2 | BASIC PLANNING DATA

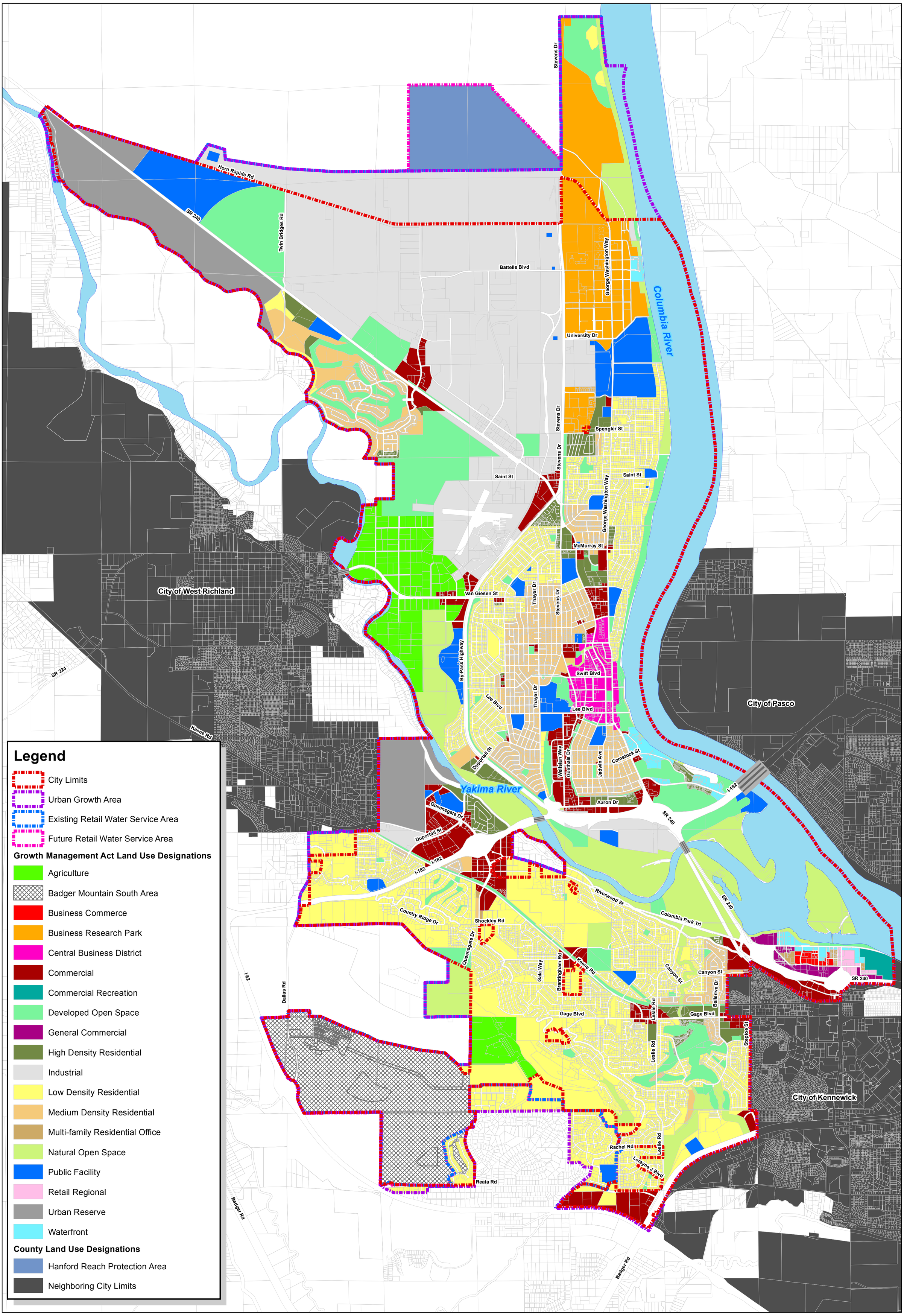
EXISTING DATA

EXISTING LAND USE

The City of Richland's (City) service area is located within the Benton County (County) planning area; however, the City performs land use planning within the City limits, which encompasses an area of approximately 42.60 square miles. The City's urban growth area (UGA) encompasses an additional 4.70 square miles outside of the current City limits, for an area of approximately 47.30 acres. There is overlap in planning efforts outside the City limits but within the UGA where both agencies cooperate to ensure consistent planning. The City's existing retail water service area has approximately the same boundary as the UGA, except in portions of south Richland that are currently provided potable water service by Badger Mountain Irrigation District (BMID). A breakdown of area by land use within the City's existing retail water service area is shown in **Figure 2-1**.

The City's land use designations, as shown in **Figure 2-1**, guide City development. **Figure 2-1** represents the future land uses in the City, with the exception of future changes in land use as a result of City-initiated neighborhood plan updates and private citizen requests. County land use designations for areas within the City's future water service area and outside of the City limits and UGA are also shown on **Figure 2-1**.

A summary of the existing land uses within the City's boundaries is presented in **Table 2-1**.



Legend

- City Limits
- Urban Growth Area
- Existing Retail Water Service Area
- Future Retail Water Service Area

Growth Management Act Land Use Designations

- Agriculture
- Badger Mountain South Area
- Business Commerce
- Business Research Park
- Central Business District
- Commercial
- Commercial Recreation
- Developed Open Space
- General Commercial
- High Density Residential
- Industrial
- Low Density Residential
- Medium Density Residential
- Multi-family Residential Office
- Natural Open Space
- Public Facility
- Retail Regional
- Urban Reserve
- Waterfront

County Land Use Designations

- Hanford Reach Protection Area
- Neighboring City Limits

Z:\RICHLAND\DATA\RIC\715-107\GIS\MAPS\FIG2-1.MXD BY: RWITHERS PLOT DATE: MAR 20, 2017 COORDINATE SYSTEM: NAD 1983 STATEPLANE WASHINGTON SOUTH FIPS 4602 FEET

RH2 ENGINEERS PLANNERS SCIENTISTS

NORTH

1 inch = 2,500 feet

0 1,250 2,500 5,000 Feet

DRAWING IS FULL SCALE WHEN BAR MEASURES 2”

Richland Washington

Figure 2-1
Land Use

City of Richland
2017 Comprehensive Water System Plan

Vicinity Map

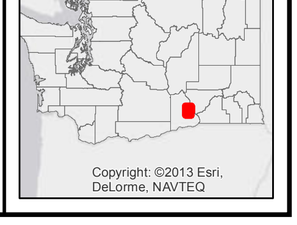


Table 2-1
Summary of Land Use Designations

Land Use	Area (square miles)			
	Within City Limits	Within UGA	Within Existing Retail Water Service Area	Within Future Retail Water Service Area
Agriculture (AGR)	1.37	1.37	1.37	1.37
Badger Mountain South Area (BMSA)	2.21	2.21	2.19	2.19
Business Commerce (BC)	0.04	0.04	0.04	0.04
Business Research Park (BRP)	1.09	1.77	1.77	1.77
Central Business District (CBD)	0.34	0.34	0.34	0.34
Commercial (COM)	1.65	1.68	1.68	1.68
Commercial Recreation (CREC)	0.08	0.08	0.08	0.08
Developed Open Space (DOS)	3.40	3.63	3.63	3.63
General Commercial (GCOM)	0.13	0.13	0.13	0.13
High Density Residential (HDR)	0.84	0.84	0.84	0.84
Industrial (IND)	6.77	8.41	8.41	8.41
Low Density Residential (LDR)	7.43	8.51	7.89	7.89
Medium Density Residential (MDR)	2.22	2.22	2.22	2.22
Multi-family Residential Office (MFRO)	0.03	0.03	0.03	0.03
Natural Open Space (NOS)	3.32	3.67	3.67	3.67
Public Facility (PF)	1.56	1.60	1.57	1.57
Retail Regional (RREG)	0.05	0.05	0.05	0.05
Urban Reserve (URES)	1.90	1.90	1.90	1.90
Waterfront (WTR)	0.25	0.25	0.25	0.25
Hanford Reach Protection Area (HRPA)	---	---	---	1.18
Right-of-way and Water Bodies (ROW)	7.92	8.57	8.57	8.57
Land Use Total	**42.60**	**47.30**	**46.62**	**47.81**

EXISTING POPULATION

In 2015, the Washington State Office of Financial Management (OFM) estimated that 70 percent of all housing units in the City were single-family residential. According to OFM, the average household size in the City for all single-family residential, multi-family residential, and mobile home residences was 2.27 persons per household in 2015, as compared to 2.53 persons per household County-wide based on data presented in the Benton County *Comprehensive Land Use Plan*.

The County has continued to experience rapid population growth and additional physical developments in recent years. The population of the County increased by more than 7 percent from 2010 to 2015. The population of the City increased approximately 10 percent during the same period. **Table 2-2** illustrates the historical population growth within the City limits since 1990. The population of the City has steadily increased since 1990.

Table 2-2
Historical Population Trends

Year	City Limits Population	Water Service Area Population
1990	33,993	Data Not Available
1995	35,736	Data Not Available
2000	38,708	41,318
2005	43,520	44,270
2010	48,058	48,866
2011	49,090	50,019
2012	49,890	51,171
2013	51,150	52,324
2014	52,090	53,476
2015	53,080	54,466

The actual number of people served by the City's water system differs from the City limits population, as the water service area includes customers outside of the current City limits. The City's 2010 *Comprehensive Water System Plan* (WSP) estimated the historical and projected water service area population to be equivalent to the UGA population presented in the Benton County *Comprehensive Land Use Plan*. The UGA populations presented in the 2013 update of the Benton County *Comprehensive Land Use Plan* have been used to calculate the City's historical water service area population presented in **Table 2-2**.

WATER USE CLASSIFICATIONS

The City has divided its water customers into seven different classes for billing purposes: single-family residential with domestic irrigation; single-family residential with separate irrigation; multi-family residential; irrigation (individual services used to irrigate with potable water); commercial/industrial; and two interties that provide wholesale water service to two separate water systems (City of West Richland and Badger Mountain Irrigation District). For the purposes of the demand analysis that follows, the commercial and large industrial classes were combined into a commercial/industrial classification. The demand analysis in this chapter will report on the water use patterns of these six user groups.

EXISTING WATER DEMANDS

WATER CONSUMPTION

Water consumption is the amount of water used by all customers of the system, as measured by the customers' meters. **Table 2-3** shows the historical average number of connections and average annual consumption within the City from 2008 through 2015. As shown in **Chart 2-1**, the single-family residential with domestic irrigation class represents approximately 49 percent of all connections in 2015, but only 41 percent of total system consumption, as shown in **Chart 2-2**. This

is due to lower consumption per connection for single-family residential customers as compared to other customers.

Table 2-3
Average Annual Metered Consumption and Service Connections

Year	Customer Class							Totals
	Single-family Residential		Multi-family Residential	Commercial/ Industrial	Irrigation	West Richland Intertie (Wholesale)	Badger Mountain ID Intertie (Wholesale)	
	Domestic Irrigation	Separate Irrigation						
Average Number of Connections								
2008	14,168			1,375	552	1	1	16,097
2009	14,943			1,419	577	1	1	16,941
2010	15,337			1,435	589	1	1	17,363
2011	15,428			1,444	590	1	1	17,464
2012	15,639			1,466	595	1	1	17,702
2013	8,902	6,570	468	1,490	598	1	1	18,031
2014	9,080	6,701	468	1,512	600	1	1	18,363
2015	9,235	6,816	468	1,562	606	1	1	18,689
Annual Consumption[1] (million gallons)								
2008 [1]	---	---	---	---	---	---	---	---
2009 [1]	---	---	---	---	---	---	---	---
2010 [2]	2,350		0	1,335	773	100	0	4,559
2011 [2]	2,374		0	1,281	774	120	0	4,549
2012 [2]	2,392		30	1,209	792	123	0	4,546
2013	2,092	418	179	1,107	884	163	38	4,882
2014	2,199	454	158	1,064	981	370	51	5,278
2015	2,193	453	166	1,049	1,002	394	43	5,300
Average Daily Consumption per Connection (gal/day/conn)								
2008	---			---	---	---	---	---
2009	---			---	---	---	---	---
2010	420			2,549	3,598	275,049	0	719
2011	422			2,430	3,594	329,347	0	714
2012	424			2,258	3,650	336,096	0	704
2013	644	174	1,046	2,036	4,049	446,962	104,144	742
2014	664	186	926	1,928	4,482	1,012,901	140,950	787
2015	651	182	969	1,840	4,529	1,078,380	118,934	777
2013 - 2015 Average	**653**	**181**	**980**	**1,934**	**4,353**	**846,081**	**121,343**	**769**

(1) Changes to the City's utility billing system in 2009 resulted in historical consumption volumes for each customer class being inconsistent with the volumes within the upgraded billing system. To eliminate confusion, historical consumption volumes prior to 2010 are not included. 2010 volumes represent the first full year of data with the upgraded billing system.

(2) Multi-family residential consumption data was included in single-family residential consumption through the fall of 2012.

Chart 2-1
2015 Water Connections by Customer Class

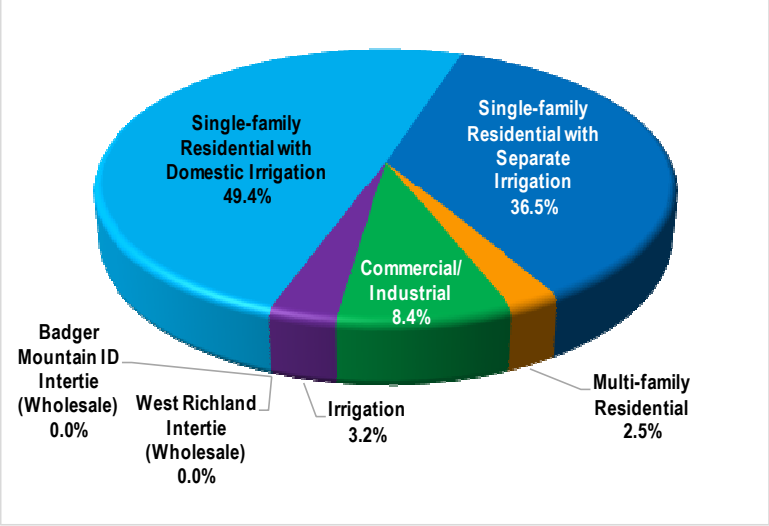
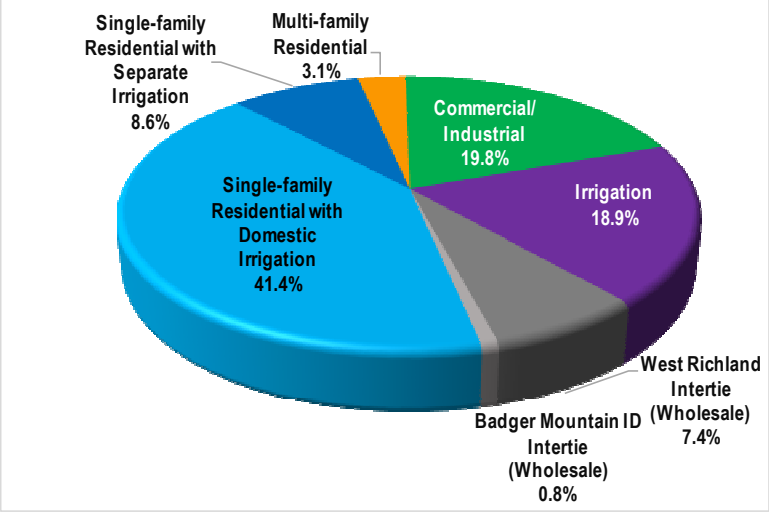


Chart 2-2
2015 Water Consumption by Customer Class



As shown in **Table 2-3**, single-family residential customers with domestic irrigation consume an average of approximately 653 gallons per day (gpd) per connection; single-family residential customers with separate irrigation consume an average of approximately 181 gpd per connection; multi-family customers consume an average of approximately 980 gpd per connection; commercial/industrial customers consume an average of approximately 1,934 gpd per connection; and irrigation customers consume an average of approximately 4,353 gpd per connection. The higher consumption from non-single-family residential customers is expected, as these customers include multi-family residential customers where one connection typically serves several units, commercial/industrial customers that include the system's highest individual water users, and irrigation customers that include City-owned parks and other areas requiring large water volumes.

Table 2-4 shows the largest water users of the system in 2014 and their total amount of metered consumption for the year (2015 individual metering data was not immediately available for inclusion with this WSP). The total water consumption of these 20 individual water meters represents approximately 18 percent of the system's total consumption in 2014. The list of accounts in **Table 2-4** primarily consists of City-owned parks, apartment complexes, and commercial/industrial businesses. The City's wholesale interties with BMID and the City of West Richland are included in **Table 2-4** for comparison with the other large individual points of consumption within the water system.

Table 2-4
2014 Largest Water Users

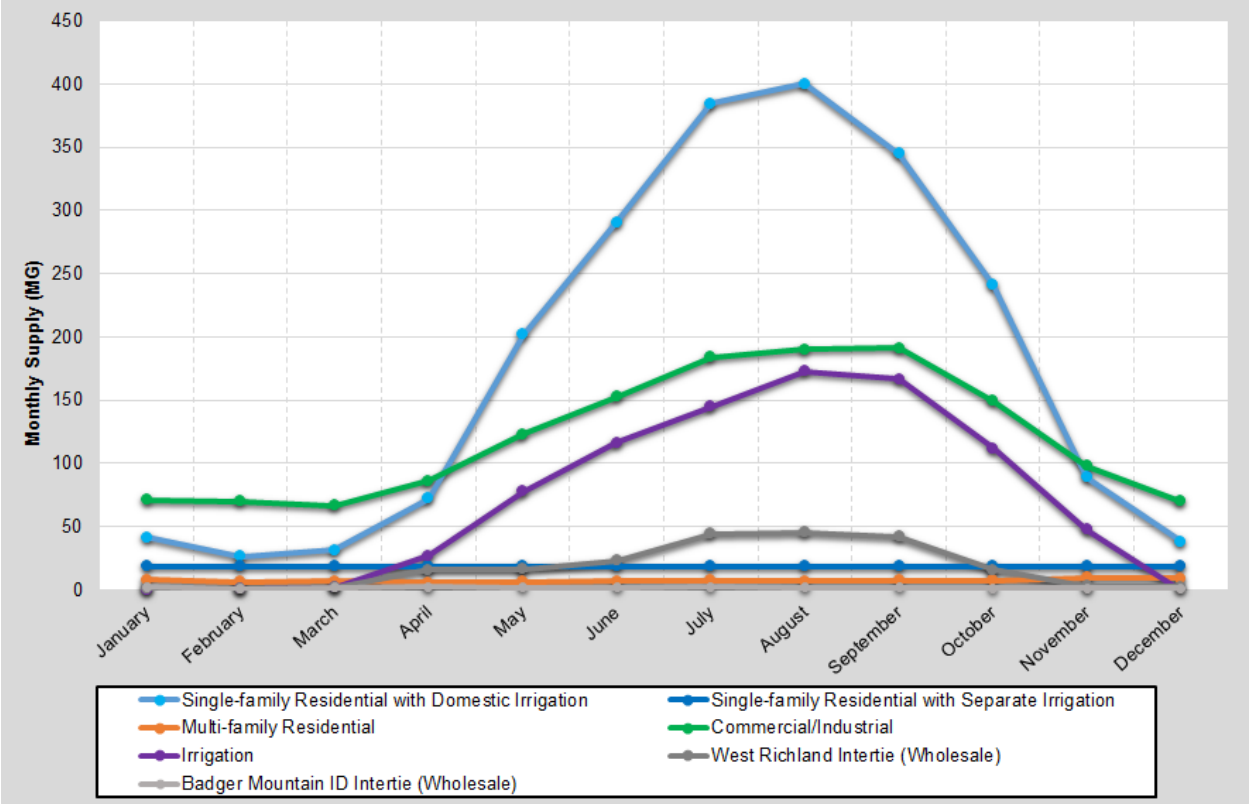
Name	Address	Total Annual Consumption (gallons)
City of West Richland Intertie	4490 Kennedy Road	369,733,437
ConAgra Food/Lamb Weston[1]	2013 Saint Street	222,800,028
Penford Food Ingredients	2917 Waterfront Drive	53,959,224
Badger Mountain Irrigation District Intertie	2700 Allison Way	51,450,131
ConAgra Food/Lamb Weston[2]	2013 Saint Street	31,674,060
Richland Mobile Home Park	40 Apollo Boulevard	27,279,560
Kadlec Regional Medical Center	888 Swift Boulevard	26,443,296
The Hills Management, LLC	250 Skyline Drive	25,645,928
Alyson Manor Estates	2021 Mahan Avenue	20,030,692
Penford Food Ingredients	216 University Drive - Bldg A	18,861,792
Mission Support Alliance	3475 George Washington Way	17,676,512
Areva NP Richland	2101 Horn Rapids Road	12,918,708
City/Sewer	555 Lacey Road	12,197,935
RL Richland, LLC	802 George Washington Way	11,783,992
Shilo Inn/Rivershore	50 Comstock Street	11,336,688
Mission Support Alliance	2890 Horn Rapids Road	11,028,512
ATI Richland Operations	3101 Kingsgate Way	10,441,332
Richland Cemetery Association	915 Bypass Highway	9,864,400
Battelle	3335 Innovation Boulevard	9,620,028
US Linen	1106 Harding Street	9,269,216
Top 20 Meters Consumption Total		964,015,471
Water System Total Consumption		5,277,691,164
Percentage of Total		18.3%

(1) Meter number 66028439

(2) Meter number 27962627

Demand varies throughout the year, typically peaking in the hot summer months. Residential and commercial/industrial customers often peak at different times or have different peaking factors because their uses differ. Based on the average of 2010 through 2015 monthly consumption data, the demand for single-family residential customers with domestic irrigation in the City's water service area peaks in August, as shown in **Chart 2-3**. **Chart 2-3** shows an average trend for each customer class to approximate the actual monthly consumption based on 2010 through 2015 average consumption data.

Chart 2-3
Historical Average Monthly Consumption by Customer Class (2010 – 2015)



WATER SUPPLY

Water supply is the total amount of water supplied to the system, as measured by the meters at each supply source. Water supply differs from water consumption in that water supply is the recorded amount of water put into the system, and water consumption is the recorded amount of water taken out of the system. The measured amount of water supply in any system is typically more than the measured amount of water consumption, due to water system leaks and non-metered water uses, which will be described more in the **Distribution System Leakage** section.

Table 2-5
Historical Water System Demand

Year	Annual Supply Volume (MG)							System-wide Average Day Demand[3] (gpm)	Domestic Average Day Demand[4] (gpm)	Water Service Area Population	Average Demand Per Capita[5] (gal/day/capita)
	Water Treatment Plant	North Richland Wellfield	Columbia Well	Wellsian Way Wells	Net Supply[1]	North Richland Wellfield Influent	Gross Supply[2]				
2000	5,685.1	764.9	36.4	566.1	7,052.5	---	7,052.5	13,418.0	13,418.0	41,318	468
2001	5,447.0	525.7	74.7	611.8	6,659.2	---	6,659.2	12,669.7	12,669.7	41,992	434
2002	4,732.7	1,187.4	68.5	495.7	6,484.3	---	6,484.3	12,336.9	12,336.9	42,562	417
2003	5,248.2	535.4	17.6	449.5	6,250.7	---	6,250.7	11,892.5	11,892.5	43,131	397
2004	4,881.0	409.8	57.9	406.4	5,755.1	---	5,755.1	10,949.6	10,949.6	43,701	361
2005	4,858.3	0.0	132.8	516.0	5,507.1	---	5,507.1	10,477.7	10,477.7	44,270	341
2006	2,974.7	1,791.0	79.6	469.3	5,314.6	---	5,314.6	10,111.5	10,111.5	44,840	325
2007	3,078.1	1,785.5	77.2	433.9	5,374.7	---	5,374.7	10,225.8	10,225.8	45,409	324
2008	3,341.5	1,835.4	40.4	339.6	5,556.9	3,871.5	9,428.3	10,572.4	10,572.4	46,561	327
2009	3,587.6	1,978.5	17.8	194.7	5,778.6	3,592.7	9,371.2	10,994.2	10,994.2	47,714	332
2010	3,505.6	1,345.6	12.1	339.6	5,203.0	3,861.2	9,064.2	9,899.1	9,681.1	48,866	285
2011	3,691.0	1,128.2	64.6	375.2	5,259.0	3,599.2	8,858.2	10,005.6	9,741.3	50,019	280
2012	2,875.2	1,952.8	3.5	254.2	5,085.7	4,243.1	9,328.7	9,675.9	9,414.8	51,171	265
2013	4,079.4	1,229.4	3.5	282.6	5,594.8	2,906.9	8,501.7	10,644.7	10,206.0	52,324	281
2014	4,428.0	1,308.1	2.7	283.2	6,022.1	2,649.5	8,671.6	11,457.5	10,543.2	53,476	284
2015	4,392.3	1,464.6	1.7	342.6	6,201.2	3,977.2	10,178.4	11,798.3	10,825.4	54,466	286
Average 2013 to 2015											**284**

(1) Does not include supply to the North Richland Wellfield infiltration basins (Net Supply = WTP + North Richland Wellfield + Columbia Well + Wellsian Way Wells).
(2) Includes supply to the North Richland Wellfield infiltration basins (Gross Supply = Net Supply + North Richland Wellfield Influent)
(3) System-wide ADD is based on the water system's net supply, and includes wholesale supply to Badger Mountain Irrigation District and West Richland.
(4) Domestic ADD is based on the water system's net supply, and does not include wholesale supply to Badger Mountain Irrigation District and West Richland.
(5) Average demand per capita is based on the domestic average day demand.
gpm = gallons per minute
MG = million gallons

The City has experienced a trend of decreasing per capita water demand since 2000, as shown in **Table 2-5**, which is most likely the result of water use efficiency practices. The City's average per capita demand of 284 gallons per day from 2013 and 2015 will be used later in this chapter to forecast average water demands in future years based on future population projections shown in **Table 2-10**.

Table 2-6 shows the average day demand (ADD) of each of the City's nine existing pressure zones based on 2015 water demand data. Most of the water system demand is in the Core 548 Zone. **Figure 1-1** displays the City's existing pressure zones.

Table 2-6
2015 Demands by Pressure Zone

Zone	ADD (gpm)	Percentage of System Demand
Core 548	7,979	68.3%
Horn Rapids	142	1.2%
Tapteal I [1]	2,507	21.5%
Tapteal II	570	4.9%
Tapteal III	179	1.5%
Tapteal IV [2]	124	1.1%
Tapteal V	0	0.0%
Core Y	137	1.2%
Riverwood	37	0.3%
Total	**11,675**	**100.0%**

(1) Includes supply to West Richland.
(2) Includes supply to BMID.

Chart 2-4 shows the historical amount of water supplied to the City on a monthly basis for 2010 through 2015, with and without the North Richland Wellfield (NRW) influent supply. The peak supply months generally occur in July and August when temperatures are the warmest and irrigation demands are highest.

Chart 2-4
Historical Monthly Water Supply

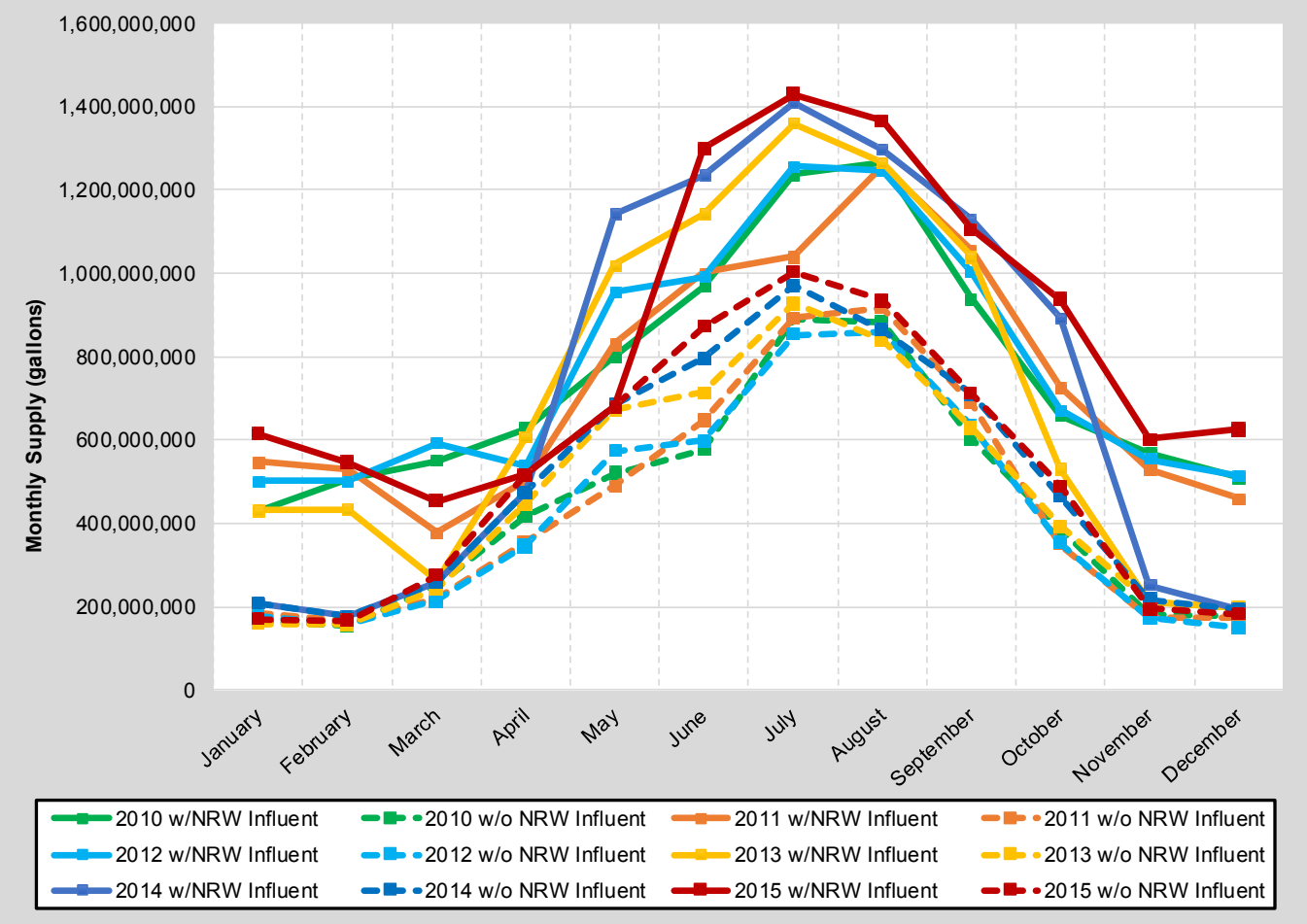
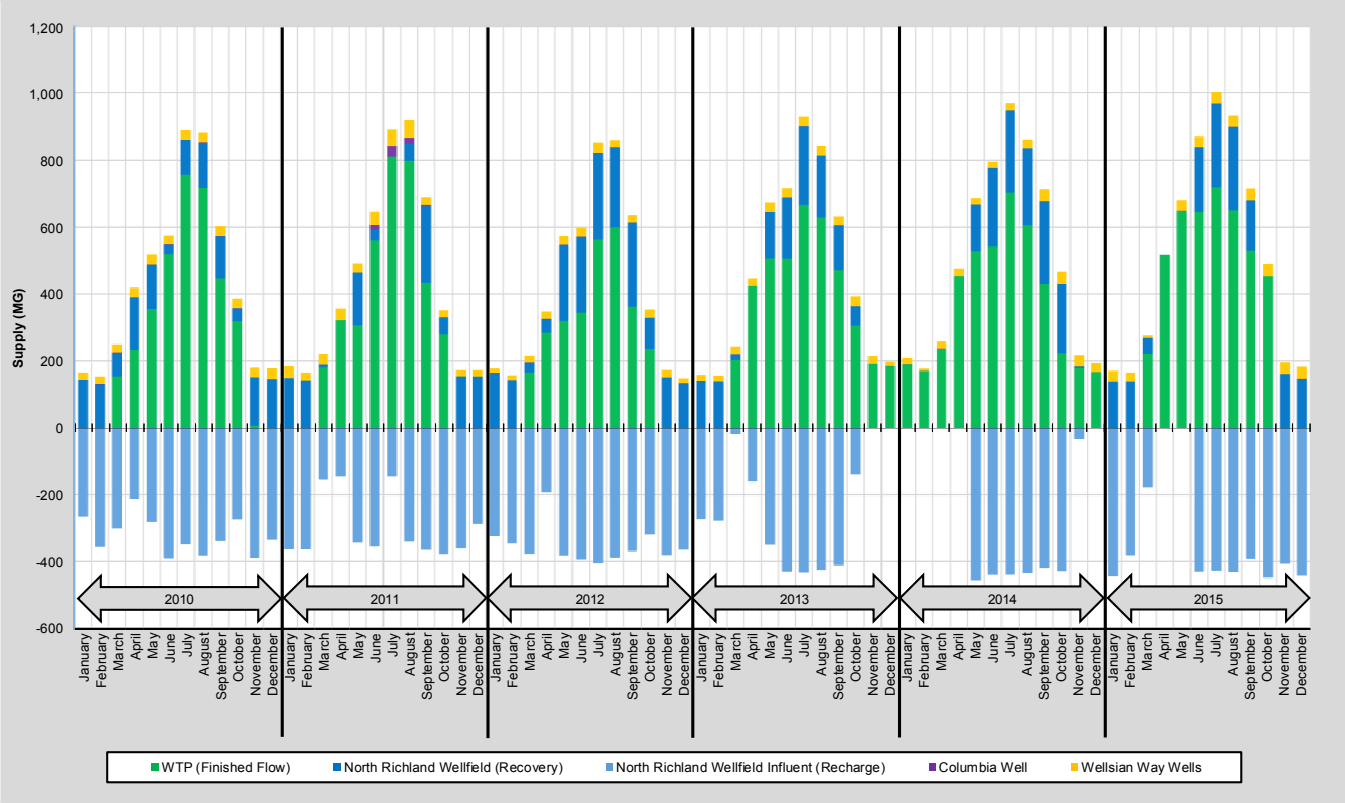


Chart 2-5 identifies the monthly proportion of the City's water supplied by the Water Treatment Plant (WTP), North Richland Well Field, Columbia Well, and Wellsian Way Well Field from 2010 through 2015.

Chart 2-5
2010 through 2015 Monthly Water Supply by Source



DISTRIBUTION SYSTEM LEAKAGE

The difference between the amount of water supply and authorized water consumption is the amount of distribution system leakage (DSL). There are many sources of DSL in a typical water system, including water system leaks, inaccurate supply metering, inaccurate customer metering, well backwash, illegal water system connections or water use, unauthorized fire hydrant usage, unmetered water main flushing, and malfunctioning telemetry and control equipment resulting in reservoir overflows. Several of these types of usages, such as water main flushing and fire hydrant usage, may be considered authorized uses if they are tracked and estimated. Although real losses from the distribution system (such as reservoir overflows or leaking water mains) should be tracked for accounting purposes, these losses must be considered leakage and not included in the authorized consumption calculations.

The Water Use Efficiency (WUE) Rule, which became effective in 2007, establishes a DSL standard of 10 percent or less based on a rolling 3-year average. The City was believed to be meeting this standard annually since 2010. However, inconsistencies between the City's billing software and water consumption database were realized during preparation of this WSP, resulting in DSL percentages in excess of 10 percent from 2010 to 2015. The amount of DSL in the City's system has remained

constant at approximately 9 to 13 percent annually since 2010, as shown in **Table 2-7**. The City intends to implement automated meter reading (AMR) system to assist in identifying the location of DSL and to verify the magnitude of DSL in each pressure zone. The City will conduct leak detection surveys in potentially problematic DSL areas based on the results of the AMR data. During implementation of the AMR system, the City intends to continue improving its documentation of authorized, non-revenue consumption and water lost during water main breaks. The City will also implement the WUE program contained in **Chapter 4**.

Table 2-7
Distribution System Leakage

Description	Year					
	2010	2011	2012	2013	2014	2015
Authorized Consumption (MG)						
Metered Customer Use	4,559	4,549	4,546	4,882	5,278	5,300
Hydrant Meter Consumption	68.69	73.98	82.11	75.36	71.09	55.04
Miscellaneous Street Dept. Usage	0.08	0.05	0.06	0.06	0.03	0.04
Miscellaneous Usage (Landfill, WWTP)	0.62	0.01	2.19	---	---	2.04
Total Authorized Consumption	**4,628.4**	**4,623.5**	**4,630.4**	**4,956.9**	**5,348.8**	**5,356.9**
Total Supply (MG)						
Net Supply (Finished Water)	**5,203.0**	**5,259.0**	**5,085.7**	**5,594.8**	**6,022.1**	**6,201.2**
Distribution System Leakage: All Authorized Consumption (MG)						
Total DSL Volume	**574.6**	**635.4**	**455.3**	**637.9**	**673.2**	**844.3**
Total DSL Percentage	**11.0%**	**12.1%**	**9.0%**	**11.4%**	**11.2%**	**13.6%**
Rolling 3-Year Average DSL Percentage	**---**	**---**	**10.7%**	**10.8%**	**10.6%**	**12.1%**
Distribution System Leakage: Metered Customer Use Only (MG)						
Total DSL Volume	644.0	709.5	539.6	713.3	744.4	901.5
Total DSL Percentage	12.4%	13.5%	10.6%	12.7%	12.4%	14.5%

WWTP = wastewater treatment plant

The annual DSL percentages are applied to the consumption by water use classification as reported in **Table 2-3** to determine the net supply per water use classification without adjustment for consumption that occurs (e.g., hydrant meter consumption, street department usage, etc.). Supply per water use classification for 2010 through 2015 is summarized in **Table 2-8**. The net supply per water use classification is used in the equivalent residential unit (ERU) calculations.

Table 2-8
Average Annual Supply by Customer Class

Year	Percentage of Supply Not Metered in Customer Classes[1]	Annual Supply (MG)[2]							
		Single-family Residential with Domestic Irrigation	Single-family Residential with Separate Irrigation	Multi-family Residential	Commercial	Irrigation	West Richland Intertie	Badger Mountain ID Intertie	Total Demand (i.e., Net Supply)
2010	12.4%	2,682.2		0.0	1,524.0	882.2	114.6	0.0	5,203.0
2011	13.5%	2,744.4		0.0	1,480.3	895.3	139.0	0.0	5,259.0
2012	10.6%	2,676.2		33.9	1,352.1	886.2	137.2	0.0	5,085.7
2013	12.7%	2,398.1	479.6	204.8	1,269.1	1,012.7	187.0	43.6	5,594.8
2014	12.4%	2,509.4	518.0	180.5	1,213.9	1,119.6	421.9	58.7	6,022.1
2015	14.5%	2,566.2	530.5	193.7	1,227.1	1,172.4	460.6	50.8	6,201.2

(1) This percentage is the difference in metered consumption and supply. The calculation does not include the DSL reduction associated with other authorized consumption.

(2) The percentage of supply not metered in customer classes is applied to the metered consumption for each individual water use classification to calculate the demand associated with each individual water use classification.

EXISTING EQUIVALENT RESIDENTIAL UNITS

The demand of each customer class can be expressed in terms of ERUs for demand forecasting and planning purposes. One ERU is equivalent to the amount of water used by a single-family residence. The City defines an ERU as a single-family residential connection that utilizes domestic water for irrigation, which is representative of approximately 58 percent of the existing parcels within the City's water service area based on the location of known irrigation systems within water service area.

Table 2-9 presents the computed number of ERUs for each customer class from 2010 through 2015. Multi-family residential connection and consumption data was included with the single-family residential prior to the fall of 2012. As a result, 2013 is the first full year with data available that separates the following customer classes: single-family residential with domestic irrigation, single-family residential with separate irrigation, and multi-family residential. The average annual demands shown are based on the net supply data that was computed from the consumption of each customer class (**Table 2-3**) and the average percentage of adjusted DSL from each year (**Table 2-7**). Based on the system's average day demands, the average demand per ERU from 2013 through 2015 was 752 gallons per day. For consistency with Chapter 6 of the Washington State Department of Health *Water System Design Manual*, only 2013 through 2015 data was used to calculate the City's average demand per ERU that will be used later in this chapter to forecast ERUs in future years based on estimated future demands. This demand per ERU value will also be used to determine the capacity (in terms of ERUs) of the City's existing water system in **Chapter 3**.

Table 2-9
Equivalent Residential Units (Computed Values)

Year	Average Number of Connections	Average Annual Demand (MG)	Demand per ERU (gallons/day/ERU)	Total ERUs
Single-family Residential with Domestic Irrigation (ERU Basis)[1,2]				
2010	15,337	2,682.2	---	---
2011	15,428	2,744.4	---	---
2012	15,639	2,676.2	---	---
2013	8,902	2,398.1	738	8,902
2014	9,080	2,509.4	757	9,080
2015	9,235	2,566.2	761	9,235
Average 2013 to 2015			**752**	
Single-family Residential with Separate Irrigation[1,2]				
2010	Included in Single-family Residential with Domestic Irrigation			
2011	Included in Single-family Residential with Domestic Irrigation			
2012	Included in Single-family Residential with Domestic Irrigation			
2013	6,570	479.6	738	1,780
2014	6,701	518.0	757	1,874
2015	6,816	530.5	761	1,909

(continued on next page)

Table 2-9
Equivalent Residential Units (Computed Values)

(continued from previous page)

Year	Average Number of Connections	Average Annual Demand (MG)	Demand per ERU (gallons/day/ERU)	Total ERUs
Multi-family Residential[1]				
2010	0	0.0	---	---
2011	0	0.0	---	---
2012	0	33.9	---	---
2013	468	204.8	738	760
2014	468	180.5	757	653
2015	468	193.7	761	697
Commercial				
2010	1,435	1,524.0	---	---
2011	1,444	1,480.3	---	---
2012	1,466	1,352.1	---	---
2013	1,490	1,269.1	738	4,711
2014	1,512	1,213.9	757	4,392
2015	1,562	1,227.1	761	4,416
Irrigation				
2010	589	882.2	---	---
2011	590	895.3	---	---
2012	595	886.2	---	---
2013	598	1,012.7	738	3,759
2014	600	1,119.6	757	4,051
2015	606	1,172.4	761	4,219
City of West Richland Intertie (Wholesale)				
2010	1	114.6	---	---
2011	1	139.0	---	---
2012	1	137.2	---	---
2013	1	187.0	738	694
2014	1	421.9	757	1,526
2015	1	460.6	761	1,657
Badger Mountain Irrigation District Intertie (Wholesale)				
2010	1	0.0	---	---
2011	1	0.0	---	---
2012	1	0.0	---	---
2013	1	43.6	738	162
2014	1	58.7	757	212
2015	1	50.8	761	183
System-wide Totals				
2010	17,363	5,203.0	---	---
2011	17,464	5,259.0	---	---
2012	17,702	5,085.7	---	---
2013	18,031	5,594.8	738	20,768
2014	18,363	6,022.1	757	21,789
2015	18,689	6,201.2	761	22,316
Average 2013 to 2015			**752**	

(1) Multi-family residential consumption is included in single-family consumption prior to 2013.

(2) Single-family residential consumption with domestic irrigation and with separate irrigation were included as a single customer class prior to 2013.

Although the demand per ERU has increased each of the past three years, the average of these years is believed to be representative of the future demand per ERU within the system. 2015 was a very hot and dry year, with significant watering restrictions imposed by Kennewick Irrigation District and Columbia Irrigation District throughout the summer. Therefore, the 2015 demand per ERU data is believed to be most representative of a peak year and is not representative of what is most likely to occur on a repeated basis in the future.

In addition to the average demand per ERU calculated and presented in **Table 2-9**, the City also calculates demand per ERU based on summer demands because the single-family residential with domestic irrigation customer class consumes significantly more water in the summer months, as shown in **Chart 2-3**. **Table 2-10** shows the summer demand per ERU for both single-family residential customer classes. In the summer, the demand per ERU of the single-family residential with domestic irrigation customer class is 1,392 gpd/ERU, based on the average of 2013 to 2015 data. The summer demand per ERU for single-family residential customers with separate irrigation systems is also presented in **Table 2-10**. The resulting calculations indicate that a single-family residential customer with separate irrigation is representative of 0.13 ERUs based on summer demands. For comparison, based on the average demand per ERU data presented in **Table 2-9**, a single-family residential customer with separate irrigation is representative of 0.28 ERUs based on year-round demands.

Table 2-10
Summer-based Equivalent Residential Units

Year	Average Number of Connections	Average Summer Demand[2] (MG)	Daily Summer Demand (MGD)	Daily Summer Demand per ERU (gallons/day/ERU)
Single-family Residential with Domestic Irrigation[1]				
2013	8,902	729.4	11.8	1,322
2014	9,080	786.9	12.7	1,398
2015	9,235	834.5	13.5	1,458
Average 2013 to 2015				**1,392**
Year	**Average Number of Connections**	**Average Summer Demand[2] (MG)**	**Daily Summer Demand (MGD)**	**Daily Summer Demand per ERU (gallons/day/ERU)**
Single-family Residential with Separate Irrigation[1]				
2013	6,570	71.1	1.1	174
2014	6,701	77.1	1.2	186
2015	6,816	77.0	1.2	182
Average 2013 to 2015				**181**
Separate Irrigation/Domestic Irrigation				**0.13**

(1) Multi-family residential consumption is included in single-family consumption prior to 2013, and is not shown in this table.

(2) Summer demand includes July and August.

SERVICE AREA PROJECTIONS

PROJECTED LAND USE, POPULATION, AND WATER DEMAND

Projected Land Use

The City is expected to infill existing undeveloped and underdeveloped land within the City limits with residential and commercial development. The City anticipates a large concentration of growth to occur in the Horn Rapids area (Core 548 Zone) and in the proposed Badger Mountain South development (Tapteal IV Zone). The timeline and extent of the growth will be developer driven, and exact locations of future growth are unknown due to the various options available to developers.

Projected Population

Projected future growth for the City was presented in the 2013 update to the County *Comprehensive Plan* through 2034, and is shown in **Table 2-11**. The projected 2035 (20 year) and 2036 (21 year) City limits population projection was calculated assuming growth will occur at an average annual growth rate equal to the 2029 to 2034 projections. The projected 2035 (20 year) and 2036 (21 year) water service area population projection was calculated based on the future retail water service area and assuming growth will occur at the same rate projected within the City limits. **Table 2-11** includes the projected future growth within the future retail water service area boundary, which represents an average growth rate of approximately 1.4 percent per year within the City limits and water service area. The resulting projections for the City's water service area are in accordance with the 2013 update to the County's *Comprehensive Plan*.

Table 2-11
Population Projections

Year	Description	City Limits Population	Water Service Area Population
2014	Base Year	52,090	53,476
2015	Existing	53,080	54,466
2016	+1 Year	55,072	56,510
2017	+2 Years	57,063	58,553
2018	+3 Years	59,055	60,597
2019	+4 Years	61,046	62,640
2020	+5 Years	62,013	63,632
2021	+6 Years	62,980	64,624
2022	+7 Years	63,946	65,616
2023	+8 Years	64,913	66,608
2024	+9 Year	65,880	67,600
2025	+10 Years	66,847	68,592
2035	+20 Years	76,581	78,581
2036	+21 Years	77,628	79,655

These population projections, along with the historical per capita water use data presented in this chapter, form the basis for determining the future water demands of the City's water system. This analysis and its results are presented in the following sections.

Projected Non-residential Water Needs

The projected future water system in 6 years and 20 years is expected to have the same proportion of non-residential connections as the existing ratio, which is approximately 12 percent.

Projected Non-revenue Water

The projected non-revenue water is expected to decrease or have the same proportion as it currently does. See the WUE program contained in **Chapter 4** for additional information.

Average Day Demand

Average Day Demand (ADD) is the total amount of water delivered to the system in a year divided by the number of days in the year. The ADD is determined from the system's historical water use patterns and can be used to project future demand within the system. ADD data is typically used to determine standby storage requirements for water systems. Standby storage is the volume of a reservoir used to provide water supply under emergency conditions when supply facilities are out of service. Water supply records from the City's supply facilities were reviewed to determine the system's ADD, which is based on the net supply to the system, as shown in **Table 2-5**.

Maximum Day Demand

Maximum day demand (MDD) is the maximum amount of water used throughout the system during a 24-hour time period of a given year. MDD typically occurs on a hot summer day when lawn watering is occurring throughout much of the system. In accordance with Washington Administrative Code (WAC) 246-290-230 – Distribution Systems – the distribution system shall provide fire flow at a minimum pressure of 20 pounds per square inch (psi) during MDD conditions. Supply facilities (e.g., wells, treatment plants, pump stations, interties) are typically designed to supply water at a rate that is equal to or greater than the system's MDD.

Water supply and reservoir level telemetry records for 2008 through 2014 were used to determine the system's peaking factors. The MDD between 2008 and 2014 is calculated to be 26,651 gallons per minute (gpm), based on the demands on July 8, 2014. Daily 2015 reservoir and supply data was not immediately available for all of the City's facilities for inclusion with this WSP. However, the 2015 ADD was larger than any previous year, and the system supply in July of 2015 exceeded the maximum monthly supply of any previous year. Therefore, the MDD/ADD peaking factor calculated in 2014 was applied to the 2015 ADD to estimate the system's MDD, which likely occurred during July 2015. The historical MDD is calculated to be 27,444 gpm based on 2015 data, as shown in **Table 2-12**.

Table 2-12
System-wide (Includes Wholesale Supply) Peak Demands and Peaking Factors

Description	Date	Demand (gpm)
2014 Data (Calculated From Actual Daily Facility Data)		
Average Day Demand (ADD)	2014	11,457
Maximum Day Demand (MDD)	Tuesday, July 08, 2014	26,651
Peak Hour Demand (PHD)	Hourly Data Unavailable Assumed PHD/ADD = 3.08 (Same as 2010 WSP)	35,284
System-wide (Includes Wholesale Supply) Peaking Factors		
MDD/ADD		2.33
PHD/MDD		1.32
PHD/ADD		3.08
2015 Data (Estimated From 2015 ADD Data and 2014's Peaking Factors)		
Average Day Demand (ADD)	2015	11,798
Maximum Day Demand (MDD)	Assumed in July 2015	27,444
Peak Hour Demand (PHD)	Hourly Data Unavailable Assumed PHD/ADD = 3.08 (Same as 2010 WSP)	36,334

Peak Hourly Demand

Peak hour demand (PHD) is the maximum amount of water used throughout the system, excluding fire flow, during a 1-hour time period of a given year. In accordance with WAC 246-290-230 – Distribution Systems – new public water systems or additions to existing systems shall be designed to provide domestic water at a minimum pressure of 30 psi during PHD conditions. Equalizing storage requirements are typically based on PHD data.

The PHD, like the MDD, is typically determined from the combined flow of water into the system from all supply sources and reservoirs. Historical hourly water supply and reservoir level telemetry records for the City's supply and storage facilities are not available. Therefore, the system's PHD could not be computed based on actual system data. Instead, it was estimated by applying the same PHD/ADD ratio as was presented in the City's 2010 WSP. This PHD peaking factor is comparable to the peaking factors for similarly sized water systems within the region. This peaking factor results in an estimated PHD of 36,334 gpm for the peak hour, as shown in **Table 2-12**.

Table 2-12 also shows the peaking factors of the water system based on the ADD, MDD, and PHD data presented above. These peaking factors will be used later in this chapter in conjunction with projected ADD to project future MDDs and PHDs of the system.

DEMAND FORECASTING

BASIS FOR PROJECTING DEMANDS

Future demands were calculated from the results of the existing per capita demand computations shown in **Table 2-6** and the projected population data from **Table 2-11**. Future demand projections were computed with and without water savings expected from implementing WUE measures contained in the City's WUE program in **Chapter 4**. The City's 3-year average per capita demand of 284 gpd from 2013 through 2015 was used for all demand projections without savings from WUE measures. The per capita demand was reduced to reflect the WUE goals and used as the basis for future water demand projections with implementation of the WUE program. The City's WUE program presents a goal to reduce the summer demand per ERU for single-family residential customers with domestic irrigation to 1,350 gpd by 2021, and maintain an average demand per ERU below 1,350 gpd through 2027. This goal approximately equates to reducing the average demand per ERU to 745 gpd, based on the average day demands of the single-family residential customers with domestic irrigation.

DEMAND FORECASTS AND WUE

Table 2-13 presents the incremental 6-year, 10-year, 12-year, 20-year, and 21-year water demand forecasts for the City's water system. The actual demand data from 2014 and 2015 is also shown in the table for comparison purposes. The City's future ADDs were projected based on population estimates for the given years and the estimated demand per capita values. The future MDDs and PHDs shown were computed from the projected ADDs and the existing system peaking factors shown in **Table 2-12**. The City's future demand projections are also shown with and without estimated reductions in water use from achieving WUE goals. Future BMID demands are based on the demand projections presented in the BMID *2010 Water System Plan*, but have been reduced as the City's existing City limits and UGA have expanded to include a large percentage of the future water service area presented in the BMID *2010 Water System Plan*. BMID's projected demands are included for conservatism as the end-date of the City's currently temporary agreement to supply BMID is unknown. Future West Richland intertie ADDs are based on the 2015 actual metered use, and an annual increase of 3 percent, which is equivalent to the projected population growth rate presented in the West Richland's *2006 Comprehensive Plan*, which was most recently amended in 2014. Future MDD and PHD projections for the West Richland intertie are assumed to be equivalent to the maximum pumping capacity of the Intertie BPS, which is 2,500 gpm.

The analysis and evaluation of the existing water system with proposed improvements, as presented in **Chapters 3** and **8**, is based on the 21-year projected demand data without WUE reductions. This ensures that the future system will be sized properly to meet all requirements, whether or not additional water use reductions are achieved. However, the City will continue to pursue reductions in water use by implementing the WUE program contained in **Chapter 4** of this WSP.

Table 2-13
Future Water Demand Projections

Description	Historical	Existing	Projected													
	2014	2015	2016 +1 yr	2017 +2 yrs	2018 +3 yrs	2019 +4 yrs	2020 +5 yrs	2021 +6 yrs	2022 +7 yrs	2023 +8 yrs	2024 +9 yrs	2025 +10 yrs	2026 +11 yrs	2027 +12 yrs	2035 +20 yrs	2036 +21 yrs
Population Data																
Water Service Area Population	53,476	54,466	56,510	58,553	60,597	62,640	63,632	64,624	65,616	66,608	67,600	68,592	69,584	70,576	78,581	79,655
Increase from Base Year 2014	---	990	3,034	5,077	7,121	9,164	10,156	11,148	12,140	13,132	14,124	15,116	16,108	17,100	25,105	26,179
Demand Basis Data (gal/day/capita)																
ADD per capita without WUE	284	286	284	284	284	284	284	284	284	284	284	284	284	284	284	284
ADD per capita with WUE	---	---	283	283	283	283	283	282	282	282	282	282	282	282	282	282
Average Day Demand (gpm)																
City Domestic Demand without WUE	10,543	10,825	11,132	11,534	11,937	12,339	12,535	12,730	12,926	13,121	13,317	13,512	13,707	13,903	15,480	15,691
City Domestic Demand with WUE	---	---	11,124	11,518	11,912	12,305	12,491	12,677	12,871	13,066	13,261	13,455	13,650	13,844	15,414	15,625
BMID Intertie Demand	112	97	101	105	109	114	118	122	127	131	135	139	144	148	202	225
West Richland Intertie Demand	803	876	903	930	958	986	1,016	1,046	1,078	1,110	1,143	1,178	1,213	1,249	1,583	1,630
Total ADD without WUE	**11,457**	**11,798**	**12,135**	**12,569**	**13,004**	**13,439**	**13,669**	**13,899**	**14,130**	**14,362**	**14,595**	**14,829**	**15,064**	**15,300**	**17,264**	**17,547**
Maximum Day Demand (gpm)																
City Domestic Demand without WUE	23,968	24,786	25,306	26,221	27,137	28,052	28,496	28,940	29,384	29,829	30,273	30,717	31,162	31,606	35,190	35,671
City Domestic Demand with WUE	---	---	25,289	26,185	27,079	27,973	28,396	28,818	29,261	29,703	30,146	30,588	31,030	31,473	35,042	35,521
BMID Intertie Demand	183	158	165	172	179	186	193	200	207	214	221	228	235	242	330	368
West Richland Intertie Demand	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Total MDD without WUE	**26,651**	**27,444**	**27,971**	**28,894**	**29,816**	**30,738**	**31,189**	**31,640**	**32,092**	**32,543**	**32,994**	**33,445**	**33,897**	**34,348**	**38,020**	**38,540**
Peak Hour Demand (gpm)																
City Domestic Demand without WUE	32,452	33,546	34,281	35,521	36,760	38,000	38,602	39,204	39,805	40,407	41,009	41,611	42,213	42,814	47,670	48,322
City Domestic Demand with WUE	---	---	34,257	35,471	36,683	37,893	38,466	39,039	39,638	40,237	40,837	41,436	42,035	42,634	47,470	48,119
BMID Intertie Demand	332	288	300	313	326	339	351	364	377	390	402	415	428	441	600	670
West Richland Intertie Demand	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Total PHD without WUE	**35,284**	**36,334**	**37,081**	**38,334**	**39,586**	**40,838**	**41,453**	**42,068**	**42,682**	**43,297**	**43,911**	**44,526**	**45,140**	**45,755**	**50,770**	**51,492**

Table 2-14 presents the existing and projected number of ERUs of the system. The ERU forecasts are based on the projected water demands from **Table 2-13** and the average demand per ERU that was computed from the actual 2013 through 2015 data (**Table 2-10**).

Table 2-14
Future ERU Projections

Description	Historical	Existing	Projected													
	2014	2015	2016 +1 yr	2017 +2 yrs	2018 +3 yrs	2019 +4 yrs	2020 +5 yrs	2021 +6 yrs	2022 +7 yrs	2023 +8 yrs	2024 +9 yrs	2025 +10 yrs	2026 +11 yrs	2027 +12 yrs	2035 +20 yrs	2036 +21 yrs
Demand Data (gpm)																
ADD without WUE	11,457	11,798	12,135	12,569	13,004	13,439	13,669	13,899	14,130	14,362	14,595	14,829	15,064	15,300	17,264	17,547
ERU Basis Data (gal/day/ERU)																
Demand per ERU without WUE	757	761	752	752	752	752	752	752	752	752	752	752	752	752	752	752
Equivalent Residential Units (ERUs)																
Total System ERUs	21,789	22,316	23,232	24,062	24,895	25,728	26,167	26,608	27,050	27,495	27,941	28,389	28,839	29,291	33,050	33,591