Chapter 2 - Water System Requirements

Introduction

This chapter presents basic information from which criteria has been developed for evaluating the City of Stanfield's existing water system and for defining and sizing the required components of the system for the 20-year planning period. Information concerning the service area, population projections, water use, and state and federal requirements is presented.

Service Area

The term "service area" refers to the area being served with water from the City's water system. For this Water System Master Plan (WSMP), the service area is projected to be inside the city limits. Although unanticipated, the city limits could potentially expand within the urban growth boundary (UGB) within the 20-year planning period. The present service area primarily consists of the developed lands within the boundaries of the city limits and is shown on Figure 1-1 at the end of Chapter 1. The City's zoning map is shown on Figure 2-1. The City has the potential for residential, commercial, and industrial growth. Issues related to the service area and service limits of the existing water system are discussed in more detail in Chapters 3, 4, and 5.

Service Population and Planning Period

To estimate the demands that may be placed on a municipal water system, a determination of the population to be served must be made. Population estimates must be made with reference to time. Projections are usually made on the basis of an annual percentage change estimated from past growth rates, tempered by future expectations. It is difficult to accurately predict the population of a small community over an extended period of time. The addition or deletion of a major business, industry, or recreational use in the area could significantly affect the population and the overall water system needs.

The certified 2016 population of the City of Stanfield was 2,130 according to Portland State University's (PSU) Population Research Center (PRC). This agency is the official source of population data available in Oregon between the official Census data generated at the beginning of each decade. For the purposes of this WSMP, the current population will be assumed to be 2,130. The historical and forecast populations and average annual growth rates (AAGR) provided by the PRC are presented on Table 2-1 and Chart 2-1.

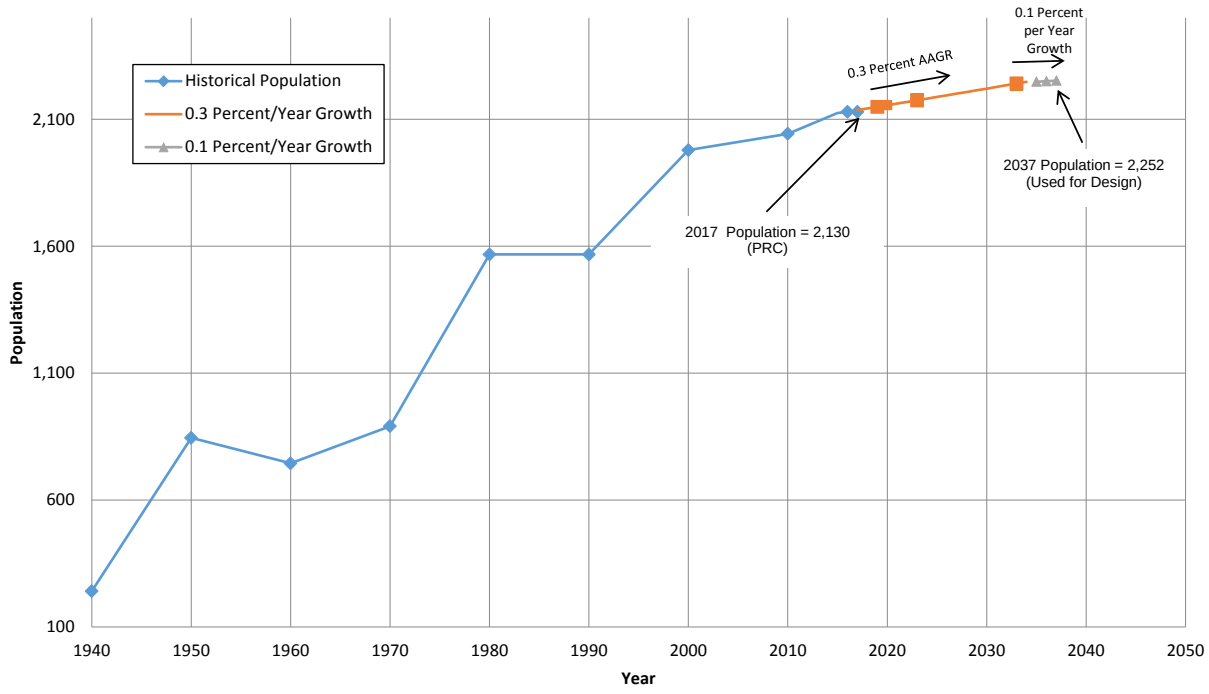
TABLE 2-1
HISTORICAL AND FORECASTED POPULATION

Historical			Forecasted				
2000	2010	AAGR (2000 through 2010)	AAGR (2017 through 2035)	AAGR (2035 through 2066)	2017	2035	2037
2,011	2,061	0.20 percent	0.30 percent	0.10 percent	2,130	2,248	2,252

In 2013, the State of Oregon passed legislation assigning coordinated population forecasting to the PRC at PSU. The population forecast estimated an AAGR in the City of Stanfield of 0.3 percent per year between the period of 2017 and 2035 and 0.1 percent per year after 2035. Population growth in the UGB will experience the same growth rate. According to the forecast provided by the PRC, the

population of Stanfield, including the UGB, was 2,144 in 2016 and is expected to be 2,280 in 2035. Water service is not anticipated to be provided to the full PRC-projected population within the UGB. For comparison purposes, past population trends through the year 2017 are shown on Chart 2-1. The 0.3 and 0.1 percent AAGRs are also presented for reference. The assumed AAGRs result in a planning population in the year 2037 of 2,252. However, over the planning period of this WSMP, actual growth could exceed or fall well below the figures presented on Chart 2-1.

CHART 2-1
HISTORICAL AND PROJECTED POPULATION



Existing Land Use

The current zoning in the City is shown on Figure 2-1. As shown, eleven land use classifications have been identified within city limits: Residential, Residential/Neighborhood Commercial Subdistrict, Residential/Multi-family Subdistrict, Residential/Manufactured Home Park Subdistrict, Residential/Urban Holding Subdistrict, Downtown District, Downtown/Tourist Commercial Subdistrict, Light Industrial, General Industrial, General Industrial/Transportation Subdistrict, and Open Space.

Commercial areas are primarily located on the south end of town in the Downtown/Tourist Commercial Subdistrict. The majority of the City's industrial area is located in the west portion of the City with a large zone in the south as well. The City is primarily zoned Residential throughout. In general, the City has significant area available for residential, commercial, and industrial expansion, particularly in the north and south portions of the City.

Federal and State Requirements

The City's water system comes under the jurisdiction of the Oregon Health Authority - Drinking Water Services (DWS). The DWS assumed primacy (responsibility) from the U.S. Environmental Protection Agency (EPA) in February 1986 for enforcement of the federal Safe Drinking Water Act (SDWA).

Therefore, the City is currently, and will principally be, working with the DWS as the regulating agency with regard to their water system. The City is required to publish annual Consumer Confidence Reports; a copy of the 2017 Report is located in Appendix B.

Regulatory Background

The SDWA was originally passed by Congress in 1974 to protect public health by regulating the nation's public drinking water supply. The law was amended in 1986 and 1996 and requires many actions to protect drinking water and its sources, including rivers, lakes, reservoirs, springs, and groundwater wells. The primary regulations associated with the SDWA address requirements concerning trace minerals, compounds, and microorganisms that may affect the health of water consumers. The SDWA provides monitoring, testing requirements, reporting, recordkeeping, and public notification procedures in the event of noncompliance.

The 1986 amendments to the SDWA included provisions for wellhead protection, new monitoring for certain substances, filtration for certain surface water systems, disinfection for certain groundwater systems, and restrictions on lead content in pipe solder and plumbing.

The 1996 amendments to the SDWA also included provisions for consumer confidence reporting, stronger protection against microbial contaminants and disinfection byproducts, operator certification, lowering maximum contaminant levels (MCLs), and source water assessments.

Enacted in 1981, the Oregon Drinking Water Quality Act established periodically amended statutes and subsequent administrative rules to enforce, at a minimum, the federal SDWA requirements. DWS administers and enforces drinking water quality standards for public water systems in the State of Oregon. The agency focuses resources in the areas of highest public health benefit and promotes voluntary compliance with state and federal drinking water standards. The DWS also emphasizes prevention of contamination through source water protection, provides technical assistance to water system owners, and provides water system operator training. The DWS also works closely with public water systems to ensure public notification is made in accordance with regulatory guidelines when required. If the City is unaware of their compliance status or in need of regulatory guidance, it is recommended that the regional DWS office in Pendleton be contacted.

Recent Regulatory History (Last Five Years)

Following is a list of regulations that have been enacted in the past 5 years:

1. **Reduction of Lead in Drinking Water Act**, which requires any new installation or purchase of materials used in potable locations to be "lead-free." Lead-free has been redefined as "(A) not containing more than 0.2 percent lead when used with respect to solder and flux; and (B) not more than a weighted average of 0.25 percent lead when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures." This law was enacted on January 4, 2014. Oregon requires drinking water components to be National Sanitation Foundation/American National Standards Institute Standard 61 compliant to meet the intent of this law.

2. **Stage 2 Disinfectants and Disinfection Byproduct Rule (D/DBPR)**, which focuses on public health protection by limiting exposure to disinfection byproducts. The D/DBPR specifically targets total trihalomethanes and five haloacetic acids, which can form in water through

disinfectants used to control microbial pathogens. This rule applies to all community water systems (CWSs) and non-transient non-community (NTNC) water systems that add a primary or residual disinfectant other than ultraviolet light. Stage 2 of the D/DBPR was enacted in 2012 for large CWSs and NTNCs and in October 2013 for all CWSs and NTNC water systems.

3. **Unregulated Contaminant Monitoring Rule (UCMR) 3.** The EPA uses the UCMR program to collect data for contaminants suspected to be present in drinking water but that do not have health-based standards set under the SDWA. Every five years, the EPA develops a new list of UCMR contaminants, largely based on the Contaminant Candidate List. Oregon Administrative Rule 333-061-0043 requires CWSs to report detection of unregulated contaminants in their annual Consumer Confidence Report.

4. **Revised Total Coliform Rule**. This rule requires that total coliform samples be collected by public water systems at sites that are representative of water quality throughout the distribution system according to a written sample site identification plan.

Potential Regulatory Changes

Following is a list of regulations that may be enacted in the future:

1. **Radon in Drinking Water Rule**, which would attempt to reduce airborne and waterborne radon concentrations to limit exposure levels. This rule would apply to CWSs that use groundwater or mixed groundwater and surface water. The proposal is currently on hold, and the EPA has no timeline for publishing this rule.

2. **Fourth Contaminant Candidate List (CCL4) Regulatory Determinations.** The CCL4 is currently in draft form. The EPA has made a preliminary determination to regulate strontium, which is currently still pending. Two new nominated contaminates, manganese and nonylphenol, have been added for the final publication.

3. **Carcinogenic Volatile Organic Chemicals (cVOC) Rule.** The EPA is developing a proposed national primary drinking water regulation for a group of 16 known cancer-causing compounds, including eight currently regulated cVOCs and up to eight from the Third Contaminant Candidate List.

4. **Perchlorate Rule.** The EPA is developing a proposed national primary drinking water regulation for perchlorate. Perchlorate may cause adverse health effects. Scientific research indicates this contaminant can disrupt the thyroid's ability to produce hormones needed for normal growth and development.

5. **Hexavalent Chromium.** The EPA currently regulates hexavalent chromium as part of the total chromium drinking water standard. New information on health effects has become available since the original standard was set, and the EPA is reviewing this information to determine whether new health risks need to be addressed. The State of California has already implemented a hexavalent chromium-specific MCL.

6. **Fluoridation.** Fluoride MCLs may be lowered in the future as the health impacts of fluoride are fully realized. The current MCL of 4 parts per million could be reduced to 1 or less. This

lower MCL could require systems with naturally occurring fluoride above the MCL to treat to reduce levels.

7. **Cybersecurity.** Executive Order 13636: Improving Critical Infrastructure Cybersecurity was established in February 2013. The order calls for the development of a voluntary, risk-based cybersecurity framework. The EPA will evaluate whether any additional authority and/or regulations to address cybersecurity in the water sector are needed.

8. **Lead and Copper Rule (LCR) Long-Term Revisions.** The LCR is a treatment technique rule. The rule requires public water systems take certain actions to minimize lead and copper in drinking water in lieu of setting a MCL. The goals for the revisions are to improve the effectiveness of the corrosion control treatment and prompt additional actions that may help reduce public exposure to lead and copper.

Regulatory Violations

According to the DWS website, the City of Stanfield has received two alerts and two violations over the past five years. The alerts were a result of elevated sodium levels in Well No. 5 and the Pilot Well. Sodium is a contaminant that has a secondary MCL established by the EPA. Contaminants with secondary MCLs typically affect aesthetics and taste of water and do not present health and safety issues. The two violations were for late/non-reporting. Both violations have been brought back to compliance.

Regulatory Requirements Summary

In summary, many regulations affect operation of the City of Stanfield's water system. The information presented herein is intended to provide the City with a brief summary of the regulations and possible future regulations that will likely affect operation of the City's water system. These regulations continue to expand and will require careful attention to maintain compliance. It is recommended the City of Stanfield consult periodically with the DWS in Pendleton to ensure compliance with current regulatory requirements and to address any regulatory questions or issues.

Water Demand

Future water demands, for the purpose of identifying needed future water system improvements, can be estimated from past water use data and population projections. Water use data are usually expressed in terms of various rates of water used for various periods of time. This allows components of the water system to be sized for the maximum demands that will be placed on them. The rates of water use that are important in evaluation of a water supply system are the average daily demand (ADD), which is the total amount of water used during a 1-year period divided by 365 days; the peak daily demand (PDD), which is the maximum total amount of water used during any 24-hour period; and the peak hourly or peak instantaneous demand, which is a measure of the maximum flow of water at any given time.

Water supply facilities are normally designed for PDD. As a rule, a well would be sized for supplying the needed water during the PDD without continuous 24-hour operation. For example, if the water usage during high demand summer months required a well pump to operate 18 hours or more per day to keep up with the PDD, the situation may warrant the addition of another well or other water supply source to provide some backup capability and to not over-stress the well pumping equipment. Booster pumps and

distribution pipelines are generally sized to deliver peak instantaneous demands, because they must be capable of meeting the highest demand. Storage reservoirs are sized to make up the difference between water supply capacity and peak water use rates, at a minimum. Additional capacity (reserve) is usually provided in water storage reservoirs for both emergencies and fire suppression.

Per Capita Water Use

To be utilized for projecting future water demands, past water use data must be converted to a per capita (per person) rate of use. This is done by dividing the average daily, peak daily, and peak instantaneous water use rates by the number of people being served by the water system. These water demand rates would then be expressed as gallons per capita day (gpcd). These values multiplied by a population projected for some future year would then give estimated total demand rates for that year.

Historical Average Water Use

To determine current water demands, production records for the City's water supply system were reviewed from 2010 through September 2016. Population data for the same time frame were also utilized. Charts 2-2 through 2-5 present the total monthly production for each of the City's wells. The City had difficulty with collecting accurate data during the years 2012 through 2014 due to mechanical and operational problems with flowmeter instruments. Due to the flowmeter equipment problems, production shown for those years is under-represented.

CHART 2-2
WELL NO. 3 MONTHLY PRODUCTION

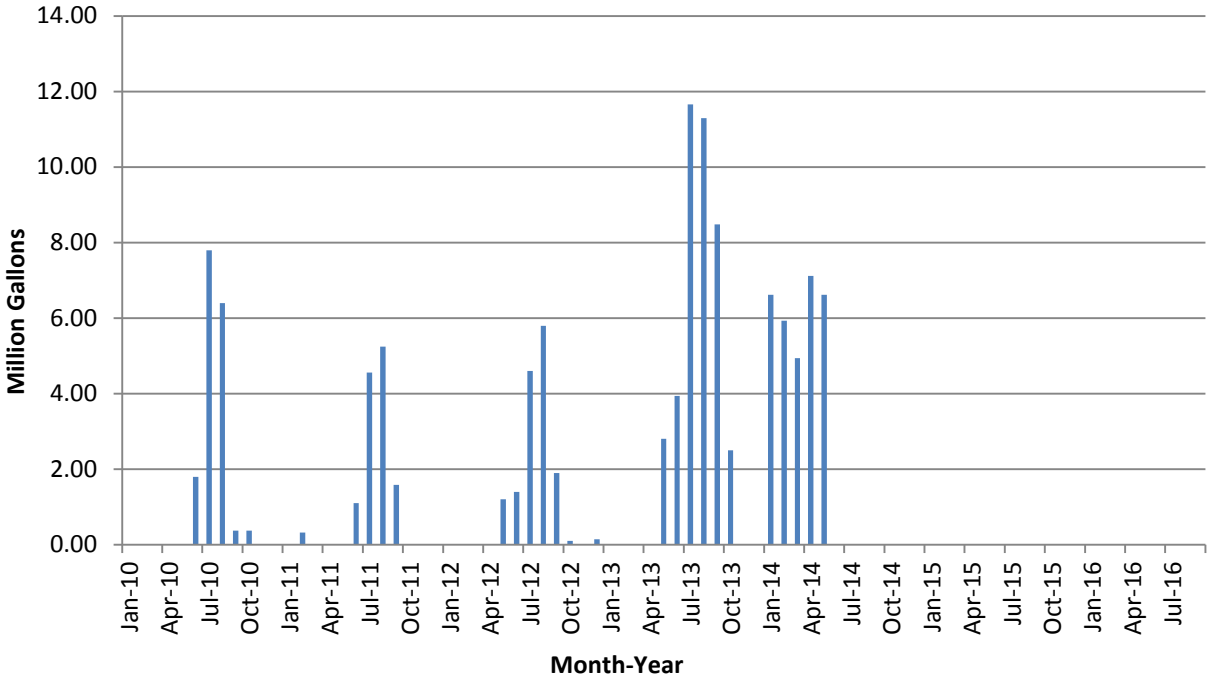


CHART 2-3
WELL NO. 4 MONTHLY PRODUCTION

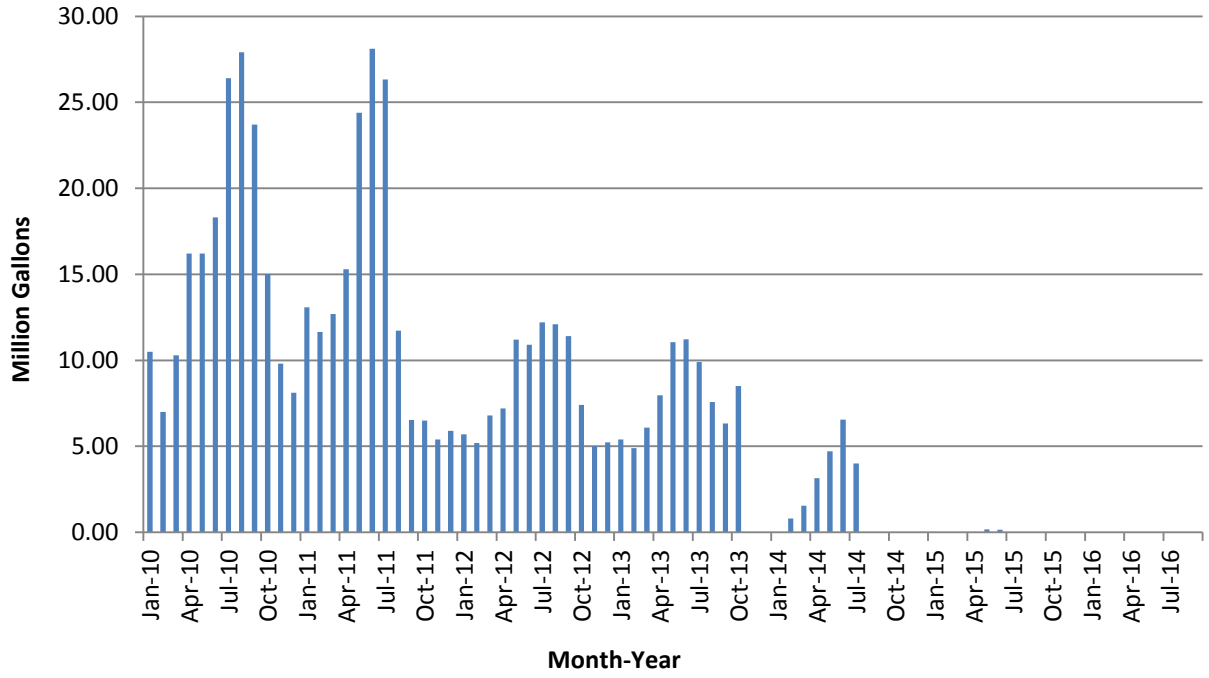


CHART 2-4
PILOT WELL MONTHLY PRODUCTION

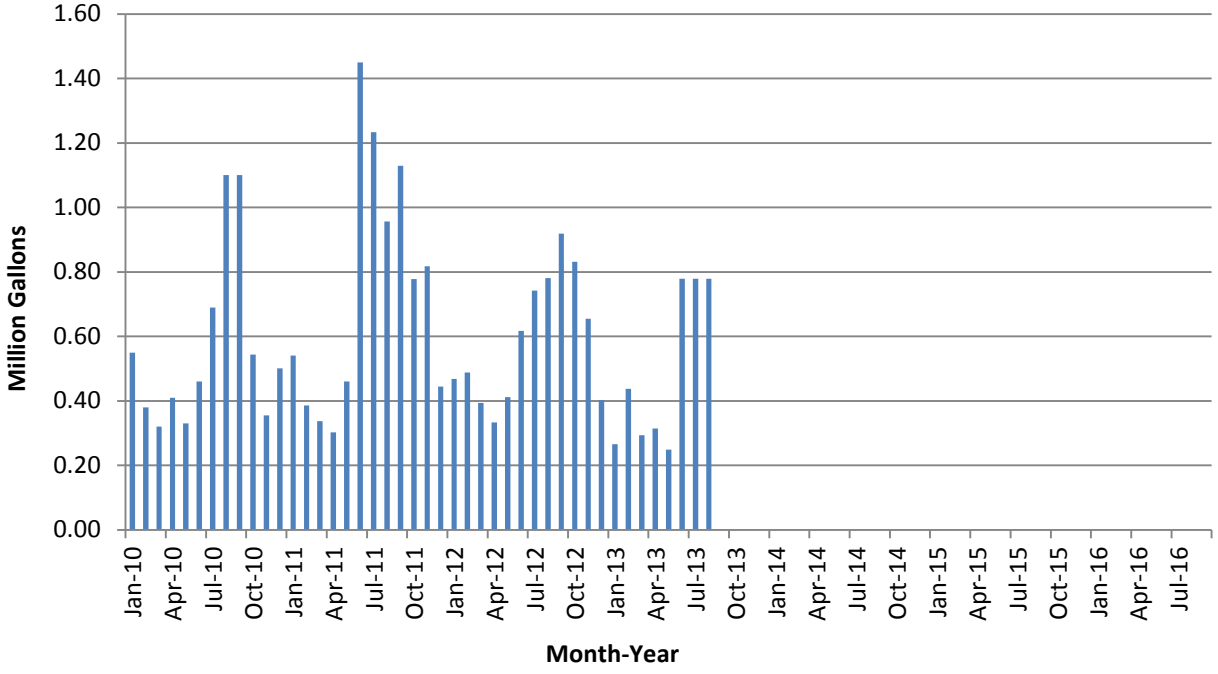
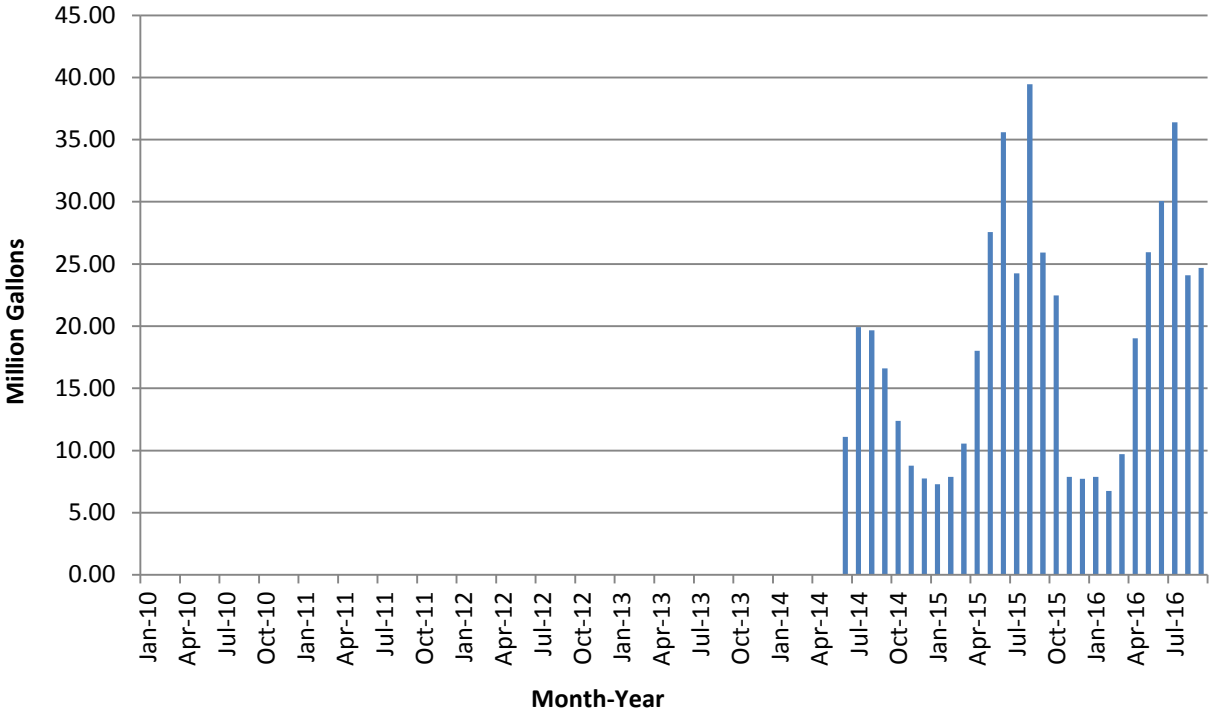
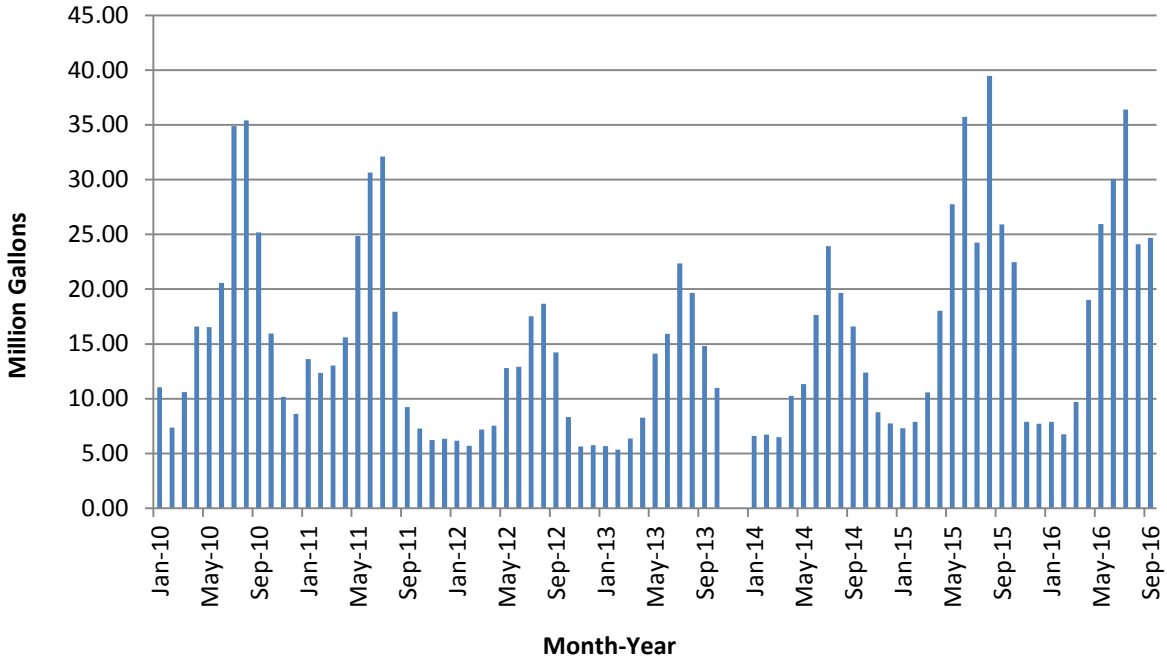


CHART 2-5
WELL NO. 5 MONTHLY PRODUCTION



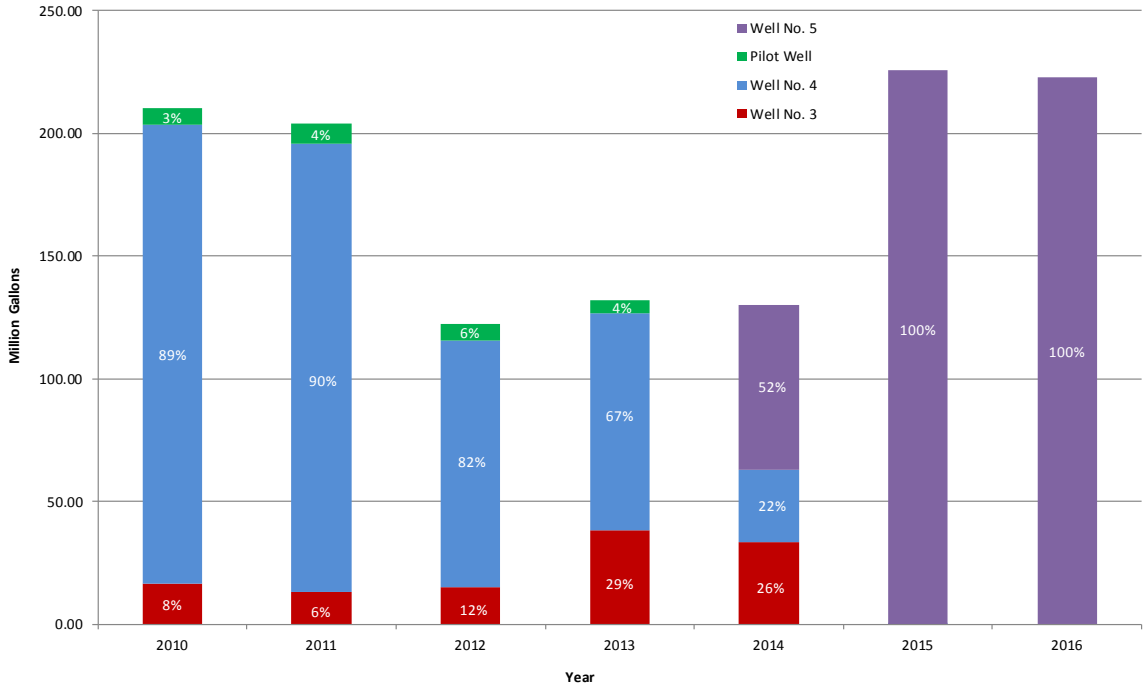
Well No. 3 was primarily used during high demand months until 2014. Well No. 4 was the primary source of City water until 2014. After construction of Well No. 5, Well No. 4 was used sparingly in the summer of 2015. The Pilot Well was pumped actively until summer 2013. Construction of Well No. 5 and associated improvements were completed in the summer of 2014. Since that time, the City has relied primarily on Well No. 5 for water supply. The combined monthly production from the City's wells is shown on Chart 2-6. Water production data from the City were not available on the Oregon Water Resources Department website for November and December 2013.

CHART 2-6
COMBINED WELL SOURCES MONTHLY PRODUCTION



The total annual production from all sources is further broken into percentage input from each source compared to the total annual volume, as shown on Chart 2-7.

CHART 2-7
TOTAL ANNUAL WELL PRODUCTION



The well production records show typical patterns of high summer demand and low fall, winter, and spring demand. The data depicted on Chart 2-6 show summer demand can be five to six times higher than winter demand due to warmer weather and irrigation needs.

Average Daily Demands

The ADD is a measure of the overall annual average rate of consumption. It is derived, in general, by dividing the total water produced during the year by the estimated population for that year. ADD is stated in gpcd and can be converted to flow rates of gallons per minute (gpm) for use in analyzing source and storage facility requirements (see Table 2-2).

TABLE 2-2
AVERAGE DAILY DEMAND

Year	Total Year Flow (MG)	Population	ADD		
			gpd	gpm	gpcd
2010	210.1	2,045	575,600	400	281
2011	204.1	2,055	559,200	390	272
2012	122.6	2,075	335,900	230	162
2013	132.3	2,095	362,400	250	173
2014	130.3	2,115	356,900	250	169
2015	225.8	2,125	618,600	430	291
2016*	208.8	2,130	572,100	400	268

**Metering issues were reported in this year, which could cause artificially low results.*
gpd = gallons per day
MG = million gallons

The ADD in gpcd between the years 2010 and 2016 was determined by excluding outliers and periods of unusual water demand. The ADD utilized for this WSMP is 275 gpcd.

Peak Daily Demands

PDD values presented on Table 2-3 represent the one day of the year with the highest daily production. The day of the occurrence of peak daily flows and the associated total volume were obtained from the City. The highest peak flow between the years 2010 and 2016 occurred on July 27, 2010, with a flow of 1,348,690 gallons.

TABLE 2-3
PEAK DAILY DEMAND

Year	Population	Day of Peak Flow	Total Daily Production (gallons)	PDD (gpcd)
2010	2,045	July 27	1,348,690	660
2011	2,055	July 25	819,100	401
2012	2,075	July 11	752,100	368
2013	2,095	July 13	1,034,600	506
2014	2,115	July 31	891,400	436
2015	2,125	August 27	920,000	433
2016	2,130	July 27	1,029,500	483

Using the estimated population for the City for the various years, the PDD has ranged from approximately 368 to 660 gpcd. For planning purposes, a PDD of 660 gpcd was chosen. Table 2-4 illustrates the City's total average and PDD and the total system capacity.

TABLE 2-4
YEAR 2016 TOTAL AVERAGE AND PEAK DAY DEMAND DATA

Parameter	Per Capita Demand (gpcd)	Flow Demand (gpm)	Percentage of System Capacity*
ADD	275	410	32
PDD	660	980	75

**Assumes a total combined capacity of 2,150 gpm from Wells No. 3, 4, and 5, excluding the Pilot Well.*

Water supply facilities (well pumps) are normally designed to meet PDD without providing 24-hour service. It is preferable well pumps operate a maximum of 18 hours per day, if possible. While it appears the system could rely solely on Well No. 5, with a production capability of 1,100 gpm, the well would have to operate for more than 20 hours per day to meet the current PDD. Since Well No. 5 would be required to operate more than the recommended 18 hours per day, Wells No. 3 and 4 are recommended to be utilized, as needed, to help meet the PDD. This suggests that the existing system has enough well capacity to meet current demands. The City's average and peak water demand is in the middle range of typical demands when compared to other water systems with water meters in eastern Oregon and Washington, as shown on Table 2-5. Table 2-5 is sorted by ADD in descending order.

TABLE 2-5
COMPARATIVE WATER USAGE
TYPICAL FOR METERED WATER SYSTEMS IN EASTERN OREGON AND EASTERN WASHINGTON

City	ADD (gpcd)	PDD (gpcd)	Peak Factor (peak daily)	Population
Confederated Tribes of the Umatilla Indian Reservation, Oregon	732	2,666	3.6	1,020
Halfway, Oregon	600	1,240	2.1	352
Wallowa, Oregon	487	1,900	3.9	890
Ione, Oregon	461	1,865	4.0	250
St. John, Washington	379	993	2.6	554
Joseph, Oregon	375	1,100	2.9	1,060
Hines, Oregon	350	1,600	4.6	1,700
Lexington, Oregon	325	1,150	3.5	260
Helix, Oregon	323	1,130	3.5	155
Boardman, Oregon	320	960	3.0	3,445
Milton-Freewater, Oregon	300	750	2.5	6,550
Irrigon, Oregon	290	800	2.8	1,790
Enterprise, Oregon	284	582	2.0	1,940
La Pine, Oregon	280	700	2.5	982
Stanfield, Oregon	**275**	**660**	**2.4**	**2,130**
Island City, Oregon	270	810	3.0	989
John Day, Oregon	270	865	3.2	2,010
Athena, Oregon	250	710	2.8	1,142
Vale, Oregon	250	625	2.5	1,890
Mt. Vernon, Oregon	240	585	2.4	617
Prairie City, Oregon	234	549	2.3	1,195
La Grande, Oregon	230	667	2.9	13,238
Union, Oregon	230	890	3.9	2,121
Baker City, Oregon	227	834	3.7	10,035
Cove, Oregon	215	628	2.9	594
Umatilla, Oregon	210	483	2.3	4,686
Ice Fountain Water District, Oregon	207	621	3.0	1,921
Adams, Oregon	195	625	3.2	265
Weston, Oregon	195	834	4.3	670
White Salmon, Washington	176	452	2.6	3,761
Echo, Oregon	175	525	3.0	700
Lostine, Oregon	170	545	3.2	250

Description of Customers Served

The City of Stanfield's water service accounts are summarized on Table 2-6. These data were sourced from the 2016 Water Management and Conservation Plan.

TABLE 2-6
WATER ACCOUNT INFORMATION

Account Type	Number of Accounts[1]	2015 Total Annual Use (gallons)	2015 Average Annual Use Per Connection (gallons)	Percentage of Total Water Use
Residential	755	72,755,000	96,000	74
Commercial	29	24,873,000	858,000	25
Industrial	3	25,000	8,300	1
Total	**787**	**97,653,000**	**962,300**	**100**

[1] *The number of accounts by account type was provided by the City's billing records.*

As shown on Table 2-6, residential water use accounts for approximately 74 percent of the total water use in the City of Stanfield, while commercial and industrial use accounts for approximately 26 percent.

Fire Demand

Fire Protection Ratings

Flow rates for fire suppression in residential, commercial, and industrial areas within developed communities are usually determined from the size, density, and occupancy of buildings, type of construction materials, and desired fire insurance rating. Incorporated cities and some rural areas are given a fire suppression rating by Insurance Services Office, Inc. (ISO). The rating is used by insurance companies to determine the cost for providing fire insurance to home and business owners. ISO's fire suppression rating schedule is used to review those features of available public fire protection that have a significant influence on minimizing damage once a fire has begun. These features include the receiving and handling of fire alarms; the fire district's manpower, equipment and training; and the capability of the water system to provide the needed fire flows.

ISO periodically evaluates fire suppression capabilities of incorporated cities and rural fire districts. The numerical ratings range from Class 1 down to Class 10, with Class 1 indicating the highest fire suppression capability and Class 10 the lowest. A Class 10 rating is reserved for unprotected areas that have no fire department and no water supply system. Most protected areas outside of cities have a Class 9 rating, and most small rural cities with municipal water systems are rated Class 8, 7, or 6, depending on the strength of their water system and fire department. The ISO rating for Stanfield, based on the 1980 evaluation, is Class 5. No evaluation has been completed since 1980. It is recommended the City obtain an ISO report based on their current system.

ISO's fire suppression rating schedule evaluates a city's fire department capabilities and the domestic water supply capacity on an approximately equal basis (50 percent and 40 percent of the rating schedule, respectively). To reduce the cost of fire insurance in a community, improvements usually must be made to the fire department, the water system, or both, depending on their present condition. It is difficult to determine possible fire insurance savings on commercial buildings, because the insurance costs are determined by many other factors related to the type of occupancy and the type of building construction. The City of Stanfield has an average rating for typical rural communities of similar size. Improving the rating as a result of the City's recently completed water system improvements may be possible.

Needed Fire Flows

ISO also recommends fire flows for various conditions in both residential and commercial settings. Needed fire flows for residential areas are set forth in the 2012 ISO Fire Suppression Rating Schedule and shown on Table 2-7, below.

TABLE 2-7
ISO NEEDED FIRE FLOWS

Distance Between Buildings	Required Fire Flows
Over 100 feet	500 gpm
31 to 100 feet	750 gpm
11 to 30 feet	1,000 gpm
10 feet or less	1,500 gpm

Recommended fire flows for commercial buildings are based on many factors including building size, construction materials used, and what is housed in the building.

The Oregon Fire Code (OFC) requires a minimum flow of 1,000 gpm in residential areas and a minimum of 1,500 gpm for a minimum of two hours in all other occupancies. These requirements increase with square footage of the building and can be quite large for commercial and institutional buildings (schools). These fire flows must be maintained with a system-wide minimum of 20 pounds per square inch residual pressure. Attaining the required fire flows for commercial areas may not be realistically achievable. The OFC has an allowance for decreases in fire flows for small communities (if approved by the local fire chief), where development of full fire flows is impractical.

ISO reports typically include a Hydrant Flow Data Summary that recommends needed fire flow protection rates for both residential and commercial districts to receive full credit ratings. ISO does not consider needed fire flows over 3,500 gpm in determining the Public Protection classification for cities. The fire flow design criterion for this WSMP is based on the typical maximum fire flow recommended by ISO, which is 3,500 gpm for a two-hour duration. This maximum fire flow is typically recommended for school areas, industrial areas, and other high-density development. For residential areas, a minimum fire flow design criterion of 1,000 gpm was used. This value is based on the minimum flow allowed by the OFC.

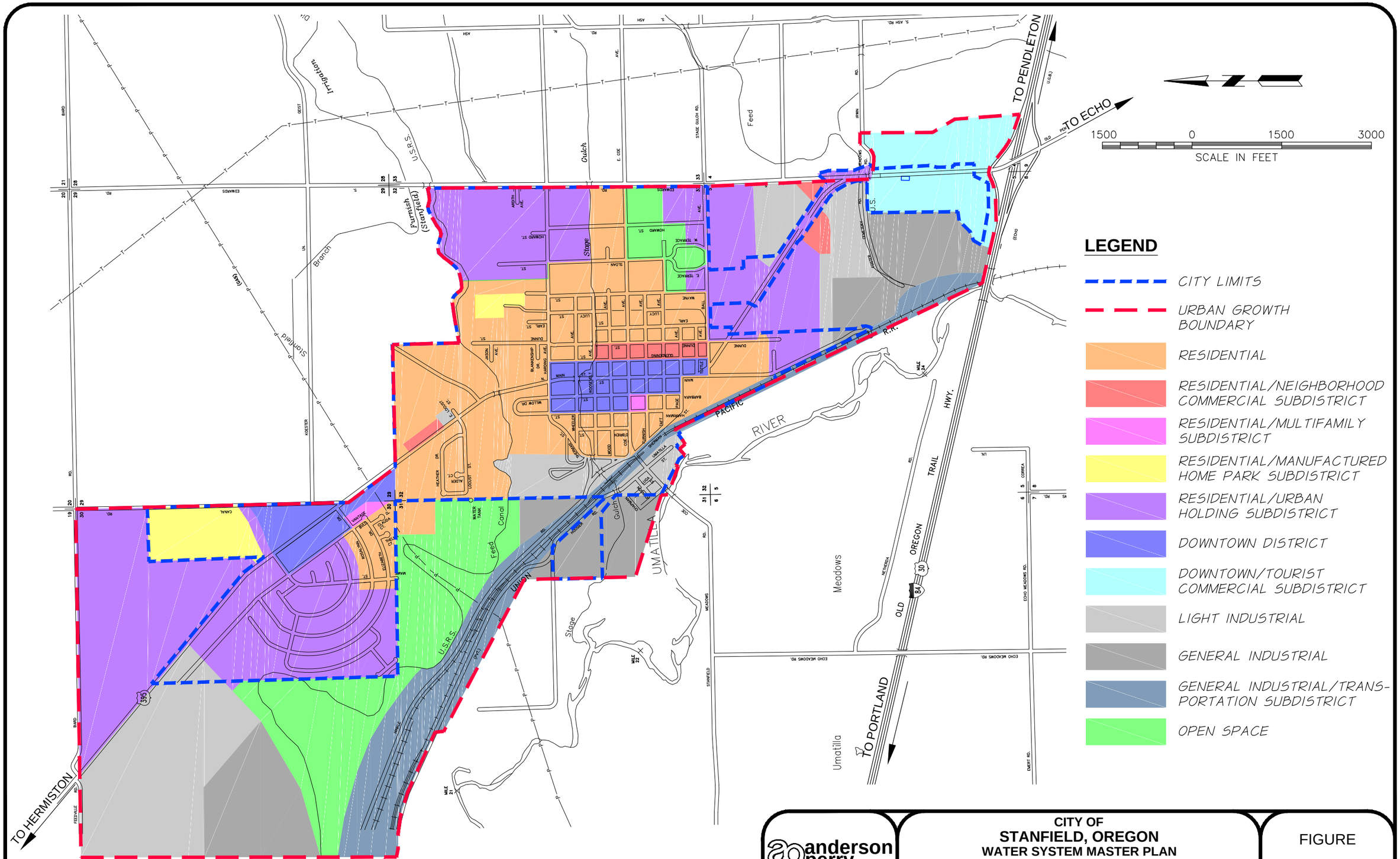
Available Fire Flow

The City routinely tests fire hydrants to help ensure the hydrants remain operable and to estimate available fire flows. Fire hydrant flow testing data were provided by the City for this WSMP. Based on the test results, the City of Stanfield's water system is generally able to deliver water flows ranging from approximately 1,000 to 1,160 gpm at individual fire hydrants while maintaining working distribution system pressures from 36 to 51 psi. These pressures are not necessarily the minimum pressures that occurred in the distribution system when the fire flow tests were conducted. A copy of the fire hydrant flow test results is included in Appendix C. Refer to Chapter 5 for a more detailed discussion of fire flow capacity.

Design Criteria

In establishing design standards for a water system, primary consideration must be given to state and federal rules and regulations governing water quality and construction standards for water systems. These regulations, as previously stated, are set by both the EPA and DWS. In addition to these public health and safety requirements, many other factors control the design parameters for municipal water systems. The City must evaluate factors such as financial feasibility, philosophy and policies of the City Council, past system performance and service, and expectations of the water users. All of these factors are important and can influence the standards by which water system improvements are made.

Figure 2-2 presents a summary of the water system design criteria for evaluating the existing water system and developing improvements to satisfy present and future needs. Application of these criteria is discussed further in the specific chapters that address the water supply, storage, and distribution system facilities. Figure 2-2 presents design criteria based on the estimated present service population of 2,130 and presents estimated ADD and PDD. Design criteria are shown for the year 2037 based on a 0.3 percent growth rate per year in the City between the years of 2017 and 2035 and 0.1 percent between the years 2035 and 2037. Storage volumes are derived from calculations summarized in Chapter 4. The design criteria presented on Figure 2-2 are used as base information in later chapters for evaluating existing and future system needs and capability.



anderson perry & associates, inc.

CITY OF
STANFIELD, OREGON
WATER SYSTEM MASTER PLAN

ZONING MAP

FIGURE
2-1

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SUMMARY OF DESIGN CRITERIA

	Year 2017	Year 2037
Design Population*	2,130	2,252
Supply		
Average Daily Demand (gpcd)	275	275
Average Daily Flow (gpd)	585,800	619,300
Average Daily Flow (gpm)	410	430
Peak Daily Demand[1] (gpcd)	660	660
Peak Daily Flow[1] (gpd)	1,405,800	1,486,300
Peak Daily Flow (gpm)	980	1,030
Peak Hourly Flow[2] (gpm)	2,450	2,580
Estimated Supply Flow Available[3] (gpm)	2,150	2,150
Estimated Supply Flow Required[4] (gpm)	1,310	1,370
Fire Demand		
Residential (gpm)	1,000	1,000
Multi-Family Residential (gpm)	2,000	2,000
Commercial/Public (gpm)	3,000	3,000
Industrial	3,500	3,500
Duration (hour)	2	2
Minimum Residual Line Pressure Under Peak Demands Plus Fire Flow (psi)	20	20
Storage		
Operating Storage[5] (gal)	100,000	100,000
Equalization Storage[6] (gal)	45,000	64,500
Fire Reserve[7] (gal)	420,000	420,000
Emergency Reserve[8] (gal)	585,800	619,300
Total Recommended Storage[9] (gal)	1,150,800	1,203,800

gpcd = gallons per capita per day
gpd = gallons per day
gpm = gallons per minute
gal = gallons
psi = pounds per square inch

[1]Peak daily water demand obtained from City staff for years 2009 to 2016. The peak daily water demand during this period occurred on July 27, 2010.

[2]2.5 times peak daily flow.

[3]Combined well capacity (gpm) for Wells No. 3, 4, and 5. This capacity excludes the Pilot Well.

[4]Total capacity required to operate well pumps a maximum of 18 hours per day and meet peak demands.

[5]Operating range for Reservoir No. 2 is 40 to 45 feet (64,000 gallons), operating range for Reservoir No. 3 is 33.2 to 36 feet (36,000 gallons).

[6]Difference between peak hourly flow and available supply for a 2.5-hour period.

[7]3,500 gpm flow based on industrial fire demand for two-hour duration, assuming only storage is used.

[8]One-day supply at average daily demand, assuming only storage is used.

[9]Available existing storage is approximately 1,625,000 gallons.

*Population estimate and projections from the Population Research Center at Portland State University. Population is projected to have an average annual growth rate of 0.3 percent per year between the period of 2017 and 2035 and 0.1 percent per year after 2035.

anderson perry & associates, inc.

CITY OF
STANFIELD, OREGON
WATER SYSTEM MASTER PLAN

SUMMARY OF DESIGN CRITERIA

FIGURE
2-2