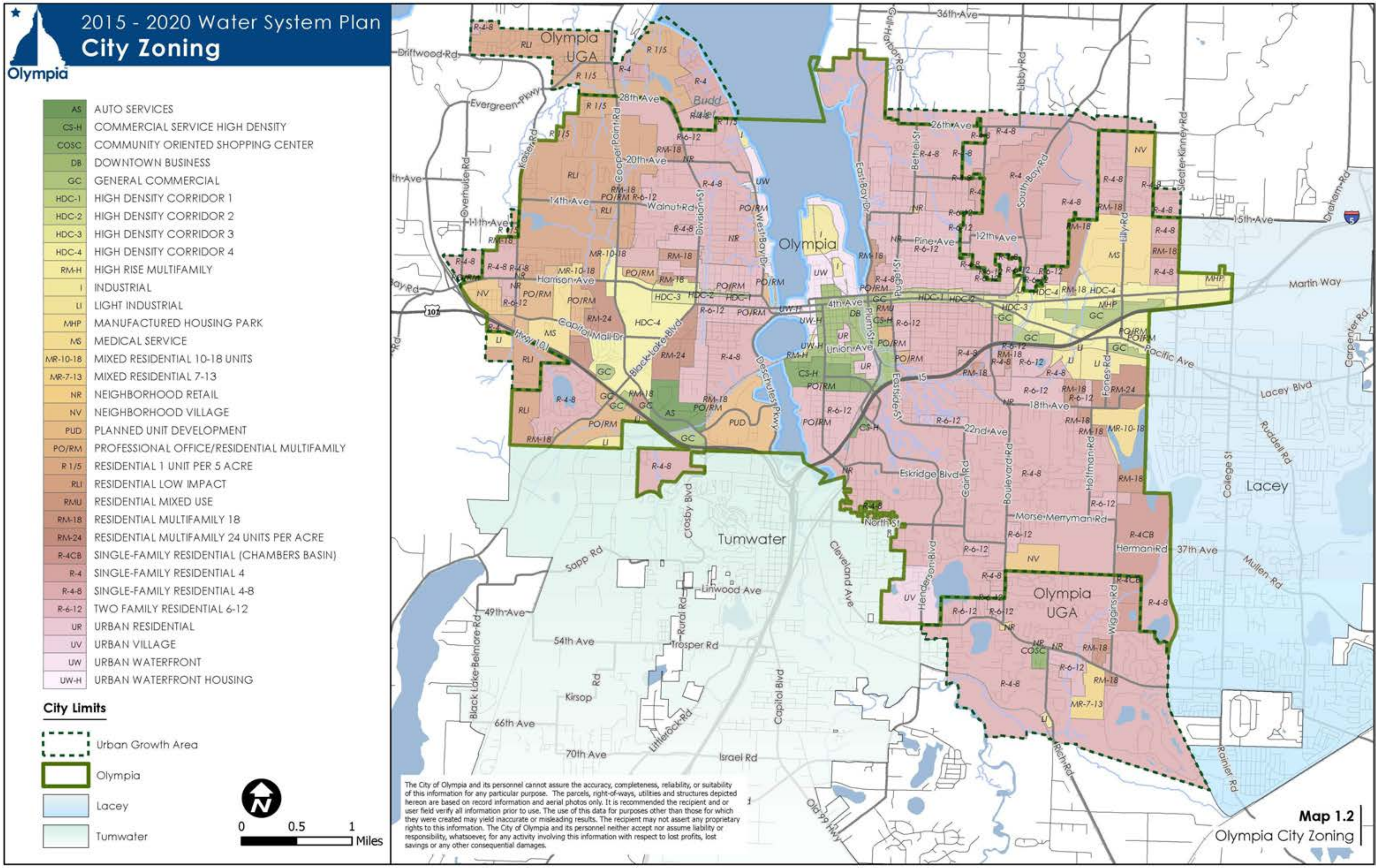
The recipient may not assert any proprietary rights to this information. The City of Olympia and its personnel neither accept nor assume liability or responsibility, whatsoever, for any activity involving this information with respect to lost profits, lost savings or any other consequential damages.
Enlargement: Services off 36" Main
Lacey Service Area
Sleater-Kinney Rd
14th Ave
College St
Ruddell Rd
Pacific Ave
Union Mills Rd
Marvin Rd
Olympia
Olympia UGA
Existing Service/Retail Area
Future Service Area
Olympia Water Mains
36" Main
Existing Services off 36" Main
Lacey Service Area
Tumwater Service Area
Major Road
Map 1.1
Water System Service Area


2015 - 2020 Water System Plan
City Zoning
Olympia
AS AUTO SERVICES
CS-H COMMERCIAL SERVICE HIGH DENSITY
COSC COMMUNITY ORIENTED SHOPPING CENTER
DB DOWNTOWN BUSINESS
GC GENERAL COMMERCIAL
HDC-1 HIGH DENSITY CORRIDOR 1
HDC-2 HIGH DENSITY CORRIDOR 2
HDC-3 HIGH DENSITY CORRIDOR 3
HDC-4 HIGH DENSITY CORRIDOR 4
RM-H HIGH RISE MULTIFAMILY
I INDUSTRIAL
LI LIGHT INDUSTRIAL
MHP MANUFACTURED HOUSING PARK
MS MEDICAL SERVICE
MR-10-18 MIXED RESIDENTIAL 10-18 UNITS
MR-7-13 MIXED RESIDENTIAL 7-13
NR NEIGHBORHOOD RETAIL
NV NEIGHBORHOOD VILLAGE
PUD PLANNED UNIT DEVELOPMENT
PO/RM PROFESSIONAL OFFICE/RESIDENTIAL MULTIFAMILY
R 1/5 RESIDENTIAL 1 UNIT PER 5 ACRE
RLI RESIDENTIAL LOW IMPACT
RMU RESIDENTIAL MIXED USE
RM-18 RESIDENTIAL MULTIFAMILY 18
RM-24 RESIDENTIAL MULTIFAMILY 24 UNITS PER ACRE
R-4CB SINGLE-FAMILY RESIDENTIAL (CHAMBERS BASIN)
R-4 SINGLE-FAMILY RESIDENTIAL 4
R-4-8 SINGLE-FAMILY RESIDENTIAL 4-8
R-6-12 TWO FAMILY RESIDENTIAL 6-12
UR URBAN RESIDENTIAL
UV URBAN VILLAGE
UW URBAN WATERFRONT
UW-H URBAN WATERFRONT HOUSING
City Limits
Urban Growth Area
Olympia
Lacey
Tumwater
0 0.5 1 Miles
Olympia UGA
Olympia
Tumwater
Lacey
Budd Inlet
Driftwood Rd
Evergreen Pkwy
28th Ave
20th Ave
14th Ave
Walnut Rd
Harrison Ave
Capitol Mall Dr
Black Lake Blvd
Cooper Point Rd
Kaiser Rd
Overhulse Rd
Division St
West Bay Dr
East Bay Dr
Deschutes Pkwy
4th Ave
Union Ave
Plum St
Eastside St
Bethel St
Gull Harbor Rd
36th Ave
26th Ave
Pine Ave
12th Ave
South Bay Rd
Libby Rd
Lilly Rd
Sleater Kinney Rd
15th Ave
Martin Way
Pacific Ave
Lacey Blvd
Ruddell Rd
College St
Carpenter Rd
Graham Rd
18th Ave
22nd Ave
Eskridge Blvd
Cain Rd
Boulevard Rd
Hoffman Rd
Fones Rd
Morse Merryman Rd
Herman Rd
37th Ave
Mullen Rd
North St
Henderson Blvd
Wiggins Rd
Rich Rd
Rainier Rd
Cleveland Ave
Crosby Blvd
Sapp Rd
Linwood Ave
Rural Rd
Trosper Rd
49th Ave
54th Ave
Kirsop
66th Ave
70th Ave
Littlerock Rd
Israel Rd
Capitol Blvd
Old 99 Hwy
Black Lake-Belmore Rd
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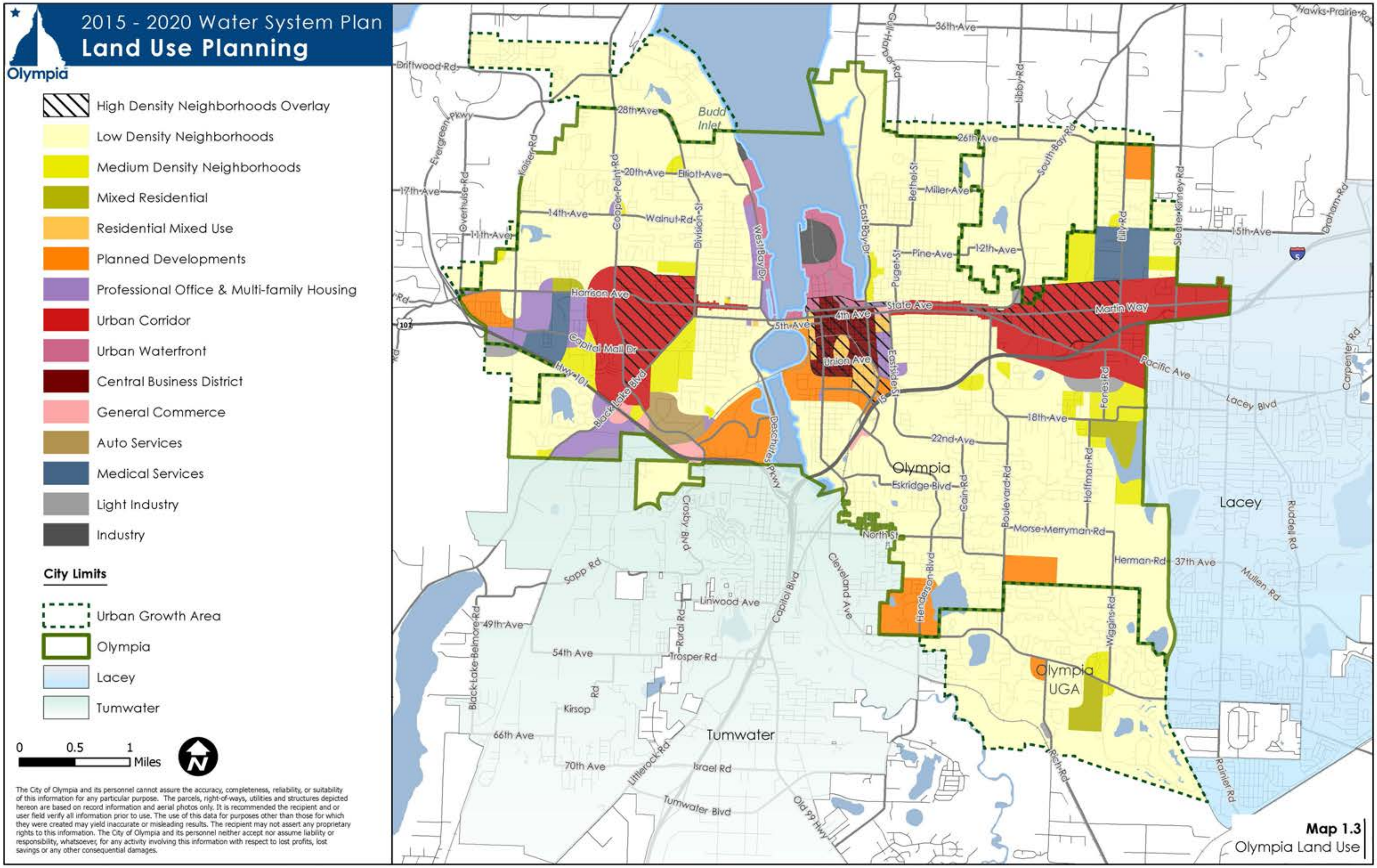
Map 1.2
Olympia City Zoning


2015 - 2020 Water System Plan
Land Use Planning
Olympia
High Density Neighborhoods Overlay
Low Density Neighborhoods
Medium Density Neighborhoods
Mixed Residential
Residential Mixed Use
Planned Developments
Professional Office & Multi-family Housing
Urban Corridor
Urban Waterfront
Central Business District
General Commerce
Auto Services
Medical Services
Light Industry
Industry
City Limits
Urban Growth Area
Olympia
Lacey
Tumwater
0 0.5 1 Miles
N
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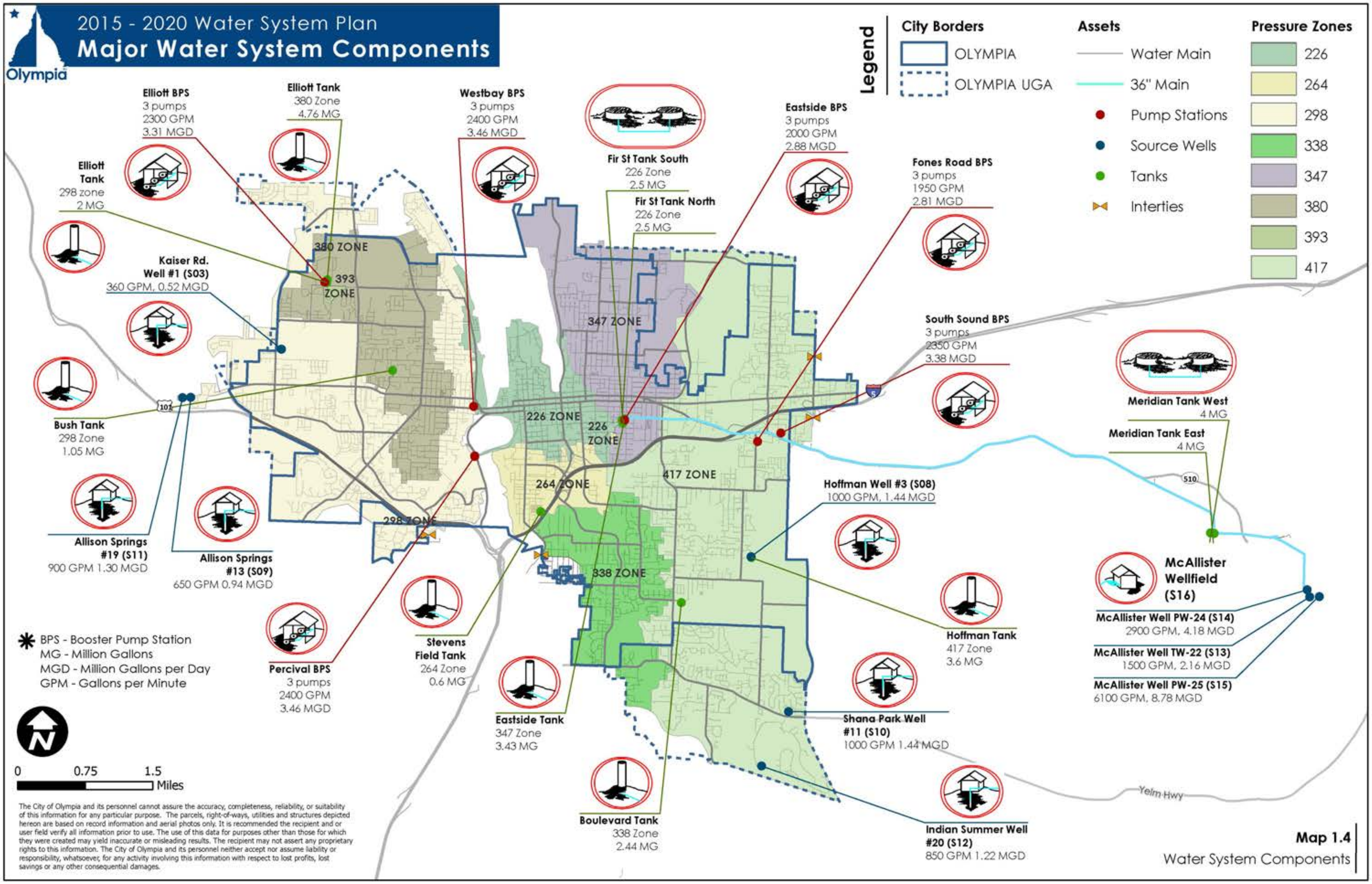
Budd Inlet
Olympia
Lacey
Tumwater
Olympia UGA
Map 1.3
Olympia Land Use


2015 - 2020 Water System Plan
Major Water System Components
Olympia
Legend
City Borders
OLYMPIA
OLYMPIA UGA
Assets
Water Main
36" Main
Pump Stations
Source Wells
Tanks
Interties
Pressure Zones
226
264
298
338
347
380
393
417
Elliott BPS
3 pumps
2300 GPM
3.31 MGD
Elliott Tank
380 Zone
4.76 MG
Westbay BPS
3 pumps
2400 GPM
3.46 MGD
Fir St Tank South
226 Zone
2.5 MG
Fir St Tank North
226 Zone
2.5 MG
Eastside BPS
3 pumps
2000 GPM
2.88 MGD
Fones Road BPS
3 pumps
1950 GPM
2.81 MGD
South Sound BPS
3 pumps
2350 GPM
3.38 MGD
Elliott Tank
298 zone
2 MG
Kaiser Rd. Well #1 (S03)
360 GPM, 0.52 MGD
Bush Tank
298 Zone
1.05 MG
Allison Springs #19 (S11)
900 GPM 1.30 MGD
Allison Springs #13 (S09)
650 GPM 0.94 MGD
380 ZONE
393 ZONE
347 ZONE
226 ZONE
226 ZONE
264 ZONE
298 ZONE
417 ZONE
338 ZONE
Meridian Tank West
4 MG
Meridian Tank East
4 MG
Hoffman Well #3 (S08)
1000 GPM, 1.44 MGD
McAllister Wellfield (S16)
McAllister Well PW-24 (S14)
2900 GPM, 4.18 MGD
McAllister Well TW-22 (S13)
1500 GPM, 2.16 MGD
McAllister Well PW-25 (S15)
6100 GPM, 8.78 MGD
Hoffman Tank
417 Zone
3.6 MG
Shana Park Well #11 (S10)
1000 GPM 1.44 MGD
Indian Summer Well #20 (S12)
850 GPM 1.22 MGD
Percival BPS
3 pumps
2400 GPM
3.46 MGD
Stevens Field Tank
264 Zone
0.6 MG
Eastside Tank
347 Zone
3.43 MG
Boulevard Tank
338 Zone
2.44 MG
Yelm Hwy
101
5
510
✱ BPS - Booster Pump Station
MG - Million Gallons
MGD - Million Gallons per Day
GPM - Gallons per Minute
N
0 0.75 1.5 Miles
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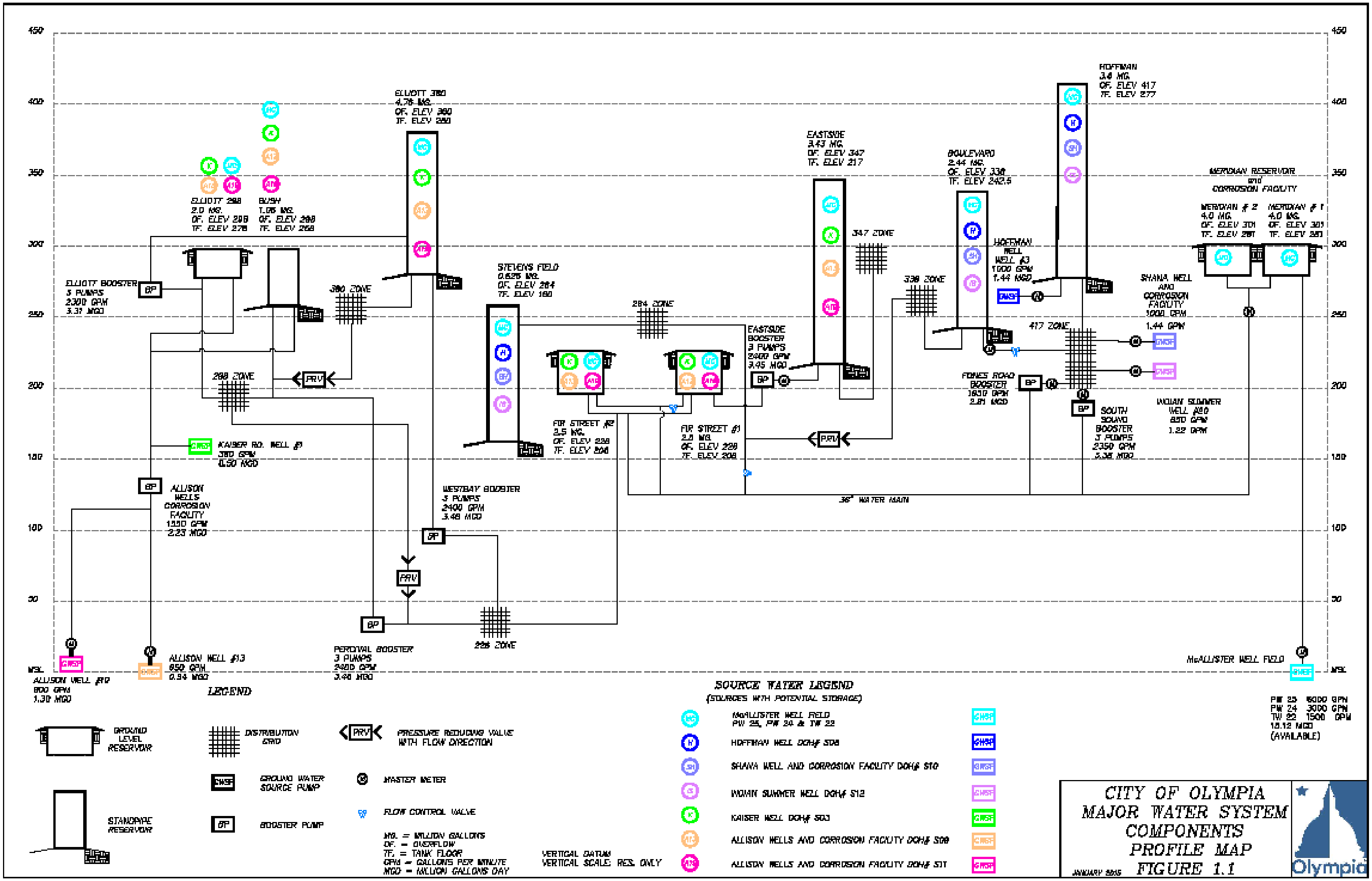
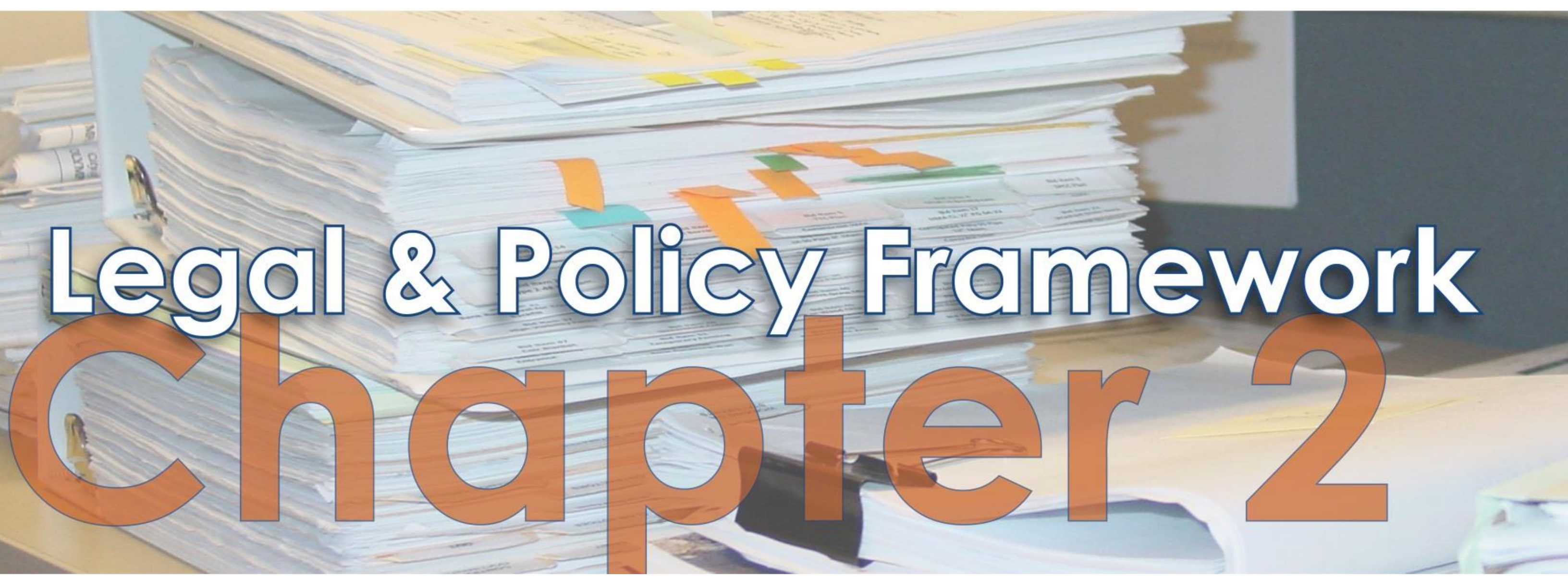
Map 1.4
Water System Components


450
400
350
300
250
200
150
100
50
MSL
ELLIOTT 380
4.78 MG.
OF. ELEV 380
TF. ELEV 280
ELLIOTT 298
2.0 MG.
OF. ELEV 298
TF. ELEV 278
BUSH
1.06 MG.
OF. ELEV 298
TF. ELEV 268
ELLIOTT BOOSTER
3 PUMPS
2300 GPM
3.31 MGD
380 ZONE
298 ZONE
STEVENS FIELD
0.625 MG.
OF. ELEV 284
TF. ELEV 180
284 ZONE
FIR STREET #2
2.5 MG.
OF. ELEV 238
TF. ELEV 206
FIR STREET #1
2.0 MG.
OF. ELEV 228
TF. ELEV 208
EASTSIDE
3.43 MG.
OF. ELEV 347
TF. ELEV 217
347 ZONE
EASTSIDE BOOSTER
3 PUMPS
2400 GPM
3.45 MGD
BOULEVARD
2.44 MG.
OF. ELEV 338
TF. ELEV 242.5
338 ZONE
HOFFMAN
3.4 MG.
OF. ELEV 417
TF. ELEV 277
HOFFMAN WELL
WELL #3
1000 GPM
1.44 MGD
417 ZONE
FONES ROAD BOOSTER
1650 GPM
2.81 MGD
SOUTH SOUND BOOSTER
3 PUMPS
2350 GPM
3.38 MGD
SHANA WELL AND CORROSION FACILITY
1000 GPM
1.44 GPM
WOLAN SUMMER WELL #80
850 GPM
1.22 GPM
MERIDIAN RESERVOIR W/O CORROSION FACILITY
MERIDIAN # 2
4.0 MG.
OF. ELEV 301
TF. ELEV 281
MERIDIAN # 1
4.0 MG.
OF. ELEV 301
TF. ELEV 281
KAISER RD. WELL #1
380 GPM
0.50 MGD
ALLISON WELLS CORROSION FACILITY
1550 GPM
2.23 MGD
WESTBAY BOOSTER
3 PUMPS
2400 GPM
3.46 MGD
36" WATER MAIN
PRV
BP
GWSP
ALLISON WELL #19
800 GPM
1.30 MGD
ALLISON WELL #13
650 GPM
0.94 MGD
PERCIVAL BOOSTER
3 PUMPS
2400 GPM
3.46 MGD
226 ZONE
McALLISTER WELL FIELD
PW 25 6000 GPM
PW 24 3000 GPM
TW 22 1500 GPM
18.12 MGD
(AVAILABLE)
LEGEND
GROUND LEVEL RESERVOIR
DISTRIBUTION GRID
PRESSURE REDUCING VALVE WITH FLOW DIRECTION
GROUND WATER SOURCE PUMP
MASTER METER
FLOW CONTROL VALVE
STANDPIPE RESERVOIR
BOOSTER PUMP
MG. = MILLION GALLONS
OF. = OVERFLOW
TF. = TANK FLOOR
GPM = GALLONS PER MINUTE
MGD = MILLION GALLONS DAY
VERTICAL DATUM
VERTICAL SCALE: RES. ONLY
SOURCE WATER LEGEND
(SOURCES WITH POTENTIAL STORAGE)
McALLISTER WELL FIELD PW 25, PW 24 & TW 22
HOFFMAN WELL DOH# S08
SHANA WELL AND CORROSION FACILITY DOH# S10
WOLAN SUMMER WELL DOH# S12
KAISER WELL DOH# S03
ALLISON WELLS AND CORROSION FACILITY DOH# S09
ALLISON WELLS AND CORROSION FACILITY DOH# S11
CITY OF OLYMPIA
MAJOR WATER SYSTEM
COMPONENTS
PROFILE MAP
FIGURE 1.1
Olympia



Chapter 2 – Legal and Policy Framework – Contents

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CHAPTER 2 - LEGAL AND POLICY FRAMEWORK

This chapter gives an overview of the many federal, state and local laws, regulations, policies and plans that form the legal context within which the Utility operates. Details are found in subsequent chapters of the Water System Plan.

2.1 Federal and State

In Washington, public water supply laws and regulations can be organized around these categories:

- Water rights
- Water quality
- Groundwater protection
- Water use efficiency
- Reclaimed water
- Source development and system operation
- Planning and financing

The major federal and state laws and accompanying regulations are described in this section and summarized in **Table 2.1**.

Table 2.1 Federal and State Laws Affecting Olympia's Drinking Water Utility

Category	Law	Implementing Regulations	Implementing Agency
Water Rights	Water Code (Chapter 90.03 RCW) and Regulation of Ground Water (Chapter 90.44 RCW).	Chapter 173-152 WAC	WA Dept of Ecology
Water Quality	Safe Drinking Water Act (Federal)	Chapter 246-290 WAC	WA Dept of Health
Groundwater Protection	Clean Water Act (Federal) Water Pollution Control Act (State) – (Chapter 90.48 RCW)	Chapter 173-200 WAC (groundwater quality standards); Chapter 173-201A WAC (surface water quality standards) WAC 246-290-135 (source water protection)	WA Dept of Ecology WA Dept of Health
Water Use Efficiency	Municipal Water Law – Efficiency Requirements Act (RCW 90.03.386(3) RCW and RCW 70.119A.180)	WAC 246-290-800.	WA Dept of Health
Reclaimed Water	Reclaimed Water Use Act (Chapter 90.46 RCW)	Water Reclamation and Reuse Standards (1997); Chapter 173-219 WAC (proposed)	WA Dept of Ecology WA Dept of Health

Source Development, System Operations		Chapter 173-160 WAC Chapter 246-290 WAC (Pt 3,5) Chapter 246-292 WAC Chapter 246-294 WAC	WA Dept of Health
Planning	Growth Management Act (Chapter 36.70A RCW) Watershed Planning Act (Chapter 90.82 RCW) Public Water System Coordination Act (Chapter 70.116 RCW) Water System Planning Utility Financing (Chapter 35.92 RCW)	Chapter 246-293 WAC WAC 246-290-100.	WA Dept of Community, Trade and Economic Development WA Dept of Health WA Dept of Ecology

Water Rights

The basic laws governing water rights and withdrawals from groundwater and surface water in Washington are the Water Code (Chapter 90.03 RCW) and Regulation of Public Ground Water (Chapter 90.44 RCW). These laws are implemented by the Washington State Department of Ecology (Ecology). Water rights rules are in Chapter 173-152 WAC. (See Chapter 4.)

Water Quality

The federal Safe Drinking Water Act of 1974, as amended, and state laws and regulations implementing this act establish rules for public water suppliers. The US Environmental Protection Agency (EPA) is authorized to develop national drinking water regulations and oversee their implementation. The Washington State Department of Health (DOH) implements this law on the EPA's behalf.

DOH regulates Olympia as a large "Group A" water system, primarily through *State Board of Health Rules Regarding Public Water Supplies* (Chapter 246-290 WAC), and deriving its legislative authority from Chapter 43.20 RCW. The rules are codified in Chapter 70.119A RCW.

Water quality rules under the Safe Drinking Water Act are contained in WAC 246-290 Parts 4-7, and cover the following categories:

- Monitoring – for compliance at the source, in the distribution system, and at the tap (WAC 246-290-300); and surveillance monitoring of background water quality (WAC 246-290-135).
- Treatment – includes requirements for surface water and groundwater treatment. The requirement for public water systems to provide adequate treatment to protect public health is in RCW 70.119A.060 (1)(b). The Ground Water Rule, covering potential disinfection requirements for groundwater sources, was codified in 2011 as Chapter 246-290 WAC.
- Program management – includes public notification, record keeping and reporting (Chapter 246-290 WAC, Part 7).

In addition, the State has requirements for:

- Cross-connection control (WAC 246-290-490).
- Customer complaint response (RCW 43.20.240).

Chapter 11 of the Plan describes the Utility's compliance with these rules. Table 11.1 summarizes the applicable rules and the regulated contaminants affected.

Groundwater Protection

Pursuant to the federal Safe Drinking Water Act, water systems are required to develop and implement a source protection program. In Washington, DOH requires a wellhead protection program for utilities that rely on groundwater and a watershed control program for utilities using surface water.

Implementing state regulations are in WAC 246-290-135, WAC 246-290-668, and WAC 246-290-690. See Chapter 7 for details on Olympia's Groundwater Protection Program.

The State's Groundwater Management Area program was established under RCW 90.44.030 to protect groundwater quality and quantity, and manage the resource over a large area and for all beneficial uses (including drinking water). The City's designation and regulation of drinking water (wellhead) protection areas is an important component of its Groundwater Protection Program and serves as the starting point for groundwater protection implementation efforts. Implementation requirements are in Chapter 173-100 WAC.

In order to protect water quality for drinking water supplies and other beneficial uses, the federal Clean Water Act, state Water Pollution Control Act and state Surface Water Quality Standards (Chapter 173-201A WAC) set limits on pollution in lakes, rivers and marine waters. Groundwater quality standards are in Chapter 173-200 WAC.

Water Use Efficiency

The Municipal Water Supply – Efficiency Requirements Act of 2003 requires water system plans to include conservation programs (RCW 90.03.386(3)). Implementing regulations are in WAC 246-290-800. The requirements address distribution system leakage, metering, water conservation planning, goals, performance evaluation and reporting. For details on applicability to Olympia's Drinking Water Utility, see Chapter 5, Table 5.1.

Reclaimed Water

State law (Chapter 90.46 RCW) encourages the use of reclaimed water to replace potable water in non-potable applications such as industry and agriculture. Such use supplements existing surface and groundwater supplies, and can assist in meeting future water requirements. In 2006, the State Legislature directed Ecology to develop and adopt rules on all aspects of reclaimed water use by December 2010. The rule-making process initiated in 2006 was suspended by the Governor under two consecutive Executive Orders from 2010 through 2012. Ecology reactivated the rule-making process in June 2014, and estimated the rule would be adopted by late 2016. The

Municipal Water Law (70.119A.180 RCW) requires utilities to evaluate potential uses of reclaimed water in their water system plans. For details see Chapter 6.

Source Development and System Operation

DOH rules on source development are in Chapter 173-160 WAC and Chapter 246-290 WAC, Part 3 (design of public water systems). Detailed specifications are in the DOH Design Manual.

DOH regulations related to system operation, described in Chapter 12, cover the following:

- Operation and maintenance, system reliability, emergency response and metering (Chapter WAC 246-290 Part 5).
- Water Works Operator Certification (Chapter 70.119 RCW and Chapter 246-292 WAC).
- Drinking Water Operating Permits (Chapter 246-294 WAC).

Planning and Financing Requirements

The Utility is subject to several state laws that apply to land use and watershed planning, water system planning and financing.

Growth management. Under the Growth Management Act (Chapter 90.48 RCW), the City is required to plan for future growth for the next 20 years. State-mandated growth management planning is designed to create denser urban areas while protecting the rural character of unincorporated areas. Thus, the Drinking Water Utility must manage its infrastructure capacity to accommodate projected development within Olympia's Urban Growth Area (UGA).

Watershed planning. The 1998 Watershed Planning Act (Chapter 90.82 RCW) sets a framework for developing local solutions to watershed issues on a watershed basis. It created water resource inventory areas (WRIAs) to inventory and manage water resources within these areas and to give local citizens an opportunity for input in planning. Olympia's service area and drinking water protection areas include parts of WRIA 11 (Nisqually) and WRIA 13 (Deschutes). (See Chapter 4.)

Water system coordination. The Public Water System Coordination Act of 1977 (Chapter 70.116 RCW) requires coordinated planning among public water supply systems within critical water supply service areas. Rules are in Chapter 246-293 WAC. Olympia's service area is part of the North Thurston County Coordinated Water System Area and subject to the *North Thurston County Coordinated Water System Plan, 1996 Area-wide Supplement*.

Water system plans. WAC 246-290-100 requires public water systems with more than 1,000 connections to submit a water system plan for review and approval by DOH every six years. Plans are intended to demonstrate the system's operational, technical, managerial and financial capability to achieve and maintain compliance with relevant local, state and federal plans and regulations. They also are to demonstrate how the system will address present and future needs in a manner consistent with other relevant plans and local, state and federal laws.

Utility financing. State law governing financing of municipal utilities is in Chapter 35.92 RCW. Regulatory authority is in WAC 246-290-100, Chapters 246-293, WAC 246-294 and elsewhere.

Department of Health Guidance

The Office of Drinking Water provides numerous guidance documents to help water systems comply with the laws and regulations described above.

2.2 Regional and Local

In addition to the federal and state laws and regulations described above, the City has its own service area policies and conditions of service, established in the Olympia Comprehensive Plan and Olympia Municipal Code (OMC). The Thurston County Coordinated Water System Plan (CWSP) and other regional and local plans also affect Drinking Water Utility planning and operation.

Service Area Policies

This section summarizes the regional and local policies applicable to the Drinking Water Utility's service area. The service area is generally congruent with the Urban Growth Area boundary (Map 1.1), with exceptions noted in Chapter 1, Section 1.3. Table 2.2 summarizes key policies related to Olympia's water service area.

Olympia Comprehensive Plan

Olympia's Comprehensive Plan (2014 as amended) provides maps of future land use and policy guidance for the City of Olympia and its Urban Growth Area (UGA), including specific direction for the City's utilities.

The Comprehensive Plan's policies support coordinated regional planning, public involvement and education, special review of proposed land uses near water supply sources, protection of aquifers and other critical areas, and groundwater monitoring. Public utilities policies direct the Utility to secure water supply rights 50 years in advance of projected need, protect water quality, conserve water and encourage reclaimed water use. These policies support integrated and regional approaches to water resources planning and management; and efficient operation and maintenance for adequate fire flow, pressure and preventive maintenance.

Comprehensive Plan goals and policies in the Environment and Public Utilities chapters were updated in December 2014 for consistency with the 2015 Water System Plan.

Olympia Municipal Code

Olympia Municipal Code (OMC) Title 13 regulates City Public Service operations to provide reliable utility services to City of Olympia residents and non-residents the City agrees to serve. Water Utility provisions are located in OMC Chapter 13.04, including those concerning service availability, service beyond city limits, extension of mains, service connections, connection size, meters, cross-connection and backflow protection, interruption of service for emergencies, waste of water, rates, charges and billing. Citations are below and provisions are summarized in Table 2.2.

- Rates and fees for services, Chapter 4.24 OMC.
- Drinking Water Utility policies, Chapter 13.04 OMC (includes the adopted Water System Plan, administrative rules, service applications and uses of water, prohibitions on wasting water and cross-connections).
- Fire hydrant policies, Chapter 16.36 OMC.
- Reclaimed water policies, Chapter 13.24 OMC (sets forth uniform policies and procedures for the distribution of reclaimed water and the use of reclaimed water by the City and its customers, as required by the State Reclaimed Water Permit issued to the LOTT Clean Water Alliance).

Conditions of service are found in these documents:

- Olympia Development Standards (Chapter 12.02 OMC), Public Works Standard Specifications (Chapter 12.08 OMC), and Public Services – Water (Chapter 13.04 OMC).
- Olympia Engineering Design and Development Standards.
- Critical Areas Wellhead Protection (Chapter 18.32 OMC).
- Drainage Design and Erosion Control Manual for Olympia (updated in 2009, contains development standards for protecting surface water quality).

Related Plans

The Drinking Water Utility is also influenced by related plans adopted by Thurston County, the LOTT Clean Water Alliance, City of Olympia and neighboring cities. These plans have been reviewed to ensure that this Plan is compatible and consistent with them.

Thurston County Region

The following plans affect Olympia's Drinking Water Utility as well as other planning entities in Thurston County:

- *City of Lacey Water System Plan* (2013) and *City of Tumwater Water System Plan* (2010). Olympia has interties with each of these jurisdictions; an agreement to sell wholesale water to Lacey through 2016; and a mutual aid agreement with Tumwater to provide water in emergencies. (See Appendix 1-3, Appendix 1-4 and Appendix 1-5.) A mutual aid agreement with Lacey is being negotiated.
- *Coordinated Water System Plan*, Thurston County, 1986 and *Area-wide Supplement,* 1996. This plan establishes policies and standards for water utility expansion, priority of water service, service areas, satellite service, shared facilities and interties within the Critical Water Supply Service Area.
- *Water Conservation Coordination Plan*, LOTT Clean Water Alliance (LOTT), 2013. The current plan, developed in cooperation with the Olympia, Lacey and Tumwater municipal

water utilities, will guide the regional program from 2013 through 2018, with a goal of reducing wastewater flow by at least 175,000 gallons per day (gpd), and ideally by 250,000 gpd, by 2012. Based on this plan, LOTT funds support local programs that reduce water going “down the drain” to LOTT wastewater treatment plants (**Chapter 5**).

- *Thurston County Comprehensive Plan,* 1995 as amended. Adopted pursuant to the Growth Management Act, this plan establishes land use designations and policies for the unincorporated areas of Thurston County. It was developed in coordination with comprehensive planning efforts by cities within the County, and may be amended annually with concurrence by the cities on policies in their growth management areas.
- *Northern Thurston County Ground Water Management Plan*, 1992. This plan includes groundwater protection goals and an implementation strategy. It was developed cooperatively by Ecology; Thurston County; the cities of Olympia, Lacey, and Tumwater; the Squaxin Island and Nisqually tribes; and members of the public.
- *Final Implementation Plan for the Nisqually Watershed,* February 2007. The Phase IV implementation plan was approved by the WRIA 11 Nisqually Planning Unit in February 2007. It recommends short and long-term actions at both the watershed and sub-basin scale. Critical actions include: identifying potential supply aquifers; processing water right applications in batches by sub-watershed; monitoring the quantity and quality of stream flows and groundwater supplies; understanding the interconnection between groundwater and surface water, including the impact of exempt wells on groundwater; and strengthening Coordinated Water System Plan policies to more directly link land use planning and water supply availability.

In addition to this Water System Plan, the following plans help frame the Utility’s policy environment:

- *Wastewater Management Plan*, October 2013. This plan takes a proactive approach to planning and managing development of the wastewater system by maintaining and replacing existing utility infrastructure and planning for expansion into areas within the City and its Urban Growth Area that are currently undeveloped or served by onsite septic systems.
- *Storm and Surface Water Management Plan*, November 2003. This plan includes goals and strategies the Storm and Surface Water Utility is using to reduce the frequency and severity of flooding, improve or maintain water quality in streams and wetlands, and maintain or slow the decline of aquatic habitat.
- City of Olympia and Thurston County, Percival Creek, Indian/Moxlie Creeks, Woodard Creek, McAllister/Eaton Creek, and Chambers/Ward/Hewitt Comprehensive Drainage Basin Plans. These plans were developed during the 1990s, in cooperation with neighboring jurisdictions, to provide a basis for storm and surface water management planning.

Table 2.2 Regional and Local Service Area Policies

Policy Name	Policy Statement	References
Retail Water Service Area	This plan defines and identifies the City's Water Service Area (WSA) as the Existing / Retail Water Service Area. The City will plan for and provide water service to all land uses identified in the City's Comprehensive Plan and within the WSA. Provisions for water service should be consistent with the goals, objectives, and policies of the City's Water System Plan and Comprehensive Plan.	2015 Water System Plan Map 1.1
Government Consistency	The City's Water System Plan will be consistent with local, county, and state land use authorities and plans.	North Thurston County Coordinated Water Service Plan 1996 Area Wide Supplement
Condition of Service	The City will plan to provide water service to all customers within the City's WSA. If the City is unable to provide water service to a property within the WSA, the owner or developer may facilitate an agreement between the City and another water purveyor to temporarily provide water service within the City's WSA. The City will review its WSA as part of the Water System Plan update. Revisions to the City's WSA shall be made only by written agreement in accordance with local, county and state regulations. Appropriate compensation to the City may be required as a result of cost associated the connection to the City's water system.	North Thurston County Coordinated Water Service Plan 1996 Area Wide Supplement OMC 13.04.040 WAC 246-290-106
Properties with an Existing Water Source	All properties requesting water service that have a water source and/or water right associated with them will be required to meet additional conditions of service, such as cross connection control, EDDS, DOH and DOE requirements. All "exempt" wells on the property must be decommissioned except where use of such wells is for the purpose of resource protection, environmental monitoring, remediation of contamination, or, on a case-by-case basis, irrigation. All water right wells that are no longer in service must either be decommissioned or deeded to the City, at the discretion of the City. Appropriate compensation will be made for water rights and/or infrastructure deeded to the City, provided it is of value to the City.	2015 WSP, to be codified in OMC
New or Replacement Exempt Wells	For any existing customer or those requesting/required to connect to the City's water supply, new or replacement "exempt" wells will not be permitted, except for wells that will be used solely for resource protection, environmental monitoring, or contamination remediation.	2015 WSP, to be codified in OMC

Service Extension	Whenever an applicant requests water service to premises with no main in the adjacent street, a standard main must be installed as a prerequisite to connection to the City water supply system. The standard main must conform to the EDDS and must be installed along the complete street frontage of the premises to be served in accordance with the EDDS. A standard main may be installed by any of the following methods: 1. The main may be installed at the expense of the owner or developer by a competent, licensed and bonded contractor under the supervision and approval of the Public Works Director or their designated representative. 2. If the premises lie within the corporate limits of the City, the owner may elect to have the main installed by the formation of a local improvement district as prescribed by state law and the ordinances of the City. All new development within the corporate City limits or the City's Urban Growth area shall connect to a public water supply, provided that the property lies within 200 feet of a public water main, or when made a condition of project approval.	OMC 13.04.280, OMC 13.04.290 EDDS Chapter 6
Ownership of Mains and Service Connections	Private ownership of domestic service lines will start at the downstream side of the meter. Private ownership of fire service lines will start at the downstream side of the fire service valve. The Drinking Water Utility will operate and maintain all approved and accepted water mains in public streets or utility rights-of-way. In no case shall an owner, agent, officer or employee of any premises have the right to remove or change any part thereof without the approval of the Public Works Director. No person shall install a water main which is connected to the Olympia water system without procuring a permit for such installation or connection.	OMC 13.04.180, OMC 13.04.270
Design and Performance	The City has published development standards for extension of water utilities within the service area. Design and performance of all new water infrastructure shall conform to the City of Olympia's adopted Engineering Design and Development Standards (EDDS). Approval of the plans for the extension of water utilities by the Public Works Department shall be required. The latest EDDS can be obtained from the City of Olympia website.	OMC 13.04
Oversizing Main Extensions	Whenever the City requires a main size larger than would be required to serve the adjacent property or, in the case of a subdivision or development, a main size larger than required to serve that development, the City shall participate in the cost of the main to the extent of the additional size required, provided the amount of such participation shall be established by the City Engineer prior to the commencement of construction.	OMC 13.04.295

Service Connections	Refer to the OMC and EDDS for the City's latest service connection requirements.	OMC 13.04.200, EDDS 6.040, EDDS 6.20
Water Meters	All service connections shall be metered. The City shall own, maintain, and repair all service meters. The City shall have and be given the right to replace or place a meter on a service and to remove the service at any time, and when so doing, the meter shall remain the property of the City. Water meters for new services will be issued after building permit approval. Meter specifications are provided in the EDDS. Fees for the installation of meters are established in the OMC.	OMC 13.04, OMC 4.24, EDDS 6.075
Water General Facility Charges	The City assesses and collects Water General Facility Charges (GFCs) in accordance with the OMC.	OMC 4.24.010, OMC 13.04.375
Latecomer Agreement	Any person who constructs a water main extension at the direction of the City, in excess of that which is required to meet minimum standards or which meets minimum standards and will benefit properties abutting the new main, may, with the approval of the Public Works Director, enter into a contract with the City that will allow the developer to be reimbursed for that portion of the construction cost that benefits the adjoining properties and/or is in excess of the minimum standard.	OMC 13.04, EDDS 2.080
Water Service Outside City Limits	As a condition of water service outside city limits, properties shall be annexed or agreements to annex shall be executed in accordance with the OMC	OMC 13.04.240, OMC 13.04.242, OMC 13.04.244
Surcharges for Service Outside City Limits	The City collects a surcharge for water and fire protection services outside of the corporate city limits in accordance with the OMC	OMC 13.04.390, OMC 13.04.400
Wholesaling Water	The City may enter into an agreement with any other municipal corporation or governmental unit for the purpose of obtaining or providing wholesale water.	OMC 13.04.230
Wheeling Water	The City may enter into an agreement with any other municipal corporation or governmental unit for the purpose of obtaining or providing water wheeling services. The City shall consider wheeling water on a case-by-case basis.	OMC 13.04.230
Cross-connection control devices and requirements for inspecting and testing	The installation or maintenance of a cross-connection is prohibited. Any such cross-connection now existing or hereafter installed is a nuisance and shall be abated immediately. The control or elimination of cross-connections shall be in accordance with WAC 246-290-490 or subsequent revisions, together with the City's Cross-Connection and Backflow Prevention Manual approved by the City and the DOH. The water supply will be discontinued to any premises for failure to comply with the provisions of this section.	OMC 13.04.110

Chapter 3 – Population and Demand Forecast – Contents

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CHAPTER 3 - POPULATION AND DEMAND FORECAST

Accurate data about projected water demand is essential for long-term water system planning. This chapter presents the Utility's forecasts of population, households, employment and water demand. Following a review of historical and projected demographic data is a summary of use characteristics including production, consumption and related factors. The chapter concludes with a demand forecast for the next 50 years based on the demographics, water supply characteristics and related uncertainties.

3.1 DEMOGRAPHIC DATA

Demographic data presented here includes total population, number of single-family and multi-family households and total employment. Table 3.1 shows the historical and projected demographics at specific planning horizons from 2015 to 2064.

Forecasts are based on the Thurston Regional Planning Council (TRPC) November 2012 data set. See Appendix 3-1 for more information on how these demographics were developed and a breakdown of the demographics by pressure zone.

Table 3.1 Projected Demographics

Year	Population	Single-Family Households	Multi-family Households	Employment
2015 (Plan Year 1)	62,097	17,144	11,601	58,840
2020 (Plan Year 6)	68,011	18,147	13,644	62,825
2034 (Plan Year 20)	83,388	22,122	17,595	73,981
2064 (Plan Year 50)	113,427	29,815	25,600	102,026

3.2 Water Use Characteristics

This section describes the water use characteristics used in making the demand forecast:

- Production and peaking factor
- Customer categories and consumption
- Non-revenue water and leakage
- Water use factors and ERUs

Production and Peaking Factor

Olympia produces water from the McAllister Wellfield and six wells, as described in Chapter 4. Before the McAllister Wellfield came online in October 2014, Olympia obtained the majority of its drinking water from McAllister Springs. Table 3.2 shows average production over the last three years, by source and by month. The total average annual production has been 2,581 million gallons (Mg). Of that, 77 percent was derived from McAllister Springs (2010-2012 average. As is typical with most water utilities, production peaks in the summer months of May through October.

Figure 3.1 and Figure 3.2 show this same information graphically, and Figure 3.3 shows the annual production for each year from 2003 to 2012.

Table 3.2 Water Production Summary (2010 - 2012 average in million gallons)

Month	McAllister Springs (S01)	Kaiser Well 1 (S03)	Hoffman Well 3 (S08)	Allison Well 13 (S09)	Shana Park Well 11 (S10)	Allison Well 19 (S11)	Indian Summer 20 (S12)	Total	Percent
Jan	148.5	0.0	0.0	9.2	12.0	9.0	0.2	178.8	7%
Feb	140.4	0.0	0.0	3.6	17.0	4.9	0.2	166.2	6%
Mar	152.6	3.1	0.0	3.9	20.5	5.4	0.2	185.7	7%
Apr	151.2	4.2	0.0	3.8	19.7	5.9	0.2	185.0	7%
May	154.3	7.1	0.0	11.3	23.4	11.1	0.3	207.4	8%
Jun	170.8	8.7	0.0	13.9	17.9	13.9	5.1	230.2	9%
Jul	205.1	9.2	0.0	17.6	25.4	22.1	19.1	298.5	11%
Aug	219.0	4.6	0.0	20.9	34.8	25.4	19.4	324.1	12%
Sep	170.4	0.8	0.0	16.4	32.1	23.1	7.8	250.5	10%
Oct	132.6	3.0	0.0	13.0	26.0	15.5	0.0	190.2	7%
Nov	168.6	0.0	0.0	5.1	5.1	8.5	0.1	187.5	7%
Dec	167.5	0.0	0.0	4.1	0.2	5.3	0.0	177.1	7%
Total	**1,981**	**41**	**0.08**	**123**	**234**	**150**	**53**	**2,581**	**100%**
Percent	**77%**	**2%**	**0.003%**	**5%**	**9%**	**6%**	**2%**	**100%**	

Note: Ten years of production data was analyzed. However, this table uses the most recent three years in order to focus on current trends.

Figure 3.1 Water Production by Source (2010 - 2012 Average)

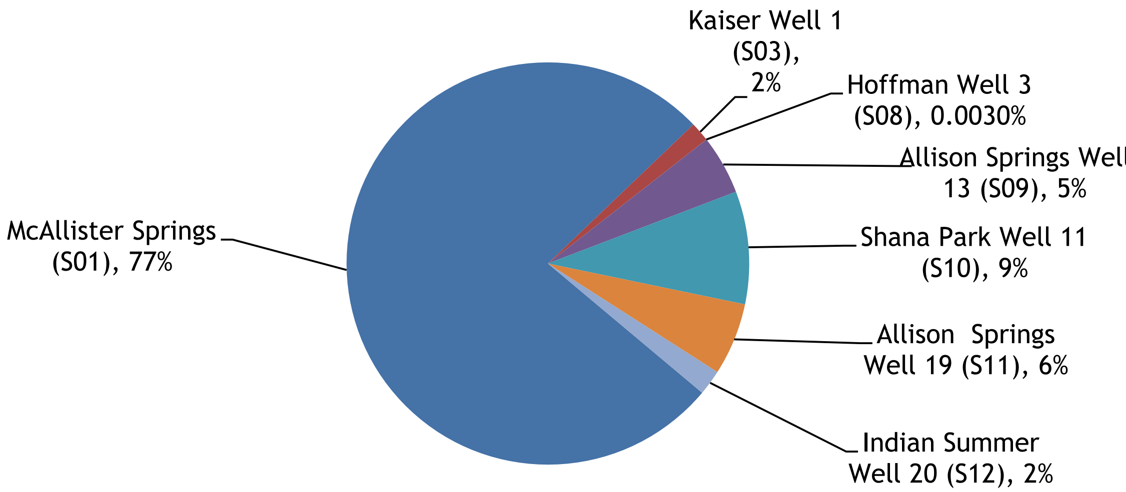


Figure 3.2 Water Production Monthly Distribution (2010-2012 Average)

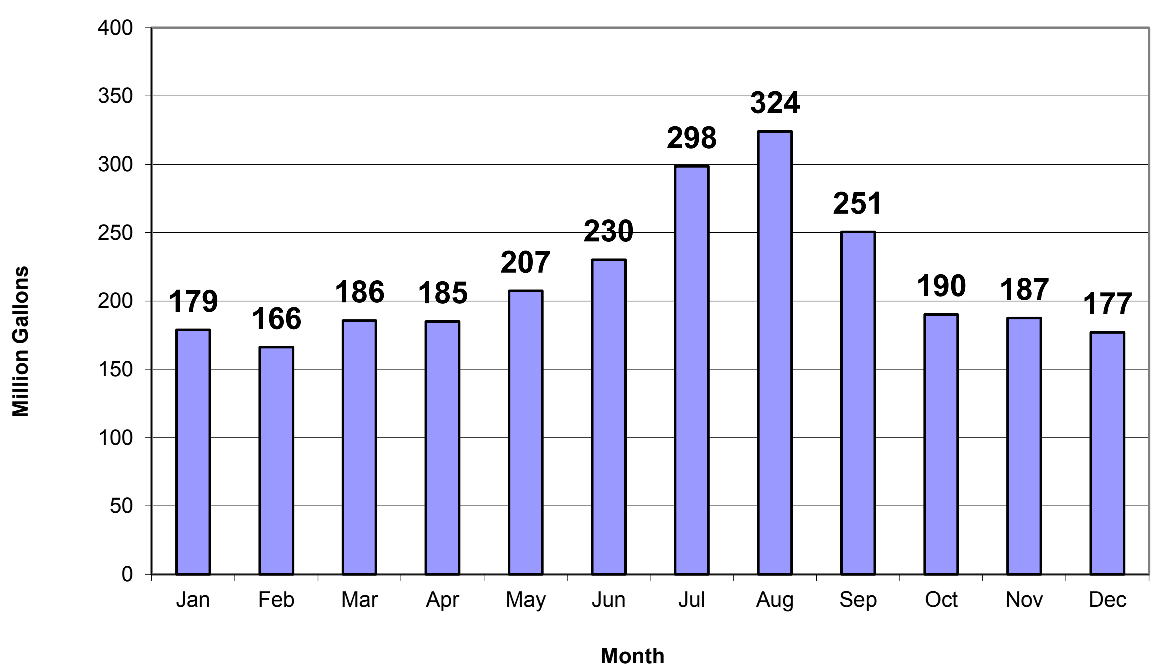


Figure 3.3 Annual Production (2003-2012)

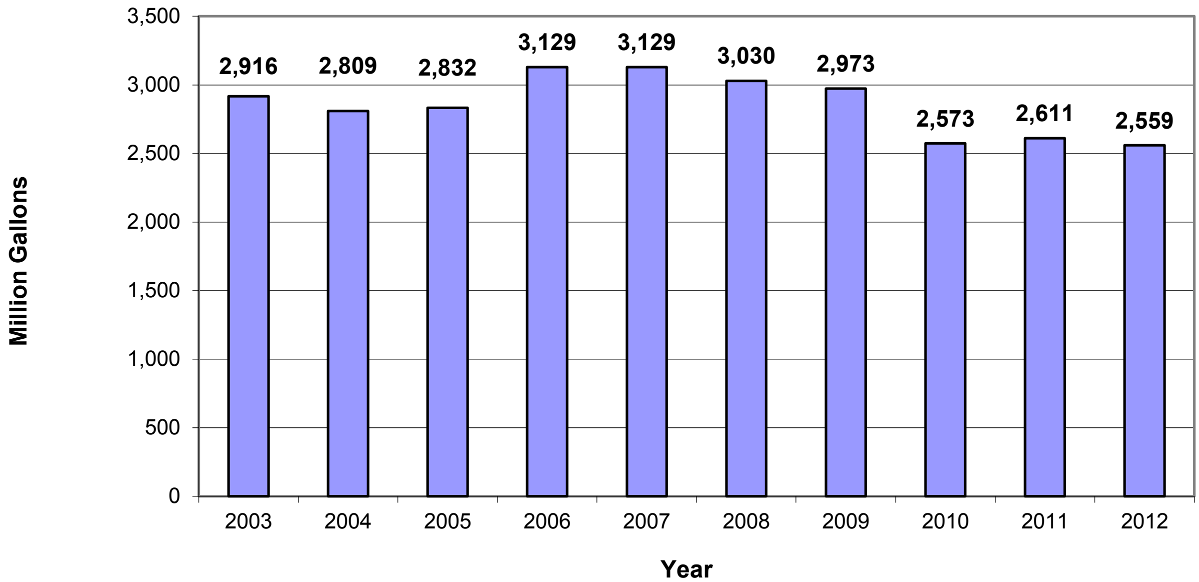


Table 3.3 gives the peaking factors from 2003 to 2012. The peaking factor has ranged from 1.6 to 2.5, and has averaged 1.7 for the most recent three years. Note that the demand forecast presented later in this chapter uses a slightly higher peaking factor of 2.0 for the current year (2013). This is approximately halfway between the average of the most recent three years and 2.3, which Olympia used in its 2009 Water System Plan.

Table 3.3 shows that the peaking factor has trended downward. To incorporate this decreasing trend in the peaking factor, a 0.3 percent annual decrease is applied to the peaking factor each year until the end of the forecast period.

Table 3.3 Peaking Factors

Year	Average Day (Mgd)	Peak Day		Peaking Factor
		(Mgd)	Date	
2003	8.0	15.6	7/29/2003	2.0
2004	7.7	19.5	7/20/2004	2.5
2005	7.8	15.0	8/6/2005	1.9
2006	8.6	16.1	7/6/2006	1.9
2007	8.6	15.1	7/11/2007	1.8
2008	8.3	13.8	8/15/2008	1.7
2009	8.1	15.9	7/29/2009	1.9
2010	7.1	12.5	8/14/2010	1.8
2011	7.2	11.7	8/4/2011	1.6
2012	7.0	11.6	8/15/2012	1.7
2010-2012 Avg	7.07	11.92	n/a	1.7

Note: Data is presented for ten years to show a lengthy history.

Customer Categories and Consumption

Olympia has six retail customer categories. Each category has standard connections and irrigation-only connections.

- **Single-family**. Detached residential buildings serving a single family, duplex, triplex or four-plex.
- **Multi-family.** Residential buildings such as apartment buildings or condominiums that serve multiple households.
- **Commercial.** Business and governmental customers.
- **Municipal.** City of Olympia facilities.
- **Political subdivision.** Includes quasi-governmental customers such as Intercity Transit, Port of Olympia and schools.
- **State.** State of Washington facilities.

The City also sells water wholesale to the City of Lacey and Thurston Public Utility District No. 1 (PUD). Prior to June 2005, Olympia provided retail service to customers in the PUD's service area. From 2005-2015, Olympia sold water wholesale to the PUD, which in turn provided water service to its customers. Over the past several years the PUD has moved toward securing its own water supply and plans to stop purchasing wholesale water from Olympia completely in early 2015.

The amount of water expected to be wholesaled to the City of Lacey was developed based on the wholesale agreement with Lacey. The agreement states that Olympia will provide Lacey with up to 2 Mgd from November to June and up to 1 Mgd from July to October. The agreement is valid until December 31, 2016. After this date, the demand associated with Lacey is assumed to be zero.

Table 3.4 gives the number of connections for each customer category from 2003 to 2012. Most connections are either single-family (86%) or commercial (9%).

Average consumption, by customer category and by month, over the last three years, is shown in Table 3.5. The largest share of water consumption is accounted for by the single-family customer category (40%), followed by commercial (20%), and multi-family (15%). These collectively represent 75 percent of consumption.

Figure 3.4 and Figure 3.5 show the same information as Table 3.5, graphically.

Actual monthly consumption of water may differ slightly from the data presented in Table 3.5 and Figures 3.4 and Figure 3.5. Most water meters are read bi-monthly and consumption is assigned to the month in which the meter is read.

Table 3.4 Connections by Customer Category (Retail Only, No Wholesale)

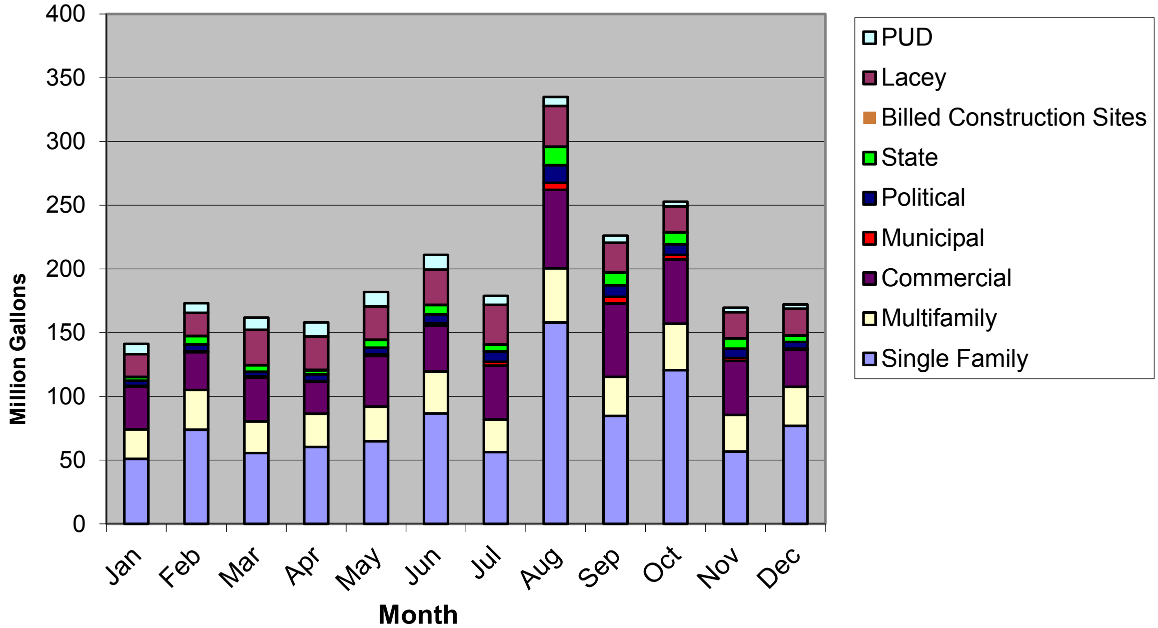
Customer Category		Number of Connections										
											2010-2012 Avg	
		2003	2004	2005	2006	2008	2009	2010	2011	2012	#	%
1. Single-family	Standard	14,768	15,122	15,201	15,492	14,648	14,905	15,284	15,625	15,962	15,624	85%
	Irrigation	161	161	166	170	60	65	63	63	69	65	0.4%
	Total	**14,929**	**15,283**	**15,367**	**15,662**	**14,708**	**14,970**	**15,347**	**15,688**	**16,031**	**15,689**	**86%**
2. Multi-family	Standard	610	622	643	644	666	688	702	709	720	710	4%
	Irrigation	18	20	22	22	21	24	23	29	30	27	0.1%
	Total	**628**	**642**	**665**	**666**	**687**	**712**	**725**	**738**	**750**	**738**	**4%**
3. Commercial	Standard	1,495	1,510	1,528	1,549	1,402	1,415	1,427	1,424	1,427	1,426	8%
	Irrigation	259	271	282	291	228	237	238	243	251	244	1.3%
	Total	**1,754**	**1,781**	**1,810**	**1,840**	**1,630**	**1,652**	**1,665**	**1,667**	**1,678**	**1,670**	**9%**
4. Municipal	Standard	58	57	55	56	55	54	53	58	60	57	0.3%
	Irrigation	50	50	48	53	10	10	12	13	16	14	0.1%
	Total	**108**	**107**	**103**	**109**	**65**	**64**	**65**	**71**	**76**	**71**	**0.4%**
5. Political Subdivision	Standard	59	60	60	61	55	55	55	58	64	59	0.3%
	Irrigation	30	30	32	32	13	13	13	14	13	13	0.1%
	Total	**89**	**90**	**92**	**93**	**68**	**68**	**68**	**72**	**77**	**72**	**0.4%**
6. State	Standard	94	95	97	97	58	57	62	63	63	63	0.3%
	Irrigation	50	53	56	56	30	31	32	35	36	34	0.2%
	Total	**144**	**148**	**153**	**153**	**88**	**88**	**94**	**98**	**99**	**97**	**0.5%**
Total	Standard	17,084	17,466	17,584	17,899	16,884	17,174	17,583	17,937	18,296	17,939	98%
	Irrigation	568	585	606	624	362	380	381	397	415	398	2%
	Total	**17,652**	**18,051**	**18,190**	**18,523**	**17,246**	**17,554**	**17,964**	**18,334**	**18,711**	**18,336**	**100%**

Table 3.5 Average Metered Water Consumption 2010-2012 (Mg) [1]

Customer Category		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Percent
1. Single-family	Standard	51	74	56	60	65	86	56	148	82	113	56	77	923	39%
	Irrigation	0.03	0.02	0.03	0.04	0.02	1.25	0.41	9.85	2.65	7.80	0.39	0.14	23	1%
	Total	**51**	**74**	**56**	**60**	**65**	**87**	**56**	**158**	**85**	**121**	**57**	**77**	**946**	**40%**
2. Multi-family	Standard	23	31	25	26	27	32	24	39	28	34	28	31	348	15%
	Irrigation	0	0	0	0	0	1	1	3	3	3	1	0	12	0%
	Total	**23**	**31**	**25**	**26**	**27**	**33**	**26**	**42**	**31**	**36**	**29**	**31**	**360**	**15%**
3. Commercial	Standard	33	29	34	25	39	30	35	37	41	31	39	28	402	17%
	Irrigation	0	0	0	0	1	5	8	25	16	19	3	1	79	3%
	Total	**33**	**30**	**34**	**25**	**40**	**36**	**42**	**61**	**57**	**50**	**42**	**29**	**481**	**20%**
4. Municipal	Standard	1	1	1	0	1	1	1	1	2	1	1	1	11	0%
	Irrigation	0.1	0.0	0.1	0.2	0.5	1.3	1.8	4.4	3.5	2.5	1.0	0.1	16	1%
	Total	**1**	**1**	**1**	**1**	**2**	**2**	**3**	**6**	**5**	**3**	**2**	**1**	**27**	**1%**
5. Political Subdivision	Standard	4	5	4	5	4	5	5	7	5	5	6	5	60	3%
	Irrigation	0.1	-0.1	0.2	0.1	0.6	2.2	3.0	7.0	3.7	3.0	1.2	0.4	21	1%
	Total	**4**	**5**	**4**	**5**	**5**	**7**	**8**	**14**	**9**	**8**	**7**	**5**	**82**	**3%**
6. State	Standard	3	6	5	3	6	7	5	9	4	6	8	5	66	3%
	Irrigation	0.0	0.0	0.0	0.1	0.0	0.5	1.0	5.7	5.8	3.3	0.3	0.0	17	1%
	Total	**3**	**6**	**5**	**3**	**6**	**7**	**6**	**14**	**10**	**9**	**8**	**5**	**83**	**4%**
7. Billed Construction Sites		0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	3	0%
8. Lacey Wholesale		17.8	18.1	27.6	26.2	26.0	27.9	30.9	31.8	23.2	20.2	20.2	20.9	291	12%
9. PUD Wholesale		7.9	7.6	9.7	11.1	11.3	11.3	7.1	7.2	5.5	3.8	3.6	3.3	89	4%
Total	Standard	115	147	124	120	142	160	126	241	163	190	139	146	1,815	77%
	Irrigation	0	0	1	1	2	11	15	55	35	39	6	2	167	7%
	Wholesale	26	26	37	37	37	39	38	39	29	24	24	24	380	16%
	Total	**141**	**173**	**162**	**158**	**182**	**211**	**179**	**335**	**226**	**253**	**170**	**172**	**2,362**	**100%**
Percent		6%	7%	7%	7%	8%	9%	8%	14%	10%	11%	7%	7%	100%	

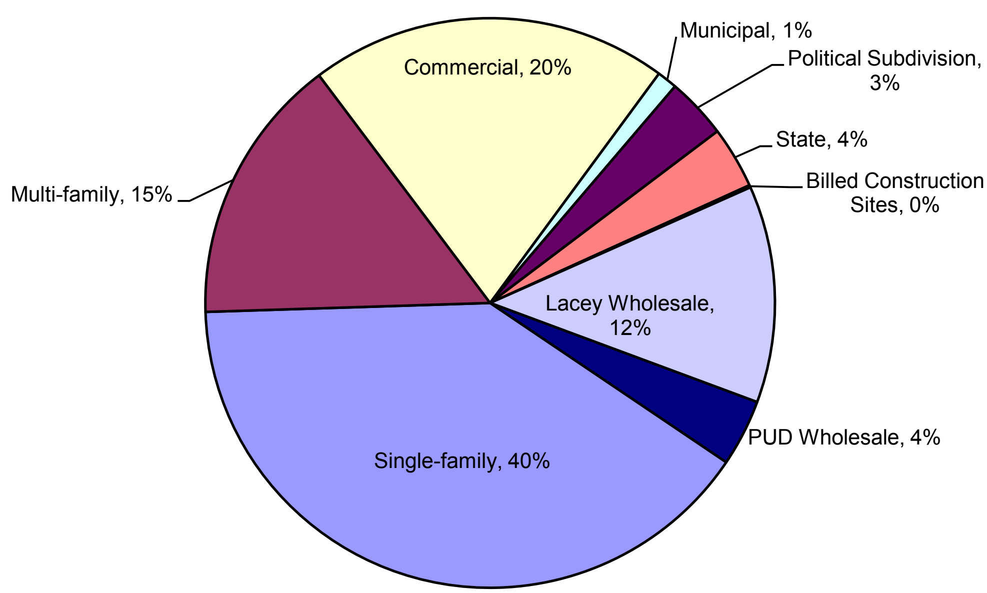
1. Actual monthly distribution water use may differ somewhat since the month of consumption is based on meter read dates and many meters are read bi-monthly.

Figure 3.4 Monthly Distribution of Water Consumption (2010-2012 Average)



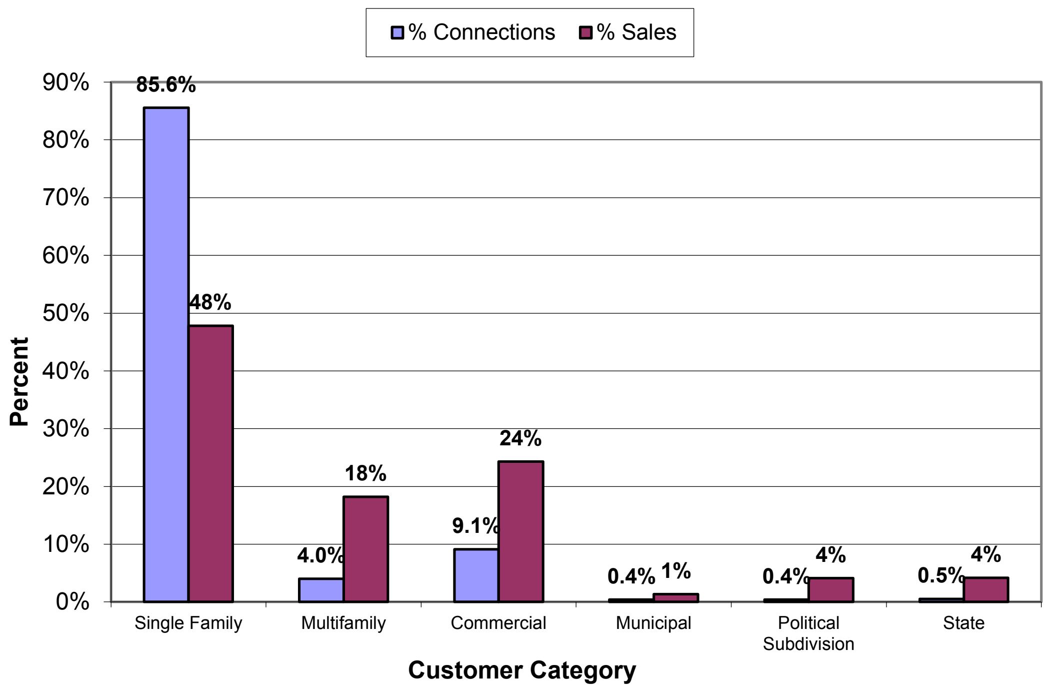
Note: Actual monthly distribution water use may differ since the month of consumption is based on meter read dates and many meters are read bi-monthly.

Figure 3.5 Water Consumption by Customer Category (2010-2012 Average)



Comparing the percent of connections to the percent of consumption can be useful, since water consumption does not always follow the same proportion as customer connections. This comparison is shown in Figure 3.6, which focuses on retail deliveries. Three customer categories stand out in this comparison. Single-family has a much larger percent of connections (86%) compared to the percent of retail consumption (48%). Multi-family has a much smaller percent of connections (4%) compared to the percent of retail consumption (18%). This is because one multi-family connection serves many multi-family households. Commercial has a much smaller percent of connections (9.1%) compared to retail consumption (24%).

Figure 3.6 Retail Connections and Consumption Comparison (2010-2012 Average)



Customers with large water demand are of interest since their demand could have significant impact on overall demand. This is particularly true when the largest customers are commercial and industrial customers. Table 3.6 summarizes water use for the customers with the highest water use for 2011 and 2012.

Given the nature of these customers, any changes in their future demand would likely be reflected in the demographic projections; therefore no special treatment of these customers was used for the demand forecast.

Table 3.6 Customers with Highest Water Use (2011-2012 Average Consumption)

Rank	Customer Name	Service Address	Total Consumption (Mg)
1	Crown Beverage & Packaging Company	1202 Fones Road SE	41.5
2	St Peters Hospital	413 Lilly Road NE	33.2
3	Evergreen State College	2700 Evergreen Parkway NW	33.1
4	Olympia School District #111	Multiple Locations	28.7
5	LOTT Clean Water Alliance	500 Adams Street NE	26.1
6	Cambridge Court Apartments	2323 9th Avenue SW	17.0
7	Black Lake LLC	1900 Black Lake Boulevard SW	16.5
8	Capital Medical Center	3900 Capital Mall Drive SW	16.5
9	City Of Olympia Parks	Multiple Locations	14.6
10	Colonial Estates	3601 18th Avenue SE	13.5
11	Capitol Building & Grounds	Multiple Locations	13.4
12	Courtside Apartments	515 Courtside Street SW	13.1
13	Bellwether Apartments [2]	1400 Fones Road SE	12.6
14	Apple Park Apartments	3200 Capital Mall Drive SW	12.4
15	Thurston County Facilities [1]	2000 Lakeridge Drive SW	11.7
16	Extendicare Health/Assisted	430 Lilly Rd Ne/4001 Capital Mall Drive SW	11.2
17	Olympic Heights Apartments [2]	300 Kenyon Street NW	10.3
18	Western Heritage / Coopers Glen [2]	3138 Overhulse Road NW	9.6
		Total	335.0
		Percent	100%

1. This account only appeared in the largest 15 customer list in 2012.
2. This account only appeared in the largest 15 customer list in 2011.

Non-Revenue Water and Leakage

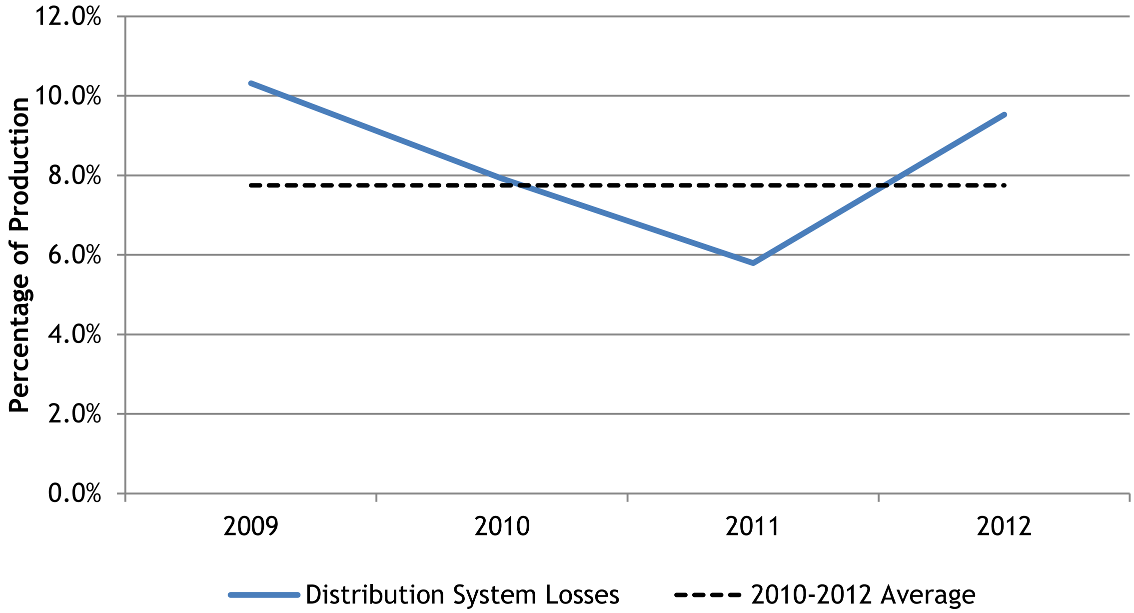
The forecast of future demand includes a calculation of "non-revenue water," which includes leakage and all other unmetered and metered uses that are not sold for revenue. Authorized uses of unmetered (and therefore, unbilled) water include firefighting and hydrant flushing, sampling, water and sewer line flushing and testing, street cleaning and other maintenance. For this purpose, a simple calculation of production minus sales was used to determine non-revenue water, as shown in Table 3.7. Distribution System Losses (DSL) are determined by subtracting unbilled authorized use from non-revenue water. Figure 3.7 graphically shows distribution system losses for the last four years compared to the four-year average.

Table 3.7 Distribution System Losses and Non-Revenue Water (million gallons)

Year	Production[1]	Sales[2]	Unbilled Authorized Use		Distribution System Losses		Non-Revenue Water		
			Qty[3]	Percent of Production	Qty[4]	Percent of Production	Qty[5]	Percent of Production	Percent of Sales
2004	2,809	2,581	41	1.5%	187	6.7%	228	8.1%	8.85%
2005	2,832	2,616	41	1.5%	175	6.2%	217	7.6%	8.28%
2006	3,129	2,757	46	1.5%	327	10.4%	372	11.9%	13.51%
2007	3,074	2,713	45	1.5%	316	10.3%	361	11.7%	13.31%
2008	3,030	2,662	--	--	--	--	368	12.2%	13.84%
2009	2,973	2,651	15	0.5%	307	10.3%	322	10.8%	12.13%
2010	2,573	2,355	14	0.5%	204	7.9%	218	8.5%	9.25%
2011	2,611	2,433	27	1.0%	151	5.8%	178	6.8%	7.31%
2012	2,559	2,297	18	0.7%	244	9.5%	262	10.2%	11.41%
2010-2012 Average[6]	**2,581**	**2,362**	**20**	**0.8%**	**200**	**7.7%**	**219**	**8.5%**	**9.3%**

1. Data Source: "Production Data" spreadsheet and "Meridian2_2010-2012" PDF provided by City staff.
2. Data Source: "WSP Monthly Consumption Rate Class CF. Revised" spreadsheet provided by City staff.
3. Production minus sales and distribution system losses.
4. Data Source: "Water Use Efficiency Workbook_2009-2013 Revised" spreadsheet provided by City staff.
5. Production minus sales.
6. Data is presented for nine years to show a lengthy history; however the average uses the most recent three years to focus on current trends.

Figure 3.7 Distribution System Losses (2009-2012)



Water Use Factors and ERUs

Water use factors were calculated for three customer categories: single-family; multi-family; and industrial, commercial and institutional (ICI). Table 3.8 shows the data used for the calculations, including the number of Equivalent Residential Units (ERUs) in each customer category.

ERUs are a method of representing water use by non-residential customers as an equivalent number of residential customers. An ERU is the amount of water used by a single-family household, which in Olympia averages 166 gallons per day (gpd). The number of ERUs for each customer category is obtained by dividing the consumption (in gpd) for a customer category by 166. Therefore, the single-family customer category equates to 15,624 ERUs; the multi-family category to 5,940 ERUs; and the industrial, commercial, institutional category to 11,099 ERUs.

Below are the key water use factors and how they were calculated:

- **166 gpd per single-family household**. Single-family consumption (2,591,885 gpd) divided by the number of households (15,624).
- **92 gpd per multi-family household**. Multi-family consumption (986,023 gpd) divided by the number of households (10,748).
- **33 gpd per employee**. Industrial, commercial, institutional consumption (1,842,518 gpd) divided by the number of employees (55,834).

Water use factors have trended downward in the last decade. To incorporate the downward trend in water use factors, the forecast assumes a 0.3% annual decrease in the water use factors for single-family residential and multi-family residential throughout the forecast period. Due to the variability in ICI demand, the water use factor for ICI remains the same throughout the forecast period.

Table 3.8 Water Use Factors and ERUs (2010-2012 Average)

Customer Category	Sales (gpd)[1]	Households or Employees	Sales Per Household or Employee (gpd)	Number of ERUs[5]
Residential				
Single-family (SF)	2,591,885	15,624 [2]	166 [4]	15,624
Multi-family (MF)	986,023	10,748 [3]	92	5,940
Non-Residential				
Commercial	1,317,595	39,927 [6]	33 [7]	7,937
Municipal	73,963	2,241 [6]	33 [7]	446
Political Subdivision	223,799	6,782 [6]	33 [7]	1,348
State	227,161	6,884 [6]	33 [7]	1,368
Lacey Wholesale	796,596	N/A	N/A	4,799
PUD Wholesale	245,136	N/A	N/A	1,477
Unbilled Authorized Use	53,777	N/A	N/A	324
Distribution System Leakage	547,082	N/A	N/A	3,296
			Total ERUs	**42,560**

1. Data Source: "WSP Monthly Consumption Rate Class CF_Revised" spreadsheet provided by City staff.
2. Assumed to be the same as the number of single-family connections.
3. Based on average of 2010-2012 TRPC data.
4. 166 gallons per day is the City of Olympia's ERU (equivalent residential unit).
5. The number of ERUs in any customer category is calculated by dividing that customer category's water sales by the ERU value.
6. Estimated by dividing the total sales by the 33 gpd per employee estimated demand.
7. Assumes the same value (33 gpd) that is used for the overall ICI category.

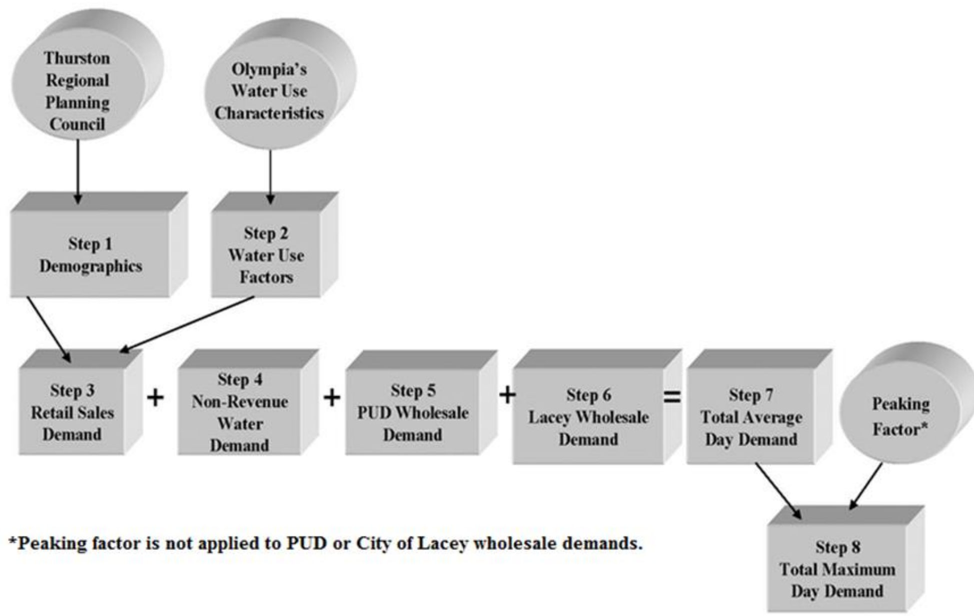
3.3 Demand Forecast

Olympia's Comprehensive Plan requires the Utility to reserve water supply rights for at least 50 years in advance of need, so that supplies can be protected from contamination or commitment to lower priority uses (Policy PU 5.1). This section describes the methodology used in developing the demand forecast and provides the results with and without additional conservation.

Demand Forecast Methodology

The methodology used to develop the demand forecast for retail consumption is illustrated in Figure 3.8. The basic process is to combine demographic data with water use factors to calculate customer demands. Demand components for non-revenue water, the PUD wholesale water and Lacey wholesale water are then added to create the total average day demand (ADD). To generate the total maximum day demand, a peaking factor is applied to all demands except the Lacey and PUD demands. See Appendix 3-1, Planning Data and Demand Forecast Technical Memorandum from HDR Engineering, Inc., for more information on the methodology.

Figure 3.8 Demand Forecast Methodology



Demand Forecast with and without Conservation

Projected demand for average day and maximum day are shown in Table 3.9 and Figure 3.9, with and without additional conservation. Additional conservation as shown reflects what demand would look like if conservation goals are met (Chapter 5). Figure 3.10 shows the six components of the average day demand in order to illustrate the relative impact of each component. The decrease in demand in 2017 reflects the end of the City's wholesale water agreement with the PUD in early 2015 and the end of the agreement with Lacey in December 2016. Beyond 2017, demand is projected to increase every year.

Table 3.9 Projected Demand with and without Additional Conservation

	Demand without Additional Conservation						Demand with Additional Conservation					
	Average Day Demand (mgd)				Max Day Demand (Mgd)	Total ERU	Average Day Demand (Mgd)				Max Day Demand (Mgd)	Total ERU
Year	Retail	PUD	Lacey[1]	Total			Retail	PUD	Lacey[1]	Total		
2015 (Plan Yr 1)	6.4	0.5	1.7	8.6	14.9	51,560	6.3	0.5	1.7	8.5	14.8	51,183
2020 (Plan Yr 6)	6.8	0	0	6.8	13.4	41,166	6.7	0	0	6.7	13.3	40,339
2034 (Plan Yr 20)	8.1	0	0	8.1	15.2	48,782	8.0	0	0	8.0	15.1	48,171
2064 (Plan Yr 50)	10.5	0	0	10.5	18.1	63,431	10.4	0	0	10.4	18.0	62,628

1. Demand for Lacey and PUD are not included for the entire planning period since sales to both are expected to end by the start of 2017 or sooner.

Figure 3.9 Average Day and Maximum Day Demand Forecast with and without Conservation

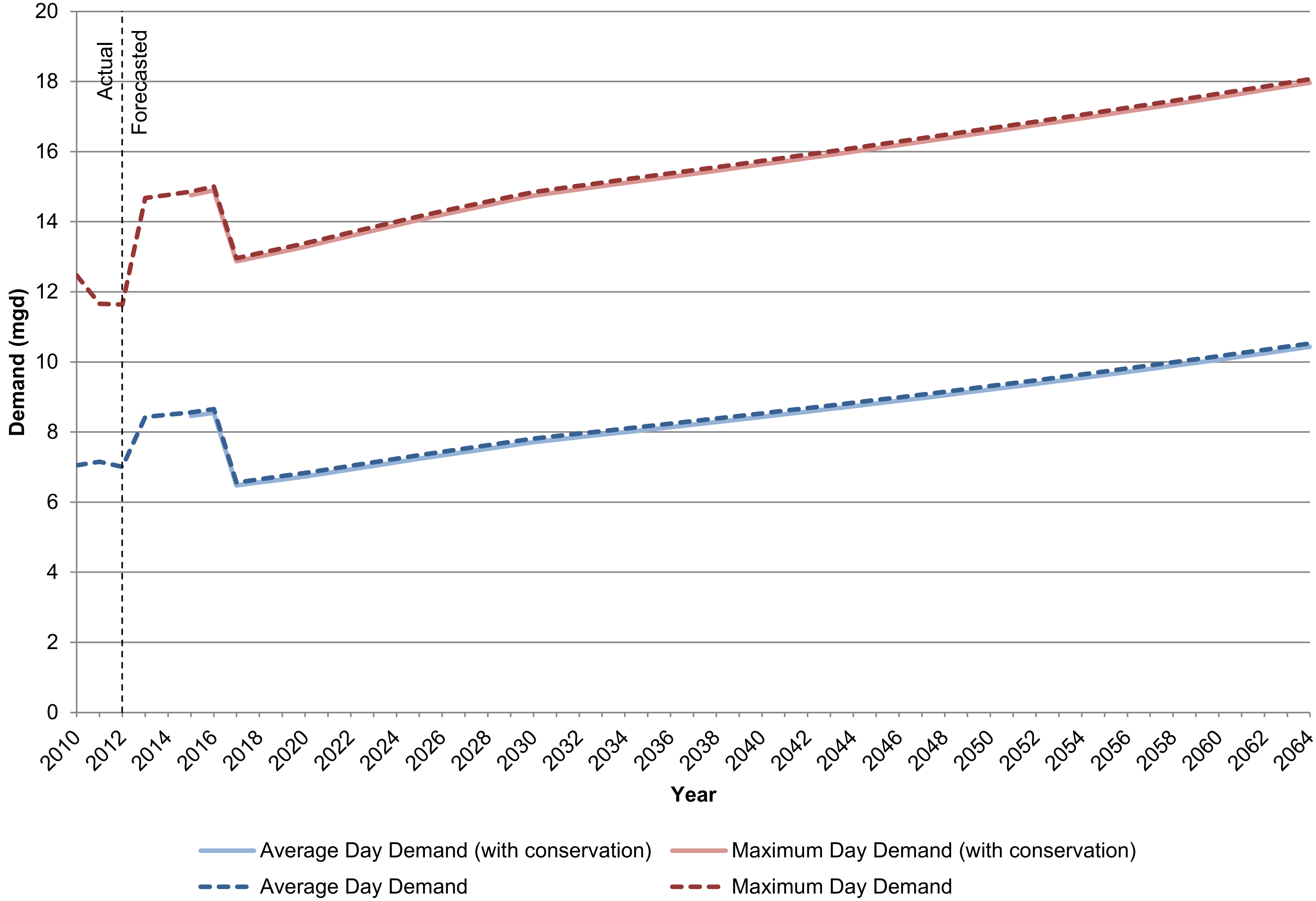
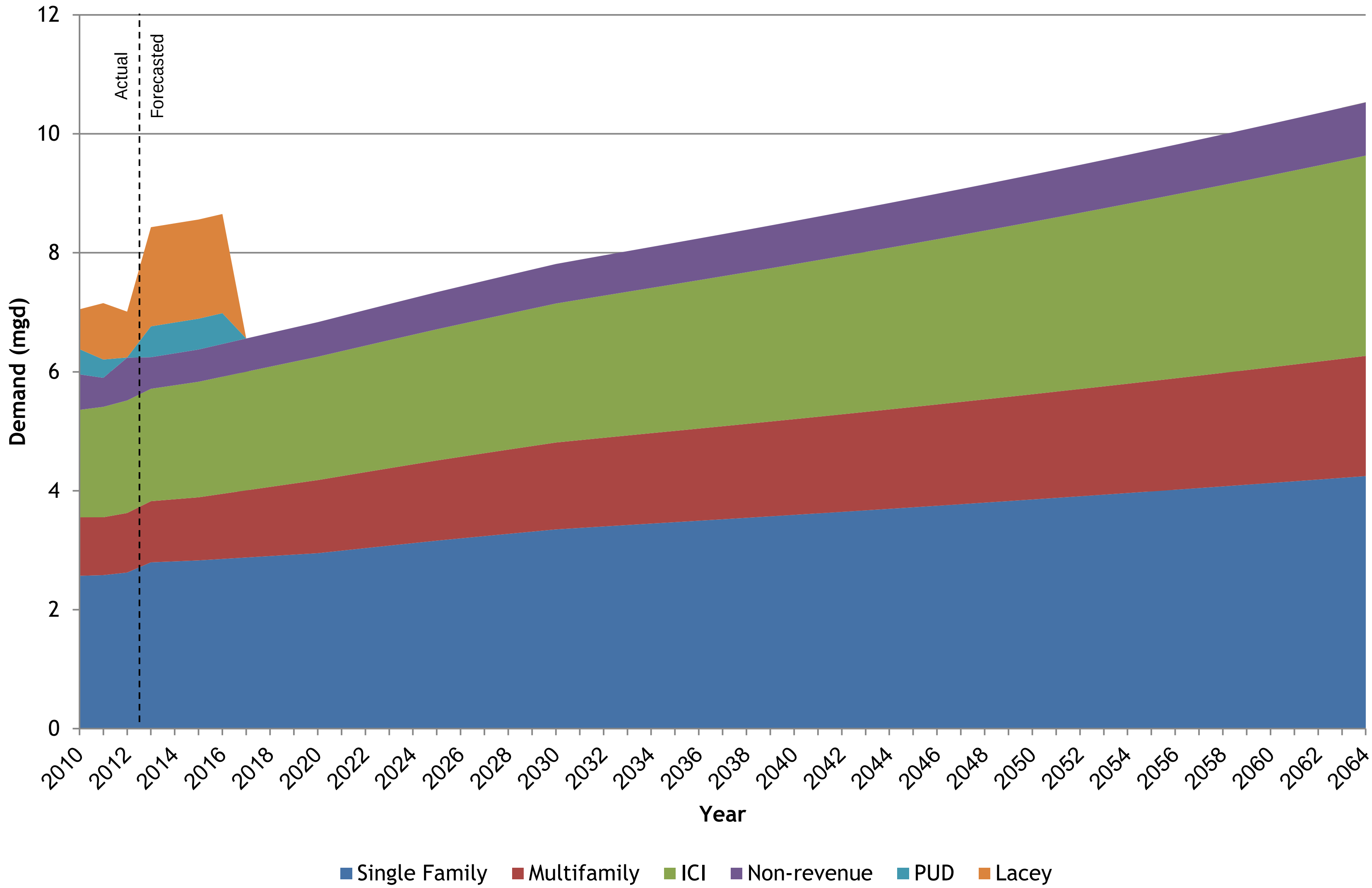


Figure 3.10 Average Day Demand Forecast Details

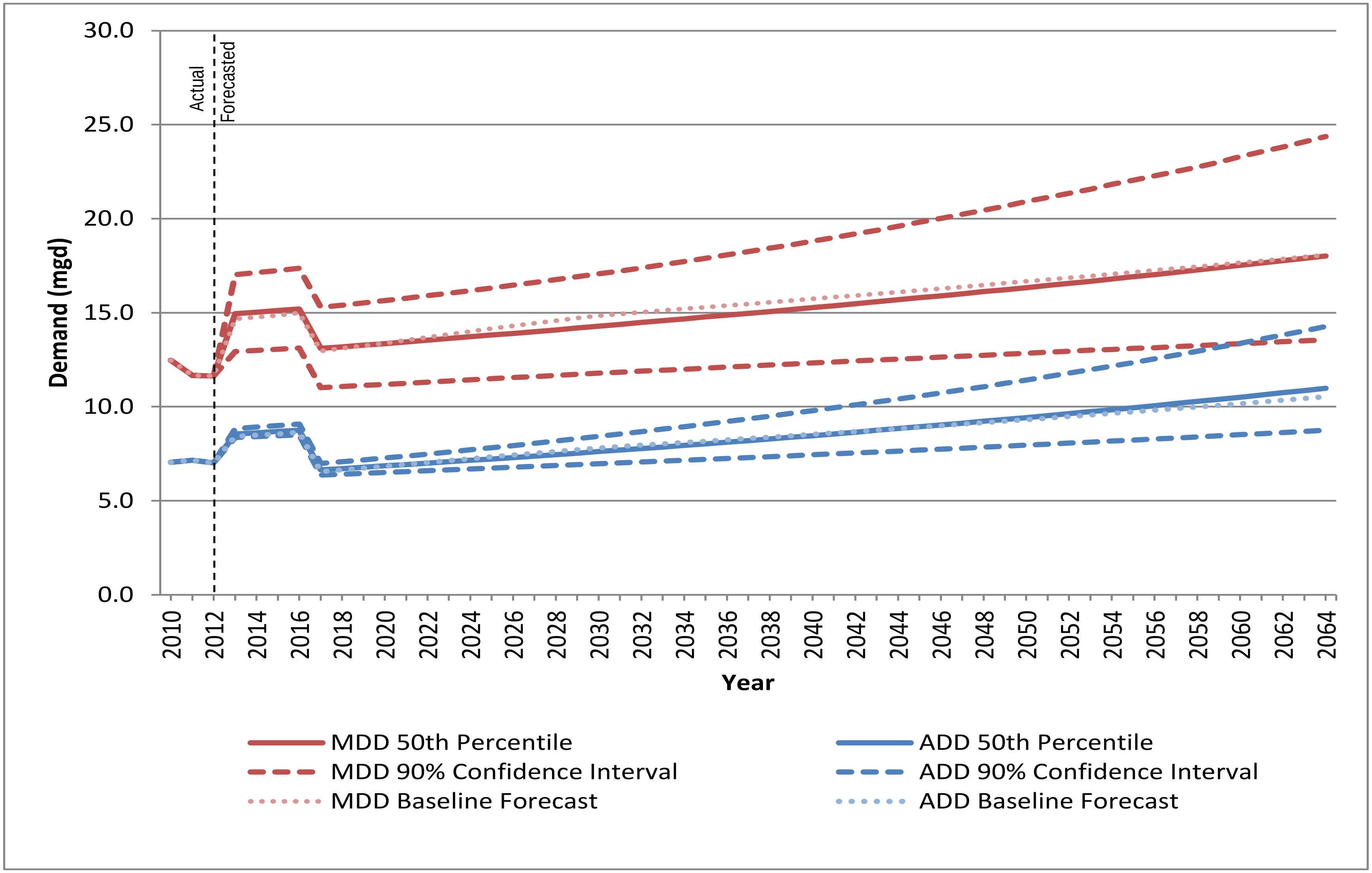


3.4 UNCERTAINTY ANALYSIS OF DEMAND FORECAST

The baseline demand forecast is an *estimate* of what future demand might be. To understand the uncertainty in the future values, an uncertainty analysis was conducted to define a *range* of possible future demands relative to the base demand forecast. The analysis takes into consideration uncertainty of demographics, peaking factor and water use factors by using Monte Carlo computational algorithms to determine an overall uncertainty range for demand. Appendix 3.2 is a technical memorandum from HDR Engineering, Inc. presenting the methodology and additional information on the analysis.

The results of the analysis are shown in Figure 3.11 and are compared with the baseline demand forecast presented in Section 3.3. The figure shows the range of Average Day Demands (ADD) and Maximum Day Demands (MDD) for the planning period through 2064. The 50^{th} percentile curve generated by the uncertainty analysis closely matches the baseline demand forecast presented in Section 3.3. The 90 percent confidence interval increases (widens) over time because the uncertainty increases over time. In 2034, the 90 percent confidence interval for ADD ranges from 7.2 to 8.9 Mgd and for MDD ranges from 12.0 to 17.7 Mgd. In 2064, the 90 percent confidence interval for ADD ranges from 8.7 to 14.3 Mgd and for MDD ranges from 13.6 to 24.4 Mgd.

Figure 3.11 Results of Demand Forecast Uncertainty Analysis



Chapter 4 - Source of Supply Program – Contents

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4-1 Water Rights Documents for Olympia Water Sources

4-2 Memorandum of Agreement with the Nisqually Indian Tribe

4-3 McAllister Wellfield Mitigation Plan

CHAPTER 4 - SOURCE OF SUPPLY PROGRAM

As described in **Chapter 1**, Olympia depends on groundwater to meet its drinking water needs, drawing on sources within the Nisqually and Deschutes Watersheds. McAllister Wellfield is the City's primary supply, serving all Utility customers from September through May. In the spring and summer, when outdoor water use increases, the City supplements this source with six wells in East Olympia and the Allison Springs area of West Olympia. The City is extending the supply resource through aggressive water conservation and the use of reclaimed water strategies (**Chapter 5** and **Chapter 6**).

The Utility's Goal 1 is:

> **Adequate supplies of water are available for the Olympia community while protecting in-stream flows and sustaining the long-term capacity of aquifers.**

This goal is consistent with Olympia's Comprehensive Plan Goal GU5, and associated policies, PU5.1-PU5.5.

The last planning period focused on securing the transfer of McAllister Springs/Abbott Springs water rights to the McAllister Wellfield. This planning period will focus on fulfilling mitigation requirements associated with the McAllister Wellfield water rights, as well as further evaluating the timing and sequencing of the City's undeveloped water rights.

The Program will focus on three objectives during this planning period:

- Maintain water rights that ensure sufficient supply for at least 50 years, so sources can be protected from contamination or commitment to lower priority uses.
- Encourage multi-jurisdictional approaches to water rights and source development.
- Monitor water levels in all pumped aquifers and maintain numerical groundwater models to better understand aquifer characteristics and evaluate the impacts of the City's withdrawals used for water supply.

4.1 Source of Supply Regulations

A number of legal mechanisms limit the use of water. The basic laws governing water rights and withdrawals from groundwater and surface water in Washington are the Water Code (Chapter 90.03 RCW) and Regulation of Public Ground Water (Chapter 90.44 RCW). These laws are implemented by the Washington State Department of Ecology (Ecology). Water rights rules are in Chapter 173-152 WAC. Each water right includes specific withdrawal limits and often includes other conditions that may limit water use.

In addition, legal constraints can result from Endangered Species Act recovery plans, interlocal agreements, watershed plans, water resource management plans and court decisions.

The City draws water from the Nisqually and Deschutes watersheds, where salmon species are listed under the Endangered Species Act. Watershed planning activities are underway, but no specific legal constraints limit the City's use of its water rights.

4.2 Source Description

This section focuses on the interactions between surface and groundwater in the two regional watersheds from which Olympia withdraws water, and the basic hydrology of the aquifers that supply each of Olympia's drinking water wells.

This information has been used to assess the ability of these sources to continue to reliably supply the City's water needs. The additional information needed to complete the reliability assessment is in several other chapters. Chapter 7 gives details on hydrogeology of the Drinking Water (Wellhead) Protection Areas; Chapter 8 provides an analysis of source infrastructure and describes planned improvements; and Chapter 11 describes treatment methods.

Regional Water Resources

Olympia views its water system from the perspective of the full hydrologic cycle. This perspective recognizes the connection between groundwater and surface water, and the effect that a groundwater-dependent water system may have on surrounding surface water bodies.

The City withdraws water from aquifers in two watersheds. McAllister Wellfield is located in the Nisqually Watershed. The other six wells and future Briggs and Brewery Wells are in the Deschutes Watershed. The State of Washington designates these watersheds as Water Resource Inventory Area (WRIA) 11 and 13, respectively.

Analysis indicates relatively active interaction between the City's aquifers and surface water bodies in these watersheds. This work includes the groundwater modeling that was done to assess the impact of transferring the McAllister Springs/Abbott Springs water rights to the McAllister Wellfield, delineate Drinking Water Protection Areas (DWPAs) and to support watershed planning efforts in the Nisqually and Deschutes watersheds.

Olympia's 2009 Water System Plan Chapter 5 provides more detailed information about streamflow and groundwater interaction, as well as fish stocks, in both the Nisqually and Deschutes River watersheds.

Drinking Water Supply Sources

This section briefly summarizes the basic hydrology of areas around McAllister Wellfield, Olympia's other six supply wells, and the future Briggs and Brewery wells. The most recent hydrogeological information is in two reports prepared by Golder and Associates to support the 2009 revisions to delineations of the City's Drinking Water Protection Areas (DWPA) (Golder, 2008a and 2008b), referred to in this Plan as the Golder reports. In Chapter 7, findings of these reports are described in detail for each DWPA.

Although hydrogeological information is somewhat limited, the interaction between surface water and groundwater in the McAllister numerical model area, which includes the East Olympia wells, is generally well understood. The surface water-groundwater interaction is less understood in the Allison Springs area of West Olympia because less supporting hydrogeological data is available to calibrate the model.

The McAllister groundwater modeling work simulated the impacts of McAllister Wellfield operation and conservatively predicted the long-term impacts on surface water. These impacts are being addressed in mitigation plans prepared by the cities of Olympia, Lacey and Yelm and the Nisqually Indian Tribe (see Section 4.4).

No studies have been completed to determine the long-term impacts of Olympia's existing six supply wells. However, with numerical groundwater models in place for all of Olympia's water sources, the Utility now has the basic analytical tools to predict the impacts of withdrawals from these wells on surface water and groundwater.

State regulations require aquifer pumping tests to establish the capacity of wells used for public water supply. For information about the wells and their pumping capacities see Chapter 8, Section 8.1.

McAllister Wellfield

The City's major source, McAllister Wellfield (S16), is located approximately eight miles east of Olympia at the southern edge of the Nisqually Valley in WRIA 11 (see Map 1.4). The City of Olympia and Nisqually Indian Tribe have developed the McAllister Wellfield as a more protected source of supply than the previously used McAllister Springs surface water withdrawal site.

The McAllister Wellfield taps into the McAllister Gravel Aquifer three-quarters of a mile up-gradient of McAllister Springs. According to the Golder report (2008a), recharge is primarily from infiltration of precipitation and subsurface inflow from the up-gradient area to the south. Groundwater discharge occurs through natural springs and seeps, groundwater pumping, seepage from shallow aquifers to rivers, lakes and streams, and subsurface outflow to the north.

Manual and electronic groundwater level monitoring data for the McAllister Springs area has been collected for over a decade. The quantity of electronic data-logger information is enormous because of the number of readings taken, on a daily basis at most locations. The Utility has formatted these data to allow meaningful analysis. Although some of the McAllister Springs groundwater level data is pertinent to the McAllister Wellfield, the Utility is in the process of revising the monitoring strategy for the entire McAllister Wellfield Drinking Water Protection Area.

East Olympia Wells

The City uses three wells in the East Olympia area: Hoffman Well 3 (S08) located off Hoffman Road, Shana Park Well 11 (S10) near Yelm Highway, and the Indian Summer Well 20 (S12) located in the Indian Summer gated community development, all shown in Map 1.4. No large-scale aquifer pumping tests have been completed to determine the long-term impacts of these specific wells on surrounding groundwater and surface water bodies. The Utility does have several years of monitoring well water level data surrounding Shana Park Well 11 (S10), which was used to delineate the Drinking Water Protection Area for the 2009 Plan (see Chapter 7, Section 7.4).

The Golder (2008a) report provides some information on historical groundwater levels. The report found typical annual reductions and recovery in shallow groundwater levels but overall water levels were relatively unchanged throughout the periods of study. Hoffman Well (S08), completed in a deep, confined aquifer, is not connected to local shallow groundwater or surface water, but is recharged several miles to the south. Indian Summer Well 20 (S12) is recharged more locally and is completed in a confined aquifer. The report identifies a potential direct connection between the Shana Park Well 11 (S10), which is completed in the shallower unconfined aquifer, and a surrounding surface water lake, and recommends further analysis to explore this possibility.

West Olympia Wells

Olympia has three wells in the West Olympia area: Allison Springs Well 13 (S09) and Allison Springs Well 19 (S11), located near Mud Bay Road, and Kaiser Well 1 (S03) near Kaiser Road and Louise Lake (see **Map 1.4**).

No large-scale aquifer pumping tests have been completed to determine the long-term impacts of these wells on surrounding groundwater and surface water bodies. However, the Golder report (2008a) found that the primary source of water for this aquifer is vertical seepage from the overlying aquifer. The main discharge occurs at Eld Inlet and Budd Inlet. Analysis of water levels by Golder and City staff for monitoring wells in the Allison Springs area shows that groundwater levels typically vary by less than 15 feet (as measured between 2007 and 2014).

Future Briggs Well

A new Briggs Well (S13) is planned in the Briggs Village development west of the East Olympia wells and immediately west of the former Briggs Nursery

This well would draw from the Deschutes Valley Aquifer (DVA) system. Golder (2008a and 2008b) reported that the main sources of groundwater in the well area are infiltration of precipitation and underflow from the southeast. The primary discharge features are underflow to the northwest, withdrawals at groundwater wells, and seepage to surface water, including the Deschutes River, and Ward and Hewitt Lakes.

Future Brewery Wellfield

The cities of Olympia, Lacey and Tumwater are investigating joint development of the former Olympia Brewery wellfield to meet future demand. The wellfield is located next to the Deschutes River, north of Custer Boulevard.

In 2012, the cities evaluated existing infrastructure and assessed aquifer conditions through pumping tests and water quality sampling at selected wells. The testing revealed the presence of separate shallow and deep aquifer systems, in both upland and lowland areas. The three cities are continuing evaluations to better understand potential alternatives for wellfield operation.

4.3 Water Rights

Water rights granted by the State can establish limits on withdrawal of water from the environment in two ways: by establishing specific limits on annual and instantaneous withdrawals and by establishing other conditions. Appendix 4-1 includes the final and most recent water rights documents for all City of Olympia water sources.

This section compares Olympia's existing water rights with current and projected demand.

Total Water Rights

The City currently has water rights totaling:

- 26,552 gallons per minute (gpm) instantaneous withdrawal
- 29,649 acre-feet annual (AFY) withdrawal

These totals reflect changes in water rights status since completion of the City's 2009 Water System Plan, as a result of Ecology's approval of two blocks of water rights:

- **McAllister Wellfield.** Ecology approved change applications to transfer existing water rights for McAllister Springs and a water right permit for Abbott Springs, totaling 26 Mgd, to the McAllister Wellfield (three Reports of Examination dated October 21, 2011). These water rights were shown in the 2009 Water System Plan as pending applications to change water rights.
- **Brewery Wellfield Water Rights.** Ecology approved water right transfer applications for the former Olympia Brewery water rights, to be shared jointly by the cities of Olympia, Lacey and Tumwater for municipal supply use. These water rights were shown as pending in the 2009 Water System Plan. Olympia received one-third of the approved water rights for a total of 2,172 gpm and 761 acre feet per year (Reports of Examination dated July 20, 2009).

Individual Source Analysis

The individual source analysis shows that the existing maximum instantaneous and maximum annual quantities used are within the limits of the water rights for the City's sources.

The City's forecasted 20-year demand totals are also within the City's existing water rights, so with proper management of each source, the City's projected 20-year demands should not exceed the water rights for individual source.

Table 4.1 shows the City's existing water rights compared with existing consumption (based on 2013 data). The difference between these amounts is shown as the City's current excess in water rights. Table 4.2 and Table 4.3 show the same information for the City's forecasted six-year and 20-year demands, as well as the forecasted excess. This assessment demonstrates that the City has sufficient water rights to meet demand throughout the 20-year planning period with current sources.

Existing water rights also allow for further development of the McAllister Wellfield, and development of the planned Briggs and Brewery wells. These new sources support the City's intent to secure a 50-year supply of water, as stated in the City's Comprehensive Plan. Bringing them online will assure sufficient supply through 2064. (See Chapter 3, Section 3.3 for 50-year demand forecast.) Also, because they are geographically dispersed the new sources will provide additional system reliability.

Maintaining Compliance with Water Rights

This section reviews how the City is complying with conditions included in recently acquired water rights.

McAllister Wellfield

In the early 1990s, the City began moving to replace McAllister Springs with a new, more protected and productive water source known as the McAllister Wellfield. The Springs were vulnerable to contamination, had limited productivity, and would have required extensive treatment under new federal Safe Drinking Water Act regulations.

In May 2008, the City of Olympia and the Nisqually Indian Tribe signed an historic Memorandum of Agreement to jointly pursue the development of the McAllister Wellfield as a water source for both communities (Appendix 4-2). The agreement also calls for permanent protection of the culturally and environmentally important McAllister Springs and nearby Abbott Springs.

Water Rights

Ecology approved a transfer of the City's water rights from McAllister and Abbott Springs to the McAllister Wellfield on January 3, 2012. The three-phase plan for developing the water rights is described in in Chapter 8, Section 8.1.

Three wells, with a combined maximum capacity of 10,500 gpm or 15 Mgd, have been installed at the new wellfield and began pumping in October 2014. After a test period, the pumps at the McAllister Springs facility were retired and the pipe connecting McAllister Springs to the distribution system was cut in January 2015.

Under the Memorandum of Agreement with the Nisqually Indian Tribe, the City will develop an additional 2,403 gpm or 3.46 Mgd under the Abbott Springs water right permit, and lease and/or deed up to 3 Mgd of water rights to the Tribe.

The Cities of Lacey and Yelm also acquired water rights for development of new sources in their service areas.

Mitigation Plan

Pumping of the new wells is expected to impact surface waters in the Nisqually and Deschutes watersheds. As part of their applications for transfer of water rights, the Cities of Olympia, Lacey and Yelm jointly developed a Mitigation Plan outlining how they will compensate for these impacts. Each city submitted a Mitigation Plan covering the aspects of the overall plan pertinent to their jurisdiction. Olympia's Mitigation Plan was submitted jointly with the Nisqually Indian Tribe (see Appendix 4-3). The plan includes a collaborative approach to mitigation, including joint acquisition of water rights, land purchase and habitat restoration, and a reclaimed water infiltration facility.

The overall plan includes several documents that formalize the agreements between various jurisdictions. These agreements are included in Appendix 4-3:

- McAllister Wellfield Mitigation. Memorandum of Agreement between Olympia and the Nisqually Indian Tribe (Mitigation Plan Appendix A). The Tribe agrees to mitigate impacts on the Nisqually River, and the City agrees to mitigate impacts on Woodland Creek, Lake St. Clair, Tri-Lakes and Deschutes River. (Olympia to share these responsibilities with the Cities of Lacey and Yelm.) (Mitigation Plan Appendix A)
- Woodland Creek/Tri-Lakes Mitigation. Interlocal Agreement between Olympia and Lacey to use reclaimed water from the LOTT's Martin Way Wastewater Treatment facility for groundwater recharge and instream flow enhancement in the Woodland Creek Basin (Mitigation Plan Appendix D). (See Chapter 6, Section 6.3.)
- Deschutes River Mitigation Actions. Interlocal Agreements between Olympia, Lacey and Yelm for water rights acquisitions, property acquisition and habitat restoration actions in the Deschutes basin. (Mitigation Plan Appendix E).

In November 2011, Olympia City Council approved another agreement focusing on a mile-long Deschutes riverfront property jointly owned by the cities of Olympia, Lacey and Yelm:

- Deschutes River Mitigation. Memorandum of Understanding between the Squaxin Island Tribe and the cities of Olympia, Lacey and Yelm to participate in a Budd Inlet/Deschutes Watershed Environmental Coalition. The Coalition will pursue short- and long-term solutions towards restoration of a healthy watershed.

Mitigation activities are currently underway and progress on implementing the approved Mitigation Plan is reported to Ecology annually.

Briggs Well

In April 2005, Ecology approved the City's purchase of water rights associated with the former Briggs Nursery. A well on this site that provided irrigation water for the nursery has been abandoned.

A new City well was scheduled to be completed by December 2009, but in response to the City's April 2009 request, Ecology extended the Construction Notice date to May 2014. In July 2013, Ecology granted the City another extension until May 2019. The delay is pending evaluation of how this new source would be used in conjunction with the Brewery Wellfield. The current schedule anticipates construction of this new well to begin in 2019, with the source considered to be online sometime between 2020 and 2034.

Development of the Briggs Well would add 1.58 Mgd of daily supply.

Brewery Wellfield

In 2008, the cities of Olympia, Tumwater and Lacey jointly acquired the infrastructure and most of the water rights for the historic Olympia Brewery's wellfield, located north of Custer Way next to the Deschutes River.

Infrastructure and Water Rights

For nearly 100 years, the wellfield had been used for potable, commercial and industrial supply by a succession of beer manufacturers. Olympia Brewery closed in 2003. The wellfield consists of 30 wells, some of which are equipped with pumps, a one-million gallon tank, and a distribution system of pipelines that connects most of the wells to the storage tank and all of the wells to the former brewery facility.

The water rights, shared equally among the three cities, authorize a maximum instantaneous combined rate of 6,515 gallons per minute and an annual combined withdrawal of 2,283.53 acre-feet per year. Olympia's share of the rights is approximately 2,171 gpm and 761 acre-feet per year.

Wellfield Evaluation

In November 2010, Olympia signed an Interlocal Agreement with the cities of Tumwater and Lacey to conduct a preliminary engineering evaluation of the former Olympia Brewery property.

The first evaluation phase of this project was completed in November 2012, and included well evaluations and aquifer pumping tests, water quality testing and assessment of the need for water quality treatment, and evaluation of the existing storage tank and other acquired water facilities.

The second phase (underway at the time this Plan was written) will create a strategic planning document to support each city in considering the ownership structure, operational structure, and anticipated shared costs associated with municipal development of the wellfield.

Pending Water Right Applications

The City has no pending water right applications at this time.

4.4 Alternate Sources

The Washington State Department of Health (DOH) and Ecology both require public water systems to include an alternate source of supply analysis in water system plans if they are seeking new water rights within 20 years.

The DOH Water System Planning Guide identifies five categories of alternate supply strategies that should be explored before pursuing new water rights and developing new sources:

- Water conservation
- Reclaimed water
- Water right changes/transfers
- Interties
- Aquifer storage and recovery (artificial aquifer recharge)

As described in Section 4.3, the City has sufficient water rights to meet demand throughout the 20-year planning period and beyond. Nevertheless, the City is engaged in two of the alternate supply strategies: water conservation and use of reclaimed water. These are discussed briefly below. Olympia does not obtain water through interties with other purveyors, and does not anticipate doing so in the future. Using interties as a source is not necessary or technically feasible since adjacent water systems operate at lower pressures than Olympia's system. Also, the neighboring cities of Lacey and Tumwater do not have excess supply for wholesale purchase by Olympia. The City has not conducted any analysis to determine whether aquifer storage and recovery is a feasible supply alternative.

Water Conservation

Since 1996, Olympia has been seen as a regional leader in water conservation. The Utility will continue to implement a robust Water Conservation Program, described in detail in Chapter 5. By 2020, implementation is expected to reduce water consumption indoors by an additional 100,000 gallons per day, and outdoors by an additional 5 percent. This means that Olympia will use over 100,000 gallons per day less water than predicted by the demand forecast presented in Chapter 3.

Reclaimed Water

Olympia began distributing Class A reclaimed water in 2005. Reclaimed water used in the downtown Olympia area is generated at the LOTT Clean Water Alliance Budd Inlet Reclaimed Water Plant. LOTT also generates reclaimed water at its Martin Way Reclaimed Water Plant, and has long-term plans to construct other satellite facilities in Thurston County. Olympia has negotiated with LOTT for distribution rights to a total of 1,060,000 gallons per day from the Budd Inlet, Martin Way and planned satellite facilities.

The City has agreements with four customers who use reclaimed water for direct beneficial use (mostly irrigation). Between 2006 and 2013, they used an average of about 9.1 million gallons per year, or about 5.4 percent of Olympia's allotment of reclaimed water from the Budd Inlet plant. Although this use of reclaimed water has reduced outdoor use of potable water, developing reclaimed water further has not proven to be a cost-effective strategy.

The City also has a joint project with the City of Lacey to infiltrate reclaimed water from the Martin Way plant for groundwater recharge in the Woodland Creek basin, as part of the McAllister Wellfield water rights mitigation plan. See Chapter 6 for details about Olympia's Reclaimed Water Program.

4.5 2015-2020 Source of Supply Program

The source of supply program aims to meet the Utility's Goal 1:

> **Adequate supplies of water are available for the Olympia community while protecting in-stream flows and sustaining the long-term capacity of aquifers.**

The objectives and strategies for 2015-2020 are listed below.

Objective 1A. Maintain water rights that ensure adequate supply for at least 50 years, so sources can be protected from contamination or commitment to lower priority uses.

Strategy 1A1 -- Evaluate existing water rights and forecasted demand every six years.

Strategy 1A2 -- Continue implementing required mitigation actions associated with McAllister water rights.

Performance Measures

1. Submit an annual report to Ecology describing progress toward meeting required mitigation for the McAllister Wellfield water rights.

Objective 1B. Encourage multi-jurisdictional approaches to water rights and source development.

Strategy 1B1 -- Through agreements and in consultation with neighboring tribes and cities, take a cooperative, regional approach to mitigating aquifer pumping impacts on water bodies in the Deschutes and Nisqually WRIAs (11 and 13, respectively).

Strategy 1B2 -- Continue to evaluate future operational strategies for development of the former Olympia Brewery water rights.

Performance Measures

1. Continue to implement mitigation actions jointly with the cities of Lacey and Yelm and the Nisqually Tribe, as required by the McAllister Wellfield Mitigation Plan.

2. Participate with the cities of Tumwater and Lacey in an engineering and operational evaluation of the Brewery wellfield.

Objective 1C. Monitor water levels in all pumped aquifers and maintain numerical groundwater models to better understand aquifer characteristics and evaluate the impacts of the City's withdrawals.

Strategy 1C1 -- Continue to monitor water level data and update numerical models as needed for all water sources.

Strategy 1C2 -- Continue to expand the long-term water level monitoring protocol for implementation in all water supply areas to better understand impacts of the City's withdrawal on the water bodies used for water supply.

Strategy 1C3 -- Evaluate whether aquifer pumping tests are needed in certain water supply aquifers and conduct tests as needed.

Strategy 1C4 -- Maintain numerical models for all water sources. Use these models to predict future water supply impacts from climate, development, and additional withdrawals.

Performance Measures

1. Continue to download water level pressure transducer data quarterly from monitoring wells in each DWPA.
2. Continue to use new groundwater level management database as part of the internal annual groundwater report to evaluate accuracy of the new DWPA delineations.
3. By 2017, compare measured groundwater levels with numerical model output and evaluate potential for future impacts to water supply from low-water conditions.
4. Within the planning period, use measured groundwater levels in numerical models to simulate aquifer pumping tests; results could be used to determine whether to conduct full-scale aquifer pumping tests in the field.

4.5 Implementation and Staffing

Having obtained new water rights in the last planning period that secured a 50 year supply, focus has now shifted toward evaluation of the timing of putting new sources online and toward fulfilling mitigation actions associated with the McAllister Wellfield water rights. Staffing to oversee this work is accomplished by a number of staff in the Utility's Planning and Engineering section.

The 2015-2020 Capital Improvement Program includes ongoing funds for McAllister Wellfield Mitigation as described in Section 4.3. Future projects beyond 2020 include the Briggs Well construction and Brewery wellfield engineering analysis (Chapter 8).

Table 4.1 Status of Existing Water Rights

Through September 2014, prior to using the McAllister Wellfield

Permit, Certificate, or Claim Number	Rightholder or Claimant	Priority Date	Source Name	Primary or Supplemental Quantity	Existing Water Rights		Existing Consumption		Current Water Right Status Excess (positive) Deficiency (negative)	
					Max Instant.[1] Flow Rate (Qi)	Max Annual Volume (Qa)	Max Instant.[1] Flow Rate (Qi)	Max[2] Annual Volume (Qa)	Max Instant.[1] Flow Rate (Qi)	Max[2] Annual Volume (Qa)
					gpm*	AFY*	gpm*	AFY*	gpm*	AFY*
8030 (certificate)	City of Olympia	1/10/1941	McAllister Springs	Primary	25 cfs* (11,250 gpm[3])	18,099	11,250	8,143 (2007)	0	9,956 (2007)
S2-01105 (certificate)	City of Olympia	1/10/1949	McAllister Springs	Primary	5.33 cfs* (2,400 gpm[4])	782	0	0	2,400	782
				Supplemental	0	3,088	0	0	0	3,088
10191 (permit)	City of Olympia	6/8/1955	Abbott Springs	Primary	10 cfs* (4,500 gpm[5])	7,240	0	0	4,500	7,240
8030 (certificate)	City of Olympia	1/10/1941	McAllister Wellfield	Primary	11,220	18,099	0	0	11,220	18,099
CS2-01105 (certificate)	City of Olympia	1/10/1949	McAllister Wellfield	Primary	2,392	782	0	0	2,392	782
				Supplemental	0	3,088	0	0	0	3,088
CS2-SWP10191 (certificate)	City of Olympia	6/8/1955	McAllister Wellfield	Primary	4,488	7,240	0	0	4,488	7,240

Permit, Certificate, or Claim Number	Rightholder or Claimant	Priority Date	Source Name	Primary or Supplemental Quantity	Existing Water Rights		Existing Consumption		Current Water Right Status Excess (positive) Deficiency (negative)	
					Max Instant.[1] Flow Rate (Qi)	Max Annual Volume (Qa)	Max Instant.[1] Flow Rate (Qi)	Max[2] Annual Volume (Qa)	Max Instant.[1] Flow Rate (Qi)	Max[2] Annual Volume (Qa)
					gpm*	AFY*	gpm*	AFY*	gpm*	AFY*
G2-00979 G2-01116 G2-00213 G2-23683 (certificates)	City of Olympia	3/7/1969 4/30/1971 10/12/1971 1/28/1975	Indian Summer Well 20 (S12)	Primary	850	329	850	333 (2009)	0	-4 (2009)
G2-24052 (certificate)	City of Olympia	1/29/1976	Kaiser Road Well 1 (S03)	Primary	380	450	380	217 (2011)	0	233 (2011)
G2-27217 (certificate)	City of Olympia	8/13/1986	Shana Well 11 (S10)	Supplemental	900	1143	900	925 (2011)	0	218 (2011)
G2-27225 (certificate)	City of Olympia	8/13/1986	Hoffman Well 3 (S08)	Supplemental	900	720	900	18 (2007)	0	702 (2007)
G2-27426[6] (certificate)	City of Olympia	8/13/1986	Allison Springs Well 13 (S09)	Primary	900	800	900	540 (2009)	0	260 (2009)
G2-27941[6] (certificate)	City of Olympia	8/13/1986	Allison Springs Well 19 (S11)	Primary	1,200	900	1,200	687 (2010)	0	213 (2010)

Permit, Certificate, or Claim Number	Rightholder or Claimant	Priority Date	Source Name	Primary or Supplemental Quantity	Existing Water Rights		Existing Consumption		Current Water Right Status Excess (positive) Deficiency (negative)	
					Max Instant.[1] Flow Rate (Qi)	Max Annual Volume (Qa)	Max Instant.[1] Flow Rate (Qi)	Max[2] Annual Volume (Qa)	Max Instant.[1] Flow Rate (Qi)	Max[2] Annual Volume (Qa)
					gpm*	AFY*	gpm*	AFY*	gpm*	AFY*
60 2643 S2-21810 S2-21811 G2-26836 (certificates)	City of Olympia	4/20/1929 10/30/1945 1/23/1974 1/23/1974 11/26/1985	Briggs Nursery Well	Primary	1,100	288	0	0	1,100	288
785-D[7] (certificate)	Cities of Lacey, Olympia, and Tumwater	7/20/1936	Brewery Wellfield	Primary	203	328	0	0	203	328
784-D[7] (certificate)	Cities of Lacey, Olympia, and Tumwater	7/15/1937	Brewery Wellfield	Primary	200	323	0	0	200	323
34-A[7] (certificate)	Cities of Lacey, Olympia, and Tumwater	5/22/1946	Brewery Wellfield	Primary	500	800	0	0	500	800
453-A[7] (certificate)	Cities of Lacey, Olympia, and Tumwater	3/23/1950	Brewery Wellfield	Primary	700	228	0	0	700	228

Permit, Certificate, or Claim Number	Rightholder or Claimant	Priority Date	Source Name	Primary or Supplemental Quantity	Existing Water Rights		Existing Consumption		Current Water Right Status Excess (positive) Deficiency (negative)	
					Max Instant.[1] Flow Rate (Qi)	Max Annual Volume (Qa)	Max Instant.[1] Flow Rate (Qi)	Max[2] Annual Volume (Qa)	Max Instant.[1] Flow Rate (Qi)	Max[2] Annual Volume (Qa)
					gpm*	AFY*	gpm*	AFY*	gpm*	AFY*
4587-A[7] (certificate)	Cities of Lacey, Olympia, and Tumwater	1/22/1960	Brewery Wellfield	Supplemental	2,250	1,723	0	0	2,250	1,723
G2-01073C[7] (certificate)	Cities of Lacey, Olympia, and Tumwater	1/23/1967	Brewery Wellfield	Supplemental	900	1,440	0	0	900	1,440
G2-01072C[7] (certificate)	Cities of Lacey, Olympia, and Tumwater	4/22/1971	Brewery Wellfield	Supplemental	900	1,440	0	0	900	1,440
G2-20844C[7] (certificate)	Cities of Lacey, Olympia, and Tumwater	3/13/1973	Brewery Wellfield	Supplemental	862	1,379	0	0	862	1,379
G2-26058C[7] (certificate)	Cities of Lacey, Olympia, and Tumwater	1/12/1982	Brewery Wellfield (Well 39)	Primary	0	604	0	0	1,500	604
				Supplemental	1,500[8]	604				

Permit, Certificate, or Claim Number	Rightholder or Claimant	Priority Date	Source Name	Primary or Supplemental Quantity	Existing Water Rights		Existing Consumption		Current Water Right Status Excess (positive) Deficiency (negative)	
					Max Instant.[1] Flow Rate (Qi)	Max Annual Volume (Qa)	Max Instant.[1] Flow Rate (Qi)	Max[2] Annual Volume (Qa)	Max Instant.[1] Flow Rate (Qi)	Max[2] Annual Volume (Qa)
					gpm*	AFY*	gpm*	AFY*	gpm*	AFY*
Olympia's 1/3rd share of Brewery rights[9]					2,172	761	0	0	2,172	761
Total[9]					**26,552 gpm**[9]	**29,649 acre ft/yr**[9,10]	**16,380 gpm**	**9,449**[11] **acre ft/yr** (2006)	**10,172**[9] **gpm**	**20,200**[9] **acre ft/yr** (2006)

* gpm = gallons per minute; AFY = acre-feet per year; cfs = cubic feet per second

1. Maximum instantaneous flow rate.
2. Maximum annual volumes shown for individual sources are the maximum volumes produced in any single year from 2004 – 2013. The year of maximum consumption is shown in parentheses.
3. The McAllister Springs Water Right Certificate 8030 does not specify Qa in gpm. The Qa shown in gpm is calculated from 25 cfs.
4. The McAllister Springs Water Right Certificate S2-01105 does not specify Qa in gpm. The Qa shown in gpm is calculated from 5.33 cfs.
5. The Abbott Springs Water Right Permit 10191 does not specify Qa in gpm. The Qa shown in gpm is calculated from 10 cfs.
6. When Allison Springs Well 13 (S09) and Well19 (S11) are pumped simultaneously, the combined instantaneous flow rate Qi is limited to 2,000 gpm.
7. The full Qi and Qa of each individual Brewery Wellfield water right is shown in the table, not just Olympia's one-third share. See footnote 9.
8. The Brewery Wellfield Well 39 Qi (Supplemental quantity) is not included in the Total Qi because of limitations on concurrent pumping with other Brewery Wellfield wells per Record of Examination G2-26058C.
9. Total Qi and Qa include Olympia's one-third share of the Brewery Wellfield water rights, not the full Qi and Qa shown in the table. See footnote 7.
10. The total Qa for existing water rights does not include Supplemental Rights.
11. Total maximum annual volume shown is consumption for the year 2006 and is not the total of the individual sources shown. The total for 2006 represents the largest total annual volume pumped from all wells during the years from 2004 – 2013.

Note: The City of Olympia does not obtain water through interties with other purveyors, but is capable of doing so during emergencies via established agreements.

Table 4.2 Status of Water Rights Forecast for 2020

Permit, Certificate, or Claim Number	Rightholder or Claimant	Priority Date	Source Name	Primary or Supplemental Quantity	Existing Water Rights		Forecasted Water Use (6 Year Demand)		Forecasted Water Rights Status (6 Year Demand) Excess (positive) Deficiency (negative)	
					Max Instant.[1] Flow Rate (Qi)	Max Annual Volume (Qa)	Max Instant.[1] Flow Rate (Qi)	Max Annual Volume (Qa)	Max Instant.[1] Flow Rate (Qi)	Max Annual Volume (Qa)
					gpm*	AFY*	gpm*	AFY*	gpm*	AFY*
8030 (certificate)	City of Olympia	1/10/1941	McAllister Wellfield	Primary	11,220	18,099	See totals below	See totals below	See totals below	See totals below
CS2-01105 (certificate)	City of Olympia	1/10/1949	McAllister Wellfield	Primary	2,392	782	“	“	“	“
				Supplemental	0	3,088	“	“	“	“
CS2-SWP10191 (certificate)	City of Olympia	6/8/1955	McAllister Wellfield	Primary	4,488	7,240	“	“	“	“
G2-00979 G2-01116 G2-00213 G2-23683 (certificates)	City of Olympia	3/7/1969 4/30/1971 10/12/1971 1/28/1975	Indian Summer Well 20 (S12)	Primary	850	329	“	“	“	“
G2-24052 (certificate)	City of Olympia	1/29/1976	Kaiser Road Well 1 (S03)	Primary	380	450	“	“	“	“
G2-27217 (certificate)	City of Olympia	8/13/1986	Shana Well 11 (S10)	Supplemental	900	1143	“	“	“	“
G2-27225 (certificate)	City of Olympia	8/13/1986	Hoffman Well 3 (S08)	Supplemental	900	720	“	“	“	“

Permit, Certificate, or Claim Number	Rightholder or Claimant	Priority Date	Source Name	Primary or Supplemental Quantity	Existing Water Rights		Forecasted Water Use (6 Year Demand)		Forecasted Water Rights Status (6 Year Demand) Excess (positive) Deficiency (negative)	
					Max Instant.[1] Flow Rate (Qi)	Max Annual Volume (Qa)	Max Instant.[1] Flow Rate (Qi)	Max Annual Volume (Qa)	Max Instant.[1] Flow Rate (Qi)	Max Annual Volume (Qa)
					gpm*	AFY*	gpm*	AFY*	gpm*	AFY*
G2-27426[2] (certificate)	City of Olympia	8/13/1986	Allison Springs Well 13 (S09)	Primary	900	800	"	"	"	"
G2-27941[2] (certificate)	City of Olympia	8/13/1986	Allison Springs Well 19 (S11)	Primary	1,200	900	"	"	"	"
60 2643 S2-21810 S2-21811 G2-26836 (certificates)	City of Olympia	4/20/1929 10/30/1945 1/23/1974 1/23/1974 11/26/1985	Briggs Nursery Well	Primary	1,100	288	"	"	"	"
785-D[3] (certificate)	Cities of Lacey, Olympia, and Tumwater	7/20/1936	Brewery Wellfield	Primary	203	328	"	"	"	"
784-D[3] (certificate)	Cities of Lacey, Olympia, and Tumwater	7/15/1937	Brewery Wellfield	Primary	200	323	"	"	"	"
34-A[3] (certificate)	Cities of Lacey, Olympia, and Tumwater	5/22/1946	Brewery Wellfield	Primary	500	800	"	"	"	"

Permit, Certificate, or Claim Number	Rightholder or Claimant	Priority Date	Source Name	Primary or Supplemental Quantity	Existing Water Rights		Forecasted Water Use (6 Year Demand)		Forecasted Water Rights Status (6 Year Demand) Excess (positive) Deficiency (negative)	
					Max Instant.[1] Flow Rate (Qi)	Max Annual Volume (Qa)	Max Instant.[1] Flow Rate (Qi)	Max Annual Volume (Qa)	Max Instant.[1] Flow Rate (Qi)	Max Annual Volume (Qa)
					gpm*	AFY*	gpm*	AFY*	gpm*	AFY*
453-A[3] (certificate)	Cities of Lacey, Olympia, and Tumwater	3/23/1950	Brewery Wellfield	Primary	700	228	"	"	"	"
4587-A[3] (certificate)	Cities of Lacey, Olympia, and Tumwater	1/22/1960	Brewery Wellfield	Supplemental	2,250	1,723	"	"	"	"
G2-01073C[3] (certificate)	Cities of Lacey, Olympia, and Tumwater	1/23/1967	Brewery Wellfield	Supplemental	900	1,440	"	"	"	"
G2-01072C[3] (certificate)	Cities of Lacey, Olympia, and Tumwater	4/22/1971	Brewery Wellfield	Supplemental	900	1,440	"	"	"	"
G2-20844C[3] (certificate)	Cities of Lacey, Olympia, and Tumwater	3/13/1973	Brewery Wellfield	Supplemental	862	1,379	"	"	"	"

Permit, Certificate, or Claim Number	Rightholder or Claimant	Priority Date	Source Name	Primary or Supplemental Quantity	Existing Water Rights		Forecasted Water Use (6 Year Demand)		Forecasted Water Rights Status (6 Year Demand) Excess (positive) Deficiency (negative)	
					Max Instant.[1] Flow Rate (Qi)	Max Annual Volume (Qa)	Max Instant.[1] Flow Rate (Qi)	Max Annual Volume (Qa)	Max Instant.[1] Flow Rate (Qi)	Max Annual Volume (Qa)
					gpm*	AFY*	gpm*	AFY*	gpm*	AFY*
G2-26058C[3] (certificate)	Cities of Lacey, Olympia, and Tumwater	1/12/1982	Brewery Wellfield (Well 39)	Primary	0	604	"	"	"	"
				Supplemental	1,500[4]	604				
Olympia's 1/3rd share of Brewery rights[5]					2,172	761	"	"	"	"
Total[5]					**26,552 gpm[5]**	**29,649 acre ft/yr[5,6]**	**9,360 gpm**	**15,008 acre ft/yr**	**17,192[5] gpm**	**14,641[5] acre ft/yr**

* gpm = gallons per minute; AFY = acre-feet per year; cfs = cubic feet per second

1. Maximum instantaneous flow rate.
2. When Allison Springs Well 13 (S09) and Well19 (S11) are pumped simultaneously, the combined instantaneous flow rate Qi is limited to 2,000 gpm.
3. The full Qi and Qa of each individual Brewery Wellfield water right is shown in the table, not just Olympia's one-third share. See footnote 5.
4. The Brewery Wellfield Well 39 Qi (Supplemental quantity) is not included in the Total Qi because of limitations on concurrent pumping with other Brewery Wellfield wells per Report of Examination G2-26058C.
5. Total Qi and Qa include Olympia's one-third share of the Brewery Wellfield water rights, not the full Qi and Qa shown in the table. See footnote 3.
6. The total Qa for existing water rights does not include Supplemental Rights.

Note: The City of Olympia does not obtain water through interties with other purveyors, but is capable of doing so during emergencies via established agreements.

Table 4.3 Status of Water Rights Forecast for 2034

Permit, Certificate, or Claim Number	Rightholder or Claimant	Priority Date	Source Name	Primary or Supplemental Quantity	Existing Water Rights		Forecasted Water Use (20 Year Demand)		Forecasted Water Rights Status (20 Year Demand) Excess (positive) Deficiency (negative)	
					Max Instant.[1] Flow Rate (Qi)	Max Annual Volume (Qa)	Max Instant.[1] Flow Rate (Qi)	Max Annual Volume (Qa)	Max Instant.[1] Flow Rate (Qi)	Max Annual Volume (Qa)
					gpm*	AFY*	gpm*	AFY*	gpm*	AFY*
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G2-27217 (certificate)	City of Olympia	8/13/1986	Shana Well 11 (S10)	Supplemental	900	1143	"	"	"	"
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Olympia's 1/3rd share of Brewery rights[5]					2,172	761	"	"	"	"
Total[5]					**26,552 gpm[5]**	**29,649 acre ft/yr[5,6]**	**10,555 gpm**	**17,024 acre ft/yr**	**15,997[5] gpm**	**12,625[5] acre ft/yr**

* gpm = gallons per minute; AFY = acre-feet per year; cfs = cubic feet per second

1. Maximum instantaneous flow rate.
2. When Allison Springs Well 13 (S09) and Well19 (S11) are pumped simultaneously, the combined instantaneous flow rate Qi is limited to 2,000 gpm.
3. The full Qi and Qa of each individual Brewery Wellfield water right is shown in the table, not just Olympia's one-third share. See footnote 5.
4. The Brewery Wellfield Well 39 Qi (Supplemental quantity) is not included in the Total Qi because of limitations on concurrent pumping with other Brewery Wellfield wells per Report of Examination G2-26058C.
5. Total Qi and Qa include Olympia's one-third share of the Brewery Wellfield water rights, not the full Qi and Qa shown in the table. See footnote 3.
6. The total Qa for existing water rights does not include Supplemental Rights.

Note: The City of Olympia does not obtain water through interties with other purveyors, but is capable of doing so during emergencies via established agreements.

Chapter 5 – Water Use Efficiency Program - Contents

Tables

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Appendix

CHAPTER 5 - WATER USE EFFICIENCY PROGRAM

As shown in Chapter 4, the City has secured sufficient supply to meet the water demands projected through 2064. Chapter 5 and Chapter 6 describe how the City is using water conservation and reclaimed water strategies to make efficient use of the water supply.

Both the Water Conservation Program and Reclaimed Water Program (**Chapter 6**) help meet the Drinking Water Utility's Goal 3:

> **Olympia's water supplies are used efficiently to meet the present and future needs of the community and natural environment.**

This goal is consistent with the City's Comprehensive Plan Goal GU4 and subsequent policies.

Water conservation helps meet the City's water needs by reducing the amount of water taken from the environment to support community demand. Using reclaimed (treated) water for non-potable purposes reduces the demand for potable water.

Olympia's first Water Conservation Plan was adopted by City Council in December 1996, and the City began implementing conservation measures in mid-1997. Subsequent plans have been approved and implemented ever since.

The Water Conservation Program for 2015-2020 is designed to maintain past program success, and to continue to meet State water use efficiency regulations. The Program will focus on three objectives during this planning period:

- Reduce indoor use by 100,000 gallons per day (gpd)
- Reduce outdoor use by 5 percent
- Maintain water loss below 10 percent of production

5.1 Water Use Efficiency Regulations

In January 2007, the State of Washington adopted water use efficiency regulations (WAC 246-290). Some of the requirements are directly related to planning, while others address metering and performance reporting. Table 5.1 lists the water use efficiency requirements and demonstrates Olympia's compliance in each area. The required annual water use reports submitted to the State for 2009-2013 are in Appendix 5-1.

Table 5.1 Water Use Efficiency Requirements

Category	Requirement	Olympia's Compliance
Meters	Meter all sources.	All sources are metered.
	Meter all service connections.	All service connections are metered.
Data Collection	Provide monthly and annual production for each source.	See Chapter 3, Table 3.2, Figure 3.2, Figure 3.3.
	Provide annual consumption by customer class.	See Chapter 3, Table 3.5 and Figure 3.4, Figure 3.5.
	Provide "seasonal variations" consumption by customer class.	See Chapter 3, Table 2.5, Figure 3.4.
	Provide annual quantity supplied to other public water systems.	See Chapter 3, Table 3.5.
	Evaluate reclaimed water opportunities.	See Chapter 6.
	Consider water use efficiency rate structure.	Olympia charges inclining block rates and seasonal rates. See Section 5.2 and Chapter 14.
Distribution System Leakage	Calculate annual volume and percent using formula defined in the Rule.	See Section 5.2, Table 5.6.
Goals	Establish measurable (in terms of water production or usage) conservation goals. Provide schedule for achieving goals.	See Section 5.3.
	Use a public process to establish the goals.	
Efficiency Program	Describe existing conservation program.	See Section 5.4.
	Estimate water saved over last six years due to conservation program.	See Section 5.2.
	Describe conservation goals.	See Section 5.3.
	Implement or evaluate 1-12 measures, depending on size (nine measures required for Olympia).	Olympia is required to implement or evaluate nine measures. See Section 5.4 for planned activities.
	Describe conservation programs for next six years including schedule, budget and funding mechanism.	See Section 5.4 and Section 5.5.
	Describe how customers will be educated on efficiency practices.	
	Estimate projected water savings from selected measures.	
	Describe how efficiency program will be evaluated for effectiveness.	
Demand Forecast	Provide demand forecast reflecting no additional conservation.	See Chapter 3, Figure 3.9 and Table 3.9.
	Provide demand forecast reflecting savings from efficiency program.	
	Provide demand forecast reflecting all "cost-effective" evaluated measures.	N/A, Olympia only implements cost-effective measures.

Performance Reports	Develop annual report including: goals and progress towards meeting them, total annual production, annual leakage volume and percent, and, for systems not fully metered, status of meter installation and actions taken to minimize leakage.	Olympia distributed its first performance report in June 2008; and has done so annually thereafter.
	Submit annually by July 1 to DOH and customers and make available to the public.	

5.2 Water Conservation Performance

The Water Conservation Program goal for the 2009-2014 planning period was to reduce water use by 5 percent per service connection. By the end of 2013, per connection consumption had decreased by 11.4 percent and overall consumption by 8.4percent.

Olympia's success in meeting its conservation goal can be attributed to a combination of rate incentives, customer education and distribution of efficient appliances, and controlling leakage from the system.

The City's partnership with the LOTT Clean Water Alliance (LOTT) was largely responsible for this water savings. LOTT helped make a variety of conservation programs available to residential and commercial sewer customers in Olympia, Lacey and Tumwater to meet LOTT's 1,000,000 gallon per day flow reduction goal as well as local conservation goals. During this period, the City also introduced programs for customers on septic systems who did not qualify for LOTT's conservation programs.

The new activities identified for the 2009 planning period were all piloted or implemented. Some will continue in 2015-2020 and others have been retired for various reasons (see Section 5.3).

Water conservation performance can be measured in many ways. Each year, water utilities are required to report to the Washington Department of Health (DOH) and their customers their total water production and distribution system leakage, along with a narrative description of progress toward meeting water conservation goals.

This section summarizes these and other measures the City uses to track performance:

- Total production
- Consumption (total and per connection, and the influence of rate incentives)
- Distribution system leakage
- Water shortage planning

Total Production

In 2013, the City produced 2,541,449,000 gallons of water. Between 2009 and 2013, average annual water production was 2,669,197,730 gallons. Since 2009, despite population growth, production has decreased by over 14 percent.

Consumption

Some of the decrease in consumption during 2009-2014 can be attributed to the wetter/cooler summers of 2010 and 2011. With the return of a warmer summer in 2012, consumption increased slightly. However, consumption decreased the following year despite the even warmer summer of 2013 and the increase in service connections. Table 5.2 reflects the changes in water consumption and number of service connections since 1996, when the Water Conservation Program was adopted.

Connections vs Consumption

As shown in Figure 5.1, consumption has decreased or remained fairly flat despite the increasing number of service connections. Between 2009 and 2013, the total number of connections to the water distribution system increased by 3.4 percent, while consumption decreased by 8.4 percent.

Extreme changes in consumption are most often weather-related; as shown by lower consumption values in Figure 5.1 for the wetter/cooler summers of 2010 and 2011. Substantial increases in water use occur in years with abnormally warmer summers.

Figure 5.1 Annual Water Use and Number of Connections, 2009 - 2013

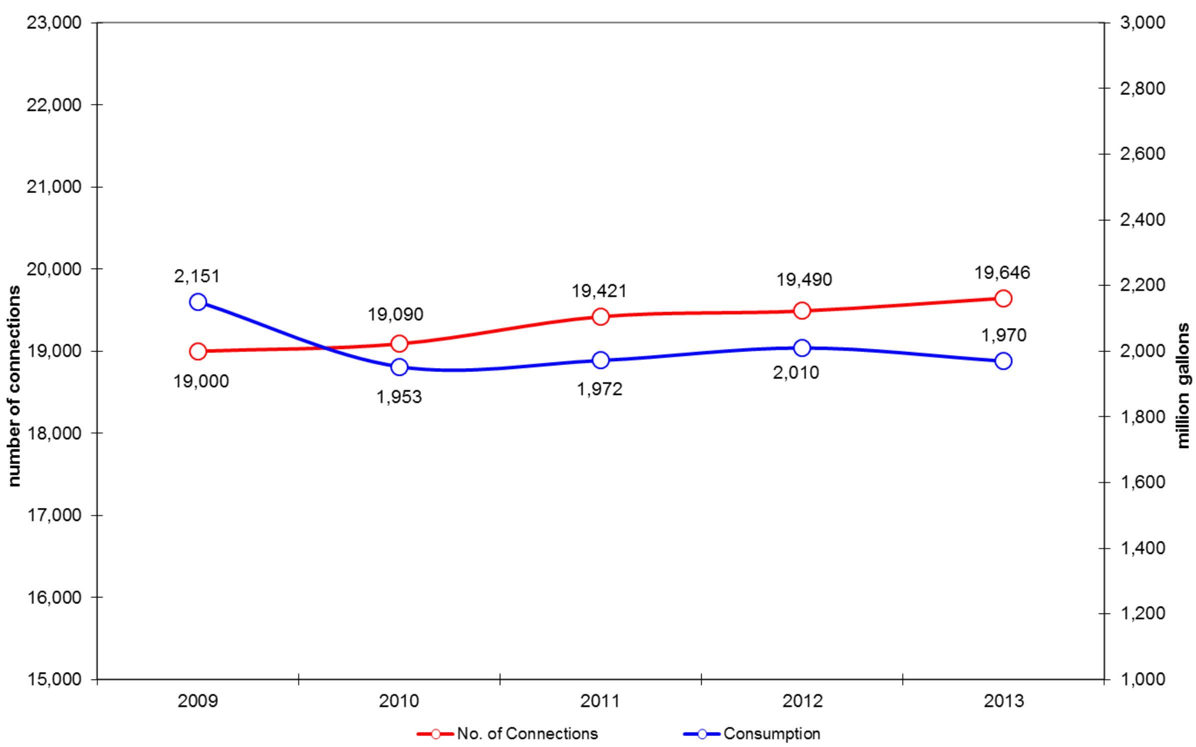


Table 5.2 Changes in Water Consumption, 1996-2013

Year	Connections	Consumption (million gallons)	Total annual usage change from 1996	Gallons used per connection per day	Per connection reduction from 1996	Per connection reduction from previous year
1996	15,279	2,557	n/a	457	n/a	n/a
1997	15,697	2,592	1.37%	452	-1.06%	-1.06%
1998	16,022	2,850	11.46%	487	6.58%	7.72%
1999	16,544	2,454	-4.03%	406	-11.12%	-16.61%
2000	16,653	2,453	-4.07%	402	-11.98%	-0.97%
2001	16,904	2,308	-9.74%	374	-18.19%	-7.05%
2002	17,139	2,348	-8.17%	375	-17.91%	0.34%
2003	17,652	2,547	-0.39%	395	-13.55%	5.32%
2004	18,051	2,375	-7.59%	358	-21.78%	-9.52%
2005	18,190	2,286	-10.64%	344	-24.73%	-3.78%
2006	18,523	2,331	-9.11%	344	-24.82%	-0.12%
2007	18,827	2,184	-14.82%	317	-30.68%	-7.80%
2008	19,000	2,127	-16.82%	306	-33.11%	-3.50%
2009	19,236	2,127	-16.82%	303	-33.75%	-0.96%
2010	19,090	1,939	-24.17%	278	-39.14%	-8.14%
2011	19,421	1,977	-22.68%	279	-39.01%	0.22%
2012	19,490	2,010	-21.39%	282	-38.38%	1.03%
2013	19,646	1,970	-22.96%	275	-39.92%	-2.50%
Total	31.0%	**Average Change**	-10.62%	**Average Change**	-23.16%	-2.89%

Rate Incentives and Consumption

The City uses an “inclining block” rate structure for single-family residential customers, meaning that the cost of water increases as a customer uses more. Prior to 2005, the City had a three-tier rate structure with the third tier specifically designed to discourage discretionary use of water during summer months. In 2005, the City added a fourth tier to provide a stronger price signal to those who use the most water during the summer. Table 5.3 shows the tiered rate structure from 2009 through 2013.

In addition to the inclining block rate structure, the City uses seasonal water rates for non-residential, multi-family and irrigation customers to help curb summer water waste. These customer classes pay more for each unit of water used during the summer months than in winter. Non-residential customers also pay consumption-based sewer charges (based on water use). For more information on the utility rate structure, see Chapter 14.

Table 5.3 Drinking Water Utility Tiered Rate Structure: Single-Family Residential (SFR)

SFR Rates	Tier 1 0 to 800 cubic feet (cf)	Tier 2 801 to 1,800 cf	Tier 3 1,801 to 2,800 cf	Tier 4 2,801 + cf
2009	$1.43 per ccf*	$1.88 per ccf	$2.89 per ccf	$4.14 per ccf
2010	$1.43 per ccf	$1.88 per ccf	$2.99 per ccf	$4.43 per ccf
2011	$1.45 per ccf	$2.02 per ccf	$4.01 per ccf	$5.27 per ccf
2012	$1.48 per ccf	$2.15 per ccf	$4.01 per ccf	$5.27 per ccf
2013	$1.51 per ccf	$2.29 per ccf	$4.01 per ccf	$5.27 per ccf

*ccf – hundred cubic feet

Table 5.4 and Table 5.5 provide consumption information per rate tier and the changes between tiers annually since 2009 for single-family residential customers. The drastic decrease from Tier 4, and the continuing increases in Tier 1 consumption demonstrate the effectiveness of the rate structure.

Table 5.4 Annual Water Consumption by Rate Tier (Million Cubic Feet)

	Tier 1	Tier 2	Tier 3	Tier 4	Total
2009	14.61	52.53	28.44	41.81	137.39
2010	15.63	54.85	25.28	29.54	125.30
2011	16.23	53.98	25.20	30.43	125.84
2012	16.33	54.14	25.70	31.82	127.99
2013	19.15	52.74	24.46	29.02	125.37

Table 5.5 Change in Water Consumption by Rate Tier (Percentage)

	Tier 1	Tier 2	Tier 3	Tier 4
2010	6.98%	4.42%	-11.11%	-29.35%
2011	3.83%	-1.59%	-.32%	3.01%
2012	.62%	.30%	1.98%	4.56%
2013	17.26%	-2.59%	-4.82%	-8.80%

Distribution System Leakage

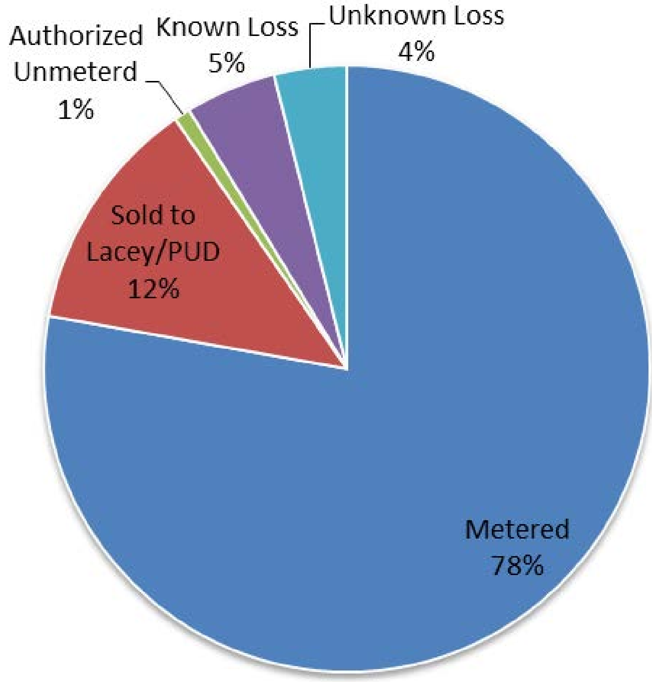
Water utilities are required to report their distribution system leakage (DSL) to DOH annually. Utilities are required to meet a DSL standard of 10 percent or less of total production. To track DSL, the Utility works closely with various City staff to track and estimate authorized but unmetered uses, such as fire suppression, hydrant flushing, operation and maintenance, and water quality sampling. DSL is calculated by subtracting metered consumption and authorized non-metered consumption from total production. The result indicates how much water was lost to leaks, main breaks, meter inaccuracies and theft of water. Chapter 3, Section 3.2 explains how the Utility accounts for leakage in forecasting future demand.

The Utility reported to DOH a total water loss of 8.7 percent for 2013; with a current rolling three-year average of 8 percent. Table 5.6 offers an overview of the Utility's DSL for 2009-2013.

Table 5.6 Distribution System Leakage

Year	Total Production	Total Authorized Consumption	Total DSL	Percent DSL
2013	2,534,219,994	2,313,354,365	220,865,629	8.7%
2012	2,558,897,815	2,315,182,946	243,714,869	9.5%
2011	2,611,172,762	2,459,958,302	151,214,460	5.8%
2010	2,573,285,541	2,369,612,695	203,672,846	7.9%
2009	2,973,046,550	2,666,146,316	306,900,234	10.3%

Figure 5.2 2013 Water Usage



Water Shortage Plan

Olympia's Water Conservation Program encourages customers to voluntarily decrease their water use in order to use the water supply more efficiently. During times of drought or other supply emergencies, established curtailment measures would be put in place quickly to reduce water usage.

In the Puget Sound area, drought usually occurs when there is less than average fall/winter precipitation, or a summer of sustained higher than normal temperatures and lower than normal precipitation. Either condition can contribute to above-average demand and an accelerated drawdown of the City's water supplies.

The Water Shortage Plan (Appendix 5-2) details four levels of curtailment:

- Advisory
- Voluntary
- Mandatory
- Emergency

As a water shortage situation becomes more serious, higher stages of response are implemented. Each stage has progressively more stringent requirements to coincide with conditions of increasing severity.

5.3 2015-2020 Water Conservation Program

The Water Conservation Program objectives and strategies help meet the Drinking Water Utility's Goal 3:

Olympia's water supplies are used efficiently to meet the present and future needs of the community and natural environment.

The Water Conservation Program for 2015-2020 is designed to maintain past program success, and to continue to meet State water use efficiency regulations. The Program will focus on three objectives during 2015-2020:

- Reduce indoor use by 100,000 gallons per day (gpd)
- Reduce outdoor use by 5 percent
- Maintain water loss below 10 percent of production

For each objective, this section lists a number of strategies and performance measures. Specific conservation activities are described in Section 5.4.

Objective 3A Reduce Indoor Use By An Additional 100,000 Gallons Per Day (Gpd) Over Past Program Savings.

Strategy 3A1 -- Continue to implement flow reduction programs through partnership with the LOTT Clean Water Alliance and Cities of Lacey and Tumwater for single-family, multi-family and industrial/commercial/institutional (ICI) customers who receive LOTT sewer service.

Strategy 3A2 -- Continue to implement water-saving programs for residential City water customers who are on septic systems and therefore cannot participate in the LOTT programs.

Strategy 3A3 -- Continue outreach to raise awareness of the importance of water use efficiency.

Performance Measure

1. Using industry-wide water saving assumptions for various efficient devices (e.g. toilets), determine the water savings achieved through program efforts annually.

Objective 3B Reduce outdoor use by an additional 5 percent over past program savings.

Strategy 3B1 -- Continue to implement outdoor water use reduction programs for residential customers.

Strategy 3B2 -- Continue to implement the Efficient Irrigation Hardware Rebate Program for ICI customers.

Strategy 3B3 -- Continue outreach to raise awareness of the importance of water use efficiency.

Performance Measures

1. Monitor irrigation meter consumption annually. Adjust consumption data for year-to-year weather conditions that affect plant irrigation needs.
2. Monitor domestic seasonal water use through consumption records annually. Again, consumption data needs to be adjusted for weather conditions.

Objective 3C Maintain water loss below 10 percent of production.

Strategy 3C1 -- Continue to monitor water loss in the system annually as required by the DOH by evaluating production, authorized consumption (both metered and unmetered) and resulting distribution system leakage (DSL).

Strategy 3C2 -- Continue to work closely with the Olympia Fire Department and surrounding fire districts to get accurate estimates of water used for fire suppression, fire flow testing, sprinkler flushing and training conducted off-site.

Strategy 3C3 -- Continue to work closely with the Utility's Operations & Maintenance section to monitor water loss due to field use, main breaks and leaks, as well as expanding leak detection efforts.

Strategy 3C4 -- If the water system exceeds the DSL standard, develop and implement a Water Loss Control Action Plan as required by DOH.

Performance Measure

1. Calculate water loss annually and submit required Water Use Efficiency Report to DOH.

5.4 Planned Water Conservation Activities

This section describes the conservation activities that will continue in this planning period and estimated water savings for each. The activities are summarized in Table 5.7.

Table 5.7 Planned Water Conservation Activities (2015 - 2020)

Indoor	Outdoor	Additional Ongoing
High-Efficiency Toilets/Rebate WashWise Rebate WaterSmart Technology Rebate Better-Than-Code Rebate Water Saving Kits	Smart Irrigation Controller Rebate Rain Sensors Rain Barrel Rebate Hose Watering Timers Water Saving Kits Efficient Irrigation Equipment Rebate	Pressure Reducing Valves Annual Water Conservation Utility Insert Annual Smart Irrigation Month Campaign Olympia's Water Supply School Presentation Annual Fix-a-Leak Week Campaign Sustainability Event Staffing Regional Partnerships Targeted Program Outreach Water Loss Accounting

Indoor Water Conservation

For indoor conservation, the Program focuses on installation of water-efficient technologies. The bulk of the indoor program is implemented through a cooperative effort with LOTT and the Cities of Lacey and Tumwater. Because its primary motivation is reducing wastewater flow to the LOTT Wastewater Treatment Plant, LOTT funds 100 percent of all non-staff program costs for customers with sewer service. The City offers rebates for customers with septic systems that do not qualify for LOTT's programs.

The following activities, with water savings assumptions and calculations for each, are described in greater detail in the *LOTT Water Conservation Coordination Plan (*Appendix 5-3)*,* updated by the LOTT partners in 2013. Ongoing activities are:

- High-Efficiency Toilets/Rebates
- WashWise Rebates
- WaterSmart Technology Rebate Program
- Better-Than-Code Rebates
- Free Water Saving Kits

High-Efficiency Toilets

High-efficiency toilets (HETs) offer water savings in many applications, across all customer categories. Toilets installed prior to 1994, using between 3.5 and 5 gallons per flush (gpf), do not meet current national water use standards. Conventional toilets meeting current standards use 1.6 gpf, about 20 percent more than high-efficiency toilets using 1.28 gpf or less. Replacing either type of conventional toilet with an high-efficiency model results in substantial water savings, as shown in Table 5.8.

Table 5.8 Water Savings Assumptions for High-Efficiency Toilets

	Replacing 3.5 gpf +	Replacing 1.6 gpf
Single-Family Residential	34 gpd	11 gpd
Multi-Family Residential	25 gpd	7.8 gpd
Industrial, Commercial & Institutional	45 gpd	14 gpd

For the 2015-2020 planning period, three HET offerings will be available across all customer categories through the LOTT program:

1. HET Rebates
2. Free Toilets for Multi-Family Customers
3. WaterSmart Technology Rebates

The program chosen will depend on customer category, water usage of existing fixtures, and in some cases the number of toilets to be replaced.

Residential water customers with septic systems who do not qualify for LOTT's programs are eligible for a rebate from the City of $100 per toilet, the same rate as LOTT's rebate program.

WashWise Rebates

For this planning period, residential customers on either sewer or septic systems will be eligible for a rebate on the purchase of resource-efficient clothes washers. LOTT offers sewer customers a $50 rebate and the City gives septic system customers a $100 rebate per household. Qualifying machines can be found through the Consortium for Energy Efficiency, an independent organization that rates energy and water efficiency for various appliances.

Water Savings Assumptions: 29 gpd

Watersmart Technology Rebates

Available to Olympia's ICI customers, this program offers rebates of up to 75 percent of the installed costs of water-efficient devices and fixture upgrades, such as plumbing, water-cooled ice machines, laundry equipment, boiler and steam systems, and rinsing and cleaning processes.

Interested customers work with City staff to identify prospective projects and complete the rebate application, describing the proposed project, estimating total cost and providing water savings assumptions. Following staff review of the proposal and approval by LOTT's Water Conservation Coordination Committee (WC3), the customer completes the project and then submits invoices and work orders to the City. City staff inspects the new equipment, confirms installation and recommends that LOTT award the rebate.

Water Savings Assumptions: Vary, calculated on a case-by-case basis.

Better-Than-Code Rebates

The Better-Than-Code program provides rebates to all customer classes for the installation of high-efficiency fixtures and/or equipment to replace equipment that already meets current plumbing code standards. These rebates may apply to existing buildings, remodels of existing buildings and new construction. Better-than-code rebates apply to three scenarios:

- Toilets - $100 per toilet.
- Urinals - $125 per urinal.
- Other equipment – rebate customized based on cost differences between better-than-code equipment and standard, at-code equivalent equipment and the potential water savings.

Water Savings Assumptions: Vary, calculated on a case-by-case basis.

Water Saving Kits

Indoor Water Saving Kits, which include a low-flow showerhead, kitchen and bathroom faucet aerators, toilet leak detection tablets and installation instructions, are distributed to single-family and multi-family customers free of charge. The fixtures included use less water than current plumbing code standards without compromising function. Kits are available to water customers on either sewer or septic systems. LOTT funds the kits for sewer customers; the City funds the kits for septic customers.

Water Savings Assumptions: 18 gpd

Outdoor Water Conservation

Since water use doubles (and sometimes triples) in the summer months, this strategy focuses on reducing outdoor water waste for all customer categories. Because water used outdoors for lawns, gardens, car washing, etc. does not end up in the wastewater system, these programs are funded entirely by the City.

For the 2015-2020 planning period, ongoing offerings include:

Residential Customers

- Smart Irrigation Controller Rebates
- Free Rain Sensors
- Rain Barrel Rebates
- Free Hose Watering Timers
- Free Water Saving Kits

ICI Customers

- Efficient Irrigation Equipment Rebates

Smart Irrigation Controller Rebate

Residential customers with in-ground irrigation systems are eligible for a rebate of up to 50 percent of the installed cost of a "smart" irrigation controller, not to exceed $200. Smart irrigation controllers automatically adjust watering times based on weather conditions to provide optimal moisture for healthy plants and conserve water. Water savings of 15 to 30 percent is common when traditional irrigation timers are changed to smart controllers.

Rain Sensors

Residential customers with in-ground irrigation systems may request a free rain sensor for their system. Rain sensors turn off automatic irrigation systems when it is raining, so systems don't run when nature is doing the watering. They are easy to install and adjust, and will fit all irrigation controllers. In a typical Puget Sound summer, a rain sensor can reduce water use by 5 to 10 percent, and that is often just the start of savings. On systems that are not monitored and adjusted regularly, a rain sensor can eliminate weeks of wasted irrigation when autumn rains start before a contractor comes to shut off the system—saving another 10 to 20 percent.

Rain Barrel Rebates

Residential customers are eligible for a rebate of up to $20 per rain barrel, with a maximum of three rebates per residence. A rain barrel collects rain water from the roof and stores it for later uses like watering the garden. Rain barrels help to conserve drinking water and reduce stormwater flows. Each barrel holds about 55 gallons of rain water.

Hose Watering Timers

Residential customers who water their lawns and gardens with a hose-end sprinkler can reduce overwatering by using a timer provided free by the City. Timers can be set to water only as long as needed.

Water Saving Kits

Outdoor Water Saving Kits include an adjustable spray nozzle for car washing, a hose repair kit to fix leaks and a rain/sprinkler gauge to monitor how much water lawns and gardens are receiving. Free kits are available to residential customers.

Efficient Irrigation Equipment Rebates

ICI customers with in-ground irrigation systems are eligible for rebates of up to $2,500 for installing selected efficient irrigation equipment to improve existing systems. Equipment eligible for these rebates includes spray nozzle retrofits, smart controller sensor retrofits, smart controller installation, drip irrigation conversions, flow sensor installation, pressure regulators and networked control systems. Water savings varies depending on the existing system and the upgrades made.

Additional Ongoing Program Activities

Other ongoing activities described below are:

- Pressure Reducing Valves
- Water Conservation Utility Bill Inserts
- Smart Irrigation Month Campaigns
- Water Supply School Presentations
- Fix-a-Leak Week Campaign
- Sustainability Event Staffing
- Regional Partnerships
- Targeted Program Outreach
- Water Loss Accounting

Pressure Reducing Valves

Residential customers with water pressure above 80 pounds per square inch (psi) are eligible for a rebate of up to 50 percent of the installed cost of a pressure reducing valve (PRV), not to exceed $125. Installing a PRV can reduce the strain on plumbing fixtures and reduce water waste. Water savings varies depending on the pressure before and after the PRV is installed.

Water Conservation Utility Bill Insert

Customers receive a special water conservation insert with their utility bill annually. The publication focuses on indoor and outdoor conservation practices, tips and incentives available to water customers. It is also often used to promote a special giveaway, such as soil moisture meters. This publication had been awarded the *Excellence in Communication* award for a large utility by the Pacific Northwest Section of the American Water Works Association in 2011, 2013 and 2014. It is one of the Utility's most important and far-reaching publications.

Smart Irrigation Month Campaign

July has been designated as Smart Irrigation Month by the Irrigation Association. The City celebrates this campaign by promoting efficient water use outdoors through news releases, reader boards, street banners, direct mailings, conservation giveaways and utility bill inserts. Program staff hopes to work with inter-jurisdictional partners to expand the campaign county-wide within the planning period.

Water Supply School Presentation

The Water Conservation Program has developed a presentation on Olympia's water supply for sixth grade students. The presentation and interactive activity have been well received by participating students. During the 2015-2020 planning period, this presentation will be offered to all sixth grade science classes in the Olympia School District to increase participation.

Fix-a-Leak Week Campaign

Each March, the EPA sponsors Fix-a-Leak Week, a campaign to raise awareness on the water wasted through household leaks. Household leaks can waste more than 1 trillion gallons of water annually nationwide. The City participates by promoting the event through the website, street banner, news releases and free toilet leak detection tablets to encourage customers to check for and repair leaks in their homes.

Sustainability Event Staffing

Periodically the Water Conservation Program Office is invited to host a table at events that promote sustainability. These events are an opportunity to promote water conservation through a creative display, conversations and giveaways that remind people to think about the water they are using. Items typically distributed at these events include, brochures, shower timers, dish squeegees and rain/sprinkler gauges.

Regional Partnerships

Regional partnerships are critical to ensuring regional coordination of resource conservation and environmental protection messages. They also increase program efficiency and the consistency of messages to the public. The City will continue to foster relationships and partnerships with the LOTT Clean Water Alliance's Water Conservation Coordination Committee (WC3), the Thurston County Chamber's Green Business Committee, the Partnership for Water, the Pacific Northwest Section of the American Water Works Association (PNWS-AWWA), and the Environmental Education Technical Advisory Committee (EETAC).

Targeted Program Outreach

The Utility will continue to use a variety of outreach methods to promote programs that directly engage customers. These methods include utility bill inserts, web site postings, social media postings, brochures, street banners, water conservation performance reports, news releases, direct customer invitations, vendor contact and purchased advertising.

Water Loss Accounting

Water loss accounting is a regulatory priority for the City. Water loss includes leaks and main breaks, system flushing, fire-fighting, theft and meter inaccuracies. The Water Conservation Program devotes significant staff time to identifying and minimizing all components of water loss (Table 5.6). The work involves data collection and analysis and coordination with multiple City staff and surrounding fire districts to obtain accurate information about authorized but unmetered water use.

5.5 Implementation and Staffing

This Plan serves as a guide for staff as they implement specific activities and projects aimed at accomplishing Water Conservation Program objectives.

Implementation

A key element of program implementation is flexibility. Most water saving activities will continue throughout the six-year planning period. Some may be replaced if promising new water saving technologies or alternative delivery methods are identified. Also, activity priorities, scheduling and budget allocations may change as staff evaluates results and learns more about water conservation opportunities. Each year staff will evaluate the accomplishments and challenges of that year's activities, and will identify priorities for the next year through the Water Conservation Program Annual Report.

Staffing

Program management includes coordinating all water conservation activities, designing and implementing programs to promote water conservation, collecting and analyzing water production and consumption data, generating reports, managing the water conservation budget, responding to questions and offering technical assistance related to water conservation.

The Water Conservation staff consists of 1.75 FTEs:

- Water Conservation Program Coordinator (0.75 FTE)
- Water Conservation Program Assistant (1.0 FTE)

The current staffing level has proven adequate, given that the water savings goals for the 2009-2014 planning period were fully achieved.

Reclaimed Water Program

Chapter 6

Chapter 6 – Reclaimed Water Program – Contents

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CHAPTER 6 – RECLAIMED WATER PROGRAM

Reclaimed water is highly treated wastewater that can be used for a variety of beneficial purposes. Use of reclaimed water supports conservation and can extend available water resources by offsetting the demand on potable water. By using reclaimed water for non-potable purposes, higher quality water can be saved for drinking water supplies. For these reasons, reclaimed water is an important element of the City's overall water portfolio.

Both the Water Conservation Program and the Reclaimed Water Program aim to achieve the Drinking Water Utility's Goal 3:

> **Olympia's water supplies are used efficiently to meet the present and future needs of the community and natural environment.**

For the Reclaimed Water Program, this goal is consistent with and is a refinement of the City's Comprehensive Plan Goal GU4 and Policy PU4.6 which is to "advance the use of reclaimed water as defined in Council-adopted policies."

While the Water Conservation Program achieves greater efficiency by *reducing* use of potable water, the Reclaimed Water Program supports efficiency by *reusing* and *recycling* potable water. Potable water has been used once in homes and businesses and then treated at the LOTT Clean Water Alliance (LOTT) wastewater treatment plants. Rather than being discharged to Puget Sound, the treated wastewater is *reused* for irrigation, toilet flushing, heating/cooling, industrial and commercial processes, and educational and interactive water features. It is also *recycled* by using it to recharge groundwater rather than discharging it into Puget Sound.

Since 2014, the City has shifted from emphasizing reclaimed water as a conservation strategy, which has not proven to be cost-effective, to prioritizing reclaimed water for groundwater recharge and enhanced stream flow.

Three objectives have been identified for 2015-2020:

- Meet the needs of current and future City reclaimed water customers.
- Direct reclaimed water towards meeting the regional wastewater management goal of reducing the amount of treated wastewater discharged into Puget Sound.
- Enhance Reclaimed Water Program efficiency and effectiveness.

6.1 Reclaimed Water Regulations

During the 2009-2014 planning period, revisions to state reclaimed water regulations were initiated, and updates were made to Thurston County and City of Olympia reclaimed water-related ordinances.

Legislation

State law, initially developed in 1995 (Chapter 90.46 RCW), encourages the use of reclaimed water to help meet growing water requirements and directs the Washington State Department of Ecology (Ecology) and Department of Health (DOH) to encourage the development of water reclamation facilities.

A 2006 legislative amendment, Engrossed Substitute House Bill (ESHB) 2884, directed Ecology to develop and adopt rules on all aspects of reclaimed water use by December 31, 2010. It also directed Ecology to coordinate with DOH and form a rule-making advisory committee with a broad range of interested individuals. Reclaimed Water Program staff has participated in this advisory committee since its inception in 2007.

A 2007 legislative amendment, Engrossed Second Substitute Senate Bill (E2SSB) 6117, reaffirmed the State's commitment to reclaimed water and recognized the importance of the benefits of reclaimed water use, including:

- Consistent, reliable water supply as Washington faces climate change challenges.
- Reduced discharge of treated wastewater into Puget Sound.
- More water in rivers and streams for salmon recovery.

The Municipal Water Law (70.119A.180 RCW), a 2003 amendment to Washington water law, clarifies the nature of water rights issued for municipal supply purposes and provides flexibility for municipal water suppliers in exercising their water rights. Ecology and DOH share responsibilities under the law, bringing to it elements of water resources and watershed management, as well as public health and safety. Collaboration between these agencies resulted in a requirement for utilities to evaluate potential uses of reclaimed water in their water system plans (see Chapter 5, Table 5.1).

State Regulations

In 1997, DOH and Ecology developed the *Water Reclamation and Reuse Standards* to specify general requirements for the use of reclaimed water, which is categorized into four Classes: A, B, C and D. Class A is the highest quality and is considered safe for public contact and virtually all uses except human consumption. The *Standards* include requirements for treatment and plant design, engineering and operations.

In 2008, Ecology's Water Quality Program developed the *Criteria for Sewage Works Design* (also known as the *Orange Book*) which contains a Water Reclamation and Reuse chapter covering the use of sewage treatment plant effluent (reclaimed water) for beneficial purposes. The *Orange Book* is intended to supplement the *Standards*.

A new State Reclaimed Water Rule, in the making as Chapter 173-219 Washington Administrative Code (WAC), will replace the 1997 *Standards*. The purpose of the new rule is to establish an efficient, effective, and consistent statewide implementation framework for reclaimed water, including standards and permit requirements. The rule-making process initiated in 2006 was suspended by the Governor under two consecutive Executive Orders from 2010 through 2012. Ecology reactivated the rule-making process in June 2014 and expects the rule will be adopted and implemented by late 2016. The new state rule is currently proposing to regulate only two categories of reclaimed water: Class A and Class B. The current Classes B and D will be eliminated because they have not been in demand by reclaimed water users; the current Class C will become the new Class B.

Thurston County Critical Areas Ordinance

In 2012, Thurston County Commissioners revised Thurston County Code Title 24 Critical Areas Ordinance (CAO). The revision changed Chapter 24.10 Critical Aquifer Recharge Areas (CARA), which includes Section 24.10.190 Reclaimed Water. This regulation allows irrigation with Class A reclaimed water at agronomic rates, but prohibits infiltration of reclaimed water by application to the land's surface above agronomic rates. Table 24.10-1 of the CARA (in Section 24.10.020 Standards and Restricted and Prohibited Uses) indicates infiltration of reclaimed water is prohibited in all County aquifer recharge area categories. This prohibition will stand until more information is available to the County from LOTT's Regional Reclaimed Water Infiltration Study and other studies and information about reclaimed water. LOTT's study is scheduled to be completed in 2017, after which the County is expected to revisit the Critical Areas Ordinance to reevaluate the prohibition on infiltrating reclaimed water.

Olympia Reclaimed Water Ordinance

As a requirement of LOTT's Reclaimed Water Permit, Olympia was required to adopt a reclaimed water ordinance. The ordinance was adopted in 2005 as Chapter 13.24 Reclaimed Water of the Olympia Municipal Code. It includes policies and procedures for the distribution and use of reclaimed water. The initial ordinance established a rate for reclaimed water at 70 percent of the equivalent potable rate to encourage its use, and placed the Reclaimed Water Program within the Drinking Water Utility. (Reclaimed water could not be a stand-alone utility since rates would not be sufficient to cover the costs of the needed infrastructure.)

In 2007, the City Council directed staff to revise the ordinance *requiring* use of reclaimed water in some locations in order to increase conservation of potable water. Council's directive was to require customers fronting reclaimed water mains (and meeting other criteria) to connect to the City's reclaimed water system; customers were to bear the connection costs with some rebate assistance from the City. Council direction was also to require developers of projects (meeting certain criteria on use and proximity to existing pipeline) to install reclaimed water mains.

In 2011, Utility staff initiated the process of adopting into ordinance the direction of the 2007 Council. However, upon considering the cost of the rebate program and an excessive-cost exemption from the connection requirement, the cost of infrastructure and anticipated revenue, Utility management decided to pursue a less assertive strategy for advancing reclaimed water use.

Instead of revising the ordinance to require the use of reclaimed water, staff focused on updating the ordinance to address regulatory gaps and achieve consistency with other updated utility ordinances. Also added were fees, rates, and charges not included in the original reclaimed water ordinance; these changes in revenue base aligned the reclaimed water financial structure with that of the drinking water, storm and surface water, and wastewater utilities. The amended ordinance was adopted by Council in late 2013 and became effective January 1, 2014.

The City's Engineering Design and Development Standards (EDDS), an ordinance typically updated and adopted annually, contains Chapter 10 for reclaimed water systems. The EDDS specifies standards for infrastructure and accessories (for example, valves and meters), service interruptions, testing and inspections, submittals, and other technical specifications. It parallels the Drinking Water Utility's EDDS Chapter 6, given the similarities in the two water systems.

Reclaimed Water End User Agreements

Reclaimed Water End User Agreements are required between the City and each reclaimed water customer prior to actual use of reclaimed water. A model End User Agreement was developed by the LOTT partner jurisdictions when establishing the various initial General Interlocal, Distribution, and Supply Agreements (described in Section 6.2). The model was approved by DOH and Ecology as part of the Agreement review process. The End User Agreement is tailored to each customer regarding the type, location and period of intended reclaimed water use, and quantity and price. The End User Agreement also specifies restrictions and other conditions for compliance.

As of 2014, Olympia has End User Agreements with four customers: the Washington State Department of Enterprise Services (DES, formerly General Administration or GA), the Port of Olympia, Weyerhaeuser Company, and the Hands On Children's Museum. The Olympia Parks, Arts and Recreation Department also uses reclaimed water, but an End User Agreement is not required because distribution by the City to City departments is regulated directly under LOTT's permit.

6.2 Regional Implementation and Infrastructure

Olympia's Reclaimed Water Program has been developed as part of a regional system through its partnership with LOTT. As a reclaimed water purveyor, Olympia is an active participant in LOTT-related activities. LOTT regional and Olympia local reclaimed water distribution lines as of 2014 are shown in Map 6.1

LOTT Clean Water Alliance

LOTT is a nonprofit corporation formed by the cities of Lacey, Olympia and Tumwater, and Thurston County to provide wastewater treatment and reclaimed water production services for the urban area.

LOTT Treatment Facilities

LOTT operates a large central treatment facility, the Budd Inlet Treatment Plant, in downtown Olympia. Wastewater is piped to the plant from Lacey, Olympia and Tumwater residential and commercial customers. Each day about 11.5 to 15 million gallons of wastewater receives advanced secondary treatment, the highest level of treatment on Puget Sound. Most of the final treated effluent is discharged into Budd Inlet; however, some is diverted to the Budd Inlet Reclaimed Water Plant for further treatment to Class A reclaimed water standards.

Satellite Reclaimed Water Facilities

As part of its 1998 Wastewater Resource Management Plan, LOTT identified construction of satellite reclaimed water facilities throughout its service area as a cost-efficient way to manage the need for future treatment capacity as the area continues to grow. Generation of Class A reclaimed water is one of LOTT's key strategies to meet regulatory restrictions on the volume and quality of treated wastewater that can be discharged into Budd Inlet.

In addition to the Budd Inlet Reclaimed Water Plant, LOTT has constructed the Martin Way Reclaimed Water Plant in the City of Lacey. In the long term, LOTT plans to construct other reclaimed water plants and infiltration basins in Thurston County.

Permits

Ecology and DOH issued permits to LOTT for each of its reclaimed water facilities. Because it discharges to surface water, the Budd Inlet facility was issued a combined National Pollutant Discharge Elimination System/Waste Discharge and Reclaimed Water Permit, specifying regulation of monitoring, reporting and recordkeeping, as well as distribution and use of reclaimed water. The Martin Way facility, which discharges to groundwater only, was issued a Reclaimed Water Permit, covering monitoring, reporting, recordkeeping, reclaimed water distribution and use, and plant operation and maintenance.

Olympia's Reclaimed Water Allocation

LOTT does not sell reclaimed water as a commodity, but provides it to the partner utilities for distribution and beneficial use. LOTT allocates Olympia a portion of the reclaimed water from the Budd Inlet Reclaimed Water Plant to distribute within city limits for direct beneficial use. Olympia is also allotted a portion of reclaimed water generated at the Martin Way Reclaimed Water Plant. (See Distribution Agreement for the allotted quantities.)

As a distributor of LOTT's reclaimed water, Olympia is required to uphold the permit requirements and ensure that the City and its customers abide by these requirements.

Olympia uses reclaimed water from the Budd Inlet plant for irrigation, toilet flushing, heating/cooling, industrial processes, commercial processes (such as dust suppression and wash-down water), and educational and interactive water features. Olympia's reclaimed water from the Martin Way plant is being infiltrated at the Woodland Creek Groundwater Recharge Facility in Lacey's Woodland Creek Community Park to enhance groundwater recharge and stream flow as part of the cities' water rights mitigation portfolios and as a key element in the broader approach to managing the sustainability of regional water resources.

Reclaimed Water Task Force and Partner Agreements

In 2001, LOTT convened a Reclaimed Water Policy Task Force, composed of staff from LOTT, the three cities and the County. The Task Force resolved numerous policy issues related to the initial distribution and use of reclaimed water, through a series of general interlocal, distribution, supply, and end user agreements. These agreements offer regional resource management structure while preserving each jurisdiction's operating autonomy.

General Interlocal Agreement. Specifies policies, distribution methodology, negotiation protocols, and roles and responsibilities. It is required by the state reclaimed water permit and was approved by Ecology and DOH.

Supply Agreement. Defines how much water LOTT will make available to Olympia from specific plants, and includes the general operating and technical Distribution Agreement and the model End User Agreement.

Distribution Agreement. Exhibit A of the Supply Agreement, the Distribution Agreement details the volume of reclaimed water available to the City from the Budd Inlet and Martin Way plants. The City was allotted 460,000 gallons per day from the Budd Inlet plant beginning in 2005, when it came on-line. The City was also allotted 300,000 gallons per day from the Martin Way plant beginning in 2007, when it started producing reclaimed water. The Distribution Agreement also includes a future facility in the Chambers Prairie (Mullen Road) area, with an allotment of 300,000 gallons per day for the City when it is built (post-2030); however, it is not certain at this point whether the next facility will be constructed in this area. Thus, under the current Distribution Agreement, the City has been allotted a total of 1,060,000 gallons per day. As LOTT increases reclaimed water production or finalizes new facility locations and production, the LOTT partners will revisit the Distribution Agreement.

A model End User Agreement was also developed by LOTT and the partners; it was approved by Ecology and DOH as Exhibit B of the Supply Agreement.

In 2005, as required by LOTT's permit, Olympia and Lacey adopted uniform reclaimed water ordinances to ensure permit requirements were met (Section 6.1). In 2014, Olympia adopted amendments to the City's municipal code, OMC 13.24 Reclaimed Water, to fill regulatory gaps, achieve consistency with other updated City utility ordinances, and to add fees, rates, and charges in alignment with other City utilities.

Recent and Future Regional Expansion

LOTT's 2009-2025 *Capital Improvements Plan* resulted in the construction of a pipeline to carry reclaimed water to groundwater recharge sites, beginning with one planned for the Tumwater area. As shown in Map 6.1, the first leg of this pipeline (installation completed in 2010) extends from Marathon Park, south on Deschutes Parkway to the Tumwater Valley Municipal Golf Course, and includes an extension of reclaimed water pipe up Lakeridge Drive leading to Olympia's west side.

LOTT's *2014 Budget and Capital Improvements Plan* highlights three strategies for future management of wastewater directly associated with use of reclaimed water:

- A multi-year **Reclaimed Water Infiltration Study** to inform decisions about the use of reclaimed water for groundwater recharge. The study includes a scientific portion to gather local data about potential environmental, ecological and human health risks, and a public engagement portion to encourage community conversations about what can be done to reduce those risks. The study is expected to be completed in 2017.
- Development of **new reclaimed water treatment facilities** on 45 acres of LOTT-owned land on the former brewery property in the Tumwater valley. Three kinds of facilities could be built at this location: a satellite plant similar to the Martin Way Reclaimed Water Plant; a plant to provide further treatment of treated wastewater piped from the Budd Inlet Treatment Plant; or a plant using advanced treatment such as reverse osmosis. This site also offers opportunity for riparian corridor restoration along the Deschutes River and improved public access to the riverfront. A master plan with the City of Tumwater is needed to help guide future development of the property.
- Construction of **a reclaimed water storage tank**, also in the Tumwater valley area, to provide equalizing storage to meet peak use demands that currently exceed the Budd Inlet Reclaimed Water Plant, as well as standby storage and operational storage for future planned recharge basins. This storage tank could benefit Olympia by increasing pressure for reclaimed water service to higher elevation areas in the City.

6.3 Reclaimed Water Activities

Olympia uses reclaimed water in two ways: for direct beneficial use by agencies and businesses and for groundwater recharge.

Direct Beneficial Use

As shown in Map 6.1, LOTT has constructed a reclaimed water distribution main that runs south from the Budd Inlet plant to Heritage Park, under the pedestrian bridge across Capitol Lake and through Marathon Park to LOTT's Capitol Lake Pump Station. The south line provides reclaimed water to DES for irrigation of state park grounds. (This line continues south along Deschutes Parkway to the Tumwater Valley Golf Course area.)

In a cost-share arrangement with the City, the Port of Olympia installed a reclaimed water distribution line that runs north from the Budd Inlet plant to the end of the Port peninsula. The north line provides reclaimed water to the Port, Hands On Children's Museum and Anthony's Hearthfire Grill Restaurant, and is available for use by Weyerhaeuser and other Port tenants.

Olympia has approximately 4.85 miles of reclaimed water pipeline within city limits.

Current Customers and Uses

LOTT's Budd Inlet Reclaimed Water Plant began generating Class A reclaimed water in 2005. The following year, Olympia began distributing reclaimed water in the downtown area. By 2014, Olympia had Reclaimed Water End User Agreements with four reclaimed water customers in downtown Olympia (shown in Map 6.1):

- Washington State Department of Enterprise Services (DES, formerly General Administration) – For irrigation at Heritage and Marathon Parks.
- Port of Olympia – For irrigation along Marine Drive and at the Anthony's Hearthfire Grill Restaurant at the north end of the Port peninsula, and for equipment cleaning and wash-down in the Swantown Marina area. The Port also has a filling station with three meters to supply reclaimed water to Port and Port tenant tank trucks for dust suppression at the log yard. Use of the filling station was suspended in 2012 until the Port improved the stormwater treatment system in the log handling area.
- Weyerhaeuser Company – To use reclaimed water from the Port's filling station for dust suppression in the log yard area.
- Hands On Children's Museum – For irrigation and toilet flushing in the City-owned building to the east of the LOTT Administration Building.

In addition, Olympia Parks, Arts and Recreation Department uses reclaimed water at Percival Landing and Percival Landing Park, for irrigation. (No End User Agreement is needed for City departments.)

Quantity of Reclaimed Water Used in Olympia

As specified in the Distribution Agreement (Section 6.2), Olympia has been allotted 460,000 gallons per day (equivalent to about 167.9 million gallons per year) from the Budd Inlet plant.

Table 6.1 shows the annual reclaimed water use for Olympia's reclaimed water customers during the first nine years of program implementation. On average, the City used about 5.5 percent of its allotted reclaimed water from the Budd Inlet plant each year during this period. The average annual use of reclaimed water between 2006 and 2014 was about 9.24 million gallons per year. The year of highest usage, 2012, (11.12 million gallons) represents just over one-half percent (0.55%) of the City's potable water usage for that year (2,010 million gallons; Table 5.6).

Table 6.1 Annual Reclaimed Water Use, 2006-2014 (million gallons)

Customer	2006	2007	2008	2009	2010	2011	2012	2013	2014
Washington State Dept. of Enterprise Services	2.80	6.86	5.07	5.67	5.05	4.94	5.63	4.47	4.61
Port of Olympia (including Weyerhaeuser)	2.10	2.31	2.39	3.48	4.60	3.35	3.97	1.47	3.33
Anthony's Hearthfire Grill Restaurant (included in the Port of Olympia End User Agreement)	0.01	0.43	0.31	0.54	0.32	0.34	0.44	0.21	0.33
Olympia Parks, Arts and Recreation Dept.	0.67	0.60	0.59	0.86	0.39	1.00	1.09	0.86	0.89
Hands On Children's Museum								0.32	1.24
Total	**5.58**	**10.19**	**8.36**	**10.55**	**10.36**	**9.61**	**11.12**	**7.33**	**10.07**

Groundwater Recharge - McAllister Wellfield Mitigation

The City began using reclaimed water from LOTT's Martin Way Reclaimed Water Plant in 2014 as part of its mitigation plan for the McAllister Wellfield (Chapter 4, Section 4.3).

Mitigation Plans

The McAllister Wellfield mitigation planning process concluded that predicted impacts in the Deschutes River basin from wellfield pumping could be effectively mitigated by infiltrating reclaimed water to enhance in-stream flows in the Woodland Creek sub-basin as part of the City's portfolio of in-kind mitigation actions. In 2008, the Cities of Lacey and Olympia submitted to Ecology separate but coordinated mitigation plans proposing to jointly mitigate predicted impacts to Hicks Lake, Pattison Lake and Long Lake (the "Tri-Lakes") in the Woodland Creek sub-basin resulting from the new and additional water sources (Olympia's McAllister Wellfield and Lacey's groundwater wells).

The City of Olympia and the Nisqually Indian Tribe jointly developed the McAllister Wellfield Mitigation Plan and submitted a final version to Ecology in December 2010. The mitigation plan acknowledges the potential for reclaimed water to benefit the lower reach of the Deschutes River as was determined during the mitigation planning process.

Infiltration Facility

In October 2008, Lacey and Olympia signed an Interlocal Agreement to mitigate the predicted impacts to the Tri-Lakes by infiltrating Class A reclaimed water downstream from the outlet of Long Lake and upstream of where Woodland Creek passes beneath Martin Way. The cities have applied their respective shares of reclaimed water from the Martin Way Reclaimed Water Plant to share the cost and ownership of a mitigation facility at Lacey's Woodland Creek Community Park.

As specified in the Interlocal Agreement, based on the predicted impact by McAllister Wellfield pumping, Olympia's share is 21.7 percent of the cost to construct, operate and maintain the

Woodland Creek Community Park Groundwater Recharge Facility. This effort is an important component of Olympia's McAllister Wellfield water rights mitigation portfolio.

During the water rights mitigation planning period (2000-2013), a hydrogeological (infiltration) feasibility study was conducted (2009-2010), followed by facility design (2011-2012) and construction (2013). A pilot test, infiltrating potable water at the new facility, was conducted in early 2014. Lacey began operating the facility in mid-2014. The cities have collaborative reporting requirements to Ecology, due annually in January. The feasibility study indicates between 0.3 and 0.8 million gallons per day of reclaimed water will need to be infiltrated to mitigate for the predicted impacts from the cities' new and transferred water rights. The facility may be able to infiltrate up to 1.3 million gallons per day depending on seasonal groundwater levels at the site. Olympia has been allotted up to 0.3 million gallons per day from the Martin Way plant, while Lacey's allotment is up to 1.46 million gpd.

Potential Future Customers and Uses

The City's 2005 *Business Plan* and 2010 *Reclaimed Water System Expansion Plan* (**Section 6.4**) identify potential future users of reclaimed water at approximate volumes and peak demands. The *Business Plan* focused on potential users located close to existing reclaimed water mains, while the *Expansion Plan* proposed extending reclaimed water infrastructure to new areas east and south and within the downtown Olympia core; it also included existing irrigation meters.

The largest potential future user identified in both plans is the State Capitol Campus, which used an average of about 8.4 million gallons of potable water annually (in 2012, 2013 and 2014) for irrigation and other outdoor uses. Directed through Section 11 of E2SSB 6117, DES (then the Department of General Administration) worked with the City to provide a report to the Legislature in December 2007 regarding the potential use of reclaimed water on the Capitol Campus. The report identified needed infrastructure, implementation costs and potential funding sources for irrigation and related outdoor applications using reclaimed water. The recommended approach would cost approximately $2.32 million in 2007 dollars, with the City contributing approximately $750,000 in 2009 dollars. The City and DES periodically revisit their mutual interest in extending reclaimed water to the Capitol Campus; however, given the cost of infrastructure, the project has not yet been pursued. Completion of LOTT's reclaimed water storage tank in the Tumwater valley area could enhance the potential for reclaimed water use on the Capitol Campus by helping to address pressure needs at the higher elevation of the campus.

A relatively new potential benefit of reclaimed water use involves the extraction of thermal energy from the water as it is used for heating and cooling. The feasibility of this use could be explored further to determine whether it boosts the economic viability of reclaimed water use, particularly in cases where this energy could be extracted prior to other downstream uses such as irrigation or toilet flushing. During 2015-2020, the Reclaimed Water Program plans to evaluate amending the Reclaimed Water Ordinance (OMC 13.24) to require developers to individually assess different types of reclaimed water uses for economic feasibility. The use of reclaimed water for thermal energy extraction could be included in such an analysis (see Performance Measures, Section 6.6).

6.4 Reclaimed Water Program Development (2005-2014)

In launching the Reclaimed Water Program in 2005, the Utility envisioned reclaimed water would significantly reduce potable water use. By 2008, much had been accomplished to establish reclaimed water as a new water resource: generation by LOTT, installation of infrastructure by LOTT and the City, development of local regulations and partnership agreements, first customers, billing processes, new signs and educational materials, and initial program staffing and implementation.

The 2009 Water System Plan described the status of the Reclaimed Water Program through about 2008, and projected the strategy of advancing the direct beneficial use of reclaimed water in a fairly assertive manner through that planning period. The initial *Business Plan for Reclaimed Water Distribution* in 2005 captured the Program's early developmental efforts, and the 2011 *Reclaimed Water System Expansion Plan* laid out an ambitious plan to extend reclaimed water infrastructure throughout the City's core east side.

Also in 2011, the *Reclaimed Water Procedures Manual* was approved, spelling out specific program implementation procedures and summarizing the history and legal basis of the Program.

In 2014, the City revisited the financial structure of the Reclaimed Water Program, with an analysis that showed that direct beneficial use of reclaimed water was not cost effective enough to fully implement as initially envisioned.

These major developmental documents are summarized in this section, as a prelude to the shift in program focus planned for 2015-2020.

Business Plan for Reclaimed Water Distribution (2005)

The Drinking Water Utility contracted with HDR, Inc. to develop the initial *Business Plan for Reclaimed Water Distribution*. Completed in June 2005, the plan presents a long-range vision for the City's Reclaimed Water Program and discusses policy issues that would affect development and financing in the program's early years. The plan estimated $40 million (in 2005 dollars) would be needed to construct the infrastructure necessary to deliver 2.8 million gallons a day of reclaimed water from LOTT reclaimed water plants to the potential customers that had been identified. (This 2.8 million gallons a day is about six times the current allotment from the Budd Inlet plant.)

Procedures Manual (2011)

In April 2011, a *Reclaimed Water Procedures Manual*, written by staff for internal use, was approved by the then-Acting Director of the Public Works Department. The manual documents programmatic roles and responsibilities, and implementation and operating procedures. Included are sections on program history and partnerships; regulations, guidance and plans; record keeping and reporting; and funding, rates and billing, and enforcement. The manual highlights incident response procedures for cases of reclaimed water spillage or cross-connection control violations. The *Procedures Manual* will be reviewed and updated during the 2015-2020 planning period.

System Expansion Plan (2011)

In November 2011, the Drinking Water Utility contracted with the engineering firm Skillings Connolly, Inc. to develop a *Reclaimed Water System Expansion Plan*. The *Expansion Plan*, completed as a Technical Memorandum, is intended to provide guidance to the City ahead of any development-driven expansion of the reclaimed water system.

The *Expansion Plan* builds on previous evaluations and predictions of reclaimed water use in the City by identifying geographic service areas and pipeline alternatives to serve current and future potential users. Potential new users previously identified in the 2005 *Business Plan*, and new customers added since then, were included in the analysis, as well as over 100 existing potable-water irrigation meters (that could be retrofitted to deliver reclaimed water). Potential user demand was quantified and peak instantaneous demand was calculated to determine any storage needs. Locations of users were considered to create a basic pressure zone map that has been helpful in evaluating delivery of reclaimed water to the higher-elevation Capitol Campus and areas further south from the Budd Inlet plant. Therefore, planning-level cost estimates provided in the plan include both a storage tank and pump station.

Build-out of the new service areas was proposed in eight phases. The total cost of build-out was more than $11.1 million, not including any railroad crossings/permitting, property acquisition for storage tank(s) and booster pump station(s), and possible re-chlorination facilities. LOTT's planned storage tank in the Tumwater valley area could alleviate the need for storage and pumping.

Financial Considerations (2014)

In recent years, the community – notably represented by the LOTT Reclaimed Water Infiltration Study Community Advisory Group and the City's Utility Advisory Committee – has posed questions regarding the cost effectiveness of using reclaimed water for various purposes.

In 2014, Reclaimed Water Program staff worked with HDR Engineering, Inc. to explore basic financial considerations relating to the costs of using reclaimed water for direct beneficial use (instead of potable water for non-potable uses) and for groundwater recharge and enhancing in-stream flows.

The City and HDR distilled the community's broader cost-related questions into two specific questions:

1. Is reclaimed water use for non-potable purposes an economical means of reducing potable water use?
2. How does the cost of using reclaimed water for non-potable purposes compare to the cost of using it for groundwater recharge?

To answer these questions, HDR conducted a general cost-benefit analysis. To estimate costs, the firm reviewed existing information, plans and analyses. These included the *Reclaimed Water System Expansion Plan*, the Woodland Creek Groundwater Recharge Facility Engineering Report, a City demand forecast analysis, the capital improvement program and irrigation water rates. HDR's

Technical Memorandum, *Reclaimed Water Cost Benefit Analysis* (September 2, 2014), is summarized here.

Present Value Analysis

HDR conducted a 20-year present value analysis to capture "life cycle" capital and operational/maintenance costs, and benefits. Present value cost totals were divided by the volumes of water considered to arrive at present value unit costs ($/gallon) to enable a relative cost-effectiveness comparison of the various options considered. An important assumption made for this analysis acknowledges that LOTT has developed reclaimed water as a new water resource and plans to continue expansion of its reclaimed water program, regardless of the extent to which the City uses reclaimed water for its particular purposes. Therefore, reclaimed water production costs by LOTT are not included.

Reducing Potable Water Use

"Is reclaimed water use for non-potable purposes an economical means of reducing potable water use?"

HDR addressed this first question by calculating the cost of delivering reclaimed water through a separate "purple pipe" distribution network dedicated for direct beneficial use purposes. This cost was compared with the cost of delivering potable water from the City's potable water system, which is supplied by groundwater wells, for the same volume of non-potable use.

An estimate of the total volume of reclaimed water usage for irrigation in downtown Olympia and the Capitol Campus/Stevens Field area (obtained from the *Reclaimed Water System Expansion Plan*) correlated to a total annual volume of reclaimed water usage of approximately 49,820,000 gallons. Delivery costs indicated in the plan amounted to about $12,000,000 (in 2014 dollars). Operation and maintenance costs, primarily for energy and labor, were estimated at $50,000 per year. Because the City's reclaimed water rate is 70 percent of the potable water rate, revenue is lost when potable irrigation demand is replaced with reclaimed water. This lost revenue was estimated to be about $125,000 per year.

A benefit of using reclaimed water can be realized by deferring capital investments in future water supply projects, such as the planned Briggs well (Chapter 4, Section 4.2) used in this analysis. A potential deferment, calculated to be four years, resulted in an estimated cost savings of $270,000, which offsets a portion of the costs of using reclaimed water.

To fully answer this first question, the analysis also estimated the cost of delivering potable water, for the same use as estimated for reclaimed water, using the City's 2014 summer irrigation water rate ($6.19 per hundred cubic feet) and the same volume of reclaimed water delivered. Thus, the total potable water costs could be compared with the total reclaimed water delivery costs.

The result of this analysis gives a unit cost of approximately $0.0141 per gallon of reclaimed water used for non-potable purposes. By comparison, the unit cost of delivering potable water supplied by City wells for such uses is approximately one-third of the reclaimed water cost, or $0.0055 per gallon of potable water used. The City recognizes that specific, targeted uses of reclaimed water for non-potable purposes may make economic sense in some applications. However, it does not appear cost effective at this time for the City to focus on expanding this element of its reclaimed water program extensively. Other factors may be considered that could make direct beneficial uses of reclaimed water more economically feasible, but such factors were not explored in this general level analysis.

Comparing Uses: Non-Potable Water vs Groundwater Recharge

"How does the cost of using reclaimed water for non-potable purposes compare to the cost of using it for groundwater recharge?"

HDR addressed this second question by comparing the cost of delivering reclaimed water for non-potable purposes (as estimated above) with the cost of constructing and operating groundwater recharge facilities. Information on the Cities of Lacey and Olympia Woodland Creek Groundwater Recharge Facility (Section 6.3) was used for this analysis. This facility, constructed in 2013 and placed online in July 2014, has a total project cost of $4.3 million and annual operation and maintenance costs of about $36,000. The hydrogeological analysis for infiltration feasibility estimates this site can accept about 179,200,000 gallons of reclaimed water per year.

With cost and rate escalation factors, and a discount factor assumed over a 20-year "life-cycle" time frame, the unit cost is approximately $0.0014 per gallon for reclaimed water used for groundwater recharge. Therefore, it appears more cost-effective, in terms of a general strategy, to use reclaimed water for groundwater recharge as opposed to using it for non-potable purposes. This result was not unexpected, as groundwater recharge facilities require infrastructure that is typically less extensive than a "purple pipe" distribution system network, and can make beneficial use of reclaimed water on a larger scale and over the course of the entire year, as compared to the limited seasonality of use in most non-potable applications, like irrigation.

Summary of Results

The results of this general cost-benefit analysis indicate the unit cost per gallon of using reclaimed water for direct beneficial use ($0.0141) is about 2.5 times the cost of using potable water ($0.0055) and 10 times the cost of reclaimed water use in groundwater recharge facilities ($0.0014).

Based on this analysis, the 2015-2020 Plan shifts the City's focus to using reclaimed water for groundwater recharge. However, the City remains fully committed to extending reclaimed water for direct beneficial use where it best suits a specific application or area or meets a particular customer's preference.

6.5 2015-2020 Priorities and Direction

The 2007 Council policies (Section 6.1) and 2009 Water System Plan emphasized using reclaimed water by direct beneficial use – such as irrigation and toilet flushing, and heating and cooling, dust suppression, wash-down, and other commercial and industrial uses. Infiltrating reclaimed water for groundwater recharge or stream-flow enhancement was not considered in the previous plan.

The City's shift away from emphasizing direct beneficial use to focusing on infiltration of reclaimed water to enhance groundwater recharge and stream flow has roots in a desire to exercise regional partnerships and goals, and achieve financial economies of scale.

Therefore, the 2015-2020 Water System Plan emphasizes using reclaimed water in support of regional wastewater management priorities:

- **Reduce the use of drinking water for non-potable uses**. This priority aligns with the City's water conservation goals (Chapter 5). For example, reclaimed water used for outdoor irrigation reduces the use of potable water for this purpose. The City has been manifesting this priority through its existing customers who use reclaimed water for irrigation and a variety of other applications.
- **Reduce wastewater going to LOTT**. This priority supports regional wastewater management efforts by helping to avoid increasing capacity at existing treatment facilities or building new treatment facilities. Any use of reclaimed water that reduces wastewater to LOTT supports this priority, including using reclaimed water to replace potable water.
- **Reduce treated wastewater discharge into Budd Inlet**. This priority provides environmental benefits to Puget Sound by complying with LOTT's wastewater discharge limits, and contributing to a reduction in wastewater discharge to Puget Sound. Recently, Olympia has been supporting this priority by using reclaimed water for groundwater recharge to mitigate the impacts of the McAllister Wellfield (Section 6.3). With other LOTT partners, Olympia is exploring the further use of reclaimed water for groundwater recharge in LOTT's Reclaimed Water Infiltration Study (Section 6.2).

6.6 2015-2020 Reclaimed Water Program

The purpose of the Reclaimed Water Program is to support and advance the use of reclaimed water as defined in Council-adopted policies. These policies are primarily captured in Olympia's municipal codes for reclaimed water (OMC 13.24) and the EDDS (Chapter 10) (Section 6.1).

In 2015-2020, the Reclaimed Water Program will maintain existing procedures and support for direct beneficial use reclaimed water customers. However, the emphasis will be on taking advantage of economies of scale by seeking opportunities to increase the local use and regional applications of reclaimed water for groundwater recharge and stream-flow enhancement.

The Reclaimed Water Program objectives and strategies help meet the Drinking Water Utility's Goal 3:

> **Olympia's water supplies are used efficiently to meet the present and future needs of the community and natural environment.**

The objectives and strategies listed below are derived from the priorities in Section 6.5, which are supported by the financial considerations described in Section 6.4. Performance measures will be used to evaluate program effectiveness.

Given the two programs' shared Goal 3, the objectives of the Reclaimed Water Program follow those of the Water Conservation Program (Chapter 5; Objectives 3A, 3B, and 3C).

Objective 3D Meet the needs of current and future City reclaimed water customers.

This objective aims to help reduce the use of drinking water for non-potable uses, and ensure customer satisfaction with the City's reclaimed water service.

Strategy 3D1 -- Continue to respond to inquiries about reclaimed water use, regulations, availability, capacity, opportunities and requests for assistance with existing infrastructure.

Strategy 3D2 -- Continue to support development-driven advancement of reclaimed water for direct beneficial use, using the *Reclaimed Water System Expansion Plan* to guide placement of infrastructure.

Strategy 3D3 -- Continue to implement and enforce the City's reclaimed water ordinance, engineering design and development standards, and End User Agreements to ensure compliance.

Performance Measures

1. Respond to a request for assistance and/or information within one week of receiving the inquiry, either directly to an individual or entity, through the City's Community Planning and Development Department process, or other appropriate means, including assistance from the Public Works Department.
2. Respond to a complaint or report of reclaimed water misuse (such as over-application of irrigation) before the end of the next business day. Ensure reclaimed water is available for seasonal irrigation by March 15 of each year. Inform customers of the target shut-down date (typically mid-October) within one week of being informed by LOTT of the shut-down schedule.
3. Continue to monitor for detectable chlorine residual on a monthly basis during the irrigation season at the reclaimed water sampling station near the Anthony's Hearthfire Grill Restaurant at the north end of the Port peninsula. Monitoring for detectable residual (rather than a specified concentration) is allowed by DOH and Ecology as captured in April 2008 correspondence to LOTT from each of these regulating state agencies.
4. Complete initial and routine cross-connection control inspections within two weeks of request. Complete an emergency-precipitated cross-connection control inspection before the end of the next business day.
5. Evaluate Reclaimed Water End User Agreements and update as needed within six months of when a change occurs in a customer's use of reclaimed water.

6. Evaluate whether to develop Levels of Service for the Reclaimed Water Program, potentially modeled after those determined for the Water Quality and Operations and Maintenance Programs.

Objective 3E Direct reclaimed water towards meeting the regional wastewater management goal of reducing the amount of treated wastewater discharged into Puget Sound.

Strategy 3E1 -- Seek opportunities to increase infiltration of reclaimed water to recharge groundwater and enhance in-stream flows.

Strategy 3E2 -- Participate as a LOTT partner in state and local reclaimed water regulation development activities, including presence on technical and advisory groups.

Strategy 3E3 -- Support efforts to expand infrastructure for partnered or regional uses.

Performance Measures

1. Provide staffing to actively engage with the LOTT Reclaimed Water Policy Task Force and the LOTT Reclaimed Water Infiltration Study Science Task Force meetings and implementation activities.
2. Provide staffing to participate as a LOTT partner in Ecology's Reclaimed Water Rule Advisory Committee activities through completion of the state rule-making effort anticipated in 2016.
3. Meet all obligations and deadlines specified in the *Interlocal Agreement between the City of Lacey and the City of Olympia for Water Rights Mitigation* (October 10, 2008) regarding the Woodland Creek Community Park Groundwater Recharge Facility.
4. Provide staffing and resources through the 2015-2020 planning period to coordinate with reclaimed water partners on regional projects, including those involving areas outside City limits or the urban growth area.

Objective 3F Enhance Reclaimed Water Program efficiency and effectiveness.

Strategy 3F1 -- Engage in a reclaimed water project or effort involving direct beneficial use when it:

- Benefits implementation of the City's Reclaimed Water Program.
- Results in the use of significant volumes of reclaimed water.
- Involves a high-profile or model use or user.
- Aligns with implementing the *Reclaimed Water System Expansion Plan*.

Strategy 3F2 -- Research and pursue grants and other funding sources that support the Reclaimed Water Program's objectives and strategies.

Performance Measures

1. Evaluate by the end of 2016 whether to amend the Reclaimed Water Ordinance, OMC 13.24, to clarify that development applications involving reclaimed water use include analysis of potential use types individually rather than collectively (to see whether one type of use would be more feasible than others).
2. Review the *Reclaimed Water Procedures Manual* annually and update as needed.
3. Pursue connecting the north end of Olympia's reclaimed water line to the Port's gravity sewer system to provide reclaimed water year-round at the Port peninsula by 2018.
4. Stay appraised of legislative activity associated with opportunities to advance reclaimed water to the State Capitol Campus.
5. Monitor on a quarterly basis, websites and other information sources about reclaimed water funding opportunities, including the Ecology Reclaimed Water Grants Program, the WateReuse Association, the Water Environment Research Foundation, US Environmental Protection Agency federal programs, and others.
6. Stay apprised of activity at the newly formed (2012) Pacific Northwest Chapter of the WateReuse Association via review of monthly meeting minutes.

6.7 Implementation and Staffing

This Plan guides staff in implementing projects and activities that are intended to accomplish Reclaimed Water Program objectives. Although the program direction has shifted from an emphasis on direct beneficial use to groundwater recharge, no net increase in staffing or resource needs has resulted.

Staffing

The Program's activities will be conducted at the current staffing level of ~0.5 FTE Senior Program Specialist. (Reclaimed Water Program staffing is shared with the Groundwater Protection Program to equal one FTE. (Staff responsibilities in support of reclaimed water customers include:

- Implementing the Reclaimed Water Ordinance and EDDS, and developing program tools (such as procedures manuals).
- Maintaining End User Agreements.
- Coordinating the City's Community Planning and Development Department on development-related inquiries about reclaimed water availability and requirements.
- Preparing analyses and reports on consumption to LOTT for annual state reporting and monthly use (at the Hands On Children's Museum and East Bay Public Plaza).
- Providing signage and other educational materials.

Staff works with regional partners in support of state and local efforts to regulate and advance the development of reclaimed water primarily by actively participating as a LOTT partner, with the LOTT inter-jurisdictional team as well as with individual jurisdictions.

No increases in Reclaimed Water Program financial or staffing needs have been identified for the 2015-2020 planning period, despite the shift in program strategy and priorities (Section 6.6). Therefore, program activities will be accomplished with current staffing.

Reclaimed Water Revenue

Revenue from reclaimed water sales supports about two-thirds of the program staffing and operating budget, with the remaining third subsidized by drinking water rate payers. Prior to 2014, reclaimed water customers were charged 70 percent of the drinking water rates for seasonal irrigation. With the 2014 amendments to the Reclaimed Water Ordinance, reclaimed water is sold at the discounted rate of 70 percent of drinking water rates for both seasonal irrigation and indoor use (that is, "consumption"). No discount is provided for the ready-to-serve meter fee. Also, engineering, building code and land use fees, as well as fines for violations, are charged the same as for other utilities. No general facility charge (GFC) is incurred for reclaimed water.

LOTT ultimately subsidizes reclaimed water as a new water resource by generating reclaimed water and installing reclaimed water infrastructure. LOTT has a written agreement with the City Public Works Department for Drinking Water Utility staff to maintain reclaimed water infrastructure and respond to emergencies solely or in coordination with LOTT staff or contractors.

Reclaimed Water Projects

Although capital funds have been appropriated for the Reclaimed Water Program during this planning period (and beyond), the 2015-2020 Capital Improvement Program (Chapter 13, Table 13.2) identifies reclaimed water infrastructure projects as low priority. Therefore, expansion of the reclaimed water system will occur as opportunities arise and funding allows.

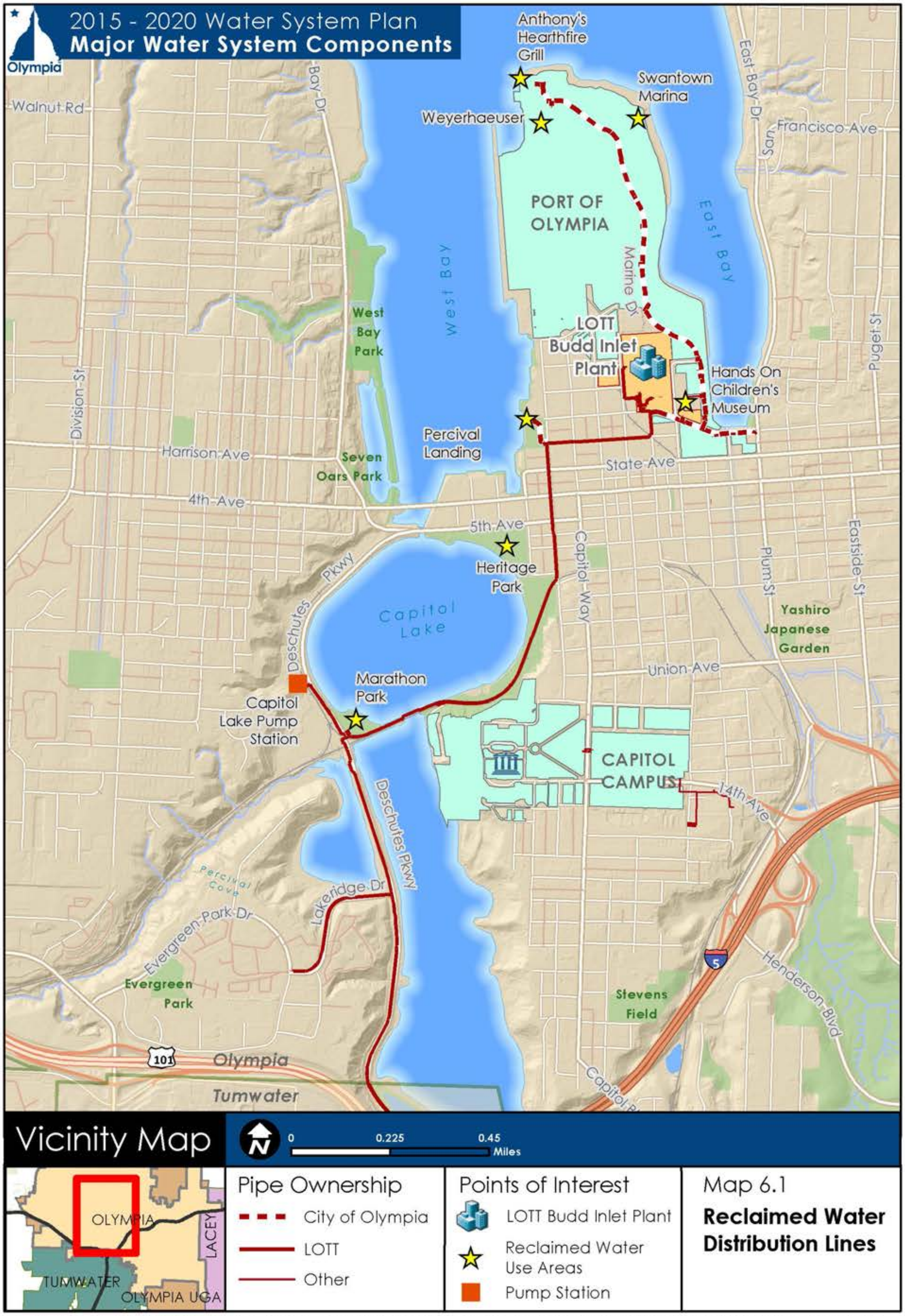
For the 2015-2020 planning period, the City's Capital Improvement Program includes $50,000 in 2017 for:

- Additional water piping to provide looping and eliminate the northern dead end in the reclaimed water system serving the Port of Olympia.

Projects planned after 2020 include $350,000 for:

- Reclaimed water filling stations for construction-related purposes.
- Reclaimed water infrastructure system development as needed to support efforts meeting regional wastewater management goals.

This total of $400,000 represents a decrease from a total of $1,000,000 allotted for 2013 and 2014 in the 2009 Water System Plan Capital Improvement Plan.



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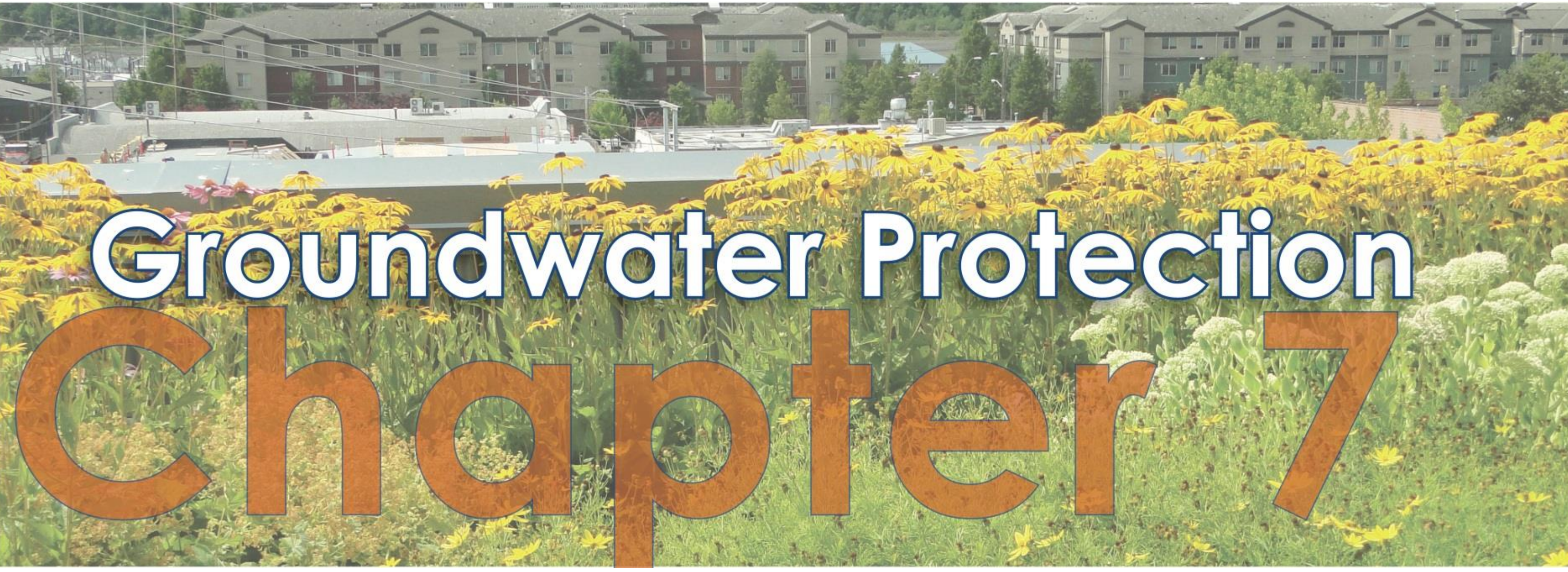

Chapter 7 – Groundwater Protection Program

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CHAPTER 7 – GROUNDWATER PROTECTION PROGRAM

As described in Chapter 4, the City is securing sufficient supplies to meet water demands projected through 2064. The Groundwater Protection Program, by working to prevent contamination of those water supplies, helps meet the Drinking Water Utility's Goal 5:

> **Groundwater quality is protected to ensure clean drinking water for present and future generations and to avoid the need for expensive replacement or treatment facilities.**

This goal is consistent with the City's Comprehensive Plan Goal GU6 for the Drinking Water Utility. The Groundwater Protection Program implements Comprehensive Plan Policies PU6.1 through PU6.5.

The Program has three objectives for 2015-2020:

- Prevent contamination of groundwater through surveillance and response.
- Strengthen and exercise partnerships with citizens and state/local agencies.
- Improve program policies, procedures and tools.

Implementation strategies have been developed to achieve these objectives, with performance measures designed to meet the Utility's groundwater protection goal (see Section 7.6)

The Groundwater Protection Program applies to Olympia's seven Drinking Water (Wellhead) Protection Areas (DWPAs), which encompass the McAllister Wellfield, the City's other six drinking water wells, and one planned well.

The 2015-2020 Groundwater Protection Program continues the 2009 program's proactive and precautionary approach to preventing contamination of the City's water sources. The foundations of the Program continue to be the DWPA delineations and the contaminant source inventories, which together enable staff to focus on the areas of greatest risk to the City's drinking water aquifers.

7.1 Groundwater Protection Regulations

The City protects its groundwater sources by complying with amendments to the 1986 federal Safe Drinking Water Act. This federal regulation is implemented through the Washington State Department of Health's (DOH) Source Water Protection requirements, which are captured in Chapter 246-290 of Washington's Administrative Code (WAC). The City is in compliance with the sanitary control area and wellhead protection requirements of WAC 246-290-135, but is no longer required to maintain a watershed control program given the replacement of McAllister Springs (DOH Source Number S01) with the McAllister Wellfield (S16) in late 2014. Past source water protection plans written for the City are dated 1995, 1997 and 2003.

Portions of Olympia's DWPAs extend into the City of Tumwater, the City of Lacey and Thurston County jurisdictions (Section 7.2). Because Olympia can exercise groundwater protection requirements only within its own city limits, the City coordinates with neighboring jurisdictions to ensure protection of Olympia's groundwater supplies.

Olympia's groundwater protection ordinance was codified in 2005 in Olympia Municipal Code, Title 18 Unified Development Code, Chapter 18.32 Critical Areas, with Sections 18.32.200–240 applying to Drinking Water (Wellhead) Protection Areas. The ordinance was revised in 2009, adopting the new DWPA delineations.

The City also regulates the construction of groundwater monitoring wells through the City's Engineering Design and Development Standards (EDDS). Chapter 6-Drinking Water includes Section 6.300 Groundwater Monitoring Wells, and Drawing No. 6-27 Resource Protection–Monitoring Well Design to ensure consistent construction of wells that also meet Washington State Department of Ecology (Ecology) well construction standards (Chapter 173-160 WAC). Program staff has developed a process to deviate from the EDDS monitoring well standard as needed, with the approval of the City Engineer. Ecology has supported such deviations.

To protect groundwater within Olympia's urban growth area, the Utility collaborates with Thurston County Health Department to implement Thurston County's Code of Ordinances. Specifically, Title 23 Olympia Urban Growth Area Zoning and Title 24 Critical Areas (Chapter 24.10 Critical Aquifer Recharge Areas) are used to protect Olympia's groundwater resources within County jurisdiction. City of Tumwater and City of Lacey regulations apply to Olympia DWPAs within their jurisdictions.

7.2 Regional Environment

This section reviews the physical environment of Olympia's Drinking Water Utility service area as reflected in the regional topography and hydrogeology of north Thurston County.

Topography

Olympia lies within the Puget Sound lowlands basin, which was formed by glacial action and erosion and sediment deposits since the last ice age. The topography of the City's water service area is generally low-lying, ranging from sea level to about 380 feet mean sea level (msl).

Because land elevation within and between neighborhoods varies appreciably, the service area is divided into pressure zones. Storage tanks and booster pumps ensure adequate water pressure regardless of location (see Chapter 1).

Most of Olympia is at the mouth of a watershed drained by the Deschutes River, discharging into Puget Sound's Budd Inlet (Map 7.1). Near its confluence with Budd Inlet, the river flows through Capitol Lake, an artificial lake created in 1951 by a dam on the Deschutes River. The lake separates the downtown business district from Olympia's west side.

A portion of west Olympia drains into Green Cove Creek in the Eld Inlet watershed, and a portion of east Olympia drains into Woodard Creek in the Henderson Inlet watershed. The McAllister Wellfield (S16), the City's primary water source, is within the Nisqually River watershed (WRIA 11). The other six wells are in the Deschutes River watershed (WRIA 13).

Geology and Hydrology

The most recent information on the geology and hydrogeology of Olympia's DWPAs is in two companion reports prepared by Golder and Associates to support the 2009 revisions to delineations of the City's Drinking Water Protection Areas. One report is focused on the hydrogeological conditions of the City's wellfield areas; the other report addressed the groundwater modeling which resulted in the new delineations. These reports are collectively referred to in this chapter as the Golder reports (2008a and 2008b).

This section highlights key points from these reports that are relevant to understanding Olympia's drinking water supply aquifers and delineation of Drinking Water Protection Areas.

Geology

Geology in Olympia and the rest of Thurston County is the result of substantial glacial activity in Puget Sound. Receding glaciers left the land dotted with lakes and ponds. Materials deposited during successive glacial periods vary from fine-grained sand and clay to large-sized gravel. These materials are dispersed throughout the area in a complex series of geologic formations created by thousands of years of land, water and ice movement. Many of the formations are highly permeable, with the capacity to absorb 50-plus inches of annual precipitation.

Olympia's most productive aquifers are in these glaciated areas, and are extremely vulnerable to contamination. Several minor incidents of groundwater contamination have occurred in northern Thurston County over the years, and studies have documented steadily increasing levels of nitrate in the groundwater, particularly in the area around the Shana Park Well 11 (S10), due to soluble lawn and turf fertilizers and on-site septic systems.

Following is a general description of the various hydrostratigraphic units (layers) under the current interpretation as offered in the Golder reports. The units are ordered from shallower to greater depths below ground surface.

- **Post-Vashon (Holocene) Alluvial and Deltaic Sediments.** Along shallow valley bottoms of the main streams. Minimally significant in storing or transmitting groundwater.
- **Vashon Recessional Outwash (Qgo, Qgos).** Permeable sand and gravel deposits that make up the unconfined water table aquifer in large parts of the region, but may not always contain groundwater. Supports wells for mostly small-scale, domestic use. Shana Park Well 11 (S10) withdraws water from this aquifer, as well as from the Vashon Advance Outwash **(**Qga).
- **Vashon Glacial Till (Qgt).** Sand, gravel and boulders encased in a silt-clay matrix. Commonly referred to as "hardpan" where laid down beneath heavy glacial mass, but less compact where formed by melting ice. Exposed in many parts of the region, notably above incised stream valleys and in upland areas. Generally acts as an extensive confining bed with occasional permeable windows.
- **Vashon Advance Outwash (Qga).** Fine- to coarse-grained sand and gravel, laterally extensive in the region, but exposed only along steep riverbanks and Puget Sound bluff faces. The main aquifer for most small-scale private wells; supplies several larger-yielding municipal and industrial wells. Shana Park Well 11 (S10) and Kaiser Well 1 (S03) withdraw water from this aquifer.

- **Pre-Vashon Glaciolacustrine Deposits (Qpf).** Laminated clayey and silty sediments, with low permeability. Confining layer between the overlying Vashon and underlying pre-Vashon aquifers.
- **Pre-Vashon Gravel (Qpg).** Coarse, stratified sand and gravel, laterally extensive and exposed along the bottom of the Nisqually River between the confluence with the McAllister Valley and Muck Creek. Rarely more than 50 feet thick (between 15 and 70 feet), it forms the principal (mostly confined) aquifer in the area and is tapped extensively by wells. Primary supply source for the Allison Springs Well 13 (S09) and Well 19 (S11), Hoffman Well 3 (S08) and Indian Summer Well 20 (S12).
- **Undifferentiated Quaternary and Tertiary Deposits (TQu).** Fine to coarse-grained unconsolidated sediments extending to bedrock. Consists of a sequence of aquifers and confining beds, tapped locally by a few water wells.
- **Bedrock.** Relatively impermeable sedimentary sandstone, siltstone and claystone, and some igneous bodies of andesite and basalt. Does not contribute to the regional groundwater flow system, although some private wells produce groundwater from these layers.

Two locally defined aquifer units, the Unconfined McAllister Gravel (Qmg) and Deschutes Valley Aquifer (DVA) systems supply most of Olympia's water. The McAllister Wellfield (S16) is supplied by the deep and productive Unconfined McAllister Gravel. The planned Briggs Well will be supplied by the Deschutes Valley Aquifer system.

Groundwater Flow

This section summarizes information on groundwater flow, and regional recharge and discharge from the Golder reports (Golder 2008a and 2008b).

Regional groundwater flow occurs in the three primary regional aquifers: the Vashon Advance Outwash (Qga), the Pre-Vashon Gravel (Qpg) and the Undifferentiated Quaternary and Tertiary Deposits (TQu). Local flow occurs in the mostly perched Vashon Recessional Outwash **(**Qgo) unit and in the highly transmissive, unconfined McAllister Gravel aquifer (Qmg) located in the McAllister-Nisqually area. Where present, the intervening till and fine-grained lacustrine units act to hydraulically separate the aquifers, resulting in hydraulic head differences of more than 100 feet between the water table and the Undifferentiated Quaternary and Tertiary Deposits **(**TQu) aquifers in some areas.

Regionally, groundwater flows from the upland recharge areas in the southern part of Thurston County toward the north, where groundwater discharges to Puget Sound, the main rivers (the Nisqually and Deschutes), natural springs and seeps, numerous shallow lakes, and streams. Groundwater elevations up to 400 feet above msl occur in the area south of the towns of Rainier and Yelm. Conversely, groundwater levels are as low as a few feet above msl along the Puget Sound and less than 20 feet above msl in the upper part of the McAllister Valley.

The primary regional source of groundwater is infiltration of precipitation (or precipitation-derived) recharge. Locally, seepage from rivers, streams and lakes also provides a source of groundwater where surficial soils are sufficiently permeable to allow the vertical movement of water to the water table. Also, some relatively minor return flow of groundwater pumped by individual private wells occurs via on-site septic systems in areas that are not connected to sanitary sewer systems. Some inflow of groundwater into the area also occurs from the south of Fort Lewis.

The main discharge of groundwater occurs as subsurface outflow to Puget Sound, seepage to support the main rivers, lakes and streams, discharge at natural springs and groundwater pumping. Most of these are non-point flows and therefore are difficult to measure directly. However, records of discharge at some of the main features (such as McAllister Spring and the municipal wells) do allow local water budgets to be estimated.

Groundwater Quality

The regional groundwater quality is considered good, although a few water chemistry issues can be found in localized areas, including:

- **Iron and Manganese** at elevated levels.
- **Nitrates**, likely associated with on-site septic systems and soluble fertilizer applications.
- **Chloride**, particularly in deeper groundwater in aquifers in continuity with saline Puget Sound that are at risk from seawater intrusion under excessive pumping pressure. Although none of the Olympia's wells have exhibited elevated chlorides, this risk is monitored as groundwater development increases in the region.

See Section 7.4 for potential sources of contamination in Drinking Water Protection Areas. See Chapter 11 for information on how the Utility maintains quality of water at the tap.

7.3 Drinking Water Protection Areas

Drinking Water Protection Areas (DWPAs) are drawn around Olympia's water supply sources (groundwater wells) to represent the primary recharge areas for specific water supply aquifers (Map 7.1). These groundwater flow areas also contain designations of 0.5-year, 1-year, 5-year and 10-year time-of-travel capture zones within their boundaries.

Wells are referred to by their Olympia name (for example, Well 13) and DOH source number (for example, S09). In this chapter, information on the City's DWPAs (and associated wells) is presented from east to west:

McAllister Wellfield DWPA (S16) around three individual wells:

- Test Well TW-22 (S13)
- Production Well PW-24 (S14)
- Production Well PW-25 (S15)

East Olympia DWPAs:

- Shana Park DWPA around Well 11 (S10)
- Indian Summer DWPA around Well 20 (S12)
- Hoffman DWPA around Well 3 (S08)
- Briggs DWPA around the planned Briggs Well

West Olympia DWPAs:

- Allison Springs DWPA around Well 13 (S09) and Well 19 (S11)
- Kaiser DWPA around Well 1 (S03)

The 2009 Water System Plan presented new delineations of the City's DWPAs and capture zones, which were determined by computer models to mathematically simulate the inflows (recharge) and outputs (discharge) of aquifers. The 2009 plan contains extensive detail about these updated DWPAs, including hydrogeological characteristics, groundwater flow conditions, water quality, land use and zoning. That information was taken from the source susceptibility assessments (completed by City staff as required by DOH) and the Golder reports.

This section summarizes the basic characteristics of each DWPA. It focuses on activities and accomplishments made during the previous planning period, including expansion of the Utility's network of monitoring wells, and completion of source susceptibility assessments for the wells that comprise the new McAllister Wellfield (S16).

DWPA Descriptions

Below are the general location and uses of drinking water sources in each DWPA.

McAllister Wellfield DWPA

The City's newest DWPA protects the McAllister Wellfield (S16), located in north Thurston County (Map 7.2). Beginning in late 2014, the McAllister Wellfield (S16) replaced the City's surface water supply, McAllister Springs (S01) (Chapter 4). The Wellfield, located about one mile southeast of McAllister Springs, can supply the entire water service area and provides most of the City's drinking water year-round. Much of the McAllister Wellfield DWPA overlaps the McAllister Springs DWPA and several monitoring wells in the McAllister Springs DWPA are used for Wellfield monitoring. The Utility plans to consider supplementing the Wellfield DWPA with additional monitoring wells during 2015-2020.

East Olympia DWPAs

Three DWPAs in southeast Olympia protect three wells: Shana Park Well 11 (S10), Indian Summer Well 20 (S12) and Hoffman Well 3 (S08). Shana Park Well 11 (S10) (Map 7.3) supplements the City's annual supply seasonally, primarily between May and October. The Indian Summer Well 20 (S12) (Map 7.4) came on line in late 2009 and provides additional water supply mostly during the summer. The Hoffman Well 3 (S08) (Map 7.5) is rarely used. In 2013, the City installed two new monitoring wells in the Shana Park DWPA, for a total of four monitoring wells. In 2014, the City installed one monitoring well in the Indian Summer DWPA. Monitoring wells have not been installed in the Hoffman DWPA given the well's limited use and naturally protective aquifer system.

A DWPA also has been delineated for the planned Briggs Well (Map 7.6). Well construction has been deferred to May 2019 under a construction extension granted by Ecology. The well is planned to be on the site of the Briggs Village development (former Briggs Nursery) near Ward Lake. At the appropriate time, the City will work with the property developer to install a monitoring well.

West Olympia DWPAs

Two DWPAs protect three wells on the west side of Olympia: Allison Springs Well 13 (S09), Allison Springs Well 19 (S11) and Kaiser Well 1 (S03). The Allison Springs wells (Map 7.7) are used primarily during the summer months, and occasionally year-round. The Kaiser Well 1 (S03) (Map 7.8) primarily provides seasonal support during the summer. In 2011, 2012 and 2013, three monitoring wells were installed in the Allison Springs DWPA: one by the City and two by separate developers (required for compliance with the City's groundwater protection ordinance). A total of four monitoring wells are now located within the Allison Springs DWPA. No monitoring wells have been installed in the Kaiser DWPA given the limited use of the well, its location in a mostly rural area of West Olympia, and the Utility's likely eventual designation of the Kaiser Well 1 (S03) as an emergency source.

Hydrogeology of Olympia's DWPAs

As stated previously, DWPA boundaries were re-delineated in 2009 for each of Olympia's supply wells. Groundwater modeling techniques were used with peak summer pumping rates in steady-state flow field simulations for each well. Available hydrogeological data and the results of modeled sensitivity analyses were interpreted for each DWPA to simulate contaminant transport flow paths and delineate time-of-travel zones to wells. The combination of known physical data (such as from boreholes and groundwater levels) and predicted flow paths helped improve the Utility's understanding of hydrogeological conditions of each supply well and associated DWPA.

The major hydrogeological features of Olympia's DWPAs are summarized in Table 7.1.

Table 7.1 Summary of DWPA Hydrogeological Characteristics

	Aquifer Conditions (the supply aquifer is shaded)				Major Surface Water Features			Groundwater Flow Directions			General Groundwater Quality		
	Well Depth	Shallow	Intermediate	Deep	Lakes	Rivers	Seeps/Springs	Shallow	Intermediate	Deep	Shallow	Inter-mediate	Deep
McAllister Wellfield (S16)													
Wells TW-22 (S13), PW-24 (S14), and PW-25 (S15)	Up to 400 ft	Semi-confined McAllister Gravel (Qmg) 1			Lake St. Clair	Nisqually River, Eaton Creek, McAllister Creek	McAllister Springs, Abbot Springs, McAllister Bluff	N/NE - toward Nisqually River			Excellent. Some elevated iron and manganese in area wells. Some increasing nitrates in shallower monitoring wells.		
Briggs (planned)													
Planned Well	350-450 ft	Deschutes Valley Aquifer (DVA)			Ward Lake, Hewitt Lake	Deschutes River	None	Limited water level data - assumed N/NW			No water quality monitoring data available.		
East Olympia Area													
Hoffman Well 3 (S08)	362 ft	Unconfined (Qga)	Confined Pre-Vashon (Qpg)		Chambers Lake	Chambers Creek	None	N/NW with mounding beneath lakes	N/NE with north trending groundwater divide	Limited water level data - assumed N/NW	N/A	N/A	Elevated iron/man-ganese
Shana Park Well 11 (S10)	90 ft	Unconfined (Qga)	Confined Pre-Vashon (Qpg)		Smith Lake						Elevated nitrate	N/A	N/A
Indian Summer Well 20 (S12)	211 ft	Unconfined (Qga)	Confined Pre-Vashon (Qpg)		Golf Course Lakes						Elevated nitrate	Elevated iron/man-ganese	N/A
West Olympia Area													
Kaiser Well 1 (S03)	111 ft	Confined (Qga)	Confined Pre-Vashon (Qpg)		Louise Lake	Cave Creek	None	East to West. North-south groundwater divide in east half of study area	Limited data – assumed W/NW	N/A	N/A	N/A	N/A
Allison Well 13 (S09)	200 ft	Confined (Qga)	Confined Pre-Vashon (Qpg)		Ken Lake	Mud Bay, McLane Creek, Percival Creek	Allison Springs				TCE plume at former landfill (up-gradi-ent)	Increasing nitrate trend	N/A
Allison Well 19 (S11)	183 ft	Confined (Qga)	Confined Pre-Vashon (Qpg)									Increasing nitrate trend	N/A

1 Hydrostratigraphic units (such as Qmg) are defined in Section 7.2

McAllister Wellfield DWPA

The McAllister Wellfield DWPA is shown on Map 7.2. The primary aquifer supplying the Wellfield (S16) is the highly transmissive, semi-confined McAllister Gravel unit with a thickness of at least 400 feet (Table 7.1). Hydrogeological cross-sections are available in the Golder reports on hydrogeological conditions that led to the updated DWPA delineations.

Groundwater flow from surrounding upland areas converges towards the McAllister Valley, flowing northward toward the Nisqually River and eventually into Puget Sound. Up to an estimated 70 million gallons of groundwater per day flows through the McAllister Gravel unit. Although the large volume of water moving through the aquifer provides a high dilution capacity, the aquifer supplying the Wellfield (S16) is semi-confined and is therefore at risk from potentially contaminating activities on the land surface.

As shown on Map 7.2, the Wellfield (S16) capture zones are relatively narrow in the area between the supply wells (in the northern portion of the DWPA) and Lake St. Clair (in the middle portion) due to the presence of the highly transmissive McAllister Gravel aquifer. The hydraulic gradient in this area is predicted to remain relatively flat in response to planned pumping. The capture zones widen south of Lake St. Clair as the groundwater is drawn in from the surrounding Pre-Vashon glacial and non-glacial sediments.

In general, groundwater quality in the McAllister area is excellent. The Utility performs regular groundwater quality sampling at the water supply wells, and at two City-owned and five private monitoring wells in the McAllister Wellfield DWPA. Since 1987, sampling frequency has ranged from quarterly to annually in as many as 16 monitoring wells located throughout the old McAllister Springs DWPA and the new McAllister Wellfield DWPA. The Utility has sampled for pathogenic indicators, synthetic organic compounds, volatile organic compounds and inorganic compounds including nitrates. (See Section 7.4.)

East Olympia DWPAs

The East Olympia DWPAs for Shana Park, Indian Summer and Hoffman wells are shown in Map 7.3, Map 7.4 and Map 7.5, respectively. A future Briggs Well is also in East Olympia.

Two of the three wells in the East Olympia DWPA, Indian Summer Well 20 (S12) and Hoffman Well 3 (S08), draw water from the confined Pre-Vashon sediments. The third (Shana Park Well 11 (S10) draws water from the shallower unconfined aquifer (Table 7.1). Flow directions in the shallow aquifer are to the north-northwest and are affected by groundwater mounding beneath Chambers Lake that provides recharge to the shallow unconfined aquifer in the vicinity of the Hoffman Well 3 (S08) (Map 7.5). Flow directions in the deeper Pre-Vashon aquifer are different, with flow to the north-northeast and a north-south trending groundwater divide. There is a downward hydraulic gradient from the shallow unconfined (Qga) aquifer to the confined Pre-Vashon aquifer (Qpg).

Hydrogeological cross-sections are shown in the Golder reports, while additional hydrogeologic description is provided in the 2009 Water System Plan. Groundwater level and water quality data in the East Olympia local area aquifers are very limited, affecting the accuracy of hydrogeological characterization that may be important for DWPA planning.

Shana Park DWPA. Shana Park Well 11 (S10) (Map 7.3) is highly vulnerable to contamination from the surface because it draws water from the shallow unconfined aquifer (Table 7.1). The 2009 DWPA groundwater modeling results indicate the shallow aquifer is vulnerable to surface contamination within a radial distance of less than one mile from Well 11 (S10). Many of the modeled particles migrated to the water table in less than five years, and some migrated to nearby Smith Lake within this time period. Therefore, an Extended Capture Zone has been drawn around Smith Lake to account for surface water and subsurface drainage. The well is more than 2000 feet from Smith Lake, so DOH does not require testing for possible designation as "groundwater under the direct influence of surface water".

The Utility has collected groundwater quality samples at the Shana Park Well 11 (S10) and, since 1998, up to eight monitoring wells at frequencies ranging from quarterly to annually. Samples have been tested for pathogenic indicators, synthetic organic compounds, volatile organic compounds and inorganic compounds including nitrates. Elevated nitrate has been observed in the Shana Park Well 11 (S10) and monitoring wells, confirming that surface activities have impacted groundwater quality. Nitrogen isotope monitoring has indicated that fertilizers and on-site septic systems are the primary sources of nitrates. (See Section 7.4.)

Indian Summer DWPA. Despite being installed in the deeper (Qpg) sediments (Table 7.1), Indian Summer Well 20 (S12) (Map 7.4) has a relatively shallow water level (20 feet below ground surface) and may also be vulnerable to contamination from the surface. The 2009 DWPA modeling analysis indicates none of the recharge to the water table that occurs in the five-year travel zone is withdrawn at the well, and the actual recharge occurs to the south of the five-year zone. This suggests that the well is protected against surface contamination within an up-gradient distance of at least one mile.

The Utility has also collected groundwater quality samples from the Indian Summer Well (S12) and one now-unused monitoring well (S5-3) at frequencies ranging from quarterly to annually. Samples have been tested for pathogenic indicators, synthetic organic compounds, volatile organic compounds and inorganic compounds including nitrates. Nitrate was not observed in the Indian Summer Well (S12) until 2012 and 2013, confirming that surface activities have impacted groundwater quality. The result of one nitrogen isotope sample indicates that on-site septic systems may be the primary source of nitrates. (See Section 7.4.)

Hoffman DWPA. Hoffman Well 3 (S08) (Map 7.5) pumps water from a deep, confined aquifer. The top of the well's screened interval is at a depth of 324 feet below ground surface. A coarse outwash channel, containing no protective till unit (Table 7.1), has been identified to the south of the Hoffman Well in the Chambers Creek area. However, the water pumped at this well is derived from the deep aquifer within the 10-year time-of-travel capture zone. The primary recharge source for this well has been modeled to be four to five miles to the southeast of the DWPA, with recharge reaching the well over an estimated time frame of 50 years.

The Utility has collected groundwater quality samples from the Hoffman Well 3 (S08) on a mostly annual basis. Samples have been tested for pathogenic indicators, synthetic organic compounds, volatile organic compounds and inorganic compounds including nitrates. Iron and manganese above the secondary maximum contaminant levels are the only water quality indicators of concern in the Hoffman Well. (See Section 7.4.)

Briggs DWPA (planned). The Briggs Well (Map 7.6) is planned for construction at the Briggs Village (former Briggs Nursery) site. The depiction of hydrostratigraphy in the Briggs (planned) DWPA was significantly revised by the 2009 groundwater modeling effort. The former Briggs Nursery Well is now understood to have drawn water from the lower part of the Deschutes Valley Aquifer (DVA) sequence rather than the Pre-Vashon units that occur regionally (Table 7.1). The Briggs (planned) DWPA zones are assumed to extend to the southeast more than 1.5 miles within the lower DVA and a further 0.5 miles in the upper part of the DVA unit. The planned DWPA delineation is still preliminary because of limited hydrogeological data. Hydrogeological cross-sections are available in the Golder reports.

The estimated groundwater flow direction is to the north-northwest in both the shallow and deeper DVA materials. The 2009 groundwater model analysis indicated the particles migrated to the water table near Chambers Lake in five to ten years. Therefore, water quality at the well is not expected to be at significant risk from land practices within the five-year zone. No influence from the adjacent Ward and Hewitt Lakes is expected on the deeper aquifer materials, but there is no data to confirm this.

Since the planned Briggs Well has not yet been installed, no water quality data is yet available. Information on the old Briggs Nursery well can be found on Ecology's Toxics Cleanup Program website.

West Olympia DWPAs

The West Olympia DWPAs for the Allison Springs and Kaiser wells are shown in Map 7.7 and Map 7.8, respectively.

Two of the three West Olympia area wells (Allison Springs Well 13 (S09) and Well 19 (S11)) draw water from the confined Pre-Vashon sediments, while the third (Kaiser Well 1 (S03)) draws water from the shallower unconfined aquifer (Table 7.1). The zones are subject to some uncertainty however, because of data gaps in this area, the main gap being a more accurate characterization of the groundwater flow direction in the deeper Pre-Vashon Gravel aquifer. The geology of this area appears complex, both vertically and horizontally, with distinct areas of till separating aquifer layers in some areas, but complete separation between upper and lower layers not likely in other areas. Hydrogeological cross-sections are available in the Golder reports.

Allison Springs DWPA. Flow directions in the deeper confined Pre-Vashon aquifer are not well defined because of limited water level data. However, bedrock exposed along the Black Hills just south of Allison Well 13 (S09) and Well 19(S11) is probably an important factor that affects groundwater flow in the vicinity of these wells (Map 7.7). A northwesterly component of groundwater flow is likely influenced by the Black Hills bedrock outcrop to the south of these supply wells. A north-northwest regional flow direction would be expected on the northeast side of the Black Hills and would transition to a westerly flow direction on the north side of the Black Hills, where the Allison Springs wells are located.

As with the other supply and monitoring wells, the Utility has collected groundwater quality samples at both Allison Springs wells and, since 2009, up to four monitoring wells, at frequencies ranging from quarterly to annually. Samples have been tested for pathogenic indicators, synthetic organic compounds, volatile organic compounds and inorganic compounds including nitrates. Nitrate has been detected at low levels in both source wells and some monitoring wells, confirming that surface activities have impacted groundwater quality (See Section 7.4).

Kaiser DWPA. Flow directions in the shallow aquifer that supplies the Kaiser Well 1 (S03), although fairly radial, generally trend to the northeast (Map 7.8). A north-south trending groundwater divide has also been identified along the eastern portion of the study area.

The Utility has collected groundwater quality samples at the Kaiser Well 1 (S03) at frequencies ranging from quarterly to annually. Samples have been tested for pathogenic indicators, synthetic organic compounds, volatile organic compounds and inorganic compounds including nitrates. Water quality monitoring does not indicate cause for concern at this well. There are no monitoring wells in the Kaiser DWPA. (See Section 7.4).Map

Land Use and Zoning in DWPAs

This section gives an overview of the assessed land use and zoning within each of Olympia's DWPAs. The 2009 Water System Plan provides a more comprehensive depiction of assessed land use and zoning in the DWPAs, with maps and tabulations of acreages per DWPA time-of-travel capture zone.

Assessed land use refers to the designation a parcel is given for tax purposes, such as commercial, open space or residential. Zoning determines allowable uses for the parcel. Assessed land use gives a picture of current possible risks to groundwater quality, while zoning indicates potential future development and risks to groundwater quality. Assessed land use data (as of 2007) was obtained from Thurston Regional Planning Council; zoning data (also as of 2007) was obtained from Thurston GeoData Center. Assessed land use and zoning information and maps are to be updated during the 2015-2020 planning period, as part of a Contaminant Source Inventory update.

McAllister Wellfield DWPA

The McAllister Wellfield DWPA encompasses about 2,960 acres in rural northeastern Thurston County (Map 7.1). Assessed land use is primarily residential, agriculture and parks, and government or institutional. Most of this area has a zoning designation of McAllister Geologically Sensitive Area, which allows only single-family residential development with one unit per five acres (Map 7.2).

East Olympia DWPAs

The East Olympia area includes DWPAs for Shana Park Well 11 (S10), Indian Summer Well 20 (S12), Hoffman Well 3 (S08), and the planned Briggs Well (Map 7.1).

Shana Park DWPA has a land area of about 525 acres (Map 7.3). Assessed land use in the Shana Park DWPA is predominately high, moderate and low urban residential densities, followed by parks, preserves and open space, including the Indian Summer Golf Course and Capital City Golf Course. Near the intersection of College Street and Yelm Highway in Lacey is a rapidly growing commercial area.

Zoning is urban residential in the majority of the DWPA, in both Olympia's urban growth area and in Lacey and its urban growth area. Lacey also has large areas zoned commercial and moderate density urban residential.

Indian Summer DWPA has a land area of about 1,356 acres (Map 7.4). Assessed land use in the Indian Summer DWPA is predominately urban and rural residential low density followed by vacant land. The Indian Summer Golf Course is also located in this DWPA. Zoning is a combination of urban low densities in Olympia's urban growth area, and rural densities of one unit per two and three acres in Thurston County.

Hoffman DWPA has a land area of about 811 acres (Map 7.5). Assessed land use is predominately residential low density followed by vacant land and natural resource land. The land area is zoned in a wide variety of residential urban densities in both Olympia and Lacey. There is also Neighborhood Village zoning, which allows for commercial and mixed residential uses, and a small area zoned Neighborhood Commercial.

Briggs (planned) DWPA has a land area of about 400 acres (Map 7.6). Low density residential development is the most common land use, followed by vacant or undeveloped land. The rest of the DWPA is used for roads, railroads and right-of ways; natural resource land; and parks, preserves and open-space. Commercial development within the one-year time-of-travel zone includes the Briggs YMCA and other commercial activities at the intersection of Henderson Boulevard and Yelm Highway. The development of the Briggs Urban Village has changed land use significantly, with a general increase in high-density residential and commercial properties.

Zoning designations within the Briggs (planned) DWPA include an Urban Village within the six-month and one-year time-of-travel zones. This designation allows for a combination of residential and commercial development. The Briggs Urban Village has been permitted and was under construction at the time of writing this Water System Plan. The remainder of the DWPA is zoned single-family residential at 4-8 units per acre.

West Olympia DWPAs

Two DWPAs are located in the West Olympia area, one for Allison Springs Well 13 (S09) and Well 19 (S11), and one for Kaiser Well 1 (S03) (Map 7.1).

Allison Springs DWPA land use has changed recently, particularly within the one-year and five-year time-of-travel zones, shifting from low-density rural residential uses to more high-density residential and commercial uses within Olympia's city limits and urban growth area. Despite the shift to increased densities, most of the residential land is still low density (less than 3.5 dwelling units per acre), with the remaining area primarily vacant land, roads and rights-of-way (Map 7.7).

Zoning designations in the Allison Springs DWPA primarily fall into urban use categories. Within the one-year time-of-travel zone, they include: Urban Village and professional office/mixed residential, medical services, light industrial/commercial, and professional office/mixed residential. Within the five-year time-of-travel zone they include: general commercial, medical services, residential multi-family and high-density corridor zones.

Kaiser DWPA is also undergoing a shift in assessed land use from rural residential densities to urban residential densities. All of this land is zoned for residential development, and a large portion of the DWPA lies within the Green Cove Basin, which is zoned for low impact development (Map 7.8).

7.4 Contaminant Source Inventory

This section summarizes the results of the Contaminant Source Inventory with a table of risk levels in each Drinking Water Protection Area (DWPA). The inventory mentions the types of contamination and the major sources of contamination in each DWPA, as well as resources available to Utility staff to monitor and address potential contaminating conditions and events.

Comprehensive contaminant source inventories were completed in 1997, 2003 and 2008. The complete Contaminant Source Inventory for 2008 is in the 2009 Water System Plan, Appendix 8-4. Biannual updates completed for 2009-2010 and 2011-2012 are summarized in letters to DOH (Appendix 7-1 and Appendix 7-2). The Utility plans to update the 2013-2014 inventory in 2015, and to conduct a comprehensive update for the 2017-2018 inventory period.

Sources of Contamination

Four basic types of contaminants can be found in groundwater:

- Microbial pathogens (bacteria, viruses and other microorganisms).
- Inorganic chemicals (nutrients, salts, heavy metals and others).
- Organic chemicals (pesticides, solvents, fuels and other chemicals).
- Sediments/turbidity.

The Groundwater Protection Program monitors these types of contaminants in Olympia's DWPAs, evaluates their potential impacts on groundwater, and implements strategies to minimize the chances of these contaminants from increasing to levels that would pose a risk.

For the Contaminant Source Inventory, Program staff focuses on contaminants regulated by DOH under the federal Safe Drinking Water Act, which includes the following 12 major sources of potential contamination:

1. Use, storage and disposal of hazardous waste.
2. Pesticides and fertilizers.
3. Transportation and utility corridors.
4. Underground storage tanks.
5. Contaminated sites.
6. Existing and abandoned solid waste landfills.
7. Stormwater runoff and infiltration.
8. On-site septic systems.
9. Agricultural land and golf courses.
10. Abandoned and poorly constructed wells.
11. Animal wastes.
12. Seawater intrusion.

Ranking Risk

Staff developed ranking criteria for high and low degrees of risk, and made assignments based on a standard risk assessment approach. This approach takes into account the presence of the risk, the extent or distribution of the risk, and the potential severity of the threat to groundwater. Risk levels are:

- High. The risk is distributed throughout the DWPA or the potential threat to groundwater is great.
- Low. Both the distribution of the risk and potential threat to groundwater are minimal.

Table 7.2 shows the risk rankings for each DWPA. These rankings, along with the results of the Contaminant Source Inventory were used to develop the 2015-2020 Groundwater Protection Program's goals, objectives, strategies and performance measures described in Section 7.6.

Table 7.2 Ranking of Risks in Olympia's Drinking Water Protection Areas

Risk	McAllister Wellfield (S16)	Allison Springs Well 13 (S09) and Well 19 (S11)	Kaiser Well 1 (S03)	Hoffman Well 3 (S08)	Shana Park Well 11 (S10)	Indian Summer Well 20 (S12)	Briggs Well, planned
Hazardous materials (use, storage, and disposal)	High	High	High	Low	High	High	High
Pesticides and fertilizers	Low	High	High	Low	High	High	High
Transportation and utility corridors	High	High	Low	Low	Low	High	High
Underground storage tanks	Low	High	Low	Low	Low	Low	Low
Contaminated sites	Low	High	Low	Low	Low	Low	Low
Existing and abandoned solid waste landfills	Low	High	Low	Low	Low	Low	Low
Stormwater runoff and infiltration	High	High	Low	Low	High	High	High
On-site septic systems	High	Low	High	Low	High	Low	Low
Agriculture and golf courses	High	Low	Low	Low	High	High	Low
Abandoned and poorly constructed wells	Low	High	High	High	High	High	High
Animal wastes	High	Low	Low	Low	Low	Low	Low
Seawater intrusion	Low	Low	Low	Low	Low	Low	Low

Notification of Inventory Findings

The DOH requires utilities to conduct a notification process regarding actual and potential sources of contamination within its DWPAs. In 2009, after defining new DWPAs, the Utility sent notification letters to:

- Regulatory agencies and local governments, informing them about the location of potential and actual groundwater contaminant sources in the DWPAs.
- Owners and operators of actual and potential contaminant sources.
- Occupants within DWPAs who live in the City's urban growth area and neighboring city and county jurisdictions outside Olympia's city limits.

For the second and third categories above, the Utility sent a letter describing the overall delineation and inventory process, and provided a map showing the new delineations and identified contaminant sources. Copies of the letters and mailing lists are referenced in the 2009 Water System Plan Appendix 8-6.

Because the Contaminant Source Inventory updates completed in 2011 and 2013 have indicated no change in potential contaminant sources or threats, the Utility has not conducted another notification process. The next comprehensive update to the Contaminant Source Inventory, planned for the 2017-2018 inventory period, will include a notification process.

Source Susceptibility Assessments

The susceptibility assessment forms and well logs for TW-22 (S13), PW-24 (S14) and PW-25 (S15) in the McAllister Wellfield (S16), are included in Appendix 7-3. Susceptibility assessments for the other source wells are contained in the 2009 Water System Plan (Appendix 8-2) and are on file with DOH.

Groundwater Monitoring Report

In 2011, Groundwater Protection Program staff completed a comprehensive analysis of water level measurements and water quality sample results contained in the Utility's water quality database and other sources, for the City's seven source wells and numerous monitoring wells. Most of the information for this *2011 Groundwater Report* had been collected from 1972 through 2011; however, some dated to 1945 for McAllister Springs (S01). (See also Chapter 11, Section 11.2 for groundwater monitoring information.)

The *2011 Groundwater Report* was written to bring together in one document an overview of the history of groundwater protection monitoring events and an analysis of long-term trends in water levels and water quality. Utility staff inspects all source well and monitoring well information soon after the data is collected and results are available. The initial report captured decades of groundwater protection information in one document. An update was completed in 2014 for information collected between 2011 and 2013. The Utility has scheduled subsequent updates to occur every one or two years, depending on the type and amount of activity conducted in the DWPAs as monitoring continues.

The *2011 Groundwater Report* and 2014 update reference regulations that apply to the City's water system and DWPAs. The report briefly characterizes the regional hydrogeological setting and references past studies of water development and investigations into known and potential contamination sources and risks. It also summarizes information on water rights, water facilities, supply and monitoring wells, well logs and construction, source production and monitoring schedules.

The 2011 and 2014 reports primarily focus on an analysis of groundwater level measurements and water quality sample results, displayed in the form of tabulated counts, values, ranges and averages, and graphed trends. Water level measurements were available from both manual and pressure transducer readings. Water quality measurements included organic, inorganic, radionuclide and bacteriological sample analyses. Limited statistical analysis was performed on some nitrate sample results for selected wells. The report recommended how the Utility could improve water level monitoring and interpretation, maximize collection of representative monitoring well water quality samples, and expand the network of monitoring wells in each DWPA.

The 2011 and 2014 Groundwater Reports reside on the Public Works Water Resources shared drive and are intended for in-house use by staff.

Activities, findings and recommendations included in the 2011 and 2014 Groundwater Reports are summarized below. Some of the recommendations are also included as Performance Measures in Section 7.6.

Recent Activities

Activities that were new or recent when the Groundwater Reports were written include:

- Development of the McAllister Wellfield (S16) water supply wells and associated facilities.
- Approval by Ecology to extend construction of the planned Briggs Well through May 2019.
- Installation of five monitoring wells in the Shana Park, Indian Summer and Allison Springs DWPAs with approved deviations from the City's monitoring well standards.
- Creation of a database to manage groundwater level data and enable improved analysis of groundwater levels. Application of the new groundwater level database enabled improved evaluation and interpretation of localized and some regional groundwater levels.
- Collection of water quality samples for compliance with federal monitoring requirements (UCMR3) pertaining to the City's source wells.
- Further characterization of the City's former West Olympia Landfill under the US Environmental Protection Agency (USEPA) Targeted Brownfields Assessment Program.

Findings and Recommendations

Key findings highlighted in the Groundwater Monitoring Reports (Chapter 11, Map 11.1) include:

- Nitrate continues to persist in the Shana Park Well 11 (S10), averaging about 3 milligrams per liter (mg/L).

- Detectable nitrate (just above 2 mg/L) was reported for the first time in the Indian Summer Well 20 (S12) in 2012 and again in 2013.
- New monitoring wells in the Allison Springs DWPA provided evidence that nitrate may be present throughout the DWPA at levels up to about 1.2 mg/L.

Key recommendations include:

- Develop Standard Operating Procedures to improve groundwater level data collection records, based on application of the groundwater level management database.
- Collect additional nitrogen-isotope samples to better understand the potential source(s) of nitrate in the Shana Park and Indian Summer DWPAs, based on detection of nitrates in new monitoring wells in the Shana Park DWPA.
- Install additional monitoring wells and conduct more frequent nitrate monitoring in the McAllister Wellfield DWPA and East and West Olympia DWPAs.
- Amend the City's Groundwater Protection Ordinance, OMC 18.32, to clarify the requirements for developers required to install monitoring wells, particularly with respect to well equipment.

Expand the use of GIS technology to display hydrogeological information, to improve presentation of data and interpretations.

7.5 Contingency Planning

Contingency planning is integral to managing the City's Drinking Water Protection Areas to ensure customers have an adequate supply of potable water in case contamination results in the temporary or permanent loss of the McAllister Wellfield or other supply wells (WAC 246-290-135 (3)(c)(vi) and (vii)). Through the Utility's emergency response planning efforts (Chapter 12, Section 12.2), staff is prepared to address immediate or short-term threats to groundwater (such as a transportation spill) and longer-term threats (such as the loss of a well due to contamination or natural disaster). The Utility's Emergency Response Plan contains the Vulnerability Assessment, Spill Response Plan and Contingency Plan required by DOH for groundwater protection and general emergency preparedness (Appendix 12-2).

The Vulnerability Assessment, a key element in emergency planning, identifies contamination from hazardous material spills and flood- or earthquake-caused turbidity as the highest risks to the City's water sources.

Because of these risks, the City has coordinated with local emergency response agencies to help address any immediate or short-term threats by implementing the Spill Response Plan. The Utility developed a Contingency Plan to respond to contamination events that require the management of a longer-term water supply emergency. Regardless of the degree of threat or impact, the Utility can also implement its Water Shortage Response Plan with established procedures for curtailment if necessary (Appendix 5-2).

The components of a Contingency Plan include information and necessary analyses already conducted for effective water system operations.

For example, the plan draws on information about the water system's maximum capacity in relation to source, distribution system, and water rights limits, assuming the loss of major supply wells. It references existing interties with neighboring water systems and identifies future potential sources of drinking water. The plan also applies water quality assurances and control methods already in place prior to using a source of supply (Chapters 1, 3-4 and 8-11).

The City has recently implemented DOH guidance to achieve long-term replacement of the City's principal source of supply by replacing McAllister Springs (S01) with the less vulnerable McAllister Wellfield (S16). The City has also secured a portion of the Brewery water rights for possible additional future supply, and will further evaluate the timing for development of the Briggs well during this planning period (Chapter 4).

While contingency planning addresses longer-term impacts to water supply sources, it includes procedures for emergency incident and spill response, immediate or short-term threats. Thus, the Utility is by default prepared to quickly and effectively manage spills and other immediate hazards, which is especially important should any occur within our DWPAs. Chapter 12, Section 12.2 further describes actions and resources the Utility is prepared to exercise in cases of immediate emergencies that may occur within a DWPA.

A critical component of emergency response in the DWPAs is effective coordination with neighboring jurisdictions and regional response partners, given that portions of the City's DWPAs are outside city limits. The City has complied with DOH source water protection requirements by providing partner emergency responders (Chapter 12, Table 12.3) with maps of the DWPA boundaries, the results of source water susceptibility assessments, contaminant source inventory findings, and contingency planning information.

7.6 2015-2020 Groundwater Protection Program

The Groundwater Protection Program is designed to help achieve the Drinking Water Utility's Goal 5:

> **Groundwater quality is protected to ensure clean drinking water for present and future generations and to avoid the need for expensive replacement or treatment facilities.**

During 2015-2020, the program will continue compliance with source water protection requirements and to maintain past program successes, while striving to expand program effectiveness. Staff will focus program resources on these objectives:

- Prevent contamination of groundwater through surveillance and response.
- Strengthen and exercise partnerships with citizens and state/local agencies.
- Improve program policies, procedures and tools.

These objectives are derived from groundwater monitoring plans and reports, contaminant source inventories, and the vulnerability assessment and emergency response plans that are the foundations of the Utility's contingency planning and emergency preparedness.

For each objective, this section lists a number of strategies and performance measures. Resources will be focused on addressing the highest contamination risks determined from contaminant source inventories (Table 7.2). Also essential are activities that do not directly address specific contaminant risks such as groundwater monitoring and building community awareness. Many of the planned activities are continued from the 2009 Water System Plan, which may be referenced for additional detail. Unless a particular timeframe is indicated below, staff intends to accomplish the performance measures during 2015-2020.

Objective 5A Prevent contamination of groundwater through surveillance and response

Strategy 5A1 -- Continue to monitor groundwater quality to understand risks to groundwater, detect contamination and evaluate pollution reduction efforts.

Strategy 5A2 -- Continue to improve spill prevention actions and implement spill response procedures.

Performance Measures

1. Continue to implement the groundwater monitoring plan, focusing on contamination from nitrate (fertilizers, septic systems and animal waste), stormwater infiltration facilities, pesticide use and hazardous materials spills.
2. Continue to update the Groundwater Report by the end of each year's first quarter to capture the monitoring results from the previous year.
3. Update the contaminant source inventory every two years as required by DOH: updates for 2013-2014 and 2015-2016 and a comprehensive inventory for 2017-2018 by 2019.
4. Continue to support the City's Executive Office in efforts to further characterize contamination associated with the former West Olympia Landfill site.
5. Expand the use of the City's geographic information system (GIS) to support presentation and interpretation of water quality and hydrogeological information.
6. Develop an inventory and database of existing wells on City property and within all DWPA one-year time-of-travel zones, and determine whether to use or decommission each one. Consider also evaluating all historically used monitoring wells associated with the McAllister Springs DWPA (including monitoring wells located outside the DWPA) and determine the final disposition of monitoring wells not planned for use in monitoring the McAllister Wellfield DWPA.
7. Maintain groundwater models for all DWPAs and consider further evaluating aquifer vulnerability through the use of USEPA's DRASTIC rating system.

8. Participate in the Local Emergency Planning Committee (LEPC); regularly communicate and coordinate with first responders in DWPAs; and participate in tabletop exercises involving contamination of the water supply.

9. Support efforts to better understand risk to water supplies from railway and road transportation corridors by staying apprised of Thurston County's Commodity Flow Study, Washington State Department of Transportation highway management and construction activity, and the City's Westside Transportation Access Study.

Objective 5B Strengthen and exercise partnerships with citizens and state/local agencies

Strategy 5B1 -- Raise awareness about the need to protect groundwater and change human behaviors that place groundwater at risk.

Strategy 5B2 -- Collaborate on groundwater protection with state, county and neighboring city agencies.

Performance Measures

1. Collaborate with the City Storm and Surface Water, Wastewater and Waste ReSources Utilities to develop and implement social marketing, education and outreach programs for residents and businesses within DWPAs to communicate proper use, storage and disposal of hazardous materials.

2. Implement a community-based social marketing outreach program with residents and yard care professionals to implement Best Management Practices; include estimating the effect on nitrogen loading to shallow aquifers.

3. Explore the feasibility of offering free or low-cost routine inspections for on-site septic systems located within DWPA one-year time-of-travel zones (for example, inspections of 30 systems per year).

4. Collaborate with Thurston County Environmental Health on technical assistance visits to businesses, review of water quality monitoring and new development within DWPAs in county jurisdiction, cleanups of contaminated sites, numerical groundwater model updates and uses, and social marketing outreach efforts. Support county WasteMobile events, on-site septic system workshops, research and monitoring activities, and implementation of the county's Local Hazardous Waste Management Plan.

5. Coordinate with the Cities of Lacey, Tumwater and Yelm to protect portions of Olympia's DWPAs in those cities, and to ensure McAllister Wellfield (S16) mitigation requirements are met.

6. Stay apprised of WRIA 11 (Nisqually) Technical Subcommittee and Stewardship Coalition activities, and the WRIA 13 (Budd/Deschutes) TMDL Technical Subcommittee activities.

7. Coordinate with neighboring jurisdictions on groundwater quality and water level data-sharing efforts to develop a broader understanding of water resource conditions.

Objective 5C Improve program policies, procedures and tools

Strategy 5C1 -- Continue to clarify City policies and simplify the development review process.

Strategy 5C2 -- Streamline Program Processes and Procedures.

Strategy 5C3 -- Ensure that groundwater protection-related capital projects and major equipment are included in the Utility's Asset Management Program.

Performance Measures

1. Continue to review development applications submitted to Olympia's Community Planning and Development (CP&D) Department, including technical review of hydrogeological reports when required under the City's Critical Areas Ordinance.
2. Assess allowing the option of a lysimeter to monitor stormwater infiltration or other groundwater contamination risks or monitoring needs in Drinking Water Protection Areas, and amend OMC 18.32.225.B as needed.
3. Continue to coordinate with the Storm and Surface Water Utility on reviewing pollution prevention and source control plans, and implementing and updating the Stormwater Drainage Manual as needed.
4. Consider modifying the Stormwater Maintenance Agreement requirements to specify ownership and long-term maintenance of monitoring wells and equipment installed by developers per OMC 18.32.225.B.
5. Request Thurston County and the City of Lacey to require enhanced treatment at stormwater infiltration facilities located in DWPAs that lie within their jurisdictions.
6. Continue to support the Wastewater Utility's efforts to connect properties in DWPAs to public sewer if they are using on-site septic systems and are within 200 feet of the sewer line.
7. Update the Utility's land acquisition and management strategy, specifically to incorporate transfer of development rights and easement agreements on priority parcels.
8. Evaluate the feasibility of streamlining the contaminant source inventory process with automating technologies such as GIS mapping and linkages between existing databases used by the Utility's Water Quality Program and the City's CP&D and Administrative Services Departments.
9. Review the Utility's Contingency Plan for accuracy in addressing long-term loss of water sources at greatest risk of contamination; for example, contamination of the Allison Springs wells from a transportation spill or loss of the Shana Park Well 11 (S10) from nitrate contamination.
10. Explore the feasibility of evaluating the McAllister Wellfield (S16) for participation in USEPA's Sole Source Aquifer Protection Program.
11. Work with City and Thurston County planning staff to revise and update land use and zoning regulations as needed to protect regional groundwater resources.

12. Develop a life-cycle schedule for monitoring well equipment (Hydrolab®), dedicated submersible pumps and water level pressure transducer data loggers, and develop an operating budget to cover expenses.

13 Consider the following additional activities in this planning period or beyond:

   - Require a bond to be posted by businesses/facilities that handle hazardous materials to cover the cost of spill response or remediation, prior to operation in DWPA.
   - Charge additional fees from businesses/facilities with hazardous materials or landscaped areas (fertilizer use) to offset the potential cost of aquifer cleanup.
   - Review building codes for requirements that protect groundwater, such as septic system design, and operation and maintenance.
   - Explore "zoning overlays", or establishing special districts, that add regulations to controls already in place; could help address grandfathered potential contaminating sources in DWPAs.
   - Ban the sale and use of leachable nitrate products in city limits.

14. Consider the following in developing Levels of Service for groundwater protection:

   - Ways to measure cost of service of protecting groundwater.
   - Comparing costs to mitigate the risk with the costs of the risk itself and the number of times it occurs.
   - The benefits of monitored or shared risk (insurance).
   - The costs of monitoring wells versus source replacement.
   - The cost to "rehabilitate existing systems".
   - Developing a financial strategy for land acquisition.
   - Manage and sustain prioritized land.
   - Identify the long-term groundwater protection needs of the City.
   - Incorporate groundwater protection tools into Asset Management Goals.

7.7 Implementation and Staffing

Program staff emphasizes implementing state and local groundwater protection regulations; monitoring wells for groundwater quality and water levels; identifying and addressing contaminant source risks; and engaging regional partnerships for protection and response. Program staff also attempt to identify and influence human behaviors that put drinking water at risk.

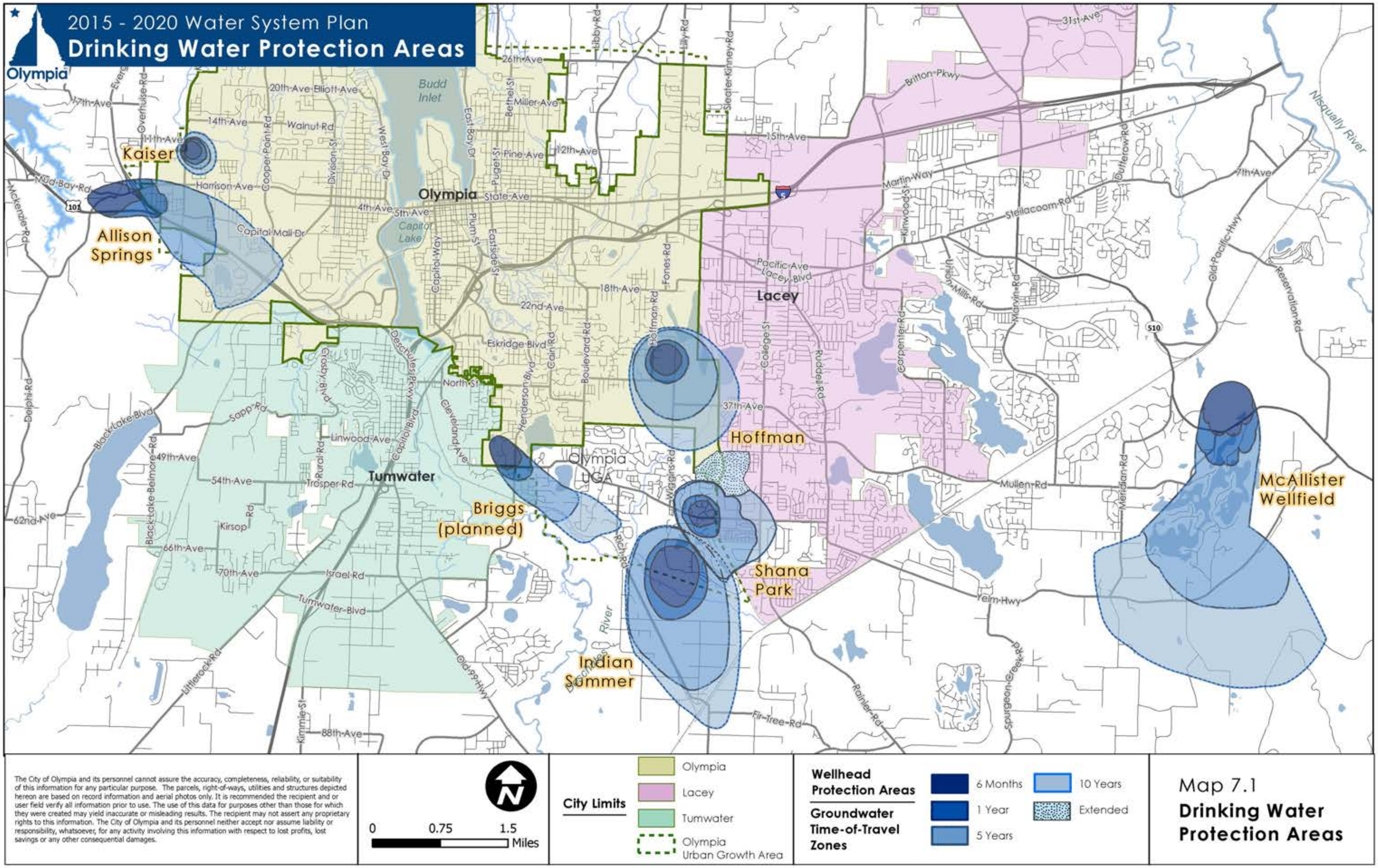
Managing the Groundwater Protection Program includes:

- Conducting groundwater protection activities
- Responding to inquiries related to groundwater protection
- Designing and implementing projects to promote the protection of groundwater
- Generating technical reports and planning documents
- Supporting other City utilities and departments on groundwater protection-related work
- Managing the program budget

Most of the activities identified for the Groundwater Protection Program are ongoing efforts that will continue throughout the next six years. Two exceptions are the Groundwater Report which will be updated approximately every year and the Contaminant Source Inventory, to be updated every two years.

The Program's activities will be conducted at the current staffing level of ~0.5 FTE Senior Program Specialist. (Groundwater Protection Program staffing is shared with the Reclaimed Water Program to equal 1.0 FTE.) Consulting contracts and support from other City resources, primarily in the Public Works and Community Planning & Development Departments, will be sought and exercised as needed. Staffing levels need to be re-evaluated for future effectiveness given that many of the activities identified in the 2009 Water System Plan were carried over into this planning period. Staffing needs for the Groundwater Protection Program will be revisited during this planning period.

For the 2015-2020 planning period, the Capital Improvement Program (Chapter 13) includes allocations for the Groundwater Protection Program to install and equip sentinel groundwater monitoring wells, conduct groundwater modeling and refine time-of-travel zones. After 2020, funds are planned for property easements, appraisals and possible acquisitions. Funds for these activities will be allocated as other priorities and resources allow.



2015 - 2020 Water System Plan
Drinking Water Protection Areas
Olympia
Kaiser
Allison Springs
Briggs (planned)
Hoffman
Shana Park
Indian Summer
McAllister Wellfield
Olympia
Tumwater
Lacey
Olympia UGA
Budd Inlet
Capitol Lake
Nisqually River
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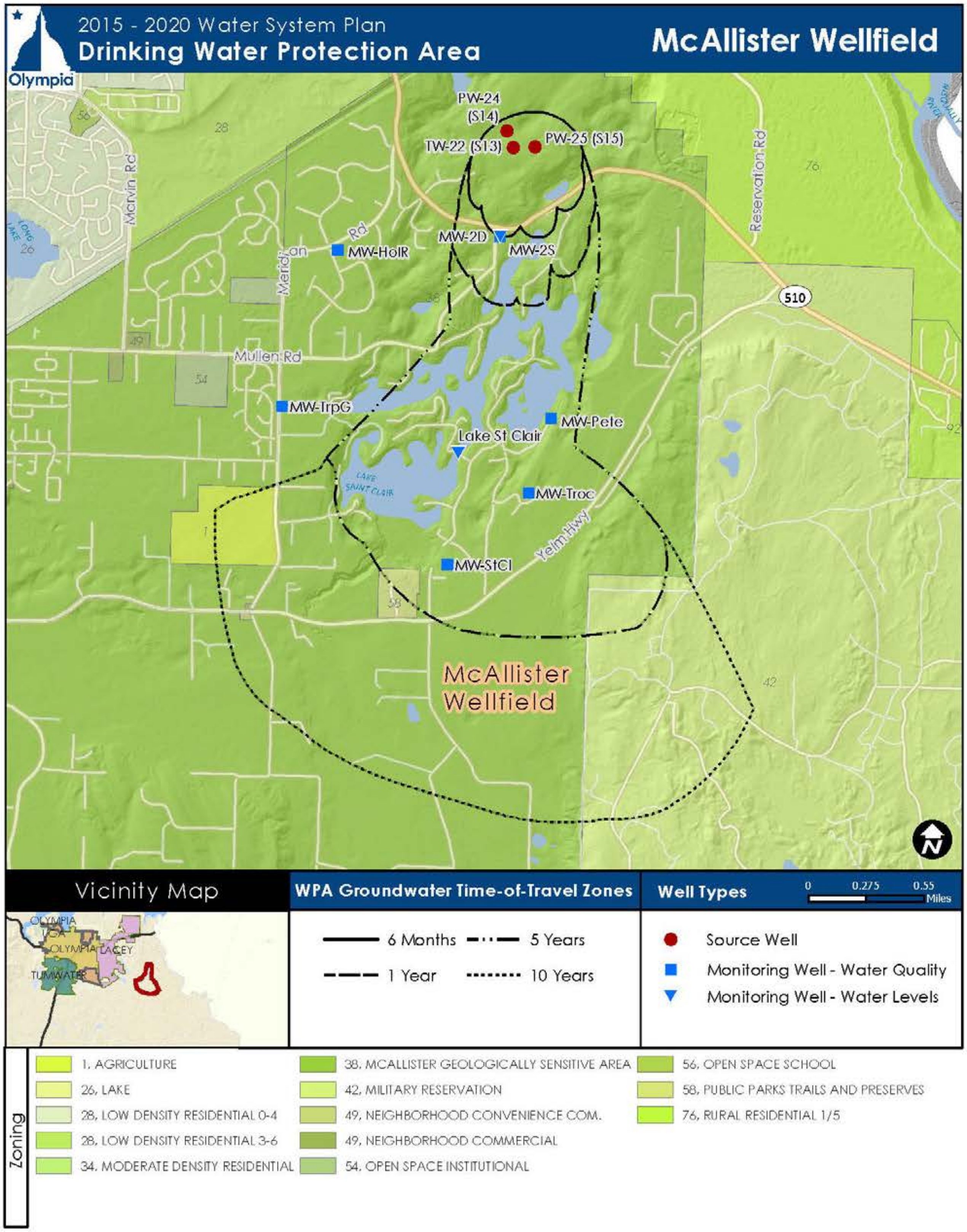
0
0.75
1.5
Miles
City Limits
Olympia
Lacey
Tumwater
Olympia Urban Growth Area
Wellhead Protection Areas
Groundwater Time-of-Travel Zones
6 Months
1 Year
5 Years
10 Years
Extended
Map 7.1
Drinking Water Protection Areas



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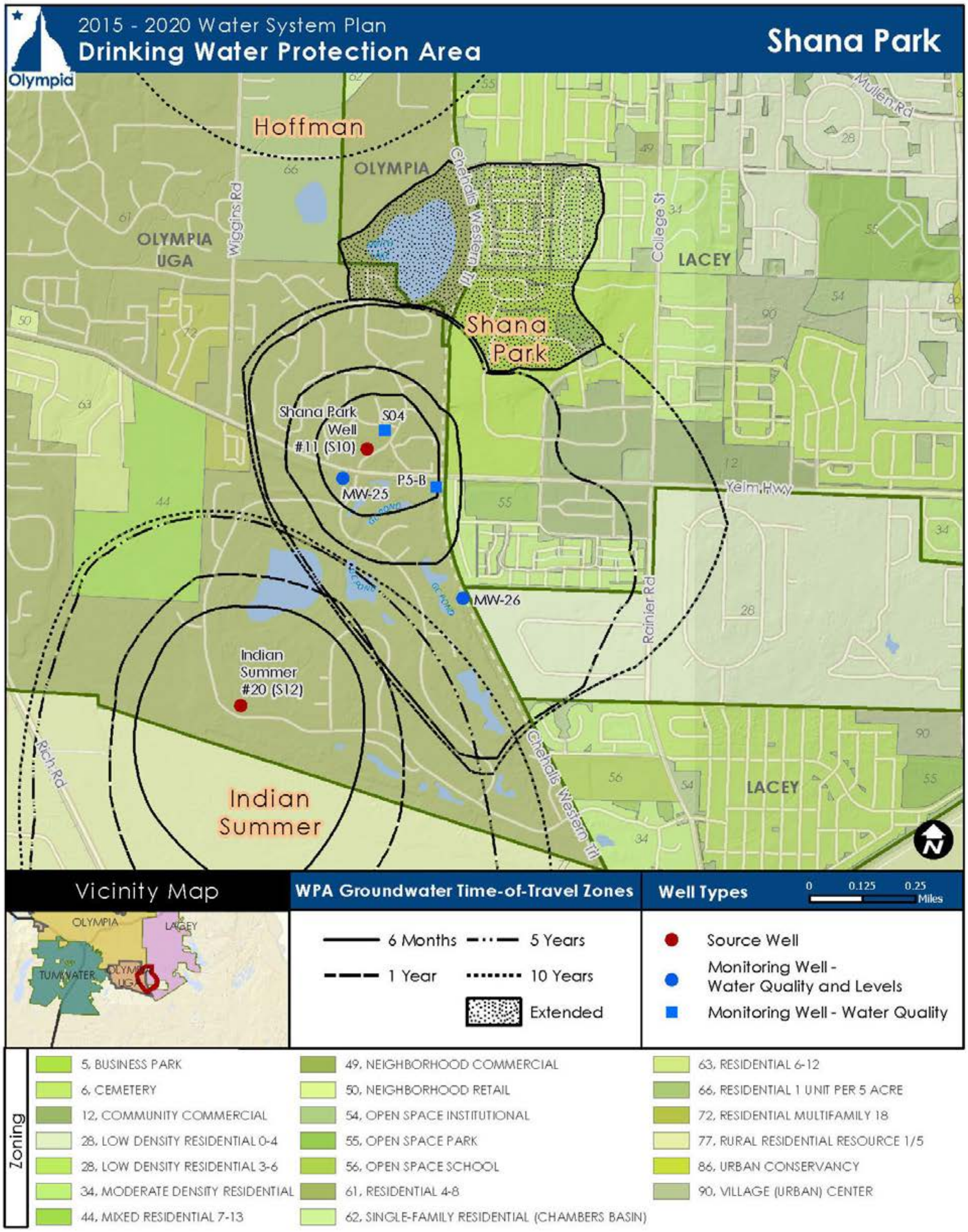
Map 7.2
McAllister Wellfield
DWPA



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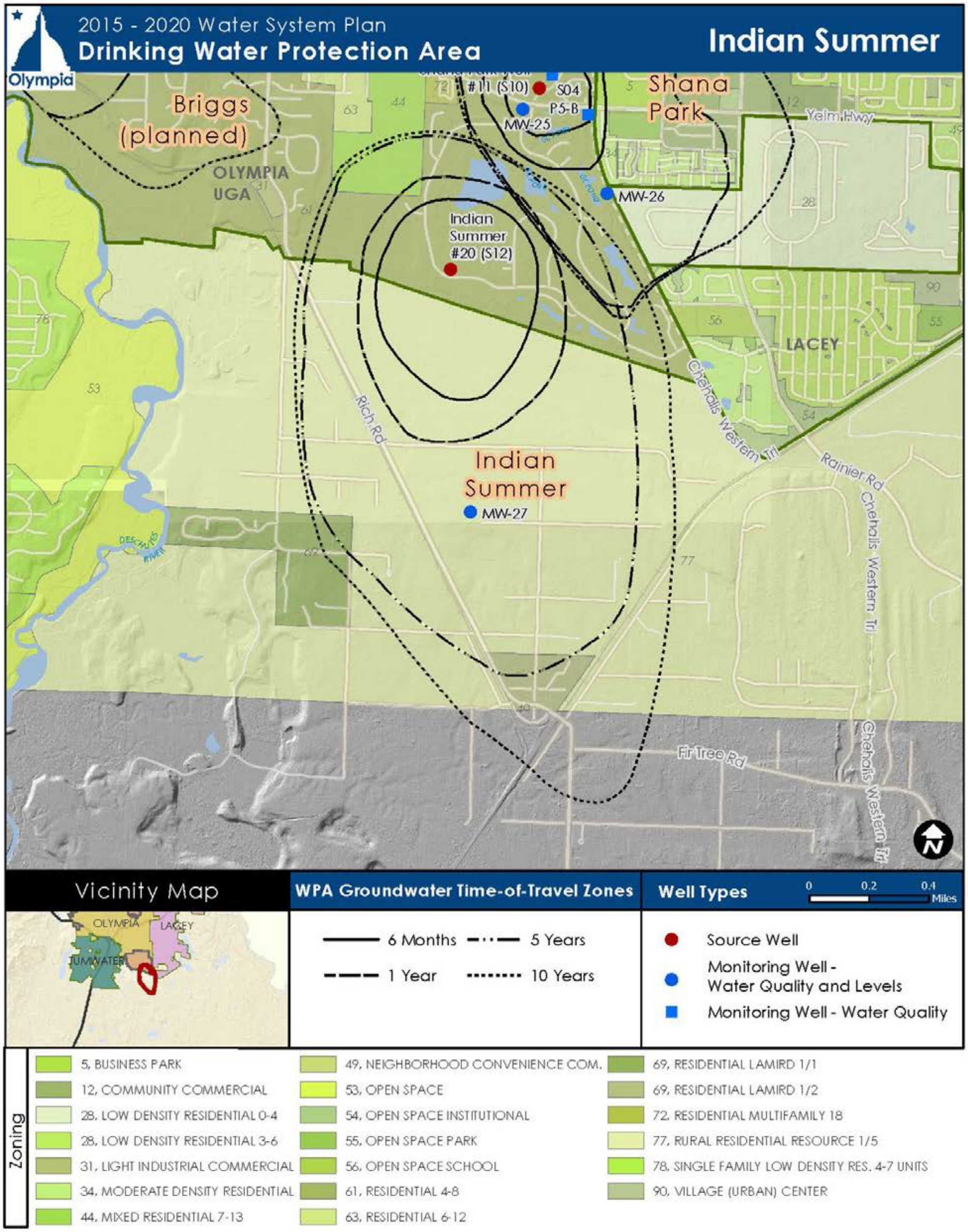
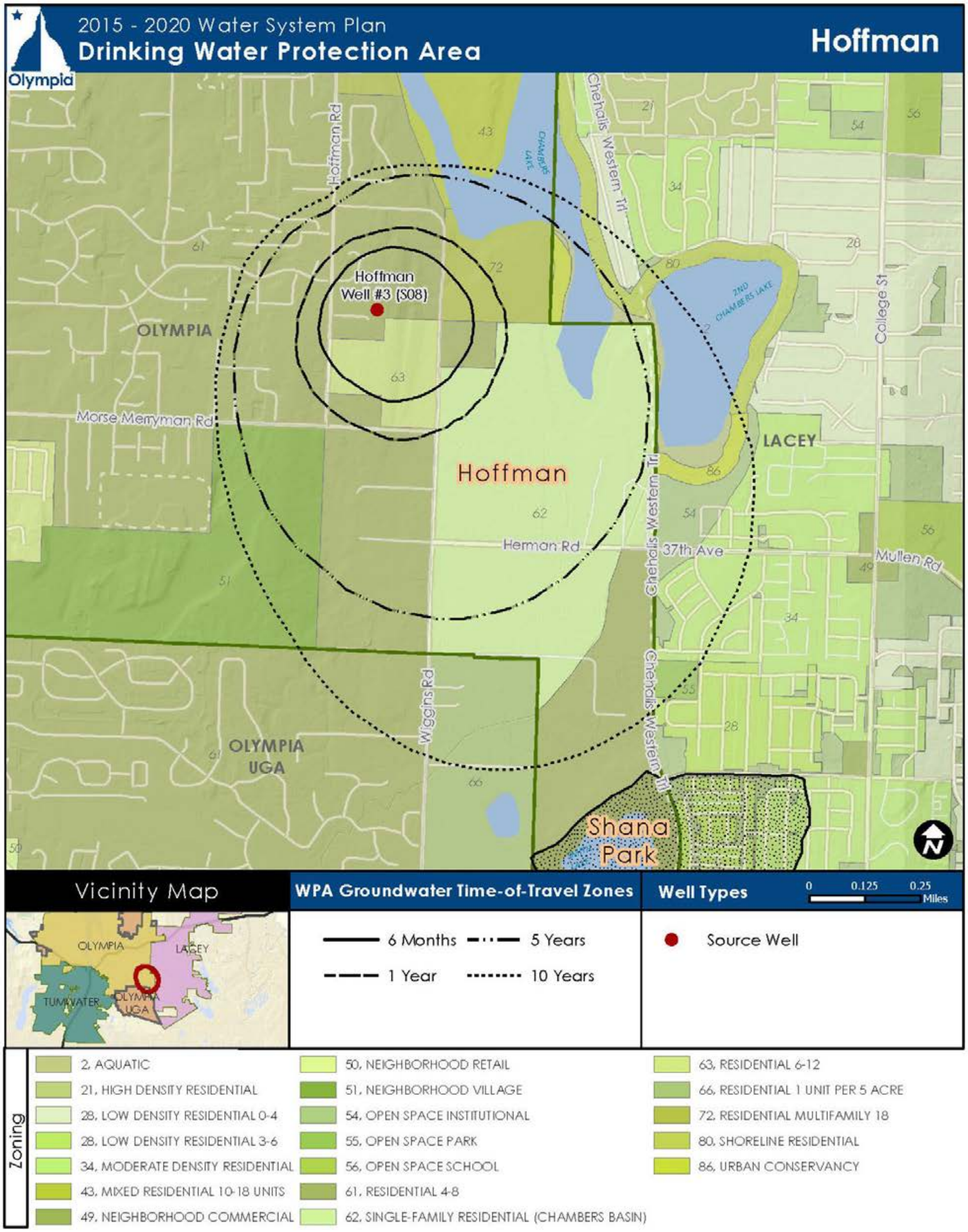
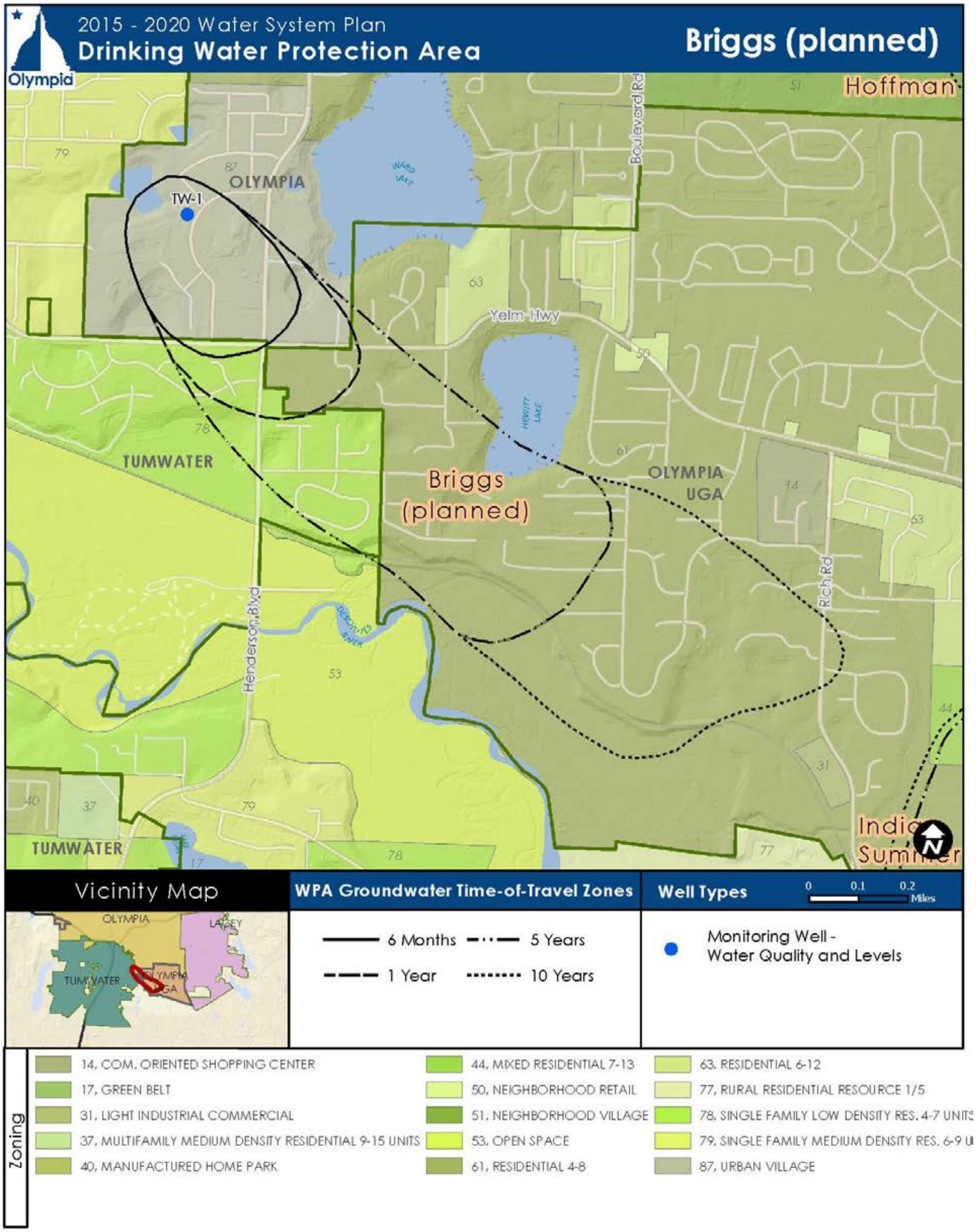
Map 7.3
Shana Park
DWPA



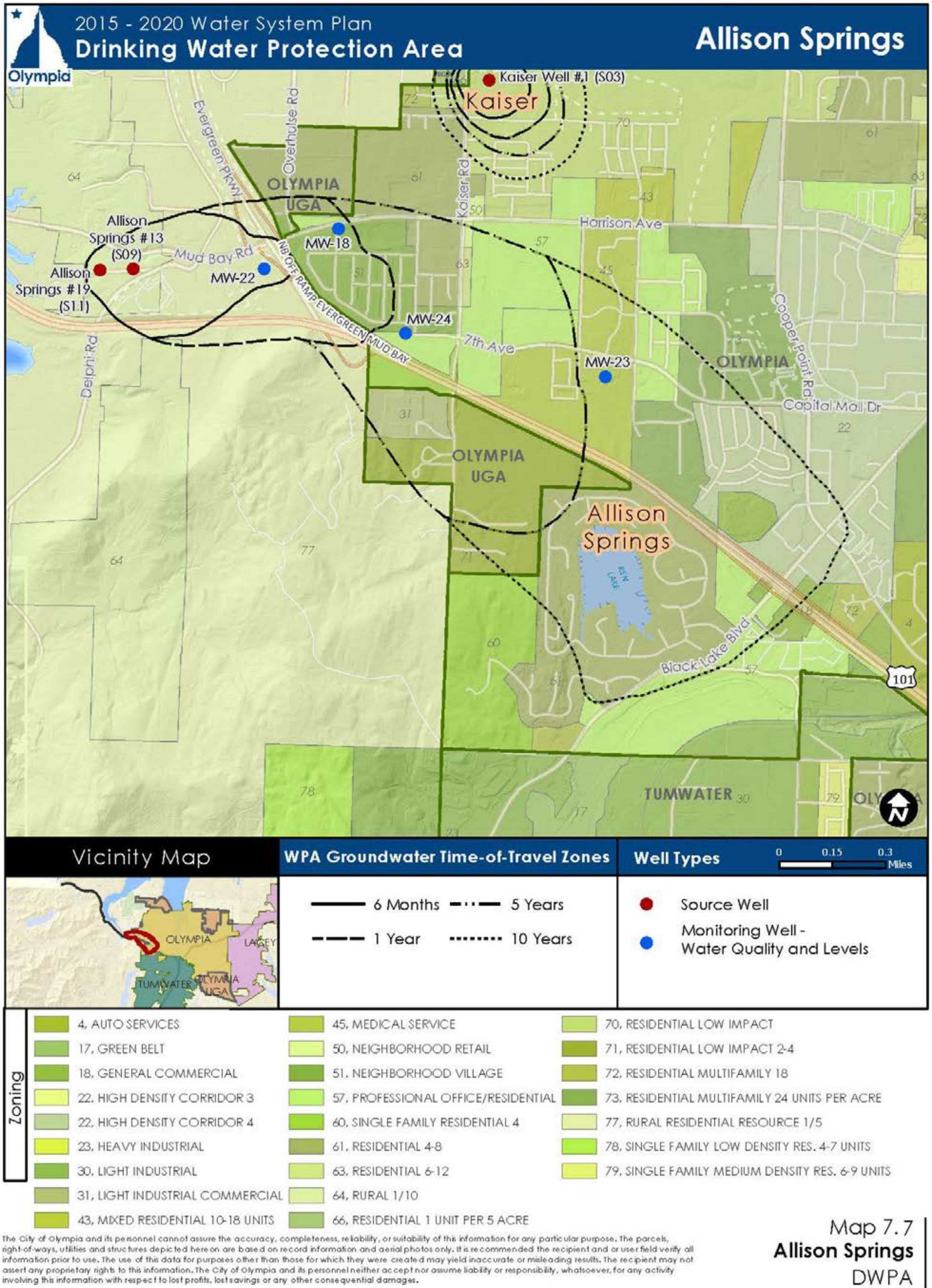
Map 7.4
Indian Summer
DWPA



Map 7.5
Hoffman
DWPA



Map 7.6
Briggs (planned)
DWPA


2015 - 2020 Water System Plan
Drinking Water Protection Area
Allison Springs
Olympia
Kaiser Well #1 (S03)
Kaiser
Evergreen Pkwy
Overhulse Rd
OLYMPIA UGA
Kaiser Rd
Harrison Ave
Allison Springs #13 (S09)
Allison Springs #19 (S11)
Mud Bay Rd
MW-22
MW-18
NB OFF RAMP EVERGREEN/MUD BAY
MW-24
7th Ave
MW-23
OLYMPIA
Cooper Point Rd
Capital Mall Dr
Delphi Rd
OLYMPIA UGA
Allison Springs
Black Lake Blvd
101
TUMWATER
Vicinity Map
OLYMPIA
LACEY
TUMWATER
OLYMPIA UGA
WPA Groundwater Time-of-Travel Zones
6 Months
5 Years
1 Year
10 Years
Well Types
0
0.15
0.3
Miles
Source Well
Monitoring Well - Water Quality and Levels
Zoning
4, AUTO SERVICES
17, GREEN BELT
18, GENERAL COMMERCIAL
22, HIGH DENSITY CORRIDOR 3
22, HIGH DENSITY CORRIDOR 4
23, HEAVY INDUSTRIAL
30, LIGHT INDUSTRIAL
31, LIGHT INDUSTRIAL COMMERCIAL
43, MIXED RESIDENTIAL 10-18 UNITS
45, MEDICAL SERVICE
50, NEIGHBORHOOD RETAIL
51, NEIGHBORHOOD VILLAGE
57, PROFESSIONAL OFFICE/RESIDENTIAL
60, SINGLE FAMILY RESIDENTIAL 4
61, RESIDENTIAL 4-8
63, RESIDENTIAL 6-12
64, RURAL 1/10
66, RESIDENTIAL 1 UNIT PER 5 ACRE
70, RESIDENTIAL LOW IMPACT
71, RESIDENTIAL LOW IMPACT 2-4
72, RESIDENTIAL MULTIFAMILY 18
73, RESIDENTIAL MULTIFAMILY 24 UNITS PER ACRE
77, RURAL RESIDENTIAL RESOURCE 1/5
78, SINGLE FAMILY LOW DENSITY RES. 4-7 UNITS
79, SINGLE FAMILY MEDIUM DENSITY RES. 6-9 UNITS
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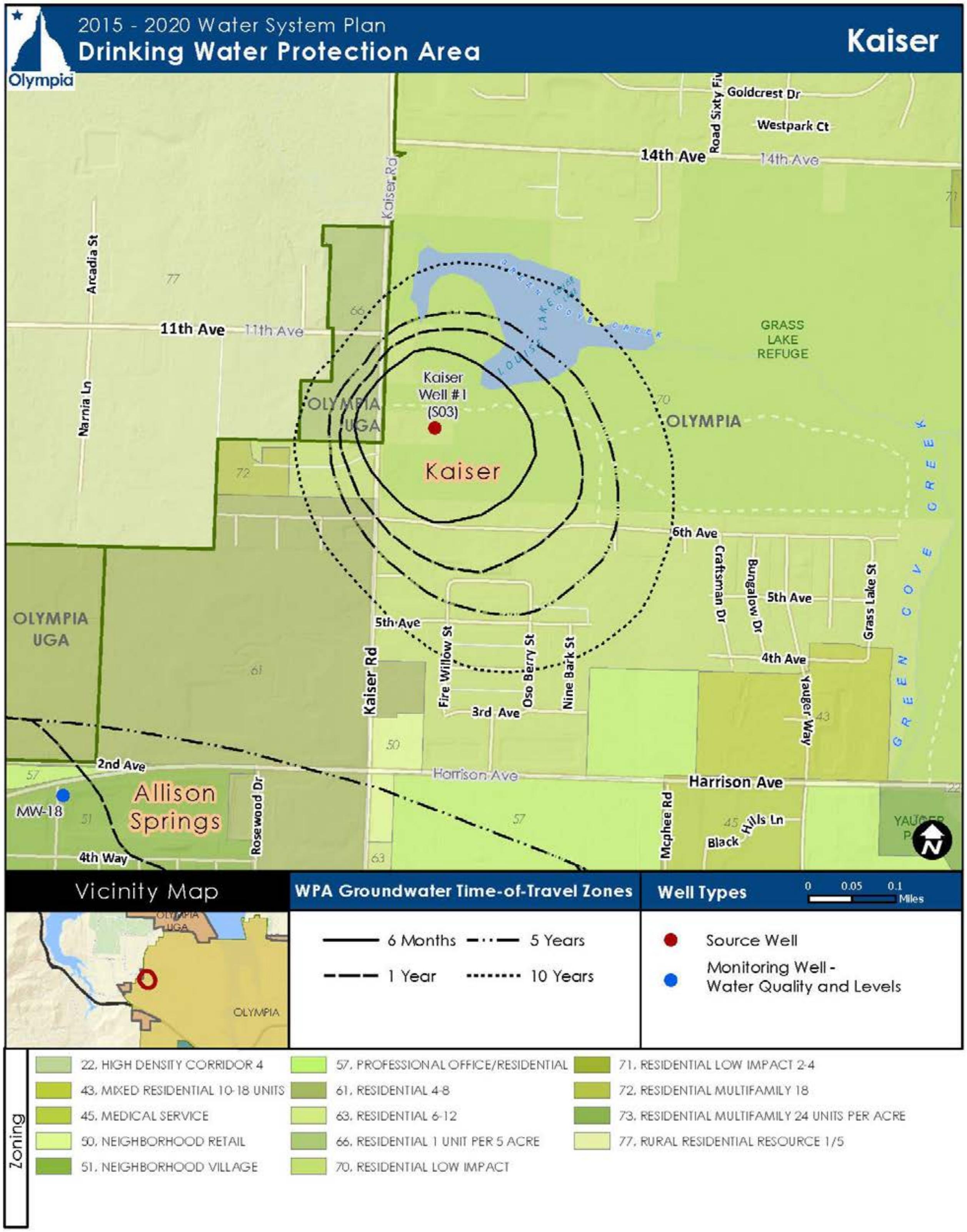
Map 7.7
Allison Springs
DWPA



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Map 7.8
Kaiser
DWPA

Source Infrastructure Chapter 8

Chapter 8 – Source Infrastructure – Contents

Tables

CHAPTER 8 - SOURCE INFRASTRUCTURE

Source infrastructure projects help meet the Drinking Water Utility's Goal 6:

> **Infrastructure is prudently financed, and sustainably constructed, maintained and operated to ensure reliable delivery of high quality water to a growing community.**

The 2015-2020 strategy for source projects is to develop and maintain multiple, geographically dispersed water supplies to enhance system reliability.

Other projects for improving the infrastructure are discussed in Chapter 9 (Storage Infrastructure) and Chapter 10 (Transmission/Distribution Infrastructure). Water quality strategies are in Chapter 11 and operations and maintenance strategies are in Chapter 12.

This chapter describes existing sources, evaluates their ability to meet current and projected needs, and identifies projects to be constructed in 2015-2020. Washington State Department of Health (DOH) rules on source development are in Chapter 173-160 WAC and Chapter 246-290 WAC, Part 3 (design of public water systems). Detailed specifications are in the DOH Design Manual.

8.1 Description of Existing Source

Olympia's current drinking water sources are McAllister Wellfield and six additional groundwater wells. They tap aquifers to obtain water that is of adequate quality and sufficient quantity to provide a long-term supply of water to the City's system. Chapter 4 describes each source, with information about water rights; Chapter 7 provides hydrogeological details about each source aquifer; and Chapter 11 includes water quality and treatment protocols.

Each of these sources is described below. Map 1.4 in Chapter 1 shows where these sources are located. Table 8.1 is an inventory of equipment at each source.

McAllister Wellfield

Olympia's main source of drinking water is McAllister Wellfield (S16), a more protected and productive source than McAllister Springs. The Wellfield is located approximately a mile southeast of McAllister Springs and eight miles east of Olympia.

The Washington State Department of Ecology (Ecology) approved developing the water rights in three phases, with full development by 2050:

- Phase 1 included drilling one new well and rehabilitating two existing wells drilled in the late 1990s. Phase 1 has a target production rate of 15 million gallons per day (Mgd) and replaced the capacity of McAllister Springs. Construction of Phase 1 was completed in 2014. Phase 1 will provide sufficient water to meet summer water demands until Phase 2 supplies come on line.
- Phase 2, planned to come on line around 2030, will increase production levels to 19.6 Mgd for the City and provide 0.5 Mgd for the Nisqually Tribe.
- Phase 3, scheduled for completion by 2050, will raise production to 23.06 Mgd for Olympia and 3 Mgd for the Tribe, thereby maximizing full use of the water rights.

Table 8.1 Source Equipment Inventory

Source Name	Pump Type	Pump Model	Pump Size (HP)	Current Capacity (GPM)	Year Installed	Current Capacity (Mgd)	Well Diameter (Inches)	Well Depth (ft.)
McAllister TW-22 (S13)	Turbine	Ruhrpumpen	200	1,500	2014	2.16	12	370
McAllister PW-24 (S14)	Turbine	Ruhrpumpen	400	2,900	2014	4.18	20	400
McAllister PW-25 (S15)	Turbine	Ruhrpumpen	700	6,100	2014	8.78	24	425
Total McAllister Wellfield (S16)						15.12		
Hoffman Well 3 (S08)	Submersible	Byron Jackson	100	1,000	1985	1.44	10	378
Shana Park Well 11 (S10)	Submersible	American Marsh	25	1,000	2005	1.44	16	100
Indian Summer Well 20 (S12)	Submersible	Peerless	125	850[1]	2008	1.22[1]	12	213
Kaiser Well 1 (S03)	Submersible	Peabody	25	360	1992	0.52	12	92
Allison Springs Well 13 (S09)	Submersible	American Marsh	40	650	2005	0.94	16	200
Allison Springs Well 19 (S11)	Submersible	American Turbine	60	900	2005	1.30	16	183
Total Other Wells						6.86		

1. Based on water right and pump test.

Pumping Facilities

McAllister Wellfield pumps were installed in 2014 in three wells. The wells are called PW (Production Well)-24, TW (Test Well)-22, and PW-25. PW-24 and TW-22 were drilled in 1998 as part of the investigation to determine the best location for the City's new water source. PW-25 was drilled and tested in 2013 after Ecology granted the City and Nisqually Tribe water rights for the new source. PW-24 is a 20-inch diameter well that produces 2,900 gallons per minute (gpm); TW-22 is a 12-inch diameter well that produces 1,500 gpm; and PW-25 is a 24-inch diameter well that produces 6,100 gpm. The pumps are located in concrete masonry block buildings. The wells pump into 36-inch, 30-inch and 24-inch ductile iron pipe and then to a 36-inch welded steel transmission main that heads north about 4,100 feet and connects to the original 36-inch main just west of McAllister Springs before heading to the Meridian Storage Tanks.

The susceptibility assessment forms and well logs for the McAllister Wellfield wells are in Appendix 7-1.

Power Supply

Power for the facility, including pumps, pump controls, chlorination equipment and telemetry systems, is provided by an air-cooled, 1,500 KVA, three-phase transformer located adjacent to the PW-25 well house.

Underground power follows the 36-inch transmission main about 4,100 feet north of the McAllister Wellfield and connects to three-phase power at Old Pacific Highway.

An emergency diesel generator capable of powering PW-24, chlorination equipment, telemetry and other systems is located at PW-25. The generator is capable of powering the 2,900 gpm well pump at PW-24. The City's winter water demands can be met using only PW-24 plus the other five City wells, rendering TW-22 and PW-25 unnecessary during a winter power outage. Power outages are more common in winter than in the summer. If necessary, the Utility has provisions to add generator capacity with Phase 2 of the wellfield development.

Water Quality Treatment

Water pumped from McAllister Wellfield is disinfected with chlorine before it reaches the Meridian Storage Tanks. At the chlorine source is an automatic switchover manifold feed system. The supply room is equipped with dual scales, ventilation, alarm systems and emergency response equipment. Aeration towers at the Meridian Storage Tanks raise the pH of the wellfield water from about 6.5 to 7.8. Because the City's population is over 50,000, Olympia is required by DOH to optimize for pH adjustment of its sources (Chapter 11).

East Olympia Area Wells

The three wells located in East Olympia are described below.

Hoffman Well 3 (S08)

In 1985, the City drilled the 16-inch-diameter Hoffman Well 3 (S08) in Zone 417. The well and pumping facilities are in a locked enclosure and have been used primarily to meet peak hour demands since May 1985.

The well casing extends 378 feet from the ground surface through various glacial deposits to bedrock. A 34-foot stainless steel screen was installed between the depths of 324 and 358 feet. Aquifer pump testing indicates a sustained yield of 1,000 gpm. This well is considered to be in good condition and requires only routine maintenance. Water quality testing indicates that the well produces water with levels of iron and manganese in excess of secondary maximum contaminant levels, which is an aesthetic rather than a health-related concern. Consequently, its use is restricted to peak hours only when needed to supplement the supply. The well pumps directly into a storage tank where mixing dilutes the higher iron and manganese levels.

Shana Park Well 11(S10)

In 1988 Shana Park Well 11 (S10) was drilled to a depth of 100 feet in Zone 417. Casing perforations begin at 38 feet. The capacity of this well is approximately 1,000 gpm. The well pump was replaced in 2005 with a more energy efficient 25-hp pump, using a 50 percent funding grant from Puget Sound Energy.

In 1989, a treatment facility was installed to elevate pH by injecting soda ash into the water. The slightly acidic nature of the aquifer (pH 6.2) had created localized complaints of blue discoloration from corroded copper leaching in household plumbing. In 1996, the Utility constructed an aeration tower, which strips the dissolved carbon dioxide from the water and raises the pH to about 7.6. This pH level allows the City to meet the requirements of the federal Lead/Copper Rule (Chapter 11**).**

In the long term, the Utility intends to shift the Shana Park Well to emergency use only because of concerns over rising nitrate levels and overall vulnerability to contamination (Chapter 7).

Well 11 is considered to be in good condition and requires only routine maintenance.

Indian Summer Well 20 (S12)

Indian Summer is a gated Master Planned Community with a golf course, located in Southeast Olympia off Yelm Highway. The community is completely built out, with about 500 single-family homes, town homes and condominiums. Indian Summer Well 20 (S12) is located in the center of the community, at the entrance to the community-owned 36-acre Nature Preserve.

The well was drilled in 1993 to a depth of 213 feet and is located in Zone 417. The initial aquifer pumping test in 1993 indicated a potential short-term pumping capacity of 900 gpm with long-term continuous capacity of 650 gpm. A minor amount of fine sand was produced at start-up. In 2006, the Utility redeveloped the well to eliminate the sand and confirm the well capacity. The short-term production was confirmed at 900 gpm while the continuous long-term pumping improved to 700 gpm. The Indian Summer Well water right limits the instantaneous pumping rate to 850 gpm. An on-site chlorine generation system using a brine solution is used to disinfect the water.

West Olympia Area Wells

Three wells located in West Olympia, in the Allison Springs/Kaiser Road area of West Olympia, are described below.

Kaiser Well 1 (S03)

Kaiser Well 1 (S03), located in Zone 298, was first put into service in 1976. Aquifer pumping tests indicated a sustained capacity of 340 to 380 gpm, with a stabilized drawdown after four hours of pumping, although flow was originally restricted to 280 gpm to prevent over-pumping. The well is equipped with a water-lubed 25-hp submersible pump. The original pump was replaced in 1992 with a larger capacity pump that is producing 360 gpm.

DOH approved gas chlorination in August 2010. This well is considered to be in good condition and requires only routine maintenance. However during dry periods in the summer, aquifer levels can drop to the point where the pump has to be shut off.

Allison Springs Well 13 (S09)

Allison Springs Well 13 (S09) was installed near Allison Springs to augment the supply to Olympia's west side (Zone 298). It consists of a 16-inch steel casing drilled to a depth of 200 feet with the screens set between 171 and 185 feet. The original 125-hp pump was replaced in 2005 with a more energy-efficient 40-hp pump, using a 50 percent grant from Puget Sound Energy. Installed well capacity is 900 gpm. The current pumping rate is approximately 650 gpm. Well 13 is considered to be in good condition and requires only routine maintenance.

Allison Springs Well 19 (S11)

Allison Springs Well 19 (S11) is located near Well 13 in Zone 298. It consists of a 16-inch steel casing drilled to a depth of 183 feet and is screened in a sand and gravel aquifer that lies 120 to 160 feet below the surface. In 2005, the well pump was replaced with a more energy efficient 60-hp pump, using a 50 percent grant from Puget Sound Energy. The current pumping rate is approximately 900 gpm. The Utility is considering options to increase the yield, as needed.

In 1996, an aeration facility was installed to strip the dissolved carbon dioxide from water from Wells 13 and 19 to raise pH. Water from both wells is pumped to the aeration tower, where it then flows to a clear well. Water is pumped to the water system from the clear well. The clear well has two variable speed pumps that automatically adjust output to match variations in well production. Well 19 is considered to be in good condition and requires only routine maintenance.

8.2 Source Capacity Analysis

The ability of existing sources to meet current and projected water supply requirements was evaluated for this Plan. This section presents the capacity analysis design criteria and a discussion of the evaluation results.

Design Criteria

The DOH requires that sources of supply be sufficient to meet maximum day demands (MDD) for each pressure zone within a system, as well as for the system as a whole. Therefore, this evaluation compares the City's total groundwater source capacity with full system water demand, as well as the source and booster pump station capacities within each pressure zone with water demand specific to that zone.

This source capacity analysis utilizes the "baseline" water demand forecast presented in Chapter 3 (Table 3.9), and does not include the effects of additional water conservation or the potential impacts of climate change on future water demands. This approach is taken for the following reasons:

- Future water conservation goals may not be fully realized, as they are dependent upon unpredictable customer behavior changes. Excluding potential future water demand reductions ensures that source capacities are sufficient to meet needs if conservation goals are not attained.
- Significant uncertainties also exist with regard to the potential effects of climate change on future demand, as discussed in Chapter 3. The Utility will monitor demand and weather variables closely in order to refine demand forecasts and source capacity analyses when needed.

These two factors will tend to alter water demands in an opposing fashion over time. While conservation savings serve to reduce future water demand, climate change may result in increased demands. Thus, the effects of one variable may be offset by the impacts of the other, resulting in minimal net change to the water demand forecast.

Evaluation of Source Capacity

Source capacity was evaluated for the entire system and then for each pressure zone or zone combination. Each evaluation compares the projected MDD with existing source capacities under two conditions:

- Assuming only existing sources are available, in order to identify source deficiencies.
- Including planned future source capacities, to highlight the ability of these new sources to address identified deficiencies.

All evaluations assume 24-hour-per-day source operation. The location of each zone is shown on Map 1.4, Chapter 1.

Full System

Table 8.2 summarizes the comparison of the City's total available source capacity with current and future system-wide demands. Current sources provide adequate supply capacity beyond 2064, the 50-year planning horizon. Additional planned sources will serve to bolster the system's reliability in the future (see also Chapter 4).

The City has transferred its McAllister Springs water rights to the McAllister Wellfield. The current capacity of the McAllister Wellfield is 10,500 gpm (15.12 Mgd). Phase 2 of the wellfield development, planned for 2030, will increase the capacity by 3,111 gpm to 13,611 gpm (19.60 Mgd) for the City.

Phase 3 production of the wellfield reflects the long-term development under the full Abbott Springs water right to meet Olympia's and the Nisqually Tribe's 50-year planning horizon, and would be completed sometime between 2030 and 2050. Maximum production at full build-out will be 23.06 Mgd for Olympia and 3.0 Mgd for the Nisqually Tribe.

The City's other planned sources are:

- **Briggs Well.** Construction of this new well in southeast Olympia is scheduled to begin in 2019, with the source considered to be online sometime between 2020 and 2034.
- **Olympia Brewery.** In partnership with the cities of Lacey and Tumwater, Olympia has obtained water rights associated with the former Olympia Brewery property. The timing and capacity of this source are uncertain, as the wellfield and associated infrastructure is currently in planning and development by the three cities.

(See Chapter 4 for details on these new sources.)

These new sources support the City's intent to secure a 50-year supply of water, as mandated in the Comprehensive Plan. Also, as geographically dispersed sources, they will provide additional system reliability. In total, the City is projected to have a source surplus of 12.55 Mgd in 2064, even without including the Olympia Brewery supply.

Zones 338 and 417

Pressure Zones 338 and 417, in the southeast and east part of the service area, are evaluated in combination. Both zones receive water from the same sources: the Shana Park Well (S10), Hoffman Well (S08), Indian Summer Well 20 (S12), South Sound Booster Station and Fones Road Booster Station. These sources feed directly into Zone 417 and indirectly into Zone 338 via a flow control valve that allows water to enter the Boulevard Storage Tank (which then establishes the hydraulic grade in Zone 338). A pressure reducing valve (PRV) on Yelm Highway is another way for water to move from Zone 417 to Zone 338. The zones cannot be analyzed independently (from a source perspective) and have been combined into one analysis zone.

The South Sound and Fones Road Booster Stations receive water through a 36-inch water main from the Meridian Storage Tanks and provide the primary supply to these zones. Shana Park

Well 11 (S10) provides a significant portion of the total supply capacity, while Hoffman Well 3 (S08) is used only during emergencies and on high demand days. Indian Summer Well (S12) was added to supplement supply to these zones.

Table 8.3 summarizes the source adequacy evaluation for Zones 338 and 417. Existing supplies are sufficient to meet demands throughout the entire planning period.

The addition of the planned Briggs Well (S13), which will feed directly into these zones, will supplement supplies in these zones. With this additional source, the zones will have a supply surplus of 5.36 Mgd in 2034.

Table 8.2 Evaluation of Source Adequacy for Full System

	Year				
	2014	2020	2034	2064	Max(2)
Equivalent Residential Units (ERUs)	53,015	43,526 (1)	51,148	66,507	74,075
Projected Demand - Gallons per Day (gpd) (3)					
Average Day	8,800,531	7,164,936	8,490,516	11,040,111	12,296,442
Maximum Day	15,376,302	14,031,639	15,942,720	18,943,337	21,456,000
Evaluation of Existing Sources					
Available Existing Source (gpd)(4)					
McAllister Wellfield (S16) (10,500 gpm)	15,120,000	15,120,000	15,120,000	15,120,000	15,120,000
Allison Springs Well 19 (S11) (900 gpm)	1,296,000	1,296,000	1,296,000	1,296,000	1,296,000
Allison Springs Well 13 (S09) (650 gpm)	936,000	936,000	936,000	936,000	936,000
Shana Park Well 11 (S10) and Corrosion Facility (1,000 gpm)	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000
Hoffman Well 3 (S08) (1,000 gpm)	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000
Kaiser Rd. Well 1 (03) (360 gpm)(9)	518,400	0	0	0	0
Indian Summer Well 20 (S12) (850 gpm)	1,224,000	1,224,000	1,224,000	1,224,000	1,224,000
Total Available Source (gpd)	21,974,400	21,456,000	21,456,000	21,456,000	21,456,000
Source Surplus/(Deficiency) (gpd)	**6,598,098**	**7,424,361**	**5,513,280**	**2,512,663**	**0**
Evaluation of Future Sources					
Future Source (gpd)(4)					
Briggs Well (1,100 gpm)(5)	0	0	1,584,000	1,584,000	1,584,000
McAllister Wellfield Phase 2 (3,111 gpm)(6)	0	0	4,480,000	4,480,000	4,480,000
McAllister Wellfield Phase 3 (2,403 gpm)(7)	0	0	0	3,456,000	3,456,000
Brewery Wellfield(8)	0	0	TBD	TBD	TBD
Total Available Source (Existing + Future) (gpd)	21,974,400	21,456,000	27,520,000	30,976,000	30,976,000
Source Surplus/(Deficiency) (gpd)	**6,598,098**	**7,424,361**	**11,577,280**	**12,032,663**	**9,520,000**

1. The total demand served by Olympia's sources decreases from 2014 to 2020 because the forecast assumes that a substantial quantity of water now delivered to the City of Lacey will be supplied by Lacey's own sources by 2017. Without the water delivered to Lacey, there would be 39,634 ERUs in 2014.
2. Maximum ERUs to be served with current sources, based on maximum production rate (i.e., 24 hours per day).
   Max ERUs = Total Available Source / Maximum Day Demand per ERU (322 gpd/ERU for additional demand beyond 2064).
3. Projected demands taken from Chapter 3. ERUs calculated as Average Day Demand / ERU water use factor (166 gpd/ERU).
4. Assumes source pumps are operating at the maximum production rate (i.e., for 24 hours per day).
5. The Briggs Well is anticipated to be online between 2020 and 2034.
6. Phase 2 of the McAllister Wellfield development will allow the City to make full use of the transferred McAllister Springs water right (13,611 gpm or 19.6 Mgd). The second phase is planned for 2030. Therefore the additional supply capacity is the full water right (13,611 gpm) less normal operating capacity of the wellfield (10,500 gpm).
7. Phase 3 of the McAllister wellfield development will provide an additional source capacity of 2,400 gpm or 3.46 Mgd. Water rights from Abbott Springs (6.46 Mgd) will be transferred to the wellfield in 2050. Per an agreement between the City and the Nisqually Tribe, the City will use 3.46 Mgd of the water right and the remaining water rights will be used by the Nisqually Tribe.
8. The Brewery well source is currently in development and the timing and estimated capacity has not been determined.
9. Kaiser Road Well 1 (S03) will likely be converted to an emergency source prior to 2020, and is therefore not considered as an available source in the analysis for future years.

Table 8.3 Evaluation of Source Adequacy for Zone 417 and Zone 338

	Year			
	2014	**2020**	**2034**	**Max[(1)]**
Equivalent Residential Units (ERUs)	14,916	16,571	20,904	32,290
Projected Demand - Gallons per Day (gpd) [(2)]				
Average Day	2,476,078	2,750,789	3,470,119	5,360,182
Maximum Day	4,890,788	5,387,080	6,515,875	10,296,000
Evaluation of Existing Sources				
Available Existing Source (gpd)[(3)]				
South Sound Booster (2,350 gpm)[(4)]	3,384,000	3,384,000	3,384,000	3,384,000
Fones Road Booster (1,950 gpm)[(5)]	2,808,000	2,808,000	2,808,000	2,808,000
Shana Park Well 11 (S10) and Corrosion Facility (1,000 gpm)	1,440,000	1,440,000	1,440,000	1,440,000
Hoffman Well 3 (S08) (1,000 gpm)	1,440,000	1,440,000	1,440,000	1,440,000
Indian Summer Well 20 (S12) (850 gpm)	1,224,000	1,224,000	1,224,000	1,224,000
Total Available Source (gpd)	10,296,000	10,296,000	10,296,000	10,296,000
Source Surplus/(Deficiency) (gpd)	**5,405,212**	**4,908,920**	**3,780,125**	**0**
Evaluation of Future Sources				
Future Source (gpd)[(4)]				
Briggs Well (1,100 gpm)[(6)]	0	0	1,584,000	1,584,000
Total Available Source (Existing + Future) (gpd)	10,296,000	10,296,000	11,880,000	11,880,000
Source Surplus/(Deficiency) (gpd)	**5,405,212**	**4,908,920**	**5,364,125**	**1,584,000**

1. Maximum ERUs to be served with current sources, based on maximum production rate (i.e., 24 hours per day). Max ERUs = Total Available Source / Maximum Day Demand per ERU (322 gpd/ERU for additional demand beyond 2034).
2. Projected demands taken from Chapter 4. ERUs calculated as Average Day Demand / ERU water use factor (166 gpd/ERU).
3. Assumes source pumps are operating at the maximum production rate (i.e., for 24 hours per day).
4. Station contains three pumps at 1,000 gpm each. Capacity of the station is 2,350 gpm with three pumps or 1,600 gpm with two pumps, when the Fones Road Booster Station is also operating.
5. Station contains three pumps at 1,000 gpm each. Capacity of the station is 1,950 gpm with three pumps or 1,400 gpm with two pumps, when the South Sound Booster Station is also operating.
6. The Briggs Well is anticipated to be online between 2020 and 2034.

Zone 347

The Eastside Booster Station supplies water to pressure Zone 347 with three pumps, each rated at 1,000 gpm. The combined supply capacity is 2,400 gpm. The source adequacy evaluation, summarized in Table 8.4, indicates that the booster station provides sufficient supply capacity throughout the entire planning period.

Table 8.4 Evaluation of Source Adequacy for Zone 347

	Year			
	2014	**2020**	**2034**	**Max(1)**
Equivalent Residential Units (ERU's)	3,398	4,038	4,455	10,682
Projected Demand - Gallons per Day (gpd) (2)				
Average Day	564,064	670,307	739,501	1,773,217
Maximum Day	1,132,020	1,312,714	1,388,568	3,456,000
Evaluation of Existing Sources				
Available Existing Source (gpd)(3)				
Eastside Booster (2,400 gpm)	3,456,000	3,456,000	3,456,000	3,456,000
Total Available Source (gpd)	3,456,000	3,456,000	3,456,000	3,456,000
Source Surplus/(Deficiency) (gpd)	**2,323,980**	**2,143,286**	**2,067,432**	**0**

1. Maximum ERUs to be served with current sources, based on maximum production rate (i.e., 24 hours per day). Max ERUs = Total Available Source / Maximum Day Demand per ERU (322 gpd/ERU for additional demand beyond 2064).
2. Projected demands taken from Chapter 3. ERUs calculated as Average Day Demand / ERU water use factor (166 gpd/ERU).
3. Assumes source pumps are operating at the maximum production rate (i.e., for 24 hours per day).

Zone 264

Zone 264 is in the center of the City's service area and obtains water from the distribution system primarily via a 16-inch connection from the 36-inch transmission main. Additional supply comes from the Capitol Way PRV, which is capable of transferring water from Zone 338 into Zone 264 under high demand situations. As indicated in Table 8.5, these supplies provide sufficient capacity throughout the planning period.

Table 8.5 Evaluation of Source Adequacy for Zone 264

	Year			
	2014	2020	2034	Max[1]
Equivalent Residential Units (ERU's)	2,802	2,800	3,108	16,911
Projected Demand - Gallons per Day (gpd) [2]				
Average Day	465,173	464,733	515,895	2,807,145
Maximum Day	935,691	910,123	968,701	5,551,200
Evaluation of Existing Sources				
Available Existing Source (gpd)[3]				
10" Water Main (2,545 gpm)	3,664,800	3,664,800	3,664,800	3,664,800
Capitol Way PRV (1,310 gpm)	1,886,400	1,886,400	1,886,400	1,886,400
Total Available Source (gpd)	5,551,200	5,551,200	5,551,200	5,551,200
Source Surplus/(Deficiency) (gpd)	**4,615,509**	**4,641,077**	**4,582,499**	**0**
Evaluation of Future Sources				

1. Maximum ERUs to be served with current sources, based on maximum production rate (i.e., 24 hours per day). Max ERUs = Total Available Source / Maximum Day Demand per ERU (322 gpd/ERU for additional demand beyond 2034).
2. Projected demands taken from Chapter 3. ERUs calculated as Average Day Demand / ERU water use factor (166 gpd/ERU).
3. Assumes source pumps are operating at the maximum production rate (i.e., for 24 hours per day).

Zone 226, 298, and 380

Due to the hydraulic characteristics of Zones 226, 298 and 380, these three zones are analyzed in combination, as well as independently of each other. Previous hydraulic analyses indicate that the capacity of the 36-inch supply line from the Fir Street Storage Tanks, which feeds Zone 226, is nearly 4,000 gpm. The West Bay Booster Station feeds Zone 380 from Zone 226. The Percival Booster Pump Station feeds Zone 298 from Zone 226. Zone 298 is also supplied directly by the Allison Springs Wells 13 (S09) and 19 (S11), and the Kaiser Road Well 1 (S03). Additional supply is provided to Zone 298 via a pressure reducing valve that allows for water to enter this zone from Zone 380. Additional supply to Zone 226 is provided by another pressure reducing valve from Zone 298. If needed, water can also be transferred from Zone 298 to Zone 380 via the Elliot Booster Station.

When analyzed together, the three zones have sufficient supply capacity throughout the planning period, as shown in Table 8.6.

Table 8.7 shows the analysis of Zones 298 and 380 together. Assuming 24-hour pumping, Zones 298 and 380 have adequate supply through 2034.

Table 8.8 shows the analysis of Zone 380 by itself. Assuming 24-hour pumping, Zone 380 has adequate supply through 2034.

Table 8.6 Evaluation of Source Adequacy for Zone 226, 298 and 380

	Year			
	2014	**2020**	**2034**	**Max[1]**
Equivalent Residential Units (ERUs)	18,736	19,754	22,681	25,459
Projected Demand - Gallons per Day (gpd) [2]				
Average Day	3,110,149	3,279,106	3,765,001	4,226,213
Maximum Day	6,232,737	6,421,722	7,069,576	7,992,000
Evaluation of Existing Sources				
Available Existing Source (gpd)[3]				
36" Water Main (4,000 gpm)	5,760,000	5,760,000	5,760,000	5,760,000
Allison Well 19 (S11) (900 gpm)	1,296,000	1,296,000	1,296,000	1,296,000
Allison Well 13 (S09) (650 gpm)	936,000	936,000	936,000	936,000
Kaiser Rd. Well 1 (S03) (360 gpm) [4]	518,400	0	0	0
Total Available Source (gpd)	8,510,400	7,992,000	7,992,000	7,992,000
Source Surplus/(Deficiency) (gpd)	**2,277,663**	**1,570,278**	**922,424**	**0**

1. Maximum ERUs to be served with current sources, based on maximum production rate (i.e., 24 hours per day). Max ERUs = Total Available Source / Maximum Day Demand per ERU (322 gpd/ERU for additional demand beyond 2034).
2. Projected demands taken from Chapter 3. ERUs calculated as Average Day Demand / ERU water use factor (166 gpd/ERU).
3. Assumes source pumps are operating at the maximum production rate (i.e., for 24 hours per day).
4. Kaiser Road Well 1 (S03) will likely be converted to an emergency source prior to 2020, and is therefore not considered as an available source in the analysis for future years.

Table 8.7 Evaluation of Source Adequacy for Zone 298 and Zone 380

	Year			
	2014	**2020**	**2034**	**Max[1]**
Equivalent Residential Units (ERUs)	13,751	14,433	16,432	28,547
Projected Demand - Gallons per Day (gpd) [2]				
Average Day	2,282,649	2,395,939	2,727,632	4,738,782
Maximum Day	4,583,196	4,692,149	5,121,700	9,144,000
Evaluation of Existing Sources				
Available Existing Source (gpd)[3]				
Westbay Booster (2,400 gpm)[4]	3,456,000	3,456,000	3,456,000	3,456,000
Percival Booster (2,400 gpm)	3,456,000	3,456,000	3,456,000	3,456,000
Allison Well 19 (S11) (900 gpm)	1,296,000	1,296,000	1,296,000	1,296,000
Allison Well 13 (S09) (650 gpm)	936,000	936,000	936,000	936,000
Kaiser Rd. Well 1 (S03) (360 gpm) [5]	518,400	0	0	0
Total Available Source (gpd)	9,662,400	9,144,000	9,144,000	9,144,000
Source Surplus/(Deficiency) (gpd)	**5,079,204**	**4,451,851**	**4,022,300**	**0**

1. Maximum ERUs to be served with current sources, based on maximum production rate (i.e., 24 hours per day). Max ERUs = Total Available Source / Maximum Day Demand per ERU (322 gpd/ERU for additional demand beyond 2034).
2. Projected demands taken from Chapter 3. ERUs calculated as Average Day Demand / ERU water use factor (166 gpd/ERU).
3. Assumes source pumps are operating at the maximum production rate (i.e., for 24 hours per day).
4. Actual installed capacity is 3,000 gpm. System hydraulics limit total pumping capacity to 2,400 gpm.
5. Kaiser Road Well 1 (S03) will likely be converted to an emergency source prior to 2020, and is therefore not considered as an available source in the analysis for future years.

Table 8.8 Evaluation of Source Adequacy for Zone 380

	Year			
	2014	**2020**	**2034**	**Max(1)**
Equivalent Residential Units (ERU's)	4,846	4,883	5,667	20,732
Projected Demand - Gallons per Day (gpd) (2)				
Average Day	804,433	810,536	940,683	3,441,518
Maximum Day	1,591,438	1,587,335	1,766,329	6,768,000
Evaluation of Existing Sources				
Available Existing Source (gpd)(3)				
Westbay Booster (2,400 gpm) (4)	3,456,000	3,456,000	3,456,000	3,456,000
Elliot Booster (2,300 gpm)	3,312,000	3,312,000	3,312,000	3,312,000
Total Available Source (gpd)	6,768,000	6,768,000	6,768,000	6,768,000
Source Surplus/(Deficiency) (gpd)	**5,176,562**	**5,180,665**	**5,001,671**	**0**

1. Maximum ERUs to be served with current sources, based on maximum production rate (i.e., 24 hours per day).
   Max ERUs = Total Available Source / Maximum Day Demand per ERU (322 gpd/ERU for additional demand beyond 2034).
2. Projected demands taken from Chapter 3. ERUs calculated as Average Day Demand / ERU water use factor (166 gpd/ERU).
3. Assumes source pumps are operating at the maximum production rate (i.e., for 24 hours per day).
4. Actual installed capacity is 3,000 gpm. System hydraulics limits total pumping capacity to 2,400 gpm.

8.3 2015-2020 Source Infrastructure Projects

The source infrastructure projects planned for 2015-2020 will help meet the Drinking Water Utility's Goal 6:

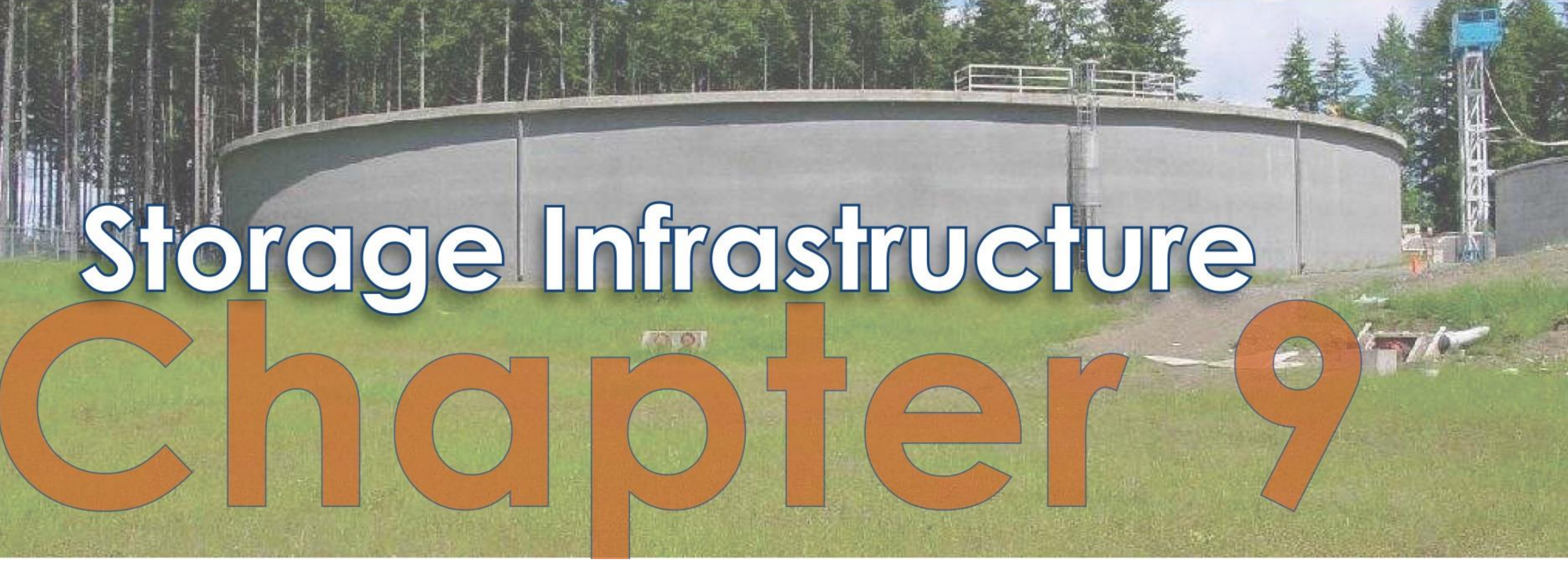
> **Infrastructure is prudently financed, and sustainably constructed, maintained and operated to ensure reliable delivery of high quality water to a growing community.**

Objective 6A is to design and construct infrastructure to ensure reliable delivery of water. These projects will implement Strategy 6A1: Develop and maintain multiple, geographically dispersed sources of water supply to enhance the reliability of the system. Chapters 9 and 10 describe storage and transmission/distribution infrastructure; Chapter 12 describes operations and maintenance of the infrastructure. Water quality strategies are in Chapter 11.

The City's Capital Improvement Program includes the following supply source projects, which may be deferred beyond 2020:

- Briggs Well. Construction of this 1,100 gpm supply well will provide an additional 1.58 Mgd of daily supply capacity for Zones 338 and 417.
- Olympia Brewery engineering evaluation of possible operational and source development options for the Brewery water source (with Cities of Tumwater and Lacey).

Project level cost estimates are shown in Chapter 13, Table 13.2.



Chapter 9 - Storage Infrastructure - Contents

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CHAPTER 9 - STORAGE INFRASTRUCTURE

Storage projects help meet the Drinking Water Utility's Goal 6:

> **Infrastructure is prudently financed, and sustainably constructed, maintained and operated to ensure reliable delivery of high quality water to a growing community.**

The 2015-2020 the strategy is to develop and maintain storage and transmission/distribution infrastructure to ensure delivery of water at adequate pressure throughout the system and maintain required fire flow.

Other projects for improving the infrastructure are discussed in Chapter 8 (Source Infrastructure) and Chapter 10 (Transmission/Distribution Infrastructure); Chapter 12 describes operations and maintenance of the infrastructure. Water quality strategies are in Chapter11.

This chapter describes existing water storage tanks, evaluates their ability to meet current and projected needs, and identifies projects to be constructed in 2015-2020. Washington State Department of Health (DOH) rules on storage facilities are in Chapter 173-160 WAC and Chapter 246-290 WAC, Part 3 (design of public water systems). Detailed specifications are in the DOH Design Manual.

9.1 Description of Existing Storage

The Utility's system has 11 water storage tanks, with a total capacity of 30.88 million gallons. Table 9.1 is an inventory of these facilities, including capacities, elevations and dimensions. Locations are shown in Chapter 1, Map 1.4. Further details regarding the storage tanks serving each pressure zone are provided below in the analysis section.

9.2 Storage Capacity Analysis

This section reports the analysis of how well existing and planned storage facilities support current and future storage requirements. The design criteria upon which the analysis is based are first presented, followed by a discussion of the evaluation results.

Storage Volume Components

According to DOH requirements, water system storage volume is comprised of five separate components:

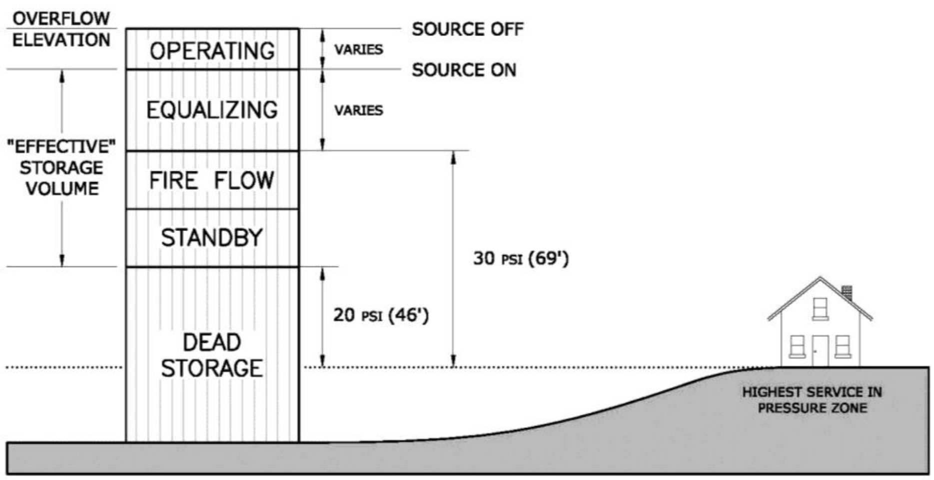
- Operating storage
- Equalizing storage
- Fire flow storage
- Standby storage
- Dead storage

These components are illustrated in Figure 9.1.

Table 9.1 Storage Facilities Inventory

	Meridian No. 1	Meridian No. 2	Fir 226 (north)	Fir 226 (south)	Hoffman 417	Boulevard 338	Eastside 347	Stevens Field 264	Bush 298	Elliott 298	Elliott 380
Zone Served											
Zone Name	All Zones	All Zones	Zone 226	Zone 226	Zone 417	Zone 338	Zone 347	Zone 264	Zone 298	Zone 298	Zone 380
Elevation Range	N/A	N/A	0 – 139 ft	0 – 139 ft	150 – 276 ft	110 – 205 ft	110 – 204 ft	16 – 165ft	0 – 230 ft	0 – 230 ft	0 – 280 ft
Capacity (mg)											
Total	4.0	4.00	2.50	2.50	3.60	2.44	3.43	0.60	1.05	2.00	4.76
Elevations (ft)											
Tank Overflow	301	299	226	226	417	338	347	264	298	298	380
Tank Floor	281	281	206	206	277	238	214	160	258	278	280
Dimensions (ft)											
Engineering Plans	Variable	Variable	Variable	Variable	67-ft Diam.	66-ft Diam.	67-ft Diam.	32	67-ft Diam.	130-ft Diam.	90-ft Diam.
Water Depth	20	20	20	20	140	95.5	130	104	40	20	100
Construction											
Year Constructed	2004	1998	~1935	~1935	1980	2001	1987	2007	2007	1975	1994
Type	Ground level	Ground level	Buried	Buried	Standpipe	Standpipe	Standpipe	Standpipe	Standpipe	Buried	Standpipe
Material	Concrete	Concrete	Concrete	Concrete	Steel	Steel	Steel	Steel	Steel	Concrete	Steel
Security											
Enclosed/covered?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fenced & locked?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Figure 9.1 Storage Components



Operating and Dead Storage

Operating storage is the water that lies between low and high water storage elevations set by City operations staff to control system pumps and flow control valves. Dead volume is the volume at the bottom of the tank that cannot be used because it is physically too low to provide sufficient pressures. Operational and dead storage volumes are subtracted from total storage to determine the effective storage available for equalizing, standby and fire flow.

Equalizing Storage

Equalizing storage is the total volume needed to moderate fluctuations in diurnal demands during periods when the demand exceeds the capacity of the supply system. Equalizing storage requirements are greatest during the peak hours of the maximum day demand. Operation of a properly balanced system results in replenishment of storage facilities during times of day when the demand curve is below the capacity of the supply system, and results in withdrawal from storage facilities when the demand exceeds the supply capacity. The equalizing storage of a storage tank must be located at an elevation that provides a minimum pressure of 30 pounds per square inch (psi) to all customers served by the tank.

Fire Flow Storage

Fire flow is defined as either 1,000 gpm for two hours or 4,000 gpm for four hours, depending on the demographics of the zone. The Olympia Fire Department establishes the fire flow needed for each zone. DOH allows for the “nesting” of standby and fire flow storage, with the larger used for the storage volume. However, the Olympia Fire Department requires that both standby and fire flow volumes be provided.

The required fire flow storage for a given pressure zone is calculated as the required fire flow multiplied by the required duration. The fire flow storage required for Zones 417, 338, 226, 264 and 298 is 960,000 gallons, based on a flow rate of 4,000 gpm for a duration of four hours. The fire flow storage required for Zones 347 and 380 is 120,000 gallons, based on a flow rate of 1,000 gpm for a duration of two hours.

The fire flow storage of a tank must be located at an elevation that provides a minimum pressure of 20 psi to all customers served by the tank.

Standby Storage

Standby storage is required to supply reasonable system demands during a foreseeable system emergency or outage. A key concept is that establishing standby storage involves planning for reasonable system outages – those that can be expected to occur under normal operating conditions, such as a pipeline failure, power outage or valve failure. Major system emergencies, such as those created by an earthquake, are intended to be covered by emergency system operations planning, since construction of sufficient reserve volume to accommodate sustained system demands under emergency conditions is not economically feasible.

DOH has established guidelines for determining minimum required standby storage. This component is calculated as the greater of: two times the average day demand, less multi-source credit; *or* 200 gallons times the number of ERUs served by the storage facility.

The multi-source credit allows the required standby storage to be reduced in pressure zones that have multiple sources of supply. The credit assumes the largest source of supply is out of service. It is calculated as the total source available to a particular pressure zone, or zone combination, less the capacity of the largest source. No credit is allowed for zones having only one source of supply.

DOH recommends that standby storage be located at an elevation that provides a minimum pressure of 20 psi to all customers served by a tank, similar to the fire flow volume requirement.

Evaluation of Storage Capacity

To meet City design standards, storage facilities must be designed so the sum of the required storage for each of the five components is met for the pressure zone(s) that will be served. Detailed results of the storage capacity analysis for each pressure zone are provided below. The minimum required storage for each pressure zone is calculated by adding the five storage components.

In addition to the storage tanks that directly serve the City's pressure zones, as described in the following subsections, the Meridian Storage Tanks provide supplemental standby storage. However, due to the long 36-inch diameter transmission main that links these storage tanks to the distribution system, the City has elected to focus its standby storage capacity analysis on those storage facilities that directly hydraulically feed a pressure zone and/or are in close proximity to the geographic area covered by the zone.

Map 1.1 in Chapter 1 shows the location of the pressure zones and major drinking water system facilities.

Zones 417 and 338

The storage capacities for Zones 417 and 338 are first analyzed together, since the Hoffman Storage Tank provides storage capacity for both zones. The Boulevard Storage Tank provides additional storage for Zone 338. As a combined system, there is sufficient storage through 2034, as shown in Table 9.2.

Zone 417 must also be analyzed independently, as only the Hoffman Storage Tank provides capacity for this zone. Table 9.3 summarizes the analysis for Zone 417. Currently, with only the Hoffman Storage Tank providing gravity storage to this zone, there is a deficiency of approximately 1.2 Mg. To resolve this deficiency, the Utility plans to construct the Log Cabin Storage Tank and have it online in 2016. A new tank the size of the Hoffman Storage Tank would contain approximately 2.5 Mg of effective storage, providing a minimum of 20 psi to all customers within the zone. As a result, storage in this zone would be sufficient through the remainder of the 20-year planning horizon.

Table 9.2 Evaluation of Storage Adequacy for Zone 417 and Zone 338

	Year			
	2015	**2020**	**2034**	**Max [10]**
Projected Equivalent Residential Units (ERUs)	14,916	16,571	20,904	37,330
Projected Demand[1]				
Average Day	2,476,078	2,750,789	3,470,119	6,196,804
Maximum Day	4,890,788	5,387,080	6,515,875	11,969,243
Available, Existing + Future Source (gpd)[2]				
South Sound Booster (2,350 gpm)	3,384,000	3,384,000	3,384,000	3,384,000
Fones Road Booster (1,950 gpm)	2,808,000	2,808,000	2,808,000	2,808,000
Shana Well and Corrosion Facility (1,000 gpm)	1,440,000	1,440,000	1,440,000	1,440,000
Hoffman Well 3 (S08) (1,000 gpm)	1,440,000	1,440,000	1,440,000	1,440,000
Indian Summer Well 20 (S12) (850 gpm)	1,224,000	1,224,000	1,224,000	1,224,000
Briggs Well (1,100 gpm)	0	0	1,584,000	1,584,000
Total Available Source (gpd)	10,296,000	10,296,000	11,880,000	11,880,000
Multi-Source Credit (gpd)[3]	8,568,000	8,568,000	10,152,000	10,152,000
Required Storage Calculations				
Operating Storage (gal)[4]	154,286	154,286	154,286	154,286
Equalizing Storage (gal)[5]	0	0	0	838,582
Standby Storage (gal)[6]	2,983,227	3,314,204	4,180,867	7,466,028
Fire Flow Storage (gal)[7]	960,000	960,000	960,000	960,000
Required Storage				
Greater than 30 psi at highest meter (gal)[8]	154,286	154,286	154,286	992,868
Greater than 20 psi at highest meter (gal)[9]	4,097,512	4,428,490	5,295,152	9,418,896
Existing Storage Greater Than 30 psi (gal)				
Hoffman Storage Tank	3,600,000	3,600,000	3,600,000	3,600,000
New 417 Zone Storage Tank	0	3,600,000	3,600,000	3,600,000
Boulevard Storage Tank	1,629,287	1,629,287	1,629,287	1,629,287
Total Existing Storage at 30 psi (gal)	5,229,287	8,829,287	8,829,287	8,829,287
Storage Surplus/(Deficiency) at 30 psi (gal)	**5,075,001**	**8,675,001**	**8,675,001**	**7,836,419**
Existing Storage Greater Than 20 psi (gal)				
Hoffman Storage Tank	3,600,000	3,600,000	3,600,000	3,600,000
New 417 Zone Storage Tank	0	3,600,000	3,600,000	3,600,000
Boulevard Storage Tank	2,218,896	2,218,896	2,218,896	2,218,896
Total Existing Storage at 20 psi (gal)	5,818,896	9,418,896	9,418,896	9,418,896
Storage Surplus/(Deficiency) at 20 psi (gal)	**1,721,384**	**4,990,407**	**4,123,744**	**0**

1. Projected demands taken from Chapter 3. ERUs calculated as Average Day Demand / ERU water use factor (166 gpd/ERU).
2. Available source assumes source pumps are on for 24 hours in a day, at the maximum production rate.
3. Multi-source credit assumes largest source is out of service (in this case, one pump at South Sound Booster Station, decreasing capacity from 2,350 to 1,150 gpm).
4. Required operating storage is based on storage tank level when pump turns on.
5. Required equalizing storage = (PHD - Total Available Source) x 150 minutes
PHD : (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18
(C & F values obtained from Table 5-1 in DOH Dec 2009 WSDM)
6. Required standby storage for existing source = greater of (2*ADD - Multi source credit) or 200 gallons per ERU.
7. Required fire flow storage = 4,000 gpm x 4 hours.
8. Total required storage greater than 30 psi is equal to the total of operational and equalizing storage.
9. Total required storage greater than 20 psi is equal to the total of operational, equalizing, fire flow, and standby storage.
10. Maximum ERUs with available storage, assuming a 20 psi minimum for standby storage.

Table 9.3 Evaluation of Storage Adequacy for Zone 417

	Year			
	2015	2020	2034	Max (11)
Projected Equivalent Residential Units (ERUs)	12,539	13,520	17,639	18,818
Projected Demand(1)				
Average Day	2,081,498	2,244,268	2,928,140	3,123,719
Maximum Day	4,095,823	4,395,120	5,498,196	5,889,353
Available, Existing + Future Source (gpd)(2)				
South Sound Booster (2,350 gpm)	3,384,000	3,384,000	3,384,000	3,384,000
Fones Road Booster (1,950 gpm)	2,808,000	2,808,000	2,808,000	2,808,000
Shana Park Well 11 (S10) and Corrosion Facility (1,000 gpm)	1,440,000	1,440,000	1,440,000	1,440,000
Hoffman Well 3 (S08) (1,000 gpm)	1,440,000	1,440,000	1,440,000	1,440,000
Indian Summer Well 20 (S12) (850 gpm)	1,224,000	1,224,000	1,224,000	1,224,000
Briggs Well (1,100 gpm)	0	0	1,188,000	1,188,000
Total Available Source (gpd)	10,296,000	10,296,000	11,484,000	11,484,000
Multi-Source Credit (gpd)(3)	8,856,000	8,856,000	10,044,000	10,044,000
Required Storage Calculations				
Operating Storage (gal)(4)	154,286	154,286	154,286	154,286
Equalizing Storage (gal)(5)	0	0	0	0
Standby Storage (gal)(6)	2,507,829	2,703,937	3,527,880	3,763,516
Fire Flow Storage (gal)(7)	960,000	960,000	960,000	960,000
Required Storage				
Greater than 30 psi at highest meter (gal)(8)	154,286	154,286	154,286	154,286
Greater than 20 psi at highest meter (gal)(9)	3,622,114	3,818,223	4,642,166	4,877,802
Existing Storage Greater Than 30 psi (gal)				
Hoffman Storage Tank	1,845,495	1,845,495	1,845,495	1,845,495
New 417 Zone Storage Tank	0	1,845,495	1,845,495	1,845,495
Total Existing Storage at 30 psi (gal)	1,845,495	3,690,989	3,690,989	3,690,989
Storage Surplus/(Deficiency) at 30 psi (gal)	**1,691,209**	**3,536,703**	**3,536,703**	**3,536,703**
Existing Storage Greater Than 20 psi (gal)				
Hoffman Storage Tank	2,438,901	2,438,901	2,438,901	2,438,901
New 417 Zone Storage Tank	0	2,438,901	2,438,901	2,438,901
Total Existing Storage at 20 psi (gal)	2,438,901	4,877,802	4,877,802	4,877,802
Storage Surplus/(Deficiency) at 20 psi (gal)	**(1,183,213)**	**1,059,579**	**235,637**	**0**

1. Projected demands taken from Chapter 3. ERUs calculated as Average Day Demand / ERU water use factor (166 gpd/ERU).
2. Available source assumes source pumps are on for 24 hours in a day, at the maximum production rate.
3. Multi-source credit assumes largest source is out of service (in this case, one pump at South Sound, which decreases capacity from 2,350 to 1,150 gpm)
4. Required operating storage is based on storage tank level when pump turns on.
5. Required equalizing storage = (PHD - Total Available Source) x 150 minutes
   PHD : (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18
   (C & F values obtained from Table 5-1 in DOH Dec 2009 WSDM)
6. Required standby storage for existing source = greater of (2*ADD - Multi source credit) or 200 gallons per ERU.
7. Required fire flow storage = 4,000 gpm x 4 hours.
8. Total required storage greater than 30 psi is equal to the total of operational and equalizing storage.
9. Total required storage greater than 20 psi is equal to the total of operational, equalizing, standby, and fire flow storage.
10. Maximum ERUs with available storage, assuming a 20 psi minimum for standby storage.

Zone 347

Storage capacity is provided to Zone 347 by the Eastside Storage Tank. This storage facility provides sufficient capacity throughout the planning period, as shown in Table 9.4.

Zone 264

Zone 264 is primarily supplied by a 10-inch water main, which receives water from the Meridian Storage Tanks. Additional supply is provided by the Capitol Way pressure reducing valve (PRV) that transfers water from Zone 338 and the Boulevard Storage Tank. Additional storage capacity is provided by the Stevens Field Storage Tank, which was constructed in 2007.

As shown in Table 9.5, the total storage capacity is sufficient to meet storage requirements throughout the planning period. The Meridian Storage Tanks and Stevens Field Storage Tank provide storage capacity for operational and equalization purposes. Hydraulic analyses indicate that fire flow storage is utilized equally from the three storage facilities available to the zone: Meridian, Stevens Field, and Boulevard Storage Tanks.

Zone 226, 298 and 380

The storage capacities for Zones 226, 298, and 380 are first analyzed together, due to the interconnectedness of these zones. The Percival Booster Pump Station can supply storage demands from the Fir Street Storage Tanks to Zones 298 and 380 because it is equipped with on-site power. PRVs allow water to be supplied from the Elliott 380 Storage Tank to Zones 298 and 226. The Elliott 298 and Bush Storage Tanks provide additional storage for Zone 298 and through a PRV to Zone 226. As a combined system, there is sufficient storage through 2034, as shown in Table 9.6.

Zone 380 must also be analyzed independently, since only the Elliott 380 Storage Tank provides storage capacity for this zone. Table 9.7 summarizes the analysis for Zone 380, indicating sufficient storage capacity throughout the planning period.

Table 9.4 Evaluation of Storage Adequacy for Zone 347

	Year			
	2015	2020	2034	Max [10]
Projected Equivalent Residential Units (ERUs)	3,398	4,038	4,455	10,258
Projected Demand[1]				
Average Day	564,064	670,307	739,501	1,702,841
Maximum Day	1,132,020	1,312,714	1,388,568	3,405,682
Available, Existing + Future Source (gpd)[2]				
Eastside Booster (2,000 gpm)	2,880,000	2,880,000	2,880,000	2,880,000
Total Available Source (gpd)	2,880,000	2,880,000	2,880,000	2,880,000
Multi-Source Credit (gpd)[3]	2,880,000	2,880,000	2,880,000	2,880,000
Required Storage Calculations				
Operating Storage (gal)[4]	105,538	105,538	105,538	105,538
Equalizing Storage (gal)[5]	0	0	0	278,095
Standby Storage (gal)[6]	679,595	807,599	890,965	2,051,616
Fire Flow Storage (gal)[7]	120,000	120,000	120,000	120,000
Required Storage				
Greater than 30 psi at highest meter (gal)[8]	105,538	105,538	105,538	383,633
Greater than 20 psi at highest meter (gal)[9]	905,133	1,033,138	1,116,504	2,555,249
Existing Storage Greater Than 30 psi (gal)				
Eastside Storage Tank	1,946,373	1,946,373	1,946,373	1,946,373
Total Existing Storage at 30 psi (gal)	1,946,373	1,946,373	1,946,373	1,946,373
Storage Surplus/(Deficiency) at 30 psi (gal)	**1,840,834**	**1,840,834**	**1,840,834**	**1,562,740**
Existing Storage Greater Than 20 psi (gal)				
Eastside Storage Tank	2,555,249	2,555,249	2,555,249	2,555,249
Total Existing Storage at 20 psi (gal)	2,555,249	2,555,249	2,555,249	2,555,249
Storage Surplus/(Deficiency) at 20 psi (gal)	**1,650,115**	**1,522,111**	**1,438,745**	**0**

1. Projected demands taken from Chapter 3. ERUs calculated as Average Day Demand / ERU water use factor (166 gpd/ERU).
2. Available source assumes source pumps are on for 24 hours in a day, at the maximum production rate.
3. Multi-source credit assumes largest source is out of service (in this case, one pump at Eastside Booster Station at 2,000 gpm since only two pumps operate at once).
4. Required operating storage is based on storage tank level when pump turns on.
5. Required equalizing storage = (PHD - Total Available Source) x 150 minutes
   PHD : (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18
   (C & F values obtained from Table 5-1 in DOH Dec 2009 WSDM)
6. Required standby storage for existing source = greater of (2*ADD - Multi source credit) or 200 gallons per ERU.
7. Required fire flow storage = 1,000 gpm x 2 hours
8. Total required storage greater than 30 psi is equal to the total operational and equalizing storage.
9. Total required storage greater than 20 psi is equal to the total operational, equalizing, standby, and fire flow storage.
10. Maximum ERUs with available storage, assuming a 20 psi minimum for standby storage.

Table 9.5 Evaluation of Storage Adequacy for Zone 264

	Year			
	2015	2020	2034	Max [12]
Projected Equivalent Residential Units (ERUs)	2,802	2,800	3,108	>3,108
Projected Demand [1]				
Average Day	465,173	464,733	515,895	515,928
Maximum Day	935,691	910,123	968,701	968,767
Available, Existing + Future Source (gpd) [2]				
10" Water Main (2,545 gpm)	3,664,800	3,664,800	3,664,800	3,664,800
Capitol Way PRV (1,310 gpm)	1,886,400	1,886,400	1,886,400	1,886,400
Brewery Well (1,000 gpm)	0	0	0	0
Total Available Source (gpd) [3]	5,551,200	5,551,200	5,551,200	5,551,200
Multi-Source Credit (gpd)	3,664,800	3,664,800	3,664,800	3,664,800
Required Storage Calculations				
Operating Storage (gal) [4]	375,000	375,000	375,000	375,000
Equalizing Storage (gal) [5]	0	0	0	0
Standby Storage (gal) [6]	560,450	559,920	621,561	621,600
Fire Flow Storage (gal) [7]	960,000	960,000	960,000	960,000
Required Storage				
Greater than 30 psi at highest meter (gal) [8]	375,000	375,000	375,000	375,000
Greater than 20 psi at highest meter (gal) [9]	1,895,450	1,894,920	1,956,561	1,956,561
Existing Storage Greater Than 30 psi (gal)				
Stevens Field Storage Tank	163,489	163,489	163,489	163,489
Meridian Storage Tanks [10]	1,549,850	1,549,320	1,610,961	1,610,961
Total Existing Storage at 30 psi (gal)	1,713,338	1,712,808	1,774,449	1,774,449
Storage Surplus/(Deficiency) at 30 psi (gal)	**1,338,338**	**1,337,808**	**1,399,449**	**1,399,449**
Existing Storage Greater Than 20 psi (gal)				
Stevens Field Storage Tank	304,882	304,882	304,882	304,882
Meridian Storage Tanks [10]	1,549,850	1,549,320	1,610,961	1,610,961
Boulevard Storage Tank [11]	316,800	316,800	316,800	316,800
Total Existing Storage at 20 psi (gal)	2,171,532	2,171,002	2,232,642	2,232,642
Storage Surplus/(Deficiency) at 20 psi (gal)	**276,082**	**276,082**	**276,082**	**276,082**

1. Projected demands taken from Chapter 3. ERUs calculated as Average Day Demand / ERU water use factor (166 gpd/ERU).
2. Available source assumes source pumps are on for 24 hours in a day, at the maximum production rate.
3. Source for Zone 264 is by gravity from the 36 inch main.
4. Required operating storage is based on storage tank level when pump turns on.
5. Required equalizing storage = (PHD - Total Available Source) x 150 minutes
   PHD : (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18
   (C & F values obtained from Table 5-1 in DOH Dec 2009 WSDM)
6. Required standby storage for existing source = greater of (2*ADD - Multi source credit) or 200 gallons per ERU. The Meridian Storage Tanks supply a portion of the standby storage requirement in the 417 and 338 zones.
7. Required fire flow storage = 4,000 gpm x 4 hours
8. Total required storage greater than 30 psi is equal to the total of operational and equalizing storage.
9. Total required storage greater than 20 psi is equal to the total of operational, equalizing, standby, and fire flow storage.
10. The operating, equalizing, and standby storage requirements for Zone 264 are supplied by the Meridian Storage Tanks. The Meridian Storage Tanks through the 10" water main account for 64% of the fire flow for the entire zone based on the capacity of the 10" waterline (2,545 gpm).
11. Supply from Zone 338 accounts for 33% of the fire flow for the entire zone, based on the capacity of the Bridge PRV (1,310 gpm).
12. Maximum ERUs with available storage, assuming a 20 psi minimum for standby storage. The maximum number of ERUs that can be supported by available storage is much larger than the 20-year projected ERUs, since the City's largest tanks (Meridian) feed this zone directly. However, because the Meridian Tanks are also considered the source of water for some of the City's booster stations, the entire tank capacity is not considered in the analysis for this zone, and it is simply noted that there is sufficient standby storage for this zone beyond the 20-year planning horizon.

Table 9.6 Evaluation of Storage Adequacy for Zone 226, 298 and 380

	Year			
	2015	2020	2034	Max (10)
Projected Equivalent Residential Units (ERUs)	18,736	19,754	22,681	36,004
Projected Demand(1)				
Average Day	3,110,149	3,279,106	3,765,001	5,976,598
Maximum Day	6,232,737	6,421,722	7,069,576	11,492,770
Available, Existing + Future Source (gpd)(2)				
36" Water Main (4000 gpm)	5,760,000	5,760,000	5,760,000	5,760,000
Allison Well 19 (S11) (900 gpm)	1,296,000	1,296,000	1,296,000	1,296,000
Allison Well 13 (S09) (650 gpm)	936,000	936,000	936,000	936,000
Kaiser Well 1 (S03) (360 gpm)	518,400	0	0	0
Indian Springs Well 20 (S12) (850 gpm)	1,224,000	1,224,000	1,224,000	1,224,000
Total Available Source (gpd)	9,734,400	9,216,000	9,216,000	9,216,000
Multi-Source Credit (gpd)(3)	3,974,400	3,456,000	3,456,000	3,456,000
Required Storage Calculations				
Operating Storage (gal)(4)	2,310,124	2,310,124	2,310,124	2,310,124
Equalizing Storage (gal)(5)	33,198	143,516	305,481	1,042,680
Standby Storage (gal)(6)	3,747,167	3,950,730	4,536,145	8,497,195
Fire Flow Storage (gal)(7)	960,000	960,000	960,000	960,000
Required Storage				
Greater than 30 psi at highest meter (gal)(8)	2,343,322	2,453,641	2,615,606	3,352,805
Greater than 20 psi at highest meter (gal)(9)	7,050,489	7,364,370	8,111,751	12,810,000
Existing Storage Greater Than 30 psi (gal)				
Fir 226 (north)	2,500,000	2,500,000	2,500,000	2,500,000
Fir 226 (south)	2,500,000	2,500,000	2,500,000	2,500,000
Bush 298	1,050,000	1,050,000	1,050,000	1,050,000
Elliott 298	2,000,000	2,000,000	2,000,000	2,000,000
Elliott 380	4,760,000	4,760,000	4,760,000	4,760,000
Total Existing Storage at 30 psi (gal)	12,810,000	12,810,000	12,810,000	12,810,000
Storage Surplus/(Deficiency) at 30 psi (gal)	**10,466,678**	**10,356,359**	**10,194,394**	**9,457,195**
Existing Storage Greater Than 20 psi (gal)				
Fir 226 (north)	2,500,000	2,500,000	2,500,000	2,500,000
Fir 226 (south)	2,500,000	2,500,000	2,500,000	2,500,000
Bush 298	1,050,000	1,050,000	1,050,000	1,050,000
Elliott 298	2,000,000	2,000,000	2,000,000	2,000,000
Elliott 380	4,760,000	4,760,000	4,760,000	4,760,000
Total Existing Storage at 20 psi (gal)	12,810,000	12,810,000	12,810,000	12,810,000
Storage Surplus/(Deficiency) at 20 psi (gal)	**5,759,511**	**5,445,630**	**4,698,249**	**0**

1. Projected demands taken from Chapter 3. ERUs calculated as Average Day Demand / ERU water use factor (166 gpd/ERU).
2. Available source assumes source pumps are on for 24 hours in a day, at the maximum production rate.
3. Multi-source credit assumes largest source is out of service (in this case, the 36” water main feed to the Fir Street tanks).
4. Required operating storage is based on storage tank level when pump turns on.
5. Required equalizing storage = (PHD - Total Available Source) x 150 minutes
   PHD : (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18
   (C & F values obtained from Table 5-1 in DOH Dec 2009 WSDM)
6. Required standby storage for existing source = greater of (2*ADD - Multi source credit) or 200 gallons per ERU.
7. Required fire flow storage = 4,000 gpm x 4 hours.
8. Total required storage greater than 30 psi is equal to the total of operational and equalizing storage.
9. Total required storage greater than 20 psi is equal to the total of operational, equalizing, standby, and fire flow storage.
10. Maximum ERUs with available storage, assuming a 20 psi minimum for standby storage.

Table 9.7 Evaluation of Storage Adequacy for Zone 380

	Year			
	2015	2020	2034	Max [10]
Projected Equivalent Residential Units (ERUs)	4,846	4,883	5,667	9,121
Projected Demand[1]				
Average Day	804,433	810,536	940,683	1,514,150
Maximum Day	1,591,438	1,587,335	1,766,329	2,913,263
Available, Existing + Future Source (gpd)[2]				
West Bay Booster (2,400 gpm)	3,456,000	3,456,000	3,456,000	3,456,000
Elliot Booster Pump Station (2,300 gpm)	3,312,000	3,312,000	3,312,000	3,312,000
Total Available Source (gpd)	6,768,000	6,768,000	6,768,000	6,768,000
Multi-Source Credit (gpd)[3]	5,904,000	5,904,000	5,904,000	5,904,000
Required Storage Calculations				
Operating Storage (gal)[4]	618,800	618,800	618,800	618,800
Equalizing Storage (gal)[5]	0	0	0	0
Standby Storage (gal)[6]	969,196	976,550	1,133,353	1,824,277
Fire Flow Storage (gal)[7]	120,000	120,000	120,000	120,000
Required Storage				
Greater than 30 psi at highest meter (gal)[8]	618,800	618,800	618,800	618,800
Greater than 20 psi at highest meter (gal)[9]	1,707,996	1,715,350	1,872,153	2,563,077
Existing Storage Greater Than 30 psi (gal)				
Elliot 380 Storage Tank	1,464,615	1,464,615	1,464,615	1,464,615
Total Existing Storage at 30 psi (gal)	1,464,615	1,464,615	1,464,615	1,464,615
Storage Surplus/(Deficiency) at 30 psi (gal)	**845,815**	**845,815**	**845,815**	**845,815**
Existing Storage Greater Than 20 psi (gal)				
Elliot 380 Storage Tank	2,563,077	2,563,077	2,563,077	2,563,077
Total Existing Storage at 20 psi (gal)	2,563,077	2,563,077	2,563,077	2,563,077
Storage Surplus/(Deficiency) at 20 psi (gal)	**855,081**	**847,727**	**690,924**	**0**

1. Projected demands taken from Chapter 3. ERUs calculated as Average Day Demand / ERU water use factor (166 gpd/ERU).
2. Available source assumes source pumps are on for 24 hours in a day, at the maximum production rate.
3. Multi-source credit assumes largest source is out of service (in this case, one pump at West Bay Booster Station, decreasing capacity from 2,400 to 1,800 gpm).
4. Required operating storage is based on storage tank level when pump turns on.
5. Required equalizing storage = (PHD - Total Available Source) x 150 minutes
   PHD : (Maximum Day Demand per ERU / 1440) * [(C) * (N) + F] + 18
   (C & F values obtained from Table 5-1 in DOH Dec 2009 WSDM)
6. Required standby storage for existing source = greater of (2*ADD - Multi source credit) or 200 gallons per ERU.
7. Required fire flow storage = 1,000 gpm x 2 hours
8. Total required storage greater than 30 psi is equal to the total of operational and equalizing storage.
9. Total required storage greater than 20 psi is equal to the total of operational, equalizing, standby, and fire flow storage.
10. Maximum ERUs with available storage, assuming a 20 psi minimum for standby storage.

9.3 2015-2020 Storage Infrastructure Projects

The storage projects planned for 2015-2020 will help meet the Drinking Water Utility's Goal 6:

> **Infrastructure is prudently financed, and sustainably constructed, maintained and operated to ensure reliable delivery of high quality water to a growing community.**

Objective 6A is to design and construct infrastructure to ensure reliable delivery of water. Storage projects will implement Strategy 6A2: Develop and maintain storage and transmission/distribution infrastructure to ensure delivery of water at adequate pressure throughout the system and maintain required fire flow. Chapters 8 and 10 describe source and transmission/distribution infrastructure; Chapter 12 describes operations and maintenance of the infrastructure. Water quality strategies are in Chapter 11.

Based on the analysis in the previous section, the City's Capital Improvement Program for 2015-2020 includes the following storage projects. Project-level cost estimates and implementation schedule are in Chapter 13, Table 13.2.

- New Log Cabin Storage Tank construction, south of Morse-Merryman Road and east of the Boulevard Storage Tank, to address storage deficiencies in Zone 417.
- Fir Street Storage Tank #1 and #2 seismic retrofit to maintain compliance with seismic codes and to ensure reliability of the facility.
- Elliot Storage Tank seismic retrofit
- Hoffman Storage Tank Interior Coating**.** Maintenance to ensure longevity of the tank.

Chapter 10 - Transmission and Distribution Infrastructure

Tables

CHAPTER 10 - TRANSMISSION AND DISTRIBUTION INFRASTRUCTURE

Transmission and distribution projects help meet the Drinking Water Utility's Goal 6:

Infrastructure is prudently financed, and sustainably constructed, maintained and operated to ensure reliable delivery of high quality water to a growing community.

The 2015-2020 the strategy for transmission and distribution projects is to develop and maintain storage and transmission/distribution infrastructure to ensure delivery of water at adequate pressure throughout the system and maintain required fire flow.

Other projects for improving the infrastructure are discussed in Chapter 8 (Source Infrastructure) and Chapter 9 (Storage Infrastructure). Water quality strategies are in Chapter 11, and operations and maintenance strategies are in Chapter 12.

This chapter describes the existing transmission and distribution systems, evaluates their ability to meet current and projected needs, and identifies projects to be constructed in 2015 - 2020. Washington State Department of Health (DOH) rules on storage facilities are in Chapter 173-160 WAC and Chapter 246-290 WAC, Part 3 (design of public water systems). Detailed specifications are in the DOH Design Manual.

10.1 Existing Transmission/Distribution System

Olympia maintains an extensive system of piping, booster pump stations, and related facilities to convey water at sufficient pressures and appropriate flows to customers in seven pressure zones. Chapter 1, Map 1.4 shows the locations of pressure zones and key transmission and distribution system facilities. Figure 1.5 is a hydraulic schematic of the system.

The following tables summarize major transmission and distribution system components. Table 10.1 is an inventory of distribution piping, by pressure zone, size and material. Table 10.2 is an inventory of equipment at each booster pump station, and Table 11.3 is an inventory of pressure reducing valve (PRV) stations. Table 10.4 lists emergency interties the City maintains with neighboring utilities.

Table 10.1 Transmission and Distribution Piping Inventory

Diameter (in)	Ductile Iron (ft)	PVC (ft)	Asbestos Cement (ft)	Concrete (ft)	Cast iron (ft)	Galvanized iron (ft)	Plastic (ft)	Steel (ft)	Poly (ft)	All Materials (ft)
<2	0	1,376	190	0	0	20,681	8,388	0	123,687	**154,322**
2	1,558	90,599	3,342	0	924	33,100	13,108	0	6,804	**149,434**
2.5	0	729	0	0	0	541	0	0	0	**1,270**
3	0	2,264	0	0	64	996	69	0	31	**3,424**
4	4,872	34,578	30,646	0	6,680	276	26	0	16	**77,094**
6	54,520	126,786	220,739	0	58,619	253	0	0	458	**461,375**
8	66,307	352,132	126,796	0	27,098	0	0	0	258	**572,590**
10	10,318	52,332	58,684	0	24,644	0	0	0	0	**145,978**
12	99,950	68,600	78,658	0	21,878	0	15	0	0	**269,101**
14	10	759	0	0	0	0	0	0	0	**769**
16	27,072	0	0	60	5,784	0	0	0	0	**32,916**
24	138	0	0	0	0	0	0	550	15	**702**
36	2,649	0	0	34,876	0	0	0	4,625	0	**42,150**
All Diameters	**267,393**	**730,153**	**519,055**	**34,936**	**145,692**	**55,847**	**21,605**	**5,175**	**131,268**	**1,911,124**

Note: The piping breakdown by size and material reflects piping in the City's GIS system as of October 2014.

Table 10.2 Booster Pump Station Inventory

Booster Pump Location	Pump Type	Pump Model	Pump Size (hp)	Installed Capacity (gpm)	(Mgd)	Head (feet)	Install Date
Zone 417							
South Sound Booster Pump Station	Centrifugal	PACO 16-50707-140101-190	50	1,000	1.44	139	2000
	Centrifugal	PACO Impellar Dia. 6.9	50	1,000	1.44	139	2000
	Centrifugal	PACO	50	1,000	1.44	139	2000
Total					3.38		
Fones Road Booster Station	Centrifugal	PACO 16-50707-140101-190	50	1,000	1.44	139	1988
	Centrifugal	PACO Impeller Dia. 6.9	50	1,000	1.44	139	1988
	Centrifugal	PACO Motors: Magnetic Century	50	1,000	1.44	139	1988
Total					2.81		
Shana Park Corrosion	Variable Speed	Johnston – 96J90009	125	1,000	1.44	270	1996
Zone 347							
Eastside Booster Station	Centrifugal	PACO	50	1,000	1.44	135	1988
	Centrifugal	PACO	50	1,000	1.44	135	1988
	Centrifugal	PACO	50	1,000	1.44	135	1988
Total					2.88		
Zone 380							
West Bay Booster Station	Centrifugal	PACO	75	1,000	1.44	220	1997
	Centrifugal	PACO	75	1,000	1.44	220	1997
	Centrifugal	PACO	75	1,000	1.44	220	1997
Total					3.46		
Zone 380							
Elliott Pump Station	Centrifugal	PACO	20	600	0.86	100	1977
	Centrifugal	PACO	50	1,000	1.44	100	1986
Total					2.30		
Goldcrest	Centrifugal	PACO	3	40	0.06	78	1994
	Centrifugal	PACO	5	90	0.13	78	1994
Total					0.19		
Zone 298							
Allison Corrosion Control	Variable Speed	Johnston – 96J5008	100	1,448	2.09	212	1996
		Johnston – 96J5007	50	700	1.01	212	1996
Percival Pump Station	Centrifugal	Peerless – 5AE14	60	1,000	1.44	155	2009
			60	1,000	1.44	155	2009
			60	1,000	1.44	155	2009
Total					7.42		

Table 10.3 Pressure Reducing Valve Inventory

Name	Type	Inlet Pressure	Discharge Pressure	Purpose
Corner of Boulevard Road & Yelm Highway.	Clayton	Variable	60 psi	Allows supply from Zone 417 into Zone 338 along Yelm Highway at reduced pressure.
Danbury Court	Clayton	Variable	55 psi	Allows supply from Zone 417 into Zone 338 at reduced pressure. It is on a 4-inch line and is of limited capacity.
Plymouth Street & Harrison Avenue	Clay-Val	Variable	Variable	Allows supply from Zone 380 into Zone 298 at reduced pressure. Under normal conditions, the smaller 2-inch line supplies flow; the larger 8-inch line opens only during high-demand times.
Bowman Avenue	Clay-Val	Variable	Variable	Allows supply from Zone 380 into Zone 298 at reduced pressure. Under normal conditions, the smaller 2-inch line supplies flow; the larger 6-inch line opens only during high-demand times.
Elliot Avenue	Clay-Val	Variable	Variable	Allows supply from Zone 380 into Zone 298 at reduced pressure. Under normal conditions, the smaller 2-inch line supplies flow; the larger 8-inch line opens only during high-demand times.
26th Avenue	Clay-Val	Variable	Variable	Allows supply from Zone 380 into Zone 298 at reduced pressure. Under normal conditions, the smaller 2-inch line supplies flow; the larger 8-inch line opens only during high-demand times.
Cooper Point Road	Clay-Val	Variable	Variable	Allows supply from Zone 380 to feed water at reduced pressure (approximately the same as Zone 298) to Evergreen State College and other developments north of 20th Avenue.
Cain Road & Wilson Street	Clay-Val	Variable	Variable	Allows supply from Zone 417 into Zone 338 at reduced pressure. Under normal conditions, the smaller 2-inch line supplies flow; the larger 6-inch line opens only during high-demand times.
59th Court	Clay-Val	Variable	Variable	Allows supply from Zone 417 into 59th Court at reduced pressure. Supply is through a 4-inch line. When maintenance is necessary, supply is through a 2-inch maintenance line.
60th Court	Clay-Val	Variable	Variable	Allows supply from Zone 417 into 60th Court at reduced pressure. Supply is through a 4-inch line. When maintenance is necessary, supply is through a 2-inch maintenance line.
Capitol Way	Cla-Val	Variable	Variable	Allows supply from Zone 338 into Zone 264. Under normal conditions, the smaller 2-inch line supplies flow; the larger 6-inch line opens only during high-demand times.
Raft Avenue	Cla-Val	Variable	Variable	Allows supply from Zone 298 into Zone 226. Under normal conditions, the smaller 2-inch line supplies flow; the larger 8-inch line opens only during high-demand times.

Table 10.4 Existing Emergency Interties

Location	Pipe Size and Type	Intertie Utility, Size and Type
Sleater-Kinney Road NE and 6th Avenue NE	10-inch, AC	Lacey, 10-inch, PVC
Sleater-Kinney Road SE (near McDonald's)	12-inch, AC	Lacey, 12-inch, PVC
Crosby Boulevard SW and Mottman Road	12-inch, CI	Tumwater, 8-inch, DI
Carlyon Avenue and Capitol Boulevard	10-inch, AC	Tumwater, 4-inch, DI

AC = Asbestos Cement

CI = Cast Iron

DI = Ductile Iron

Transmission System

A 36-inch diameter welded steel transmission line conveys water from McAllister Wellfield to the Meridian Storage Tanks. The pipe from the Wellfield to the McAllister Springs was constructed in 2013 and extends about 4,000 feet north from the Wellfield within a 60-foot wide easement. The pipe crosses beneath the BNSF Railroad tracks in a 54-inch diameter steel casing, crosses under Old Pacific Highway within a 48-inch steel casing, and proceeds to the west where it connects to the existing steel pipe west of the Springs before terminating at the Meridian Storage Tanks. The pipeline from the Springs to the Meridian Storage Tanks was installed in 1949. The original pipe that was cut to make the connection with the new pipe from the Wellfield is in good condition. The coating on the inside and outside is in good shape. The cut steel looked almost new.

Water is then conveyed from the Meridian Storage Tanks into the City's distribution system via a 36-inch reinforced-concrete pipeline extending 37,750 feet (7.2 miles) to its terminus at the Fir Street Storage Tanks. The majority of this transmission line consists of the original pipe installed in 1949. The capacity of this pipeline, when operating as a gravity line, is approximately 22.7 million gallons per day (Mgd).

There are numerous connections into the transmission line between the Meridian and Fir Street Storage Tanks. The largest connections are:

- One 12-inch intertie able to provide water to Lacey from the 36-inch main located at Pacific Avenue and Mountainaire Road, west of Marvin Road through the Lacey pump station.
- Two interties able to provide service to Thurston PUD No. 1 at the Tanglewilde and Thompson Place neighborhoods.
- Two 12-inch connections that feed the Fones Road and South Sound booster pump stations, which feed Zones 417 and 338.
- One 10-inch connection along Pacific Avenue that can serve the South Sound Shopping Center commercial complex in an emergency.

After passing into the Fir Street Storage Tanks, or through one of the connections listed above, water is then conveyed into the distribution system as described below.

Distribution System

Topography within the City's service area varies in elevation from near sea level in the downtown area to 275 feet on the east side and 310 feet on the west side. As a result, seven major pressure zones have been developed to maintain adequate pressures throughout the service area. Below is a description of each pressure zone, including pumping, piping and storage; for locations, see Map 1.4 in Chapter 1.

Zones 417 and 338

These pressure zones serve the eastern and southeastern portions of the City, covering a large area ranging from the Yelm Highway area on the south to 26th Avenue Northeast on the north. They are bordered on the east by the City limits and on the west by Zones 347, 264 and 226, all of which are at lower elevations.

Zone 417 is served by the Hoffman Storage Tank and Zone 338 is served by the Boulevard Road Storage Tank. Ground elevations in Zone 417 vary from 150 to 277 feet above sea level, and in Zone 338 from 160 to 243 feet.

Supply to Zone 417 is through a 12-inch connection to the 36-inch transmission line at Pacific Avenue and Fones Road, and a 12-inch connection to the 36-inch main at Pacific Avenue and Weir Street. The Fones Road and South Sound Booster Pump Stations boost water into Zone 417 at these locations, respectively.

PRV stations at the intersection of Cain Road and Wilson Street, and at Danbury Court allow water to move from Zone 417 to Zone 338.

Zone 347

Zone 347 supplies water to the northeastern section of the City, most of which lies north of Interstate-5. The zone is bounded on the northwest by Budd Inlet, on the southwest by approximately Central Street, on the east by Boulevard Road and South Bay Road, and on the north by the service area boundary.

Water supplied to Zone 347 is normally pumped from Fir Street Storage Tank 1 (Zone 226) through the Eastside Booster Pump Station into the Eastside Storage Tank. In an emergency, water can also be supplied from the 36-inch transmission main immediately prior to entering the Fir Street Storage Tanks. Gravity flow from the Eastside Storage Tank serves the zone with maximum pressures within the system established by the overflow elevation of 347 feet. The ground surface in Zone 347 ranges from 110 to 204 feet in elevation.

Zone 264

Zone 264 covers the South Capitol area of the City. Capitol Lake is the western border, with the south and east boundary formed by Interstate-5. This area lies just south of Olympia's central business zone, with the State's Capitol Campus on the north end, extending southward into residential areas.

The distribution system serving Zone 264 is composed of two distinct sectors, presently interconnected by a single 10-inch diameter pipe and a PRV from the 338 Zone at Capitol Way at the I-5 Bridge. The smaller sector lies south and east of Interstate-5 and serves a low-density residential area adjacent to Watershed Park and the Olympia Public Works Department Maintenance Center. The larger sector is north of Interstate-5 and supplies water to the Capitol Campus area. The ground surface in Zone 264 ranges from 16 to 165 feet in elevation.

The water supply to Zone 264 is withdrawn from the 36-inch transmission main at the point where it enters the Fir Street Storage Tanks (Zone 226). Water flows by gravity through a 16-inch line, reduced to a 10-inch line to enter the smaller sector of the distribution network.

The Stevens Field Storage Tank (Zone 264) is filled directly from the distribution system. The hydraulic grade of the water entering Zone 264 at the Fir Street valve chamber is determined by the grade in the 36-inch transmission line. It is typically 280 to 290 feet at current rates of demand. Consequently, the Stevens Field Storage Tank water is used primarily during high demands, when localized distribution system pressures drop below the 264-foot overflow level.

Zone 226

The downtown central business area encompassed by Zone 226 has the lowest elevations within the entire system. This area is heavily commercial, with many businesses located near sea level along Budd Inlet and near the Port of Olympia. Numerous government and retail buildings are in this zone, as well as residential customers to the east and northeast. The elevation of the ground surface in Zone 226 varies from zero to 150 feet above sea level.

Water is delivered to this zone by gravity from the underground Fir Street Storage Tanks. The site also houses a storage tank and booster pumps for Zone 347, as well as the diversion valves for Zone 264.

Overflow elevations of 226 feet for both storage tanks control maximum static pressure for this zone. Discharges from the storage tanks flow through 16-inch and 12-inch mains on 8th Street into the distribution network. There are several closed connections between Zone 226 and the adjacent pressure zones. In every case, emergency use of these interties would allow only one-way flow of water into Zone 226.

Zones 298 and 380

Almost all of the City's service area west of Capitol Lake is within Zones 298 and 380. One exception is the portion of Zone 226 that rims the west side of Budd Inlet. There are residential and commercial customers in the two zones, with commercial water users concentrated along Harrison Avenue and between Harrison Avenue, Black Lake Boulevard and Cooper Point Road. The static hydraulic grade for Zone 298 is based on the 298-foot overflow elevation of the Bush and Elliott Storage Tanks. The Evergreen State College is the only west-side contract customer served from a 12-inch main through a pressure reducing valve extended along Kaiser Road on the northern end of Zone 298.

Zone 380 is served by the West Bay Booster Pump Station and the Elliott (380) Storage Tank. Zone 298 is served by Kaiser Well 1 and Allison Springs Wells 13 and 19; PRVs from Zone 380; and the Elliott (298) and Bush (298) Storage Tanks.

There is sufficient pressure from the Elliott (380) Storage Tank to serve the higher elevated areas of the west side. The only exception is several of the higher homes in the Goldcrest subdivision, which continue to be served from the Elliott Booster Pump Station.

10.2 Capacity Analysis

The ability of the existing transmission and distribution system to meet pressure and flow requirements under current and future demand conditions was evaluated for this Plan. This section presents the design criteria upon which the analysis was based, followed by a description of the hydraulic model calibration and a discussion of the evaluation results.

Design Criteria

To ensure that the transmission and distribution system is in compliance with state regulations for pressure during peak hour demand and during fire flows, the Utility uses these key design criteria:

- Minimum residual pressure in the system during peak hour demand, where all equalizing storage has been depleted and all sources are operating, is 30 pounds per square inch (psi) as required by DOH.
- Minimum pressure at the site of a fire flow during maximum day demand, where the volume of water used for fire suppression and equalizing storage has been depleted, is 20 psi. The zone-wide minimum for residual pressure during a fire flow event is also 20 psi, as required by DOH.
- Maximum head loss in any pipe is 10 feet per 1,000 feet of pipe, with the potential for this being exceeded during transient conditions (e.g. fire flow).
- A maximum of 20 homes may be connected to a looped 2-inch main (connected at both ends to the water system grid); a maximum of 10 homes may be connected to a dead-end 2-inch main where the length of pipe is less than 400 feet and fire hydrants are not required.
- The minimum pipe diameter is 6 inches for looped and 8 inches for dead-end lines where fire hydrants are required.
- Valve spacing distance is a maximum of 600 feet, and hydrant spacing is a maximum of 600 feet for single family and duplex homes and 300 feet elsewhere, in conformance with City of Olympia Development Guidelines.

The minimum fire flow goal is 1,000 gallons per minute (gpm) for residential areas during maximum daily demand. Fire flow goals vary depending on the type of construction, and are building-specific in non-residential areas.

Hydraulic Model Calibration

The Utility has developed a hydraulic model using Bentley Systems' WaterCAD water system modeling software. First prepared in the mid-1990s, the model has been routinely used for system analysis and is formally calibrated during each update to the Water System Plan. The accuracy of the model is also checked periodically during its use between times of formal calibration. The model is calibrated by comparing recent fire flow data and pressure checks throughout the distribution system to the model output.

The 2013 calibration effort for this Plan consisted of obtaining field fire flow test data from 12 test sites, at least one in each pressure zone. During the field fire flow tests, static and residual pressure readings were taken from just upstream of the flowing hydrant and pressure readings were monitored at strategic locations within the tested zone. During the time of testing, the telemetry system was used to identify key system parameters, such as booster pump operational status and storage tank levels, for input into the hydraulic model.

Field results were then compared with modeled results to determine model accuracy. Results of the model calibration indicated that modeled static and residual pressures were within 5 psi of the observed pressures in all pressure zones. At three sites, the pressure difference was greater than 5 psi between the observed residual pressure and the modeled residual pressure; the static pressures were the same between the observed and the modeled data. One site in Zone 417 had a 7 psi difference; one site in Zone 226 had a 8 psi difference; and one site in Zone 380 had a 8 psi difference. The model did not match the field conditions for residual pressure in these cases. Other sites in these zones were well within 5 psi of the observed and modeled residual pressure differences. Upon further inspection, it was determined the sites chosen for the fire flows were not the best locations for truly representative flows and sufficient stresses on the system. Still, the pressure differences were less than 10 percent, so the City is satisfied the model is well calibrated. Table 10.5 summarizes the results of the model calibration.

Table 10.5 Model Calibration Data Summary

Location	Pressure Zone	Observed (Field) Data [1]			Model (Simulated) Data [2]		
		Static Pressure (psi)	Residual Pressure (psi)	Flow (gpm) [3]	Static Pressure (psi)	Residual Pressure (psi)	Flow (gpm)
Prestwick	417	95	91	1,501	95	84	1,501
Lister	417	110	58	1519	102	82	1519
Eagle Bend	338	64	58	1163	66	58	1163
Evanston	347	76	68	1178	79	68	1178
Columbia	264	77	70	1343	75	67	1343
Hearthfire	226	90	85	1424	90	77	1424
Schnieder	226	95	80	1384	90	77	1384
East of Evergreen	298	58	50	1120	56	50	1120
29th Court	298	60	49	964	59	46	964
Arcadia	298	91	57	1087	87	57	1087
Fern	380	80	71	1138	76	67	1138
Hudson	380	60	50	979	60	42	979

1. As measured during field fire flow tests conducted on December 17 and 18, 2013.
2. Hydrant flows and system parameters (pump operations and storage tank levels) were input to match field conditions. Simulated pressures are based on modeling 2013 maximum day demands throughout the distribution system.
3. As calculated based on pitot pressure gauge readings.

Evaluation of Transmission/Distribution Capacity

To evaluate transmission and distribution system capacity, two types of analyses were conducted using the Utility's computer-based hydraulic model:

- Peak hour demand conditions were analyzed to determine if the 30 psi requirement is met throughout the system.
- Fire flow simulations were performed under maximum daily demand conditions, to determine the quantity of flow available at a single point while maintaining a 20 psi minimum residual pressure zone-wide.

Both types of analyses were conducted at 2008 and 2028 (20-year) demand levels, based on the water demand forecast in Chapter 3.

Peak Hour Demand Conditions

In general, the distribution system is capable of maintaining pressures greater than 30 psi during peak hour demand, under both current and future demand conditions.

The only exception is a small portion of Zone 298 located just west of Ken Lake in the Park Drive area. Here, pressures drop to between 15 and 20 psi during peak hour demand. A pump station and storage tank constructed as part of a development project planned for the area south of Highway 101 on Kaiser Road will address this deficiency.

Pressures along East Bay Drive, at the boundary of Zones 347 and 226, are currently at approximately 100 psi during peak hour demand conditions. The planned installation of a PRV station along East Bay Drive will allow for water to pass from Zone 347 to Zone 226, and will alleviate high pressure situations. This has been included in the 20 year CFP.

Fire Flow Conditions

In general, the distribution system is capable of providing required fire flows while maintaining residual zone pressures greater than 20 psi during maximum daily demand, under both current and future demand conditions. Of a total of approximately 2,800 nodes in the hydraulic model, less than five percent (137 nodes), are unable to provide sufficient fire flows while maintaining pressures greater than 20 psi. The majority of these nodes are located in areas where fire hydrants are not present, that is, on small (less than 4-inch diameter) mains or along the 36-inch transmission main where there are no services.

The only exceptions to this condition are in discreet areas within the western portion of Zone 264, where available fire flows are lower than required. This is a result of a hydraulic "bottleneck" in the transmission piping that conveys water from the 36-inch main into this pressure zone. To resolve this, he CIP includes a project to install a new 16-inch main roughly parallel to a 10-inch diameter portion of this water main. This will remove the limitation and result in sufficient flows to Zone 264.

Available fire flows are sufficient along West Bay Drive, and have been improved during high demand days with the addition of a PRV station that was installed at Raft Avenue near West Bay Drive in 2010. This allows water to flow from Zone 298 to Zone 226, supporting fire flows in this area.

10.3 2015-2020 Transmission/Distribution Projects

The transmission and distribution infrastructure projects planned for 2015-2020 will help meet the Drinking Water Utility's Goal 6:

> **Infrastructure is prudently financed, and sustainably constructed, maintained and operated to ensure reliable delivery of high quality water to a growing community.**

Objective 6A is to design and construct infrastructure to ensure reliable delivery of water. Planned transmission/distribution projects will implement Strategy 6A2: Develop and maintain storage and transmission/distribution infrastructure to ensure delivery of water at adequate pressure throughout the system and maintain required fire flow. Chapters 8 and 9 describe source and storage infrastructure; Chapter 12 describes operations and maintenance of the infrastructure. Water quality strategies are in Chapter 11.

The projects described below are included in the 2015-2020 Capital Improvement Program (CIP) presented in Chapter 13. Project-level cost estimates have been prepared for each project. These costs and the anticipated implementation schedule for each project are presented in Table 13-2.

All projects will be designed according to the City's Engineering Design and Development Standards.

The following project addresses the fire flow capacity problem identified the capacity analysis.

- **Maintenance Center Transmission Main.** This new 16-inch main will roughly parallel the existing 10-inch pipe that presents a bottleneck in the distribution system in Zone 264. The new main will connect to an existing 16-inch main at Eastside Street, where it originates as a connection to the 36-inch transmission main near the Fir Street Storage Tanks. The new line will then extend approximately 3,500 feet through the City's Maintenance Center property, across Plum Street and to the south along Henderson Boulevard, terminating at an existing 12-inch main that feeds the portion of Zone 264 west of Henderson. A high priority is placed on installing this new main in order to increase fire flow and pressures in the westerly portion of Zone 264 during high demand days. The existing 10-inch main that crosses Moxlie Creek will be replaced in the vicinity of the creek.

Additional non-capacity related transmission and distribution system projects have been identified during development of this Plan. The 2015-2020 Capital Improvement Program includes the following projects represent transmission or distribution needs associated with source or storage projects, as well as water system projects timed with other public works improvements, such as street upgrades. Many projects involve replacement of aging asbestos cement (AC) piping, which is brittle and more prone to failure than other types of pipe material.

- **Distribution System Oversizing.** This project involves oversizing distribution pipelines associated with specific development-related improvements. Oversizing provides additional capacity to anticipate future needs that may be greater than at the time of development.
- **Fones Road Booster Pump Station Replacement.** Replacing the booster pump station to address deficiencies in the electrical system, confined space entry, ventilation and aging pumps.
- **Morse-Merryman Extension.** Installing a new 12-inch water main to connect the planned Log Cabin Road Storage Tank with existing distribution piping in Morse-Merryman Road.

- **Kaiser Road**. Installing a 12-inch water main from the LOTT lift station at Kaiser Road north to Evergreen Parkway, to complete a piping loop to the north end of Zone 298. Currently, this area has only one feed through a PRV at Cooper Point Road.
- **Boulevard Road Roundabout (Morse-Merryman) AC Pipe Replacement.** Replacing the AC water main during construction of a roundabout in Boulevard Road, at the intersection of Morse-Merryman Road.
- **Percival Creek Water Main.** This project will be constructed with structural upgrades to the utility bridge. The water main will be either replaced on the bridge or installed under the creek by boring, depending on the bridge work.
- **Meridian Overflow and 36-inch Water Main.** Enhancing protection of the 36-inch water main and improving the Meridian Storage Tank overflow outlet pipe that daylights next to the 36-inch main on City property east of the tanks.
- **McCormick Valve House.** Replacing the pipes and valves installed when the Fir Street Storage Tanks were constructed in 1935.
- **AC and Aging Pipe Replacement.** This project is an annual effort to replace substandard asbestos cement pipe throughout the City. Each year, based on maintenance records, the Utility chooses which pipes to replace based on age and material. Currently 40 percent of the City's water system is comprised of AC pipe which is prone to leaking and breaks.
- **Distribution Main Condition Assessment.** This project is part of the asset management program to assess the condition and reliability of the distribution mains, in order to prioritize repair or replacement.
- **Cross-Country Mains.** Identifying water mains that are located outside the roadway and cross through neighborhoods; and determining whether the water mains have easements and if they should be relocated to allow easier access for maintenance.
- **PRV Telemetry (Radio-Based**). This project will enable data from the pressure reducing valves to be transmitted to the telemetry system by radio. Data such as upstream and downstream pressures and valve positions (opened or closed) will enable efficient and reliable operation of the valves and ensure that fire flow is available when needed.

The following projects are planned for implementation after 2020:

- **Fones Road Water Main Replacement.** Replacing the AC water main in Fones Road, from Pacific Avenue to 18th Avenue. This project will be coordinated with the City's planned reconstruction of this roadway.
- **Eastside Street and Henderson Boulevard Water Main Extension.** Extending a 12-inch main west of Henderson and connecting it to an existing Zone 264 water main. This main will enhance system reliability by adding a secondary source to this pressure zone.
- **Indian Summer Extension to Rich Road**. Installing a water main from the existing 12-inch main on Prestwick Lane by Indian Summer Well 20 to the existing 12-inch main on Rich Road.

Chapter 13 lists additional developer-funded projects with schedules driven primarily by development-related activities: Kaiser Road pump station, storage tank and water main extensions; and main extensions on Cooper Point Road, Log Cabin Road, South Bay, and 26th Avenue.

Chapter 11 – Water Quality Program - Contents

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CHAPTER 11 - WATER QUALITY PROGRAM

The primary responsibility of the Water Quality Program is to ensure compliance with federal and state drinking water regulations and to help meet the Drinking Water City's Goal 2:

Water is delivered at useful pressures, meets Safe Drinking Water Act standards, and it looks and tastes great.

This goal is consistent with the City's Comprehensive Plan Goal GU7 and Policy PU7.2.

Water Quality Program objectives for 2015-2020 are:

- Maintain 100 percent compliance with all state and federal monitoring requirements.
- Maintain 100 percent compliance with all state and federal treatment requirements.
- Respond to customer water quality concerns promptly and maintain accurate reporting.
- Support the groundwater protection network with monitoring and data collection activities.

Since the 2009 Water System Plan, the Water Quality Program has met or surpassed all state and federal drinking water regulations, including implementing the Stage 2 Disinfection By-Products, Groundwater, and Lead and Copper Revision Rules. The Water Quality Program is designed to maintain past program successes by continuing to meet all state and federal monitoring and treatment requirements.

11.1 Water Quality Regulations

Chapter 2 gives an overview of the current and proposed federal and state regulations under which the City operates. The rules governing drinking water quality, deriving from the federal Safe Drinking Water Act (SDWA), are especially complex and extensive. In Washington they are implemented by the State Department of Health (DOH). Regulations currently in effect are summarized in Table 11.1.

Table 11.1 Safe Drinking Water Act - Summary of Rules Affecting the City

SDWA Rule	Parameters Affected[1]	EPA Rule Publication Date and Location in Chapter 246-290 WAC
Monitoring - Source		
National Primary and Secondary Drinking Water Standards	Bacteriological, IOC, VOC, SOC, Asbestos, Radionuclides, THMs, Lead/Copper, Phase II/V	Phases I – V promulgated 1987 – 1992; Part 4, 300 - 320
Arsenic	Arsenic	February 2002, Part 4, 300 - 310
Groundwater Rule	Fecal indicators in groundwater	January 2007, Part 4, 300 - 320
Radionuclide Revision	Radionuclides	December 2000, Part 4, 300 - 320
The Third Unregulated Contaminant Monitoring Rule (UCMR)	Various contaminants considered for potential future regulations	UCMR 3 – April 2012
Monitoring – Distribution System		
Phase II Rule	Asbestos	January 1991, Part 4, Part 4, 300 - 320
Revised Total Coliform Rule	Bacteriological	Must be compliant by April 2016, unless DOH selects an earlier implementation date.
Stage 2 Disinfection By-Products (DBP)	TTHMs and HAA5	January 2006, Part 4, 300 - 320
Monitoring – Quality at the Tap		
Revised Short Term Lead and Copper Rule (LCR)	Lead and copper	June 1991, Part 4, 300 – 320; Revised September 2007
Administrative Requirements – Public Information		
Consumer Confidence Report Rule, Alternative Delivery Interpretative Memo	Compliance results, violations, and variances	January 2013, Part 7 Subpart B
Public Notification (PN)	Maximum contaminant levels exceeded	May 2000, Part 7 Subpart A

1. Inorganic chemical (IOC), Volatile organic chemical (VOC), Synthetic organic chemical (SOC), Total trihalomethanes (TTHMs), and Haloacetic acids (HAAs).

As shown, the rules cover two main areas, monitoring and public information. They include:

- Monitoring requirements
    - Water at the source for bacterial contaminants, organic and inorganic compounds and radionuclides.
    - Water in the distribution system for bacterial contaminants, chlorine residual, asbestos and the presence of disinfection by-products.
    - Water at the consumer's tap for lead and copper levels.
- Administrative requirements to notify the public of excessive contaminant levels and results of water quality testing.

The City continues to meet or surpass existing requirements and is well-positioned to deal with new regulations adopted or proposed since publication of the 2009 - 2014 Water System Plan.

Recently Adopted Regulations

Since the 2009 – 2014 Water System Plan, three new federal rules and two minor revisions have come into effect: the Ground Water Rule, the Stage 2 Disinfection By-Products (DBP) Rule and the Third Unregulated Contaminant Monitoring Rule (UCMR 3); and revisions to the Consumer Confidence Rule and the Revised Total Coliform Rule. These rule changes and their implications for Olympia's Drinking Water Utility are discussed below.

New Ground Water Rule

The Utility received DOH approval of its Triggered Monitoring Plan in September 2011. The monitoring plan outlined which sources will be tested for *E. coli* if a coliform positive sample is collected from the distribution system. The Utility also chose to conduct compliance monitoring, as defined under WAC 246-290-453(2) at Shana Park Well 11 (S10). The monitoring plan was updated when the McAllister Wellfield (S16) went online on November 20, 2014 (see Appendix 11–1).

New Stage 2 Disinfection By-Products Rule

The Utility has been sampling according to the Stage 2 Disinfection By-Products (DBP) Rule monitoring plan since its approval by DOH in October 2012. Under the Stage 2 DBP Rule, the number of monitoring locations is based on the total population served. The Stage 2 DBP Rule requires calculating compliance based on the running annual average of DBP levels from each individual monitoring location. Monitoring locations are in areas of the distribution system with the longest water retention time and the highest expected DBP levels. The total number of distribution monitoring locations increased from three to eight when the City was still using McAllister Springs (S01). However, when the City switched from McAllister Springs (S01) and to McAllister Wellfield (S16), the required monitoring locations went down to four. Maximum Contaminant Levels (MCLs) are below Stage 2 DBP Rule requirements at all four locations.

New Third Unregulated Contaminant Monitoring Rule (UCMR 3)

The US Environmental Protection Agency (USEPA) uses the Unregulated Contaminant Monitoring (UCM) program to collect data for suspected contaminants present in drinking water for which no health-based standards have been set under the Safe Drinking Water Act (SDWA). Every five years, USEPA reviews the list of contaminants, largely based on the Contaminant Candidate List. The UCMR 3 requires all systems serving more than 10,000 people to conduct assessment monitoring for 21 chemicals, including selected VOCs, metals and perfluorinated compounds. UCMR 3 monitoring was last completed in 2013. Low levels of four elements were detected during this sampling event: chromium, hexavalent chromium, strontium and vanadium. These elements occur naturally in the air, water, soil and food people come in contact with every day. The City will comply with any future regulations regarding these potential contaminants.

Revised Consumer Confidence Rule - Alternative Delivery

In 2012 USEPA reviewed the Consumer Confidence Report (CCR) Rule and addressed several issues including electronic delivery. In January 2013, USEPA published options for electronic delivery of the CCR. These options include an email with a direct link to the website, the CCR attached to an email, and the CCR as an imbedded image in an email. These options are an addition to the CCR requirements. The Utility uses a utility bill insert to inform its customers that the CCR is available and provides a direct link to a web address where they can obtain a copy.

Revised Total Coliform Rule (RTCR)

> *USEPA adopted the RTCR in February 2013. The rule better addresses the public health protection goals of the original 1989 federal Total Coliform Rule. The improvements provide more effective protection by reducing exposure to fecal contamination. It includes new requirements for seasonal water systems, high-risk smaller water systems, monitoring, assessments, corrective actions, and a change in the fecal indicator from total coliform bacteria to E. coli. DOH anticipates rule development and an effective date in 2016. The Utility will continue to monitor development of this rule and will comply with any required sampling, reporting and follow-up actions.*

Along with updating Chapter 246-290 WAC to reflect requirements of the RTCR, DOH will also amend requirements for planning, emergency sources and disinfection.

Future Regulations

As of July 2014, six regulations were still in proposed regulatory status: the Carcinogenic Volatile Organic Compound Rule, DOH Drinking Water Laboratory Data Report Rule, Fourth Unregulated Contaminant Monitoring Rule, Long Term Lead and Copper Rule, Perchlorate and Radon rules.

Carcinogenic Volatile Organic Compound (cVOC) Rule

In February 2011, EPA identified cVOCs as the first group of contaminants to be regulated as a group (up to 16 cVOCs), as opposed to one at a time under the agency's 2010 Drinking Water Strategy. The intent of regulating by group is to provide public health protection more quickly and to allow utilities to more effectively and efficiently plan for improvement. The Rule is delayed into 2015 and potentially even later. The Utility will continue monitoring the development of this rule and sample accordingly.

Drinking Water Laboratory Data Report Rule

DOH is revising the Drinking Water Laboratory Data Report Rule to remove duplication of the Washington State Department of Ecology's (Ecology's) requirements for Accreditation of Environmental Laboratories, Chapter 173-50 WAC. The anticipated rule effective date is 2015.

The proposed rule revision will no longer apply to the technical capability of a lab to perform drinking water analysis and will add reporting requirements to ensure consistent, reliable reporting of data. Certified labs will be required to report data within a timeframe and in a format specified in the rule.

The two primary laboratories used by the Utility are expected to comply with the new requirements, which will result in quicker notification of results to DOH and the Utility.

Fourth Unregulated Contaminant Monitoring Rule (UCMR 4)

The UCMR 4 is expected to be finalized in 2017 and, like UCMR 3, will include testing of suspected contaminants present in drinking water for which health-based standards have not been set under the Safe Drinking Water Act. Monitoring will most likely involve two sampling events, five to seven months apart, during one consecutive 12-month period.

Long-Term Lead and Copper Rule Revisions

In 2014, USEPA solicited stakeholder input on several issues surrounding this rule making:

- Partial lead service line replacement
- Revision of compliance for lead and copper sampling locations to focus more heavily on lead service lines
- Potential separate sampling locations for copper
- Definition of appropriate optimized corrosion control

The Utility does not have any lead service lines, and the corrosion control study done as part of the McAllister Wellfield project positions the Utility well for meeting future rule requirements.

Perchlorate Rule

USEPA is in the process of evaluating advice from the Science Advisory Board on approaches to derive a maximum contaminant level for perchlorate. A proposed rule is expected to be published in 2015. The Utility will continue to monitor the development of this rule, and will conduct sampling and any required reporting and follow-up actions.

Radon Rule

Radon exposure from drinking water is very small compared to radon in soil under homes. The proposed rule provides for a multimedia approach to address the public health risks from radon in drinking water and from indoor air, as well as setting a Maximum Contaminant Level (MCL) of 300 picoCuries per liter (pCi/L). EPA is also proposing an alternative approach to complying with the rule by allowing a higher alternative MCL of 4000 pCi/L when accompanied by a multimedia mitigation program to address radon risks in indoor air. (This would apply if DOH chooses to develop an EPA-approved enhanced indoor air program.)

Initial monitoring requirements would include four consecutive quarters of sampling at each entry point to the distribution system after treatment and/or storage. Routine monitoring would include annual monitoring, with the potential for reduced monitoring at a frequency of one sample every three years.

The Utility has insufficient monitoring data to determine whether any of its sources will be impacted by this rule. Uncertainty in what the MCL will be also makes it unclear how the Utility will be impacted by this rule. At a minimum, additional sampling is needed to determine which sources might be subject to this rule. Given the uncertainty as to when the rule will be finalized and what the requirements may be, the Utility will continue to keep track of developments with this regulation, but not take any action at this time.

11.2 Water Quality Program Activities

The primary activities of the Water Quality Program described in this section are:

- Monitoring
- Treatment
- Program management

Monitoring

The Utility performs monitoring for the purposes of compliance with federal and state requirements, surveillance of ambient groundwater quality, and ensuring reclaimed water disinfection.

Compliance Monitoring

The Utility routinely collects over 1,400 compliance samples a year to satisfy Safe Drinking Water Act requirements. This activity includes source monitoring and distribution system monitoring.

Monitoring frequencies for coliform, lead and copper, asbestos, disinfection byproducts, and chemicals (IOCs, VOCs, and SOCs) are done according to the most recent DOH Water Quality Monitoring Schedule.

All Olympia sources meet all primary MCLs. Exceedances associated with secondary MCLs for iron and manganese are discussed in the section titled *Water Quality Exceedances*.

Source Monitoring

Source monitoring includes sampling from the locations required by WAC 246-290-300 and to the schedule outline in the Code of Federal Registry (CFR) 40 and WAC 246-290-300, 310, and 320. Source monitoring includes both permanent and seasonal sources. The City is granted source monitoring waivers, where appropriate, based on low susceptibility to contamination. These waivers include:

- Three years for pesticides, and soil fumigants.
- Six years for VOCs.
- Nine years for IOC and herbicides.
- No monitoring required for dioxin, endothal, glyphosate, diquate and insecticides.

See Appendix 11-1 for the Triggered Source Monitoring Plan and Appendix 11-2 for the Coliform Monitoring Plan.

Distribution System Monitoring

The water in the distribution system is monitored for total coliform, disinfectant residual, disinfection by-products (total trihalomethanes and haloacetic acids), and asbestos. Field readings for pH and temperature are also collected.

Coliform: The number of total coliform samples required is based on the population served. As required, the Utility collects a minimum of 70 distribution system samples monthly from dedicated sampling stations. Each week, 22 samples are collected throughout the distribution system. The distribution samples are chosen to represent each pressure zone and the far ends of the system. See Appendix 11-1, Triggered Source Monitoring Plan, for additional information regarding routine, repeat and special purpose sampling, a system sampling map, and a discussion of what constitutes a violation. The Utility has maintained compliance with the Total Coliform Rule since its inception.

Disinfection By-Products: The Utility monitors for disinfection by-products from four dedicated sampling locations. These locations were selected based on a 960-hour trace simulation using Bentley *WaterGems* hydraulic modeling software. The Utility anticipates qualifying for reduced annual monitoring of sample locations once it documents, for at least a year on McAllister Wellfield (S16), that the locational annual average is less than or equal to 0.04 mg/L for total trihalomethanes and less than or equal to 0.03 mg/L for haloacetic acids. See Appendix 11-1, Triggered Source Monitoring Plan for additional information regarding this sampling.

Asbestos: About 40 percent of the City's distribution system is asbestos-cement pipe, which can contribute fibers under corrosive water conditions. Asbestos cement piping is gradually being replaced with ductile iron. The Utility collects one monitoring sample every nine years from sections of the distribution system where asbestos is most likely to be found. The next monitoring round will be in 2018.

Monitoring at the Tap

DOH requires monitoring at the tap for lead and copper at a frequency based on when a home was built (between 1982 and 1987) and if it has copper plumbing. While McAllister Springs (S01) was Olympia's primary source of water, DOH allowed a reduced schedule of sampling of once every three years. Now that the McAllister Wellfield (S16) has replaced the Springs, the Utility will monitor at the initial frequency of 60 sample sites twice in one year. Based on the lead and copper results, the Utility may be eligible for reduced monitoring the following year. Monitoring results from 2012 were below the action levels for both copper and lead, as shown in Table 11.2.

Table 11.2 Lead and Copper Monitoring, 2012 Results

Contaminant	Amount Detected	Range	Number of Sites Above Action Level[1]	
Copper	90% of the homes tested had copper less than 0.907 ppm	0.036-1.26 ppm	0	0
Lead	90% of the homes tested had lead less than 6 ppb	0-25 ppb	0	0

1. The action level for lead is 0.015 mg/L and 1.3 mg/L for copper. (When the concentration of a contaminant exceeds the "action level", treatment or other action by the water system is required.)

Groundwater Protection Monitoring

Groundwater monitoring is part of the Utility's Source Protection Program (Chapter 7). This monitoring tracks background aquifer water quality and groundwater level trends using samples from a network of monitoring wells, which are different from City production wells. See the current groundwater monitoring in Table 11.3 for McAllister Wellfield, Table 11.4 for East Olympia and Table 11.5 for West Olympia. Table 11.6 shows which wells have data loggers that continuously measure water levels to track aquifer capacity and the effects of pumping and drought.

The City has three groundwater monitoring networks:

- McAllister Wellfield (S16)
- East Olympia for Shana Park Well 11 (S10) and Indian Summer well 20 (S12)
- West Olympia for Allison Springs Well 13 (S09) and Well 19 (S11)

Sample results show rising nitrate levels in the Shana Park area. All other sample results for volatile organics, inorganic chemicals, synthetic organic chemicals and herbicides are non-detectable or well below the maximum contaminant level for all three networks. See Chapter 7, Section 7.4 for more information about the Utility's groundwater monitoring network.

Table 11.3 Sampling Schedule for McAllister Wellfield DWPA Monitoring Well Network

Owner Name	Semi-Annual Sampling Events[1]
	Nitrate
City of Olympia, MW-2S	1,2,3
Washington Water Service Co. Holiday Ranchettes, MW-HolR	Obtain from Washington Water Service Co.
Washington Water Service Company Triple "G", MW-TrpG	Obtained from Washington Water Service Co.
Private, Peterson, MW-Pete	3
Private, Troche, MW-Troc	1,3
Private, St. Clair Vistas, MW-StCl	3

1. Scheduled as follows: 1 = 1st Quarter (January – March), 2 = 2nd Quarter (April-June), 3 = 3rd Quarter (July – September), 4 = 4th Quarter (October-December).

Table 11.4 Sampling Schedule for East Olympia Monitoring Well Network

Owner's Name	Semi-Annual Sampling Events[1]	
	Nitrate	Nitrogen-15 Isotope[1,2]
City of Olympia, S04	1,3	1,3
City of Olympia, Indian Summer Well 20, S12	1,2,3,4	1,3
City of Olympia, Shana Park Well 11, S10	1,3,4	1,3
City of Olympia, MW-25	1,3	1,3
City of Olympia, MW-26	1,3	1,3
City of Olympia, MW-27	1,3	1,3

1. Scheduled as follows: 1 = 1st Quarter (January – March), 2 = 2nd Quarter (April-June), 3 = 3rd Quarter (July – September), 4 = 4th Quarter (October-December).
2. Collect isotope samples twice a year for two years and then re-evaluate the need to continue.

Table 11.5 Sampling Schedule for West Olympia Monitoring Well Network

Owner Name	Semi-Annual Sampling Events[1]
	Nitrate
City of Olympia, MW-18	1,3,4
City of Olympia, MW-22	1,3,4
City of Olympia, MW-23	1,3
City of Olympia, MW-24	1,3
City of Olympia, Allison Springs Well 13 (S09)	3,4
City of Olympia, Allison Springs Well 19 (S11)	3,4

1. Scheduled as follows: 1 = 1st Quarter (January – March), 2 = 2nd Quarter (April-June), 3 = 3rd Quarter (July – September), 4 = 4th Quarter (October-December).

Table 11.6 Continuous Groundwater Level Monitoring Network

Owner Name	DWPA
City of Olympia, MW-2D	McAllister Wellfield
Nisqually Tribe, MW-17	McAllister Wellfield
City of Olympia, Lake St. Clair	McAllister Wellfield
City of Olympia, MW-25	East Olympia
City of Olympia, MW-26	East Olympia
City of Olympia, MW-27	East Olympia
City of Olympia, MW-18	West Olympia
City of Olympia, MW-22	West Olympia
City of Olympia, MW-23	West Olympia
City of Olympia, MW-24	West Olympia

Reclaimed Water Monitoring

The City shares responsibilities for compliance with requirements of Ecology's reclaimed water permit issued to the LOTT Clean Water Alliance (which includes Lacey, Olympia, Tumwater and Thurston County). The two primary water quality issues are ensuring adequate cross connection control and maintaining a detectable amount of chlorine residual. Because the City owns the pipeline that provides reclaimed water to the Port of Olympia, monitoring for detectable total chlorine residual is required monthly during the irrigation season. Also, an annual inspection of both the south and north reclaimed water pipe lines is done by the City's Cross Connection Control Specialist to verify no cross connections have occurred. See Chapter 6 for details on the City's Reclaimed Water Program.

Analytical Services

Following are the certified water quality laboratories the City uses for biological and chemical testing and analysis. In case of an emergency or for after-hours services, Dragon Analytical Laboratory is used for both bacteriological and chemical analysis.

Bacteria Testing Laboratory

Dragon Analytical
530A RonLee Lane NW
Olympia, WA 98502
360.866.0543
360.866.0556 fax
360.970.5770 after hours

Chemical Testing Laboratory

Edge Analytical Laboratory
1620 S Walnut
Burlington, WA 98223
800.755.9295
360.757.1402 fax

Water Quality Exceedances - Iron and Manganese

The City has excellent water quality when it comes to meeting primary drinking water standards that affect health. There are also secondary drinking water standards, which cover things like iron and manganese. The presence of iron and manganese in the drinking water is from minerals naturally occurring in the groundwater. The secondary standard is exceeded at two Olympia wells, creating aesthetic concerns such as taste, odor and staining on fixtures, but there are no health concerns.

The Hoffman Well 3 (S08) is a seasonal source and rarely used due to high levels of iron (0.4 mg/L – 0.89 mg/L) and manganese (0.103 mg/L – 0.162 mg/L). If it were to become a permanent source, treatment would be required.

The Kaiser Well 1 (S03) is a seasonal source and also has iron above the secondary MCL of 0.3 mg/L (0.65 mg/L). It is rarely used because of concerns about its low capacity (360 gpm) and low aquifer level.

Treatment

The City provides mandatory and optional treatment to its sources, as described below. Table 11.7 summarizes current and future treatment methods of chlorine disinfection and aeration for corrosion control.

Table 11.7 Treatment Equipment and Types

Location	Equipment	Treatment Type
Allison Springs Well 13 (S09) and Well 19 (S11)	Chlorine injection Chlorine analyzer pH meter	• Chlorine gas • Aeration tower
Indian Summer Well 20 (S12)	• Chlorine Injection • Chlorine analyzer • pH meter • Water softener	• On-site sodium hypochlorite generation
McAllister Wellfield (S16)	• Chlorine injection • Chlorine analyzer • pH meter	• Chlorine gas • Aeration towers at Meridian Storage Tank site[1]
Shana Park Well 11 (S10)	• Chlorine injection • Chlorine analyzer • pH meter	• Chlorine gas • Aeration tower

1. To be installed in 2016.

Aeration - Corrosion Control - Water Quality Parameter Optimization

The City is required under the Lead and Copper Rule (LCR) to sample for lead and copper at selected tap sites throughout the distribution system. The City has been in compliance with the LCR since 1996 when the Utility installed aeration treatment at Allison Springs Well 13 (S09) and Well 19 (S11) and Shana Park Well 11 (S10). The purpose of aeration is to remove carbon dioxide gas dissolved in the water, thereby increasing the pH and reducing copper corrosion.

In February 2011, DOH notified the Utility that because of a change in category under the LCR, Olympia's water system is now designated as a large system (i.e. it provides water to over 50,000 customers). This change requires optimal water quality parameters on sources with treatment. This means the Utility needs to operate all of its aeration treatment facilities so the pH will be "optimized" and be above 7.0. This keeps the water from being corrosive and leaching lead and copper from plumbing systems. System-wide optimization for corrosion control is also desired. The City submitted data to DOH for Allison Springs Well 13 (S09) and Well 19 (S11) and Shana Park Well 11 (S10). A minimum pH of 7.0 is assigned as the optimal water quality parameter for the entry points at these wells.

As part of the McAllister Wellfield corrosion control study, Kaiser Well 1 (S03) and Indian Summer Well 20 (S12) were also evaluated by the engineering firm of Gray and Osborne. The results showed that Indian Summer Well (S12), with a relatively high pH of approximately 7.6, is already above the 7.5 pH target for the distribution system and is considered optimized for corrosion control. Kaiser Well 1 (S03) produces water with a low pH at 6.4 – 6.6 and must be treated. DOH approved the Corrosion Control Study in August 2013 and recommended a target pH in the distribution system of 7.5 or greater.

The Utility compared the life-cycle cost of aeration towers and adding caustic soda at the Kaiser Well (S03). Given the high capital, operational and maintenance costs of treatment, and the low production capacity (360 gpm) of the well, the City will likely designate it as an emergency source and leave it untreated.

Disinfection with Chlorine Gas

The City's groundwater sources are not required to be chlorinated. However, the Utility is using disinfection at most wells to prevent a reduction of the distribution system chlorine residual, which would occur when treated and non-treated water are blended in the distribution system. The only exception is the Shana Park Well 11 (S10), which is required to show a chlorine residual of 1.07 mg/L to achieve a contact time (CT) of six or greater.

Disinfection with On-Site Hypochlorite Generation

The disinfection treatment used at Indian Summer Well 20 (S12) is on-site hypochlorite generation. This type of treatment was chosen over gas chlorination due to concern about possible gas chlorination leaks and exposure of the Indian Summer community to chlorine gas. See Chapter 13 for the schedule for replacing the on-site hypochlorite generation system with a hypo-chlorination treatment facility.

Filtration - Iron and Manganese Removal

As mentioned above under Water Quality Exceedances, water from Hoffman Well 3 (S08) contains iron and manganese at concentrations exceeding secondary MCLs. In 2007, a pilot test was conducted using a trailer-mounted pilot-scale filtration plant at the well, using pyrolusite (manganese oxide) as the filtration media. Iron dropped from 0.46 mg/L to 0.13 mg/L (a 73 percent removal rate) while manganese dropped from 0.15 mg/L to 0.015 mg/L (a 95 percent removal rate). See Chapter 13 for scheduled installation of iron and management treatment removal.

Program Management

Water quality program management includes responding to complaints, generating reports and keeping records.

Responding to Customer Complaints

Typically the Water Quality Program receives about 20 complaints a year, primarily reports of sediment in the water, low pressure, and taste and odor concerns.

The Water Quality Specialist responds to water quality complaints. Depending on the nature of the complaint, other Utility staff may respond, such as the Water Quality Monitoring Assistant, the Cross Connection Control Specialist or Water Operations staff.

Water quality complaints are investigated by phone or field visits, and the collected information is entered into the Utility's Water Quality database. The field response includes measuring pH, temperature and chlorine residual. If illness is suspected, staff collects a bacteriological sample and suggests that the customer call his/her primary health care provider.

Record Keeping and Reporting

Water quality and operational records are maintained according to WAC 246-290-480 and 485, as shown in Table 11.8. All records bear the signature of the operator in charge of the water system or the operator's representative. These records are available for inspection by DOH and will be sent to DOH if requested. Records are kept digitally, on paper, or both depending on the data. In addition to the records listed in Table 11.8, consumer confidence reports are kept in a fireproof cabinet.

Reports are submitted as required by WAC 246-290-480(1)(a) and summarized in Table 11.9. Most records are kept in hard copy, although water quality results are kept in both hard copy and electronic format. Records entered into the Water Quality database are backed up each night.

Table 11.8 Record Keeping Requirements

Type	Frequency	Description	Other
Three-year retention cycle			
Chlorine residuals	Daily	SCADA system records data on flow, pH, chlorine residual and temperature of sources.	Manual readings of pH, temperature and chlorine residual taken as part of coliform distribution system sampling and entered into the Water Quality database.
Other information as specified by DOH	N/A		
Other operational or analytical records	N/A		
Public Notices and Certifications	N/A	In response to violations of primary drinking water standards, including Tier 1 violations or DOH orders. Tier 1 violations are those that can cause acute illness, a waterborne disease outbreak or inadequate treatment. Tier 1 violations require notification to the public within 24 hours.	Public notices are kept electronically and a hard copy filed in the DOH file located in the Water Quality office.
Violations of primary drinking water standards	N/A	Records of actions taken by the City to correct the violation, including any public notifications.	
Water treatment performance	Daily	Includes type and quantity of chemicals used, amount of water treated and results of analyses.	
Five-year retention cycle			
Bacteriological analysis	Monthly	Laboratory results are entered into the Water Quality database.	At the end of each calendar year, all bacterial analyses slips are archived. The destruction date is labeled on each box.
Invalidation of groundwater source sample	N/A		
Lowest residual disinfectant concentration	N/A	Record the date and duration of any failure to maintain DOH-prescribed minimum residual disinfectant concentration for more than four hours.	

Type	Frequency	Description	Other
Recordkeeping Requirements, etc.			
Ten-year retention cycle			
Source meter readings	Monthly		
Sanitary survey or special purpose investigation reports	Once every three years or as needed	An on-site review of the water source, facilities, equipment, operation and maintenance of a public water system for the purpose of evaluating the adequacy of water system to produce and distribute safe drinking water.	Reports are kept in a fireproof file cabinet.
Minimum disinfection residual	N/A	DOH specified minimum disinfection residual.	
Corrective action	N/A	Record of each corrective action taken that is associated with a primary drinking water standard. This includes any related public notifications.	
Other			
Project reports, construction documents, inspection reports and related drawings	In perpetuity	A document that describes why a project is being proposed and includes engineering design calculations showing how the project will meet its objectives.	Project reports and construction documents are retained and archived through the Public Works Engineering department.
Monitoring Plans	N/A		Keep for the same period of time as the records of analyses taken under the plan are required to be kept for bacteriological or chemical parameters.

Table 11.9 Reporting Requirements

Type	Requirement	Description
Bacteriological	Monthly	Notify DOH within 10 days of being notified by the laboratory of coliform positive results and by close of business when notified by the laboratory of fecal coliform or *E. coli* positive results. If the purveyor is notified of the results after normal close of business, purveyor to notify DOH before the end of the next business day.
Correction Action	30 days	Notify DOH within 30 days of completing correction action(s).
Disinfection residual	Monthly	Report monthly samples taken as part of total coliform distribution monitoring.
Ground Water Rule	Semi-annual	Submit daily pH readings for Allison Springs and Shana Park Corrosion Control Facilities
Monitoring waivers	During each monitoring cycle or as directed by DOH	In 2012, DOH updated its model for granting organic waivers and applied monitoring waivers to all eligible sources.
Primary violation that is a Tier 1	24 hours	Notify DOH of any Tier 1 violation: • Distribution system sample violation when fecal coliform or *E. coli* are present. Failure to test for fecal coliform or *E. coli* after initial total coliform distribution system sample tests positive. • Nitrate, nitrite or total nitrate and nitrite maximum contaminant level violation or failure to take a confirmation sample. • Waterborne disease outbreak or other waterborne emergency. • Detection of *E. coli*, enterococci, or coliphage in a groundwater source sample. • Other violations or situations determined by DOH.
Primary violation that is not Tier 1	48 hours	Notify DOH of failure to comply with any national primary drinking water regulation, including failure to comply with monitoring requirements.
Reports	Monthly	Chlorination reports due before the tenth day of the following month (Shana Park).
Reports	Biannual	Water quality parameter report (LCR compliance). Due January 10^{th} and July 10^{th} of each year for the preceding six-month monitoring period.
Source meter readings	Made available to DOH upon request	SCADA system readings are imported into the Water Quality database.
Unregulated contaminant monitoring	Send copy to DOH within 30 days of receiving results	Contaminants suspected of being present in drinking water, but which do not have health-based regulatory standards set under the Safe Drinking Water Act. UCMR 3 monitoring occurred in 2013.
Water Facilities Inventory Form	Update annually and within 30 days of any changes	A form summarizing characteristics of the water system.

11.3 Emerging Issues

This section addresses several issues that will affect the City's Water Quality Program during 2015 - 2020:

- Water quality impact of the future Briggs Well water
- Water quality impact of the future Brewery Wellfield water
- Pharmaceutical and personal care products
- Elevated nitrate in Shana Park Well 11 (S10)

Water Quality Impact of Future Briggs Well

Water quality from a test well drilled at Briggs Village indicates the aquifer contains manganese in concentrations at or above the recommended secondary MCL. Because the City has secured adequate water rights from other sources to meet supply needs for at least 50 years, the timing to develop the Briggs Well is uncertain. Ecology has approved extending the Notice to Construction until 2019. During this planning period, the Utility will further evaluate the timing for developing this well, as well as the potential impacts the water quality may have (see Chapter 4).

Water Quality Impact of Future Brewery Wellfield

RH2 Engineering, Inc. was retained by the three cities of Tumwater, Lacey and Olympia to evaluate the infrastructure and assess the water quality of the wellfield at the former Olympia Brewery. This evaluation is ongoing and also includes the potential advantages of creating a regional treatment facility that would serve not only the Brewery wells but other sources owned by Tumwater (see Chapter 4). Planning for a future treatment facility for the Brewery wells presumably will address corrosion control requirements as well as potential iron and manganese. The Utility anticipates no impact to Olympia's water quality from the Brewery water.

Pharmaceutical and Personal Care Products (PPCPs)

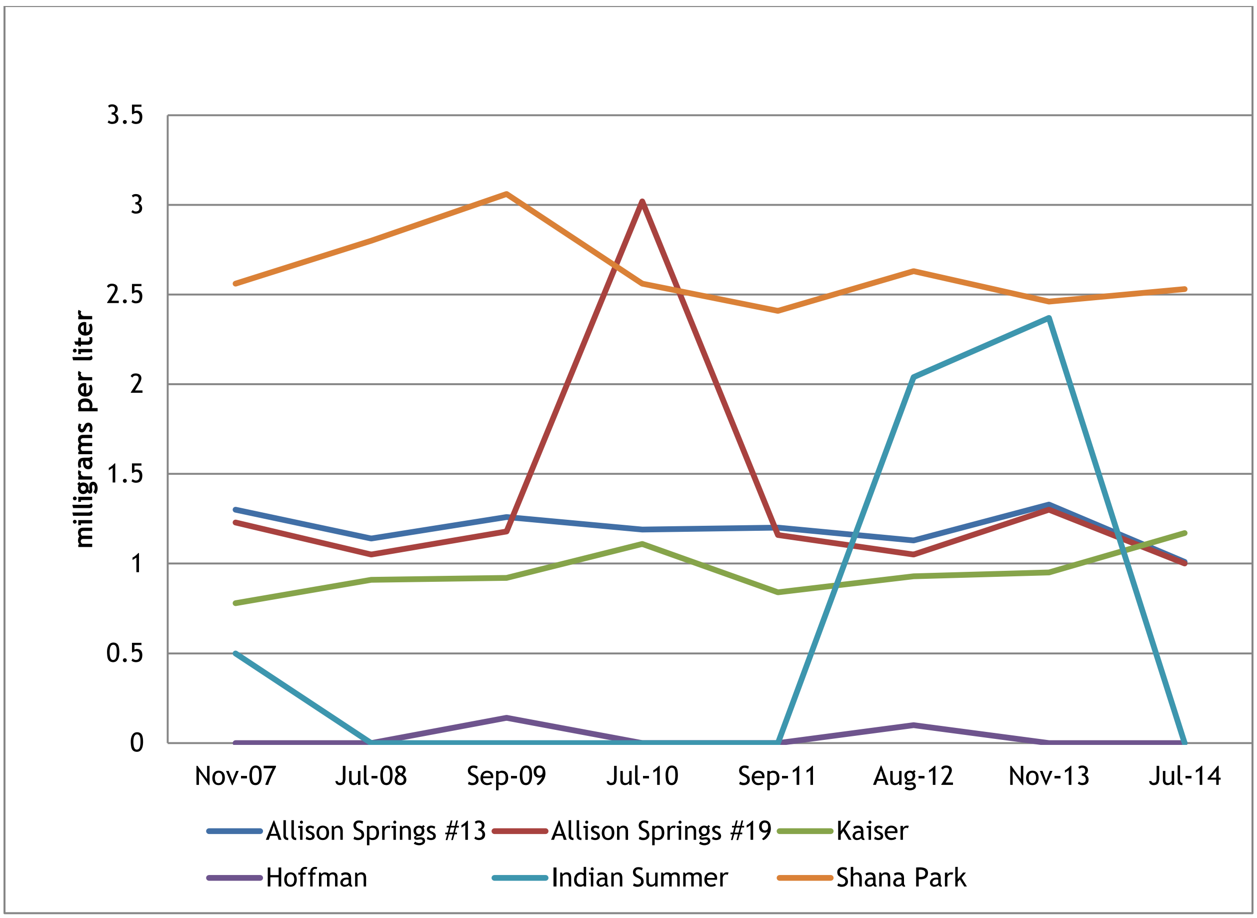
PPCP refers generally to any product used by individuals for personal health or cosmetic reasons, or by agribusiness to enhance the growth or health of livestock. PPCPs include thousands of chemical substances, such as prescription and over-the-counter therapeutic drugs, veterinary drugs, soaps, shampoos, fragrances, lotions and cosmetics. Research continues to determine the extent of ecological harm and potential human health. So far, scientists have found no evidence of adverse human health effects from PPCPs in the environment. EPA uses the Contaminant Candidate List process as a way to evaluate whether a contaminant should be regulated under the Safe Drinking Water Act. This list includes contaminants such as pesticides, chemicals used in commerce, waterborne pathogens, disinfection byproducts, pharmaceuticals and biological toxins. The Utility will continue to monitor national discussion about PPCPs.

Elevated Nitrate in Shana Park Well 11 (S10)

Levels of nitrate in the Shana Park Well 11 (S10), the City's shallowest source well, are a concern. This well is highly vulnerable to nitrate loading, probably from fertilizers and possibly septic systems in the area. The expansion of the monitoring well network by two wells in 2013 will help provide advance notice of nitrate in groundwater within the six-month and five-year time-of-travel capture zones (see Chapter 7). The City will prioritize collection of a nitrate sample from the source as soon as possible after annual start-up. For the next two years, nitrate and nitrogen-15 isotope samples will be collected twice a year from the four monitoring wells; nitrogen-15 isotope samples will also be collected at Shana Park Well 11 (S10) at the same intervals. Staff will re-evaluate the need to continue collecting isotope samples after interpreting the two years of nitrate levels and nitrate-isotope ratios.

Figure 11.1 shows the nitrate trends for all the City's permanent and seasonal sources. The initial nitrate results from the McAllister Wellfield sources -- TW-22 (S13), PW-24 (S14), and PW-25 (S15) -- were 0.33 mg/L, 0.37 mg/L, and 0.43 mg/L respectively. The maximum contaminant level for nitrate is 10 mg/L.

Figure 11.1 Source Nitrate Trends



11.4 2015-2020 Water Quality Program

Water Quality Program strategies and actions are designed to help meet the Drinking Water City's Goal 2:

> **Water is delivered at useful pressures and meets Safe Drinking Water Act standards, and it looks and tastes great.**

To continue meeting Goal 2 and maintain past program success, the Water Quality Program for 2015-2020 has four objectives, listed below with planned implementation strategies.

Objective 2A Maintain 100 percent compliance with all state and federal monitoring requirements.

Strategy 2A1 -- Continue compliance monitoring for source, distribution and tap locations according to required timelines, with analysis performed by accredited laboratories.

Strategy 2A2 -- Continue groundwater protection monitoring to alert staff about contamination that may be migrating toward drinking water sources.

Strategy 2A3 -- Continue tracking developments associated with future state and federal monitoring requirements.

Strategy 2A4 -- Continue close monitoring of nitrate levels in Shana Park Well 11 (S10). If levels begin to increase, evaluate treatment or development of a new source.

Performance Measures

1. Collect 70 monthly system samples. Increase monthly system samples per DOH requirements (based on population).
2. Collect quarterly DBP samples (two samples per location) from four sampling locations.
3. Collect an annual nitrate/nitrite sample from all of the City's permanent sources.
4. Collect lead and copper, VOC and SOC samples, based on the most current DOH Water Quality Monitoring Schedule.
5. Collect UCMR 4 samples according to the required federal schedule.
6. Collect semi-annual nitrate and nitrogen-15 isotope samples from Shana Park Well 11 (S10) for a period of two years. Evaluate results and determine next course of action.

Objective 2B Maintain 100 percent compliance with all state and federal treatment requirements.

Strategy 2B1 -- Maintain a minimum free chlorine residual of 1.07 mg/L at Shana Park Well 11 (S10) in order to maintain compliance with CT6.

Strategy 2B2 -- Maintain a minimum pH of 7.0 at Shana Park Well 11 (S10), Allison Springs Well 13 (S09) and Well 19 (S11); and a minimum pH of 7.5 at McAllister Wellfield (S16) and Indian Summer Well 20 (S12).

Strategy 2B3 -- Verify minimum chlorine residual of 0.2 mg/L in the distribution system by measuring residual chlorine levels, as part of monthly system coliform sampling.

Performance Measures

1. Submit monthly to DOH the Shana Park Chlorination and Groundwater Rule reports documenting adequate chlorine contact time is maintained.
2. Submit biannually to DOH the Water Quality Parameter Report due on January 10th and July 10th documenting minimum pH levels are maintained.
3. Check daily with each distribution system sample collection that chlorine residuals are at or above 0.2 mg/L.

Objective 2C Respond to customer water quality concerns promptly and maintain accurate reporting.

Strategy 2C1 -- Investigate, validate and respond to water quality complaints by phone call, email and/or site visit.

Strategy 2C2 – Meet all reporting and record retention deadlines.

Performance Measures

1. Respond to all water quality complaints by the end of the following business day.
2. Ensure the various record retention schedules and other state and federal reporting requirements are met.
3. Review and update all monitoring plans annually.

Objective 2D Support the groundwater protection network with monitoring and data collection

Strategy 2D1 -- Continue sampling groundwater protection monitoring wells in all Drinking Water Protection Areas.

Strategy 2D2 -- Continue maintaining data loggers in all Drinking Water Protection Areas.

Performance Measures

1. Collect initial SOC, VOC, IOC and bacteria samples on all new monitoring wells.
2. Collect semi-annual nitrate and nitrogen-15 isotope samples from the groundwater monitoring wells designated for this sampling.
3. Download data loggers from designated groundwater monitoring wells on a quarterly basis.

11.5 Implementation & Staffing

This section includes current staff, a discussion of additional staffing needed to support the planned program and projects included in the Capital Improvement Program.

Current Staffing

Water Quality Program staff members who collect water samples and make adjustments to treatment processes have appropriate Water Works Certifications required by DOH (see Chapter 12, Section 12.1). At the end of 2013, the Utility was reorganized to reassign cross connection control and meter reading activities from the Water Quality Section to the Water Operations Section. The Water Quality Program therefore currently consists of 5.75 FTEs:

- Water Monitoring Assistant (1.0 FTE)
- Water Quality Specialist (1.0 FTE)
- Two Senior Program Specialists (groundwater protection/reclaimed water and water conservation) (1.75 FTE)
- Program Assistant (water conservation) 1.0 FTE
- Water Quality Program and Planning Supervisor (1.0 FTE)

The Water Quality section encompasses four distinct program areas. Below is a brief description of activities by job classification:

1. **Water Monitoring Assistant** – primary staff member conducting compliance monitoring for all sources, as well as for the Olympia Artesian Well and the Olympia McAllister Group B water system. Supports surveillance monitoring associated with the Groundwater Protection Program.
2. **Water Quality Specialist** – prepares monthly, quarterly and annual state reports and is the primary staff member conducting surveillance monitoring associated with the Groundwater Protection Program. Monitors and adjusts water treatment systems.
3. **Senior Program Specialist (Water Conservation)** – implements the program, including compliance with water use efficiency requirements. See Chapter 5 (Water Use Efficiency) for program details.
4. **Senior Program Specialist (Reclaimed Water and Groundwater Protection**) – implements these programs; responsibilities include expanding monitoring well networks, updating the Groundwater Report, and ensuring End User Agreements for reclaimed water are maintained. See Chapters 6 (Reclaimed Water) and Chapter 7 (Groundwater Protection) for details.
5. **Program Assistant (Water Conservation and Cross Connection Control)** – provides support for both these programs, including activities associated with annual backflow testing notifications, phone calls, data entry, compliance status updates and processing of water conservation related rebates.
6. **Program and Planning Supervisor** – responsible for ensuring compliance with federal, state and local drinking water quality monitoring and treatment standards. Provides direction, mentoring and facilitation of various teams. Responsible for budget planning and expenditures.

Future Staffing

The following increases in monitoring activities will be needed during this planning period:

- Water quality parameter monitoring (lead and copper optimization) and reporting.
- Eighty (80) monthly system coliform samples due to anticipated population growth.
- New groundwater protection monitoring wells and associated sample collection and water level readings.

New monitoring and treatment activities will be absorbed by current staffing. However, this will result in less support for surveillance monitoring. Staffing needs for the Groundwater Protection Program will be revisited during this planning period.

Water Quality Projects

The projects listed below are included in the 2015-2020 Capital Improvement Program (CIP) presented in Chapter 13. Project-level cost estimates and the anticipated implementation schedule for each project are in Table 13-2.

- Replace the Indian Summer Well on-site chlorine generation system with a more reliable hypochlorite system
- Shana Park water quality study

An additional project is included for implementation after 2020:

- Design and construction of hypo-chlorination and iron/manganese removal for the Hoffman Well (S08)

11.6 Levels of Service

With the 2009 – 2014 Water System Plan, the Utility developed its first formal Level of Service (LOS) standards. Previously, the Utility relied on informal standards, based on professional experience and system history, to evaluate whether the system was performing adequately. The new LOS standards were developed for:

- System performance (including service interruption due to breakage, pressure loss, and system reliability).
- Sustainability (energy efficiency).
- Customer service (response to water quality and service-related complaints).

The customer service LOS for the Water Quality Program is:

- Staff will respond to low pressure and water quality complaints by the end of the following business day.

See Chapter 12 for more on the Utility's LOS and details on those related to Operations and Maintenance.

Chapter 12 – Operations and Maintenance Program – Contents

Tables

Appendices

12-1 Cross Connection Control Procedures Manual

12-2 Drinking Water Utility Emergency Response Plan Table of Contents

12-3 Technical Memorandum: Asset Management Strategy

CHAPTER 12 - OPERATIONS AND MAINTENANCE PROGRAM

The primary role of the Utility's Operations and Maintenance (O&M) Program is to operate and maintain the infrastructure that extracts water from groundwater sources, stores it for future use, and transports the water through the distribution and delivery system to the City's water customers. The O&M Program is also responsible for the maintenance of all reclaimed water lines inside the City.

The O&M Program helps meet the Drinking Water Utility's Goal 6:

> **Infrastructure is prudently financed, and sustainably constructed, maintained and operated to ensure reliable delivery of high quality water to a growing community.**

The program also implements Comprehensive Plan Goal GU7.

Objectives for improving the infrastructure are discussed in Chapter 8 (Source Infrastructure), Chapter 9 (Storage), and Chapter 10 (Transmission/Distribution Infrastructure). Water quality strategies are in Chapter 11, and Chapter 6 addresses the Reclaimed Water Program. O&M Program objectives for 2015-2020 are to:

- Continue to improve the maintenance management program, including preventive maintenance, repairs and replacements.
- Continue to improve the emergency response program and maintain facility security.
- Continue to improve program management, including safety and asset management.

Priorities for 2015-2020 include more fully developing the asset management program, completing Automatic Meter Reader (AMR) implementation, bringing leak detection in-house and continuing to meet Level of Service Standards (LOS).

12.1 Operations and Maintenance Regulations

The O&M Program is guided by a number of state regulations. Details on the Utility's compliance with operator certification requirements and other applicable regulations are presented below.

Operator Certification

The Washington State Department of Health (DOH) requires all public water systems with more than 100 service connections to have a certified operator. Certifications are mandatory for staff members who are in direct charge of a public water system or major segments of the system, and who are responsible for monitoring or improving water quality. (See Chapter 70.119 RCW and Chapter 246-292 WAC.)

DOH requires mandatory certification for six types of positions, as shown in Table 12.1.

Table 12.1 Mandatory Certifications

Position	Classification
Water Operations Supervisor	Water Distribution Manager (WDM) 4
Pump Stations Supervisor	WDM 4, Water Treatment Plant Operator (WTPO) 1
Water Operations Lead Worker	WDM 3
Water Quality Supervisor	WTPO 1
Water Quality Specialist	WTPO 1
Water Monitoring Assistant	WTPO 1

A WTPO 2 certification will be required should the Utility install iron or manganese treatment (**Chapter 11, Section 11.2**).

Certification is also available on a voluntary basis to individuals interested in the Water Distribution Manager (WDM), Cross Connection Specialist (CCS) and Backflow Assembly Tester (BAT) classifications. These voluntary certifications demonstrate staff incentive and competence and are an index of the professionalism and expertise available to efficiently operate the City's water system. **Table 12.2** lists Utility staff and their certification status.

Table 12.2 Water Operations and Water Quality Staff Water Certifications

Name	Certification Number	State Certification	Mandatory Certification
Bonsall, Mark	11167	CCS,WDM 2	
Coke, Steve	6185	CCS, BAT, WDM 4	
Cole, Jeremy	10219	WDM 3, CCS, WTPO 1	x
Curley, Daisy	11502	WTPO 1, CCS	x
Daniels, Curt	6329	WDM 2, CCS, WTPO 1	x
Davis, Bill	12850	WDM 2	
Davis, Steve	12409	WDM1	
Gallagher, Mike	7939	WDM 3, CCS	
Main, Ed	10739	WDM , WTPO 1	x
Maxfield, Meliss	11529	WDM1, WTPO 1, CCS	x
Michael, Tim	12881	WTPO 1	x
Miller, Cara	12303	WDM1	
Norton, Dave	7875	WDM 3, CCS	x
Klimek, Ernie	7402	WDM 4, WTPO 4, CCS	x
Reimers, Cheri	9485	WDM 4, CCS, WTPO 1	x
Black, Ronnie	11952	WDM 2	
Sloan, Dustin	10880	WDM 2, CCS	
Vessey, Mike	7809	WDM 4, CCS, WTPO1	x
Witt, Ken	10319	WDM 2, CCS, BAT	
Woods, Eric	10802	WDM , WTPO 1	x

Acronyms: WTPO=Water Treatment Plan Operator, WDM=Water Distribution Manager, BAT=Backflow Assembly Tester, and CCS=Cross Connection Specialist.

Other Regulations

Chapter 246-290 WAC, Part 5 contains detailed regulations covering operations and maintenance, system reliability, emergency response, and metering. Olympia's compliance with these regulations is described in the following section.

As required by Chapter 246-294 WAC, the City maintains a Drinking Water Operating Permit for the water system.

Olympia's municipal code (OMC 13.04) gives the City the legal authority to implement and enforce a Cross Connection Control program. Specific requirements are in the City's Engineering and Development Standards.

12.2 O&M Program Activities

The O&M Program is the most publicly visible component of the Drinking Water Utility, with staff in the field operating and maintaining water storage facilities, pumping equipment, valves, pipes, hydrants and meters.

O&M staff visually inspects or uses telemetry to remotely monitor critical system components; provide routine maintenance, repair and replacement services; maintain accurate system maps and records; and develop and test the Utility's Emergency Response Plan. In addition, O&M staff makes sure there is adequate water volume to meet fire protection and peak flow needs, thereby maintaining system reliability, performance and water quality.

The Program manages:

- Seven water supply sources (McAllister Wellfield and six wells)
- Five booster pump stations
- 11 storage tanks
- Over 360 miles of transmission and distribution pipe
- Approximately 2,500 fire hydrants
- Approximately 8,400 valves
- 19,646 service connections (as of 2013)

In addition to maintenance management, activities include reclaimed water system management, cross connection control, emergency response, and program management to address safety issues, asset management, and upgrading and replacing service meters.

Maintenance Management

The O&M Program currently uses a straightforward, subjective assessment of service levels related to the program's core functions, such as hydrant maintenance, valve exercise, pipe flushing, new service installations; and maintenance of pump stations, source facilities and water meters. The staff is organized into two crews: one responsible for supply, storage, and pump station maintenance; and one responsible for the transmission and distribution system piping.

Supply, Storage and Pump Station Maintenance

The pump station staff is responsible for all pump stations and other mechanical equipment and facilities at the supply sources and storage tanks (**Chapter 8** and **Chapter 9**). The following activities are described in this section:

- General building and grounds maintenance.
- Electrical repair and maintenance.
- Exercise, flushing and inspection of equipment.
- Scheduling of equipment maintenance.
- General maintenance, repair or replacement of parts or equipment.
- Interior tank cleaning (supported by contractors).
- Inspection, scheduling and repair of treatment equipment (that is, chlorine pumps, injector, analyzers and pressure regulators) and changing out chlorine tanks.
- Telemetry alarm checks, repairs, loading programs, re-calibration, upgrades.

Preventive maintenance is scheduled. Breaks are fixed immediately. Equipment is replaced when it becomes unreliable.

Transmission and Distribution System

The distribution system staff is responsible for maintaining the pipes that make up the transmission and distribution systems (Chapter 10). The Utility currently contracts leak detection activities, but is considering purchase of its own detecting and assessing equipment for the system. Detection efforts indicate the occurrence of very few leaks. Most leaks are associated with hydrant bleeders and valve packing, all of which have been repaired. The O&M Program will evaluate the frequency of future leak detection efforts. See Chapter 3, Section 3.2 for an explanation of how the Utility accounts for leakage in forecasting future demand. See Chapter 5, Section 5.2 for the role of controlling leakage in the conservation program.

Maintenance activities are described below for:

- Valves
- Service lines
- Hydrants
- Water meters

Preventive maintenance is done on a schedule. Breaks and other problems are immediately fixed. Replacements occur on a limited basis.

Valve Maintenance

Distribution system staff exercise and flush the system's approximately 8,400 valves on a three-year cycle. The staff is also responsible for installing new valves, and handling general maintenance and replacement activities.

Preventive maintenance is based on a rotating schedule by zone. Breaks and other problems are immediately fixed.

Service Line Maintenance

Water distribution staff is responsible for abandoning, installing, replacing, repairing and relocating service lines. Service line maintenance is a low priority and only becomes a high priority when breaks and other service losses occur; these issues are immediately addressed. This group also installs new sampling stations and replaces old ones when requested by Water Quality Program staff.

Hydrant Maintenance

The water distribution staff is responsible for flushing, exercising, installing, raising/adjusting, replacing or relocating the system's approximately 2,500 hydrants. The flushing schedule is once every three years. Preventive maintenance is a high priority to avoid leaks and breaks, and to make sure the hydrants are functional for firefighting.

Water Meter Maintenance

At the end of 2013, the Utility was reorganized to reassign meter reading activities from the Water Quality Section to the Water Operations Section. Meter readers, with assistance from the distribution crew as needed, are responsible for installing and replacing most meters. Water distribution crews also respond to after-hours customer service calls for turning meters on and off. Preventive meter maintenance is rarely done. Breaks and other problems are immediately fixed when reported. The Meter Reading system was upgraded in 2014 to an Itron AMR system where 90 percent of meters are read via a fixed network and the remaining 10 percent are read via a mobile system. This capital improvement project replaced approximately 75 percent of the meters and retrofitted the rest with new registers that allow for automated reading.

Reclaimed Water System

The water distribution staff is responsible for initial flushing of all reclaimed water lines at the beginning of the irrigation season, re-painting valve box covers, and making any needed line repairs. See Chapter 6 for additional information regarding the City's reclaimed water system and program.

Cross Connection Control

Cross connection control is needed to ensure the potable drinking water system is protected from potential backsiphonage at the customers' point of service. In 2013, this responsibility was reassigned to Water Operations and staff continued with efforts outlined in the 2009 Water System Plan to improve enforcement and annual testing. An evaluation of remaining unprotected Table 9 High Health Hazard Premises identified 75 facilities needing premises isolation. Three key steps were implemented:

- Updating the Olympia Municipal Code (OMC 13.04), Ordinance 6774 (adopted in October 2011).
- Assigning dedicated administrative support staff.
- Replacing backflow management software.

By the end of 2014, all known Table 9 facilities had achieved premises isolation, and annual testing reached 98 percent.

OMC 13.04 gives the City the legal authority to implement and enforce a Cross Connection Control Program. This authority now includes requiring regular inspections and testing on all backflow assemblies within the City's jurisdiction. Any device found not functioning properly must be promptly repaired or replaced; otherwise, the City may deny or discontinue water service to the premises.

The Engineering Design and Development Standards outline the specific requirements for cross connection controls for new construction and remodels.

Utility's *Cross Connection Control Procedures Manual* (Appendix 12-1**)** provides details on how the program is implemented, including hazard evaluations, notification activities, inspections, testing and repairs.

Emergency Response

A variety of emergencies may threaten the Utility's ability to deliver safe and reliable drinking water. The purpose of emergency response planning is to identify specific response actions to be taken during an emergency that will maintain quantity and quality of water, protect employees, minimize disruption to the public and preserve property.

To improve the security of critical facilities, the Utility hired the consulting firm EES in 2004 to conduct a Vulnerability Assessment, and began installing several security enhancements in 2007. The assessment addressed specific physical technologies and Utility policies and operational procedures relevant to securing critical potable water facilities.

Emergency Response Plan

The Utility's Emergency Response Plan (ERP), updated concurrently with this Water System Plan, follows an "all hazards" approach to emergency planning. This means that whatever the emergency might be, the same formula, outlined in the ERP, is used to respond. The ERP was developed using the Incident Command (IC) structure to ensure smooth communication between the Utility and the City's Emergency Operations Center. The ERP also provides details on the Utility's internal and external communication procedures, threat evaluation, replacement equipment, chemical supplies, employee safety protocols and returning to normal operations. For a complete list of ERP components, see the ERP Table of Contents (Appendix 12-2). The ERP itself contains 14 appendices, including a priority customer list, emergency contact list, equipment inventory, hazard analysis, water quality reporting forms, and critical facility schematics and operational specifics. Also contained in ERP appendices are:

- **Spill Response Plan** for responding to immediate or short-term threats.
- **Contingency Plan** to supply water from other sources if a water supply needs to be abandoned or temporarily shut down.
- **Water Shortage Response Plan** if water supplies become limited due to a contamination event (Chapter 5, Section 5.2).

In addition to the ERP, a field guide was developed to provide quick and practical direction to field staff on how to respond to a variety of emergency situations. Because of its sensitive nature, the field guide and several sections of the ERP are not publicly available. The Utility's Water Quality Supervisor maintains these documents.

In addition to maintaining planning documents, the Utility has prepared in the following specific ways for an immediate, short-term or long-term event that might impact a City water supply:

- Drinking Water Utility ERP and IC system in place, including the ability to communicate with first responders during spill events.
- Trained staff ready to respond, with clear understanding for the ERP, the IC system, and their roles during emergencies.
- Working relationships with first responders within DWPAs and participation on the Local Emergency Planning Committee (Table 12.3).
- Mutual Aid Agreement in place with Fort Lewis for spill response, and mutual aid and inter-tie agreements in place with the Cities of Lacey and Tumwater to receive emergency water if needed (Chapter 4).
- Protocols in place for isolating the potentially contaminated source, sampling the source to determine levels of contamination, and modeling and evaluating a contaminant plume.
- Arrangements for environmental monitoring support from all potential first responders.
- System in place to communicate with customers about the event, risks and actions the Utility is taking.

Contingency Plan

The City successfully secured approval from the Washington Department of Ecology (Ecology) to transfer McAllister Springs and Abbott Springs water rights to the new McAllister Wellfield, which went on line in 2014. This action greatly reduced the vulnerability of the City's main water source, since the Wellfield is more protected than the Springs.

The ERP outlines details of the Contingency, Spill Response and Water Shortage Plans, so staff can be prepared to maintain water supply to customers if one or more supply sources should be lost or some other major infrastructure failure occurs. The Utility's LOS standard for system reliability is to maintain capacity to meet winter demand (inside water use only) with loss of the largest water source. Currently the winter demand is approximately 6.0 million gallons a day. Meeting this demand would require complete curtailment of all outside and non-essential water use. This standard is within the Utility's current and planned capacity (Chapter 3). See Section 12.3 for more on Levels of Service.

Potential for Loss of Supply

A water supply could be lost due to contamination of a water source or damage to a source or transmission line due to natural events like an earthquake or human-caused threats. To prevent contaminants from reaching a supply source, it may be necessary to stop pumping operations until corrective actions can be completed. Under extreme circumstances, the City may need to permanently abandon or temporarily shut down a source because of source contamination.

Contamination risks are described in Chapter 7. Hazardous material spills or discharges can result in contamination of a single well or an entire wellfield. Loss of supply at McAllister Wellfield through a source or transmission failure would have a significant impact on system reliability. Loss of one or more of the other supply wells would not have as dramatic an impact. However, if loss occurred during peak season, some curtailment would be needed.

Standby (or emergency) storage in each pressure zone provides some system reliability (Chapter 9). The Utility's reliability LOS standard requires supply capacity in addition to this storage capacity. Also, interties with the cities of Lacey and Tumwater can provide water during an emergency under certain conditions.

Contingency Measures

If necessary in the event of loss of water supply, the Utility could implement the Water Shortage Response Plan (Appendix 5-2) for complete curtailment of all outside and non-essential water use, a strategy that would still allow customers to meet basic needs for consumption, sanitation and general commerce. The restriction on outdoor water use would need to be strictly enforced to ensure that indoor uses are not affected.

The Water Shortage Response Plan establishes procedures to follow if curtailment is required and outlines four progressive levels of curtailment: advisory, voluntary, mandatory and emergency.

Emergency Incident and Spill Response

Although contingency planning is designed to address longer-term impacts from water supply contaminating events, by default it also provides tools for responding to immediate or short-term threats. Thus, through the ERP, the Utility has companion emergency incident and spill response procedures in place to minimize impact to the City's water supplies. A critical component of emergency response is solid relationships and effective communication with neighboring and regional partners, particularly with respect to the City's DWPAs, since some DWPAs extend beyond city limits (Chapter 7, Section 7.3).

The existing mutual aid agreements, multi-jurisdictional response planning coordination, and multi-agency response capabilities are important tools in planning for and responding to emergency incident and spill events.

Incident Response Example - Transportation Spills

As an example of implementing incident response, transportation spills of hazardous materials are rated as "high" in the hazard analysis conducted by the Utility as part of its Vulnerability Assessment and contaminant source inventories (Chapter 7, Section 7.4, Appendix 7-1 and Appendix 7-2). Risk from transportation spills is most threatening to the Allison Springs Well 13 (S09) and Well 19 (S11), Indian Summer Well 20 (S12), McAllister Wellfield (S16), and the planned Briggs Well (Table 7.2).

First response to spills that occur along transportation corridors is the responsibility of the Washington State Patrol, in coordination with local fire districts and Ecology. The Washington State Patrol acts as IC for all jurisdictions when a spill occurs on a transportation route. Because Olympia's DWPAs are located both within and outside the City limits, local response to spills may be under the jurisdiction of the Olympia Fire Department and other fire department(s) or fire district(s). For example, Thurston County Fire District 3 (Lacey), District 6 (East Olympia), District 9 (McLane) and the Tumwater Fire Department all have a potential role in local emergency management planning and spill response in DWPAs outside the City's boundaries. The address or location of the incident reported to Thurston County's 911 Emergency Dispatch Center usually determines the jurisdictional authority.

First Responder Jurisdictions

Table 12.3 indicates the jurisdictions that could potentially be designated as the "first responder" for each of the City's DWPAs located within and outside of the City.

Table 12.3 Spill Response First Responder Jurisdictions

Olympia Supply Source	First Responder Jurisdictions
McAllister Wellfield (S16)	Washington State Patrol – Incident Command (IC) Fire District No. 3 – Lacey
Shana Park Well 11 (S10)	Washington State Patrol (IC) Fire District No. 3 – Lacey Fire District No. 6 – East Olympia
Indian Summer Well 20 (S12)	Washington State Patrol (IC) Fire District No. 3 – Lacey Fire District No. 6 – East Olympia
Hoffman Well 3 (S08)	Washington State Patrol (IC) Olympia Fire Department Fire District No. 3 – Lacey
Briggs Well (planned)	Washington State Patrol (IC) Olympia Fire Department Tumwater Fire Department
Allison Springs Well 13 (S09)	Washington State Patrol (IC) Olympia Fire Department Fire District No. 9 – McLane
Allison Springs Well 19 (S11)	Washington State Patrol (IC) Olympia Fire Department Fire District No. 9 – McLane
Kaiser Well 1 (S03)	Washington State Patrol (IC) Olympia Fire Department Fire District No. 9 – McLane
State and Federal Highways and Railroads	Washington State Patrol (IC)

Operations and Maintenance Program Management

Program management activities include developing and implementing Standard Operating Procedures (SOPs), conducting an employee safety program, developing an asset management program, and planning to upgrade and replace service meters.

Standard Operating Procedures

The Utility hired a consultant to help develop SOPs. For the most critical activities, these SOPs provide detailed steps on completing the activity, including safety and health considerations.

SOPs were also developed for reclaimed water, dealing with such issues as startup procedures, inspection and testing of backflow devices, and identifying unauthorized connections. Each Operations and Water Quality vehicle contains a binder with up-to-date copies of the SOPs, Emergency Action Plans (EAPs) and Fall Protection Plans. The Water Resources Director and Water Operations, Pump Stations and Water Quality Supervisors also have copies of these documents in their offices.

The SOPs are reviewed annually and updated as necessary. The SOP binder contains:

- Physical address of sources, storage tanks and booster pump stations.
- Day and after-hours phone numbers of Utility emergency staff contacts.
- Distribution system procedures.
- Water quality procedures.
- Emergency procedures.
- Pump station and storage tank procedures.
- Reclaimed water procedures.

Safety Program

The Utility has an active safety program guided by the City's Safety Coordinator. A safety committee meets monthly to monitor and discuss ways to improve safety. The committee reviews accidents or near misses as well as new training opportunities and regulations. Monthly trainings for staff are given by either the Safety Coordinator or an experienced outside professional. Some of the training topics include:

- Personal protection equipment
- Flagging
- Cranes, hoists and rigging
- Fall protection
- Lock out procedures
- Confined space procedures
- Respiratory protection
- Handling asbestos
- Chlorine systems

The Utility has developed an action plan to ensure implementation of the Public Works Department's *Employee Safety and Health Handbook*. The action plan identifies priority elements of the handbook which are routinely discussed at staff meetings. Material Safety Data Sheets for chemicals used are located next to the safety bulletin board, along with safety and first aid equipment. The Standard Operating Procedures include protocols for fall protection and safely dealing with such hazardous tasks as handling asbestos pipe and changing chlorine cylinders.

Asset Management

During the last planning period, the Utility began creating a process for managing its infrastructure assets. The Utility hired the consulting firm HDR Engineering, Inc. to help identify the next steps for the Utility to develop a more comprehensive asset management program (see Appendix 12-3). Also, the City has created an interdepartmental leadership team to steer the overall planning and development of asset management programs.

Asset management provides a structured approach to minimizing asset ownership life cycle costs while meeting required service levels and providing long-term confidence in the condition of system infrastructure. An effective asset management process will enable the Utility to make decisions about when to repair and replace infrastructure based on social, financial and environmental factors rather than simply on age or location of a particular asset. The expected program outcomes are lower ownership costs, assets in better condition with longer lives, and more efficient use of the City's human and capital resources.

An effective asset management process will help the Utility:

- Determine levels of service, and measures of service levels important to customers (see current LOS standards, Section 12.3).
- Develop measures tying employee work to the desired outcome or customer service level.
- Develop business case evaluations for asset decisions using a triple-bottom line approach (financial, social, environmental) and for selecting the best means to accomplish a desired level of service.
- Map workflows for maintenance, asset replacement and capital facilities planning, and set priorities for workflow improvements. This will ensure that assets are built to standards and maintained to function optimally.
- Make course corrections based on "lessons learned", the advent of new technologies, or changes in LOS standards.

The Utility has completed some fundamental efforts towards implementing an asset management program, such as updating levels of service and implementing the Vueworks computerized maintenance management system (CMMS). The Utility has begun developing the data systems for asset management by incorporating all assets into the City's GIS mapping system. A complete data system will allow the Utility to:

- Inventory each asset by its location, condition, value and cost to the Utility.
- Prioritize investment decisions based on criticality (both risk of failure and consequence of failure).
- Schedule when to repair, replace and/or expand each asset.

It will take years for the Utility to develop and fine tune a meaningful asset management program. Asset Management Plans are considered "living documents" that require regular updates to remain relevant and useful. Near-term asset management and planning activities will focus on:

- Asset knowledge
- Asset operation and maintenance
- Asset condition monitoring
- Asset management systems

A technical memorandum from HDR Engineering, Inc. (Appendix 12-3) contains more information on asset management plan development and implementation, the current state of the asset management program, and near- and short-term activities needed to close knowledge gaps.

Meter Program

Approximately 20,000 service meters were upgraded or replaced as part of the AMR capital project completed in 2014.

The Utility has two full-time staff who read meters and perform other meter related service work. Approximately 98 percent of meters are read and billed bi-monthly, while the remaining two percent (typically larger accounts) are read and billed monthly.

Future needs include a capital plan to replace the 5,000 meters that went through a register change-out only during the AMR transition. These meters warranted that approach, but will be nearing the end of their useful life during the 2015-2020 plan cycle. Also needed are plans to maintain and upgrade hardware and software infrastructure as the new AMR system moves forward.

Energy Efficiency

The Utility recently contracted with an Energy Savings Company (ESCO) through the State Department of Enterprise Services Energy Savings Performance Contracting (ESPC) program to perform a preliminary energy audit of our water facilities. Recommendations for energy savings measures included optimization of well and booster pump station operations. Additionally, the Utility will seek to incorporate energy efficiency into future capital improvement projects for both new facility designs, as well as existing station rehabilitation projects.

12.3 2015-2020 O&M Program

The O&M Program helps meet the Drinking Water Utility's Goal 6:

Infrastructure is prudently financed, and sustainably constructed, maintained and operated to ensure reliable delivery of high quality water to a growing community.

Chapters 8, 9 and 10 describe the infrastructure which is designed to meet Objective 6A: **Design and construct infrastructure to ensure reliable delivery of water.**

This section presents the 2015-2020 O&M program objectives, and ongoing and new program strategies.

Objective 6B Continue to improve maintenance management, including preventive maintenance, repairs and replacements.

Strategy 6B1 -- Document and report equipment efficiency and capacity annually.

Strategy 6B2 -- Maintain, clean, and exercise equipment per manufacturer recommendations.

Strategy 6B3 -- Maintain buildings and grounds in a park-like manner.

Objective 6C Continue to improve the emergency response program and maintain facility security.

Strategy 6C1 -- Plan for the anticipated impacts of sea level rise.

Strategy 6C2 -- Continue to maintain and be prepared to implement the water system emergency response plan.

Strategy 6C3 -- Store emergency supplies at several strategic locations and replenish before expiration dates.

Strategy 6C4 -- Conduct tabletop and/or field exercises periodically.

Strategy 6C5 -- Maintain existing security equipment at critical facilities.

Strategy 6C6 -- Update or replace pump station telemetry system hardware and software as needed.

Objective 6D Continue to improve (O&M) program management, including safety and asset management.

Strategy 6D1 -- Continue scheduling and documenting all water system maintenance in VueWorks.

Strategy 6D2 -- Continue employee safety program, including safety committee review of accidents, review of new regulations and available training, and monthly staff training sessions.

Strategy 6D3 -- Ensure that all Utility infrastructure is accurately depicted on maps and related databases.

Strategy 6D4 -- Develop and implement an asset management program, in coordination with Public Works and City-wide efforts, to prioritize future capital improvement projects.

12.4 Implementation and Staffing

This section includes current staff and additional staff needed to support the planned program and meet the new LOS standards, as well as operations and maintenance projects scheduled in the Capital Improvement Program (Chapter 13).

Current Staffing Levels

The O&M Program currently is budgeted for 21 employees, divided into two crews. The Water Operations Supervisor oversees distribution system activities and meter operations, and the Pump Stations Supervisor oversees sources, booster pump stations and storage tank facilities. Both supervisors report to the Director of Water Resources. The function of each staff position and its full-time equivalent (FTE) is detailed below.

Drinking Water Operations

- Water Operations Supervisor (1.0 FTE). Directs, plans and organizes operation and maintenance of the potable water and reclaimed water distribution system.
- Water Distribution Lead Worker (1.0 FTE). Oversees and assists with day-to-day distribution and reclaimed water system maintenance and repair activities.
- Water Distribution Maintenance Worker II (11.0 FTEs). Performs day-to-day distribution system maintenance and repair duties.
- Inventory Control Specialist I (0.5 FTE). Responsible for data entry.
- Cross Connection/Meter Reader Lead (1.0 FTE). Oversees meter operations and tests and inspects backflow assemblies.
- Meter Readers (2.0 FTEs). Reads meters and performs meter maintenance.

Pump Stations Operations

- Pump Station Supervisor (0.5 FTE). Directs, plans and organizes operation and maintenance of pump stations and source and storage facilities.
- Pump Stations Remote Systems Technician (1.25 FTE). Ensures that all remote systems necessary to operate the water system are functioning at capacity.
- Pump Stations Maintenance Technician (2.0 FTE). Performs O&M work at the McAllister Wellfield, wells, pump stations and storage tanks.

Staffing Needs

A staff position is potentially needed to make the transition from manually read to automatically read meters. The person in this position would work with customer service and also to troubleshoot/repair the radios and the radio network, and review fault reports from the network.

Developing in-house leak detection and pipe analysis may also require the addition of a position to the Drinking Water Operations staff. The person in this position would be responsible for finding leaks in the system and doing condition analysis of the distribution system at the field level to be entered into the Vueworks condition module. From here, the data will be used to identify capital projects for Drinking Water Operations as part of an Asset Management Plan.

An additional 0.25 FTE will need to be added to the current data control position (currently in Storm/Sewer operations) to help Pump Stations and Water Quality with asset management and with running monthly reports from Vueworks.

A Maintenance Worker II will need to be added to Pump Stations Operations. This position will be jointly funded by the Drinking Water and Wastewater Utilities. The position will be needed to keep up with the facility side of the Pump Stations crew's responsibilities. Duties will include building maintenance, roof maintenance and grounds maintenance. Adding this position will allow the current Maintenance Technician to complete all necessary preventative maintenance work orders in the required time frame.

Adding staff positions will be considered in developing future Utility budgets.

Projects

The 20-year Capital Improvement Program (Chapter 13) includes a number of Operations and Maintenance projects scheduled for implementation during 2015- 2020. Funds for the following ongoing projects are appropriated each year in the Capital Facilities Plan:

- Small diameter main replacement
- Asphalt overlay
- AC/aging pipe replacement
- Distribution main condition assessment
- Asset management program
- Corrosion control (aeration) tower assessment and upgrades

The following additional projects are scheduled for implementation after 2020:

- Storage tank coatings (interior/exterior)
- Booster Station upgrade/rehabilitation
- PRV telemetry (radio-based)
- Cross-country mains replacement/relocation
- On-site generator replacement
- Water meter replacement
- Water meter AMR radio replacement

12.5 Levels of Service

Municipal utilities in the United States and elsewhere commonly use LOS standards to evaluate whether the physical system and operations are functioning to an adequate level. LOS can be defined in terms of the customer's experience of utility service and/or technical standards based on professional expertise of utility staff.

The Utility complies with all regulatory standards for water quality and system design and operation. In addition to these minimum standards, the LOS standards address issues of concern for customers that influence decisions on infrastructure investments.

LOS standards can help guide investments in maintenance, repair and replacement. For new assets, LOS can be used to establish design criteria and prioritize needs. Using a structured decision process that incorporates LOS can help a utility achieve desired service outcomes while minimizing life-cycle costs.

The Utility has refined its LOS standards using the following criteria:

- Specific goal or expectation identified.
- Focused on customer and community.
- Quantifiable and measurable.
- Relatively simple to understand and apply.
- Constrained by available budgets for maintenance, repair and replacement.

The Utility's LOS are in these areas:

- System performance (including service interruption due to breakage, pressure, system reliability).
- Sustainability (energy efficiency).
- Customer service (response to water quality and service-related complaints).

LOS standards related to the O&M Program are described below. See Chapter 11 for water quality LOS standards.

System Performance

- **Service interruption due to line breaks.** During a three-year period, no customer will experience more than three service interruptions due to a line break; such service interruptions will average four hours or less.
- **Pressure.** Water will be delivered to new construction at a minimum pressure of 40 psi at the service meter.
- **System reliability with the largest source off-line.** The Utility will meet winter demand (inside water use only) with the loss of the largest water source. This would require complete curtailment of all outside and non-essential water use, particularly during peak use periods.

Sustainability

- **Energy efficiency.** All new pumps are rated 80 percent efficient or higher, unless it is not cost-effective to do so; meaning that the value of energy savings would not "pay back" the cost of the improvement within five years.

Customer Service

LOS standards for responsiveness to water quality and service-related complaints are:

- The Utility responds to main breaks within 15 minutes during work hours and within one hour during non-work hours, with a goal of no customer complaints about loss of service.
- The Utility responds to low pressure and water quality complaints by the end of the following business day.

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CHAPTER 13 - CAPITAL IMPROVEMENT PROGRAM

The Drinking Water Utility uses the Capital Improvement Program (CIP) to plan strategically for investments in capital projects over a 20-year planning horizon. As part of the budgeting process each year, City Council adopts a Capital Facilities Plan, appropriating funds for projects to be implemented during a 6-year planning horizon.

A capital project is a structure, improvement, piece of equipment, land or other major asset that has a useful life of at least five years and a project cost that exceeds $50,000.

The Capital Improvement Program helps meet the Drinking Water Utility's Goal 6:

Infrastructure is prudently financed, and sustainably constructed, maintained and operated to ensure reliable delivery of high quality water to a growing community.

This CIP incorporates projects described in:

- Chapter 4 – Source of Supply
- Chapter 6 – Reclaimed Water Program
- Chapter 7 – Groundwater Protection Program
- Chapter 8 – Source Infrastructure
- Chapter 9 – Storage Infrastructure
- Chapter 10 – Transmission and Distribution Infrastructure
- Chapter 11 – Water Quality Program
- Chapter 12 – Operation and Maintenance Program

This chapter describes the methodology used in developing the CIP, and presents the costs and schedules for projects planned for implementation in 2015-2034. Other projects are described for which schedules are primarily dependent on the timing of future development.

13.1 Development of CIP

To develop the CIP, Utility staff first identified projects that address water system needs or deficiencies. These projects were then prioritized via a formal evaluation process. Generally, projects of higher priority were scheduled for implementation within the six-year planning horizon. Cost estimates for these projects were then developed and escalated to the anticipated year of implementation. Each of these steps is described below.

Project Prioritization

The Utility developed a protocol to systematically compare and prioritize the wide range of potential capital projects. The protocol provides a consistent basis for characterizing the benefits from capital projects, comparing projects and documenting the reasons why certain projects are selected for funding. The Utility then used this protocol in a workshop attended by staff responsible for various Utility functions in order to refine the list of projects to be included in the CIP.

The prioritization process considered eight criteria, intended to address the primary benefits provided by typical Utility capital projects. Each criterion has an associated scoring system used to calculate a project priority score. In addition to the raw scores, each of these criteria was weighted. This allowed some criteria to more strongly influence how projects were selected and prioritized.

The eight criteria and the weights selected during the priority-setting workshop are shown in Table 13.1.

Table 13.1 Project Prioritization Criteria

Criteria	Weight
Regulatory Requirements and Binding Commitments	10
Reliability/Protection of Prior Investments	8
Cost Control or Cost-Sharing Opportunities	7.5
Safety and Security	7.5
Growth/Expansion	5
Environmental Stewardship	4
Water Quality (non-regulatory)	3
Information Benefits	3

The results of the prioritizing process were then reviewed by Utility management, along with an assessment of other information including potential impacts on the Utility's finances, to finalize the schedule of capital projects included in the 2015-2034 CIP.

Cost-Estimating Methodology

Total project-level cost estimates have been developed for each capital project included in the 2015-2034 CIP. Many cost estimates were generated during development of the 2009 water system plan, and have been escalated to 2014 values, according to the Engineering News Record (ENR) cost indexes. For newly developed project cost estimates, each cost includes the following components:

- **Base construction cost.** Includes all labor and material costs needed to construct a project.
- **Sales tax.** Calculated as 8.8 percent (the 2014 local tax rate) of the base construction cost.
- **Construction contingency.** Takes into account the uncertainties associated with estimating project costs at this planning level. Calculated as 25 percent of the total of base construction plus sales tax.
- **Design engineering.** Includes City and consultant design costs, and other related costs, such as permitting and construction administration. For most projects, this is calculated as 25 percent of the base construction cost. However, for projects with more complex design or permitting needs, a higher percentage of the base construction cost is used.

These elements are summed to determine the total project-level cost estimate for a project, expressed in September 2014 dollars. Where applicable, design and construction costs are depicted spanning multiple years, to reflect the phasing typically used for larger projects.

13.2 2015-2034 Planned Projects

The Utility has identified capital projects planned for implementation between 2015 and 2034. In addition, potential projects with schedules driven primarily by development-related activities have been identified.

Table 13.2 presents the schedule of CIP projects planned for implementation between 2015 and 2034. Descriptions of each project are organized by project type. Developer-contributed projects are not included in this table, as they will not require City funding; they are described in the narrative project list.

Some projects received prior appropriations from City Council through adopted Capital Facilities Plans, while other projects reflect future needed appropriations.   The City's future Capital Facilities Plans will reflect the new appropriations needed to implement the CIP shown in Table 13.2. Map 13.1 depicts approximate project locations.

The largest projects included in the first ten years of the CIP (i.e., 2015-2024) are:

- Construction of the new Log Cabin Storage Tank and the associated transmission main extension in the Morse-Merryman Road area.
- Corrosion control treatment facilities at the new McAllister Wellfield.
- Seismic retrofits of the Fir Street Storage Tanks.
- Rehabilitation of the Fones Road Booster Pump Station and nearby water main.

In addition to these and other capital projects, the CIP includes significant investment in ongoing rehabilitation and replacement of system assets such as small diameter water mains, and aging and asbestos cement piping.

Table 13.2 2015-2034 Capital Improvement Program

Code	Project Name	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Subtotal 2015-2024	Subtotal 2025-2034	Total 2015-2034
Project Schedule and Costs (in thousands of dollars) (1)														
Water Source (WS)														
WS-1	Briggs Well Construction									2,250		**2,250**	**0**	**2,250**
WS-2	McAllister Wellfield Corrosion Treatment		2,475	825								**3,300**	**0**	**3,300**
WS-3	McAllister Wellfield Mitigation - Deschutes River	200	142	100	100	100	100	100	100	100	100	**1,142**	**1,000**	**2,142**
WS-4	Groundwater Protection (Easements, Appraisals, etc.)		11	4	11	4	11	4				**45**	**0**	**45**
WS-5	Wellhead Protection Program			188	175	38						**400**	**800**	**1,200**
WS-6	Groundwater Monitoring Wells	75	138	188	200	50						**650**	**0**	**650**
WS-7	Olympia Brewery Water Engineering Analysis	38	13				38	13				**100**	**0**	**100**
WS-8	Indian Summer Well Chlorination		113	38								**150**	**0**	**150**
WS-9	Hoffman Well Treatment								1,875	625		**2,500**	**0**	**2,500**
WS-10	Shana Park Well Water Quality Study		113	38								**150**	**0**	**150**
Water Storage (ST)														
ST-1	New Log Cabin Tank Construction	6,750	2,250									**9,000**	**0**	**9,000**
ST-2	Fir Street Tank #1 and #2 Seismic Retrofit			750	250							**1,000**	**0**	**1,000**
ST-3	Elliott Tank Seismic Retrofit			938	313							**1,250**	**0**	**1,250**
ST-4	Hoffman Tank Interior Coating Replacement			434	145							**578**	**0**	**578**
Transmission and Distribution (TD)														
TD-1	Distribution System Oversizing	27	27	27	27	27	27	27	27	27	27	**270**	**270**	**540**
TD-2	Morse-Merryman Extension to New Log Cabin Tank	900	300									**1,200**	**0**	**1,200**
TD-3	PRVs - East Bay Drive					185	62					**247**	**0**	**247**
TD-4	AC Pipe - Blvd Road Roundabout - Morse-Merryman		585	195								**780**	**0**	**780**
TD-5	Fones Road Water Main Construction						1,725	575				**2,300**	**0**	**2,300**
TD-6	Fones Road Booster Replacement Design/Construction	813	273									**1,085**	**0**	**1,085**
TD-7	Kaiser Road Water Main Extension to Evergreen Park			570	190							**760**	**0**	**760**
TD-8	Indian Summer Extension to Rich Road											**0**	**600**	**600**
TD-9	McCormick Valve House		113	38								**150**	**0**	**150**
TD-10	Percival Creek Water Main	75	325	100								**500**	**0**	**500**
TD-11	West Bay Booster Station Pump and Electrical Upgrade	113	38									**150**	**0**	**150**
TD-12	Meridian Overflow and 36-inch Water Main	113	38									**150**	**0**	**150**
TD-13	Eastside Street and Henderson Boulevard Water Main Extension								900	300		**1,200**	**0**	**1,200**
Operations and Maintenance (OM)														
OM-1	Small Diameter Water Main Replacement	488	500	500	500	500	500	500	500	500	500	**4,988**	**5,000**	**9,988**
OM-2	Asphalt Overlay Adjustments	11	11	11	11	11	11	11	11	11	11	**105**	**105**	**210**
OM-3	Storage Tank Coatings (Interior/Exterior)				225	75	225	75				**600**	**600**	**1,200**
OM-4	Booster Station Upgrade/Rehabilitation			113	150	150	150	38				**600**	**600**	**1,200**
OM-5	AC and Aging Pipe Replacement	375	500	500	500	500	500	500	500	500	500	**4,875**	**5,000**	**9,875**
OM-6	PRV Telemetry (Radio-Based)							38	13			**50**	**0**	**50**
OM-7	Distribution Main Condition Assessment	19	25	25	25	25	25	25	25	25	25	**244**	**250**	**494**
OM-8	Cross Country Mains	19	25	25	25	25	25	6				**150**	**0**	**150**
OM-9	On-site Generator Replacement Plan		56	19	56	19	56	19	56	19		**300**	**225**	**525**
OM-10	Asset Management Program	38	50	50	50	50	50	50	50	50	50	**488**	**500**	**988**
OM-11	Corrosion Control (Aeration) Tower Condition Assessment & Upgrades		19	25	25	25	25	25	25	25	25	**219**	**250**	**469**
OM-13	Water Meter Replacement							375	125			**500**	**0**	**500**
OM-14	Water Meter AMR Radio Replacement							150	50			**200**	**0**	**200**
OM-15	McAllister Wellfield Mitigation - Woodland Creek	38	50	50	50	50	50	50	50	50	50	**488**	**500**	**988**
Reclaimed Water (RW)														
RW-1	Reclaimed Water Infrastructure						188	63				**250**	**0**	**250**
RW-2	Port of Olympia - Eliminate Northern Dead End		38	13								**50**	**0**	**50**
RW-3	Reclaimed Water Filling Stations						75	25				**100**	**0**	**100**
Planning (PL)														
PL-1	Water System Plan						225	75				**300**	**600**	**900**
PL-2	Infrastructure Pre-Design and Planning	16	21	21	21	21	21	21	21	21	21	**205**	**210**	**415**
TOTAL		**10,104**	**8,244**	**5,780**	**3,048**	**1,854**	**4,088**	**2,762**	**4,327**	**4,502**	**1,309**	**46,017**	**16,510**	**62,527**

1. In September 2014 dollars. Totals of individual years may not equal subtotals, due to rounding.

Supply Source Projects

The following are source-related capital projects that address deficiencies or needs described in previous chapters, as referenced in each project description.

- **WS-1 Briggs Well Construction** (anticipated 2023; estimated $2,250,000)

  Description: Drilling an additional groundwater supply well in the Briggs Urban Village area. Water rights were previously purchased and transferred to the well. Drilling was originally scheduled in 2008; however, the project has been delayed primarily due to the need for costly iron and manganese treatment. The City has obtained approval to extend the water rights development schedule until 2019, and anticipates possible future extensions of the water right, as needed, and as negotiated with Ecology. The well, which will pump into Zone 338, is anticipated to provide 1,100 gpm of source capacity.

  Justification/Need: Additional source enhances supply redundancy and reliability for Zones 417 and 338 (Chapter 8).

- **WS-2 McAllister Wellfield Corrosion Treatment** (anticipated 2017, estimated $3,300,000)

  Description: Construction of corrosion control facilities to raise the pH of water withdrawn from the McAllister Wellfield, in order to maintain compliance with the lead and copper rule.

  Justification/Need: Testing indicates that water from the McAllister Wellfield has a low pH, requiring corrosion control treatment to maintain compliance with water quality regulations (Chapter 11).

- **WS-3 McAllister Wellfield Mitigation – Deschutes River Basin** (ongoing)

  Description: The City is implementing a water rights mitigation plan associated with the development of the McAllister Wellfield. One of the plan components involves the restoration of riparian land adjacent to the Deschutes River. This property, previously known as Smith Ranch, is now jointly owned by the cities of Olympia, Lacey and Yelm.

  Justification/Need: Supports implementation of the McAllister Wellfield Water Rights Mitigation Plan, and will exhibit a level of environmental stewardship desired by the City through improvement of water quality and aquatic habitat (Chapter 4).

- **WS-4 Groundwater Protection (easements, appraisals, etc.)** (anticipated 2021, estimated $45,000)

  Description: Provides funding to support installation of groundwater monitoring wells. Depending on well locations, the City may also need to obtain easements on property for wells that are located outside the right-of-way. Appraisals may be needed to determine the cost of the easements.

Justification/Need: This is an important element in protecting source water quality from degradation. By owning land or easements for monitoring wells, the City can monitor groundwater quality changes near its water sources and help prevent contamination of critical groundwater resources (Chapter 7).

- **WS-5 Wellhead Protection Program** (anticipated 2019, estimated $400,000)

  Description: Periodic refinement of the time-of-travel zones previously delineated for the groundwater sources of supply.

  Justification/Need: Supports protection of the City's supply sources (Chapter 7).

- **WS-6 Groundwater Monitoring Wells** (anticipated 2019, estimated $650,000)

  Description: Installation of up to 12 new wells as part of the groundwater monitoring program.

  Justification/Need: Supports the City's monitoring of groundwater quality and ability to protect its groundwater sources of supply (Chapter 7).

- **WS-7 Olympia Brewery Water Engineering Analysis** (anticipated 2021, estimated $100,000)

  Description: Consultant services associated with an engineering evaluation of possible operational and source development options for the Brewery water source. This is a joint effort with the Cities of Lacey and Tumwater.

  Justification/Need: Supports need for long-term supply development and diversification (Chapter 8).

- **WS-8 Indian Summer Well Chlorination** (anticipated 2017; estimated $150,000)

  Description: Design and construction of hypo-chlorination facilities for the Indian Summer Well 20 (S12), to replace the existing on-site chlorine generation system.

  Justification/Need: Transitions treatment away from on-site facilities, which have been problematic for the City operationally (Chapter 11).

- **WS-9 Hoffman Well Treatment** (anticipated 2023; estimated $2,500,000)

  Description: Design and construction of hypo-chlorination and iron/manganese removal for the Hoffman Well 3 (S08).

  Justification/Need: Supports need for high quality water from this source (Chapter 11).

- **WS-10 Shana Park Well Water Quality Study** (anticipated 2017, estimated $150,000)

  Description: Study to evaluate the options for future management of the Shana Park Well 11 (S10), given the evidence of increasing nitrates in East Olympia groundwater. Such options may include transitioning the Shana Park Well to emergency status, drilling of a replacement well, treating for nitrate, or blending with another source.

  Justification/Need: Supports need for long-term supply development and diversification (Chapter 11).

Storage Projects

The following are storage-related capital projects that address deficiencies or needs described in **Chapter 9**.

- **ST-1 New Log Cabin Tank Construction** (anticipated 2016, estimated $9,000,000)

  Description: Construction of an additional storage tank in Zone 417, located south of Morse-Merryman Road and east of the Boulevard Storage Tank. The tank will be built to the same overflow elevation as the Hoffman Storage Tank, to address storage deficiencies in Zone 417.

  Justification/Need: Provides additional capacity that addresses current deficiencies in available fire flow and standby storage volumes.

- **ST-2 Fir Street Tank #1 and #2 Seismic Retrofit** (anticipated 2018, estimated $1,000,000)

  Description: Structural upgrades of the Fir Street Storage Tanks, including the addition of perimeter walls with reinforcing cables and the addition of collars on the interior columns.

  Justification/Need: Maintains compliance with seismic codes and enhances reliability of these facilities.

- **ST-3 Elliott Tank Seismic Retrofit** (anticipated 2018, estimated $1,250,000)

  Description: Structural upgrades of the Elliott Storage Tank, including interior column wrapping, dowels to tie the roof slab to perimeter walls, and a perimeter retaining wall.

  Justification/Need: Maintains compliance with seismic codes and enhances reliability of this facility.

- **ST-4 Hoffman Tank Interior Coating Replacement** (anticipated 2018, estimated $578,000)

  Description: Replacement of the interior coating of the Hoffman Storage Tank.

  Justification/Need: Enhances water quality reliability of this facility.

Transmission and Distribution Projects

The following transmission and distribution-related capital projects address deficiencies or needs described in **Chapter 10**.

- **TD-1 Distribution System Oversizing** (ongoing)

  Description: Oversizing of distribution pipeline projects associated with development-related improvements. This project provides additional capacity to anticipate future needs that may be greater than at the time of development. Funds are applied to developer projects to cover the additional costs of oversizing.

  Justification/Need: Supports prudent sizing of distribution facilities to accommodate anticipated future needs and avoids the need to replace undersized facilities in the future.

- **TD-2 Morse-Merryman Extension to New Log Cabin Tank** (anticipated 2016, estimated $1,200,000)

  Description: Installation of a new 12-inch water main to connect the planned new Log Cabin Tank with existing distribution piping in Morse-Merryman Road.

  Justification/Need: Required to convey water from new Log Cabin Storage Tank to the distribution system.

- **TD-3 Pressure Reducing Valves (PRVs) – East Bay Drive** (anticipated 2020, estimated $247,000)

  Description: Installation of PRV stations to reduce high pressures along East Bay Drive and allow water to flow from Zone 347 to Zone 226.

  Justification/Need: Addresses high-pressure situations along East Bay Drive.

- **TD-4 AC Pipe - Boulevard Road Roundabout - Morse-Merryman)** (anticipated 2017, estimated $780,000)

  Description: Replacement of existing Asbestos Cement (AC) water main during construction of a roundabout in Boulevard Road, at the intersection with Morse-Merryman Road.

  Justification/Need: Removes AC piping, which is brittle and prone to breaking, from the system. Coordinated with roadway project to take advantage of cost efficiencies and minimize traffic disruptions.

- **TD-5 Fones Road Water Main Construction** (anticipated 2021, estimated $2,300,000)

  Description: Replacement of an AC water main in Fones Road from Pacific Avenue to 18th Avenue during planned roadway construction.

  Justification/Need: Removes AC piping, which is brittle and prone to breaking, from the system. Coordinated with roadway project to take advantage of cost efficiencies and minimize traffic disruptions.

- **TD-6 Fones Road Booster Replacement Design & Construction** (anticipated 2016, estimated $1,085,000)

  Description: Replacement of booster pump station.

  Justification/Need: Addresses current deficiencies in the electrical system, confined space entry, ventilation and aging pumping equipment.

- **TD-7 Kaiser Road Water Main Extension to Evergreen Park Drive** (anticipated 2018, estimated $760,000)

  Description: This project will install a new 12-inch water main from LOTT's Kaiser Road sewer lift station to Evergreen Park Drive, to complete a piping loop to the north end of Zone 298.

  Justification/Need: Increases distribution system reliability in a 300-acre area which has only one feed, through a PRV at Cooper Point Road.

- **TD-8 Indian Summer Extension to Rich Road** (anticipated 2025, estimated $600,000)

  Description: Installation of a water main, extending from the existing 12-inch main on Prestwick Lane by Indian Summer Well 20, southwest to the Bonneville Power Administration lines, then west along the power line access road to the existing 12-inch main on Rich Road.

  Justification/Need: Provides distribution system looping in this part of the system.

- **TD-9 McCormick Valve House** (anticipated 2017, estimated $150,000)

  Description: Replacement of valves and complicated piping that is difficult to maintain.

  Justification/Need: Replaces/upgrades aging equipment and improves maintenance efficiency.

- **TD-10 Percival Creek Water Main** (anticipated 2017, estimated $500,000)

  Description: Replacement of the water main from Evergreen Park Lane to 15th Avenue SW associated with the utility bridge at Percival Creek. The utility bridge is structurally unreliable. The water main will either be replaced on the bridge or installed under the creek by boring depending on the bridge work.

  Justification/Need: Replaces asset that was damaged in an earthquake and removes aging AC piping to improve system reliability.

- **TD-11 West Bay Booster Station Pump and Electrical Upgrade** (anticipated 2016, estimated $150,000)

  Description: Replacement of pumps and electrical system upgrades in the West Bay Booster Station.

  Justification/Need: Replaces/upgrades aging equipment in this facility.

- **TD-12 Meridian Overflow and 36-inch Water Main** (anticipated 2016, estimated $150,000)

  Description: Improvements to enhance protection of the 36-inch water main and improve the Meridian Tanks' overflow outlet pipe that daylights next to the 36-inch main. This project is located near the storage tanks on City property.

  Justification/Need: Improves protection and reliability of existing assets.

- **D-13 Eastside Street and Henderson Boulevard Water Main Extension** (anticipated 2023, estimated $1,200,000)

  Description: New 16-inch main to replace an existing 10-inch pipe that presents a bottleneck in the Zone 264 distribution system. The replacement line will connect to an existing 16-inch main at Eastside Street, where it originates as a tap off of the 36-inch transmission main near the Fir Street Storage Tanks. The new line will then extend approximately 3,500 feet through the City's Maintenance Center property and across Henderson Boulevard, terminating at an existing 12-inch main that feeds a portion of Zone 264 west of Henderson.

  Justification/Need: Increases fire flow and pressures in the westerly portion of Zone 264 during high demand periods.

Operations and Maintenance Projects

The following operations and maintenance-related capital projects address deficiencies or needs described in Chapter 12.

- **OM-1 Small Diameter Water Main Replacement** (ongoing)

  Description: Replacement of existing small diameter substandard water mains with larger diameter piping. Funds also provide for hydraulic modeling and installation of valves and vaults.

  Justification/Need: Increases reliability of the distribution system to maintain domestic and fire flows at required minimum pressures.

- **OM-2 Asphalt Overlay Adjustments** (ongoing)

  Description: Adjustments needed to raise water system components to street level in conjunction with annual asphalt overlay/street reconstruction.

  Justification/Need: Adjusts water system structures and related components as required during some asphalt overlay and street reconstruction projects.

- **OM-3 Storage Tank Coatings (Interior/Exterior)** (anticipated 2021, estimated $600,000)

  Description: Periodic maintenance of interior and exterior linings and painting. Each storage tank is scheduled for recoating approximately every 15-20 years.

  Justification/Need: Maintains reliable water quality and increases longevity of storage tanks.

- **OM-4 Booster Station Upgrade/Rehabilitation** (anticipated 2021, estimated $600,000)

  Description: Routine upgrades to existing booster stations; includes replacing pumps and making large-scale upgrades to mechanical, electrical and instrumentation systems.

  Justification/Need: Increases reliability of booster stations.

- **OM-5 AC and Aging Pipe Replacement** (ongoing)

  Description: Replacement of aging water mains and those constructed of asbestos cement (AC) with new piping. Funds also provide for hydraulic modeling and installing valves and vaults.

  Justification/Need: Increases the reliability of the distribution system and reduces the potential for leaks in older parts of the system.

- **OM-6 PRV Telemetry (Radio-Based)** (anticipated 2022, estimated $50,000)

  Description: Installation of radio-based telemetry instrumentation in PRV vaults.

  Justification/Need: Improves system operation and efficiency by increasing the ability to monitor flows through PRVs. This improves understanding of system operation and provides detailed water usage data to calibrate the hydraulic model.

- **OM-7 Distribution Main Condition Assessments** (ongoing)

  Description: Implementation of activities, to be defined through the Asset Management Program (Project OM-10), to assess the condition of transmission and distribution system mains. Funds will support annual evaluation of discreet lengths of pipes. The results will be used to identify larger capital projects that will then be prioritized and implemented as funds are available.

  Justification/Need: Provides information on system condition, and identifies project priorities that will improve reliability of the distribution system.

- **OM-8 Cross Country Mains** (anticipated 2021, estimated $150,000)

  Description: Replacement and/or relocation of City water mains that extend outside of the right-of-way and into areas that make maintenance difficult.

  Justification/Need: Improves access to City facilities, for ease of maintenance and increased reliability.

- **OM-9 On-Site Generator Replacement Plan** (anticipated 2023, estimated $300,000)

  Description: Replacement of on-site backup power generators near the end of their useful life.

  Justification/Need: Increases reliability of facilities supported by on-site generators.

- **OM-10 Asset Management Program** (ongoing)

  Description: Implementation of the Utility's formal asset management program. Funds cover activities such as program administration, condition assessment, asset planning and development. The results of this program will define the details of some of the other projects listed in this section, such as OM-1, OM-3, OM-4, OM-5, OM-7 and OM-9.

  Justification/Need: Supports pro-active management of the system's assets.

- **OM-11 Corrosion Control (Aeration) Tower Condition Assessment & Upgrades** (ongoing)

  Description: Routine upgrades to existing corrosion control towers. Funds provide for condition assessment, planning/design, and large-scale upgrades to mechanical, electrical and instrumentation systems.

  Justification/Need: Increases reliability of corrosion control towers.

- **OM-12 Water Meter Replacement** (anticipated 2022, estimated $500,000)

  Description: Replacement of approximately 5,500 retrofitted water service meters that have exceeded their useful life span.

  Justification/Need: Increases metering accuracy, reduces operational costs associated with meter reading, improves customer service through reduced reading errors, and supports water conservation efforts by enhancing ability to track and characterize water consumption.

- **OM-13 Water Meter AMR Radio Replacement** (anticipated 2022, estimated $200,000)

  Description: Replacement of the radio transmitter units associated with the citywide automated meter reading (AMR) system. Approximately 20,000 such units were recently installed in a short time period during deployment of the AMR system. Units will be replaced in a phased manner within the 20-year planning horizon.

  Justification/Need: Maintains reliable functioning of the AMR system.

- **OM-14 McAllister Mitigation - Woodland Creek** (ongoing)

  Description: Funds the City's share of the operations and maintenance of a new facility jointly owned with the City of Lacey as part of the McAllister Water Rights Mitigation Plan. The Woodland Creek Groundwater Recharge Facility infiltrates reclaimed water into the shallow groundwater aquifer in the Woodland Creek area, partly offsetting impacts of groundwater withdrawals at the McAllister Wellfield. (See also **Chapter 6**.)

  Justification/Need: Supports continued operation of the McAllister Wellfield and is required as part of the mitigation plan.

Reclaimed Water Projects

The following reclaimed water-related capital projects address deficiencies or needs described in Chapter 6.

- **RW-1 Reclaimed Water Infrastructure** (anticipated 2021, estimated $250,000)

  Description: Continue development of an infrastructure network to convey reclaimed water to customers or support regional reclaimed water system expansion efforts.

  Justification/Need: Supports efficient use of the City's limited potable water resources.

- **RW-2 Port of Olympia – Eliminate Northern Dead End** (anticipated 2017, estimated $50,000)

  Description: Installation of additional reclaimed water piping in the existing portion of the system that provides reclaimed water to the Port, so as to provide looping and eliminate dead ends.

  Justification/Need: Reduces water quality concerns in dead-end piping, and supports efficient use of the City's potable water resources.

- **RW-3 Reclaimed Water Filling Stations** (anticipated 2021, estimated $100,000)

  Description: Installation of water filling stations that provide reclaimed water for construction-related purposes.

  Justification/Need: Increases the use of reclaimed water, which reduces the need to use potable water for non-potable needs.

Planning Projects

The following planning projects support implementation of the other CIP items listed above.

- **PL-1 Water System Plan** (anticipated 2021, estimated $300,000)

  Description: Updates to the Water System Plan, which are required every six years by the Washington State Department of Health.

  Justification/Need: This is a regulatory requirement, and also ensures the Utility is planning sufficiently to meet future needs and is investing wisely in its infrastructure.

- **PL-2 Infrastructure Pre-Design and Planning** (ongoing)

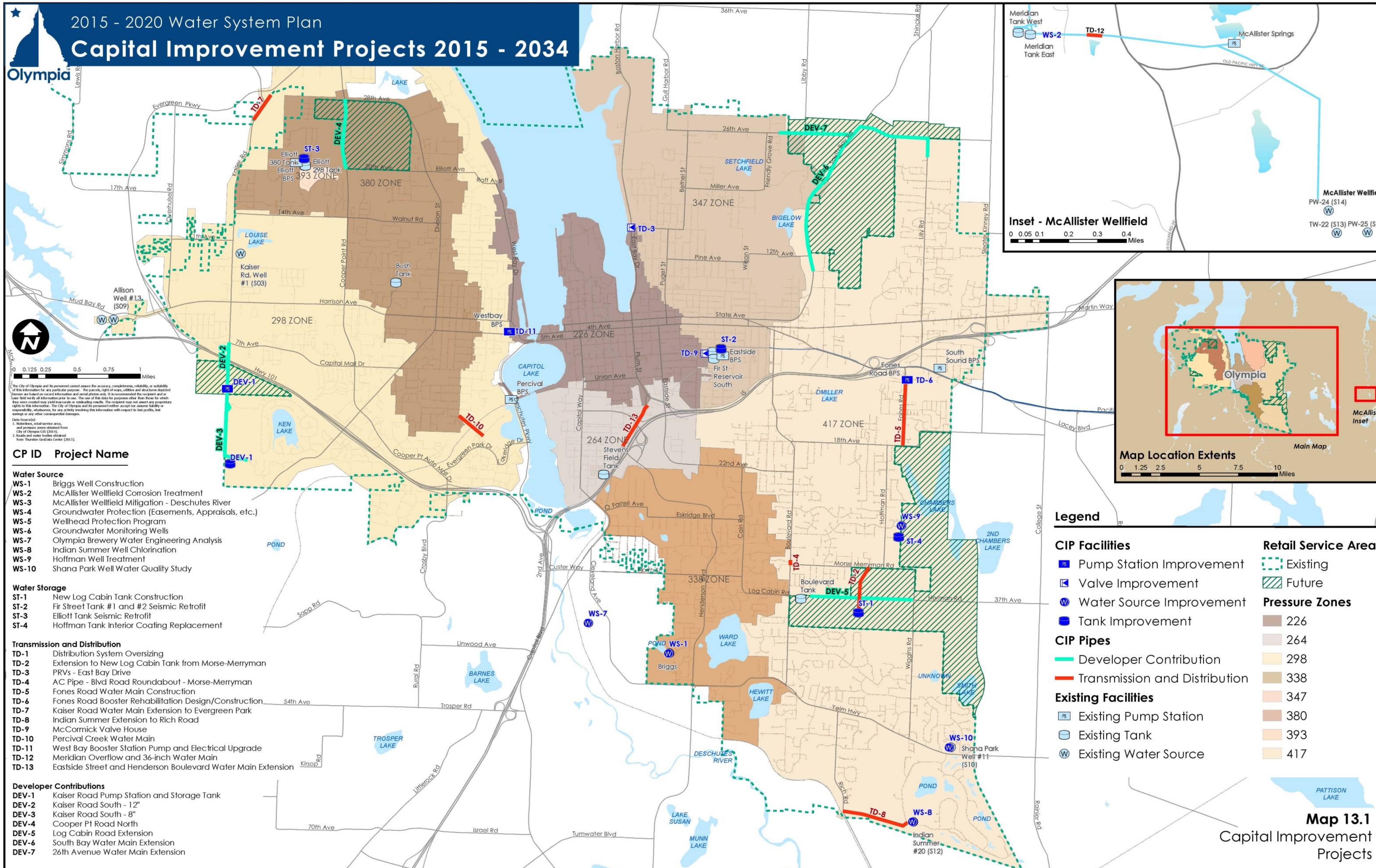
  Description: Perform pre-design evaluation and analysis of water system project alternatives.

  Justification/Need: Evaluates project needs and costs of CIP projects prior to appropriation in the annual Capital Facilities Plan, in order to refine information provided in the CIP.

Development-Related Projects

The following projects will be implemented as part of private development projects. Scheduling of these improvements will depend on the timing of development activity. Development-related projects are not included in Table 13.2**,** since no City funds are required.

- **DEV-1 Kaiser Road Pump Station and Storage Tank.** This pump station and storage tank will be constructed as part of a development project planned for the area south of Highway 101 on Kaiser Road. While these facilities will primarily serve future development, they will also address deficiencies in the distribution system's ability to provide adequate pressures during peak hour demand conditions to a small area of Zone 298, as described in Chapter 10.
- **DEV-2 Kaiser Road South (12-inch)**. Installation of 4,900 lineal feet of 12-inch water main, extending from the existing 12-inch main on Kaiser Road near 7th Avenue, south to a point west of Park Drive.
- **DEV-3 Kaiser Road South (8-inch)**. Installation of 1,000 lineal feet of 8-inch water main, extending from the future Kaiser Road Storage Tank to Park Avenue.
- **DEV-4 Cooper Point Road North**. Installation of 3,000 lineal feet of 12-inch water main, extending north in Cooper Point Road.
- **DEV-5 Log Cabin Road Extension**. Installation of 4,350 lineal feet of 16-inch water main, extending from the existing 12-inch main at the south end of Van Epps Drive, east to the existing 12-inch main on Wiggins Road by 7th Avenue.
- **DEV-6 South Bay Water Main Extension**. Installation of 10,650 lineal feet of 12-inch water main.
- **DEV-7 26th Avenue Water Main Extension**. Installation of 2,900 lineal feet of 12-inch water main, extending from the existing 12-inch main on 26th Avenue by Huber Lane, east on 26th to a proposed 12-inch main in South Bay.



2015 - 2020 Water System Plan
Capital Improvement Projects 2015 - 2034
Olympia
CP ID Project Name
Water Source
WS-1 Briggs Well Construction
WS-2 McAllister Wellfield Corrosion Treatment
WS-3 McAllister Wellfield Mitigation - Deschutes River
WS-4 Groundwater Protection (Easements, Appraisals, etc.)
WS-5 Wellhead Protection Program
WS-6 Groundwater Monitoring Wells
WS-7 Olympia Brewery Water Engineering Analysis
WS-8 Indian Summer Well Chlorination
WS-9 Hoffman Well Treatment
WS-10 Shana Park Well Water Quality Study
Water Storage
ST-1 New Log Cabin Tank Construction
ST-2 Fir Street Tank #1 and #2 Seismic Retrofit
ST-3 Elliott Tank Seismic Retrofit
ST-4 Hoffman Tank Interior Coating Replacement
Transmission and Distribution
TD-1 Distribution System Oversizing
TD-2 Extension to New Log Cabin Tank from Morse-Merryman
TD-3 PRVs - East Bay Drive
TD-4 AC Pipe - Blvd Road Roundabout - Morse-Merryman
TD-5 Fones Road Water Main Construction
TD-6 Fones Road Booster Rehabilitation Design/Construction
TD-7 Kaiser Road Water Main Extension to Evergreen Park
TD-8 Indian Summer Extension to Rich Road
TD-9 McCormick Valve House
TD-10 Percival Creek Water Main
TD-11 West Bay Booster Station Pump and Electrical Upgrade
TD-12 Meridian Overflow and 36-inch Water Main
TD-13 Eastside Street and Henderson Boulevard Water Main Extension
Developer Contributions
DEV-1 Kaiser Road Pump Station and Storage Tank
DEV-2 Kaiser Road South - 12"
DEV-3 Kaiser Road South - 8"
DEV-4 Cooper Pt Road North
DEV-5 Log Cabin Road Extension
DEV-6 South Bay Water Main Extension
DEV-7 26th Avenue Water Main Extension
Inset - McAllister Wellfield
Meridian Tank West
Meridian Tank East
McAllister Springs
McAllister Wellfield
PW-24 (S14)
TW-22 (S13) PW-25 (S15)
Map Location Extents
Main Map
McAllister Inset
Legend
CIP Facilities
Pump Station Improvement
Valve Improvement
Water Source Improvement
Tank Improvement
CIP Pipes
Developer Contribution
Transmission and Distribution
Existing Facilities
Existing Pump Station
Existing Tank
Existing Water Source
Retail Service Area
Existing
Future
Pressure Zones
226
264
298
338
347
380
393
417
393 ZONE
380 ZONE
298 ZONE
226 ZONE
264 ZONE
338 ZONE
347 ZONE
417 ZONE
Elliott 380 Tank
Elliott 298 Tank
Elliott BPS
Bush Tank
Kaiser Rd. Well #1 (S03)
Allison Well #13 (S09)
Westbay BPS
Percival BPS
Eastside BPS
Fir St Reservoir South
Fones Road BPS
South Sound BPS
Stevens Field Tank
Boulevard Tank
Briggs
Shana Park Well #11 (S10)
Indian Summer #20 (S12)
CAPITOL LAKE
LOUISE LAKE
KEN LAKE
SETCHFIELD LAKE
BIGELOW LAKE
DMILLER LAKE
CHAMBERS LAKE
2ND CHAMBERS LAKE
WARD LAKE
HEWITT LAKE
BARNES LAKE
TROSPER LAKE
LAKE SUSAN
MUNN LAKE
PATTISON LAKE
DESCHUTES RIVER
Map 13.1
Capital Improvement Projects

Chapter 14 - Financial Program

Tables

Appendix

CHAPTER 14 - FINANCIAL PROGRAM

This chapter describes the current finances of the Drinking Water Utility, and summarizes its financial policies and the funding needed to implement this Plan. A detailed financial analysis was performed by the Utility's financial consultant, FCS Group (Appendix 14-1). The results indicate that the overall financial condition of the Utility remains healthy. The Utility continues to be guided by water conservation and sustainability policies along with sound and prudent financial management principles.

The Utility's financial program is designed to meet the Drinking Water Utility's Goal 7:

> **Drinking Water Utility finances are managed responsibly, and costs are recovered equitably based on customer use.**

Objectives for 2015-2020 are:

- Set rates that accurately reflect financial policies and recover the cost of providing services to each customer class.
- Manage Utility rates and connection fees consistent with the City's guiding principles of growth paying for growth.
- Use debt financing responsibly to support needed capital facility investments and "smooth" rate impacts.

Further direction is provided for this chapter by the City's Comprehensive Plan. In particular, Utilities Goal 2 and its associated policies help guide the Utility's financial program.

As required by state regulations (WAC 246-290-100), this chapter demonstrates the Utility's financial viability by providing: a summary of past income and expenses, a balanced budget, a funding plan, and consideration of a rate structure addressing affordability and conservation.

14.1 Current Financial Status

This section reviews the Utility's operating revenue and expenses, balance sheet and budget. The Utility's financial consultant, FCS Group, concluded that the Utility's operating condition remained strong as of December 2013. Revenues, including fund balance, were sufficient to meet expenditures.

Operating Revenue and Expenses

Comparative financial statements for the most recently available six years (2008 - 2013) are summarized in Table 14.1.

Table 14.1 Summary of Fund Resources and Uses Arising from Cash Transactions

	2008	2009	2010	2011	2012	2013
OPERATING REVENUES:						
Charges for Services	$ 8,209,610	$ 8,413,275	$ 8,409,679	$ 8,909,380	$ 9,534,070	$ 10,778,301
Intergovernmental Revenues	7,797	-	25,828	495,922	-	12,873
Miscellaneous Revenues	1,269,804	941,170	1,499,051	1,495,814	1,056,664	285,743
Total Operating Revenues	**$ 9,487,211**	**$ 9,354,445**	**$ 9,934,558**	**$10,901,116**	**$10,590,734**	**$11,076,916**
OPERATING EXPENSES:						
Operations & Maintenance	$ 3,348,075	$ 4,044,932	$ 1,188,110	$ 1,265,120	$ 1,685,108	$ 1,670,147
Administration & Overhead	4,758,556	4,993,438	4,810,597	4,674,235	4,899,156	4,947,060
Taxes	801,882	958,476	1,258,394	1,383,851	1,467,658	1,526,273
Compensated Absences	22,235	9,440	13,373	(22,639)	(1,943)	(8,942)
Depreciation & Amortization	1,208,103	1,228,844	1,504,808	1,571,156	1,588,242	1,618,291
Total Operating Expenses	**$10,138,851**	**$11,235,130**	**$ 8,775,282**	**$ 8,871,723**	**$ 9,638,221**	**$ 9,752,830**
OPERATING INCOME (LOSS)	***$ (651,640)***	***$ (1,880,685)***	***$ 1,159,276***	***$ 2,029,393***	***$ 952,513***	***$ 1,324,086***
NON-OPERATING REVENUES (EXPENSES)						
Investment Earnings	$ 366,982	$ 75,510	$ 20,292	$ 11,576	$ 11,439	$ 10,368
Loss on Plant	-	-	-	(39,326)	(4,025)	59,108
Interest Expense & Fiscal Charges	(518,988)	(517,679)	(385,812)	(436,348)	(410,574)	(494,968)
Total Non-Operating Revenues (Expenses)	**$ (152,006)**	**$ (442,169)**	**$ (365,519)**	**$ (464,098)**	**$ (403,161)**	**$ (425,492)**
NET INCOME (LOSS) BEFORE CONTRIBUTIONS AND TRANSFERS	***$ (803,646)***	***$ (2,322,853)***	***$ 793,756***	***$ 1,565,295***	***$ 549,352***	***$ 898,594***
Capital Contributions	-	-	458,850	82,450	1,036,450	52,950
Operating Transfers - In	2,932,217	6,576,291	3,595,038	5,156,969	2,971,792	3,041,441
Operating Transfers - Out	(3,029,918)	(6,482,633)	(3,907,873)	(5,215,807)	(3,149,718)	(3,893,078)
TOTAL NET INCOME (LOSS)	***$ (901,347)***	***$ (2,229,195)***	***$ 939,771***	***$ 1,588,906***	***$ 1,407,877***	***$ 99,906***
TOTAL NET POSITION AS OF JANUARY 1	$ 33,859,357	$ 32,781,818	$ 34,915,837	$ 37,892,620	$ 39,590,435	$ 41,067,050
NET INCOME (LOSS)	(901,347)	(2,229,195)	939,771	1,588,906	1,407,877	99,906
PRIOR PERIOD ADJUSTMENT	-	-	5,936,796	-	-	-
TOTAL NET POSITION AS OF DECEMBER 31	**$32,958,011**	**$30,552,622**	**$41,792,404**	**$39,481,526**	**$40,998,312**	**$41,166,956**
O&M Coverage Ratio	***93.6%***	***83.3%***	***113.2%***	***122.9%***	***109.9%***	***113.6%***
Net Operating Income as a % of Operating Revenue	***-6.9%***	***-20.1%***	***11.7%***	***18.6%***	***9.0%***	***12.0%***

Revenue from water sales increased 31.3 percent overall between 2008 and 2013, while consumption decreased (Chapter 3). Water rates increased by 31.9 percent during this period, demonstrating that water usage declined despite a growing customer base.

The O&M Coverage Ratio, which is defined as the total operating revenue divided by total operating expenses, was 113.6 percent in 2013. The Utility has maintained ratios of 100 percent or greater since 2010, indicating that revenues more than cover expenses.

The City's practice is to maintain a minimum balance in the operating fund equal to 25 percent of annual operating revenues. Any accumulation of operating fund balance over 30 percent is transferred to the capital fund. This policy aims to provide liquid "working capital" to accommodate cash balance fluctuations associated with differences in revenue and expense cycles, along with other unforeseen variations in revenues or costs.

Assets and Liabilities

The Drinking Water Utility maintains a balance sheet of current and long-term assets and liabilities. Between 2008 and 2013, total assets increased from $45.74 million to $62.58 million. Over the same period, current and long-term liabilities increased from $12.78 million to $19.19 million. As of 2013, the City's long-term debt for the Utility was $17.82 million from two revenue bonds and two State loans.

FCS Group concluded that the Utility's ratio of unrestricted current assets to current liabilities remained healthy as of the end of 2013 at 8.6. This ratio measures the Utility's ability to pay short-term obligations; the industry benchmark ratio is 2.0 or above. The Utility's ratio has not fallen below 7.2 during the six-year period.

14.2 Rates and Rate Structure

Drinking Water rates are composed of a fixed monthly "ready-to-serve" charge based on meter size, plus a volume charge per hundred cubic feet (ccf) of metered water usage. The variable usage charge is designed to increase a customer's water bill progressively with increasing levels of consumption, sending a price signal that encourages water conservation. Single-family residences pay volume charges based on an inverted four-tier structure. Multi-family, commercial and irrigation customers pay a seasonal volume charge with winter rates for November-June and summer rates for July-October.

A series of moderate rate increases (4%-6% per year) are proposed in order to accommodate projected operating and capital needs during the 2015-2020 planning period. This results in a cumulative increase of roughly 33% over the six-year period. A number of factors drive the need for the proposed rate increase. Primary among these are the loss of the City of Lacey and Thurston PUD 1 as wholesale water customers after 2015, increases in debt service associated with the City's 2013 Bond and the Drinking Water State Revolving Fund (DWSRF) loan for the Log Cabin Reservoir, as well as recent State legislation that allows the City to recover fire protection costs through water rates, rather than through the General Fund. Additionally, the success of the Utility's water conservation program continues to result in lower volume-based user revenues despite growth in the number of Utility customers.

The Washington Department of Health and Department of Commerce Public Works Board use an affordability index to prioritize low-cost loan awards depending on whether rates exceed 2.0 percent of the median household income for the service area. The median household income for the City of Olympia was $53,147 in the 2008 – 2012 American Community Survey conducted by the U.S. Census Bureau. This corresponds to a maximum annual water bill of $1,062.94, or $88.58 monthly. Based on an average residential monthly usage of 6 ccf, an average monthly residential bill would increase from $21.50 to $22.16, which is still significantly below the monthly threshold and suggests an affordable water rate structure.

14.3 Capital Funding Strategy

For the 2015-2020 planning period, the proposed capital facilities projects will cost an estimated total of $33.11 million, as shown in Chapter 13, Table 13.2. The Utility funds its capital program using resources in the following priority order:

1. Accumulated capital reserves.
2. Annual revenue collections from general facility charges (GFCs).
3. Annual resources from rates earmarked for system reinvestment funding.
4. Annual transfers of excess resources (over minimum balance targets) from the Operating Fund, if any.
5. Interest earned on Capital Improvement Fund balances and other miscellaneous capital resources.
6. Revenue bond financing.

General facility charges (GFCs) are imposed on new customers connecting to the system as a condition of service and are in addition to any other costs related to connecting a customer to the water system. The GFC is typically based on a blend of historical and planned future capital investment in system infrastructure. Its underlying premise is that growth (future customers) will pay for growth-related costs that the Utility has incurred (or will incur) to provide capacity to serve new customers. GFC revenues provide a source of cash funding for the capital facilities plan (CFP).

FCS Group calculated an updated GFC as part of the financial analysis for this Plan. The updated GFC per ERU (equivalent residential unit) should increase by $730 or about 21.1% from the 2014 charge of $3,456. The Utility's practice is to phase increases in order to smooth impacts to customers. Therefore, the Utility proposes an increase of approximately 6.7% each year from 2015-2017, resulting in a GFC of $4,186 per ERU beginning in 2017.

In addition to funding the capital program with charges to new customers, the Utility requires existing ratepayers to support the City's full cost of providing service, including annual depreciation expense on existing Utility assets. Existing customers benefit from a system of infrastructure that has been funded through a combination of sources; this infrastructure deteriorates over its useful life and will eventually fail, requiring replacement.

The Utility has been moving toward increasing annual depreciation funding from 45% of current depreciation to 75% of depreciation by 2020. While this approach does not ensure full cash funding of system replacements, it provides a reasonable basis for equitably charging current customers for the use and decline in value of the system. It is consistent with standard accounting practices and is a commonly used benchmark in the industry.

The Utility manages its capital fund reserves according to the following policy: the Capital Fund is assumed to maintain a minimum reserve balance equal to 5 percent of active capital appropriations as a capital contingency reserve. This policy intends to provide a source of funding for unanticipated capital needs, such as cost overruns.

Analysis performed by FCS Group, shown in Table 14.2, indicates that the Utility will have enough cash resources to pay for the projected capital costs without incurring any additional debt. In the event that CFP project costs exceed the estimates developed by staff or cash funding sources fall short of projections, the Utility can consider deferring projects as an alternative to incurring debt.

Table 14.2 Proposed CFP Funding Strategy

Project	2014	2015	2016	2017	2018	2019	2020	Total
Total Capital Costs	$ 898,350	$ 8,516,075	$ 6,829,000	$ 5,504,500	$ 3,048,000	$ 1,853,750	$ 4,087,750	$ 30,737,425
Planned Funding Strategy								
DWSRF Loan Proceeds	$ 532,725	$ 5,792,275	$ 4,500,000	$ -	$ -	$ -	$ -	$ 10,825,000
Cash	365,625	2,723,800	2,329,000	5,504,500	3,048,000	1,853,750	4,087,750	19,912,425
Total	**$ 898,350**	**$ 8,516,075**	**$ 6,829,000**	**$ 5,504,500**	**$ 3,048,000**	**$ 1,853,750**	**$ 4,087,750**	**$ 30,737,425**

Projected Capital Fund Activity	2014	2015	2016	2017	2018	2019	2020
Beginning Balance	$ 5,812,970	$ 7,146,420	$ 6,412,212	$ 6,395,478	$ 3,030,306	$ 2,521,902	$ 3,952,834
Plus: Interest Earnings	14,532	17,866	32,061	31,977	22,727	18,914	39,528
Plus: GFC Revenue	950,000	1,025,913	1,147,959	1,272,807	1,288,185	1,303,753	1,319,514
Plus: Existing DWSRF Loan	532,725	5,792,275	4,500,000	-	-	-	-
Plus: System Reinvestment Funding	734,543	734,543	734,543	734,543	1,228,684	1,312,015	1,399,949
Plus: Transfer from Operating Fund	-	211,270	397,703	100,000	-	650,000	167,462
Less: Capital Expenditures	(898,350)	(8,516,075)	(6,829,000)	(5,504,500)	(3,048,000)	(1,853,750)	(4,087,750)
Ending Balance	$ 7,146,420	$ 6,412,212	$ 6,395,478	$ 3,030,306	$ 2,521,902	$ 3,952,834	$ 2,791,537
Minimum Balance	*$ 44,918*	*$ 425,804*	*$ 341,450*	*$ 275,225*	*$ 152,400*	*$ 92,688*	*$ 204,388*

14.4 2015-2020 Financial Program

The overall financial condition of the City's Drinking Water Utility remains healthy. The City continues to be guided by a policy of water conservation and sustainability along with sound and prudent financial management principles. While the proposed 2015-2020 rates represent an increase over current rates, the overall rates and resulting billings to the City's customers fit within this policy framework.

This financial strategy will enable the City to achieve a reasonable balance between its goals of offering its customers affordable rates while encouraging water conservation through prudent pricing signals and a projected operating and capital plan that will meet the needs of the Utility over the next six years.

Financial Program objectives and strategies are designed to help meet the Drinking Water Utility's Goal 7:

> **Drinking Water Utility finances are managed responsibly, and costs are recovered equitably based on customer use.**

Objective 7A. Set rates that reflect financial policies and recover the cost of providing services to each customer class.

Strategy 7A1 – Increase annual depreciation funding to 75 percent of depreciation by 2020, in order to equitably charge current customers for the use and decline in value of the system.

Strategy 7A2 – Analyze how the tiered and seasonal rate structure is affecting consumption patterns/revenue, and propose changes to the rate structure as appropriate.

Strategy 7A3 – Conduct a cost-of-service study for wholesale and retail customers on a six year cycle or more often as needed.

Strategy 7A4 – Coordinate regular water rate studies with the City's other water resources utilities so that the full impact of utility rate increases on customers is considered.

Objective 7B. Manage Utility rates and connection fees consistent with the City's guiding principle of growth paying for growth.

Strategy 7B1 – Increase the general facility charges to reflect the current pro rata share of system costs.

Strategy 7B2 – Review general facilities charges regularly to ensure that they accurately and equitably distribute system costs to new development and adjust for inflation.

Objective 7C. Use debt financing responsibly to support needed capital facility investments and "smooth" rate impacts.

Strategy 7C1 – Continue the capital funding strategy that utilizes existing resources from reserves and general facility charges first before relying upon debt financing.

Strategy 7C2 – Maintain the required debt coverage ratio and a solid bond rating.

Strategy 7C3 – Pursue grants and state low-interest loans when available.