STATISTICAL REPORT
FY 2014-2015

CITY OF PORTLAND, WATER BUREAU

PORTLAND WATER BUREAU
FROM FOREST TO FAUCET

CITY OF PORTLAND, OREGON 1851

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The Errata Section contains updates and corrections since the publication of the FY 2013-14 Report.

1. INTRODUCTION

Mission Statement

Portland Water Bureau (PWB) provides the highest quality water, customer service and stewardship of the critical infrastructure, fiscal, and natural resources entrusted to our care. We enhance public health and safety and contribute to the economic viability and livability of the Portland metropolitan region. We are a recognized leader among water service agencies across the country.

Portland's Water Supply

PWB supplies drinking water to more than 588,000 customers throughout Portland and an additional 370,000 customers through regional wholesale providers. Portland's drinking water is primarily surface water supplied from the Bull Run watershed. Groundwater from the Columbia South Shore Well Field (CSSWF) is used as an emergency back-up and for supply augmentation during the summer high-demand and low-precipitation season.

The Bull Run Watershed has an area of 102 square miles, and typically receives 80-170 inches of rainfall a year. The heaviest rains occur from late fall through spring. Two reservoirs store water for producing drinking water. The watershed has a long history of source protection – President Benjamin Harrison first established the Bull Run Reserve in 1892 and a 1977 act of Congress (Public Law 95-200) formally established the Bull Run Watershed Management Unit (BRWMU) and closed it to public entry. No recreational, residential, or commercial uses occur within the unit boundaries. PWB carefully monitors water quality and quantity in the Bull Run Watershed. The Oregon Health Authority Drinking Water Program (OHA) regularly inspects the watershed and the related treatment and distribution facilities. The Bull Run supply complies with all applicable state and federal regulations for source water, including the 1989 Surface Water Treatment Rule filtration-avoidance criteria. PWB also operates under a variance from the U.S. Environmental Protection Agency's (EPA) Long Term 2 Enhanced Surface Water Treatment Rule (LT2 rule) for the treatment requirements for *Cryptosporidium*.

The Columbia South Shore Well Field (CSSWF) is made up of 27 active wells that can supply 10[1]-102 million gallons of drinking water per day from three aquifers. The CSSWF is used during emergencies or to augment Bull Run supply in the summer. Groundwater from the CSSWF meets or exceeds all state and federal drinking water standards. Portland's long history of groundwater protection in the CSSWF dates back to the original development of the well field in the early 1980s. In June 2008, the State of Oregon certified the most recent update of the Columbia South Shore Well Field Protection Program. This program, a collaborative effort of Portland, Gresham, and Fairview, identified commercial and industrial activities as the most significant potential sources of contamination for groundwater. Together these cities regulate businesses in the groundwater protection area to prevent hazardous material spills that could seep into the ground.

[1] *This information has been corrected in the Errata Section at the end of this report.

Figure 1 displays proximity of the Bull Run Watershed to Portland and the areas supplied by PWB. Figure 2 displays the retail service area and the wholesale customers supplied by PWB.

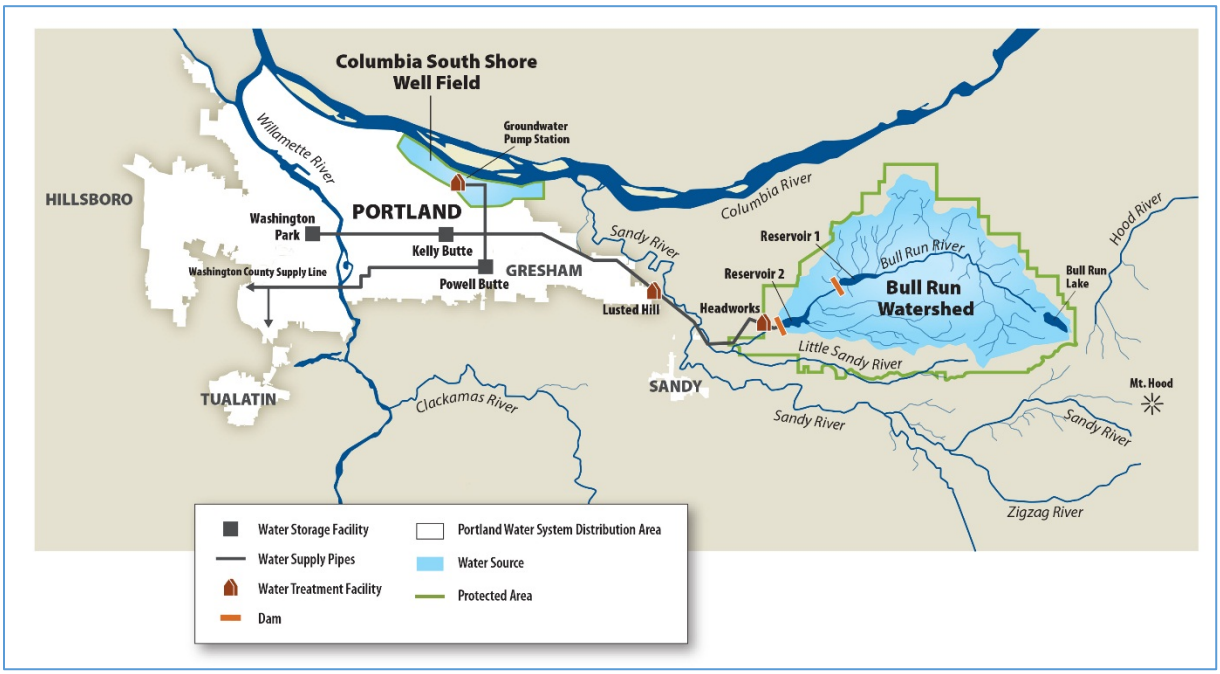

Figure 1 – Portland Water Bureau Supply System and Watershed Map

Figure 2 – Portland Water Bureau Retail and Wholesale Service Area

2. SERVICE LEVELS

Service levels establish measurable standards against which actual achievement can be compared. These include characteristics such as reliability, quality, quantity, and safety. The bureau has identified service levels and the associated cost of service through asset management planning. Table 1 is a summary of the past five year's accomplishments toward meeting Service Level goals.

Table 1 – Service Level Tracking

Fiscal Year (FY)	Number of Service Levels Met	Number of Service Levels Not Met	Number of Service Levels with Unclear Status	Total Number of Service Levels
FY 10-11	22	5	0	27
FY 11-12	19	6	2	27
FY 12-13	20	6	1	27
FY 13-14	20	6	1	27
FY 14-15	20	6	1	27

Table 2 describes the Key Service Levels and the status at the end of each fiscal year.

Table 2 – Key Service Level Tracking Results, Fiscal Years 2010-11 to 2014-15

Key Service Level	FY 2010-11	FY 2011-12	FY 2012-13	FY 2013-14	FY 2014-15
A.1 100% compliance with water quality regulations	Met	Met	Not Met	Not Met	Met
A.2 Adequate pressure, more than 20 psi 99% of time	Unclear 44% of areas monitored	Unclear 57% of areas monitored	Met 93% of areas monitored	Met 93% of areas monitored	Met 93% of areas monitored
A.3 Fewer than 7 water quality complaints per 1000 customers	Met 6, water line only	Met 5, water line only	Met 5, water line only[a]	Met 6.99[a]	Not Met[a] 9.5
A.4 Chlorine is 0.5–4.0 in 95% of samples	Met 99%	Met 99.3%	Met 98.2%	Met 96.3%	Met 99.7%
B.1 High or Very High rating for quality of water service, at least 75% of customers	Met 77%	Not Met 72%	Not Met 73%	Not Met 70%	Not Met 62%
B.2 Respond to 95% of customer inquiries in less than 5 days	Met	Met	Met	Met	Met
B.3 Answer 80% of calls within 60 seconds	Not Met 54% (Av. CHT= 1:39)	Not Met 49% (Av. CHT= 2:03)	Not Met 55% (Av. CHT= 1:50)	Not Met 43% (Av. CHT= 1:52)	Not Met 65% (Av. CHT= 1:50)
B.4 Use of preferred payment methods	39%	45%	50%	Met 54%	Met 59%
C.1 Less than 5% of customers out of water more than 8 hours a year	Met	Met	Met	Met	Met
C.2 No one out of water more than 3 times in a year[b]	Not Met	Unclear	Met	Met	Met
C.3 90% of service installs completed in 15 days	Not Met 76%	Not Met 61%	Not Met 62%	Met 93%	Met 95%
C.4 Working hydrants within 500 feet of all services	Met	Met	Met	Met	Met
C.5 90% of valves tested worked	Met >95%	Met >97%	Met >97%	Met	Met
D.1 Aaa bond rating	Met	Met	Met	Met	Met
D.2 Debt service coverage 1.9/1.75	Met 2.4/1.9	Met 2.3/1.9	Met 2.5/1.9	Met	Met
E.1 CIP projects on schedule[c]	Met 97%	Not Met 78%	Met 80%	Met 100%	Met 78%
E.2 Maintenance improvement	Met 55%	Met 60%	Met +12.5%	Met	Met
E.3 Manage risks, 80% of risk standards met	Met 91%	Met 92%	Met 95%	Met 96%	Met 97%
E.4 Benefit cost analysis for new projects	Met	Not Met	Not Met	Met	Met
F.1 50% of employees engaged	Met	Met	Met	Met	Met
F.2 OSHA SHARP certification	Met Renewed	Met Year 5	Met Graduated	---------	---------
F.3 Promotion of internal candidates 60–80%	Met 65%	Met 71%	Met 69%	Met 63%	Met 78%
F.4 Workforce diversity	Not Met	Not Met	Not Met	Not Met	Not Met
G.1 Per capita water use steady or declining	Met	Met	Unknown	Met	Unknown[d]
G.2 25% water savings from technical assistance	Met 29%	Met 33%	Not Met 23.7%	Met 32%	Met 40%
G.3 Carbon emissions lower than 2007 levels	Met At 9,788	Met At 11,526	Met At 10,885	Met At 9,062	Unknown[e]
G.4 % Renewable energy up from 2007	Met	Met	Met	Met	Met

Abbreviations: psi= pounds per square inch, CHT=call hold time, CIP= Capital Improvement Program, OSHA SHARP=Occupational Safety and Health Administration Safety and Health Achievement Recognition Program

[a]Due to an error in data collection methodology, the results for KSL A.3 for Fiscal Years 2012-13 and 2013-14 were initially reported differently. The values in this table are accurate.
[b]Due to an error in data collection methodology, the quantified results for KSL C.2 for all years are not available.
[c]Major construction projects (estimated at $500,000 or more) completed within three months of the planned/adjusted date.
[d]Consumption data from FY 2014-15 not available at time of reporting.
[e]Carbon footprint calculation and reporting transitioning to a fiscal-year basis; FY 2015-15 data not yet available.

3. WATER SUPPLY AND CONSUMPTION

Table 3 describes water production and consumption statistics from the past five years. "Production" refers to the amount of water sent to in-town facilities, including non-revenue water, to meet system requirements (demands). Consumption, in this context, refers to the actual amount of water use measured through water meters.

Table 3 – Demand and Consumption Information

SYSTEM-WIDE PRODUCTION DATA	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15
Total Bull Run water produced (BG)	34.4	34.5	36.8	35.9	36.1
Total well field water produced (BG)	1.3	1.1	0	0	0.6
Total water produced (BG)	35.7	35.6	36.8	35.9	36.7
Total water consumed (BG)	32.9	32.9	33	32	33.6
Total non-revenue water (BG)	2.8	2.7	3.8	3.9	3.1
Percent of non-revenue water to total produced	7.8%	7.6%	10.4%	10.9%	8.4
Winter Flow Average (MGD) (November through March)	84	84	86	86	84
Summer Flow Average (MGD) (June through September)	122	120	124	119	129
Peak Day Flow (MG)	164	143	152	148	163
Average Annual Production (MGD)	98	97	101	98	101
Total people served (a)	931,912	937,398	944,999	951,324	958,765
System annual per capita consumption (gallons)	35,300	35,100	34,900	33,600	35,000
System daily per capita consumption (gallons)	97	96	96	92	96
TOTAL RETAIL CUSTOMERS					
Total annual consumption (BG)	19.1	19	19.1	18.5	19.2
Retail Population (a)	565,812	568,898	572,999	580,224	588,365
# of services (c) (approx.)	181,200	180,600	182,900	183,150	183,300
Retail daily consumption per service in gallons	289	287	289	277	287
Retail daily per capita consumption in gallons	92	91	91	87	89
Residential Single Family					
Total annual consumption (BG)	7.8	7.7	7.9	7.5	7.8
# of services (approx.)	150,700	150,700	152,700	152,800	152,800
Average daily consumption per service in gallons	142	140	142	134	140
Residential Multifamily					
Total annual consumption (BG)	3.3	3.3	3.3	3.2	3.3
# of services (approx.)	10,600	10,500	10,650	10,700	10,800
Residential Customers Total					
Total annual consumption (BG)	11.1	11	11.2	10.7	11.1
Residential population (b)	548,396	551,227	555,073	562,175	564,746
Residential daily per capita consumption (gallons)	55	55	55	52	54
Commercial, Industrial, & Institutional					
Total annual consumption (BG)	8.0	8.0	7.9	7.8	8.1
# of services (approx.)	19,900	19,400	19,550	19,650	19,700
# of Fireline services (approx.)	3,700	3,500	3,500	3,600	3,700
Average daily consumption per service (adjusted to exclude fireline services) (gallons)	1,350	1,380	1,350	1,330	1,390
TOTAL WHOLESALE CUSTOMERS					
Total annual consumption (BG) (c)	13.8	13.9	13.9	13.5	14.4
Wholesale consumption (as % of total consumption)	42%	42%	42%	42%	43%
Population served (a)	366,100	368,500	372,000	371,100	370,400
Wholesale daily per capita consumption (gallons)	103	103	103	100	107

BG = Billion Gallons, MG = Million Gallons, MGD = Million Gallons per Day

(a) Population figures are based on Portland State University Population and Research Center forecasts prepared for the Regional Water Providers Consortium (RWPC). Wholesale population is adjusted to exclude an estimate for customers receiving water from sources other than Portland. Wholesales Population served has reduced as they purchase more water from other sources.

(b) Residential Population includes only people living in single family or multifamily buildings and excludes people living in hospitals or institutions.

Figure 3 displays information pertaining to average annual daily production and peak-day flow. Average annual production is the daily average of the total water produced for the fiscal year. Peak-day flow is the highest amount of water produced on a single day during that fiscal year.

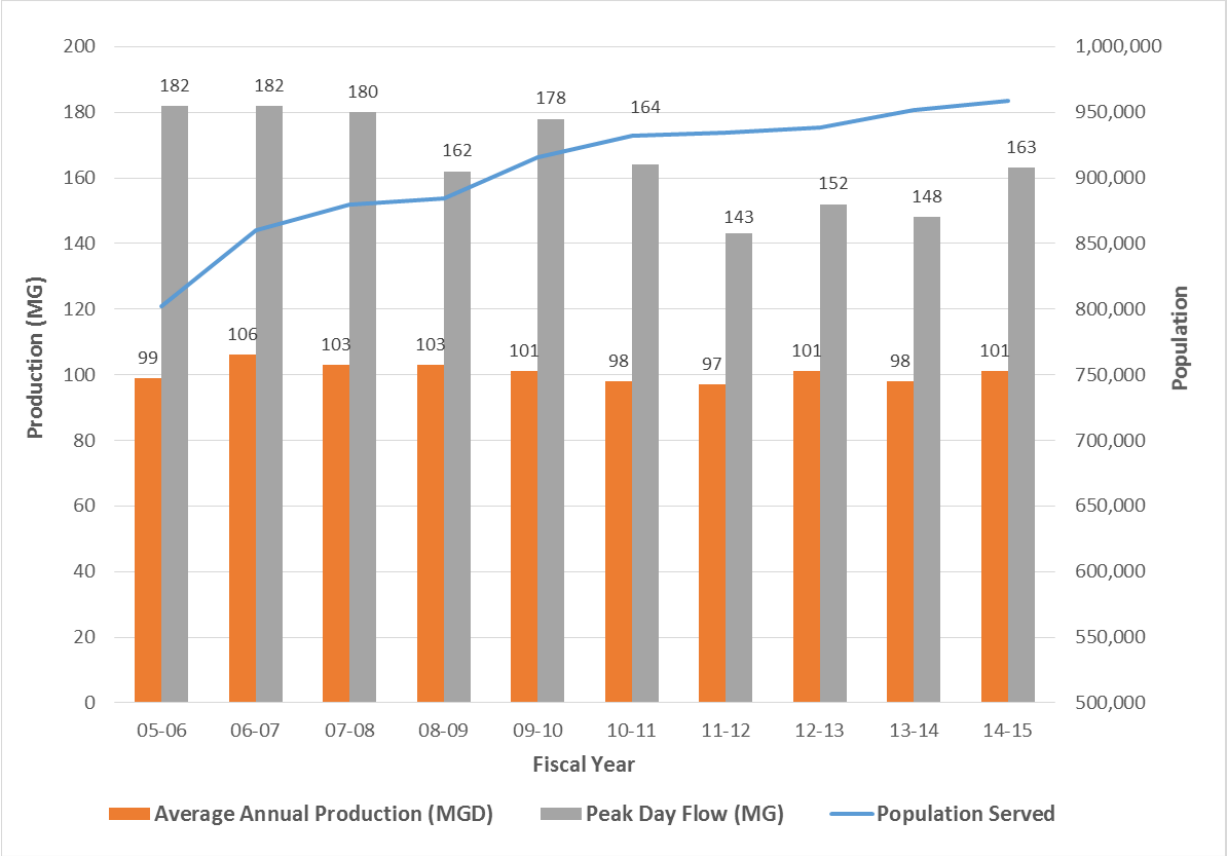

Figure 3 – Historical Water Production Trends

Figure 4 displays five years of precipitation data measured at the Headworks treatment facility.

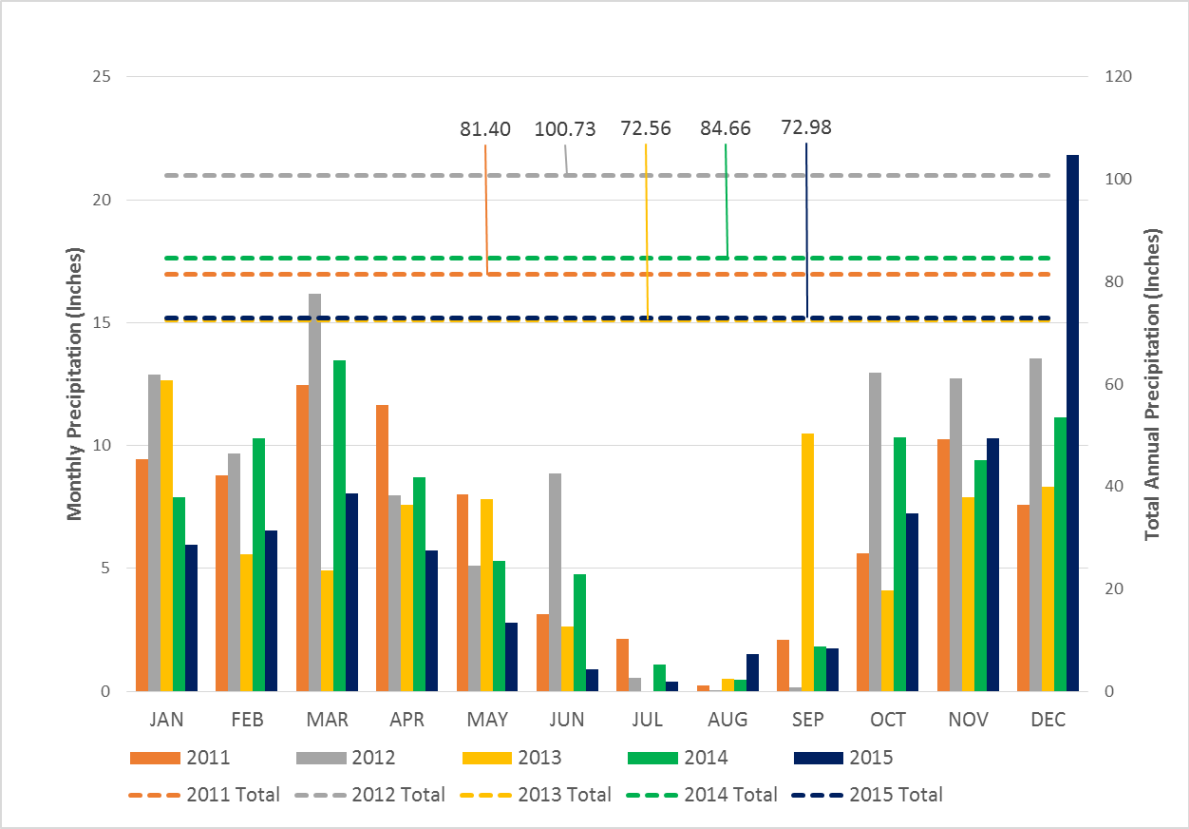

Figure 4 – Annual Precipitation Totals at Headworks, 2011 – 2015

Table 4 contains five years of climate data measured at the Portland Airport.

Table 4 – Portland (PDX) Monthly Average Temperatures

Calendar Year		2011	2012	2013	2014	2015
January	Average Maximum	47	47	43	48	50
	Average Minimum	36	34	33	35	37
February	Average Maximum	47	49	51	46	57
	Average Minimum	34	38	38	35	42
March	Average Maximum	52	52	57	58	63
	Average Minimum	40	38	40	40	42
April	Average Maximum	56	62	61	63	63
	Average Minimum	40	44	43	45	43
May	Average Maximum	63	68	69	71	71
	Average Minimum	46	48	50	51	51
June	Average Maximum	70	70	75	73	83
	Average Minimum	53	52	55	54	58
July	Average Maximum	77	78	82	84	87
	Average Minimum	56	58	58	60	61
August	Average Maximum	80	84	82	85	84
	Average Minimum	59	59	61	61	60
September	Average Maximum	79	79	73	79	75
	Average Minimum	56	54	57	56	53
October	Average Maximum	62	65	63	68	69
	Average Minimum	49	47	44	52	51
November	Average Maximum	51	54	52	52	52
	Average Minimum	39	43	39	41	39
December	Average Maximum	45	47	42	49	48
	Average Minimum	33	39	31	39	39

Monthly average of daily maximum/minimum temperatures

Table 5 contains data for the individual wholesale customers of PWB, their water use for the previous fiscal year, and information about their contracts with PWB.

Table 5 – Wholesale Customer Statistics, 2014-15

Distributor	Consumption in 100 cubic feet (a)	Revenue (a)	Active Services (b)	Service Population (c) Served by Portland	Service Population (c) Served by Other	Contract Expires
Burlington Water District	14,780	28,944	113	292		2026
Gresham, City of	3,018,577	2,118,868	16,789	66,762	6,137	2026
Lake Grove Water District (d)	176,825	193,100	1,327	2,233	744	2021
Lusted Water District	72,134	84,191	410	1,075		2026
Palatine Hill Water District	183,588	327,527	603	1,526		2027
Pleasant Home Water District (d)	78,530	82,483	546	1,464		2021
Raleigh Water District	272,749	246,738	1,008	4,187		2026
Rockwood Water PUD	3,040,125	2,149,325	13,417	59,712	2,463	2026
Sandy, City of	229,487	109,224	3,608	4,577	6,030	2028
Tigard, City of	2,514,233	3,026,545	18,535	55,966	5,652	2016
Tualatin, City of (d)	2,275,654	1,719,876	6,384	26,714		2021
Tualatin Valley Water District (d)	6,694,702	5,699,623	60,550	134,163	83,768	2021
Valley View Water District	67,399	124,401	383	923		2026
West Slope Water District	566,461	862,744	3,310	10,484		2026
Total - large users	**19,205,244**	**$ 16,773,589**	**126,983**	**370,078**	**104,794**	
GNR Water Company	3,611	2,479	25	48		2016
Green Valley Water Company	231	539	3	7		2016
Hideaway Hills Water Company	2,537	1,863	14	51		2016
Lorna Water Company	8,329	5,184	87	249		2016
Skyview Acres Water Company (e)	-	406	73	-	37	2016
Two Rivers Water Association	999	980	5	14		2016
Small water companies	**15,707**	**$ 11,451**	**207**	**369**	**37**	
Total wholesale customers	**19,220,951**	**$ 16,785,040**	**127,190**	**370,447**	**104,831**	

As of June 30, 2015

(a) Consumption and revenue figures are adjusted for water sold to City customers.

(b) Number of active services as of June 30, 2015 data supplied by wholesalers.

(c) Population estimates are based on PSU Population forecasts. Population split is based on share of water purchased from Portland and other water sources.

(d) These customers with 10-year agreements must provide notice of non-renewal prior to July 1, 2016, for their contract to end 2021 or the contract shall continue for another ten years, through June 30, 2026.

(e) Skyview Acres Water Company is currently purchasing water directly from City of Sandy.

4. CAPITAL ASSETS

Table 6 list the acquisition value, accumulated depreciation and current book value of the capital assets owned by Portland Water Bureau.

Table 6 – Summary of Capital Assets

	Acquisition Value	Depreciation	Book Value	SAP Asset Class
Land				
Land	$15,029,156	$0	$15,029,156	110000
Land Use Rights, Non-Depreciable	$3,211,842	$0	$3,211,842	610000
Land Use Rights, Depreciable	$322,212	($13,025)	$309,187	810000
Total Land	**$18,563,210**	**($13,025)**	**$18,550,185**	
Buildings & Grounds				
Buildings & Improvements	$78,443,618	($13,967,715)	$64,475,903	300000
Land Improvements	$24,635,145	($2,925,681)	$21,709,463	200000
Total Buildings & Grounds	**$103,078,763**	**($16,893,396)**	**$86,185,367**	
Plant				
Supply	$83,631,450	($34,619,271)	$49,012,179	55WS00
Conduit, Mains, Steel > 16"	$137,794,093	($48,066,337)	$89,727,757	55MSL0
Pumps - Structures, Improvements & Equipment	$92,256,585	($49,361,230)	$42,895,355	55PS00 & 55PE00
Distrib, Mains, CI < 16"	$32,224,252	($25,927,309)	$6,296,943	55MCD0
Supply, Mains, CI > 16"	$9,808,468	($8,186,936)	$1,621,532	55MCS0
Reservoirs & Tanks	$166,960,741	($11,676,872)	$155,283,869	55RT00
Services	$170,871,158	($53,333,242)	$117,537,915	55SVC0
Meters	$14,171,559	($3,118,848)	$11,052,711	55MTR0
Mains	$347,464,905	($83,836,582)	$263,628,323	55MA00
Hydrants & Fountains	$53,882,313	($7,867,283)	$46,015,030	55HYD0 & 25FTN0
Treatment, Equipment	$8,289,878	($6,275,816)	$2,014,062	55TLE0 & 55TSE0
Structures & Improvements	$64,766,570	($15,207,145)	$49,559,425	55SI00
Total Plant	**$1,182,121,971**	**($347,476,871)**	**$834,645,100**	
Equipment	$32,478,668	($17,932,804)	$14,545,864	410000-490000
Capital Lease	$0	$0	$0	
Computer Software & Related Costs	$2,886,937	($1,352,279)	$1,534,659	800000
Patent	$10,776	($3,079)	$7,697	820000
Total in Service	**$1,339,140,325**	**($383,671,454)**	**$955,468,872**	
Construction in Progress	$95,499,308	$0	$95,499,308	900000
Total	**$1,434,639,634**	**($383,671,454)**	**$1,050,968,180**	

As of June 30, 2015

Acquisition values are not the same as the replacement value of water system assets, which is published in the latest Inventory & Condition Report.[2] Replacement values are cost estimates adjusted for inflation to reflect costs that are current at the time of publication of this report.

Definitions for some of the terms in Table 5 can be found in the Appendix. Easements are an example of Land Use Rights. Water Bureau assets classed as Structures & Improvements (55S100) include conduit bridges, structures at Headworks, and telemetry. Examples of Buildings & Improvements (SAP Asset Class 300000) include the Interstate Facility, Powell Butte Caretaker's house, and the Sandy River Station buildings. Land Improvements include

[2] The latest Inventory and Condition Report was published in 2013. The report is issued every four years.

permanent improvements (i.e., non-moveable) assets other than buildings that add value to land, such as fences, landscaping, or parking lots on existing bureau-owned property.

Tables 7, 8, and 9 provide inventory trends of various components of the water distribution system for the past three years. The costs listed are the acquisition values, which do not include depreciation or adjustments for inflation.

Table 7 – Services, Hydrants, Drinking Fountains, Meters, and Distribution Mains

	As of June 30th, 2013		As of June 30th, 2014		As of June 30th, 2015	
	Units	Acquisition Value	Units	Acquisition Value	Units	Acquisition Value
Services						
1/2" to 2"	179,341	$115,155,858	179,854	$121,292,260	180,370	$128,874,547
>2"	4,406	$36,251,284	4,520	$38,851,181	4,629	$41,996,611
Total	**183,747**	**$151,407,142**	**184,374**	**$160,143,441**	**184,999**	**$170,871,158**
Hydrants	**14,308**	**$39,076,907**	**14,350**	**$41,626,717**	**14,399**	**$45,365,191**
Drinking Fountains	**130**	**$558,988**	**130**	**$558,988**	**130**	**$558,988**
Meters						
Small (5/8" to 1-1/4")	173,421	$6,376,915	173,313	$7,005,428	177,405	$7,676,648
Large (1-1/2" and larger)	5,121	$5,996,460	5,185	$6,069,745	5,258	$6,494,911
Total	**178,542**	**$12,373,375**	**178,498**	**$13,075,173**	**182,663**	**$14,171,559**
Mains (Linear Feet)						
1/2" to 6"	4,603,790	$126,876,129	4,603,351	$130,537,899	4,605,307	$135,972,259
8" to 14"	5,131,893	$137,349,780	5,135,521	$140,835,804	5,140,620	$145,486,913
16" to 60"	1,305,948	$115,924,824	1,309,496	$120,295,078	1,313,415	$126,450,322
Total	**11,041,631**	**$380,150,733**	**11,048,368**	**$391,668,781**	**11,059,342**	**$407,909,495**

Mains totals do not include conduits or transmission mains.

Table 8 – Additions and Removals of Mains

Size of Main	Installed (Feet)	Abandoned (Feet)	Net Change (Feet)
As of June 30, 2013			
1/2" to 6"	23,705	(29,732)	(6,027)
8" to 14"	18,302	(15,163)	3,139
16" to 60"	17,084	(20,871)	(3,787)
Total	**59,091**	**(65,766)**	**(6,675)**
As of June 30, 2014			
1/2" to 6"	12,792	(13,231)	(439)
8" to 14"	6,118	(2,490)	3,628
16" to 60"	5,520	(1,972)	3,548
Total	**24,430**	**(17,693)**	**6,737**
As of June 30, 2015			
1/2" to 6"	23,240	(21,284)	1,956
8" to 14"	13,302	(8,203)	5,099
16" to 60"	4,609	(690)	3,919

Table 9 – Additions and Removals of Services

	Additions		Removals		Totals	
	Number	Cost	Number	Cost	Number	Cost
As of June 30, 2013						
1/2" to 2"	1,244	$8,396,600	(809)	(483,313)	435	$7,913,287
3" to 16"	103	$2,603,959	(19)	(146,461)	84	$2,457,498
Total	**1,347**	**$11,000,558**	**(828)**	**(629,774)**	**519**	**$10,370,784**
As of June 30, 2014						
1/2" to 2"	1,166	$6,540,979	(653)	(419,298)	513	$6,121,681
3" to 16"	139	$2,805,590	(25)	(205,693)	114	$2,599,897
Total	**1,305**	**$9,346,569**	**(678)**	**(624,991)**	**627**	**$8,721,578**
As of June 30, 2015						
1/2" to 2"	1,354	$8,160,904	(838)	(578,617)	516	$7,582,287
3" to 16"	136	$3,377,505	(27)	(232,076)	109	$3,145,430
Total	**1,490**	**$11,538,409**	**(865)**	**(810,693)**	**625**	**$10,727,717**

Table 10 lists total miles of active main by type of material.

Table 10 – Main Totals by Material

Material	Material	Length (feet)	Length (miles)
AC	Aesbestos Concrete	5,074	0.96
BR	Brass	226	0.04
CCP	Bar-Wrapped Concrete Cylinder Pipe	135,717	25.70
CI	Cast Iron	7,246,930	1372.52
CU	Copper	8,650	1.64
DI	Ductile Iron	3,755,348	711.24
DI 56	Ductile Iron (Thicker Pipe Wall)	6,490	1.23
ER150	Earthquake Resistant	836	0.16
ER200	Earthquake Resistant	683	0.13
GALV	Galvanized Steel	124,543	23.59
HDPE	High Density Polyethylene	10,657	2.02
IDSTL	Steel (Measured by Internal Diameter)	26,495	5.02
ODSTL	Steel (Measured by Outside Diameter)	11,668	2.21
PVC	Polyvinyl Chloride	46,820	8.87
STL	Steel	437,900	82.94
STL80	Steel (Thicker Pipe Wall)	1,384	0.26
WI	Wrought Iron	46,611	8.83
UNK	Unknown Material	644	0.12
	Grand Total*	11,866,676	2247.48

As of June 30th, 2015

*This information has been corrected in the report Errata Section at the end of this report.

Table 11 is an inventory of active valves, which does not include pressure regulators or some pump station and tank site facility valves.

Table 11 – Valve Inventory by Type and Size

Active Valves by Subtype	Valve Size			
System Valves	**Small (<12")**	**Large (12" - 24")**	**Very Large (>24")**	**Total**
Altitude	6	6		12
Ball	33	6	2	41
Butterfly	51	1,306	207	1,564
Check	102	48	2	152
Flapper Gate	8	2		10
Gate	24,989	3,424	62	28,475
Globe	1	1		2
Hydrant Gate	4,456	10		4,466
Hydrant Patent Tap Gate	1,002	1		1,003
Insta-valve	28	4		32
Pressure Reducing Valve	37	3		40
Patent Tap Gate	3,072	256	2	3,330
Service	4,446	56		4,502
Service Patent Tap Gate	2,792	80		2,872
Sleeve Valve	1	1		2
Unknown	1,473	186	6	1,665
Site Valves not in GIS (est.)	350	350		700
Total System Valves	42,497	5,390	281	48,868
Miscellaneous Valves				
Air release	1,477	3		1,480
Blowoff	3,069	3		3,072
Combination	77			77
Standpipe	16	1	3	20
T-500	196			196
Vacuum	124	6		130
Unknown	45		4	49
Total Miscellaneous Valves	5,004	13	7	5,024
Total All Valves*	**47,501**	**5,403**	**288**	**53,892**

As of June 30th, 2015

*This information has been corrected in the report Errata Section at the end of this report.

Table 12 describes the attributes of the three large-diameter water mains, commonly referred to as conduits, which transport water from the Headworks treatment facility to the Powell Butte Reservoirs.

Table 12 – Conduit Descriptions

Conduit 2 - Built in 1911; lock-bar steel pipe with riveted joints. 50 MGD design capacity.		
Location	**Diameter (inches)**	**Miles**
Headworks to Lusted Hill	52	10
Lusted Hill to SE 162nd Ave	44	9.6
	Total Miles	**19.6**
Conduit 3 - Built in 1925; lock-bar steel pipe with riveted joints. 75 MGD design capacity.		
Location	**Diameter (inches)**	**Miles**
Headworks to Lusted Hill	58	10
Lusted Hill to SE 162nd Ave	50	9.4
	Total Miles	**19.4**
Conduit 4 - Built in 1953; welded steel pipe with alternating welded and unrestrained flex coupling joints. 100 MGD design capacity.		
Location	**Diameter (inches)**	**Miles**
Headworks to Lusted Hill	66	10
Lusted Hill to SE 162nd Ave	56	10.1
	Total Miles	**20.1**
Conduit Interties (All pipe material is welded steel)		
Location	**Diameter (inches)**	**Miles**
Larson's	66	0.3
Hudson's	66	0.2
SE 162nd Avenue*	90	0.7
SE 162nd Avenue	84	0.4
SE 162nd Avenue	72	0.6
SE 162nd Avenue	56	0.3
	Total Miles	**2.5**

*Note: The conduits end at SE 162nd Avenue and are classified as transmission mains between the SE 162nd Avenue interties and Mt Tabor. There are three intertie vaults in SE 162nd Avenue at Stephens St., Division St., and Rhone St.; the pipe sizes vary at each location.

Tables 13 and 14 describe the attributes of the pipes that cross the Willamette River and the active terminal storage reservoirs, respectively. Terminal storage reservoirs are defined as the primary in-town storage points within the system.

Table 13 – Willamette River Crossings

Crossing	Diameter (inches)	Material	Year Installed	Type	Length (Miles)
St. Johns	36	CCP	1976	Buried	0.6
Clay Street	30	Steel	1911	Buried	0.4
Marquam	36	DI	1931	Buried	0.3
Ross Island North	24	Steel	1931	Bridge	0.5
Ross Island South	24	Steel	1931	Bridge	0.5
WCSL	60	CCP	1983	Buried	0.4
Sellwood	30	CI	1961	Buried	0.2
				Total Miles	**2.9**

Crossings are listed from north to south.
CCP = Concrete Cylinder Pipe; DI = Ductile Iron; CI = Cast Iron
WCSL = Washington County Supply Line

Table 14 – Terminal Storage Reservoirs

Reservoir	Size (MG)	Overflow Elevation[1] (Ft)	Type	Install Year
Powell Butte 1	50	530	Buried	1981
Powell Butte 2	50	530	Buried	2014
Kelly Butte	25.2	427	Buried	2015
Mayfair	5.6	300	Ground Level	1967
Sam Jackson 2	2.75	300	Standpipe	1964
Total usable storage	133.6			

1. Elevations are in feet above mean sea level.
MG = Million Gallons

Tables 15 and 16 list the active water storage tanks and pump stations, respectively, their capacities and install dates.

Table 15 – Distribution Storage in Standpipes and Tanks

Storage Tank	Capacity (MG[1])	Overflow Elevation[2] (Ft)	Material	Type	Year Installed
104th & Klickitat Tank	4.0	261	Concrete	Ground Level	1978
148th & Halsey	2.0	261	Concrete	Buried	1968
Alto Park	0.20	669	Concrete	Partially Buried	1950
Arlington Heights #2	1.0	865	Concrete	Partially Buried	1959
Arlington Heights #3	3.0	865	Concrete	Partially Buried	1963
Arnold Tank #1	0.50	685	Concrete	Partially Buried	1948
Arnold Tank #2	0.50	685	Concrete	Partially Buried	1957
Arnold Tank #3	0.60	685	Concrete	Ground Level	1957
Bertha #1	0.20	1,049	Concrete	Ground Level	1947
Bertha #2	0.85	1,049	Concrete	Ground Level	1963
Broadway Drive	0.38	496	Steel	Ground Level	1964
Burlingame #2	0.38	644	Steel	Standpipe	1943
Burlingame #3	0.38	644	Steel	Standpipe	1951
Burlingame #4	0.86	643	Steel	Standpipe	1958
Calvary	1.0	1,044	Steel	Ground Level	1957
Clatsop	3.0	814	Steel	Ground Level	1982
Council Crest	0.50	1,144	Steel	Standpipe	1942
Denver	3.0	328	Steel	Elevated	1962
Forest Park High	0.50	1,250	Steel	Elevated	1996
Forest Park Low	1.30	1,044	Concrete	Buried	2014
Greenleaf #1	0.03	1,250	Steel	Standpipe	1942
Greenleaf #2	0.30	1,250	Steel	Ground Level	1951
Kings Heights	0.20	865	Concrete	Partially Buried	1911
Lexington	1.0	658	Steel	Ground Level	1977
Marigold	1.0	634	Steel	Elevated	1967
Marquam Hill #1	0.29	737	Steel	Standpipe	1929
Marquam Hill #2	2.20	737	Prestressed Concrete	Partially Buried	1964
Mt. Scott	0.40	522	Steel	Ground Level	1967

1. MG = Million gallons
2. Feet above mean sea level
3. Does not include the groundwater storage tank or terminal storage reservoirs as these are considered part of the supply facilities.

Table 15 – Distribution Storage in Standpipes and Tanks, continued.

Storage Tank	Capacity (MG[1])	Overflow Elevation[2] (Ft)	Material	Type	Year Installed
Mt. Tabor Reservoir 7	0.20	590	Concrete	Buried	1912
North Linnton	1.0	180	Steel	Ground Level	1973
Penridge	0.05	1,317	Steel	Standpipe	1951
Pittock	1.0	990	Concrete	Ground Level	1965
Portland Heights #2	0.50	866	Concrete	Buried	1929
Portland Heights #3	1.8	866	Prestressed Concrete	Ground Level	1975
Powell Valley 144th/Center (Vivian)	0.16	246	Steel	Ground Level	2001
Powell Valley 160th Avenue #2*	3.0	417	Concrete	Partially Buried	1964
Powell Valley 160th Avenue #3*	7.0	417	Concrete	Buried	1962
Raymond	2.0	635	Concrete	Ground Level	1960
Rocky Butte	0.50	389	Steel	Ground Level	1981
Rose Parkway	0.50	325	Steel	Elevated	1961
Saltzman	0.0005	140	Steel	Hydropneumatic	2005
Sherwood Field	0.38	534	Steel	Ground Level	1966
Stephenson #1	1.0	763	Concrete	Buried	1966
Stephenson #3	0.25	763	Concrete	Patially Buried	1940
Vermont Hills #2	0.58	585	Concrete	Ground Level	1947
Vermont Hills #3	0.87	587	Steel	Ground Level	1954
Vermont Hills #4	0.53	585	Concrete	Partially Buried	1958
Vermont Hills #5	2.8	587	Prestressed Concrete	Partially Buried	1967
Vernon Intermediate (low)	2.5	305	Steel	Standpipe	1962
Vernon Standpipe (high)	3.2	362	Steel	Elevated	1962
Westwood	1.0	653	Prestressed Concrete	Partially Buried	1962
Whitwood	0.13	577	Concrete	Partially Buried	2001
Willalatin	0.20	1,200	Steel	Elevated	1968
Willamette Heights	0.06	444	Concrete	Buried	1907
54 Total Tanks[3]	60.8	Total Capacity			

1. MG = Million gallons
2. Feet above mean sea level
3. Does not include the groundwater storage tank or terminal storage reservoirs as these are considered part of the supply facilities.

*This information has been corrected in the report Errata Section at the end of this report.

Table 16 – Pump Stations, Elevations, Nominal Power, and Pumping Capacity

Site Name	Pump Number[1]	Pump Elevation (Ft)	Destination Elevation[2] (Ft)	Nominal Horsepower	Nominal Flow (GPM[3])	Year Installed/ Refurbished[4]
105th & Fremont	105PS201	218	389	25	500	1980
	105PS202	218	389	40	750	1980
112th Ave Pump Station	I12PS201	253	658	25	300	1993
	I12PS202	253	658	100	900	2000
	I12PS203	253	658	100	900	2000
162nd Ave Pump Station	162PS201	312	814	30	250	1988
	162PS202	312	814	100	800	2001
	162PS203	312	814	100	800	2003
1st & Kane	1KNPS201	410	530	25	460	1986
	1KNPS202	410	530	25	460	1986
Arlington Heights	ARLPS201	840	990 (HGL)	5	90	1967
	ARLPS202	840	990 (HGL)	5	90	1989
Arnold	ARNPS201	670	763	30	1100	1985
	ARNPS202	670	763	30	800	1972
Barbur Gibbs	BARPS201	222	737	125	600	1954
	BARPS202	222	737	125	800	1954
	BARPS203	222	737	125	900	1959
Burnside	BURPS201	700	1044	50	500	1998
	BURPS202	700	1044	50	600	1991
Calvary	CALPS201	992	1250	75	1000	1993
	CALPS202	992	1250	75	1000	2000
	CALPS203	992	1250	40	250	1993
	CALPS204	992	1250	100	1100	2004
Capitol Highway	CAPPS201	572	763	50	1300	1998
	CAPPS202	572	763	50	1300	1998
	CAPPS203	572	763	125	3100	1998
Carolina	CARPS201	81	653	350	3000	1988
	CARPS202	81	653	350	3000	2000
	CARPS203	81	653	350	2700	2000
	CARPS204	81	653	350	2700	1965
	CARPS205	81	653	350	2900	1973
	CARPS206	81	653	350	2900	1973

1. Supervisory Control and Data Acquisition (SCADA) designation
2. HGL = Hydraulic grade line; implies the pump station pumps directly into the distribution system, not to a tank. Elevations are in feet above mean sea level.
3. Gallons per minute.
4. Motor installation dates are used if pump and motor installation dates differ.

Table 16 – Pump Stations, continued.

Site Name	Pump Number[1]	Pump Elevation (Ft)	Destination Elevation[2] (Ft)	Nominal Horsepower	Nominal Flow (GPM[3])	Year Installed/ Refurbished[4]
Clatsop	CLAPS201	770	943 (HGL)	15	240	2007
	CLAPS202	770	943 (HGL)	25	500	2007
	CLAPS203	770	943 (HGL)	25	500	2007
Fulton	FULPS201	54	644	300	3200	1997
	FULPS202	54	644	200	2000	1995
	FULPS203	54	644	200	2100	1996
	FULPS204	54	644	250	1600	2004
	FULPS205	54	644	300	2600	1961
	FULPS206	54	644	300	3200	1994
Greenleaf	GRNPS201	1224	1317	5	130	1994
	GRNPS202	1224	1317	15	180	2005
Groundwater	GWPMS101	28	530	500	3300	1987
	GWPMS102	28	530	500	3300	1987
	GWPMS201	28	530	2350	12000	1987
	GWPMS202	28	530	2350	12000	1987
	GWPMS203	28	530	2350	12000	1987
	GWPMS204	28	530	2350	12000	1987
	GWPMS205	28	530	2350	12000	1987
	GWPMS206	28	530	2350	12000	1987
Hoyt	HYTPS201	820	1044	100	1300	1972
	HYTPS202	820	1044	100	1300	1972
	HYTPS203	820	1044	100	1350	1972
Latigo Lane	LADPS201	588	710 (HGL)	8	150	1992
	LADPS202	588	710 (HGL)	8	150	1992
Linnton	LINPS201	144	549	40	150	1996
	LINPS202	144	549	40	150	1996
	LINPS203	144	549	7.5	130	1996
Marquam Hill No. 1	MARPS201	693	1049	100	800	1954
	MARPS202	693	1049	100	800	1954
Marquam Hill No. 2	MARPS203	691	1049	250	2200	1964
	MARPS204	691	1049	250	2200	1964
Mt Tabor	TABPS201	335	580	40	525	2002
	TABPS202	335	580	60	850	2000
	TABPS203	335	580	60	850	2001

1. Supervisory Control and Data Acquisition (SCADA) designation
2. HGL = Hydraulic grade line; implies the pump station pumps directly into the distribution system, not to a tank. Elevations are in feet above mean sea level.
3. Gallons per minute.
4. Motor installation dates are used if pump and motor installation dates differ.

Table 16 – Pump Stations, continued.

Site Name	Pump Number[1]	Pump Elevation (Ft)	Destination Elevation[2] (Ft)	Nominal Horsepower	Nominal Flow (GPM[3])	Year Installed/ Refurbished[4]
Portland Heights	PORPS201	841	1144	100	1100	1990
	PORPS203	841	1144	200	2100	1989
	PORPS204	841	1144	150	1500	2014
Powell Butte Heights	PBBPS201	403	600 (HGL)	7.5	200	1999
	PBBPS202	403	600 (HGL)	7.5	200	1999
	PBBPS203	403	600 (HGL)	30	900	1999
	PBBPS204	403	600 (HGL)	30	900	1999
Powell Valley 144th/Center	VIVPS201	226	415	150	2100	2000
(Vivian)	VIVPS202	226	415	150	2100	2000
	VIVPS203	226	415	100	1000	2000
Powell Valley Raymond	RAYPS201	418	552	3	50	2002
	RAYPS202	418	552	3	50	2002
	RAYPS203	418	552	20	350	2002
	RAYPS204	418	552	50	1000	2002
	RAYPS205	418	552	50	1000	2002
Rivergate	RIVPS201	63	270 (HGL)	250	2400	1974
	RIVPS202	63	270 (HGL)	250	2400	1974
	RIVPS203	63	270 (HGL)	250	2400	1974
Rocky Butte	RBWPS201	230	676 (HGL)	20	150	1993
	RBWPS202	230	676 (HGL)	70	600	1969
Saltzman	SALPS201	137	340 (HGL)	7.5	30	2005
	SALPS202	137	340 (HGL)	7.5	30	1995
Sam Jackson	SAMPS201	265	496	350	2500	2003
	SAMPS202	265	866	350	2500	2003
	SAMPS203	265	866	350	1700	2003
	SAMPS204	265	737	350	1600	1997
	SAMPS205	265	737	75	700	1999
	SAMPS206	265	496	75	1000	1999

1. Supervisory Control and Data Acquisition (SCADA) designation
2. HGL = Hydraulic grade line; implies the pump station pumps directly into the distribution system, not to a tank. Elevations are in feet above mean sea level.
3. Gallons per minute.
4. Motor installation dates are used if pump and motor installation dates differ.

Table 16 – Pump Stations, continued.

Site Name	Pump Number[1]	Pump Elevation (Ft)	Destination Elevation[2] (Ft)	Nominal Horsepower	Nominal Flow (GPM[3])	Year Installed/ Refurbished[4]
Springville	SPRPS201	426	1250	150	600	1993
	SPRPS202	426	1250	100	600	1993
	SPRPS203	426	1250	100	300	1993
Stephenson	STPPS201	748	890 (HGL)	20	250	2005
	STPPS202	748	890 (HGL)	20	250	2005
	STPPS203	748	890 (HGL)	100	1750	2005
Taylors Ferry	TAYPS201	450	685	125	2000	1996
	TAYPS202	450	685	125	2000	1971
Tenino Court	TENPS201	277	522	15	300	1982
	TENPS202	277	522	15	300	1982
Verde Vista	VVIPS201	680	990 (HGL)	40	1000	1998
	VVIPS202	680	990 (HGL)	40	1000	1998
Washington Park No. 1	WASPX201	236	534	Hydraulic	625	1894
	WASPS204	236	866	350	1600	1972
	WASPS205	236	866	350	1600	1972
	WASPS206	236	866	350	1700	1972
Washington Park No. 2	WASPS211	195	865	350	1600	1963
	WASPS212	195	865	350	1600	1963
	WASPS213	195	865	300	1900	1954
	WASPS214	195	865	300	1700	1954
	WASPS215	195	865	350	2200	1968
	WASPS216	195	865	350	2200	1968
	WASPS217	195	534	150	1500	2010
	WASPS218	195	534	150	1400	1973
Washington Park No. 3	WASPS219	195	865	350	1900	1972
	WASPS220	195	865	350	1900	1972
Whitwood	WITPS201	42	577	125	1000	1993
	WITPS202	42	577	40	400	1993
	WITPS203	42	577	40	400	1993

1. Supervisory Control and Data Acquisition (SCADA) designation
2. HGL = Hydraulic grade line; implies the pump station pumps directly into the distribution system, not to a tank. Elevations are in feet above mean sea level.
3. Gallons per minute.
4. Motor installation dates are used if pump and motor installation dates differ.

Table 17 – Pump Station Summary*

Total Number of Pump Stations	38
Total Number of Pumps	123
Total Combined Horsepower[1]	30,290
Total Combined Flow Rate[1] (MGD)	308

1. Nominal

*This information has been corrected in the report Errata Section at the end of this report.

Table 18 lists the 150 pressure zones that serve Portland customers and their respective hydraulic grade line (HGL) elevations.

Table 18 – Pressure Zones

Pressure Zone	HGL (FT)	Pressure Zone	HGL (FT)
ARLINGTON 600 CUMBERLAND	600	CALVARY 943 54TH	943
ARLINGTON 626 BURNSIDE	626	CALVARY 963 WOODSIDE	963
ARLINGTON 731 CORNELL	731	CLATSOP 522 BARBARA WELCH	522
ARLINGTON 733 CHAMPLAIN	733	CLATSOP 577 NEHALEM	577
ARLINGTON 743 WARRENTON	743	CLATSOP 701 BARBARA WELCH	701
ARLINGTON 865 TANK	865	CLATSOP 814 TANK	814
ARLINGTON PUMP 990	990	CLATSOP PUMP 804 141ST	804
ARNOLD 545 BOONES FERRY	545	CLATSOP PUMP 943	943
ARNOLD 685 TANK	685	CONDUITS	0
BERTHA 1048 TANK	1048	COUNCIL CREST 1017 MT ADAMS	1017
BERTHA 615 IOWA	615	COUNCIL CREST 1056 GALE	1056
BERTHA 681 CHELTENHAM	681	COUNCIL CREST 1103 FAIRMOUNT	1103
BERTHA 688 26TH	688	COUNCIL CREST 1144 TANK	1144
BERTHA 750 SUNSET	750	COUNCIL CREST 703 JERALD	703
BERTHA 805 25TH	805	COUNCIL CREST 747 PATTON	747
BERTHA 819 19TH	819	COUNCIL CREST 813 MARTINS	813
BERTHA 845 WESTWOOD	845	COUNCIL CREST 846 ALTADENA	846
BERTHA 874 SEYMOUR	874	COUNCIL CREST 850 TWOMBLY	850
BERTHA 937 18TH	937	COUNCIL CREST 896 HILLSIDE	896
BERTHA 962 MITCHELL	962	COUNCIL CREST 941 MARQUAM HILL	941
BROADWAY DRIVE 396 GIBBS	396	COUNCIL CREST 942 CHESAPEAKE	942
BROADWAY DRIVE 412 VIEW POINT	412	COUNCIL CREST 947 PATTON	947
BROADWAY DRIVE 496 TANK	496	COUNCIL CREST 953 DOSCH	953
BURLINGAME 369 FULTON PARK	369	COUNCIL CREST 992 TALBOT	992
BURLINGAME 458 ARNOLD	458	DENVER 272 SWAN ISLAND	272
BURLINGAME 465 62ND	465	GREENLEAF 1034 CORNELL	1034
BURLINGAME 468 MAPLECREST	468	GREENLEAF 1082 BIRKENDENE	1082
BURLINGAME 473 NEVADA	473	GREENLEAF 1088 THOMPSON	1088
BURLINGAME 473 PLUM	473	GREENLEAF 1092 HAZELTINE	1092
BURLINGAME 487 6TH	487	GREENLEAF 1101 PINNACLE	1101
BURLINGAME 525 12TH	525	GREENLEAF 1134 ROYAL	1134
BURLINGAME 545 TERWILLIGER	545	GREENLEAF 1140 SKYLINE	1140
BURLINGAME 547 LANCASTER	547	GREENLEAF 1250 TANK	1250
BURLINGAME 560 TERWILLIGER	560	GREENLEAF 690 BIRKENDENE	690
BURLINGAME 573 62ND	573	GREENLEAF 697 MILLER	697
BURLINGAME 584 CANBY	584	GREENLEAF 705 SILVER RIDGE	705
BURLINGAME 643 TANK	643	GREENLEAF 742 VILLAGE HEIGHTS	742
CALVARY 1044 TANK	1044	GREENLEAF 745 BIRKENDENE	745
CALVARY 935 SCHOLLS FERRY	935	GREENLEAF 751 BARTHOLOMEW	751

HGL = Hydraulic grade line

Table 18 – Pressure Zones, Continued.

Pressure Zone	HGL (FT)	Pressure Zone	HGL (FT)
GREENLEAF 824 ASH	824	ROCKY BUTTE PUMP 676	676
GREENLEAF 840 RYAN	840	ROSE PARKWAY 325 TANK	325
GREENLEAF 892 BIRKENDENE	892	SALTZMAN 362 TANK	362
GREENLEAF 893 PINNACLE	893	SHERWOOD 369 PARK	369
GREENLEAF 970 HAWKINS	970	SHERWOOD 381 29TH	381
GREENLEAF 991 PINNACLE	991	SHERWOOD 436 CORNELL	436
KELLY BUTTE 280	280	SHERWOOD 457 RES 4 WASHDOWN	457
KELLY BUTTE 305	305	SHERWOOD 534 TANK	534
KELLY BUTTE 338 CULLY	338	STEPHENSON 763 TANK	763
KELLY BUTTE 427 TANK	427	STEPHENSON PUMP 773 VACUNA	773
LATIGO PUMP 760	760	STEPHENSON PUMP 890	890
LEXINGTON 451 112TH	451	TABOR 503 MOUNTAIN VIEW	503
LEXINGTON 463 133RD	463	TABOR 590 TANK	590
LEXINGTON 575 118TH	575	VERMONT 458 VERMONT	458
LEXINGTON 658 TANK	658	VERMONT 511 BEAVERTON HILLSDALE	511
LINNTON 313 4TH	313	VERMONT 562 GARDEN HOME	562
LINNTON 332 WILARK	332	VERMONT 585 TANK	585
LUSTED 652	652	VERNON 119 GERTZ	119
MARQUAM 607 6TH	607	VERNON 183 BRIDGETON	183
MARQUAM 737 TANK	737	VERNON 203 HOLLAND	203
MT SCOTT 522 TANK	522	VERNON 211 HAYDEN ISLAND	211
PARKROSE 261 TANK	261	VERNON 270	270
PENRIDGE 1315 TANK	1315	VERNON 362 TANK	362
PITTOCK 990 TANK	990	WASHINGTON PARK 229	229
PORTLAND HEIGHTS 582 BROADWAY	582	WASHINGTON PARK 299	299
PORTLAND HEIGHTS 615 RIVINGTON	615	WHITWOOD 326 HARBOR	326
PORTLAND HEIGHTS 690 DAVENPORT	690	WHITWOOD 336 GERMANTOWN	336
PORTLAND HEIGHTS 727 BROADWAY	727	WHITWOOD 372 SPRINGVILLE	372
PORTLAND HEIGHTS 734 VISTA	734	WHITWOOD 493 SPRINGVILLE	493
PORTLAND HEIGHTS 866 TANK	866	WHITWOOD 577 TANK	577
POWELL BUTTE 530 FLAVEL	530	WILLALATIN 1055 SKYVIEW	1055
POWELL BUTTE 530 TANK	530	WILLALATIN 1200 TANK	1200
POWELL BUTTE PUMP 600	600	WILLALATIN 802 RED CEDAR	802
RAYMOND 435 TANK	435	WILLALATIN 962 SKYVIEW	962
RAYMOND PUMP 552	552	WILLAMETTE HEIGHTS 329 32ND	329
ROCKY BUTTE 389 TANK	389	WILLAMETTE HEIGHTS 445 TANK	445
150 Pressure Zones			

HGL = Hydraulic grade line

PWB owns and manages 108 non-supply wells in or near the CSSWF, including monitoring, pilot, and test wells, piezometers, and exploratory borings. The 27 groundwater production wells used for supply purposes draw water from three aquifers in the Columbia South Shore Well Field. Table 19 lists the groundwater production wells and some of their physical attributes.

Table 19 – Groundwater Production Wells

Production Well Number	Aquifer[1]	Drilled Depth (Ft)	Top Flange Elevation[2] (Ft)	Casing Diameters (In)	Nominal Capacity (gpm)	Nominal Power (HP)	In Service Year	Pump Rehab Year
PW-1	SGA	531	26.72	20/16	3,000	300	1980	1999
PW-2	SGA	538	21.36	24/16	3,400	450	1980	2007
PW-3	TSA	317	27.72	20/14	1,150	75	1980	2009
PW-4	SGA	534	22.99	24/16	2,000	300	1980	2001
PW-5	TSA	340	19.64	24/16	1,100	75	1980	1997
PW-6	SGA	568	29.15	24/18/10	3,200	500	1981	1999
PW-7	SGA	450	25.81	20/16/10	1,750	175	1981	2010
PW-8	SGA	450	23.92	24/20/10	1,550	175	1981	2008
PW-9	SGA	495	27.17	24/20/10	2,400	300	1982	2010
PW-10	TSA	375	18.91	16	1,950	150	1982	2010
PW-11	SGA	585	27.79	24/20/10	3,200	175	1982	2008
PW-12	BLA	123	22.98	23.25 ID	4,500	250	1982	2011
PW-13	BLA	169	30.26	35 ID	7,000	500	1983	1996
PW-14	SGA	361	23.79	22/18/16	2,500	175	1983	2008
PW-15	TSA	287	25.69	16	1,200	75	1983	2001
PW-16	SGA	560	38.03	22/18/12	3,100	350	1983	2011
PW-17	BLA	165	29.26	35 ID	3,000	200	1983	2011
PW-18	BLA	193	22.68	35 ID	7,000	600	1983	2012
PW-19	BLA	118	24.94	35 ID	7,000	400	1984	2011
PW-26	TSA	457	23.63	16	1,600	150	1984	2000
PW-28	TSA	431	21	16	2,000	200	1985	2005
PW-29	TSA	457	23.23	16/9.5	1,000	125	1984	2000
PW-34	SGA	667	27.4	24/20/12	3,000	350	1985	2005
PW-35	SGA	624	24.94	24/20	2,800	450	2000	2007
PW-36	SGA	521	23.3	24/20	3,000	350	2001	2007
PW-37	SGA	623	20.88	26/20	3,500	450	2000	2007
PW-38	SGA	635	35	24/20	2,500	450	2006	2007

1. BLA – Blue Lake Aquifer; TSA – Troutdale Sandstone Aquifer; SGA – Sand and Gravel Aquifer
2. Reference City of Portland Datum
3. PW-17 is not in use due to high manganese levels

Table 20 – Groundwater Production Well Summary

Total Number of Wells	27
Total Number of Pumps	27
Total Combined Horsepower*	7,750
Total Combined Flow Rate* (MGD)	114

*Nominal
MGD = million gallons per day

Based on the 2012 Well Field Pumping Plan, the Columbia South Shore production wells can provide the following levels of service:

Table 21 – Cumulative Groundwater Production Well Yields

Time	Reliable Rate of Use (MGD)	Cumulative Reliable Volume over Duration (BG)
30-day yield	88	2.7
30-90-day yield	80	7.4
90-151-day yield	71	11.7

MGD = million gallons per day
BG = billion gallons

Figure 6 – Well 17 Submersible Pump and Motor

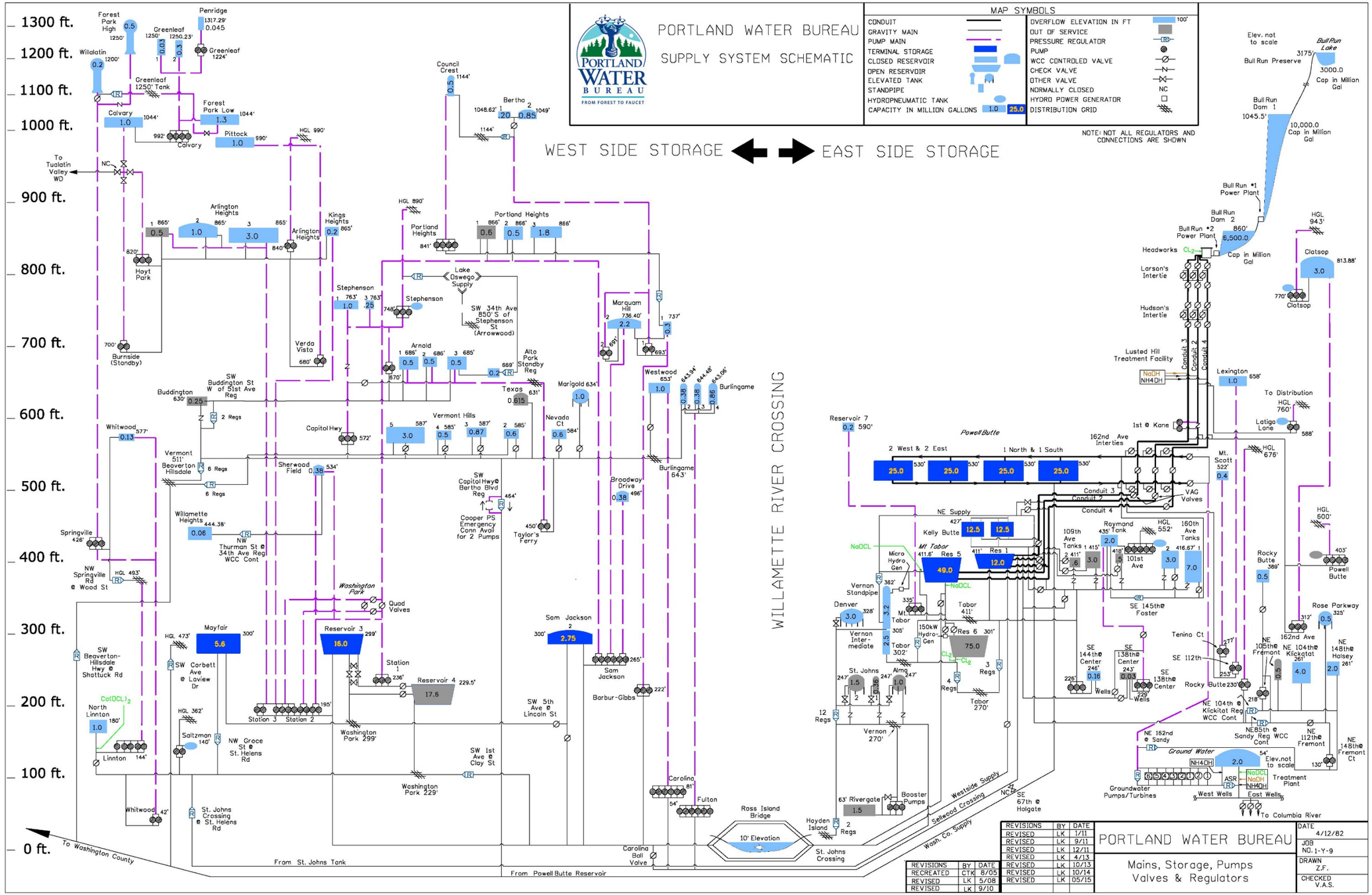

Figure 7 - Supply System Schematic (1-Y-9)

Drinking fountains are the infrastructure used to keep the thirsty citizens and visitors of Portland hydrated. Table 22 is an inventory of the drinking fountains currently in use in the City of Portland.

Table 22 – Drinking Fountains

Type	Quantity
Single-bowl Bubbler	68
Four-bowl Benson Bubbler (1912 Design, named after Simon Benson)[1]	52
Push-button	5
Three-bowl Bubbler	1
Two-bowl Bubbler with dog bowl	2
Ornamental stone drinking fountain	2
Total	130

1. Three four-bowl bubblers were designed in 1921, slightly different from the Benson Bubblers, and are referred to as "Nellie Robinson Bubblers."

Bull Run Watershed Data

Releases from the reservoirs are coordinated to manage demands in the water distribution system and wholesale demands, provide minimum flows and water temperature in the Bull Run River, and power generation by the Portland Hydroelectric Project Powerhouses.

As water levels in the reservoirs are lowered, there is a greater likelihood of suspended particles (turbidity) from bank erosion and the stirring up of silt from the reservoir bottom.

Datum: The benchmark for the elevations[3] of Dams No. 1 and No. 2 is the City of Portland (COP) Vertical Datum dated 1896. This is 1.375-feet below the National Geodetic Vertical Datum of 1929 (NGVD29). The North American Vertical Datum of 1988 (NAVD88) superseded the datum of 1929. All elevations listed in this document are in reference to the City of Portland datum. The following conversion factors apply:

- NGVD29 Elevation + 1.375-feet = COP Elevation
- NAVD88 Elevation – 2.10-feet = COP Elevation

Tables 23 and 24 describe some of the physical properties of Dam 1 and Dam 2, respectively.

[3] All elevations in this document are described as feet above mean sea level.

Table 23 – Dam No. 1 Data

Year Constructed	1929	
Type of Structure	Gravity Arch	
Storage Retention (gallons)	Elevation	
9,959,000,000	1,045	ft
8,798,000,000	1,036	ft
8,049,000,000	1,030	ft
Elevation References		
Roadway on dam (crest)	1,050	ft
Top of flash boards	1,045	ft
Spillway crest	1,036	ft
Streambed	865	ft
Dam Radius	600	ft
Crest Length	950	ft
Width		
Top	18	ft
Bottom	165	ft
Height	194	ft

Reservoir No. 2 normally operates at an elevation of approximately 849 feet.

Table 24 – Dam No. 2 Data

Year Constructed	1962	
Type of Structure	Earth & Rock	
Storage Retention (gallons)	Elevation	
6,839,000,000	860	ft
5,370,000,000	849	ft
4,410,000,000	840	ft
Elevation References		
Roadway on dam (crest)	875	ft
Top of impervious core	870	ft
Spillway crest	860	ft
Diverson pool dam crest	747	ft
Crest (length x width)	900 x 25	ft
Width	1,200	ft
Height	145	ft

Total storage: The total useable (before turbidity becomes an issue) combined storage of Dams No. 1 and No. 2 is approximately 9.9 billion gallons.

Energy Management

Reducing energy consumption has been a bureau service level goal since the Energy Management Charter was developed in 2010. PWB's annual carbon emissions rise or fall primarily based on the amount of electricity used, and the groundwater pump station is the largest single contributor to PWB's electricity use. Table 25 describes the energy use and carbon emission trends since 2011.

Table 25 – Energy Use, Fuel Use, & Carbon Emissions

Energy Use, Fuel Use, and Carbon Emissions	Calendar Year				
	2011	2012	2013	2014	2015
Electricity (kWh)[1]	23,335,253	22,520,834	18,173,351	18,961,318	38,395,933
Fleet Fuel (gallons)[2]	239,557	242,105	224,338	212,663	231,952
Natural Gas (therms)[3]	64,024	67,707	62,441	77,630	59,379
Carbon Emissions (MT)[4]	11,526	10,885	9,062	8,004	13,965

1. kWh = kilowatt hours
2. Fleet fuel includes B5 & B20 biodiesel, and E10 gasoline
3. Natural gas is used solely for heating
4. MT = Metric Tons

The decline in electricity-related emissions from 2011 to 2013 is primarily a result of less groundwater pumped in 2013 compared to 2011 or 2012.

The City of Portland's Green Building Policy requires on-site renewable energy systems at all new City-owned facilities, as practical or as required by the State of Oregon. PWB has installed multiple solar and micro-hydro renewable energy facilities, and has been tracking renewable energy generated, since 2009 (see Table 26).

Table 26 – Renewable Energy Facilities

Renewable Energy Capacity	Power Capacity (kW)	Energy Generation by Calendar Year (kWh)					Total Energy Generation[3] (kWh)
		2011	2012	2013	2014	2015	
Groundwater Solar on the Slough Array[1]	268	276,705	293,843	274,968	284,661	285,870	1,704,399
Groundwater Treatment Building Solar Array	10		6,576	10,697	11,075	11,596	39,944
Meter Shop Solar Array	12	12,840	13,541	13,576	13,942	14,193	73,977
Powell Butte Solar Array[2]	8				7,739	7,739	15,478
Vernon Micro-Hydro Turbine	25		48,926	136,762	126,548	123,167	435,403
Total	323	289,545	362,886	436,003	443,965	442,565	2,269,201

1. Generating since December 2009 - This array is owned by a third-party.
2. Annual production estimated from Energy Trust of Oregon
3. As of December 31st, 2015

Energy = Power x Time (KWh = kW x h), where kWh = kilowatt-hours, kW = kilowatt, h = hours

5. WATER QUALITY ANALYSIS

- This section presents five years of analytical results for Portland's water, from July 1, 2010 through June 30, 2015 (Fiscal Year 2010-11 through FY 2014-15), unless otherwise stated.
- Most analytical results listed within this document are reported in units of milligrams per liter (mg/L). When other units are used, they are either listed adjacent to the name of the analyte, or in the table headers or notes.
- Many substances were either present at levels below the reporting limits of the prescribed analytical method or were not detected. These results are shown with a less than symbol ("<") followed by the method reporting limit. The Method Reporting Limit (MRL) is the lowest amount of a substance in a sample that can be quantitatively determined with stated, acceptable precision and accuracy under stated analytical conditions.
- MRLs may vary over time due to differences or changes in analytical methods or instruments, fluctuations in instrument sensitivity, analyst performance, and other factors. Thus for some substances there is more than one MRL.
- Where all results for a substance were below the MRL and there was more than one MRL, the highest MRL is reported, unless a preponderance of evidence indicates concentrations are below a lower MRL.
- In a few instances, analytical method improvements have resulted in improved quantification. Therefore newer quantified values can be lower than the older MRLs. In these cases, all results are reported as below the higher MRL, unless a preponderance of evidence indicates quantifiable concentrations are present at a lower MRL.

Drinking Water Treatment

The first step in the treatment process for Portland's drinking water is disinfection using chlorine. Next, ammonia is added to form chloramines which ensures that the disinfection residual remains adequate throughout the distribution system. Finally, sodium hydroxide is added to increase the pH and alkalinity of the water to reduce corrosion of premise plumbing systems. Corrosion control treatment helps limit lead and copper levels at customers' taps, should these metals be present in commercial or household plumbing systems.

Water Quality Standards

In order to ensure that tap water is safe to drink, the Environmental Protection Agency (EPA) establishes regulations that limit the amount of certain contaminants in water and sets monitoring requirements.

Primary standards are legally enforceable water quality standards that apply to public water systems. Under the Safe Drinking Water Act (SDWA), EPA sets legal limits on the levels of certain chemical and microbial contaminants in drinking water. For these

contaminants, Maximum Contaminant Levels (MCLs) that protect human health are established. EPA rules also set monitoring schedules, laboratory analytical methods that water systems must use, and acceptable treatment techniques. Oregon Health Authority (OHA) is responsible for enforcing the legal contaminant limits and other requirements established by federal regulations.

Secondary standards are non-mandatory water quality standards established as guidelines to assist public water systems in managing their drinking water for aesthetic considerations, such as taste, color, and odor. Secondary Maximum Contaminant Levels (SMCLs) are established as guidelines for utilities. Secondary contaminants do not present a risk to human health at the SMCLs. Public water systems test for secondary contaminants on a voluntary basis.

Water Quality Testing

Portland monitors for a broad range of regulated and unregulated microbiological, chemical, and physical measures of water quality. Monitoring and testing results presented in this document include results from the following locations:

- **Untreated or raw Bull Run Water** – surface water samples collected at the Headworks facility before the water is treated and routed to the distribution system (sampled at the Headworks intake, either the Primary Intake Structure (BRRE2PIS) or the Screenhouse 3 Intake Structure (BRRE002P)).
- **Treated Bull Run Water –** treated surface water samples collected at the entry point to the distribution system after the addition of chlorine, ammonia and sodium hydroxide (EP-A, TRLHC3LO on Conduit 3 at Lusted Hill) or in the distribution system (multiple sampling points).
- **Treated CSSWF Groundwater** – treated groundwater samples collected at the groundwater entry point to the distribution system after the addition of chlorine, ammonia and sodium hydroxide (EP-B, GWPSL003 at the groundwater pump station outlet). The water quality observed at the groundwater pump station outlet can vary over time depending on the water quality characteristics of the wells that are in service at the time of sample collection.

Bull Run Filtration Exemption

Portland's Bull Run surface water source is one of the few in the nation that meets criteria for avoiding filtration. To qualify for the exemption, a number of conditions must be met including the following source water quality criteria:

- 90 percent of the samples taken from the source water must have fewer than 20 fecal coliform bacteria per 100 mL.
- The turbidity level prior to disinfection must not exceed 5 neptholometric turbidity units (NTU).

Portland has been able to consistently meet these criteria, but occasionally has to shut down the Bull Run system and operate from the backup groundwater supply when storms and other natural disturbances in the Bull Run reservoirs increase the turbidity. As an unfiltered system, the Bull Run supply experiences seasonal increases in color levels resulting from naturally occurring organic matter. Figures 7 and 8 display the turbidity and color concentrations, respectively, over the past five years.

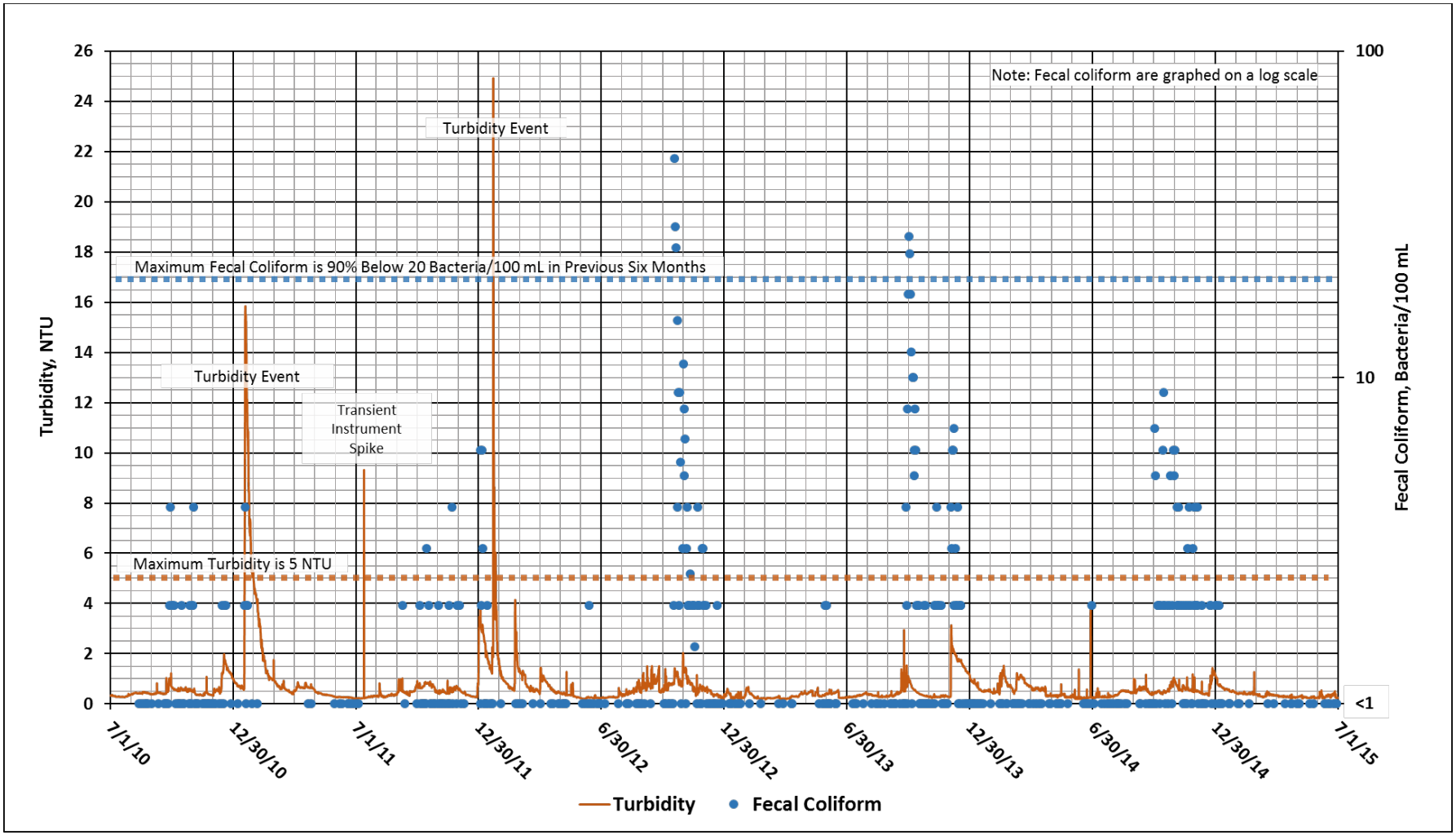

Figure 8 – Bull Run Raw Water Turbidity and Fecal Coliform Concentrations

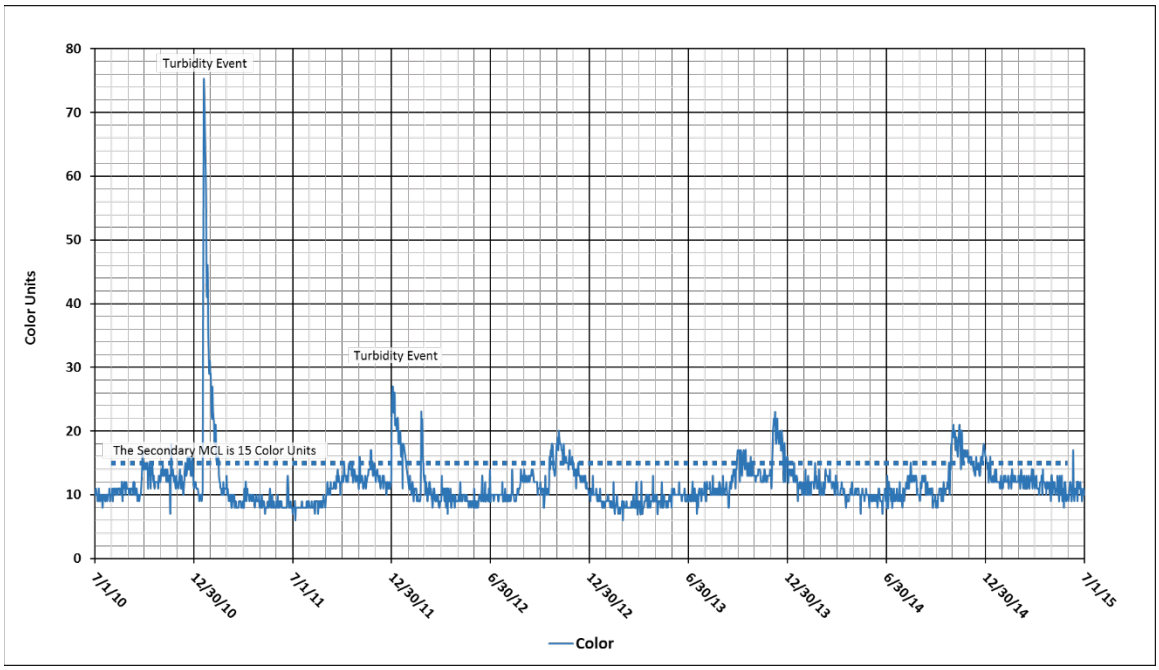

Figure 9 – Bull Run Raw Water Color

Bull Run Treatment Variance for Cryptosporidium

In March 2012, OHA issued PWB a variance from the state and federal requirements to treat raw water for the parasite *Cryptosporidium*. As one of the conditions of the variance, PWB must monitor the raw water for *Cryptosporidium* at least two days each week.

Table 27 – Cryptosporidium Monitoring Results in Raw Bull Run Water, April 2012 through June 2015

Number of Samples	Total Volume	Detections
767	17,726.5 L	None

Algae

Algae are a large and diverse group of naturally occurring unicellular and multicellular organisms that are commonly found in bodies of water, including freshwater lakes. Normally, algae are not a problem in the Bull Run reservoirs due to low nutrient levels, but they can 'bloom' under certain conditions. Algae are unregulated, but because the Bull Run system is unfiltered, algae can be a concern for a number of reasons, including taste, odor, increased chlorine demand, resistance to treatment, and their tendency to clog filters. In addition, algae are typically found at shallower depths in the water column in the Bull Run reservoirs, and their presence is potentially of greater concern since the North Intake Tower improvements have been completed, because water is now drawn from shallower depths in the Bull Run reservoirs to supply the in-town distribution system. As a result of the issues associated with the presence of algae in higher concentrations, algae levels are proactively monitored by PWB in the raw surface water

supply. Algae levels were also monitored in treated water at the Washington Park and Mt. Tabor open reservoirs until they were taken out of service in September 2013 and December 2015, respectively.

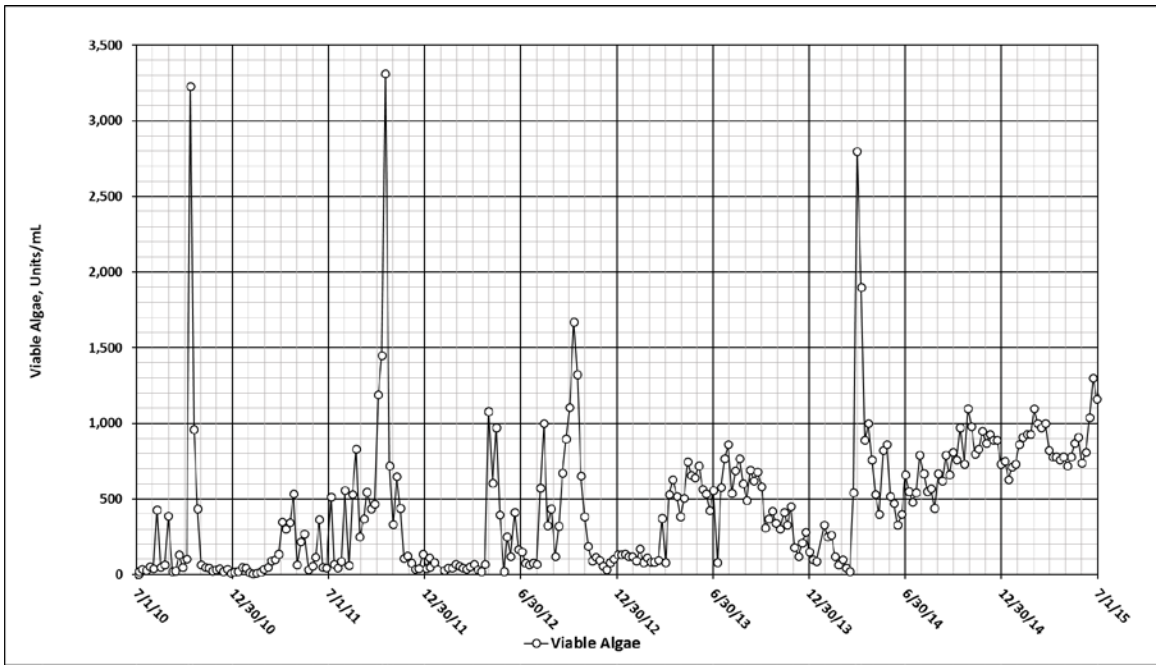

Figure 10 – Viable Algae in Raw Bull Run Water, FY 2010-11 through FY 2014-15.

Physical and Aggregate Chemical Characteristics

Portland routinely monitors the physical and aggregate chemical characteristics of the Bull Run surface water and CSSW groundwater to detect changes in water quality. Definitions for the parameters can be found in the Appendix.

Table 28 – Physical and Aggregate Chemical Characteristics of Treated Bull Run and CSSWF Groundwater, FY 2010-11 through FY 2014-15.

Parameter (units)	Treated Bull Run Water (mg/L)			Treated Groundwater (mg/L)			SMCL
	Min	Median	Max	Min	Median	Max	
Temperature (°C)	3.8	9.4	18.0	10.0	15.0	18.1	Not regulated
Turbidity (NTU)	0.18	0.40	2.74	0.01	0.18	0.85	5 NTU for BR filtration exemption
Color (Color Units)	5	9	22	<5	7	34	15
Total Solids (TS) (mg/L)	8	28	39	100	150	240	Not Regulated
Total Dissolved Solids (TDS) (mg/l)	7.5	28	38	100	150	240	500 mg/L
Total Suspended Solids (TSS) (mg/L)	<0.5	<0.5	0.8	<0.5	<0.5	2.2	Not Regulated
pH (Standard pH Units)	7.75	8.00	8.50	6.39	7.78	8.81	6.5 – 8.5
Specific Conductance (µmhos/cm)	23.9	33.0	36.1	169	234	368	Not Regulated
Hardness (mg/L as $CaCO_3$)	5.1	7.5	9.4	59	80	150	250 mg/L
Total Alkalinity (mg/L as $CaCO_3$)	6.3	8.9	19	77	110	190	Not Regulated

SMCL = Secondary maximum contaminant level.
NTU = neptholometric turbidity unit

Organics

Synthetic Organic Chemicals

Synthetic Organic Chemicals (SOCs) are a group of anthropogenic chemical compounds currently or formerly used in a variety of pesticides, herbicides, dielectric liquids, fuel additives and other agricultural, industrial, commercial and household products. Portland is required to monitor for 29 SOCs that are currently regulated by EPA. Monitoring for SOCs is done at the entry point to the distribution system of the Bull Run and the CSSWF groundwater sources at the prescribed schedule of two consecutive quarters in one year during every three-year compliance period.

Table 29 – SOC Results for Treated Bull Run and CSSWF Groundwater, FY 2010-11 through FY 2014-15.

Synthetic Organic Chemical	Treated Bull Run Water (mg/L)	Treated Groundwater (mg/L)	MCL (mg/L)
Alachlor	<0.000072	<0.000072	0.002
Atrazine	<0.0001	<0.0001	0.003
Benzo(a) pyrene	<0.00002	<0.00002	0.00002
Carbofuran	<0.001	<0.001	0.04
Chlordane	<0.0001	<0.0001	0.002
Dalapon	<0.001	<0.001	0.2
Dibromochloropropane	<0.00001	<0.00001	0.0002
Dinoseb	<0.0002	<0.0002	0.007
Diquat	<0.0004	<0.0004	0.02
Di(2-ethylhexyl) adipate	<0.0006	<0.0006	0.4
Di(2-ethylhexyl) phthalate	<0.0006	<0.0006	0.006
Endothall	<0.005	<0.005	0.1
Endrin	<0.00001	<0.00001	0.002
Ethylene Dibromide	<0.00001	<0.00001	0.00005
Glyphosate	<0.025	<0.025	0.7
Heptachlor	<0.00001	<0.00001	0.0004
Heptachlor epoxide	<0.00001	<0.00001	0.0002
Hexachlorobenzene	<0.0001	<0.0001	0.001
Hexachlorocyclopentadiene	<0.0001	<0.0001	0.05
Lindane	<0.00001	<0.00001	0.0002
Methoxychlor	<0.00001	<0.00001	0.04
Oxamyl (Vydate)	<0.001	<0.001	0.2
Pentachlorphenol	<0.00004	<0.00004	0.001
Picloram	<0.0001	<0.0001	0.5
Polychlorinated Biphenyls	<0.0001	<0.0001	0.0005
Simazine	<0.00005	<0.00005	0.004
Toxaphene	<0.0001	<0.0001	0.003
2,4-D	<0.0001	<0.0001	0.07
2,4,5-TP Silvex	<0.00005	<0.00005	0.05
MCL = maximum contaminant level			

Volatile Organic Compounds

Volatile Organic Compounds (VOCs) are a large group of chemicals that easily evaporate at room temperature. VOCs include (1) chlorinated solvents used in industrial and commercial degreasers and dry cleaning; (2) components of widely used household and commercial products such as paints and paint thinners, lacquers, cleaning supplies, building materials, office equipment, graphics and craft materials, and (3) lighter components of liquid fossil fuels. Portland is required to monitor for 21 VOCs that are currently regulated by EPA. Monitoring for VOCs is done at minimum annually at the entry points to the distribution system for both the Bull Run and CSSWF groundwater sources.

Table 30 – VOC Results for Treated Bull Run and CSSWF Groundwater, FY 2010-11 through FY 2014-15.

Synthetic Organic Chemicals	Treated Bull Run Water (mg/L)	Treated Groundwater (mg/L)	MCL (mg/L)
Benzene	<0.0005	<0.0005	0.005
Carbon tetrachloride	<0.0005	<0.0005	0.005
Cis-1,2-Dichloroethylene	<0.0005	<0.0005	0.07
Dichloromethane	<0.0005	<0.0005	0.005
Ethylbenzene	<0.0005	<0.0005	0.7
Monochlorobenzene	<0.0005	<0.0005	0.1
0-Dichlorobenzene	<0.0005	<0.0005	0.6
P- Dichlorobenzene	<0.0005	<0.0005	0.075
Styrene	<0.0005	<0.0005	0.1
Tetrachloroethylene (PCE)	<0.0005	<0.0005	0.005
Toluene	<0.0005	<0.0005	1.0
Trans-1,2-Dichloroethelyne	<0.0005	<0.0005	0.1
Trichloroethylene (TCE)	<0.0005	<0.0005	0.005
Vinyl chloride	<0.0005	<0.0005	0.002
Total xylenes	<0.001	<0.001	10
1,1-Dichlorethylene	<0.0005	<0.0005	0.007
1,1,1-Trichloroethane	<0.0005	<0.0005	0.2
1,1,2-Trichloroethane	<0.0005	<0.0005	0.005
1,2-Dichlorethane	<0.0005	<0.0005	0.005
1,2-Dichloropropane	<0.0005	<0.0005	0.005
1,2,4-Trichlorobenzene	<0.0005	<0.0005	0.07
MCL = maximum contaminant level			

Inorganic Constituents

Inorganic Chemicals (IOCs) are typically naturally occurring compounds of geologic origin. Industrial concentrations of naturally occurring IOCs, manufacturing processes and other anthropogenic activities can also contribute to elevated levels of inorganic chemicals found in the environment. A number of inorganic chemicals are regulated contaminants because they have potential adverse health effects above the established MCLs. Others can be nuisance contaminants causing taste, odor, color or other aesthetic issues when present in water above the recommended SMCLs. Higher levels of inorganics are often

found in groundwater as compared to surface water as a result of longer contact times with soluble constituents of geologic materials (e.g. soil and rock) in the groundwater environment.

Table 31 – Inorganic Chemicals in the Bull Run and CSSWF Groundwater Sources, FY 2010-11 through FY 2014-15.

Inorganic Chemical	Treated Bull Run Water (mg/L)	Treated Groundwater (mg/L)	Regulated Level
Regulated Inorganic Contaminants			**MCL (mg/L)**
Antimony (Sb)	<0.0005	<0.0005	0.006
Arsenic (As)	<0.0005	0.0009 – 0.0015	0.010
Barium (Ba)	0.0007 – 0.0013	0.0068 – 0.0107	2
Beryllium (Be)	<0.0005	<0.0005	0.004
Cadmium (Cd)	<0.0005	<0.0005	0.005
Chromium (Cr)	<0.0005 – 0.0008	<0.0005 – 0.0007	0.1
Copper (Cu)	0.0004 – 0.0011	<0.0020 – 0.0036	Action Level: 1.3
Cyanide (CN)	<0.01	<0.01	0.2
Fluoride (F)	<0.05	0.12 – 0.16	4.0; SMCL: 2.0
Lead (Pb)	<0.00005	<0.00005 – 0.00025	Action Level: 0.015
Mercury (Hg)	<0.0002	<0.0002	0.002
Selenium (Se)	<0.0025	<0.0025	0.05
Thallium (Th)	<0.0005	<0.0005	0.002
Secondary Inorganic Contaminants			**SMCL (mg/L)**
Aluminum (Al)	0.014 – 0.059	<0.0020 – 0.0126	0.05 – 0.2
Chloride (Cl)	2.2 – 3.7	3.9 – 14	250
Iron (Fe)	<0.022 – 0.100	0.017 – 0.172	0.3
Manganese (Mn)	0.001 – 0.019	0.013 – 0.192	0.05
Silver (Ag)	<0.0005	<0.0005	0.1
Zinc (Zn)	<0.0005 – 0.0012	<0.0005 – 0.0009	5
Unregulated Inorganics			
Calcium (Ca)	1.3 – 2.2	14 – 34	Not Regulated
Carbon Dioxide – Free (CO_2-F)	0.15 – 1.5	Not Tested	Not Regulated
Carbon Dioxide - Total (CO_2-T)	6.8 – 12	Not Tested	Not Regulated
Cobalt (Co)	<0.001	<0.001	Not Regulated
Magnesium (Mg)	0.52 – 0.94	6.1 – 16	Not Regulated
Molybdenum (Mo)	<0.001	<0.001	Not Regulated
Nickel (Ni)	<0.0005	<0.0005 – 0.0008	Not Regulated
Potassium (K)	<0.22 – 0.29	2.2 – 3.4	Not Regulated
Sodium (Na)	2.4 – 4.0	10 - 24	Not Regulated
Strontium (Sr)	0.010 – 0.019	0.068 – 0.074	Not Regulated
Vanadium (V)	<0.0005	0.0022 – 0.0054	Not Regulated

MCL = maximum contaminant level
SMCL = secondary maximum contaminant level

Nutrients

Nutrients are a subclass of organic and inorganic compounds that help support the growth of microorganisms and algae in water. They can either be naturally occurring or present in the environment as a result of agricultural activities or insufficient treatment and/or improper disposal of sanitary waste (e.g., septage or sewerage). Portland monitors for nutrients regularly at the entry points to the distribution system for both the Bull Run and CSSWF groundwater sources.

Table 32 – Nutrient Levels in Treated Bull Run and CSSWF Groundwater, FY 2010-11 through FY 2014-15.

Nutrients	Treated Bull Run Water (mg/L)	Treated Groundwater (mg/L)	Regulated Level
Regulated Nutrients			**MCL (mg/L)**
Nitrate (NO_3) as N	<0.01 – 0.07	0.03 – 0.24	10
Nitrite (NO_2) as N	<0.005	<0.005	1
Total NO_2 + NO_3 as N	<0.010 – 0.066	0.037 – 0.240	10
Unregulated Nutrients			
Total Nitrogen (N)	0.29 – 0.51	Not Tested	Not Regulated
Free Ammonia (NH_3-F)	<0.02 – 0.043	<0.02 – 0.17	Not Regulated
Total Ammonia (NH_3-T)	0.23 – 0.62	Not Tested	Not Regulated
Organic Nitrogen (N)	<0.05 – 0.14	Not Tested	Not Regulated
Total Phosphorous (P)	<0.010	0.10	Not Regulated
Reactive Phosphorous (PO_4) as P	<0.003 – 0.004	0.099 – 0.140	Not Regulated
Total Organic Carbon (TOC)	0.78 – 1.80	0.31 – 0.98	Not Regulated
Silica (SiO_2) as Si	3.5 – 4.9	16.5 – 20.0	Not Regulated
MCL = Maximum contaminant level			

Radionuclides

Radionuclides are atomic species or isotopes of certain elements which have unstable nuclei and undergo radioactive decay. Radionuclides are typically naturally occurring, but can also originate from anthropogenic concentration or creation of sources of radiation (e.g. medical, military, scientific and industrial or commercial activities). Portland is required to monitor once every nine-year compliance period for four regulated radionuclides at the entry point to the distribution system of the Bull Run and the CSSWF groundwater sources. Detectible levels of naturally-occurring radon are present in groundwater and, although radon is currently unregulated, it is monitored periodically when the CSSWF groundwater source is in use.

Table 33 – Radionuclide Results for Treated Bull Run and CSSWF Groundwater, FY 2010-11 through FY 2014-15.

Radionuclides	Treated Bull Run Water (pCi/L)	Treated Groundwater (pCi/L)	MCL
Combined Radium-226/228 (pCi/L)	<1.02	<0.87	5 pCi/L
Gross Alpha (pCi/L)	<2.43	<1.43	15 pCi/L
Gross Beta/Photon Emitters (pCi/L)	<3.3	<1.4	50 pCi/L
Uranium (mg/L)	<0. 001	<0.001	0.03 mg/L
Radon (pCi/L)	Not Tested	310 - 370	Not Regulated
MCL = maximum contaminant level pCi = picocuries			

Total Coliform Rule

The Total Coliform Rule (TCR) requires every public water system to monitor for the presence of total coliform bacteria (including *E. coli*) in the distribution system at a frequency proportional to the number of people served. Portland is currently required to collect a minimum of 210 monthly TCR samples and typically collects a monthly target of 240 samples to provide adequate surveillance throughout the distribution system and a buffer in the event some samples are missed or invalidated. The TCR established public health goals and maximum contaminant levels (MCLs) for both total coliform and *E. coli* bacteria. If total coliform (TC) or *E. coli* (EC) are detected in the distribution system, repeat/confirmation sampling must be conducted. The public health goal, called a maximum contaminant level goal (MCLG), is zero for both total coliform and *E. coli* bacteria. The maximum contaminant levels (MCLs) are set as follows:

Table 34 – Total Coliform Maximum Contaminant Level Goals

Analyte	Maximum Contaminant Level (MCL)
Total Coliform	Greater than 5% of samples in a month are total-coliform-positive
E. coli	Routine sample and a confirmation sample are both total-coliform-positive, and one is also *E. coli* positive

A violation of either MCL results in a required public notification by the water system. For these public notices, the timing and precautionary language required for an *E. coli* MCL violation is more stringent than that required for a total coliform MCL violation. For an *E. coli* violation, PWB is required to issue a Boil Water Notice (BWN) for the affected area within twenty-four hours. For a total coliform violation, PWB is required to notify all affected customers within thirty days.

Table 35 – Portland Water Bureau TCR Violations, FY 2009-10 through FY 2014-15

Date	Type of Violation	Sample Location	BWN Issued?
November 28, 2009	*E. coli* MCL	Reservoir 3 Outlet	Yes
July 20, 2012	*E. coli* MCL	Reservoir 3 Outlet	Yes
September 2013	Total coliform MCL	Southwest Portland (Bertha 750 pressure zone)	No

In a fourth incident, during May 2014, OHA required PWB to issue a Boil Water Advisory when *E. coli* was detected at three separate east-side sites on three consecutive days. One sample was from the Mt. Tabor Reservoir 1 outlet, one sample was from the Mt. Tabor Reservoir 5 outlet and one sample was from an east-side distribution system site. None of the confirmation samples at any of the sites tested positive for coliform bacteria so this was not a TCR violation. However TCR monitoring was the basis for the state-imposed public notice.

Disinfection Byproducts

Disinfection byproducts (DBPs) are formed when naturally occurring organic matter in the water react with disinfectants such as chlorine. These DBPs, if consumed in excess of the MCL over many years, may lead to increased health risks. DBPs are currently regulated under the Stage 2 Disinfectant and Disinfection Byproducts Rule (Stage 2 DBP Rule). Under the Stage 2 DBP Rule, compliance with the maximum contaminant levels for two groups of disinfection byproducts, Trihalomethanes (THMs) and Haloacetic Acids (HAAs) is calculated as the Locational Running Annual Average (LRAA) for each monitoring location in the distribution system. Portland currently monitors quarterly (twice in each 6-month monitoring period) for DBPs at 12 distribution system locations.

Table 36 – Stage 2 DBP Distribution System Results, April 2012 through June 2015.

Disinfection Byproduct	Distribution System Finished Water (mg/L)	Max LRAA at any of the 12 sampling sites (mg/L)	MCL (mg/L)
Total Trihalomethanes (TTHM)	0.0032 – 0.0470	0.033	0.080 LRAA
Chloroform	0.0023 – 0.0455		
Bromodichloromethane	<0.0005 – 0.0015		
Dibromochloromethane	<0.0005		
Bromoform	<0.0005		
Five Haloacetic Acids (HAA5)	<0.006 – 0.070	0.039	0.060 LRAA

Monochloroacetic acid	<0.006	
Dichloracetic acid	<0.005 – 0.037	
Trichloroacetic acid	<0.006 – 0.035	
Bromoacteic acid	<0.003	
Dibromoacteic acid	<0.003	
LRAA = locational annual running average MCL = maximum contaminant level		

Lead and Copper rule

Portland Water Bureau complies with the Lead and Copper Rule (LCR) through a Lead Hazard Reduction Program (LHRP) which consists of limited water treatment for chemical corrosion control, testing and monitoring, education, and outreach measures to minimize the risk of exposure to all sources of lead.

Corrosion control treatment consists of the addition of sodium hydroxide during the treatment process to raise the pH of the water, which reduces the dissolution of metals from pipes and plumbing fixtures. The target pH at the two entry points to the distribution system is 8.0, and daily entry point pH data is submitted on a monthly basis to the OHA.

Portland participates in a Joint Monitoring Plan together with a subset of its wholesaler providers in order to comply with other monitoring requirements of the LCR. Water is tested quarterly at a minimum of 25 locations in the distribution system for pH and alkalinity by PWB and its wholesale customers. In addition, a minimum of 100 first-draw water samples are collected from LCR Tier 1 Home customer taps every six months. Tier 1 Homes are single family structures that contain copper plumbing installed with lead solder between January 1, 1983 and June 30, 1985. Compliance with the action level is based on the 90th percentile values for lead and copper for all samples collected during a sampling period. If the action level for lead or copper is exceeded during any of the sampling periods, PWB must conduct additional outreach and education. Action levels are set by USEPA and enforced by OHA. The action level for lead is 0.015 mg/L (15 µg/L) and the action level for copper is 1.3 mg/L (1,300 µg/L).

Portland also provides free non-regulatory water testing for lead and copper to customers requesting it under the Lead in Water Education and Testing (LWET) program.

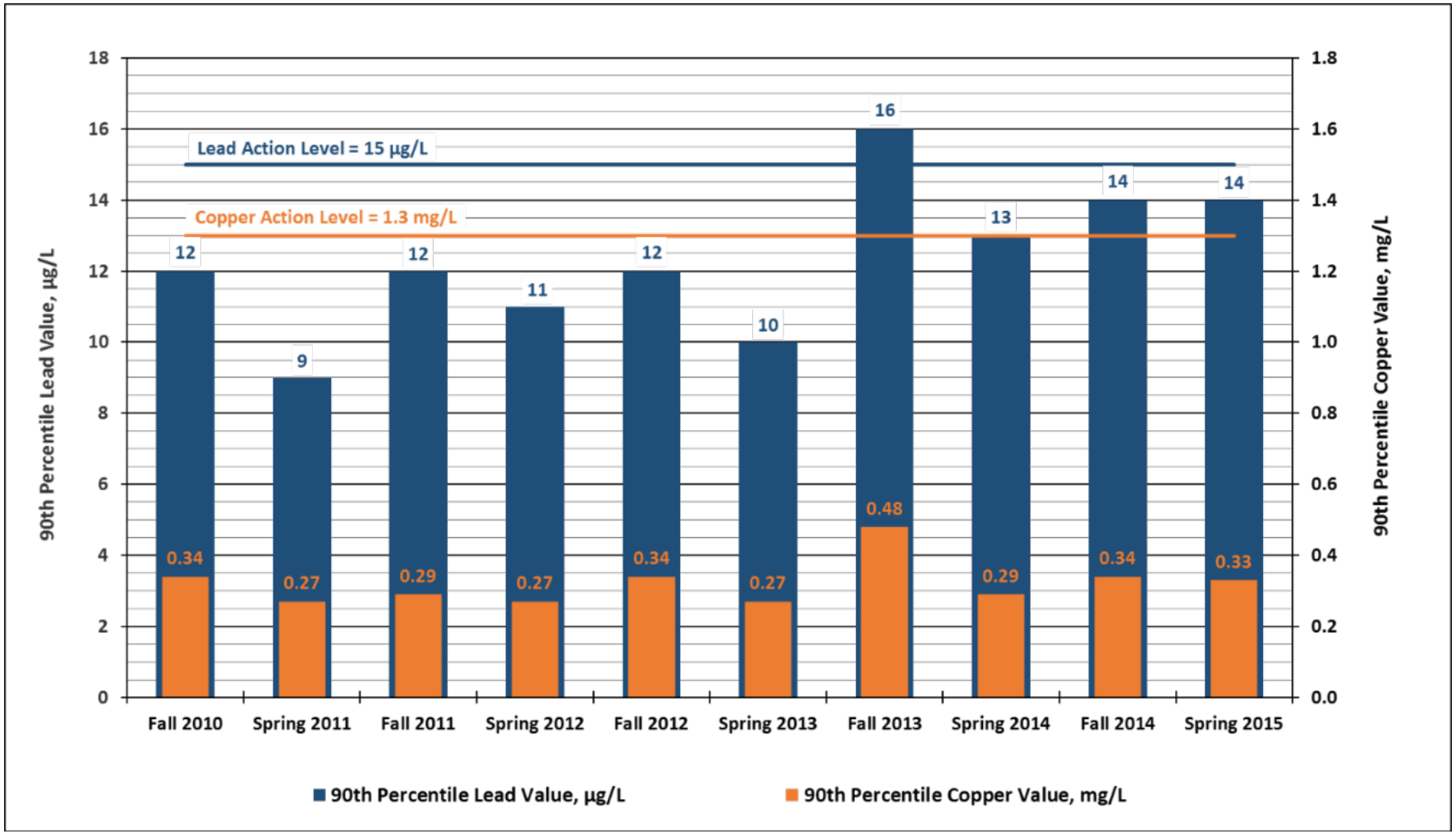

Figure 11 – LCR Tier 1 Home Lead and Copper 90th Percentile Results, FY 2010-11 through FY 2014-15.

6. PERSONNEL

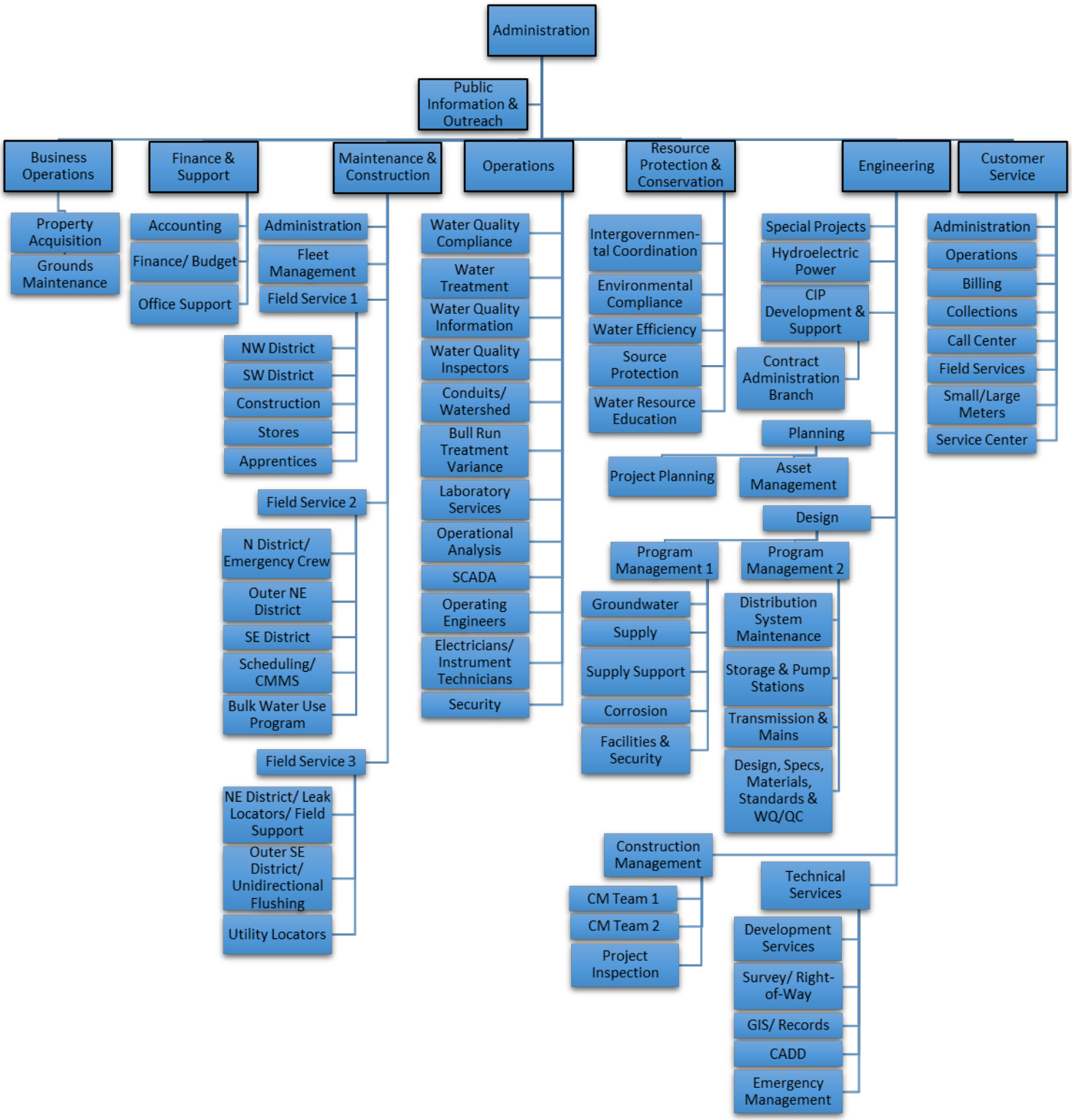

Figure 12 – Organizational Chart

Payroll Summary

Table 37 – Personnel Data

Fiscal Year (as of June 30th)	2010-11	2011-12	2012-13	2013-14	2014-15
Average Number of Full Time Employees	587	567	565	532	543
Average Number of Part Time Employees	15	19	19	13	24
Permanent Employees	626	619	617	590	568
Hired	17	20	28	42	52
Resigned, Terminated	18	28	33	31	52
Retired	8	6	17	9	10
Payroll Recap					
Payroll Cost	$56,121,938	$57,370,003	$57,884,622	$57,148,032	$58,377,638
Hours Worked	1,011,811	982,281	978,626	917,355	946,498
Vacation Hours	89,339	89,707	87,499	89,044	86,435
Management Leave	9,190	8,047	8,005	3,354	6,336
Sick Leave Hours	41,056	35,143	34,465	30,657	39,731
Injury Leave Hours	675	364	632	480	2,541
Overtime Hours	24,714	19,466	22,069	19,542	25,590

Figure 13 – Kelly Butte Reservoir

7. APPENDIX

Definitions:

"Alkalinity" is a measure of the ability of water to neutralize acids. Alkaline compounds in water such as bicarbonates (baking soda is one type), carbonates, and hydroxides remove H+ ions and lower the acidity of the water (which means increased pH). The measure of alkalinity is the sum of concentrations of these substances measured as equivalent $CaCO_3$.

"Ancillary charges" mean incidental costs necessary to place a capital asset into its intended location, condition, or use. Examples include title fees, attorney or architect fees, freight charges, taxes, and site preparation costs. Ancillary charges are capitalized in addition to the purchase price and/or construction cost of capital assets.

"Building" means a relatively permanent structure used to house persons or property. Buildings may be purchased or constructed by the City. Major components may be capitalized separately. Also classified as buildings are fixtures that are permanently attached to and made part of buildings in such a manner that removal is not possible without damage to the building. The new Interstate facility is an example.

"Capital Asset" means a tangible or intangible asset having significant value that is used in operations and has an initial useful life that benefits more than a single CAFR reporting period. Capital assets include land, land improvements, buildings, infrastructure, equipment, leasehold improvements, and construction in progress.

"Capital Lease" means a lease which transfers the benefits and risks inherent in the ownership of facilities and/or equipment to the lessee, who in turn capitalizes the leased assets and records the capital lease as a liability. See Accounting Administrative Rule FIN-6.07 – Leases.

"Color" in water is caused by substances in solution, known as *true color*, and by substances in suspension, mostly organics, known as *apparent or organic color.*

"Construction in progress" means costs incurred for buildings, improvements, infrastructure, software, or other projects which remain incomplete and as a result, have not yet been placed into service. Construction in progress is not depreciated.

"Depreciation" means the systematic allocation of the cost of a capital asset, less any salvage value, over the estimated useful life of the capital asset. The City calculates and records depreciation expense using the straight-line method.

"Easement" means the right to a specific limited use of land or other property, though it does not transfer actual ownership of the land. An easement is classified as land, and is not depreciated.

“Equipment” means property with a useful life greater than one year that does not lose its identity when removed from its location and is not changed materially or expended in use. Equipment does not include the cost of internally developed software.

“Fair value” means the amount paid, or that would be paid, between a willing seller and willing buyer. Fair value may be estimated using catalogs, price lists, historical records, or recent sales or purchases of comparable assets.

“Hardness” in water is caused by the presence of polyvalent (but not singly charged) metallic cations. Total hardness is typically defined as the sum of the concentration of the divalent cations of calcium and magnesium, expressed in terms of milligrams per liter as calcium carbonate ($CaCO_3$).

“Historical cost” means the purchase price or construction cost of a capital asset including any ancillary charges.

“Hydraulic Grade Line (HGL)” - The surface or profile of water flowing in an open channel or a pipe flowing partially full. If a pipe is under pressure, the hydraulic grade line is that level water would rise to in a small, vertical tube (open to atmospheric pressure) connected to the pipe.

“Improvement” means an addition or change to a capital asset, other than maintenance and repairs, which extends its useful life and/or improves its efficiency, capacity, or usability. Improvements to land such as retaining walls, swimming pools, or picnic facilities that have identifiable useful lives, shall be capitalized as Improvements. Improvements to buildings shall be capitalized as Buildings and improvements to equipment as Equipment. Leasehold improvements are classified separately.

“Infrastructure” means long-lived capital assets that are normally stationary and can be preserved for a significantly greater number of years than most capital assets. Examples are bridges, roads, street lighting, water mains, and sewer systems. Land associated with infrastructure should be reported as land rather than infrastructure. Buildings may be classified as infrastructure if they represent components of an infrastructure subsystem or network.

“Intangible asset” means an asset lacking physical substance that has a useful life greater than a single Comprehensive Annual Financial Report (CAFR) reporting period, for example, computer software. See also Accounting Administrative Rule FIN-6.09 - Capitalization of Computer Software Developed or Obtained for Internal Use.

“Land” means real estate held for productive use. The cost of land shall include any ancillary charges necessary to ready the land for its intended use such as draining, filling, and grading. Land is not depreciated. Land improvements include things like fences, landscaping, and swales.

“Maintenance and repairs” mean periodic expenditures that sustain an asset in good working order throughout its estimated useful life. Maintenance and repairs do not expand the capacity or extend the useful life of the asset and are therefore not capitalized.

“Minor equipment” means tools and equipment with a unit cost of less than $5,000. Minor equipment is expensed at acquisition and is not capitalized.

“New component” means the addition of an item, structure, or function to an existing asset for which no such item, structure, or function previously existed. A new component shall be treated as a separate asset.

“pH” is a measure of the strength of an acid or base. In water, pH is expressed by the number of hydrogen or hydroxide ions in the water. A *neutral* solution has a pH of 7. Solutions with a pH below 7 are acidic; solutions with a pH above 7 are basic.

“Plant” assets are assets with a useful life of more than one year that are used in producing revenues in a business's operations.

“Salvage Value” means the expected residual value of a capital asset at the end of its useful life. Salvage value is deducted from cost in calculating depreciation.

“Specific Conductance” is a measure of the ability of water to conduct an electrical current. Conductivity measurements are used as a way of measuring the ionic content in a solution. It is highly dependent on the amount of dissolved solids (such as salt) in the water. Pure water, such as distilled water, will have a very low specific conductance, and sea water will have a high specific conductance.

“Total Solids” are the material residual left in a vessel after the evaporation of the sample at 103-105°C. Total solids include total suspended solids and total dissolved solids.

“Total Dissolved Solids” are in solution and pass through the pores of a standard glass-fiber filter. Dissolved solids are determined by passing the sample through a filter, collecting the filtrate in a weighed drying dish, and evaporating the liquid at 180°C. The gain in weight represents the dissolved solids.

“Total Suspended Solids” are the material retained on a standard glass-fiber disk from a sample of water. The filter is weighed before filtration, dried at 103-105°C, and weighed again. The increase in weight is the amount of suspended solids.

“Turbidity” is a measure of the light-transmitting properties of water and is comprised of suspended and colloidal material. Turbidity is expressed in *nephelometric turbidity units* (NTU)**.**

“Useful Life” means the typical estimated life of a capital asset placed into service at the purpose for which the asset was acquired.

8. ERRATA

This section contains statistics that were corrected from the 2013-14 report.

Table 38 – Errata

Section	Page Number	Correction
1	1	The CSSWF can supply 10 - 102 MGD; changed from 82-102 MGD.
4	12	FY 2013-14 Report total miles of main should be 2246.17 not 2261.88
4	13	FY 2013-14 Report total of all valves should be 53,715 not 51,806
4	17	Powell Valley 160th Avenue #2 HGL is 417 ft, not 170 ft; Install Year is 1964 not 1962.
4	17	Powell Valley 160th Avenue #3 HGL is 417-ft, not 170-ft; Install Year is 1962 not 1974.
4	21	FY 2013-14 Report total number of pump stations should be 39 not 41.

MGD = million gallons per day
HGL = Hydraulic grade line
Ft = feet
FY = Fiscal year
CSSWF = Columbia South Shore Well Field