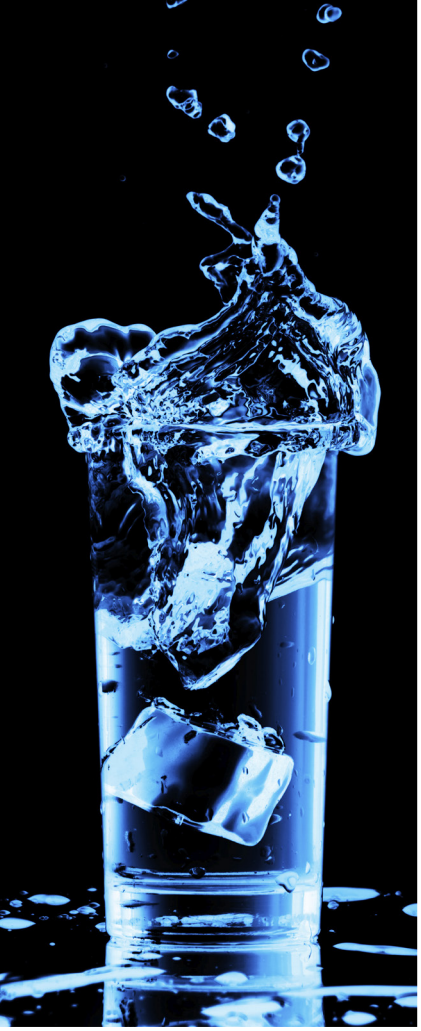


2016

City of Bellevue

Water System Plan

Volume 1

Bellevue City Council
Resolution No. 9104
June 6, 2016

CITY OF BELLEVUE WASHINGTON

City of Bellevue

Water System Plan

6/23/2016

6-29-16

STATE OF WASHINGTON
DEPARTMENT OF HEALTH
NORTHWEST DRINKING WATER REGIONAL OPERATIONS
20425 72nd Avenue South, Suite 310, Kent Washington 98032-2388

January 18, 2017

Douglas Lane, PE
City of Bellevue
450 110th Avenue NE
Bellevue, Wa 98009-9012

RE: Bellevue, City of Water System, ID# 05575
King County
Water System Plan – 2017
Submittal #:15-1102

Dear Mr. Lane:

The City of Bellevue water system plan (WSP), received in this office on November 9, 2015, with a subsequent submittal on December 12, 2016, has been reviewed and in accordance with the provisions of WAC 246-290-100, is hereby **APPROVED**.

Approval of this WSP is valid as it relates to current standards outlined in Washington Administrative Code (WAC) 246-290 revised April 2016, WAC 246-293 revised September 1997, RCW 70.116, and is subject to the qualifications herein. Future revisions in the rules and statutes may be more stringent and require facility modification or corrective action. An approved update of this WSP is required on or before **January 18, 2027**, unless ODW requests an update or plan amendment pursuant to WAC 246-290-100(9).

APPROVED NUMBER OF CONNECTIONS

The analysis provided in this WSP shows the water system has sufficient capacity to meet the growth projections during this planning period. The City of Bellevue water system can support an **"unspecified"** designation for its approved number of connections. A specific number of approved connections will not be applied at this time. Development may occur in compliance with the schedule and information provided in this WSP. This designation may be rescinded (and replaced with a specified number of approved connections) if ODW determines that the WSP is no longer representative of system activities.

LOCAL GOVERNMENT CONSISTENCY

This document meets local government consistency requirements for WSP approval pursuant to RCW 90.03.386 and RCW 43.20.

SERVICE AREA AND DUTY TO SERVE

Pursuant to RCW 90.03.386(2), the service area identified in this WSP service area map may now represent an expanded "place of use" for this system's water rights. Changes in service area should be made through a WSP amendment.

The City of Bellevue has a duty to provide new water service within its retail service area. This WSP includes service policies to describe how your system plans to provide new service within your retail service area.

CONSTRUCTION WAIVERS

Standard Construction Specifications for distribution main extensions in this WSP are approved. Consistent with WAC 246-290-125(2), this system may proceed with the installation of distribution main extensions provided this system completes and keeps on file the enclosed construction completion report form in accordance with WAC 246-290-125(2) and WAC 246-290-120(5) and makes it available for review upon request by ODW.

WATER RESOURCES

Below is the general regulatory language that applies to all water system approvals:

The department's review of your water system plan will not confer or guarantee any right to a specific quantity of water. The approved number of service connections is based on your representation of available water quantity. If the Washington Department of Ecology, a local planning agency, or other authority responsible for determining water rights and water system adequacy determines that you have use of less water than you represented, the number of approved connections may be reduced commensurate with the actual amount of water and your legal right to use it.

Thank you for your cooperation. King County is being notified of the terms and requirements of this approval and the determination of the approved number of connections. If you have any questions or wish to check our records, you may contact either of us at the numbers listed below.

Sincerely,

Robert James, P.E.
Regional Office Manager
(253) 395-6768

Richard Rodriguez
Regional Planner
(253) 395-6771

Encl: Construction Completion Report

cc: Brietta Carter, DOH
Steve Hirschey, King County UTRC
Seattle/King County Health
Ria Berns, Dept. of Ecology, NWRO

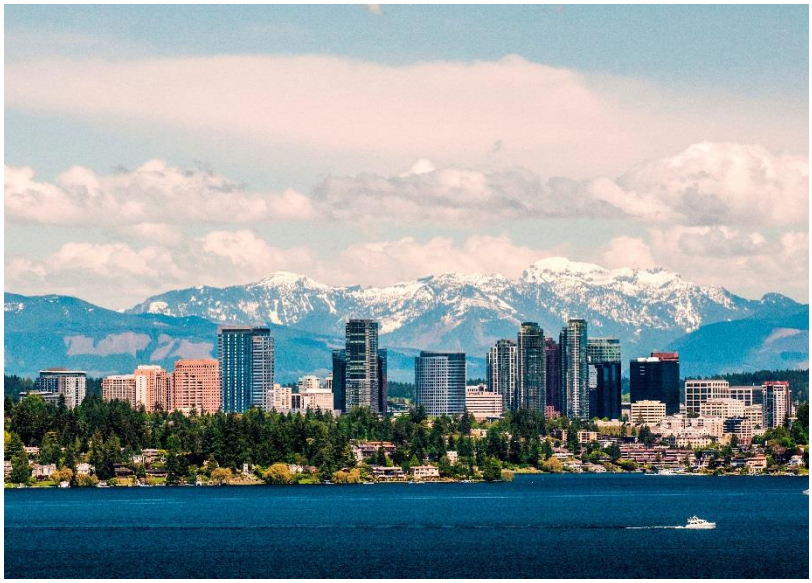
Executive Summary

The Water System Plan provides a comprehensive overview of water system policies and operations, identifies challenges and opportunities, and develops recommendations so Bellevue can continue to provide a reliable supply of safe, high quality drinking water that meets the community's needs in an environmentally responsible and cost-competitive manner, consistent with Bellevue City Council Interest Statement approved March 23, 2015.

System History and Background

The City of Bellevue (the City) water utility service area includes the entire City of Bellevue, the Cities of Clyde Hill and Medina, the Towns of Hunts Point and Yarrow Point, and small adjacent portions of the City of Issaquah (South Cove area), the City of Kirkland (east of Watershed Park) and unincorporated King County. Since the founding of the original Bellevue Water District near Meydenbauer Bay in 1944, the utility has protected water quality and public health while facilitating economic vitality, desirable neighborhoods and significant growth.

The Water System Plan (the Plan) reflects back on a decade of change since Bellevue's 2006 Water Comprehensive Plan, while charting a course to navigate the challenges ahead. The Plan addresses policies, operational practices, financing, system expansion to accommodate growth, and aging of infrastructure. It revises forecasted growth and uses improved analytical tools to evaluate data and recommend improvements.



The Plan has been prepared in conformance with Washington State Department of Health criteria, as required by WAC 246-290-100. It forecasts anticipated water needs and provides a basis for capital improvement planning and financing for the next 20 years, based on projected growth.

The City has consulted with Bellevue's Environmental Services Commission (ESC) for review and direction of the Plan at key points of Plan development, including policy development review, evaluation criteria, results analysis and recommendations. The ESC is a panel of seven citizens who reside in Bellevue's water utility service area, appointed by Bellevue City Council to review utility policy and budgets. Their monthly meetings are open to the public. Additional public input was invited at an Open House and during Washington State Environmental Policy Act (SEPA) review (see Appendix A).

Policies

Bellevue's Comprehensive Plan was updated and adopted (City Ordinance No. 6251, August 2015) as required by the Washington State Growth Management Act (GMA). The Utilities Element of the Comprehensive Plan (see Appendix B) provides policies that guide the water utility's provision of a reliable, cost-effective, safe, and high quality drinking water supply. Consistent with the GMA, Bellevue's Comprehensive Plan policies require the Utilities Department to anticipate and facilitate growth, and the water utility's performance is measured in part on its responsiveness to zoning and development activity. The Comprehensive Plan also requires the water utility to plan for renewal and replacement. Specifically:

- POLICY ED-32. Continue to identify, construct and maintain infrastructure systems and facilities required to promote and sustain a positive economic climate. Anticipate needs and coordinate city infrastructure investments with economic development opportunities.
- POLICY UT-1. Manage utility systems effectively in order to provide reliable, sustainable, quality service.
- POLICY UT-7. Base the extension and sizing of system components on the land use plan of the area. System capacity will not determine land use.
- POLICY UT-10. Emphasize cost effective management of city utility systems over their lifetime, including planning for their renewal and replacement, balancing risk, and maintaining desired service levels. Forecast future capital and maintenance costs and manage rates so that customer rate revenue funds the cost of ownership equitably across generations.
- POLICY UT-12. Develop and periodically update functional utility system plans that forecast system capacity and needs for at least a 20 year planning horizon.
- POLICY UT-39. Provide a reliable, cost-effective supply of safe, secure, high quality drinking water that meets the community's water needs in an environmentally responsible manner.

This Water System Plan is consistent with Bellevue's Comprehensive Plan policies, and serves as the functional plan to implement those policies. Furthermore, the Water System Plan itself defines Utilities-specific policies. These Utilities-specific policies, found in Chapter 2, focus on:

- Customer Service
- Facility Abandonment
- Fire Protection
- Service Area
- Water Quality
- Regional Policy Interface
- Financial Policies

The Plan includes minor clarification to several policies since the 2006 Plan, but also some significant changes. The most significant changes to existing policies include:

- The Service Ownership/ Responsibility policy was re-worded for consistency with City Code, to clarify existing practices regarding ownership of new facilities on private property (such as hydrants and mains), and to clarify where public ownership ends on service lines.
- The Facility Abandonment policy was split into two policies, Facility Abandonment and Facility Repurposing, to reflect those separate needs and respond to emerging issues.
- The Reclaimed Water Use was re-written to acknowledge the relevant studies completed by Cascade Water Alliance and King County Wastewater Treatment Division. Previous policy language was obsolete.

In addition, several new policies have been added to the Plan:

- **Drinking Water Storage for Emergency Supply Outages**. This policy articulates the City's longstanding practice of maintaining the Washington State Department of Health minimum recommended emergency storage volume, representing one average day of water use.
- **Green Buildings**. This policy supports development of "net-zero" and sustainable buildings, while ensuring equitable treatment of new and existing customers regarding the costs to provide fire protection and backup supply (where applicable) to these buildings.
- **Water Rights for Supply Redundancy**. This policy acknowledges the City's groundwater rights and allows for their use as emergency water supplies.
- **Regional Policy Development**. This policy guides Bellevue's role in influencing regional decision-making in the interests of the City and Bellevue's rate payers.

System Infrastructure

Bellevue's water service area extends over 37 square miles, serving a local employment base of over 150,000 jobs, and a residential population of over 145,000 in 2014. The system includes approximately 69 separate pressure zones, 6,000 fire hydrants, 10,500 main isolation valves, 37,500 customer accounts with 41,000 customer meters, 25 active reservoirs (plus 2 decommissioned), 22 pump stations, 145 active pressure reducing valve (PRV) stations, and over 600 miles of pipe. Bellevue also has legacy groundwater rights to numerous wells, totaling roughly 6.6 million gallons per day.

Since the 2006 Plan, the City has improved its system assessment and understanding. The asset management program assures funding for renewal and replacement to address age-related deterioration and failures. The system inventory (Maximo) and mapping database are continuously updated; field testing of system performance and advanced hydraulic modeling software provide staff with powerful analytical tools. System infrastructure is continually observed during regular maintenance and in response to customer complaints. Bellevue embraces the principles of a High Performance Organization, which involves field crews and customer feedback in the decision-making process.

While Bellevue's water system overall is well-maintained and functional, several emerging challenges have been identified:

- Older water age in system extremities has resulted in low chlorine residuals.
- Obsolete air vacuum/ air release valves in the system could pose water quality risks.
- Current and previous use of the emergency well sites preclude expanded use of the wells.
- About 4% of households still have less than 1,000-gpm available fire flow.
- Some customers near West Lake Sammamish Blvd are not provided the minimum 30-psi pressure dictated in Bellevue's customer service policies.
- Although 24/7 staff effort maintained continuous service in the 6-day 2006 blackout, South Bellevue may be vulnerable to water supply disruption during an extended power outage.
- The vulnerability and criticality of the water distribution system during a disaster such as a major earthquake is not well understood.
- Bellevue currently has no independent water supply in case of a water supply disruption.

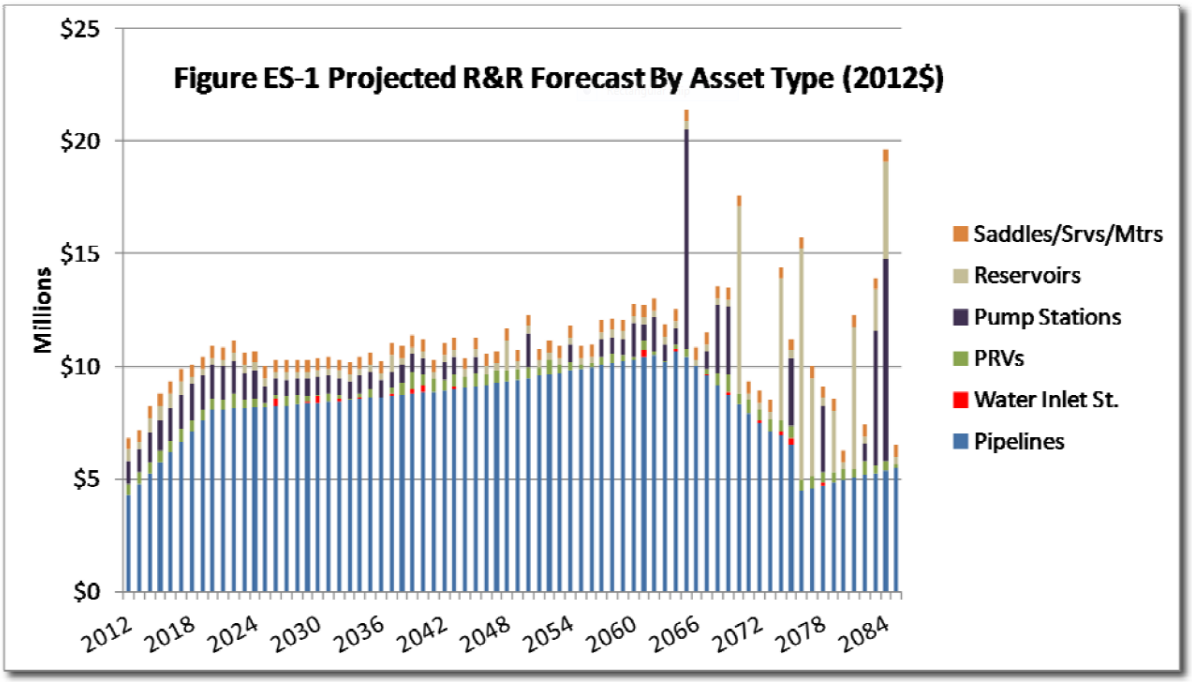
Asset Management

Bellevue's water infrastructure is aging. Planning for system renewal and replacement (R&R) is necessary to ensure adequate long-term financing and to manage the risk of system failures.

Bellevue's Utilities Department Asset Management Program incorporates the five core components of the EPA asset management framework:

1. Determine The Current State of the Assets
2. Define Service Levels
3. Determine Asset Criticality and Risk
4. Determine Best Operating and Maintenance (O&M) and Capital Improvement Program (CIP) Strategies to Minimize Life Cycle Costs
5. Determine Funding Strategy

Based on industry standards for asset life expectancy, as well as local factors specific to the City's water distribution system, in 2012 Bellevue developed a 75-year schedule of annual costs for funding anticipated R&R projects, as shown in Figure ES-1. In 2015-2016, Bellevue will be developing a 5-Year Strategic Asset Management Roadmap, to continue development and further refinement of the Asset Management Program.

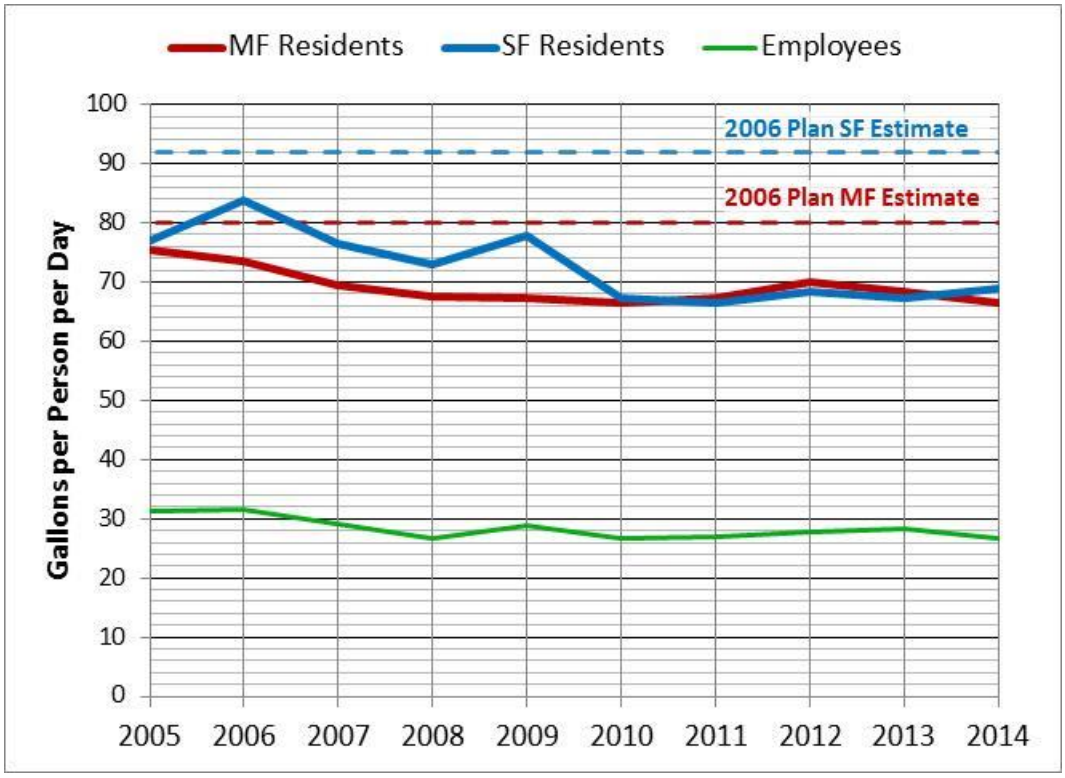


Water Consumption

Bellevue's water system is continually analyzed to understand water usage patterns, assess system performance, and plan to meet future needs.

Per capita water consumption in Bellevue's water service area has declined, consistent with other utilities in the region. Figure ES-2 shows the average Bellevue water customer's usage for the most recent 10-years, and the projected peak usage from the 2006 Water Comprehensive Plan. This decline presents challenges for maintaining water quality and generating stable revenues, but also opportunities to defer capital expenditures until they're needed.

Figure ES-2: Actual Per Capita Water Demands



How customers use water throughout the day has also changed dramatically. Figure ES-3 shows the typical water demand pattern on a peak day in 1963, 1992, and today. By understanding these trends, Bellevue has been able to demonstrate a reduced need for reservoir "equalizing" storage volume as water levels fluctuate less throughout the day, and therefore reduced capital expenditures.

Figure ES-3: Historical and Current Water Usage Patterns

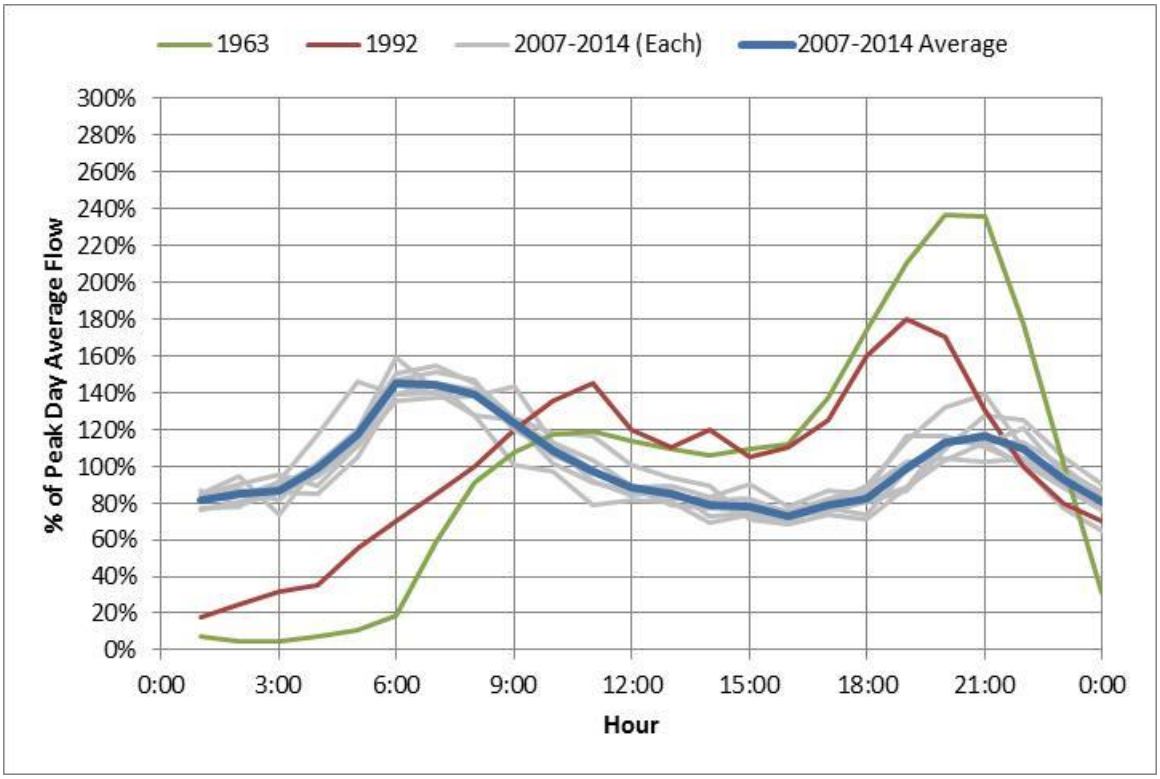


Table ES-1 summarizes updated criteria for system-wide demand projections, based on the range of recent water usage shown in Figure ES-2, and on seasonal analysis described in Chapter 3. The range of criteria shown were used to develop the revised future demand projections discussed on the following pages.

Table ES-1: Recommended Average Day Water Use Projection Criteria[1]

	High Demand Year (Used for Capacity Analysis)	Low Demand Year (Used for Water Quality Analysis)	2006 Water Comprehensive Plan Estimate
Single-Family Resident	84 gallons/day	66 gallons/day	92 gallons/day
Multi-Family Resident	75 gallons/day	66 gallons/day	80 gallons/day
Employee	32 gallons/day	27 gallons/day	90 gal/1,000 sf
Single-Family Household	232 gallons/day	185 gallons/day	248 gallons/day
Non-Revenue Demand	6% to 9%[2]	3%	8.5%
Max Day Demand/ Average Day Demand	2.2	1.7	2.25
Winter Day Demand/ Average Day Demand	N/A	0.75	N/A

1. These criteria are intended for system-wide modeling, but are not appropriate in all cases. For design of localized infrastructure, design criteria should be developed based on location-specific water usage.
2. 6% recommended for system-wide demand projections, 9% for localized analysis

Growth and Development

Bellevue's water service area experienced significant population growth throughout the 2000's. Although the recession slowed growth in 2008-2009, Bellevue's service area continues to densify and is projected to include roughly 180,000 residents and 213,000 jobs by 2040, as shown in Figure ES-4. Most of this growth is anticipated to occur Downtown and in the Bel-Red Corridor.

To estimate future water demands, the Water System Plan uses population and land use projections developed by the Bellevue Planning and Community Development Department, and by applicable planning agencies outside Bellevue's City Limits. The projections consider the Bellevue Comprehensive Land Use Plan, and are consistent with Puget Sound Regional Council forecasts and U.S. census data. Population and water demand projections consider ultimate growth within the City's urban growth boundary limits, in accordance with GMA requirements.

Population and employment projections are used to evaluate the system's ability to meet future needs, and form the basis of recommendations for capacity expansion projects.

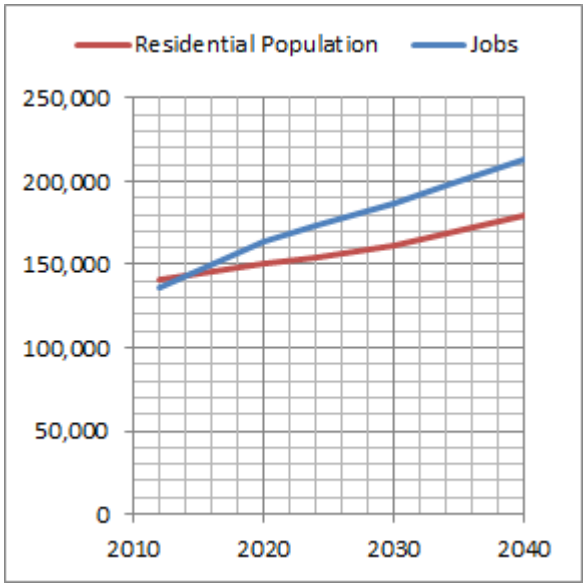
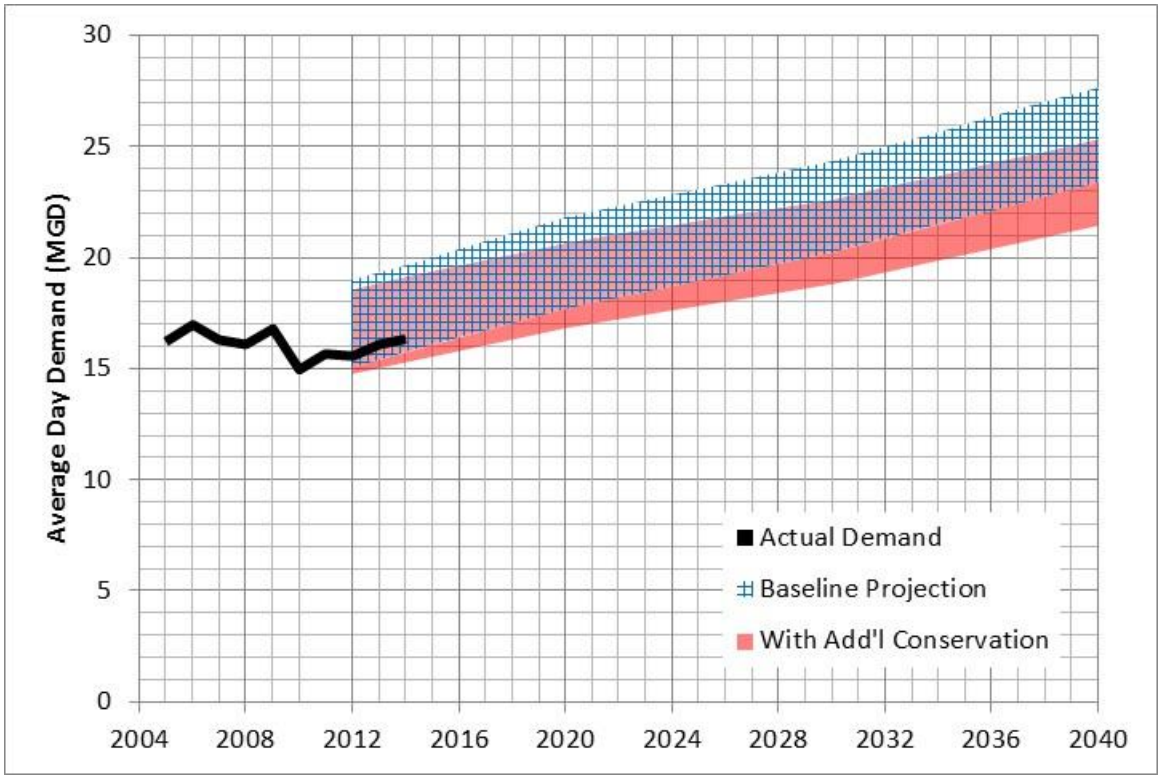


Figure ES-4: Projected Water Service Area Population and Employment

Figure ES-5 shows projected average day water demands ("Baseline Projection") based on updated per capita demands (Table ES-1) applied to forecasted growth (Figure ES-4). Bellevue coordinates with our water supplier, Cascade Water Alliance, to meet future water supply and treatment needs, while Bellevue's CIP projects W-103, W-104, W-105 and W-106 have been established to meet future needs for storage, supply inlet capacity and transmission capacity in Bellevue's system.

Figure ES-5 also projects future demands that would occur with additional water conservation, based on Cascade Water Alliance's stated future goals. It is important to realize the opportunities of further per-capita reductions in water demand, and to understand the potential unintended consequences of building excess capacity. Bellevue will continue to monitor water use trends to inform decision making and optimize the use of existing infrastructure in the years ahead.

Figure ES-5: Projected Water Demands



Recommended System Improvements

The City of Bellevue updates its Capital Investment Program (CIP) budget every 2-years. Table ES-2 shows the City's currently adopted drinking water CIP projects and programs. It is recommended that capital investment continue, with bi-annual reviews to adjust funding and assess performance in meeting Bellevue's aging infrastructure, growth, and operational needs:

Table ES-2: Current 2015-2021 CIP Budget

CIP Plan No.	Project Name	2015-2021 Budget
W-16	Small Diameter Water Main Replacement	$60,769,000
W-67	Pressure Reducing Valve (PRV) Rehabilitation	$2,855,000
W-69	Minor Water Capital Improvement Projects	$1,605,000
W-82	Fire Hydrant Improvements	$621,000
W-85	Structural/Seismic Reservoir Rehabilitation	$5,949,000
W-91	Water Pump Station Rehabilitation	$13,671,000
W-98	Replacement of Large Commercial Water Meters	$3,838,000
W-99	Water Service Line and Saddle Replacement Program	$1,771,000
W-103	Increase Reservoir Storage for West Operating Area	$2,993,000
W-104	Increase Water Supply for West Operating Area	$5,229,000
W-105	Water Facilities for NE Spring Blvd Multi-Modal Corridor	$1,648,000
W-106	Utility Facilities for NE 4th St Extension	$295,000
W-107	East Link Water Relocation	$2,630,000
TOTAL		$103,874,000

Table ES-3 summarizes the new investments that are recommended in Chapter 4 and summarized in Chapter 9. The source of funding and budget process (CIP vs. operating budget) will be determined during each bi-annual budget update.

Table ES-3: Proposed New Projects and Programs

WSP Section	Description	Applicable Policy
4.1	Air & Vacuum Release Valve Improvements	Water Quality Responsibility; Cross Connection Control
4.4	Advanced Metering Infrastructure (AMI)	Efficient Water Use
4.5	Fire Flow Improvements	Service Pressure and Flow; Service Reliability; Fire Flow Improvement Program
4.6	Access Storage for RV300, WD400, WD450	Drinking Water Storage for Emergency Supply Outages
4.7	Inlet Station Rehabilitation	Service Reliability; Financial Policies/ Capital Investment Program Policies
4.7	West Lake Sammamish AC Main Replacement	Service Reliability; Financial Policies/ Capital Investment Program Policies
4.7	Isolation Valve Replacement Program	Service Reliability; Efficient Water Use
4.7	Check Valve Replacement Program	Service Reliability; Fire Flow Responsibility; Emergency Preparedness
4.7	Re-Line Cougar Mountain 3A Reservoir	Service Reliability; Financial Policies/ Capital Investment Program Policies
TOTAL		

Multiple engineering evaluations are recommended in Chapter 4, as shown in Table ES-4. Based on the results of these evaluations, additional capital projects or programs may be recommended in future CIP updates, however those cannot be identified at this time.

Table ES-4: Proposed Engineering Evaluations

WSP Section	Description	Applicable Policy
4.1	Chlorine Residual Evaluation	Water Quality Responsibility
4.8	Backup Power Evaluation	Emergency Preparedness; Service Reliability
4.8	System-Wide Seismic Resiliency Evaluation	Emergency Preparedness;
4.8	Emergency Well Development	Emergency Preparedness; Water Shortage Response; Water Rights
TOTAL		

Summary of Recommendations

Large potential capital recommendations in this chapter are summarized below. More detailed information is provided in Chapter 4:

- Evaluate alternatives to improve chlorine residuals, and implement proposed solutions.
- Complete air & vacuum release valve evaluation and improvements.
- Expand inlet capacity to the WOA.
- Implement Advanced Metering Infrastructure (AMI) throughout the system.
- Construct NH470 fire flow & reliability improvements
- In cooperation with the City of Issaquah, add a PRV and separate South Cove pressure zone, to improve fire flow and pressure in SA270.
- Use the City's new hydraulic model to identify operational changes and infrastructure improvements to achieve the minimum 1,000-gpm objective throughout the service area.
- Increase access to storage in multiple Storage Regions:
    - Bellevue (includes Downtown, Bel-Red, Wilburton, etc)
    - Pikes Peak
    - Clyde Hill 500 (via increased pumping capacity)
    - SPU-Only (RV300, WD400, WD450)
- Reservoir replacement or rehabilitation indicated in Table 4-14.
- Pump station replacement or rehabilitation indicated in Table 4-15.
- Rehabilitate NE 40th Inlet Station and Enatai Inlet Station.
- Evaluate risk of remaining AC pipe in West Lake Sammamish Pkwy, and prioritize replacement if appropriate.
- Create an isolation valve asset management program, and prioritize rehabilitation.
- Create a check valve asset management program, and prioritize rehabilitation.
- Re-Line Cougar Mountain 3A Reservoir.
- Evaluate needs for backup power.
- Perform a system-wide seismic resiliency evaluation.
- Evaluate optimum use of Bellevue's existing water rights, and add infrastructure as needed.

Finances

The City has a sound financial base that can finance the recommended capital improvements. Bond ratings from Moody's Investors Service and Standard and Poor's indicate a high level of confidence in the ability of the City's utilities to repay debt obligations, if needed. The water utility currently has no outstanding debt.

Conclusion

The Plan supports livable communities and a healthy and sustainable environment through high quality utility services. To accomplish this vision, Bellevue should continue to:

- Provide a reliable, cost-effective supply of safe, secure, high quality drinking water that meets the community's water needs in an environmentally responsible manner.
- Proactively fund system renewal and replacement, in order to maintain service levels, keep rate increases gradual and uniform, and maintain generational equity.
- Expand system capacity to accommodate growth, consistent with the Comprehensive Plan.
- Maintain at least one average day's volume of water in reserve, consistent with industry standards, to balance water supply risks with reservoir costs and the risk of water quality deterioration.

The Plan identifies system deficiencies and investments required to accomplish these objectives and maintain appropriate levels of service. Many of these are ongoing projects (Table ES-2), and some are new projects that address potential regulatory risks.

Some proposed new initiatives reflect new policies, adoption of new technologies, or a deeper focus on emergency preparedness. Specifically:

- Use existing water rights to enhance water supply reliability by developing emergency and standby water supplies.
- Evaluate the costs and benefits of implementing advanced metering infrastructure (AMI).
- Evaluate water system seismic vulnerabilities, and plan long-term investments to reduce the impacts of an earthquake to Bellevue's residents and businesses.
- Supports development of "net-zero" and sustainable buildings, while ensuring equitable treatment of new and existing customers.
- Take a leadership role in influencing regional water policy and decision-making, in the interests of the City and Bellevue's rate payers.

The plan lays the groundwork for 20 more years of economic expansion and excellent quality of life.

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Volume 4: Water Engineering Standards

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References

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Abbreviations and Definitions

AC	Asbestos cement
AFF	Available fire flow
ADD	Average Day Demand
Add'l	Additional
AMD	Average Month Demand
AMI	Advanced Metering Infrastructure
AMP	Asset Management Program
Approx	Approximate, Approximately
APWA	American Public Works Association
AVAR	Air Vacuum/ Air Release Valve
AWWA	American Water Works Association
BAT	Backflow Assembly Tester
BCC	Bellevue City Code
BIP	Bellevue-Issaquah Pipeline
Cascade	Cascade Water Alliance
CCC	Cross-Connection Control
CCF	Hundred Cubic Feet
CCUD	Coal Creek Utility District
CCS	Cross-Connection Control Specialist
CDC.	US Dept of Health & Human Services, Centers for Disease Control & Prevention
CDD	Cooling Degree Days
CESSL	Cedar Eastside Supply Line
CFR	United States Code of Federal Regulations
CI	Cast iron
CIP	Capital Investment Program
CIPC	Cast-in-Place Concrete (Conventional Reinforced)
City	The City of Bellevue
CM	Cougar Mountain
CMP	Coliform Monitoring Plan
DBPs	Disinfection Byproducts
Dept	Department
Dia	Diameter
DI	Ductile iron
DOH	Washington State Department of Health
DSL	Distribution System Leakage
EL	Elevation (feet, NAVD88, unless otherwise noted)
EOA	East Operating Area
EPA	United States Environmental Protection Agency
EPS	Extended Period Simulation
ERU	Equivalent Residential Unit; ADD for a single-family household
FEMA	Federal Emergency Management Agency
Ft	Feet
Ft/s	Feet per second
Gal	Gallon
gpcd	Gallon per Capita per Day
gpd	Gallon per Day

gpm	Gallon per Minute
GST	Galvanized Steel
HAAs	Haloacetic Acids
HGL	Hydraulic grade line, in Feet
HPC	Heterotrophic Plate Count
HV	Horizon View
I-90	Interstate 90
KCWTD	King County Wastewater Treatment Division
Kirk	Kirkland
Max	Maximum
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MDD	Maximum Day Demand or Maximum Demand Day
MF	Multi-Family
MG	Million Gallons
MGD	Million Gallons per Day
mg/L	Milligrams per Liter
Min	Minimum
MIP	Mercer Island Pipeline
MMD	Maximum Month Demand
MWD	Maximum Week Demand (daily demand over 7-day period with max demand)
NIS	Not in Service
NR	Non-Revenue Flows
O&M	Operations & Maintenance; or City of Bellevue Utilities O&M Division
PCD	City of Bellevue Planning & Community Development Department
PF	Peaking Factor
PHD	Peak Hour Demand
PNWS-AWWA	Pacific Northwest Section – American Water Works Association
Pop	Population
ppm	Parts per Million (1 ppm = 1 mg/L in water at 4° C or 39° F)
PRV	Pressure Reducing Valve
PSC	Pre-Stressed Concrete
psi	Pounds per Square Inch
PS	Pump Station
PSRC	Puget Sound Regional Council
PWS	Public Water System
R&R	Renewal and Replacement
RCW	Revised Code of Washington
Redm	Redmond
Req'd	Required
Res	Reservoir
Retail	Direct water sales to customers within Bellevue's service area (does not include non-revenue demands or water wheeled to adjacent utilities)
RMCS	Resource Management and Customer Service Division
Roadmap	5-Year Strategic Asset Management Roadmap
ROW	Right-of-Way
SAMP	Strategic Asset Management Plan
SDWA	Safe Drinking Water Act

SEPA	Washington State Environmental Policy Act
SF	Single-Family
SOA	South Operating Area
SOP	Standard Operating Procedure
SPU	Seattle Public Utilities
SR-520	State Route 520
SWTRs	Surface Water Treatment Rule (1989) and revisions (1998, 2002, 2006)
TBD	To Be Determined
TCR	Total Coliform Rule
TDH	Total Dynamic Head, in Feet
TESSL	Tolt Eastside Supply Line
THMs	Trihalomethanes
TSP	Cascade Water Alliance Transmission and Supply Plan
UCMR	Unregulated Contaminant Monitoring Rule
ug/L	Micrograms per Liter
UNK	Unknown
Utilities	City of Bellevue Utilities Department
Utility	City of Bellevue Utilities Department (referenced in policy language)
VFD	Variable Frequency Drive
w/	with
WAC	Washington Administrative Code
WD1	King County Water District No. 1
WD22	King County Water District No. 22 (Beaux Arts Village)
WD68	King County Water District No. 68
WD97	King County Water District No. 97
WD99	King County Water District No. 99
WD117	King County Water District No. 117 (Hilltop Community)
WDD	Typical Winter Day Demand
WDM	Water Distribution Manager (Levels 1-4 based on experience per WAC 246-292)
WDS	Water Distribution Specialist
WFI	Water Facilities Inventory
Wheel/Wheeled	Water that passes through one utility to another per agreement
Wholesale	Water flowing into Bellevue's water distribution system from regional supply
WOA	West Operating Area
WPP	Wellhead Protection Plan
WSDM	WA Department of Health Water System Design Manual, December 2009
WSP	Water System Plan
WSRB	Washington Surveying & Rating Bureau
WTPO	Water Treatment Plant Operator (Levels 1-4 per WAC 246-292)
WUE	Water Use Efficiency
WWSC	Washington Water Service Company
‘	Feet
“	Inches

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Chapter 1 Description of Water System

1.1 System History and Background

Since World War II, Bellevue's water system has grown along with development on the east side of Lake Washington. Originally the area was served by Water Districts No. 68 (WD68), 97 (WD97), and 99 (WD99), as well as some smaller utilities, as shown in Figure 1-1.

The earliest development was on the west side of the service area in what is now the central part of Bellevue. Wells originally supplied water to the area and, at one time, treated surface water from Lake Washington and Lake Sammamish was used. The transition to purchasing water from the Seattle Water Department occurred in the mid-1960s.

In the early 1970s, as the City of Bellevue (the City) grew to include most of the current service area, the City moved to incorporate WD68, WD97 and WD99 into one utility under the City's management, to provide uniform water service.

In January of 1994, Rose Hill Water District was assumed by the Cities of Kirkland, Redmond and Bellevue. Bellevue assumed the portion of the district in Bellevue City limits (south of NE 60th Street, between 132nd and 148th Avenues). The Cities of Bellevue, Kirkland and Redmond also formed a Joint Board, which meets semi-annually for coordination and decision-making regarding jointly owned infrastructure.

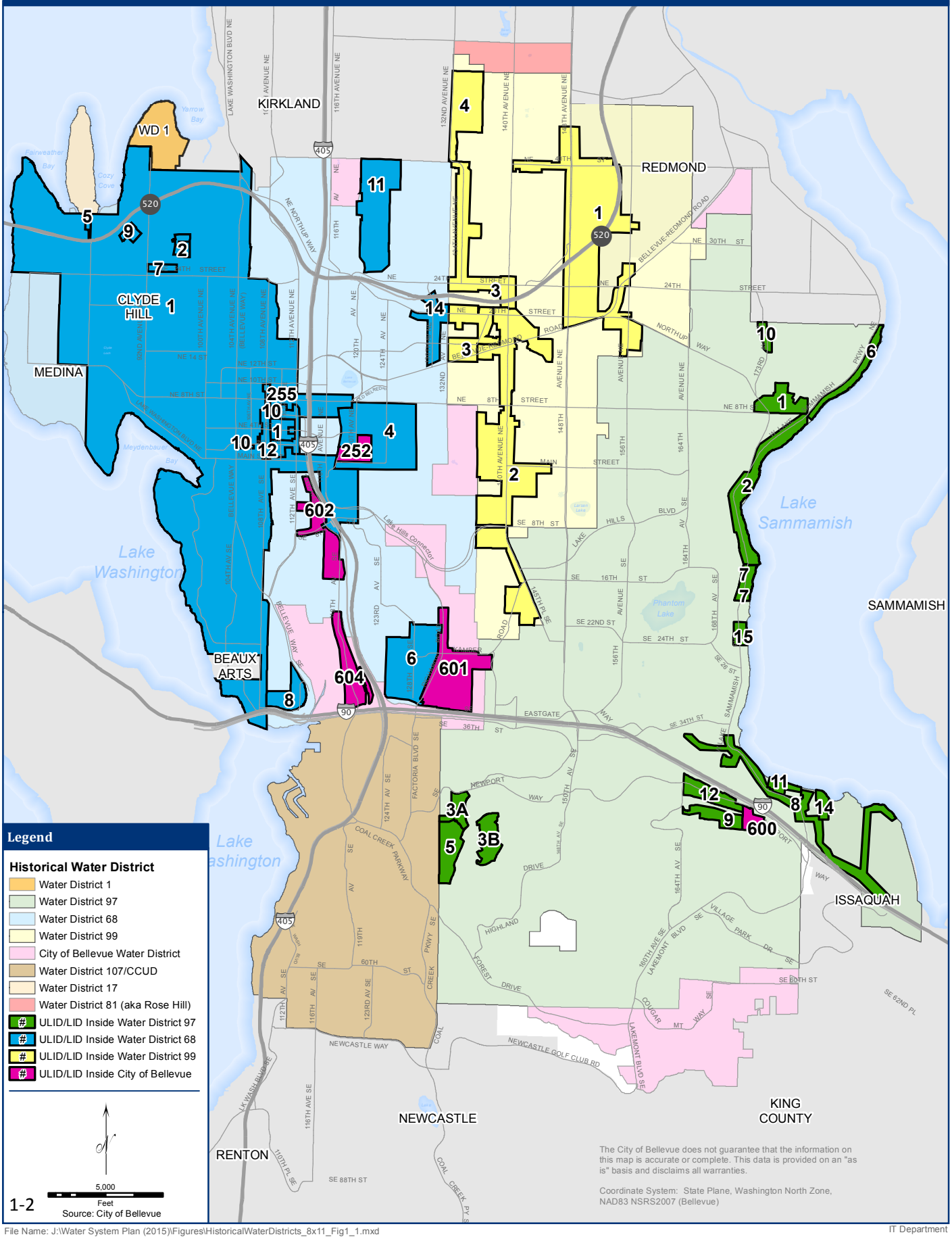
In November of 1998, Bellevue assumed Water District No. 17 (WD17) which provided water service to the northern portion of the Town of Hunts Point.

On December 31, 2003, Bellevue assumed the portion of the Coal Creek Utilities District (CCUD) lying within the Bellevue city limits. The assumption area consists of that portion of the City of Bellevue lying south of I-90 and west of 132nd Avenue SE and its extension.

In January 2004, Bellevue began receiving its water supply from the Cascade Water Alliance (Cascade). Cascade was established to provide for the long term water supply needs of its members and replaced Seattle Public Utilities as Bellevue's regional water supplier.

Historical Water Districts
Figure 1-1

City of Bellevue GIS Services



1-2

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Coordinate System: State Plane, Washington North Zone, NAD83 NSRS2007 (Bellevue)

File Name: J:\Water System Plan (2015)\Figures\HistoricalWaterDistricts_8x11_Fig1_1.mxd

IT Department

1.2 Ownership and Management

The City of Bellevue Utilities Department manages public water, sewer, storm drainage, and solid waste services within the respective service areas for each utility. It operates as part of the City of Bellevue, under the authority of the City Manager and City Council. The Utilities Department produces and annual Utilities Business Profile with additional information, which is publicly available at the Utilities Department website (http://www.bellevuewa.gov/about-utilities.htm).

The Utilities Department Director and Deputy Director oversee management of the department and serve as the primary point of contact for the Bellevue City Manager, City Council, and Environmental Services Commission. In addition to general management duties, the Director is responsible for reviewing regional and state legislative issues and for implementing policy.

The Utilities Department is separated into three divisions, as listed below. Each Division is led by an Assistant Director, who reports to the Director:

- Resource Management and Customer Service
- Engineering
- Operations and Maintenance

A functional organization chart for the Utilities Department is shown in Figure 1-2.

Utilities Director's Office

The Utilities Director's Office oversees asset management, process improvement, workforce development, intergovernmental affairs, interdepartmental relations, public information & outreach, and other functions.

Resource Management and Customer Service Division

The Resource Management and Customer Service Division (RMCS) oversees finance, public outreach, and customer service for all of the City's public utilities, and manages the City's solid waste contract. These functions include billing, customer accounts and other related services. RMCS provides payroll and personnel management for the Utilities Department, coordinates bi-annual budget development and monitoring, performs rate forecasting, and manages accounts payable and receivable. In addition, RMCS's Systems Group manages automation projects and data reporting, and serves as Utilities Department liaison for projects in the City's Information Technology (IT) Department.

Engineering Division

The Engineering Division oversees water, sewer, and storm drainage system planning, analysis, mapping, design, construction, and development review functions. This division is divided into four sections:

- The Water Resources Planning Section is responsible for system planning, hydraulic modeling, mapping and data management. This section develops the Utility's Capital Investment Program (CIP) and system functional plans, including the Water System Plan (WSP). This section also reviews and evaluates developer requests to determine their effect on system operation.

- The Design Services Section is responsible for capital project design and management. Design of projects is performed primarily by consultants, in order to effectively manage the City's internal CIP workload. Some minor work requiring rapid response is done by in-house design staff. The design section also maintains and updates the Utilities Engineering Design Standards.

- The Construction Services Section manages construction work for the department to assure timely and efficient completion of projects. This section also provides inspection services to ensure City and developer built utility projects are installed and constructed according to approved design plans and specifications.

- The Development Services Section conducts permit reviews and administers other development processes requiring coordination within Utilities and other City departments. The section also manages and staffs the utility desk at the Permit Center, which is the first contact for customer service and information on development requests. The Development Section is responsible for approving developer extension designs for construction.

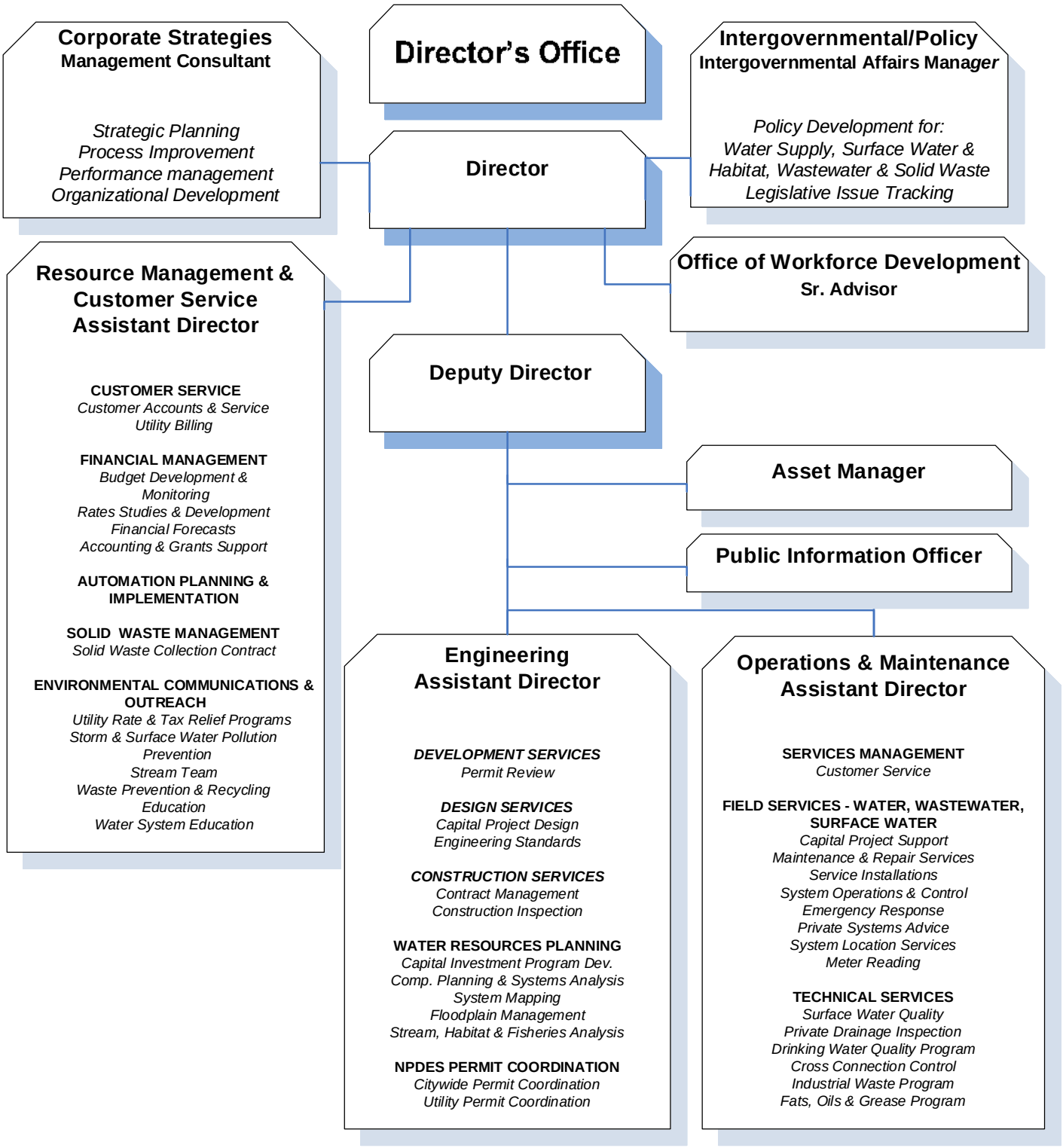
Operations & Maintenance Division

The Operations & Maintenance Division (O&M) maintains and operates the City's public water, sewer, and storm drainage infrastructure. This includes physical components as well as system telemetry. O&M monitors and assesses the condition of infrastructure to minimize failures and extend the life of system components. It also provides water quality regulatory compliance and code enforcement, and works to ensure the integrity of the existing infrastructure during development and redevelopment. O&M manages the City's unidirectional flushing program, provides emergency response, and responds to customers who report system problems. Additional O&M information is provided in Chapter 6.

Figure 1-2

CITY OF BELLEVUE UTILITIES

Water Utility Fund, Sewer Utility Fund, Storm & Surface Water Utility Fund, Solid Waste Fund



Utilities Functional Org Chart - 5-11-15

1.3 Service Area

The City of Bellevue (the "City" or "Bellevue") water utility service area includes the Cities of Clyde Hill and Medina, the Towns of Hunts Point and Yarrow Point, small adjacent portions of the City of Issaquah (South Cove area) and unincorporated King County, and the entire City of Bellevue except the Hilltop Community. The Hilltop Community (WD117) and the Village of Beaux Arts (WD22) both operate independent water districts supplied by local wells. Local municipal boundaries and Bellevue's current water service area are shown in Figure 1-3.

Bellevue and the City of Issaquah (Issaquah) are in the process of transferring the South Cove portion of Bellevue's water service area, which is within the Issaquah city limits, to Issaquah. The assumption of these assets by Issaquah is discussed in more detail in Chapter 3.

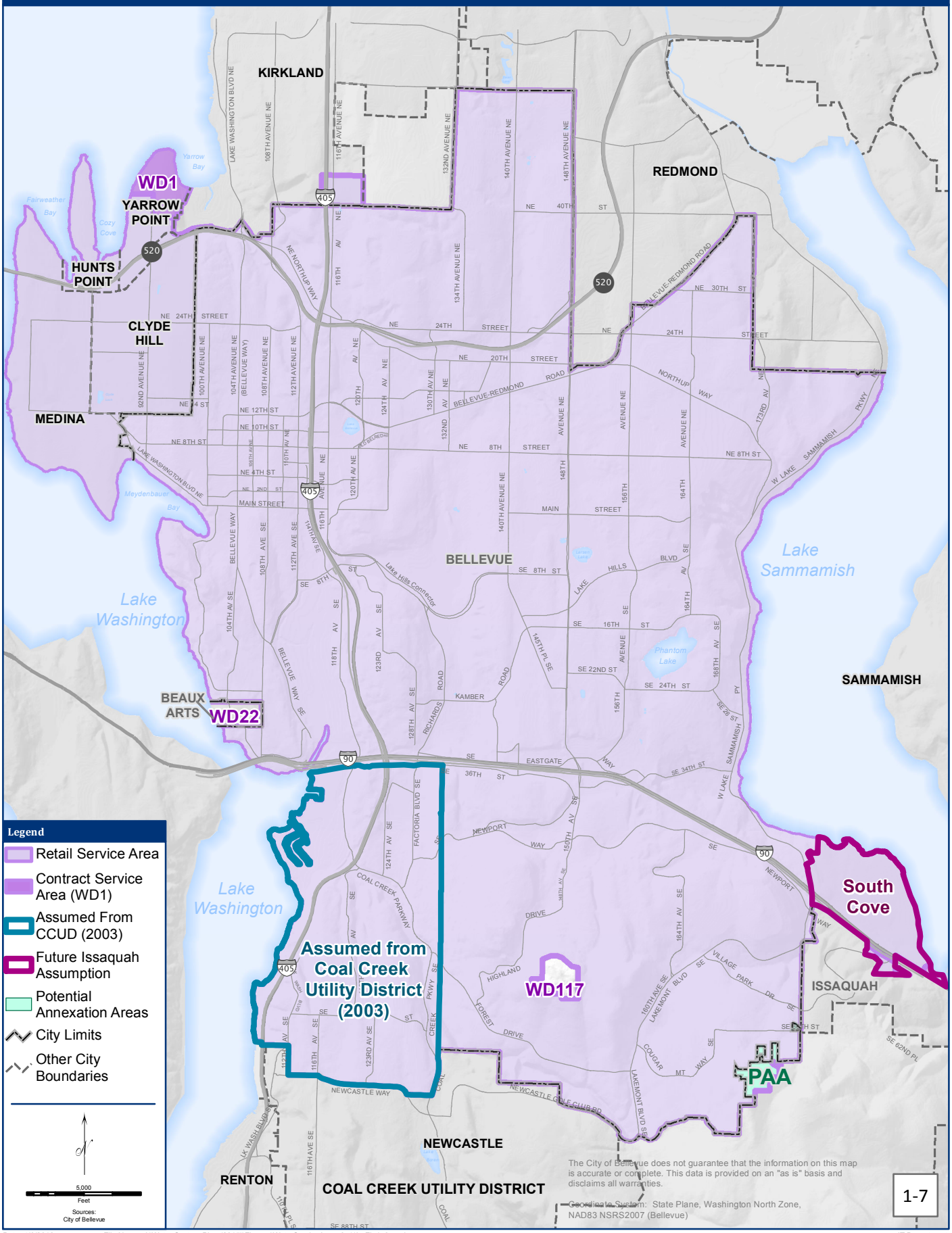
There are currently no plans to expand the City's water service area. However, water districts outside the service area may request to be assumed by the City, or Bellevue City Council may choose to initiate an assumption within Bellevue City limits. Policies to guide such actions are described in Chapter 2. Potential further expansion is limited because the City is surrounded on all sides by natural physical barriers or other communities with existing water service.

King County Water District No. 1 (WD1) exists as a separate financial entity but has been incorporated into Bellevue's water service area, per the terms of a January 2004 agreement (City of Bellevue Resolution 6952; see Volume 3).

Water Service Area

Figure 1-3

City of Bellevue GIS Services



Coordinate System: State Plane, Washington North Zone, NAD83 NSRS2007 (Bellevue)

Date: 4/6/2016 File Name: J:\Water System Plan (2015)\Figures\WaterServiceArea_8x11b_Fig1_3.mxd IT Department

1.4 Inventory of Existing Facilities

Bellevue's distribution system includes approximately 69 separate pressure zones, 6,000 fire hydrants, 10,500 main isolation valves, 37,500 customer accounts with 41,000 customer meters, 25 active reservoirs (plus 2 decommissioned), 22 pump stations, 145 active pressure reducing valve (PRV) stations, and over 600 miles of pipe. More information on major assets is provided below.

Bellevue's Washington State Department of Health (DOH) water system ID is 05575-B, as indicated on the Water Facilities Inventory (WFI).

Water Supply Facilities

Bellevue receives its water supply from regional inlet stations. These are metered connections to regional transmission pipelines, including SPU's Tolt Eastside Supply Line (TESSL), SPU's Cedar Eastside Supply Line (CESSL), SPU's Mercer Island Pipeline (MIP) and Cascade's Bellevue-Issaquah Pipeline (BIP). The TESSL and BIP provide water from SPU's Tolt supply. The CESSL and MIP provide water from SPU's Cedar supply.

Table 1-1 lists the water supply inlet stations that supply Bellevue. Twelve are active inlets operated by Bellevue under continuous service. One (Inlet #6) is normally closed but provides flow as a backup or to augment fire flows in case of a severe drop in pressure. Three inlets are operated by adjacent utilities, with water supplied to Bellevue through interties per local agreements (see Table 1-2). Four additional inlets are no longer in service, but could be re-commissioned to serve in an emergency following minor piping modifications.

These inlets, as well as separate connections to adjacent utilities, are shown in Figure 1-4. Each inlet station has both an SPU meter and one or more Cascade meter(s), to provide redundancy. More detailed analysis of inlets, including contract minimum flow/pressure and available hydraulic capacity, can be found in Chapter 4. Water supply agreements are in Volume 3.

Table 1-1: Regional Water Supply Inlet Stations

Station Name	SPU Station Number	Cascade Meter Dia	SPU Meter Dia	Pressure Zones Supply	Pressure Zones Service
161st Inlet[1]	182	12”	10”	BIP	LH520
Bel Red Inlet	62	12”	12”	TESSL	BV400
Cherry Crest Inlet[2]	63	8”, 12”	10”	TESSL	BV400
Eastgate Inlet	60	16”	10”	TESSL	LH520
Enatai	66	8”	8”	MIP	EN300
Inlet #10	---	NIS[3]	NIS[3]	CESSL	NS200
Inlet #11	124	8”	8”	MIP	FA293
Inlet #6	47	6”	8”	CESSL	NH470
Inlet #7	---	NIS[3]	NIS[3]	CESSL	NH470
Inlet #8	55	6”	6”	CESSL	FA293, FA460
Inlet #9	---	NIS[3]	NIS[3]	CESSL	FA293
NE 40th Inlet	65	18”	10”	TESSL	LH520
NE 8th Inlet	61	16”	24”	TESSL	LH520
Old PRV #48	---	NIS[3]	NIS[3]	TESSL	PP550
Richards Road	59	8”	8”	CESSL	WD450 WD400 WD340 RV300 BV400
SE 28th Inlet	58	16”	12”	TESSL	LH520
Somerset	56	12”	8”	CESSL	SS700
CCUD #4	48	N/A	8”	CESSL	CCUD580
CCUD #5	52	N/A	12”	CESSL	CCUD475
Kirkland Supply Station S1 [4]	72	12”	12”	TESSL	Kirkland 545

[1] 161st Inlet also includes two 8” meters that measure flow to Issaquah in the BIP (not listed in the table). All flow to Bellevue from this inlet station passes through the 12” meter shown.

[2] Flow branches to two separate meters downstream of Cherry Crest Inlet.

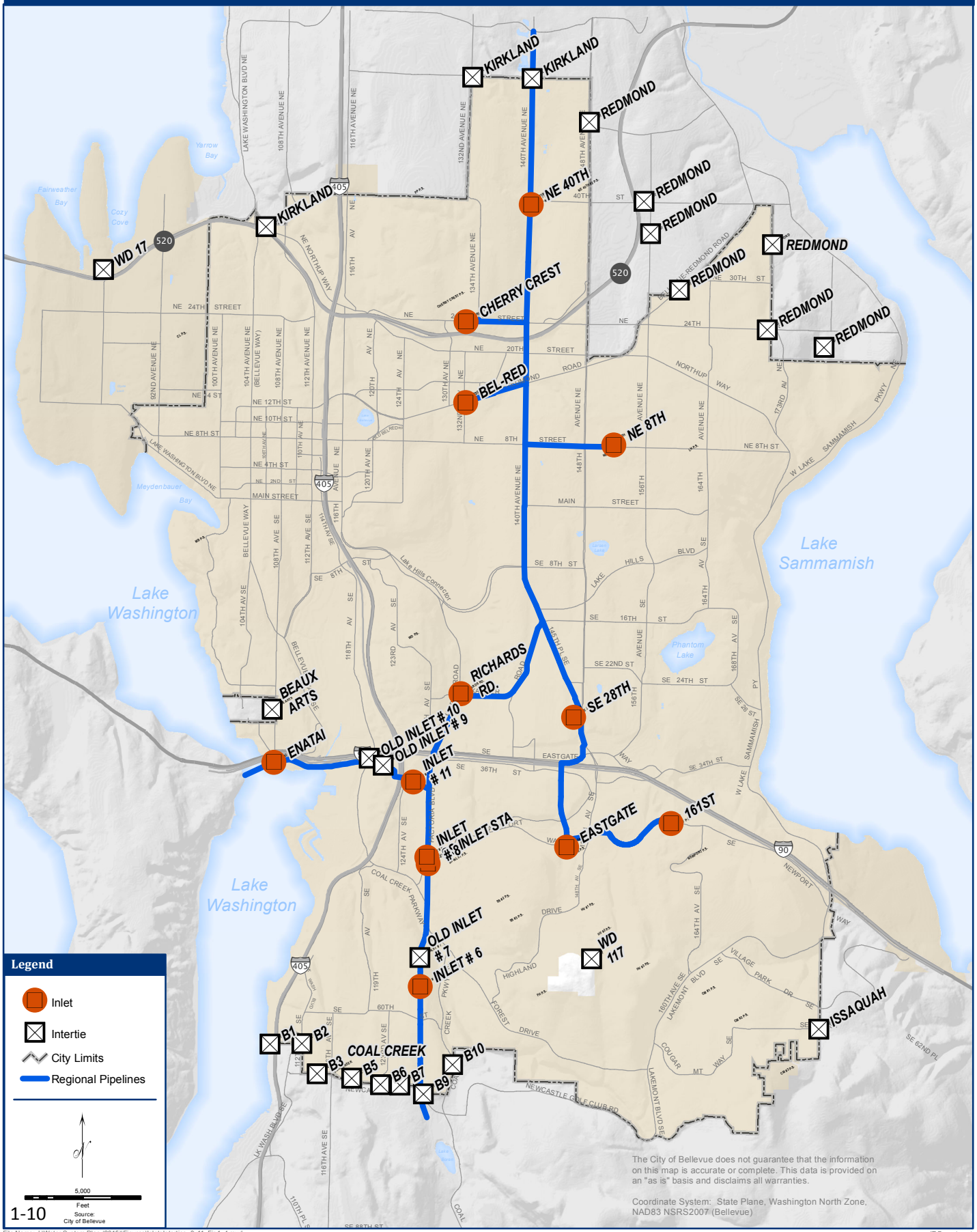
[3] Emergency use only. Inlet is not currently active and would require installation of a spool piece by SPU to return to service.

[4] Bellevue has a 13.4% share in water supply through Kirkland’s Supply Station S1 (a.k.a. Station 8) per 1997 Rose Hill Water District interlocal agreement. The station is located in Redmond but maintained by the City of Kirkland.

Inlets and Interties

Figure 1-4

City of Bellevue GIS Services



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Coordinate System: State Plane, Washington North Zone, NAD83 NSRS2007 (Bellevue)

File Name: J:\Water System Plan (2015)\Figures\InletsInterties_8x11_Fig1_4.mxd

IT Department

Table 1-2 lists connections to adjacent water utilities ("interties") per local agreements (Volume 3). Some interties flow in one direction, but some flow both into and out of Bellevue and are equipped with bi-directional meters. On net, Bellevue receives water from CCUD and Kirkland, but supplies water to Issaquah. The Beaux Arts (WD22) connection was installed for emergency use, but is metered and now provides backup water supply when their well cannot meet summer demands. Hilltop (WD117) has a normally-closed, unmetered emergency connection to Bellevue.

Table 1-2: Connections to Adjacent Utilities

Adjacent System	WFI #	Station Name (If Applicable)	To Bellevue	From Bellevue	Emergency	Metered	Meter Diameter	Zones		
								Supply	Service	Description
CCUD	41750 C	Station B1	X	X		X	4"	CCUD170	NS200	
		Station B2	X	X		X	4"	CCUD475	NH470	
		Station B3	X	X		X	6"	CCUD475	NH470	
		Station B5	X	X		X	6"	CCUD475	NH470	
		Station B6	X	X		X	6"	CCUD580	NH580	
		Station B7	X	X		X	6"	CCUD580	NH580	
		Station B9	X	X		X	4"	CCUD580	NH580	
		Station B10	X	X		X	1",1"	CCUD580	NH580	
		Station B4	X	X	X		8"	CCUD475	NH580	Closed Valve
Redmond	71650B			X		X	†	LH520	Redm 520	Many interties
				X		X	†	LH435	Redm 435	
			X			X	4"	Redm 520	LH520	
			X			X	†	Redm 335	RM330	
			X			X	†	Redm 545	RH545	
			X	X	X			RM400	Redm 330	Closed Valve
			X	X	X			Redm 545	LH520	Closed Valve
Kirkland	42250T		X			X	6"	Kirk 545	RH545	
			X	X	X		8"	BV400	Kirk 285	Closed Valve
			X	X	X		6"	Kirk 650	PP670	Emergency PRV
			X	X	X		TBD	Kirk 285	CL335	(Proposed)
Issaquah	363505			X		X	8"	CM1150	Montreux	
				X		X	†	LH520	Lakemont	
Hilltop (WD117)	41980D			X	X		6"	HV1175	WD117	Closed Valve
Beaux Arts (WD22)	051600			X	X	X	6"	EN300	Beaux Arts 243	Backup Only

† Denotes "Direct Read" areas (sum of customer meter volumes is used in lieu of a master meter).

Redmond's Overlake area is supplied by SPU's TESSL through jointly-owned (Bellevue/Redmond) facilities located in Bellevue. Redmond's 520 zone and Bellevue's LH520 zone were operated as a single pressure zone by WD99 (independent of political boundaries), and are still hydraulically interconnected today, through many connection points.

Cascade bills Redmond directly for water consumption through joint-use areas in Bellevue. There is no Bellevue wheeling charge for this volume, since facilities are jointly owned. Redmond's metered volume is provided to Bellevue for operational use, and for the purpose of water balance calculations and non-revenue flow estimates (see Chapter 5). Customer demands in Redmond's 520 zone are recorded through a combination of "direct read" (summation of individual customer meters; west of SR-520) and three master meters (shown in Figure 1-4), as defined in interlocal agreements (see Volume 3). One master meter on Bel-Red Road also serves to measure flow from Redmond back into Bellevue's LH520.

Separately, Redmond's 435 zone is a "direct read" area fed by Bellevue's LH435 zone, while small portions of Bellevue's RM330 and RH545 zones are "direct read" areas fed by Redmond. There are also multiple closed isolation valves serve as emergency connections between various zones."

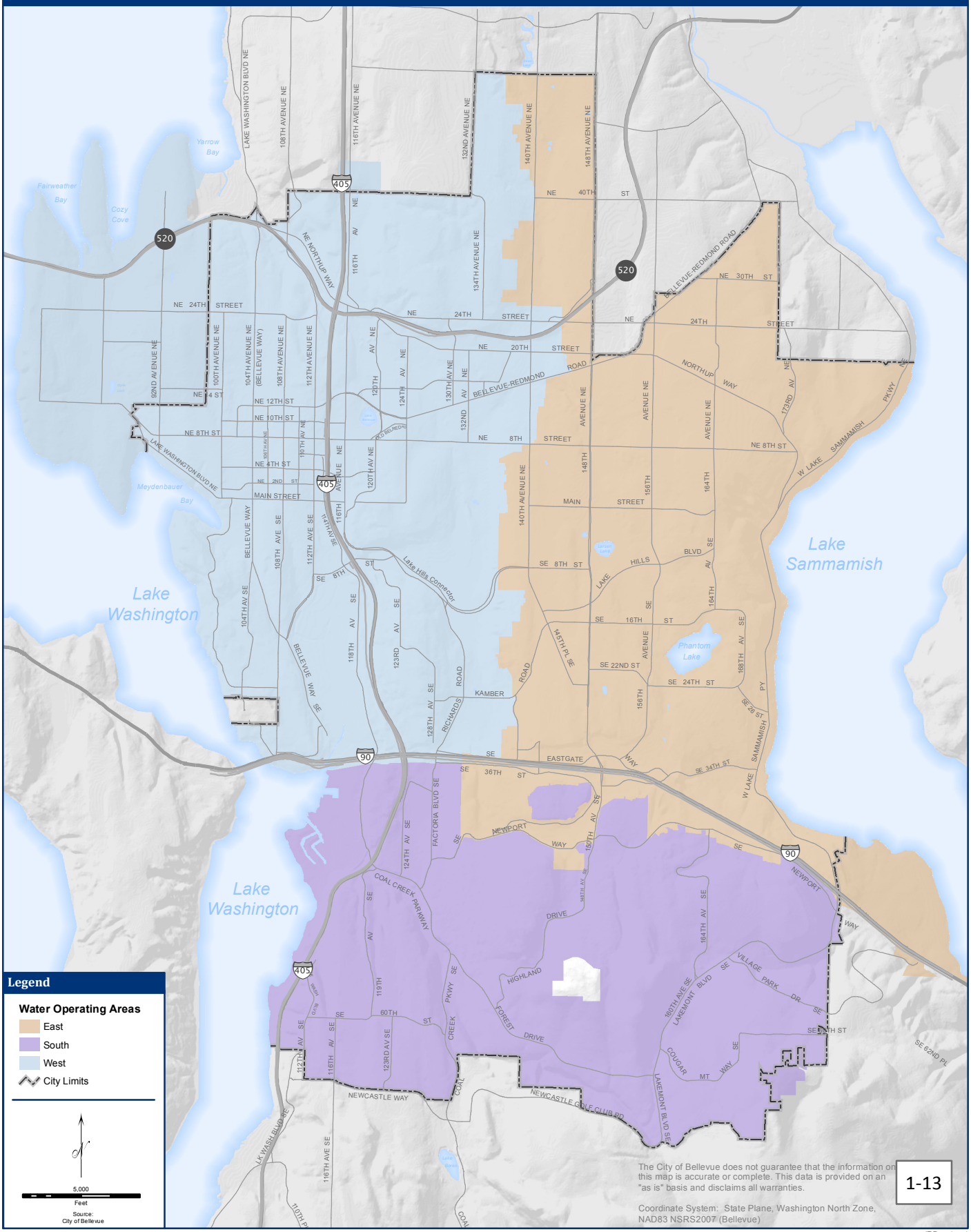
Operating Areas

Bellevue's service area has historically been conceptualized into three operating areas, as shown in Figure 1-5. The West Operating Area (WOA) and East Operating Area (EOA) generally include the service area north of Interstate 90 (I-90), roughly divided by 140th Avenue NE. The South Operating Area (SOA) includes most of the area south of I-90.

Although these areas rely mostly on separate supply inlets, they are not fully independent, and their delineations have become somewhat arbitrary due to increasing interconnectivity over time.

Water Operating Areas
Figure 1-5

City of Bellevue
GIS Services



Legend

Water Operating Areas
- East
- South
- West
- City Limits

5,000 Feet

Source: City of Bellevue

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Coordinate System: State Plane, Washington North Zone, NAD83 NSRS2007 (Bellevue)

File Name: J:\Water System Plan (2015)\Figures\WaterOperatingAreas_8x11_Fig1_5.mxd

IT Department

Pressure Zones

Table 1-3 and Figure 1-6 show the pressure Zones in Bellevue's water service area. Although there are 62 named zones, 7 of these include two non-contiguous areas that operate independently, for a total of 69 separate zones. Figure 1-7 shows a hydraulic profile of the entire system.

The number in each zone name is the approximate nominal hydraulic grade line (HGL) under static conditions (with no head loss). Actual HGL varies seasonally and hourly, and rarely matches the zone name. For zones with storage, the name typically indicates the reservoir overflow elevation (in feet), and therefore the max HGL. For pump- and PRV-fed zones, the number is determined on a case-by-case basis reflecting local operating conditions.

Table 1-3: Pressure Zones

Pressure Zone	Abbreviation	Supply	Storage	Storage Upstream
Bellefield 220	BF220	Gravity	No	Yes
Bellevue 400	BV400	Gravity	Yes	No
Clyde Hill 335	CL335	Gravity	Yes	Yes
Clyde Hill 500	CL500	Pump	No	Yes
Cougar Mountain 1000[1]	CM1000	Pump (via PRV)	No	Yes
Cougar Mountain 1150	CM1150	Pump	Yes	Yes
Cougar Mountain 1300[1]	CM1300	Pump (via PRV)	No	Yes
Cougar Mountain 1465	CM1465	Pump	Yes	Yes
Cougar Mountain 1575	CM1575	Pump	No	Yes
College Hill 380	CO380	Gravity	No	Yes
College Hill 440	CO440	Gravity	No	Yes
Eastgate 300	EG300	Gravity	No	Yes
Eastgate 370[1]	EG370	Gravity	No	Yes
Eastgate 400	EG400	Gravity	No	Yes
Eastgate 440[1]	EG440	Gravity	No	Yes
Eastgate 590[1]	EG590E	Pump (via PRV)	No	Yes
Eastgate 630	EG630	Pump (via PRV)	No	Yes
Enatai 300	EN300	Gravity	No	Yes
Factoria 293	FA293	Gravity	Yes	Yes
Factoria 460	FA460	Gravity	No	Yes
Forest Hills 1100	FH1100	Pump (via PRV)	No	Yes
Forest Hills 465	FH465	Pump (via PRV)	No	Yes
Hunts Point 250	HP250	Gravity	No	Yes
Horizon View 1080	HV1080	Pump (via PRV)	No	Yes
Horizon View 1115	HV1115	Pump (via PRV)	No	Yes

[1] CM1000, CM1300, EG370, EG440 and EG590 each include separate, non-contiguous areas that operate independently at similar HGL. See Figure 1-7.

Table 1-3: Pressure Zones (Continued)

Pressure Zone	Abbreviation	Supply	Storage	Storage Upstream
Horizon View 1175	HV1175	Pump	Yes	Yes
Horizon View 700	HV700	Pump	Yes	Yes
Horizon View 940	HV940	Pump (via PRV)	No	Yes
Kelsey Creek 300	KC300	Gravity	No	Yes
Kelsey Creek 450	KC450	Gravity	No	Yes
Lake Hills 380	LH380	Gravity	No	Yes
Lake Hills 435	LH435	Gravity	No	Yes
Lake Hills 520	LH520	Gravity	Yes	Yes
Meydenbauer 252	MB252	Gravity	Yes	Yes
Medina 230	MD230	Gravity	No	Yes
Newport Hills 320[1]	NH320	Pump (via PRV)	No	Yes
Newport Hills 380[1]	NH380	Pump (via PRV)	No	Yes
Newport Hills 470	NH470	Pump	No	Yes
Newport Hills 580	NH580	Pump	Yes	No
Newport Shores 200	NS200	Pump (via PRV)	No	Yes
Pikes Peak 550	PP550	Gravity	Yes	No
Pikes Peak 600	PP600	Gravity/Pump[2] (via PRV)	No	Yes
Pikes Peak 670	PP670	Gravity/Pump[2]	No	Yes
Rose Hill 545	RH545	Pump	Yes	No
Redmond 330	RM330	Gravity	No	Yes
Redmond 400	RM400	Gravity	No	Yes
Richards Valley 300	RV300	Gravity	No	Partial[3]
Sammamish 270	SA270	Gravity	Yes	Yes
Sunset Hills 450	SH450	Gravity	No	Yes
Somerset 1000	SS1000	Pump (via PRV)	No	Yes
Somerset 550	SS550	Pump (via PRV)	No	Yes
Somerset 700	SS700	Pump	Yes	No
Somerset 850	SS850	Pump	Yes	Yes
Somerset 940	SS940	Pump (via PRV)	No	Yes
Summit 1060	SU1060	Pump (via PRV)	No	Yes
Summit 1100	SU1100	Pump (via PRV)	No	Yes
Summit 1350	SU1350	Pump	No	Yes
Woodridge 340	WD340	Gravity	No	No
Woodridge 400	WD400	Gravity	No	Partial[4]
Woodridge 450	WD450	Pump	No	Yes
Yarrow Bay 300	YB300	Gravity	No	Yes
Yarrow Point 220	YP220	Gravity	No	Yes

[1] NH320, NH380 have separate non-contiguous areas operating independently at similar HGL. See Figure 1-7.

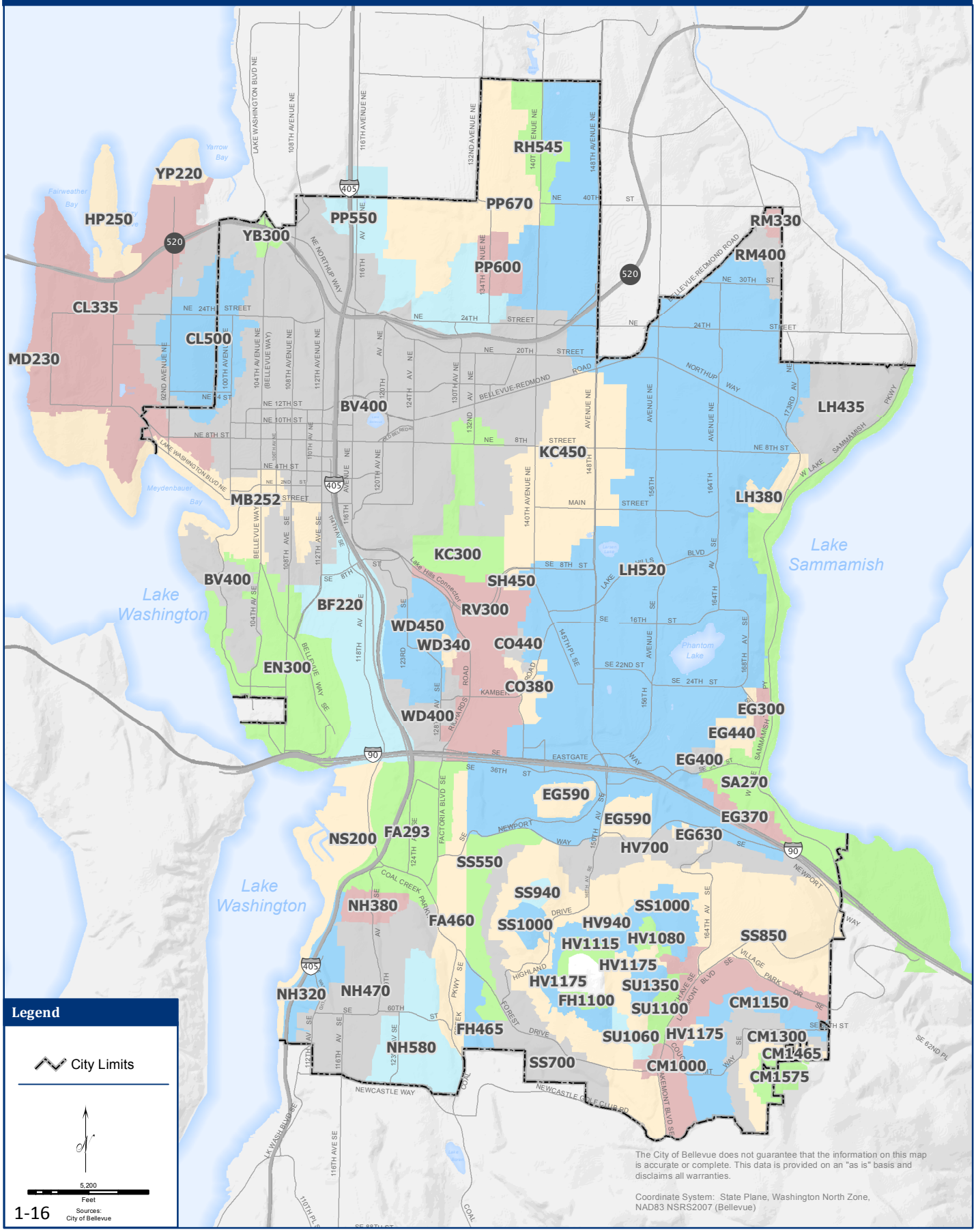
[2] PP600 and PP670 are fed by gravity or pumping based on seasonal HGL fluctuation in the TESSL.

[3] RV300 is normally fed both directly from the CESSL (PRV #86) and from CO380 (PRV #40, #158). In the event of a CESSL shutdown, fire flows would be reduced, but storage is accessible from the EOA.

[4] WD400 is fed directly from the CESSL, but has access to storage in WD450 via PRV #12. In the event of a CESSL shutdown, PRV #12 has limited capacity to meet fire flow needs, so storage is not fully available.

Pressure Zones
Figure 1-6

City of Bellevue GIS Services



Legend

City Limits

N

5,200 Feet

Sources: City of Bellevue

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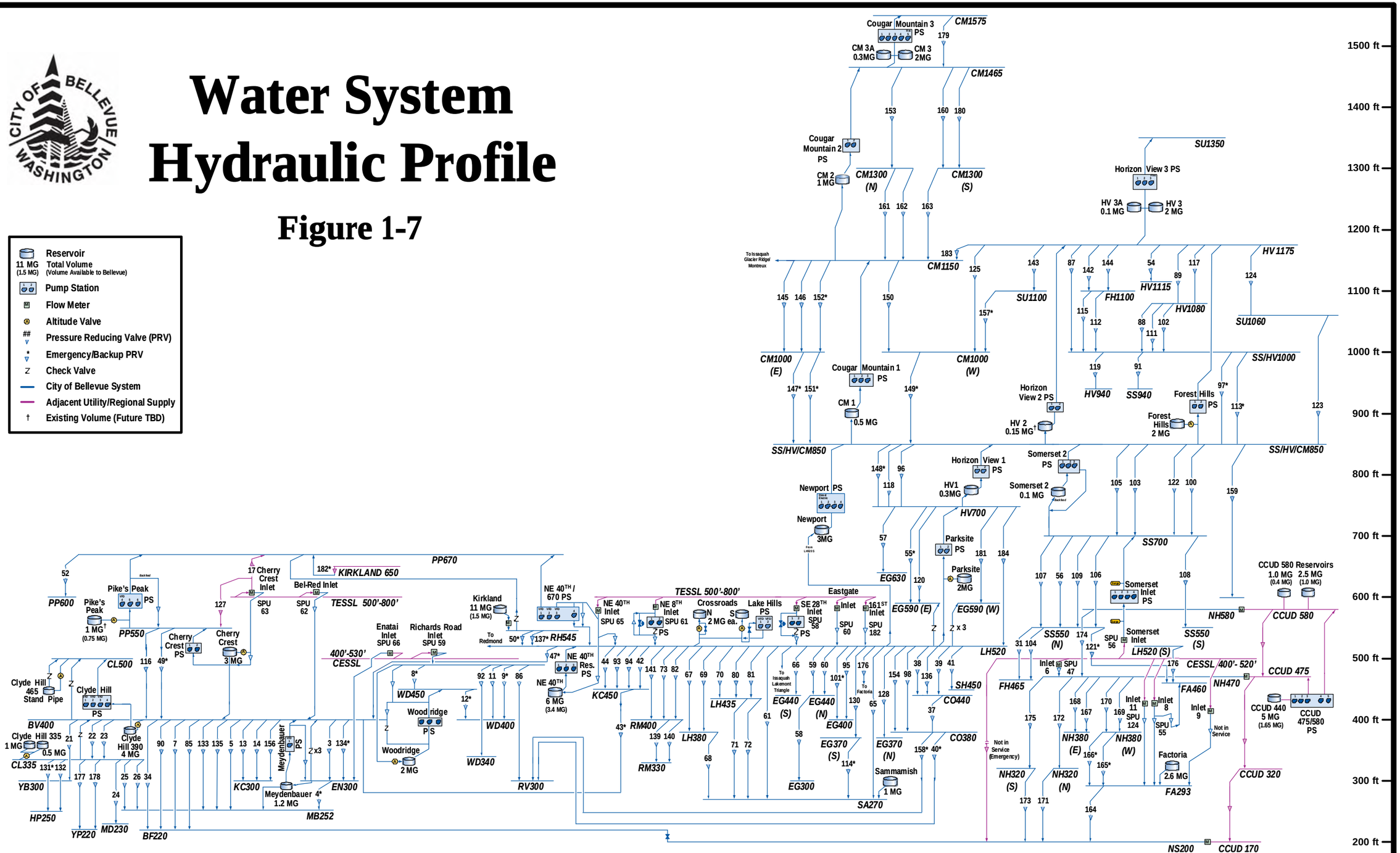
Coordinate System: State Plane, Washington North Zone, NAD83 NSRS2007 (Bellevue)

File Name: J:\Water System Plan (2015)\Figures\pzones_8x11_Fig1_6.mxd

Water System Hydraulic Profile

Figure 1-7

- Reservoir
- 11 MG (1.5 MG) Total Volume (Volume Available to Bellevue)
- Pump Station
- Flow Meter
- Altitude Valve
- ## Pressure Reducing Valve (PRV)
- * Emergency/Backup PRV
- Check Valve
- City of Bellevue System
- Adjacent Utility/Regional Supply
- † Existing Volume (Future TBD)



Pipe

Table 1-4 summarizes the approximate length of various pipe sizes and materials in Bellevue's water distribution system. Quantities shown are current as of 2015, based on the best available information, and do not include hydrant stubs, customer service lines, or exposed piping at facilities such as pump stations.

Table 1-4: Inventory of Pipe Materials*

Dia (inch)	Total Length (miles)	AC	CI	DI	GST	HDPE	PVC	UNK
< 4"	3.2	0.0	0.0	0.4	0.07	0.30	2.2	0.15
4"	32.8	10.1	0.9	21.5	0.00	0.00	0.2	0.10
6"	158.5	138.8	8.6	10.7	0.00	0.00	0.1	0.37
8"	306.9	78.9	18.8	208.2	0.00	0.00	0.4	0.59
10"	15.8	9.0	1.5	4.9	0.00	0.23	0.0	0.07
12"	83.1	24.8	9.3	48.8	0.00	0.00	0.0	0.28
14"	2.8	0.8	0.3	1.7	0.00	0.00	0.0	0.00
16"	13.8	1.2	0.9	11.6	0.08	0.00	0.0	0.00
20"	0.9	0.0	0.5	0.4	0.00	0.00	0.0	0.00
24"	1.8	0.1	1.0	0.8	0.00	0.00	0.0	0.02
Total	619.7	263.7	41.9	309.0	0.15	0.53	2.9	1.6

*** AC = Asbestos Cement, CI = Cast Iron, DI = Ductile Iron, GST = Galvanized Steel, UNK = Unknown**

Piping inventory is continually changing due to systematic pipeline replacements, developer projects, and re-locations to accommodate transportation improvements (SR-520, Sound Transit East Link, City of Bellevue street re-paving, etc).

Figure 1-8 and Figure 1-9 show the length and relative percentage of pipe materials overall. The percentage of ductile iron pipe in the distribution system is continually increasing, as smaller, less robust AC and cast iron mains are replaced. More information on the Small Diameter Water Main Replacement Program (CIP W-16) is provided in Chapter 9.

Figure 1-8: Distribution System Pipe Sizing

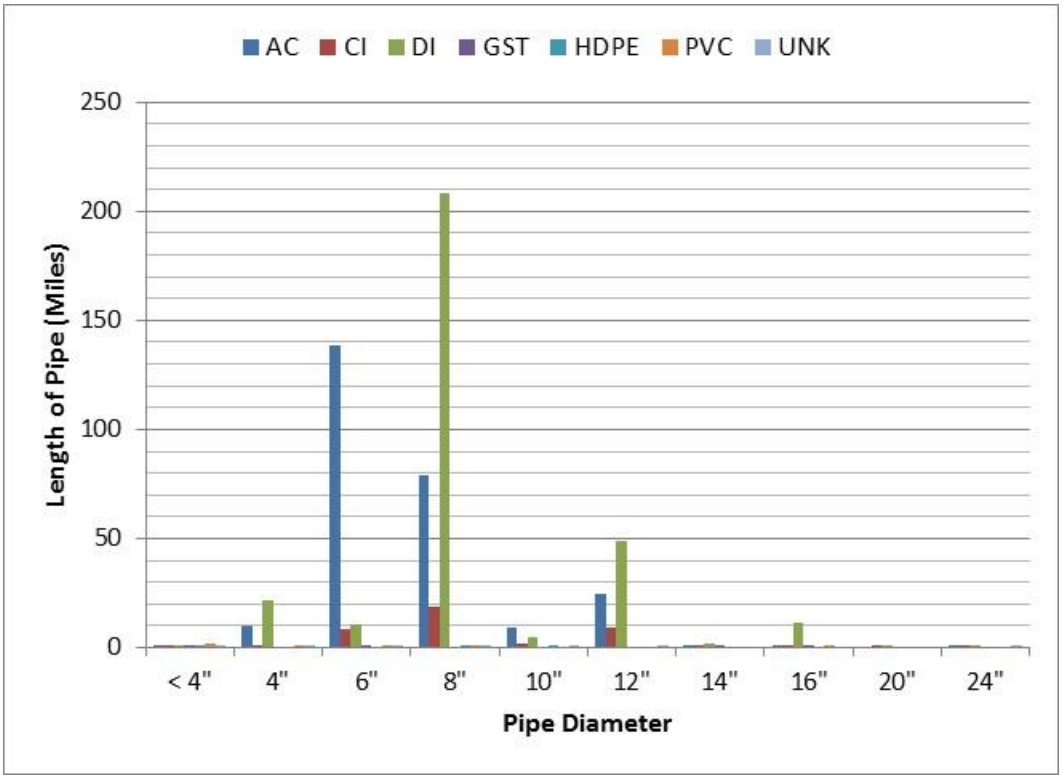
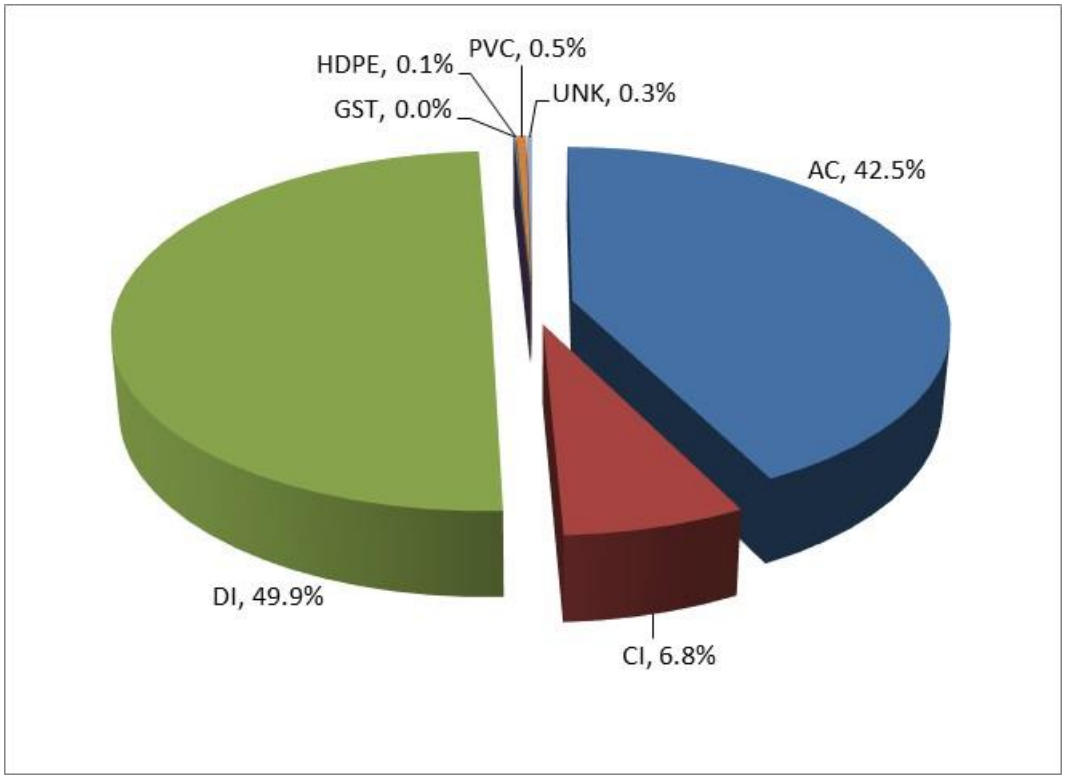


Figure 1-9: Distribution System Pipe Materials (% of Total Length)



Reservoirs

Bellevue Utilities maintains and operates 25 reservoirs, including one joint-use reservoir shared with Redmond (NE 40th Reservoir). These are shown in Figure 1-10. An additional 2 reservoirs were recently decommissioned but are still owned by the City.

In addition, Bellevue owns a portion of water in 4 reservoirs maintained by neighboring utilities. Table 1-5 summarizes the reservoir storage available to Bellevue.

Parksite Reservoir

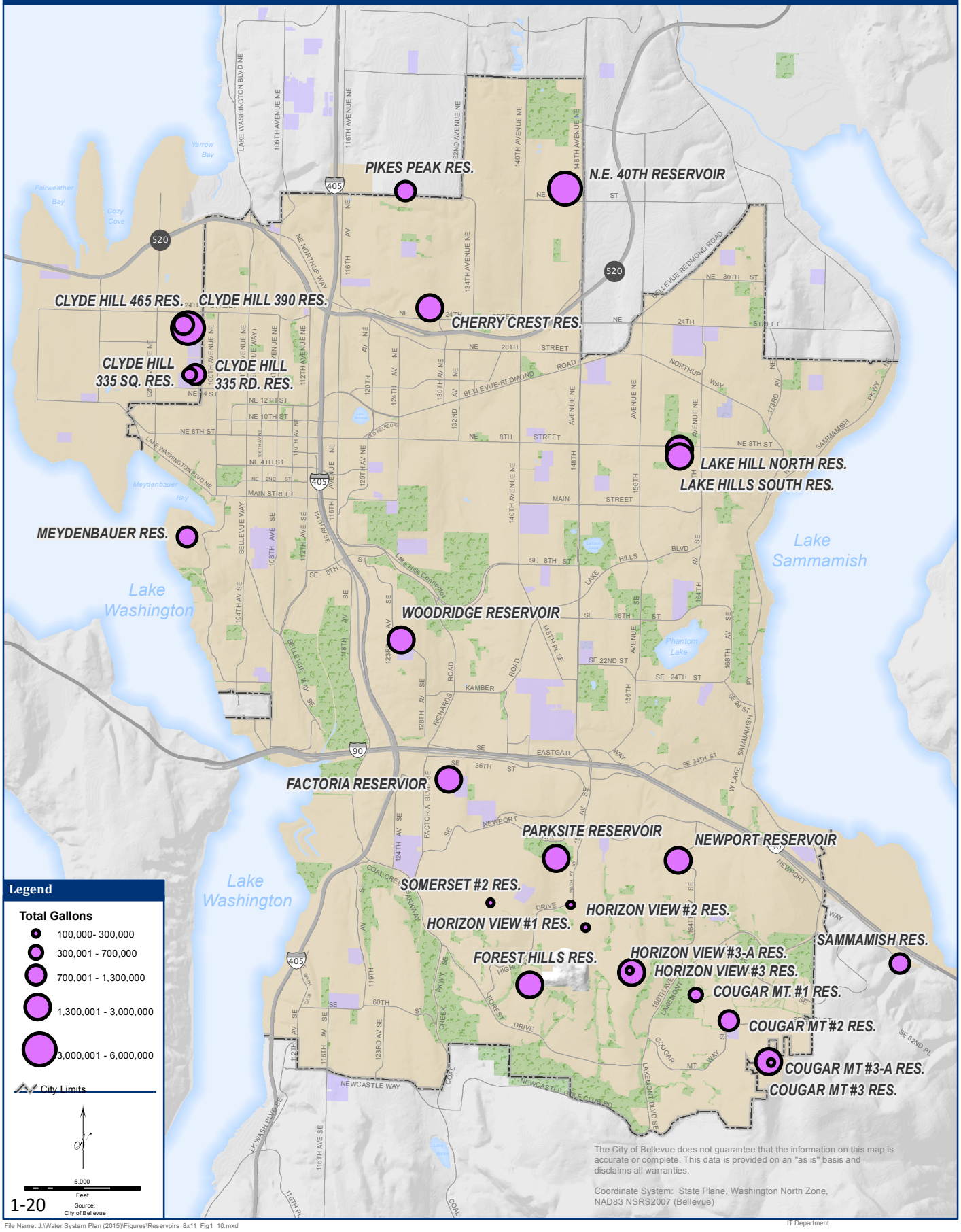
Factoria Reservoir

Forest Hills Reservoir

Woodridge Reservoir

Reservoirs
Figure 1-10

City of Bellevue
GIS Services



The City of Bellevue does not guarantee that the information on this map is accurate or complete. This data is provided on an "as is" basis and disclaims all warranties.

Coordinate System: State Plane, Washington North Zone, NAD83 NSRS2007 (Bellevue)

File Name: J:\Water System Plan (2015)\Figures\Reservoirs_8x11_Fig1_10.mxd

IT Department

Table 1-5: Reservoir Inventory (ERRATA UPDATED JUNE 2020)

Reservoir Name	Zone	Year Built	Type	Bottom EL*	Overflow EL*	Gal/Ft	Volume (MG)
Cherry Crest	BV400	1999	CIPC	384'	404'	150,000	3.0
Clyde Hill 465	CL500	1958	Steel	**371.1'**	**470.5'**	7,613	0.72
Clyde Hill 390	BV400	1970	PSC	**363'**	**393.4'**	129,000	4.0
Clyde Hill 335 Rd.	CL335	1952	Steel	**314'**	**338'**	41,667	1.0
Clyde Hill 335 Sq.	CL335	1948	CIPC	**322.2'**	**338.2'**	31,250	0.50
Cougar Mt. 1	SS850	1992	PSC	823'	846'	21,875	0.50
Cougar Mt. 2	CM1150	1991	PSC	1118'	1150'	31,250	1.0
Cougar Mt. 3	CM1465	1997	Steel	1445.15'	1465.6'	100,000	2.0
Cougar Mt. 3A	CM1465	1997	Steel	1445.15'	1465.6'	15,000	0.30
Factoria	FA293	1981	Steel	**265.3'**	**295.5'**	100,000	2.7
Forest Hills	SS850	1977	PSC	**824.7'**	**848.4'**	84,600	2.0
Horizon View 1	HV700	1963	Steel	668.8'	700'	5,925	0.20
Horizon View 2	SS850	1963	Steel	820.9'	850'	5,172	0.15
Horizon View 3	HV1175	1976	PSC	**1157.6'**	**1178.6'**	100,000	2.0
Horizon View 3A	HV1175	1988	CIPC	**1164'**	**1179'**	6,732	0.1
Lake Hills North	LH520	1959	Steel	**448.5'**	**523.7'**	26,667	2.0
Lake Hills South	LH520	1962	Steel	**448.5'**	**523.7'**	26,667	2.0
Meydenbauer N	MB252	2004	CIPC	231'	251'	28,571	0.65
Meydenbauer S	MB252	2004	CIPC	231'	251'	28,571	0.65
N.E. 40th[1]	LH520	1991	PSC	376.5'	412.5'	169,750	3.4†
Newport	LH520	1976	PSC	**502.1'**	**523.1'**	169,000	3.0
Parksite	LH520	1964	Steel	**483.9'**	**523.9'**	50,000	2.0
Pikes Peak	PP550	1968	Steel	526'	550'	41,667	1.0
Sammamish	SA270	1981	PSC	224.5'	259.5'	28,570	1.0
Somerset 2	SS700	1962	CIPC	**693.2'**	**703.5'**	10,000	0.10
Woodridge	WD450	1956	Steel	**333'**	**403.9'**	28,570	2.0
Kirkland 545[2]	545	1971	Steel	495.08'	545.08'	224,000	1.5†
CCUD 580 East[3]	580	1967	Steel	540'	580'	25,000	0.4†
CCUD 580 West[4]	580	1971	Steel	540'	580'	62,500	1†
CCUD 440[5]	470	1987	Steel	420'	440'	250,000	1.65†

* Estimated, in NAVD88 Datum. Elevations in **bold** are corrections after survey in 2020.
† Volume available to Bellevue based on contractual agreement (attached in Volume 3)

Two reservoirs, Somerset #1 and Somerset #3 (100,000-gal capacity each), have recently been removed from service. These reservoirs were originally installed by developers as part of local residential development, and have since become unnecessary due to ample storage in the SOA. Decommissioning of these reservoirs has reduced workload, while improving the operability of Forest Hills Reservoir and maintaining customer levels of service.

[1] Bellevue has a 56% share of the 6.0-MG NE 40th Reservoir per 1990 agreement with the City of Redmond.
[2] Bellevue has a 13.4% share of Kirkland's 11-MG 545 Reservoir per 1997 Rose Hill Water District agreement.
[3] Bellevue has a 40% share of CCUD's 1.0-MG 580 East Reservoir per 2002 partial assumption agreement.
[4] Bellevue has a 40% share of CCUD's 2.5-MG 580 West Reservoir per 2002 partial assumption agreement.
[5] Bellevue has a 33% share of CCUD's 5.0-MG 440 Reservoir per 2002 partial assumption agreement.

Pump Stations

The City maintains and operates 22 pump stations, as shown in Figure 1-11 and listed in Table 1-6. Bellevue also shares some joint-use facilities:

- NE 40th Reservoir Pump Station is a joint-use facility shared with the City of Redmond (56% Bellevue / 44% Redmond). It is located in Bellevue and operated and maintained by Bellevue.
- Bellevue owns 33% share of capacity in CCUD's 475/580 pump station.
- 161st Avenue Inlet Pump Station is owned and maintained by Bellevue, but all costs for operations, maintenance, repair and replacement related to this station are the responsibility of Cascade and are reimbursed to the City per agreement.
- Bellevue and SPU share capital and operating costs for NE 8th Inlet Pump Station and SE 28th Inlet Pump Station.

Table 1-6: Pump Station Inventory

Name		Zone From	Zone To	Pump No.	Motor Hp	Full Speed Rating Point gpm	@ TDH	Install or Rehab Year	Approx Site EL
Cherry Crest		BV400	PP550	1	50	500	205	1984	396’
		BV400	PP550	2	50	500	205	1984	
Clyde Hill		BV400	CL500†	1 VFD	15	200	139	1987	366’
		BV400	CL500†	2 VFD	40	650	139	1987	
		BV400	CL500†	3 VFD	40	650	139	1987	
		BV400	CL500†	4	40	650	139	1987	
Cougar Mt. 1		SS850	CM1150	1	60	565	321	1990	833’
		SS850	CM1150	2	60	565	321	1990	
		SS850	CM1150	3	100	1,000	310	1997	
Cougar Mt. 2		CM1150	CM1465	1	125	1,000	350	1997	1127’
		CM1150	CM1465	2	125	1,000	350	1997	
Cougar Mt. 3		CM1465	CM1550†	1		TBD*		2016	1444.5’
		CM1465	CM1550†	2		TBD*		2016	
		CM1465	CM1550†	3		TBD*		2016	
		CM1465	CM1550†	4		TBD*		2016	
		CM1465	CM1550†	5		TBD*		2016	
Forest Hills		SS850	HV1175	1	150	1,000	405	1989	833’
		SS850	HV1175	2	150	1,000	405	1989	
Horizon View 1		HV700	SS850	1		TBD*		2016	671’
		HV700	SS850	2		TBD*		2016	
Horizon View 2		SS850	HV1175	1	150	1,100	380	1995	825’
		SS850	HV1175	2	150	1,100	380	1995	
Horizon View 3		HV1175	SU1350†	1 VFD		TBD*		2015	1168’
		HV1175	SU1350†	2 VFD		TBD*		2015	
		HV1175	SU1350†	3 VFD		TBD*		2015	
		HV1175	SU1350†	4 VFD		TBD*		2015	
		HV1175	SU1350†	5 VFD		TBD*		2015	
Lake Hills (Crossroads)		LH520	LH520	1VFD	60	1,750	58	2000	448’
		LH520	LH520	2VFD	60	1,750	58	2000	
Meydenbauer		MB252	BV400	1VFD	50	800	170	2004	239’
NE 8th Inlet		TESSL	LH520	1	200	4,720	134	1983	316’
		TESSL	LH520	2	200	4,720	134	1983	

Denotes on-site generator

Denotes receptacle for portable generator

† Denotes “closed” zones with no storage downstream

* Cougar Mountain 3, Horizon View 1, and Horizon View 3 pump stations are scheduled for replacement in 2016 and 2017. The new pump stations are currently in design or construction (new pump data is not yet available). Existing pump information is available in the 2006 Water Comprehensive Plan.

Table 1-6: Pump Station Inventory

Name		Zone From	Zone To	Pump No.	Motor Hp	Full Speed Rating Point gpm	@ TDH	Install or Rehab Year	Approx Site EL
NE 40th Reservoir	⚡	TESSL	LH520	1	100	2,000	142	1991	393’
		TESSL	LH520	2	200	4,000	142	1991	
(56% Bellevue)		TESSL	LH520	3	200	4,000	142	1991	
Newport	⚡	LH520	SS850	1	125	1,000	350	2013	510’
		LH520	SS850	2	125	1,000	350	2013	
		LH520	SS850	3	75	530	340	2013	
Parksite	🔌	LH520	HV700	1	150	1,980	220	1983	484’
		LH520	HV700	1	150	1,980	220	1983	
Pikes Peak	🔌	PP550	PP670†	4 VFD	50	1,000	114	1999	531’
		PP550	PP670†	5	60	1,300	122	1991	
		PP550	PP670†	6	60	1,300	122	1991	
SE 28th Inlet		TESSL	LH520	1	300	4,200	210	1983	424’
		TESSL	LH520	2	250	3,800	210	1983	
Somerset Inlet	🔌	CESSL	SS700	1	60	400	392	1993	274’
		CESSL	SS700	2	200	1,200	392	1993	
		CESSL	SS700	3	200	1,200	392	1993	
		CESSL	SS700	4	125	800	392	1993	
Somerset 2	🔌	SS700	SS850	1	100	1,100	216	1993	705’
		SS700	SS850	2	100	1,100	216	1993	
		SS700	SS850	3	60	650	216	1993	
Woodridge	🔌	BV400	WD450†	1 VFD	30	800	104	1993	332.5’
		BV400	WD450†	2 VFD	100	3,000	102	1993	
		BV400	WD450†	3 VFD	100	3,000	102	1993	
161st Ave Inlet	🔌	BIP	LH520	1 VFD	40	3,500	38	2002	
		BIP	LH520	2 VFD	40	3,500	38	2002	
670	⚡	TESSL	PP670†	1 VFD	10	200	110	1991	299’
		TESSL	PP670†	2 VFD	15	300	110	1991	
		TESSL	PP670†	3 VFD	75	1,800	110	1991	
		TESSL	LH520	4	40	2,500	40	~1984	
CCUD 475/580	🔌	CCUD440	CCUD475	1 VFD	15	600	66	2011	420’
(33% Bellevue)		CCUD440	CCUD475	2 VFD	25	1,200	66	2011	
Operated and		CCUD440	CCUD475	3 VFD	25	1,200	66	2011	
Maintained by		CCUD440	CCUD580	4	75	1,200	192	1995	
CCUD		CCUD440	CCUD580	5	75	1,200	192	1995	

⚡ Denotes on-site generator

🔌 Denotes receptacle for portable generator

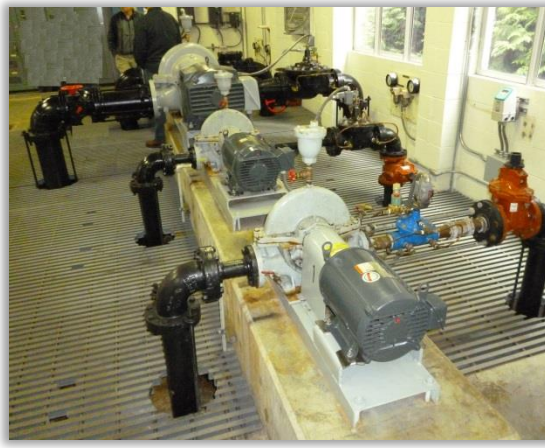
† Denotes “closed” zones with no storage downstream

Recently, former pump stations at the Somerset #3 and Factoria reservoir sites have been removed from service. Somerset #3 Pump Station is no longer needed due to redundant capacity at Horizon View #2 and Forest Hills Pump Stations. Factoria Pump Station was historically used by CCUD to supply FA460 from FA293, however this was no longer needed after assumption of these zones by the City and installation of PRV #176 from LH520.

CCUD's 475/580 pump station is not maintained by Bellevue, but indirectly serves Bellevue's customers in the Newport Hills area, and Bellevue shares in associated costs (per the terms of CCUD assumption agreement, attached in Volume 3). Bellevue will continue to work with CCUD to ensure adequate pumping capacity to meet Bellevue's current and future water supply needs.

Woodridge Pump Station

Meydenbauer Pump Station

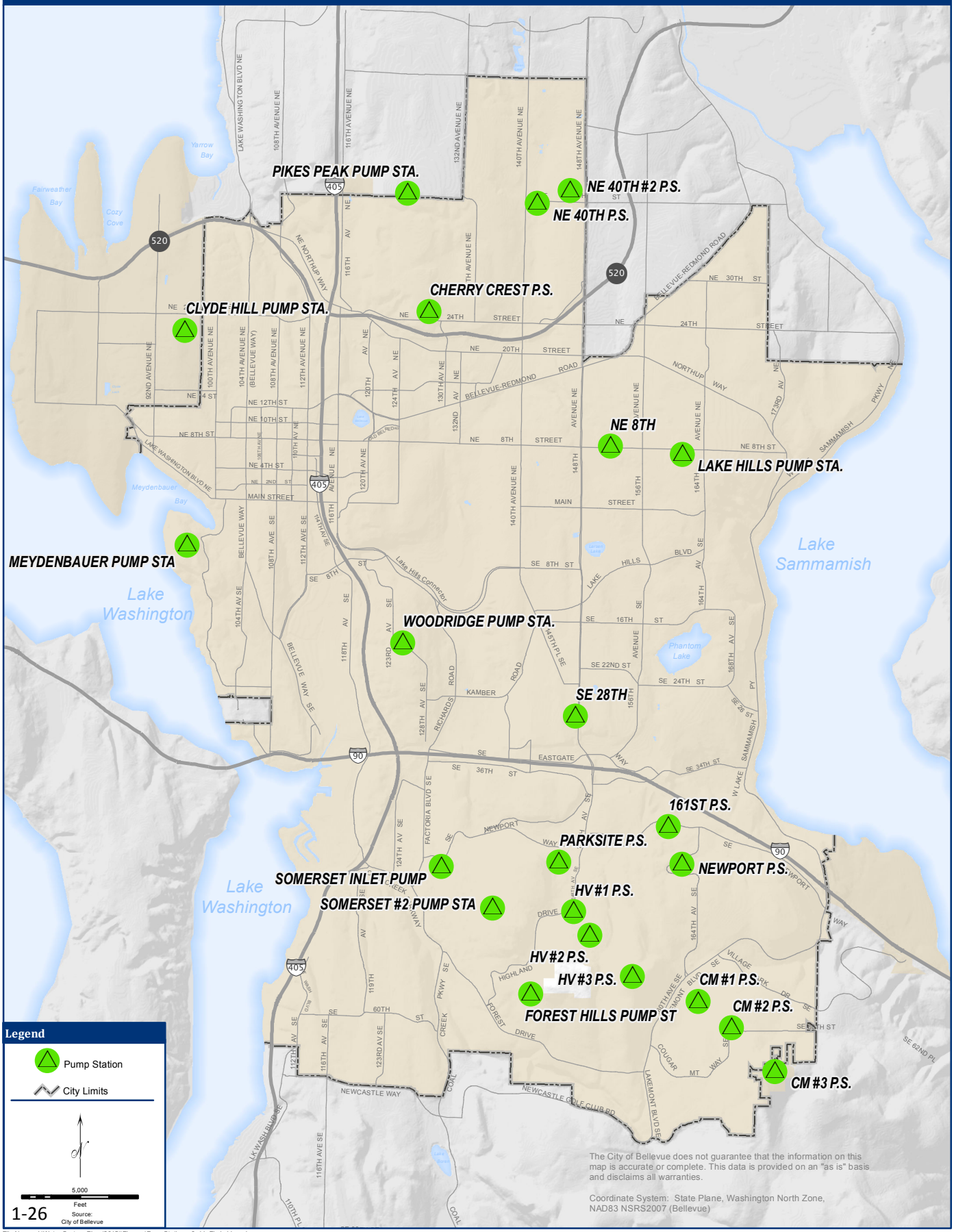


670 Pump Station

NE 8th Inlet Pump Station

Pump Stations
Figure 1-11

City of Bellevue GIS Services



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Coordinate System: State Plane, Washington North Zone, NAD83 NSRS2007 (Bellevue)

File Name: J:\Water System Plan (2015)\Figures\PumpStations_8x11_Fig1_11.mxd

IT Department

Pressure Reducing Valves

PRV stations are used to supply water from a higher pressure zone to a lower zone based on the downstream pressure setting(s). Active PRV stations are listed in Table 1-7 and shown in Figure 1-12. Breaks in sequential numbering are for stations that are no longer in service.

A typical PRV station in Bellevue's system includes both a low flow PRV (2" to 3" diameter) and high flow PRV (6" to 8" diameter) arranged in a parallel configuration. Normally the larger valve is set 5 psi lower than the smaller valve, so that the smaller valve modulates under normal demands, but the larger valve opens up during a fire event or main flushing. Settings (psi) shown in Table 1-7 are as recorded in O&M records, but do not correspond necessarily to the calibrated settings in the hydraulic model (actual settings vary).

The City performed an elevation survey of all PRV stations in 2013. Surveyors recorded elevation typically at the top slab of the PRV vault. The elevations reported in Table 1-7 include the results of this survey, minus a correction factor of 4.5-feet, representing the typical depth from the access hatch (or manhole rim) to the centerline of the PRVs. Elevations are reported in North American Vertical Datum of 1988 (NAVD88).

Table 1-7: PRV Station Inventory

PRV	Asset	Zone		Approx	Small Valve		Large Valve		Install or
Station	No.	Supply	Serves	EL	dia	psi	dia	psi	Last Rehab
003	101010	BV400	EN300	81.0	3"	81	8"	76	2008
004	101091	EN300	MB252	69.8	---	---	6"	84	1986
005	101005	BV400	MB252	63.3	3"	86	6"	81	1993
007	101003	BV400	BF220	46.1	2"	78	6"	73	1990
008	100978	CESSL	WD450	298.9	2"	70	6"	65	2011
009	101032	CESSL	WD400	191.9	2"	80	6"	75	2012
011	101102	CESSL	WD400	84.4	3"	135	8"	130	1997
012	101101	WD450	WD400	247.0	2"	54	6"	49	1985
013	101100	BV400	KC300	165.0	2"	55	6"	50	2011
014	101099	BV400	KC300	112.6	2"	80	6"	75	2010
017	101097	TESSL	PP670	403.6	3"	103	8"	98	1998
021	101096	BV400	YB300	154.1	2"	56	6"	51	2001
022	101086	BV400	CL335	161.0	2"	70	6"	65	1984
023	101094	BV400	CL335	119.5	3"	88	8"	83	1994
024	101103	CL335	MD230	163.9	3"	38	8"	33	1997
025	101092	CL335	MB252	104.1	2"	65	6"	60	2011
026	101050	CL335	MB252	58.9	2"	83	6"	78	2003
031	101062	SS550	FH465	334.6	2"	60	6"	55	1983
034	100869	BV400	BF220	29.7	2"	80	6"	75	2015
037	100871	CO440	CO380	235.5	2"	64	6"	59	1992
038	100872	LH520	CO440	282.4	1¼"	65	6"	60	1974
039	100882	LH520	CO440	285.2	2"	65	6"	60	1992
040	100884	CO380	RV300	173.9	2"	52	6"	47	1992

Table 1-7: PRV Station Inventory

PRV Station	Asset No.	Zone		Approx EL	Small Valve		Large Valve		Install or Last Rehab
		Supply	Serves		dia	psi	dia	psi	
041	100893	LH520	SH450	298.4	2”	55	6”	50	2009
042	100867	LH520	KC450	288.0	3”	65	8”	60	2012
043	100877	KC450	BV400	---	---	---	8”	65	2008
044	100878	LH520	KC450	289.0	3”	66	8”	61	1995
047	100880	LH520	BV400	214.5	3”	80	8”	70	1994
048	100889	TESSL	PP550	---	2”	85	6”	80	NIS
049	100875	LH520	BV400	299.5	---	---	6”	29	2015
050	100873	RH545	LH520	291.2	2”	96	6”	88	1994
052	100901	PP670	PP600	---	3”	72	8”	67	1997
054	100900	HV1175	HV1115	982.1	2”	58	6”	53	1979
055	100899	HV700	EG590	449.1	2”	75	6”	70	2012
056	100898	SS700	SS550	552.4	---	---	6”	5	1992
057	100897	HV700	EG630	---	2”	70	6”	65	2000
058	100896	EG440	EG300	160.1	2”	60	6”	55	2010
059	454114	LH520	EG440	307.7	2”	55	6”	50	2008
060	100894	LH520	EG440	284.1	2”	60	6”	55	2009
061	100903	LH520	SA270	86.3	3”	75	8”	70	1994
065[1]	101080	LH520	SA270	201.5	3”	20	8”	**	2005
066	100895	LH520	EG440	---	3”	75	6”	70	1972
067	100881	LH520	LH380	305.0	2”	30	6”	25	2011
068	101082	LH380	SA270	118.0	2”	63	6”	58	2001
069	101083	LH520	LH380	311.5	2”	30	6”	25	2001
070	101084	LH520	LH435	272.0	2”	66	6”	61	2008
071	454045	LH435	SA270	193.9	3”	31	8”	26	2008
072	101057	LH435	SA270	139.3	3”	54	6”	48	1974
073	101060	LH520	RM400	287.0	3”	45	6”	40	1974
080	454063	LH520	LH435	307.9	3”	49	8”	54	2008
081	101081	LH520	LH435	287.8	3”	64	6”	59	1975
082	101054	LH520	RM400	283.9	2”	47	6”	42	2008
085	101055	BV400	BF220	24.9	3”	83	8”	78	2002
086	101056	CESSL	RV300	---	3”	99	8”	92	1975
087	101067	HV1175	SS1000	826.1	2”	76	6”	71	2012
088	101058	HV1080	SS1000	900.8	2”	41	6”	37	1976
089	100996	HV1175	HV1080	974.1	2”	55	6”	50	2012
090	101053	BV400	BF220	121.0	2”	39	6”	34	2010
091	101075	SS1000	SS940	781.5	2”	55	6”	50	1998
092	454104	CESSL	WD340	213.1	3”	50	8”	45	2008
093	101078	LH520	KC450	280.0	2”	70	6”	65	1978
094	101068	LH520	KC450	330.1	2”	52	6”	47	2010
095	101076	LH520	EG400	300.6	2”	47	6”	42	2012
096	101085	SS850	HV700	579.0	2”	53	6”	48	1979

[1] The 8” valve in PRV station #65 is equipped with solenoid control. Settings are routinely changed by O&M to control operation of Sammamish Reservoir.

Table 1-7: PRV Station Inventory

PRV Station	Asset No.	Zone		Approx EL	Small Valve		Large Valve		Install or Last Rehab
		Supply	Serves		dia	psi	dia	psi	
097	101074	SS1000	SS850	740.1	2”	45	6”	40	2010
098	101073	LH520	CO380	284.9	2”	44	6”	38	1980
100	101071	SS850	SS700	577.2	2”	52	6”	47	1980
101	101070	LH520	EG400	299.8	2”	43	6”	38	1979
102	101069	HV1080	SS1000	872.0	2”	50	6”	45	1979
103	100959	SS850	SS700	---	2”	65	6”	60	1979
104	101284	SS550	FH465	351.6	2"	48	6”	43	2010
105	101113	SS850	SS700	615.5	3”	40	8”	35	1980
106	100925	SS700	SS550	435.7	2”	50	6”	45	2010
107	101182	SS700	SS550	443.2	2”	48	6”	43	1982
108	101183	SS700	SS550	450.0	2”	48	6”	43	1982
109	101184	SS700	SS550	451.2	2”	45	6”	40	1982
111	101195	HV1080	SS1000	891.8	2”	47	6”	42	1982
112	101186	HV1175	SS1000	903.5	2”	41	6”	36	1982
113	101185	SS1000	SS850	740.5	2”	44	6”	39	1983
114	101188	EG370	SA270	177.5	2”	37	6”	32	1982
115	101181	FH1100	SS1000	897.8	2”	49	6”	44	1983
116	101190	PP550	BV400	276.9	2”	56	6”	51	1984
117	101191	HV1175	HV1080	---	2”	46	6”	41	1983
118	101192	SS850	HV700	508.0	2”	84	6”	79	1984
119	101193	SS1000	HV940	811.3	2”	58	6”	53	1983
120	101168	HV700	EG590	463.3	2”	64	6”	60	1985
121	101140	SS550	FA460	312.5	---	---	6”	63	2004
122	101189	SS850	SS700	577.9	2”	54	6”	49	2007
123	101177	SU1060	SS850	755.1	2”	48	6”	43	1987
124	101179	HV1175	SU1060	959.2	2”	47	8”	42	1987
125	101150	HV1175	CM1000	881.8	2”	54	6”	49	1993
127	101194	TESSL	PP550	405.0	3”	68	6”	75	1998
128	101166	LH520	EG370	185.4	2”	80	6”	75	2007
130	101139	LH520	EG370	202.1	3”	76	8”	71	2005
131	101138	CL335	HP250	26.4	2”	87	6”	82	2012
132	101137	CL335	HP250	59.1	2”	82	6”	77	1989
133	101136	BV400	MB252	151.7	2”	44	6”	39	1986
134	101135	BV400	EN300	112.8	2”	82	6”	77	2010
135	101134	BV400	MB252	121.5	2”	58	6”	53	1988
136	101133	LH520	CO440	314.5	2”	50	6”	45	2001
137	101123	RH545	LH520	346.0	2”	70	6”	60	1986
139	101174	RM400	RM330	195.3	2”	43	6”	38	1986
140	101180	RM400	RM330	197.3	2”	48	6”	43	1986
141	101187	LH520	RM400	277.5	2”	46	6”	41	1989
142	101270	HV1175	FH1100	985.8	2”	53	6”	48	1992
143	101395	HV1175	SU1100	795.2	3”	132	8”	127	1991
144	101251	HV1175	FH1100	939.5	4”	75	8”	70	1990

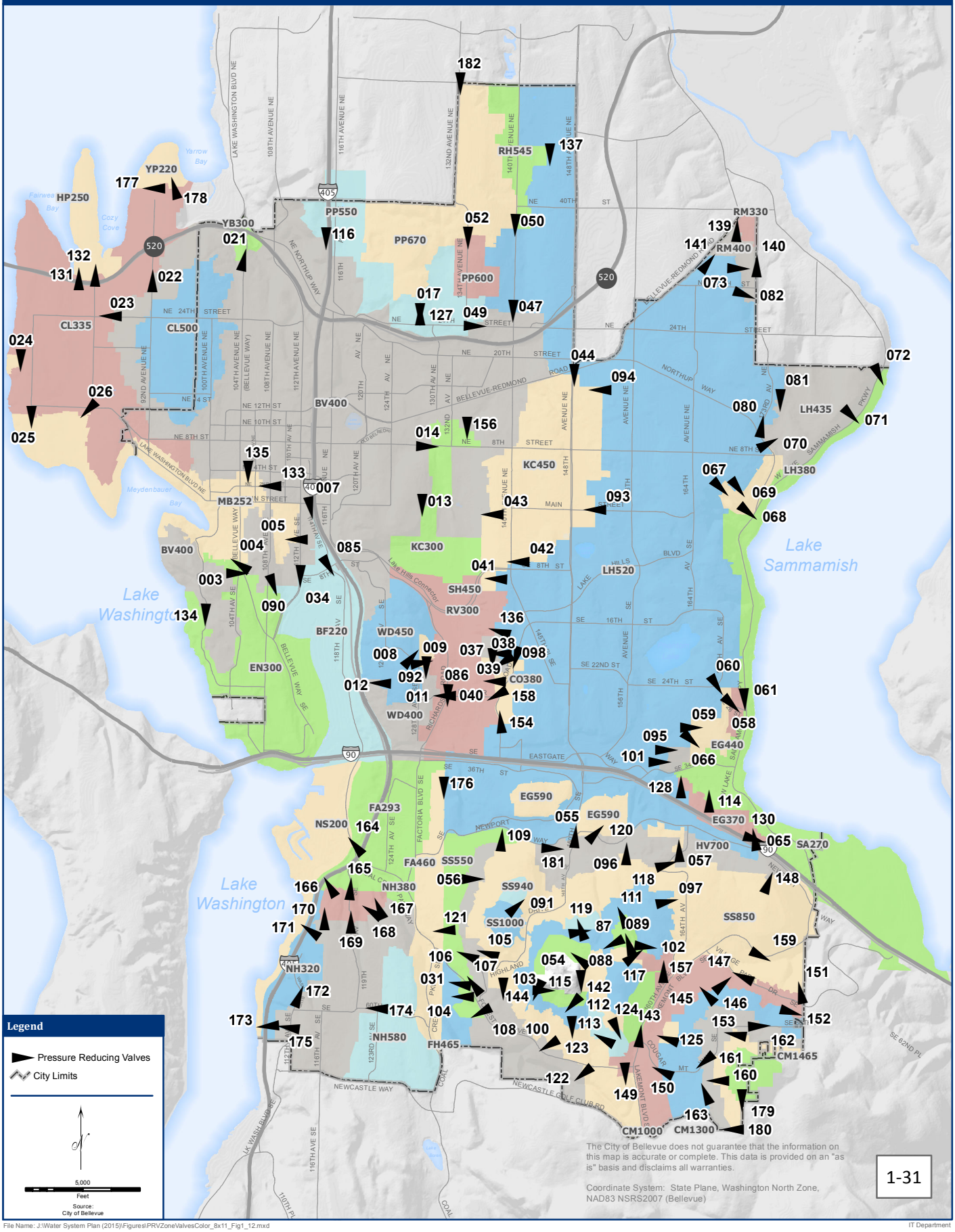
Table 1-7: PRV Station Inventory

PRV Station	Asset No.	Zone		Approx EL	Small Valve		Large Valve		Install or Last Rehab
		Supply	Serves		dia	psi	dia	psi	
145	101362	CM1150	CM1000	924.3	2”	35	6”	30	1992
146	101363	CM1150	CM1000	877.5	4”	55	8”	50	1992
147	101373	CM1000	SS850	770.1	2”	35	6”	30	1992
148	101365	SS850	HV700	632.1	2”	34	6”	29	1992
149	101175	CM1000	SS850	728.9	2”	50	6”	45	1992
150	101367	CM1150	CM1000	884.5	2”	53	6”	48	2004
151	101378	CM1000	SS850	750.1	2”	42	6”	37	1995
152	101369	CM1150	CM1000	876.8	2”	50	6”	45	1996
153	101360	CM1465	CM1300	1213.7	2”	26	6”	21	1998
154	101371	LH520	CO380	229.4	2”	64	6”	59	1996
156	101160	BV400	KC300	141.2	2”	64	6”	59	1997
157	101366	SU1100	CM1000	822.5	2”	75	6”	70	1997
158	101364	CO380	RV300	179.3	2”	55	6”	49	1998
159	101173	SS850	600	528.0	---	---	6”	30	1999
160	101172	CM1465	CM1300	1191.5	2”	58	6”	53	1999
161	101171	CM1300	CM1150	1037.0	2”	47	6”	42	2001
162	101170	CM1300	CM1150	1040.6	2”	43	6”	38	1999
163	101169	CM1300	CM1150	1048.3	2”	38	6”	33	2002
164	101159	FA293	NS200	60.3	3”	62	8”	57	2010
165	101167	NH380	FA293	185.1	2”	43	6”	38	1988
166	101176	NH380	FA293	188.5	---	---	6”	42	1999
167	101165	NH470	NH380	252.8	2”	50	6”	45	1998
168	101164	NH470	NH380	248.6	2”	50	6”	45	1998
169	101163	NH470	NH380	265.2	2”	51	6”	46	2011
170	101162	NH470	NH380	288.8	2”	40	6”	35	1988
171	101151	NH320	NS200	124.9	2”	39	6”	34	2015
172	101372	NH470	NH320	241.7	2”	49	6”	44	1988
173	101131	NH320	NS200	99.0	2”	46	6”	41	1988
174	101242	NH580	NH470	351.4	2”	60	6”	55	2011
175	101232	NH470	NH320	232.6	2”	48	6”	43	1988
176	101240	LH520	FA460	295.5	3”	74	8”	70	2005
177	101249	CH335	YP220	98.0	2”	48	6”	43	2005
178	101238	CH335	YP220	122.2	2”	37	6”	33	2005
179	101237	CM1575	CM1465	---	2”	78	6”	73	2009
180	101236	CM1465	CM1300	---	2”	50	6”	45	2009
181	101235	HV700	EG590	---	2”	74	6”	69	2009
182	454134	K650	PP670	---	---	---	6”	62	2013
183	TBD	HV1175	CM1150	827.3	2”	138	6”	133	2015
184	TBD	HV700	LH520	TBD		TBD		TBD	2015

Pressure Reducing Valve Stations

Figure 1-12

City of Bellevue
GIS Services



The City of Bellevue does not guarantee that the information on this map is accurate or complete. This data is provided on an "as is" basis and disclaims all warranties.

Coordinate System: State Plane, Washington North Zone, NAD83 NSRS2007 (Bellevue)

File Name: J:\Water System Plan (2015)\Figures\PRVZoneValvesColor_8x11_Fig1_12.mxd

IT Department

Wells

Bellevue currently maintains 4 emergency wells, as listed in Table 1-8. Historically, several more wells were operated in the current service area by WD68, WD97 and Washington Water Service Co. Inc, which are held in reserve for emergency use, as listed in Table 1-9. Bellevue retains the water rights to all of these wells.

The City also has two surface water right certificates totaling 19.7 cubic feet per second (8,840-gpm or 12.7 MGD) for withdrawals from Lake Washington, used by the WD68 surface water treatment plant at the existing Meydenbauer Reservoir site, for municipal purposes.

The City's Water Rights Self-Assessment and water right certificates are attached in Appendix C. Locations of the City's emergency wells and reserved wells, and some nearby wells owned by other water districts are shown in Figure 1-13.

Table 1-8: Emergency Well Inventory

NAME	Dept. of Ecology File No.	Certificate #	Max Instantaneous Flow (gpm)	Max Annual Withdrawal (Acre-Feet)
WD97 Well No. 3	G1-*04201CWRIS	3252	850	1,360
WD97 Well No. 5	G1-*06470CWRIS	4454	500	800
WD97 Well No. 6	G1-*06472CWRIS	4453	600	960*
WD97 Well No. 7	G1-*06350CWRIS	4391	700	1,120

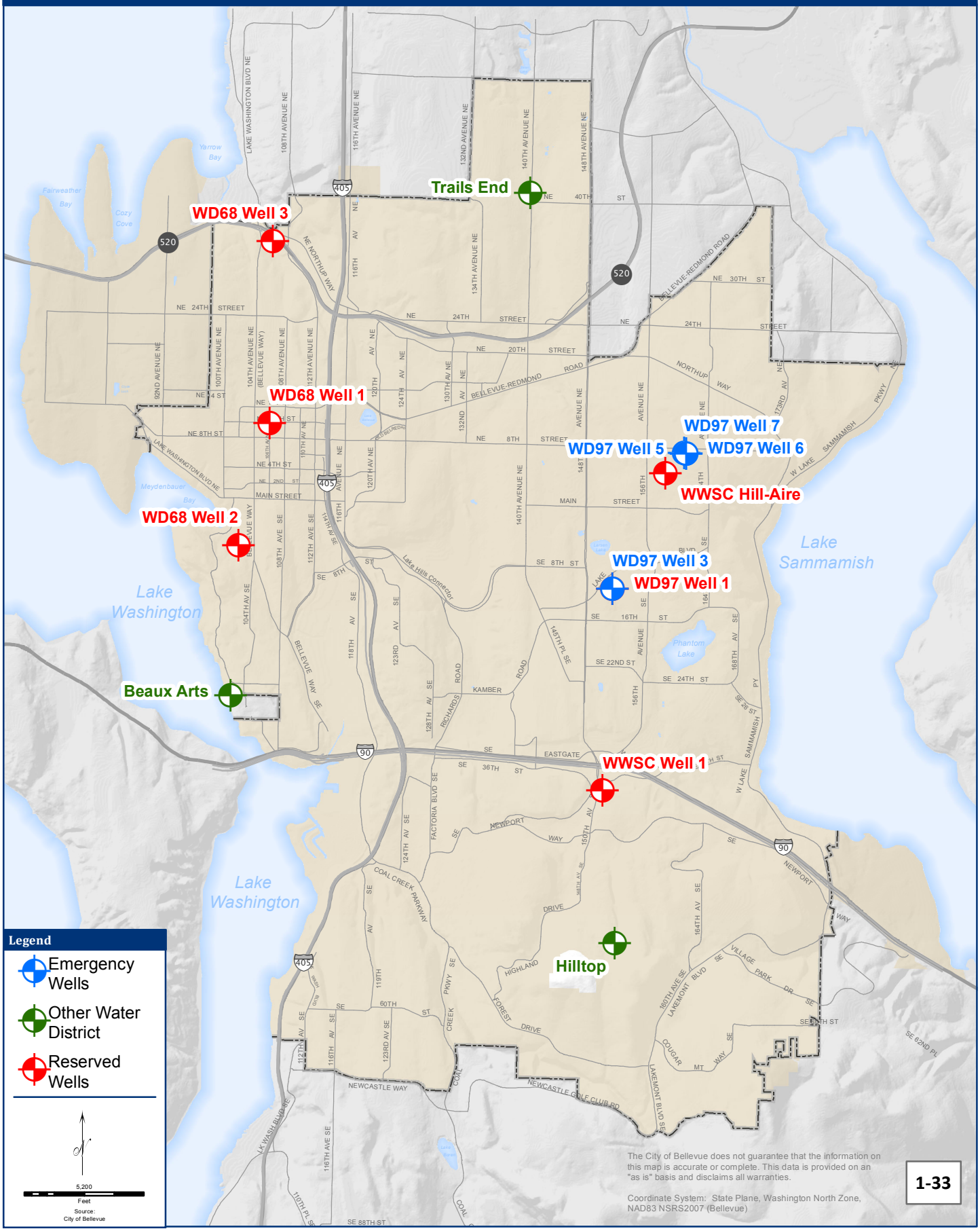
* 750 Acre-Feet/Year Additive, 210 Acre-Feet/Year Non-Additive

Table 1-9: Reserved Well Inventory

NAME	Dept. of Ecology File No.	Certificate #	Max Instantaneous Flow (gpm)	Max Annual Withdrawal (Acre-Feet)
WD68 Well No. 1	G1-*00182CWRIS	00518	300	487
WD68 Well No. 2	G1-*00490CWRIS	00360	700	780
WD68 Well No. 3	G1-*00582CWRIS	00521	700	780
WD97 Well No. 1	G1-*04058CWRIS	02539	400	450
WWSC Well No. 1	G1-*03251CWRIS	02429	300	480
WWSC Hill-Aire	G1-*01214CWRIS	02630	80	40

Domestic Water Supply Wells
Figure 1-13

City of Bellevue
GIS Services



Legend

- Emergency Wells
- Other Water District
- Reserved Wells

5,200 Feet

Source: City of Bellevue

Coordinate System: State Plane, Washington North Zone, NAD83 NSRS2007 (Bellevue)

File Name: J:\Water System Plan (2015)\Figures\Wells_8x11_Fig1_13.mxd

IT Department

1.5 Related Plans

Bellevue's local and regional relationships require coordinated water system planning. The following planning documents impact Bellevue's Water System Plan, and are available from their respective agencies.

Cascade Transmission and Supply Plan

Cascade's Transmission and Supply Plan forecasts the wholesale water supply needs for all of its members, including Bellevue. It was updated in May 2012.

Adjacent Utility Water System Plans

Bellevue's water system planning and operation are affected by adjacent water utilities. The following documents are relevant to Bellevue's water system:

- Coal Creek Utility District Water & Sewer System Plan
- City of Redmond Water System Plan
- City of Issaquah Water System Plan
- City of Kirkland Comprehensive Water System Plan
- Seattle Public Utilities Water System Plan

East King County Coordinated Water System Plan

Chapter 70.116 RCW requires water utilities to coordinate through the creation of Critical Water Supply Service Areas (CWSSAs). Each CWSSA is required to maintain a Coordinated Water System Plan (CWSP).

King County Council declared East King County a CWSSA in 1986 (Ordinance No. 7893), and created a Water Utility Coordinating Committee (WUCC) (Ordinance No. 7894), consisting of representatives of water system agencies (including Bellevue) having 50 or more service connections. King County Council adopted the CWSSA boundaries in 1987 (Ordinance No. 8214).

The WUCC, with the assistance of the East King County Regional Water Association, last updated the CWSP in 1996. Some provisions of the CWSP have been superseded by the formation of Cascade, and by other recent interlocal agreements, annexations, and assumptions of water utility infrastructure.

1.6 Duty to Serve

WAC 246-290-106 requires water utilities to provide retail water service to all new service connections within its retail service area if it can be available in a timely and reasonable manner. This requirement is reinforced in Bellevue's City Code (BCC 24.02.065, attached as Appendix D), and is complied with by the City.

1.7 Consistency with Local Planning Agencies

The City of Bellevue's Comprehensive Plan complies with the WAC 365-196 requirements of the Growth Management Act (GMA). This Water System Plan (per WAC 246-290-100) allows for water system growth consistent with the City's Comprehensive Plan, and therefore the GMA.

WAC 246-290-108 requires water utilities to request a planning consistency review from each municipality in its service area. The purpose of this review is to confirm that WSP Population and employment projections are consistent with local planning agency projections. These reviews are being conducted concurrent with the SEPA review of the Draft WSP. Consistency statements are provided in Appendix E.

1.8 Consistency for Local Watersheds

No watershed plan is in effect for Bellevue's sub-regional area.

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Chapter 2 Water Utility Policies

The City of Bellevue Utilities Department (the Utility) drinking water policies are defined below. These policies complement the City's Comprehensive Plan policies (the Utilities Element is attached as Appendix B), Water Utility Code (BCC 24.02, attached as Appendix D), and Water Engineering Standards (Volume 4).

2.1 Customer Service

These policies define the level of service provided to utility customers as well as public and private ownership and responsibility for water system components. Customer interaction policies are defined separately in the Citizen Engagement element of the City's Comprehensive Plan.

Service Ownership/Responsibility

The Utility shall own and maintain all water facilities in public rights-of-way, all water facilities in easements dedicated to the public and accepted by the utility, and all service lines up to and including the meter, except to the extent that private ownership is otherwise indicated as a matter of record. For unmetered connections (fire sprinklers), City ownership ends at the customer side of the valve closest to the water main.

The Utility shall require private ownership of facilities on private property that exclusively benefit the underlying property or a single adjacent property.

Except meters and the service line upstream of the meter, all other water facilities located on private property are owned by the fee property owner(s), unless otherwise assigned or dedicated by easement to the city, except to the extent that public ownership is indicated as a matter of record. Property owners shall be responsible for the development, maintenance, and repair of all private water facilities, including pressure reducing valves, pumps, and backflow prevention assemblies on the customer side of the meter.

The Utility uses meters on services to monitor and charge for water consumption. The Utility needs to control the meter to enforce payment and compliance with utility standards. The meter is normally located at the property line and provides a logical separation point between City and private ownership and responsibility. There are isolated existing instances where ownership of the line to the meter is private, under separate arrangement.

Property owners must maintain private facilities and piping, including the joint at the connection point inside the meter box, in serviceable condition to allow routine maintenance and replacement of the meter. Any breaks or leaks due to condition of private

facilities are the property owner's responsibility. The meter box, but not everything within it (as described in this paragraph,) is owned by the Utility.

New service connections should be through the right-of-way frontage of the property, and not through adjacent property or easements, to the extent feasible. Connections to water mains in private property or easements limit the Utility's future ability to abandon pipe, and creates the potential for private landowner disputes concerning public assets.

Emergency Preparedness

The Utility will prepare and periodically update an Emergency Management Plan. The plan will include provisions for an organized response to the most likely kinds of emergencies that may endanger the health or safety of the general public, or jeopardize the operation of the public water system. The plan will also address issues related to long term system recovery for orderly and complete restoration of the water system after an emergency.

A key Utility responsibility is to respond to the needs of all water utility customers and the general public during times of crisis. The continued availability of potable water during a disaster and restoration of service following a disaster is essential.

The Emergency Management Plan focuses on problems created by major disasters, such as an earthquake or flood. The plan encourages local and regional partnerships to strengthen response capabilities. It is not intended to address minor isolated system interruptions such as those caused by isolated main breaks and power outages; standard operating procedures have been established to address these minor interruptions.

The Emergency Management Plan complies with applicable RCW and WAC requirements as well as requirements of the water supply contract between the Utility and Cascade Water Alliance. Reconstruction of damaged infrastructure should be to current codes and standards, and should be consistent with current Water System Plan Policies, to protect current and future customers, assure consistency with the City's long range plans, and ensure access to federal funds for reconstruction, where available.

Service Pressure and Flow

The Utility shall provide domestic water to utility customers in sufficient quantity to meet peak hour demands and at a pressure that meets or exceeds applicable regulations.

The Utility's goal is to provide minimum system pressure of 30 psi, measured at the service meter under normal conditions, or 20 psi during fire flow and other emergency conditions, in accordance with WAC 246-290-230. Property owners may install private booster pumps to achieve higher pressures, if they choose. Ownership, maintenance, and liability associated with such private booster pumps is the responsibility of the property owner.

Customer complaints of low water pressure are often caused by corroded internal plumbing which restricts flow volume, rather than system pressure. In such cases, increased system pressure would make very little difference in actual service provided. Where modification of utility-owned pipes would significantly improve flow, such as replacement of single service lines that serve more than one home with adequate internal plumbing, the Utility should make such modification.

Service Reliability

The Utility shall invest resources as necessary to construct, maintain and renew water system infrastructure and equipment such that Utility customers are provided consistent, reliable service, except during maintenance activities. Where practicable, the distribution system shall have operational redundancy. Connections with adjacent water systems should be encouraged to improve reliability and reduce vulnerability to loss of water service or improve distribution capability.

The Utility shall provide sufficient maintenance and use appropriate operation practices to keep the water system infrastructure in good working order. Where operation and maintenance procedures are not sufficient or cost effective, capital projects shall be scheduled and funded to replace or rehabilitate infrastructure facilities.

Wherever possible, the Utility shall anticipate system interruptions and the system shall be designed and operated to minimize the impact of such interruptions to customers. For that reason:

- No more than 250 equivalent residential units (ERUs) should be supplied water from a single pipeline.
- Onsite backup power generation or a receptacle to connect a portable generator should be provided at all pump stations.
- To the extent practicable, equipment redundancy should be provided (i.e., provide facilities to pump maximum demand flow rates with the largest pump out of service.)
- Service interruptions are sometimes required to replace, maintain or repair the Utility's infrastructure, or to facilitate system expansion. Although continuous service is not guaranteed, the Utility strives to limit interruptions, and requires isolation valves to limit the size of the affected areas.

Drinking Water Storage for Emergency Supply Outages

The Utility shall construct and operate water storage facilities sufficient to keep a minimum volume of one average day's water usage in reserve, for use in case of water supply disruption. This storage shall be in addition to the volume of storage used for daily operations and fire flow.

The Washington State Department of Health (DOH) requires water storage for operational, equalizing, fire and standby purposes. The minimum DOH requirement for standby volume is generally based on a formula of two days of average water usage minus a volume credit where there are multiple water sources. If community expectations are amenable to one average day of service instead of two days, DOH allows for a minimum of one day.

Bellevue's long standing practice has been to maintain at least one day of standby storage, to temporarily serve customers in the event of a local or regional water supply emergency.

Construction, maintenance and operation of water storage reservoirs are a significant cost to Utility rate payers. In addition, excessive storage can negatively impact water quality. Bellevue's water is supplied from two independent sources, the Tolt and Cedar River watersheds, which adds supply redundancy. There is also significant regional system storage nearby (SPU's Eastside Reservoir). Finally, Bellevue has ground water rights that can provide some emergency water supply in the event primary supplies are interrupted.

Considering the cost and negative water quality considerations of additional storage and multiple water supply sources to mitigate risk, one day of average water usage is an appropriate standby storage volume for the Utility's service area.

Green Buildings

The Utility should anticipate, investigate and prepare for the construction or use of buildings with zero net water usage. The Utility supports sustainable development consistent with existing policies, public safety and ratepayer equity.

Innovative green building technologies are likely to be proposed for development in Bellevue in the next planning period. The Utility should anticipate policy and technical issues that may be associated with such development such as:

- Reduced water consumption;
- Building Code and regulatory changes;
- On-site water reclamation and the need for backflow prevention; and
- Appropriate service charges for public system asset management including replacement, fire protection, and other benefits received.

Where appropriate, Utility codes and standards should be updated in anticipation of and preparation for such development.

2.2 Facility Abandonment

These policies specify how to address facilities that are identified for abandonment by the Utility.

Facility Abandonment

When the Utility abandons a facility, it shall be done in a safe and environmentally sound manner, consistent with all applicable federal, state, and local regulations at the time of abandonment.

Occasionally, the Utility no longer needs some element of the water system infrastructure, such as a pipe, a pump station, or a reservoir. When a facility is abandoned in-place, detailed as-built records should be maintained in utility records. Facility abandonment should be done in the manner directed by the Engineering Standards.

In the case of abandoned asbestos cement (AC) pipe, standard practice and currently accepted environmental policy dictates that the City should leave the pipe in-place. Asbestos fibers in AC pipe are not released or harmful unless the pipe is broken or disturbed (e.g. during excavation and removal). In that case, the pipe must be dealt with as a hazardous material, and special precautions must be taken to prevent fiber inhalation. For this reason, it is preferable to limit disturbance of this material and leave AC pipe in place in the right-of-way. However, when AC pipe is abandoned in an easement on private property, where it is unlikely the City would be aware of future pipe disturbance, it should be removed by the Utility unless dictated by specific circumstances.

Facility Repurposing

If an abandoned utility facility would be appropriate for another use, it may be repurposed provided all costs and future liability are borne by the beneficiary of the facility, and provided opportunities for revenue are pursued as appropriate.

Occasionally, the Utility no longer needs some element of the water system infrastructure, such as a pipe, a pump station, or a reservoir. Whenever such facilities are abandoned, surplus of the facility should be considered, as well as opportunity to generate revenue from repurposed facilities. Utility liability associated with use of the facility should be considered and minimized. Sale or disposition of utility assets requires City Council Resolution, per Bellevue City Code section 4.32.070.

2.3 Fire Protection

These policies detail the City's responsibility for providing fire flow, including system requirements for new and existing construction and the Utility's commitment to system improvements.

Fire System Responsibility

The Utility is responsible to provide and maintain the public water system infrastructure to deliver water for fire protection to currently served customers.

The water system infrastructure, including water mains, storage, hydrants, pump stations, and related facilities, shall be designed to meet all applicable codes at the time of construction, including the capability to store, convey, and deliver water for fire protection.

The Utility is responsible to maintain, repair or replace mains, lines, hydrants, and valves as necessary to keep said facilities in good working order. Where fire protection is provided, benefited properties should pay for that benefit, even if they don't use the public water system for their drinking water supply.

Fire Flow Requirements for New Construction

The applicant or developer of new development or redevelopment is responsible to provide the minimum fire flow requirement established by the Fire Marshal for that development.

It is the developer's responsibility to install all facilities needed to serve its development, to meet applicable development standards, and to meet the required fire flow established by the Fire Marshal for the developer's proposed project. If necessary to meet these requirements, the developer shall make off-site water system improvements. If off-site improvements result in benefit to a broader geographic area, the Utility may contribute an equitable share of the improvement costs provided sufficient financial resources are available (for example, if an improvement increases fire flow to the Utility's minimum standard fire flow of 1000 gpm or greater in an area that had less than 1000 gpm available prior to the improvement).

Fire Flow Requirements for Existing Construction

The minimum fire flow available to existing facilities shall be the fire flow requirements at the time of construction.

Existing structures are not required to upgrade the water system infrastructure to meet current fire flow and development standards unless redevelopment of the structure or property triggers such upgrades. Similarly, the Utility is not obligated to upgrade available fire flow to meet current code requirements. However, when analyzing the need for water system improvements, improved fire flow should be considered when weighing the project's merits.

Fire Flow Improvement Program

The Utility shall continue to make system improvements with the objective of providing a minimum fire flow of 1,000 gallons per minute throughout the distribution system.

The Utility has systematically improved infrastructure capacities toward providing a minimum level of fire flow protection to all customers within the service area. The program should continue to make improvements such as replacing undersized water mains to provide at least 1,000 gpm (while meeting system performance criteria for pressure and velocity), installing new hydrants to provide maximum hydrant spacing of 500 ft, and replacing all two port hydrants with three port hydrants throughout the system. System improvements should generally be prioritized and scheduled according to the severity of deficiencies, although opportunities to make improvements in conjunction with other construction should be considered for economic efficiency. Because larger pipelines increase water age in the system, additional investments to monitor and/or improve water quality may also be necessary as part of this program.

Customers who have at least 1,000 gpm fire flow available, but require additional fire flow to support proposed new development or redevelopment, are required to make the necessary on- or off-site improvements. Alternatively, developers may make on-site design choices, such as fire suppression systems, that reduce the fire flow requirement per the Fire Code.

2.4 Service Area

Service area policies concern the existing and ultimate service area boundaries and conditions for service extension within those boundaries.

Satellite/Remote Systems

Satellite/Remote Systems are not allowed within Bellevue's service area. Requests for water service will be accommodated only through direct connection to Bellevue's water system.

Bellevue has in place all the major facilities (pump stations, storage reservoirs, etc.) and water mains required to make water available throughout its ultimate service area via short water main extensions. The Utility will work with property owners to facilitate developer or city-installed construction of water main extensions as needed to provide service. Therefore, the creation of remote water systems is unnecessary and there is no identified need for Bellevue to become a satellite management agency.

This policy does not preclude the Utility from evaluating and entering interlocal agreements if more efficient and effective service can be provided via connection to an adjacent utility's system.

Service Extension

Water system service will be extended to unserved areas of the water service area, including potential annexation areas, if the city's costs are reimbursed and sufficient financial resources are available. Service will be extended only upon annexation to the City.

It is most efficient and economical for the City to provide services to city residents. Therefore, the water service area coincides with the Potential Annexation Area within the Urban Growth Boundary defined in Bellevue's Comprehensive Plan. The policy is consistent with the Utilities Element of the City Comprehensive Plan.

Property owners are responsible for extending water service to their property, and to the extreme of the property to accommodate subsequent development at one or more locations, as deemed necessary by the Utility. The developer is responsible for the cost of extensions both on- and off-site, and may recover some costs from other benefitted properties, to the extent allowed by law.

Occasionally, the Utility may require a developer to install a larger water main than is needed to meet its fire flow requirement. This is done to assure that the fire flow requirements of nearby future development can be met without having to up-size an existing water main. When oversizing is required, the utility will reimburse the developer for

the incremental cost increase of the larger pipe, and may recover the cost of oversizing from future development.

The City may extend the system to assure orderly system development, in which case, benefited property owners would be responsible for an equitable share of extension costs.

Requests for Assumption by Water Districts or Private Water Systems

Bellevue may assume the operation of a water district or private water system at their request if the following conditions are met and subject to the approval of the Bellevue City Council:

1. **The district or private system is adjacent to or within Bellevue's water service area.**

2. **The district's or private system's facilities meet Bellevue's performance criteria and engineering standards, or a plan is in place to assure they will be brought up to Bellevue's standards without adversely impacting Bellevue's existing customers financially or with regard to level of service.**

3. **The assumption of the district or private system is permitted by State law.**

King County Water District #1 approached Bellevue requesting eventual assumption, and an agreement in conformance with this policy was reached in 2004.

Two other small districts could potentially request assumption by Bellevue: King County Water Districts #22 (Beaux Arts) is outside of Bellevue City limits but relies on Bellevue for emergency water supply. The service area of King County Water District #117 (Hilltop Community) was recently annexed into the City of Bellevue. Bellevue has not been approached by the owners of either of these districts to request assumption.

A limited number of small, private water systems use well water within Bellevue's service area. None of these systems have indicated an interest in assumption by the City.

Bellevue Initiated Assumption of Water Districts

Bellevue will seek to assume the operation of a water district when the City Council determines that the assumption is in the best interest of the City and the assumption is consistent with the City's Comprehensive Plan, and will do so as permitted by state law.

It is Bellevue's policy, as stated in the City's Comprehensive Plan, to own and operate all public utility systems within the City limits unless circumstances otherwise dictate. Assumption of water districts within Bellevue City limits at the direction of the City Council are in conformance with this policy.

Water Sales Outside Bellevue's Service Area

New requests for the sale of water outside of the Utility's service area will be considered only under the following circumstances:

1. **The requestor first obtains a water supply agreement with the agency responsible for supplying Bellevue's water.**

2. **The provision of water does not compromise design and performance standards for existing water customers.**

3. **The sale of water does not result in any adverse financial impact to Bellevue's existing water customers.**

Bellevue's water system has been planned and designed to accommodate the current and anticipated needs of customers within Bellevue's water service area and existing wholesale customers in accordance with the wholesale water service agreements. Any additional area that requests water supply from Bellevue must address issues relating to limited water supply and adverse impacts on Bellevue's water system and customer service levels. Water service within another jurisdiction's service area would be per interlocal agreement.

2.5 Water Quality

These policies explain the obligations of Cascade, SPU, the City, and the customer regarding water quality standards from supply to the point of use.

Water Quality Responsibility

The Utility will rely on the agency supplying Bellevue's water, Cascade Water Alliance, to provide water that meets applicable water quality standards in accordance with the supply agreement. The Utility will take action necessary to ensure that applicable water quality standards are met to the point of delivery to the customer.

Bellevue's supply agreement with the Cascade Water Alliance requires that water delivered to the City of Bellevue meets all state and federal water quality standards. Water samples collected from throughout the system are tested for compliance.

Water is a perishable product. Water quality can fall below accepted standards before reaching the customer if microbial regrowth occurs, excessive levels of disinfection by-products (DBP's) form, or outside contaminants are introduced into the water system. The Utility will take the necessary steps to ensure that water reaching the point of delivery meets or exceeds all water quality standards. To accomplish this, the Utility will maintain programs to prevent microbial regrowth, excessive DBP formation, and contamination of the water system.

Maintaining the water quality to the actual point of use is the responsibility of the Utility, except when due to conditions outside of the Utility's control, such as private system conditions that contribute to water quality degradation in the customer's system.

Cross Connection Control

The Utility shall administer a cross connection control program that protects the City's public water supply and users of the public water supply from backflow contamination, in accordance with federal, state and local requirements.

The Washington State Department of Health (DOH) requires that public water utilities implement a cross connection control program to prevent water system contamination due to backflow. Bellevue's cross connection control program requires installation of approved backflow prevention assemblies on, or disconnection of, identified cross connections. The program identifies potential cross connections through both the City's plan and permit review process, and site inspections of high risk properties. The program also requires testing of all backflow prevention assemblies within the water system at the time of installation and annually thereafter. The City will continue to implement all aspects of this program, and to amend the program as industry standards change.

2.6 Regional Policies

These policies discuss regional policy development, the Utility's contractual commitment with Cascade, conservation as it affects supply, and the Utility's response during water supply shortages. The City coordinates regional water supply efforts with Cascade as appropriate.

Regional Policy Development

The Utilities Department shall seek to:

- **Accomplish the City's environmental goals to promote a healthy environment, public safety and a strong economy, essential to maintaining the city's and region's quality of life;**
- **Ensure reasonable and prudent fiscal policies on behalf of ratepayers;**
- **Ensure regional, state and federal requirements are fiscally prudent and achievable; and**
- **Maintain local control and flexibility in policy/program implementation.**

The Utilities Department's role is to develop proposed guiding principles/interests for Council approval. Pursuant to Council direction, the Utilities Department role in monitoring, influencing, developing and implementing regional, state, and federal water utility requirements, policies and programs may include:

- **Influencing legislation through lobbying and written/verbal testimony;**

- **Participating in rule-making;**
- **Reviewing technical documents;**
- **Serving on regional forums and coalitions, advisory committees and work groups; and**
- **Providing technical and staff support for Council members serving on regional, state, or federal water utility committees.**

The Utilities Department has participated in the development and implementation of regional, state, and federal water utility requirements, policies and programs for a number of reasons:

- The City has a direct interest in helping shape regional, state and federal water utility mandates because they affect utility costs, can result in rigid programs that preclude more creative or effective local ones, or can result in requirements that are impossible to meet.
- The City has been looked to as a significant stakeholder with regard to the updating and revision of regional and state water utility requirements and therefore has had an opportunity to serve as a technical resource and participant in shaping requirements, policy and programs to benefit the City.
- The City benefits from learning about the experiences and technical expertise of others.

The Utilities Department's role in developing regional, state, and federal requirements, policies and programs varies from influencing legislation, rules, and policy to sharing technical information and participating in technical peer review groups, advisory panels, and joint studies. Through its involvement, the Utilities Department seeks to achieve the City's goals while keeping down costs to utility rate payers and maintaining local control and flexibility.

Water Supply Source

The Utility will continue to partner with regional suppliers for water supply. The Utility will work cooperatively with Cascade Water Alliance, other purveyors, and other water supply agencies to assure a safe, reliable water supply at the lowest environmental and economic and social cost.

Originally, water supply in Bellevue was provided by local wells. In the 1970s, Bellevue began purchasing water from the City of Seattle to better meet water supply needs. Bellevue continued to purchase water directly from Seattle until 2004, when Cascade Water Alliance was formed. Bellevue now purchases Seattle water indirectly through a contract with Cascade Water Alliance.

The current agreement provides Bellevue and other Cascade Water Alliance members with a greater role in determining future water supply decisions. The water supply system is a regional resource that must be managed for the benefit of all current and potential new users.

Efficient Water Use

The Utility will partner with regional suppliers to promote the wise and efficient use of water. The Utility will implement programs consistent with the Washington State Department of Health water use efficiency requirements, and intended to achieve conservation goals established cooperatively with regional water suppliers.

WAC 246-290-810 requires water utilities to establish water use efficiency programs. Water use efficiency benefits the Utility's ratepayers by potentially reducing future capital needs and by preserving water supplies for future economic growth. The efficient and wise use of water extends and makes the best use of existing water supplies before developing new sources.

It is cost-efficient and effective to work cooperatively with the regional water supplier to develop common goals that meet DOH water use efficiency requirements. The Utility will support programs that help Bellevue achieve those goals.

Reclaimed Water Use

Bellevue will consider supporting the use of reclaimed water where there is a demand for it, and where it provides an appropriate and cost effective alternative to Bellevue's potable water supply.

Cascade Water Alliance evaluated the potential sources and users of reclaimed water as part of its Transmission and Supply Plan. This evaluation identified King County's Brightwater Treatment Plant and South Treatment Plant as potential suppliers, and several large irrigation systems as potential customers. The cost of reclaimed water distribution piping was identified as the primary obstacle to reclaimed water use. Bellevue will continue to consider regional efforts to develop reclaimed water supplies, where appropriate.

Emerging technologies such as on-site water recycling and zero discharge facilities are not precluded or discouraged by this policy. Such facilities operating independently from Bellevue's water and/or sewer systems may be subject to the jurisdiction of plumbing codes, King County Public Health Department, and/or the Washington State Department of Health.

Water Shortage Response

The Utility will maintain a local response plan for water supply shortages caused by a drought or supply interruption as part of its Emergency Management Plan for emergency preparedness. The Plan will be consistent with other regional purveyors' planned response(s), and with contractual agreements. The Plan's objectives will include ensuring that, to the extent possible, the essential needs of its customers are met.

Bellevue's supply agreement with Cascade Water Alliance includes provisions for users of the regional water supply system to respond to water shortages caused by unforeseen events in a manner that ensures water is available for essential uses. Cascade and SPU work cooperatively to develop a water shortage response plan that coordinates regional response among Cascade members.

Emergencies can occur that disrupt service to localized areas of the Bellevue service area. For such events, the Utility will notify the City Manager of the emergency and provide a recommended plan of action. The City Manager is empowered to take the necessary steps to ensure, to the extent possible, that all essential uses are met.

Water Rights

The Utility should optimize use of existing water rights when it is in the best interest of rate payers and consistent with existing water supply agreements. Water rights should be used to provide resiliency in the event of a water supply emergency.

The Utility holds water rights that were issued to King County Water Districts No. 68, No. 97, and other former districts that are now part of the Utility. These assets should be used if shown to be beneficial to Utility rate payers. The Utility should evaluate the potential costs, risks and benefits associated with the use of existing water rights to provide an independent, continuous water supply during a water supply emergency. These water rights and associated infrastructure should be maintained and incorporated into emergency planning, if appropriate and cost effective.

2.7 Financial Policies

The Utilities Department's Waterworks Utility Financial Policies govern rate setting, development charges, capital improvement financing, and reserves. These Financial Policies apply to all three utilities (water, wastewater, and storm drainage), and are updated separately from the WSP.

Waterworks Utility

Financial Policies

December, 2012

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INTRODUCTION

The Waterworks Utility is the financial consolidation of the Sewer, Storm & Surface Water and Water Utilities of the City of Bellevue for debt rating and coverage purposes as established in Ordinance No.'s 2169, 2845, 3158 and 4568. It pledges the strengths and revenues of the three separate Utilities for the common financial good while keeping each Utility financially separate for budgeting, rate-setting, revenues, expenditures, debt and accounting.

These "Financial Policies" apply uniformly to the Sewer, Storm & Surface Water and Water Utilities with few, unique exceptions which are identified separately. This update reflects changes consistent with current long-range financial planning, particularly with regard to renewal and replacement funding, the use of debt and rate policies. They supersede the Financial Policies, which were adopted under Resolution No. 5967 in 1995.

These policies do not stand-alone. They must be taken in context with the other major City and Utilities documents and processes. For instance, each Utility has its own System Plan, which documents its unique objectives, planning, operations and capital needs. These Utility System Plans have historically had a 20-year planning horizon. Future Utility System Plans will need to evaluate long term renewal and replacement of aging facilities, much of which were constructed in the 1950's and 1960's during periods of high growth rates and are approaching the end of their useful life. Life cycle costs should be considered in planning the future capital facilities and infrastructure needs.

The City has a seven-year City-wide Capital Investment Program (CIP) Plan which is updated with each biennial budget cycle. All major City capital projects are included. Generally, they are described as over $25,000; involving new physical construction, reconstruction or replacement; and involving City funding. The CIP identifies the level and source of funding for each project. The CIP includes specific sections for each Utility which identify near-term capital projects consistent with each current Utility System Plan and several projects of general scope including renewal and rehabilitation, capital upgrades, response to growth and other system needs.

I. GENERAL POLICIES

A. *Fiscal Stewardship*

The Waterworks Utility funds and resources shall be managed in a professional manner in accordance with applicable laws, standards, City financial practices and these Financial Policies.

Discussion:

It is incumbent on Utility management to provide professional fiscal management of utility funds and resources. This requires thorough knowledge of and conformance with the City financial management processes and systems as well as applicable laws and standards. It also requires on-going monitoring of revenues and expenses in order to make decisions and report to City officials, as needed, regarding the status of Utilities financing. Independent financial review, analysis and recommendations should be undertaken as needed.

B*. Self-sufficient Funding*

Each Utility shall remain a self-supporting enterprise fund.

Discussion:

The revenues to each Utility primarily come from customer charges dependent on established rates. State law requires that utility funds be used only for utility purposes. Since each Utility has somewhat differing service areas, it is essential for ratepayer equity that they be kept financially separate and accountable. The City's General Fund can legally contribute to the Utility funds but does not. The City budgeting process includes a balanced and controlled biennial Utility budget. This requires careful preparation of expense and revenue projections that will be reviewed by City management, the Environmental Services Commission, the general public and the City Council prior to approval of any change in Utility rates.

C. *Utility System Planning Policies*

The Water Utility System Plan shall be updated every six years as required by state statute; the Wastewater and Storm & Surface Water System Plans shall be updated as required by changed conditions or state statute, generally every six to ten years. All Utility system plans shall use a 20-year planning horizon or greater, and shall consider life cycle costs to identify funding needs. Studies to analyze specific geographic areas or issues, such as Storm & Surface Water basin plans, Wastewater capacity and flow studies, or Water pressure zone studies will be completed as required using similar criteria for planning infrastructure needs.

Substantial portions of the City utility systems were constructed in the 1950's and 1960's. These systems are approaching the end of their useful life as illustrated on the following Exhibit 1 - Watermain Replacement Spending and Exhibit 2 - Sewermain Replacement Spending. The storm & surface water infrastructure is of similar age but has not been graphed. It most likely has a relatively shorter expected life span. The object is to determine and follow a survivor curve replacement schedule rather than the replacement schedule based on age alone. Assumptions for survivor curves and useful lives are revisited periodically. These were assessed in 2004 and updated for the most recent engineering and financial findings. Significant changes include the adjustment of replacement costs to current price levels, categorization of pipe assets based on expected useful lives, and replacement of major non-pipe Utility assets such as pump stations and reservoirs. The Exhibits illustrate an example survival replacement curve based on preliminary estimates only. As real needs are determined, they will replace the estimated curves. Renewal and/or replacement will require substantial reinvestment in the future and have major rate impacts if large portions of the systems have to be replaced in relatively short periods of time. The actual useful life of underground utilities is difficult to determine and the best available data is needed to be able to plan for the orderly and timely renewal and/or replacement. For this purpose, the utility system plans need to have at least 20 year planning horizons and must address the aging of the Utility systems.

Long term system planning for the Utility systems is required in order to assure that the future financial needs are anticipated and equitable funding plans can be developed. In order to keep funding plans current, utility system plans need to be updated approximately every six years (as required by State law for water and sewer system plans). These Financial Policies will then be reviewed and updated as needed.

Exhibit 1
Watermain Replacement Spending
(Based on 75-Year Expected Asset Life)

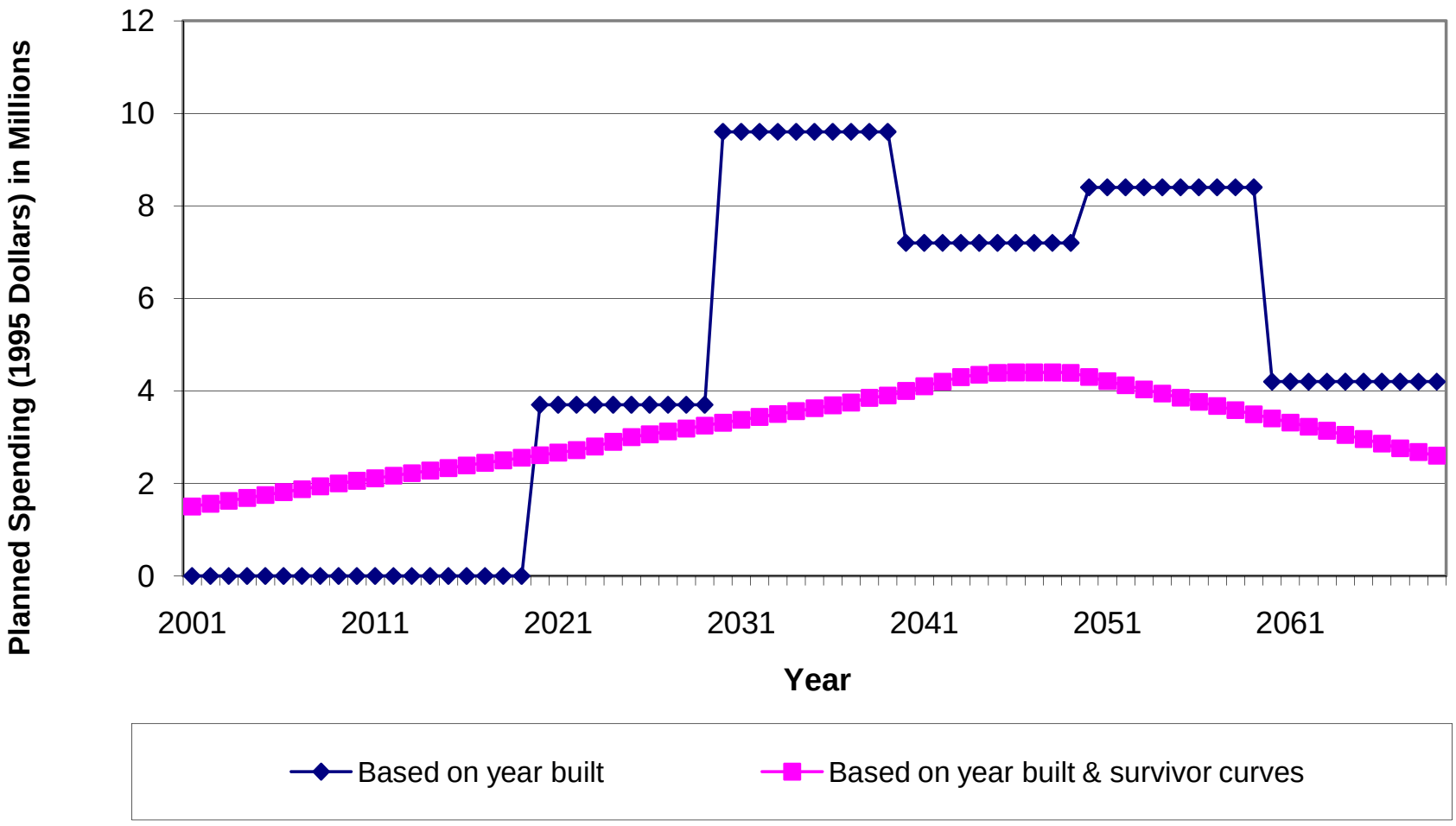
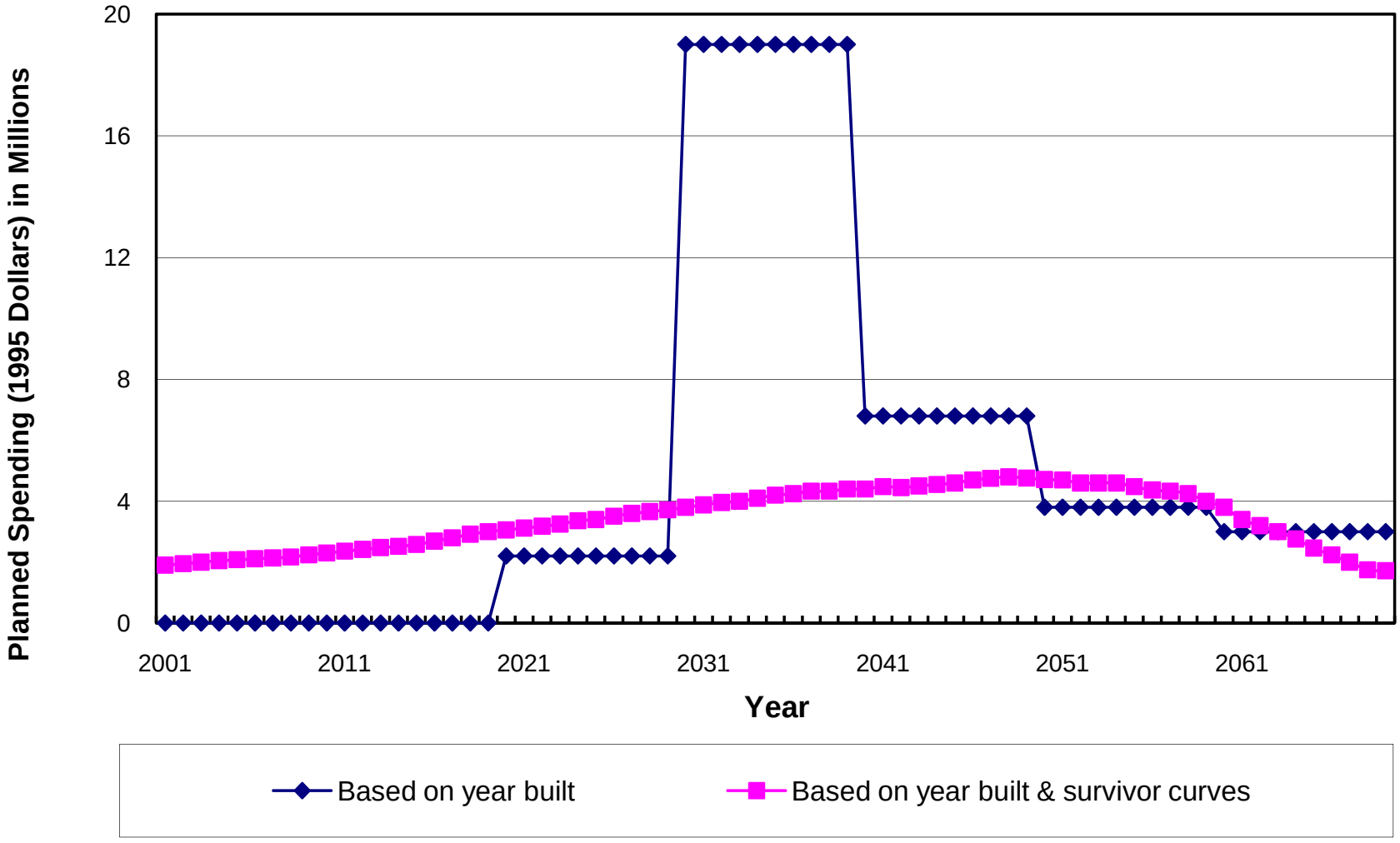


Exhibit 2
Sewermain Replacement Spending
(Based on 75-Year Expected Asset Life)



II. CAPITAL INVESTMENT PROGRAM POLICIES

A. *General Scope*

The Utilities Capital Investment Program (CIP) will provide sufficient funds from a variety of sources for implementation of both short- and long-term capital projects identified in each Utility System Plan and the City-wide Capital Investment Program as approved by the City Council.

Financial planning for long-term capital investment shall be based on principles that result in smooth rate transitions, maintain high credit ratings, provide for financial flexibility and achieve inter-generational equity.

Discussion:

These near-term capital projects are usually identified in each Utility system plan which also provides the criteria and prioritization for determining which projects will be constructed. Several projects of general scope are also included to allow for on-going projects that are less specifically identified due to their more inclusive nature.

In addition to these near-term projects, funding should be provided for long-term capital reinvestment in the system to help minimize large rate impacts as the systems near the end of their useful life and have to be renewed or replaced. Ordinance No. 4783 established a Capital Facilities Renewal & Replacement (R&R) Account for each Utility to provide a funding source for this purpose. Other policies describe how this Account is to be funded and expended.

A reinvestment policy by itself, without some form of planned and needed expenditure, could lead to excessive or unneeded expenditures, or conversely unnecessary accumulations of cash reserves. The reinvestment policy needs to tie the planned expenditures over time with a solid, long-term financial plan that is consistent with these policies.

The actual needs for the renewal/replacement expenditures should relate to the on-going need to minimize system maintenance and operating costs consistent with providing safe and reliable service, the age and condition of the system components, and any regulatory or technical obsolescence. In essence, plant should be replaced when it is needed and before it fails. As such, the goal setting measure of how much is an appropriate annual or periodic reinvestment in renewals and replacement of existing assets should be compatible with the age and condition of the infrastructure and its particular circumstances.

WP0459C-ORD
06/27/95

ORIGINAL

CITY OF BELLEVUE, WASHINGTON

ORDINANCE NO. 4783

AN ORDINANCE creating utility capital replacement accounts for the Water, Sewer and Storm and Surface Water Utilities within the Utility Capital Investment Fund for the purpose of accumulating funding for long term replacement of utility facilities.

WHEREAS, the Utilities 1995 Cost Containment Study prepared by Financial Consulting Solutions Group, Inc. (FCSG) recommends that current utility rates recover from the ratepayers amounts which at a minimum are equal to the depreciated value of the original cost of utility facilities and at a maximum are amounts equal to the replacement value of utility infrastructure; and

WHEREAS, FCSG recommends that utility funds not needed for current expenditure be placed in a replacement account to be used in the future in combination with current revenues and/or debt financing to replace capital facilities nearing the end of their useful life; and

WHEREAS, implementation of FCSG's recommendations would promote intergenerational rate equity and provide more stable rates to customers over the long term; and

WHEREAS, the Council desires to make an initial, 1995 deposit of $600,000 in savings from the Water Fund into the new capital replacement account for the Water Utility; now, therefore,

THE CITY COUNCIL OF THE CITY OF BELLEVUE, WASHINGTON, DOES ORDAIN AS FOLLOWS:

Section 1. The purpose of this ordinance is to establish capital facilities replacement accounts within the Utility Capital Investment Fund in order to assure a future funding source for replacement of utility facilities nearing the end of their useful life. The City Council will determine each year, as part of the adoption of the utilities operating budgets, how much, if any, utility revenue during the upcoming year shall be designated for transfer to a replacement account. The City Council may also authorize the receipt of other funds directly into these capital facility replacement accounts. Once deposited the funds will accumulate with interest. The decision regarding when and how to utilize such accumulated funds for the replacement of utility facilities will be made as part of the Utility Comprehensive Plans and Utility Capital Investment Program approval process.

ORIGINAL

WP0459C-ORD
06/27/95

Section 2. The following new accounts are established in the Utility Capital Investment Fund:

Capital Facilities Replacement Account - Sewer
Capital Facilities Replacement Account - Water
Capital Facilities Replacement Account - Storm and Surface Water

Section 3. There is hereby authorized the 1995 transfer from the Water Utility Operating Fund to the Capital Facilities Replacement Account - Water the amount of $600,000.

Section 4. This ordinance shall take effect and be in force five days after its passage and legal publication.

PASSED by the City Council this 24th day of July, 1995, and signed in authentication of its passage this 24th day of July, 1995.

(SEAL)

Donald S. Davidson, DDS, Mayor

Approved as to form:

Richard L. Andrews, City Attorney

Richard L. Kirkby, Assistant City Attorney

Attest:

Myrna L. Basich, City Clerk

Published July 28, 1995

B. *Funding Levels*

Funding for capital investments shall be sustained at a level sufficient to meet the projected 20 year (or longer) capital program costs.

Funding from rate revenues shall fund current construction and engineering costs, contributions to the Capital Facilities Renewal and Replacement (R&R) Account, and debt service, if any.

Inter-generational equity will be assured by making contributions to and withdrawals from the R&R Account in a manner which produces smooth rate transitions over a 20 year (or longer) planning period.

On an annual basis, funding should not fall below the current depreciation of assets expressed in terms of historical costs less any debt principal payments.

Discussion:

These policies are based on the experience gained by developing a long-term Capital Replacement Funding Plan. In absence of such a plan, the range of capital investment funding should fall between the following minimum and maximum levels:

The minimum annual rate funding level would be based on the current depreciation of assets expressed in terms of historical costs, less any debt principal payments.

The maximum annual rate funding level would be based on the current depreciation of assets expressed in terms of today's replacement costs, less any debt principal payments.

The minimum level based on historical cost depreciation approximates the depletion of asset value. Some of the cost may already be in the rates in the form of debt service. Depreciation less debt principal repayment provides a minimum estimate of the cost of assets used. Any funding level below this amount defers costs to future rate payers and erodes the Utility's equity position, which puts the Utility's financial strength and viability at risk.

The maximum level based on replacement cost depreciation represents full compensation to the utility, in terms of today's value, for the depletion of assets. The replacement cost depreciation, again less debt principal repayment, provides a ceiling to an equitable definition of "cost of service".

The purpose of long-term capital reinvestment planning is to establish a target funding level which is based on need and to assure that funds will be available for projected capital costs in an equitable manner. The best projection of the needed capital reinvestment is based on a "survival curve" approach, approximating the timing and cost of replacing the entire system. This defines the projected financial needs and allows determination of equitable rate levels, funding levels for current capital construction and engineering, contributions to and withdrawals from the R&R Account, and the use of debt, if any. It also provides a means to project depreciation on both historical cost and replacement cost basis which are used to calculate minimum and maximum funding levels, debt to fixed asset ratios, and debt coverage levels, if debt is used. These later measures can be used to assure that the financial plan meets conventional standards.

C. *Use of Debt*

The Utilities should fund capital investment from rates and other revenue sources and should not plan to use debt except to provide rate stability in the event of significantly changed circumstances, such as disasters or external mandates.

Resolution No. 5759 states that the City Council will establish utility rates/charges and appropriations in a manner intended to achieve a debt service coverage ratio (adjusted by including City taxes as an expense item) of approximately 2.00". Please note that the Moody's Investor Services rating should be Aa2 (not Aa as stated in Resolution No. 5759).

Discussion:

The Utilities are in a strong financial position and have been funding the Utility Capital Investment Program from current revenues for a number of years. The current 20 year and 75 year capital funding plans conclude that the entire long-term renewal and replacement program can be funded without the use of debt if rates are planned and implemented uniformly over a sufficient period. Customers will pay less over the long-term if debt is avoided, unless it becomes truly necessary due to unforeseen circumstances such as a disaster or due to changes in external mandates. Having long-term rate stability also assures inter-generational equity without the use of debt because the rate pattern is similar to that achieved by debt service.

Use of low interest rate debt such as the Public Works Trust Fund loans, by offering repayment terms below market rates, investment earnings or even inflation, should be viewed as a form of grant funding. When available or approved, such sources should be preferred over other forms of rate or debt funding, including use of available resources. Since such reserves would generate more interest earnings than the cost of the loan, the City's customers would be assured to benefit from incurring such debt.

WP0254C-RES
03/03/94

CITY OF BELLEVUE, WASHINGTON

RESOLUTION NO. 5759

A RESOLUTION relating to financial policy for the Waterworks Utility and adopting a debt service coverage policy for the Waterworks Utility

WHEREAS, the City of Bellevue is consistently recognized for its prudent financial management; and

WHEREAS, the City of Bellevue's Water and Sewer Bonds are currently rated Aa by Moody's Investor Services and AA- by Standard & Poor's Corporation, which are considered to be excellent ratings; and

WHEREAS, these excellent ratings result in lower interest costs on the City's Water and Sewer bonds, which, in turn, may result in lower water, sewer and storm drainage costs; and

WHEREAS, it is important to the rating agencies and to the financial community that the City articulate its financial goals for its Waterworks Utility; and

WHEREAS, a desirable debt service coverage ratio, the ratio of revenues available for debt service to the annual debt service requirement, positively affects the Utility's bond ratings; and

WHEREAS, the City Council deems it in the City's best interest to establish a debt service coverage policy target for the purpose of protecting its current bond rating and to allow for the development of financial projections, NOW, THEREFORE,

THE CITY COUNCIL OF THE CITY OF BELLEVUE, WASHINGTON, DOES RESOLVE AS FOLLOWS:

Section 1. The City Council hereby adopts the following debt service coverage policy for the bonds issued by the City's Waterworks Utility.

The City Council will establish utility rates/charges and appropriations in a manner intended to achieve a debt service coverage ratio (adjusted by including City taxes as an expense item) of approximately 2.00. The City Council authorizes the Waterworks Utility to utilize this policy in development of pro

WP0254C-RES
03/03/94

forma projections which will be disseminated to the bond rating agencies and to the financial community generally.

PASSED by the City Council this 7th day of March, 1994, and signed in authentication of its passage this 8th day of March, 1994.

(SEAL)

Donald S. Davidson, DDS, Mayor

Attest:

Myrna L. Basich, City Clerk

D. *Capital Facilities Renewal & Replacement (R&R) Account*

1. Sources of Funds

Revenues to the R&R Account may include planned and one-time transfers from the operating funds, transfers from the CIP Funds above current capital needs, unplanned revenues from other sources, Capital Recovery Charges, Direct Facility Connection Charges and interest earned on the R&R Account.

2. Use of Funds

Funds from the R&R Account shall be used for system renewal and replacement as identified in the CIP. Because these funds are invested, they may be loaned for other purposes provided repayment is made consistent with the need for these funds and at appropriate interest rates. Under favorable conditions, these funds may be loaned to call or decrease outstanding debt.

3. Accumulation of Funds

The R&R Account will accumulate high levels of funds in advance of major expenses. These funds will provide rate stability over the long-term when used for this purpose and *should not be used for rate relief.*

Discussion:

Revenues from Capital Recovery Charges, Direct Facility Connection Charges and interest earned on the R&R Account are deposited directly into the R&R Account. Other transfers are dependent on the long-term financial forecast, current revenues and expenses, and CIP cash flows. The long-term financial forecast projects a certain funding level for the transfers to the CIP and the R&R Accounts. Rates should be established consistent with this long-term financial plan and will generate the funds for such transfers. Setting rates at lower levels may result in current rate payers contributing less than their fair share for long-term equity.

R&R Account funds must only be used for the purpose intended; that is, the long-term renewal and replacement of the utility systems. They may be used for other purposes if it is treated as a loan, which is repaid with appropriate interest in time for actual R&R needs for those funds.

These accounts are each projected to accumulate tens of millions of dollars in order to meet the anticipated costs for the actual projects at the time of construction. It is the intent of these policies that these reserve funds will not be used for other purposes or to provide rate relief because that would defeat the long-term equity and could lead to the need for the use of debt to fund the actual needs when they occur.

III. SYSTEM EXPANSION AND CONNECTION POLICIES

A. *Responsibilities*

Those seeking or who are required to have Utility service are responsible for extending and/or upgrading the existing Utility systems prior to connecting.

Discussion:

It is the responsibility of the party seeking Utility service to make and pay for any extensions and/or upgrades to the Utility systems that are needed to provide service to their property. The extensions or upgrades must be constructed to City standards and requirements. This is typically accomplished through a Developer Extension Agreement with the City wherein requirements are documented, standards are established, plans are reviewed and construction is inspected and approved. Service will not be provided until these requirements are met.

The philosophical underpinning of this policy is that "growth pays for growth". Historically, developers constructed much of the City's utility infrastructure. If the infrastructure eventually would benefit more than the initial developer, the Utility signed a Latecomer Agreement to reimburse the original financier from charges to those connecting and receiving benefit at a later point in time. When the cost to extend and/or upgrade the system to accommodate development or redevelopment is beyond the means of a single developer, the Utility has employed a variety of methods to assist in the construction of the necessary infrastructure. Local Improvement Districts (LID's) historically have been used to provide financing for infrastructure for new development, with the debt paid over time by the property owners. Most of the older Utilities infrastructure was financed by this method.

The Utility has in some cases up-fronted the infrastructure construction for new development or redevelopment from rate revenues which are later reimbursed with interest, in whole or in part, by subsequent development through direct facility connection charges (see Cost Recovery Policy). Examples are the water and sewer infrastructure for Cougar Mountain housing development and Central Business District (CBD) redevelopment. Another example is the use of the Utility's debt capacity to provide for development infrastructure whereby the City sells bonds at lower interest rates than can private development, constructs the infrastructure, and collects a rate surcharge from the benefited area to pay off the bonds. Examples of this type of financing include the Lakemont development drainage infrastructure and the Meydenbauer Drainage Pipeline in the CBD.

B. *Cost Recovery*

The Utility shall establish fees and charges to recover Utility costs related to: (1) development services, and (2) capital facilities that provide services to the property.

The Utility may enter into Latecomer Agreements with developers for recovery of their costs for capital improvements, which benefit other properties in accordance with State law. The Utility will add an administrative charge for this service.

Discussion:

In general, Utility costs related to development services are recovered through a variety of fees and charges. There are fixed rates for some routine services based on historical costs and inflation. There are fixed plus direct cost charges and applicable overhead for developer extension projects to cover the lengthy but variable level of development review and inspection

typically required to implement these projects. These rates are reviewed periodically to ensure that the cost recovery is appropriate.

When the means of providing the infrastructure to serve a new development or redevelopment are beyond the means of a single developer, the Utility may elect to assist the developer by using: LID's, Latecomer Agreements, special debt (to be paid by special rate surcharges), up-fronting the costs from Utility rate revenues (to be reimbursed by future developers with interest through direct facility connection charges), or other lawful means. It is the intent of this policy to fully recover these costs, including interest, so as to reimburse the general rate payer.

Latecomer charges allow cost recovery for developers and private parties, for facilities constructed at their own expense and transferred to the Utility for general operation. Properties subsequently connecting to those systems will pay a connection charge that will be forwarded to the original individual or developer or the current owner depending on the terms of the Latecomer Agreement. The Utility collects an overhead fee on this charge for processing the agreements and repayments.

C. ***Use of Revenues***

All capital-related revenues such as Capital Recovery Charges and Direct Facility Connection Charges should be deposited in the Capital Facilities Renewal & Replacement Accounts.

Discussion:

Capital Recovery Charges are collected from all newly developed properties in the form of monthly rate surcharges over a ten year period to reimburse the Utility for historical costs that have been incurred by the general rate base to provide the necessary facilities throughout the service area. These Capital Recovery Charges should be deposited in the Capital Facilities Renewal & Replacement Accounts.

Direct Facility Connection Charges are collected for capital improvements funded by the City as described above in Section 2 under Cost Recovery. The total cost of the improvement is allocated to the area of benefit and distributed on an equitable basis such as per residential equivalent unit. Interest is collected in accordance with State law.

D. ***Affordable Housing Consideration***

The Utility shall base connection charges on the number of units allowed under the basic zoning. Only incremental cost increases will be charged to affordable housing units.

Discussion:

The City has adopted bonus density incentives for developers to build units specifically for affordable housing. Under historical practices these additional units would have been charged the same connection fee as all other units, resulting in a lower cost per unit for all units. While this is fair, it does not create any incentive to develop affordable housing. By charging only the incremental increased facility cost to the affordable housing units, all developers who include an affordable housing component will experience no increase in cost because of the affordable bonus density units. The cost per unit for affordable units is thereby reduced. The cost per unit for all other units, based on underlying land use zoning, remains unchanged.

IV. RATE POLICIES

A. *Rate Levels*

Rates shall be set at a level sufficient to cover current and future expenses and maintain reserves consistent with these policies and long-term financial forecasts.

Changes in rate levels should be gradual and uniform to the extent that costs (including CIP and R&R transfers) can be forecast.

Cost increases or decreases for wholesale services shall be passed directly through to Bellevue customers.

Local and/or national inflation indices such as the Consumer Price Index (CPI) shall be used as a basis for evaluating rate increases.

At the end of the budget cycle, fund balances that are greater than anticipated and other one-time revenues should be transferred to the R&R account until it is shown that projected R&R account funds will be adequate to meet long-term needs, and only then used for rate relief.

Discussion:

A variety of factors including rate stability, revenue stability, the encouragement of practices consistent with Utility objectives and these Waterworks Utility Financial Policies are considered in developing Utility rates. The general goal is to set rates as low as possible to accomplish the on-going operations, maintenance, repair, long-term renewal and replacement, capital improvements, debt obligations, reserves and the general business of the Utility.

Long-range financial forecast models have been developed for each of the Utilities, which include estimated operating, capital and renewal/replacement costs for a 75 year period in order to plan for funding long-term costs. Operating costs are assumed to remain at the same level of service and don't include impacts of potential changes due to internal, regional or federal requirements. Capital costs, including renewal/replacement, are projected based on existing CIP costs and approximated survival curves for the infrastructure. The models are used to project rate levels that will support the long-term costs and to spread rate increases uniformly over the period. This is consistent with the above policy that changes in rate levels should be gradual and uniform. Uniform rate increases help ensure that each generation of customers bears their fair share of costs for the long-term use and renewal/replacement of the systems.

The biennial budget process provides an opportunity to add to or cut current service levels and programs. The final budget, with the total authorized expenses including transfers to the CIP Fund and the R&R Account, establishes the amount of revenue required to balance the expenses. A balanced budget is required. The budgeted customer service revenue determines the level of new rates. For example, if the current rates do not provide sufficient revenues to meet the projected expenses, the costs have to be reduced or the rates are increased to make up the shortfall.

For purposes of these policies, wholesale costs are defined as costs to the Utilities from other regional agencies such as the Seattle Public Utilities and/or the Cascade Water Alliance (CWA), and King County Department of Natural Resources for sewer treatment and any agreed upon Storm & Surface Water programs. Costs which are directly based on the Utilities' revenues or budgets such as taxes, franchise fees and reserve levels that increase proportionally to the wholesale increases are included within the definition of wholesale costs.

B. *Debt Coverage Requirements*

Utility rates shall be maintained at a level necessary to meet minimum debt coverage levels established in the bond covenants and to comply with Resolution No. 5759 which establishes a target coverage ratio of 2.00.

Discussion:

Existing revenue bond covenants legally require the City's combined Waterworks Utility, which includes the Water, Sewer and Storm & Surface Water Utilities, to maintain a minimum debt coverage ratio of 1.25 on a combined basis. In 1994, Council also adopted Resolution No. 5759 that established a policy, which mandates the Utilities to maintain a target combined debt coverage ratio of approximately 2.00, to further protect the City's historically favorable Utility revenue bond ratings. Water and Sewer Utility resources are counted in the official coverage calculation though Storm & Surface Water is responsible for the major portion of current outstanding Utility debt. Requiring Storm & Surface Water to separately maintain the minimum 1.25 legal debt coverage level and to move toward the 2.00 level will help ensure that necessary coverage requirements are met, and that customers of the other Utilities will not be unfairly burdened with the cost of meeting this obligation. It also ensures that sufficient coverage is available to the Water and Sewer Utilities if they need to incur debt.

C. *Frequency of Rate Increases*

Utility rates shall be evaluated annually and adjusted as necessary to meet budgeted expenses including wholesale cost increases and to achieve financial policy objectives.

Discussion:

In 1996, the City changed to a biennial budget process and adopted a two-year Utilities budget including separate rates for 1997 and 1998. This practice will continue on a biennial basis. However, Utility rates will be evaluated on an annual basis and adjusted as necessary to ensure that they are effectively managed to achieve current and future financial policy objectives. Annual rate reviews will include preparation of forecasts covering a twenty-year period for Utility revenues, expenditures, reserve balances and analysis of the impact of various budgetary elements (i.e. CIP transfers, R&R Account transfers, debt service costs, debt coverage levels, operating expenses, and reserves) on both current and future rate requirements.

D. *Rate Structure - Sewer*

The Sewer Utility rate structure will be based on a financial analysis considering cost-of-service and other policy objectives, and will provide for equity between customers based on use of the system and services provided.

Discussion:

In 1993, a Sewer Rate Study was performed that resulted in Council approval of a two-step, volume-based rate structure for single-family customers based on winter average metered water volumes instead of the traditional flat rate structure. Flat rate structures were seen as inequitable to low-volume customers who paid the same amount as high volume customers. Rates are based on the level of service used, rather than the availability of service.

The revenue requirements are based on the "average" single-family winter average volume calculated annually from the billing database. The charge for an individual customer is based on their winter average and then charged at that level each bill for the entire year to avoid charging for irrigation use. The customer's winter average is based upon the prior year's three winter bills because the current year's bills include winter months, which would result in the average constantly changing. Customers without prior winter averages to use for a basis are charged at the "average" volume until they establish a “winter-average” or sufficient evidence that their use is significantly different than the "average".

E. *Rate Structure - Storm & Surface Water*

The Storm & Surface Water Utility rate structure will be based on a financial analysis considering cost-of-service and other policy objectives, and will provide adjustments for actions taken under approved City standards to reduce related service impacts.

Discussion:

In the existing Storm & Surface Water rate structure, customer classes are defined by categories of development intensity, i.e., *undeveloped, lightly developed, moderately developed, heavily developed* and *very heavily developed*. Based on theoretical run-off coefficients for each of these categories, higher rates are charged for increasing degrees of development to reflect higher run-off resulting from that development. Under this structure, billings for both residential and non-residential customers are determined by total property area and rates assigned to applicable categories of development intensity. Customers providing on-site detention to mitigate the quantity of run-off from their property receive a credit equal to a reduction of one rate level from their actual development intensity. Property classified as "wetlands" is exempt from Storm & Surface Water service charges.

Large properties, over 35,000 square feet, with significantly different levels of intensity of development may be subdivided for rate purposes in accordance with Ordinance No. 4947. In addition, properties with no more than 35,000 square feet of developed area in the light and moderate intensity categories may, at the option of the owner, defer charges for that portion of the property in excess of 66,000 square feet. The property owner may apply for a credit against the Storm & Surface Water charge when they can demonstrate that the hydrologic response of the property is further mitigated through natural conditions, on-site facilities, or actions of the property owner that reduce the City’s costs in providing Storm & Surface Water quantity or quality services.

Future design of a water quality rate component will also use cost-of-service principles to assign defined water quality costs to customer classes, according to their proportionate contribution to Utility service demand. It is anticipated that these rate structure revisions will also provide financial incentives to customers taking approved actions to mitigate related water quality impacts.

F. *Rate Structures - Water*

The water rate structure will be based on a financial analysis considering cost-of service and other policy objectives, and shall support water conservation and wise use of water resources.

Discussion:

The water rate structure consists of fixed monthly charges based on the size of the customer’s water meter and volume charges, which vary according to customer class and the actual amount

of water that the customer uses. There are three different meter rate classifications: domestic, irrigation and fire standby. The different charges are based on a cost-of-service study.

State law and the wholesale water supply contract require the Utility to encourage water conservation and wise use of water resources. Seattle first established a seasonal water volume rate structure for this purpose in 1989 with higher rates in the summer than in the winter. In 1990, based on a water rate study and the desire to provide a conservation-pricing signal to our customers, the City adopted an increasing block rate structure for local volume rates. The rate structure was revised in 1991 to pass through an increase in wholesale water costs, which also included a higher seasonal water rate for summer periods. The block water rate structure was revised again in 1997, to incorporate new cost-of-service results from a 1996 water rate study.

An increasing block rate structure, charges higher unit rates for successively higher water volumes used by the customer. The current rate structure has four rate steps for single-family and three rate steps for multi-family customers, based on metered water volumes. All irrigation-metered water is charged at a separate, higher rate. Because non-residential classes do not fit well in an increasing block rate approach due to wide variations in their size and typical water use requirements, seasonal rates, with and without irrigation, were established for these customers. This rate structure will be thoroughly reviewed, as more historical information is available on the effect of the increasing block and seasonal rate structure.

In 1997, an additional category of fire protection charges was added for structures and facilities that benefit from the City water system but are not otherwise being charged for water service. For example, a number of homes are on private wells but are near a City-provided fire hydrant and enjoy the additional benefit of fire protection yet didn't pay for the benefit on a water bill. The charge is based on an equivalent meter size that would normally serve the facility. It also applies to facilities that have terminated water service but still stand and require fire protection, such as homes or buildings that are not occupied.

G. *Rate Equity*

The rate structure shall fairly allocate costs between the different customer classes. Funding of the long-term Capital Investment Program also provides for rates that fairly spread costs over current and future customers.

Discussion:

As required under State law, Utility rates will provide equity in the rates charged to different customer classes. In general, rates by customer class are designed to reflect the contribution by a customer group to system-wide service demand, as determined by cost-of-service analysis. The RCW also authorizes utility rates to be designed to accomplish "any other matters, which present a reasonable difference as a ground for distinction". For example, increasing water rates for irrigation and higher levels of use is allowed to encourage the wise use and conservation of a valuable resource. Formal rate studies are periodically conducted to assure ongoing rate equity between customer classes and guide any future rate modifications necessary to support changing Utility program or policy objectives.

Contributions from current rates to the R&R Account also provide equity between generations of rate payers by assuring that each user pays their fair share of capital improvements, including renewal and replacement, over the long-term. (See sections B and D under the Capital Investment Program Policies).

H. *Rate Uniformity*

Rates shall be uniform for all utility customers of the same class and level of service throughout the service area. However, special rates or surcharges may be established for specific areas, which require extraordinary capital investments and/or maintenance costs. Revenues from such special rates or surcharges and expenses from capital investments and/or extraordinary maintenance shall be accounted for in a manner to assure that they are used for the intended purposes.

Discussion:

The City Water and Sewer Utilities originally formed by assuming ownership of three separate operating water districts and two sewer districts. In the assumption agreements, each included a provision that requires the Utility to uniformly charge all customers of the same class throughout the entire service area. The basic rates are set for all customers, inside and outside of the City, except for local utility taxes in Bellevue, and franchise fees in Clyde Hill, Hunts Point, Medina, and Yarrow Point. Unlike the Water and Sewer Utilities, the Storm & Surface Water Utility only serves areas within the City limits.

Under state law, Utilities are required to charge uniform rates to all customers in a given customer class, regardless of property location within the service area. The only exception permitted is for certain low-income customers (see below).

However, when conditions in particular service areas require extraordinary capital improvement or maintenance costs to be incurred, special rates or surcharges may be adopted to recover those costs directly from properties contributing to the specific service demand, instead of assigning that cost burden to the general Utility rate base. This will only apply for costs above and beyond normal operations, maintenance and capital improvements. For example, rate surcharges are being used to recover debt service costs for capital facilities in Lakemont and the CBD. An additional rate surcharge for Lakemont properties is being collected for extraordinary maintenance costs of the storm water treatment facility.

I. *Rate Assistance*

Rate assistance programs shall be provided for specific low-income customers as permitted by State law.

Discussion:

Continual increases in all utility rates have had a significant impact on low-income customers. The City has adopted a rate discount or rebate program for disabled customers and senior citizens over 62 years old and with income below certain levels as permitted under State law and defined in Ordinance No. 4458. It has two levels, one discounting Utility rates by 40 percent and the other level by 75 percent, based on the customer's income level. Customers that indirectly pay for Utility charges through their rent can obtain a rebate for the prior year's Utility charges on the same criteria. The City also rebates 100 percent of the Utility Tax for these customers. The cost of this program is absorbed in the overall Utility expenses and is recovered through the rate base. The General Fund provides for the Utility tax relief.

There are other low-income customers who are less than 62 years old and currently receive no Utility rate relief. However, the City has instituted a separate rebate of Utility taxes for qualified low-income citizens.

V. OPERATING RESERVE POLICIES

A. *Operating Reserve Levels*

The Utilities' biennial budget and rate recommendations shall provide funding for working capital, operating contingency, and plant emergency reserve components on a consolidated basis in accordance with the attached Summary of Recommended Consolidated Reserve Levels table and as subsequently updated.

Discussion:

Utility resources not spent for operations remain in the fund and are referred to as reserves. At the end of each year, these funds are carried forward to the next year's budget and become a revenue source for funding future programs and operations. Under the terms of this policy, the Utility budget is targeted to include a balance of funds for the specific purposes stated above. While included in the total operating budget, these reserves will only be available for use pursuant to these reserve policies. Setting aside these budget resources in the reserve balance will help to ensure continued financial rate stability in future Utility operations and protect Utility customers from service disruptions that might otherwise result from unforeseen economic or emergency events.

The working capital reserve is maintained to accommodate normal cyclical fluctuations within the two month billing cycle and during the budget year. These are higher for Water than for Sewer and Storm & Surface Water due to more variable revenues and expenditures. They are described in terms of a number of days of working capital as a percentage of a full-year’s budget.

The operating contingency reserve protects against adverse financial performance or budget performance due to variations in revenues or expenses. Again, the Water Utility is most susceptible to year-to-year variations in water demand. They are described in terms of percentages of budgeted wholesale costs and operations and maintenance (O&M) costs.

The plant emergency contingency reserve provides protection against a system failure at some reasonable level. The Storm & Surface Water Utility requires the largest reserve due to the risk of major flood damage to Utility facilities. Water and Sewer Utilities protect against the cost of a major main break or failure. These do not protect against the loss of facilities that are covered by the City's Self-Insurance to which the Utilities pay annual premiums nor are they sufficient to respond to a major disaster, such as a major earthquake.

The reserves of the three utilities have historically been treated separately. This protects against cross-subsidy, thereby retaining rate equity for each utility, each of which has different customers. However, it results in higher reserve targets, with more funds retained than otherwise may be needed. Sharing risks among utilities can reduce reserves. This does not require that reserves actually be consolidated into a single fund, but simply that individual reserve targets reflect the strength provided by the availability of cross-utility support. Under the "consolidated" scenario, cash shortfalls in one reserve could be funded through inter-utility loans, to be repaid from future rates. The likelihood that a serious shortfall would occur in more than one fund at the same time is slight and the benefits of lower overall reserve levels will benefit rate payers. Also, the rate policies and the debt coverage policy will ensure that there will be a strong financial response to any significant shortfall. The risk is considered a prudent financial policy.

City of Bellevue

Summary of Recommended Consolidated Reserve Levels

	Water		Wastewater		Storm Drainage	
Type of Reserve	Basis	Level	Basis	Level	Basis	Level
Working Capital – Reserves against revenue and expense fluctuations within the 2 month billing cycle and during the budget year.	48 days of budgeted O&M costs (excludes debt service, capital funding).	$4,609,100	30 days of Metro costs and 20 days of City O&M costs (excludes debt service, capital funding).	$2,877,800	29 days of budgeted O&M costs (excludes debt service, capital funding).	$841,800
Operating Contingency – Reserves against annual budget shortfalls due to poor financial performance.	7.5% of water purchase costs and 11% of other water O&M costs.	$3,252,200	2% of Metro costs and 5% of other wastewater O&M costs.	$1,113,200	2.5% of O&M costs.	$264,900
Plant Emergency Contingency – Reserves against failure of a major facility or piece of equipment.	Cost for repair of water main break.	$100,000	Cost of repair for wastewater main break.	$100,000	$500,000 based on potential net cost of flood damage.	$500,000
Less: Allowance for duplicating or offsetting reserves	None.	$0	Working Capital and Operating Contingency include offsetting reserves equal to 2% of all O&M.	$(775,300)	None.	$0
Less: Allowance for consolidating reserves	2.5% of City O&M for interfund charges between utilities.	$(445,400)	1% City O&M for interfund charges between utilities.	$(112,600)	1% of City O&M for interfund charges between utilities.	$(105,900)
	Share of reduced plant emergency reserve.	$(15,000)	Share of reduced plant emergency reserve.	$(15,000)	Share of reduced plant emergency reserve.	$(70,000)
	Lesser of min. working capital or plant emergency reserves.	$(85,000)	Lesser of min. working capital or plant emergency reserves.	$(85,000)	Lesser of min. working capital or plant emergency reserves.	$(220,000)
Total		$7,415,900		$3,103,100		$1,210,800

Note: Reserve levels based on amended 2012 utility budgets.

For this purpose, O&M costs are the entire annual operating budget of the Utility less the annual debt service, Capital Investment Program transfers and R&R Account transfers. Independent reserve levels are the levels that would be required by an individual Utility Fund (Water, Sewer and Storm & Surface Water) at any point in time to cover financial obligations if any one of the three reserve components where called for; i.e., working capital, operating contingency or plant emergency. At any single time, the full independent reserve levels should be available for the individual stated purpose, again because it is unlikely that all three components would be called for at once. For example, the Water Utility needs $100,000 available for an emergency repair but it is not likely that the Sewer Utility will need $100,000 and the Storm & Surface Water Utility will need $500,000 all at the same point in time.

The consolidated basis is for budget and rate setting purposes only, to reduce the total revenue requirement by considering the reserve risk shared between the three utilities. The dual reserve levels should be considered as circumstances evolve.

In 2004, the Financial Consulting Solution Group (FCSG) performed an analysis of recommended changes to the Water Utility's working capital and operating contingency reserves to reflect the new wholesale water contract with CWA and to update reserve levels for current conditions. Under the new contract, billing practices for wholesale costs have changed as follows:

1. CWA payment occurs before the associated revenues are collected, resulting in a greater lag between wholesale expense and when revenues are collected.

2. CWA payments are distributed over the whole year based on predetermined percentages and not based on actual consumption during the year. Due to seasonal revenue variation, there is an accumulative deficit in revenues prior to the peak revenue period.

In addition, the total costs to Bellevue are now largely fixed for the year due to the "take or pay" nature of the contract between CWA and Seattle Public Utilities. This shifts the risk during a poor water sales year to the City since there will not be a corresponding reduction in water purchase costs when water sales are down.

Changes in both billing practices as well as the fixed nature of the wholesale costs will result in an increase in required reserves for working capital and operating contingency for the Water Fund.

As part of their 2004 analysis, FCSG recommended increasing working capital operating reserve requirements for the Water fund from 48 days of budgeted O&M costs (excluding debt service and capital funding) to 70 days. The change was primarily related to an expected increase in seasonal revenue variation resulting from Cascade's fixed monthly billing percentages. However, our experience has been that since implementing the change in 2005 there has been essentially no increase in seasonal revenue variation. As a result, beginning in 2011, working capital operating reserve requirements for the Water fund will be reduced from 70 days of budgeted O&M costs (excluding debt service and capital funding) to the original level of 48 days.

B. ***Management of Operating Reserves***

Related to the recommended target reserve levels, a working range of reserves is established with minimum and target levels. Management of reserves will be based on the level of reserves with respect to these thresholds, as follows:

Above target - Reserve levels will be reduced back to the target level by transferring excess funds to the R&R Accounts in a manner consistent with the long-range financial plan.

Between Minimum and Target - Rate increases would be imposed sufficient to ensure that: 1) reserves would not fall below the minimum in an adverse year; and 2) reserves would recover 50% of the shortfall from target levels in a normal year. Depending on the specific circumstances, either of these may be the constraint, which defines the rate increase needed.

Below Minimum - Rate increases would be imposed sufficient to ensure that even with adverse financial performance, reserves would return at least to the minimum at the end of the following year. To meet this "worst case" standard, a year of normal performance would be likely to recover reserve levels rapidly toward target levels.

Negative Balance - Reserves would be borrowed from another utility to meet working capital needs. Similar to the "below minimum" scenario, rate increases would be imposed sufficient to ensure that even with adverse financial performance, reserves would return from the negative balance to at least the minimum target at the end of the following year, which would allow for loan repayment within that time frame.

Discussion:

"Adverse financial performance" or "worst case" are defined by the 95% confidence interval based on historical patterns. The worst case year is currently defined as a year with sales volumes 15% below the sales volume for a normal year. This was determined by using statistical measurements of sales volumes for 18 years with a 95% confidence interval. That is, in any given year there is only a 5% chance that the worst case year would be more than 15% below the normal year. Another way to say the same thing is that in 19 out of 20 years the worst case year would not be more than 15% below the normal year.

Maintaining the 95% confidence interval, as more and more data becomes available, a worst case year could change upward or downward from the 15% variation from a normal year.

The recommended reserve policies are premised on the vital expectation that reserves are to be used and reserve-levels will fluctuate. Although budget and rate planning are expected to use the target reserve number, reserve levels planned to remain static are by definition unnecessary. It is therefore important to plan for managing the reserves within a working range between the minimum and target levels as stated in the above policies. There may be situations in short-range financial planning where reserves are maintained above target levels to overcome peaks in actual expenses.

In the event of an inter-utility loan, the balance for the borrowing utility would essentially be any cash balance less the amount owed. The lending utility would count the note as a part of its reserves, so that it does not unnecessarily increase rates to replenish reserves that are loaned.

In this management approach, there is still a risk that a major plant emergency could exceed the amount reserved. Such a major shortfall would require rate action to assure a certain level of replenishment in one year. To avoid rate spikes due to this type of action, they should be considered on a case-by-case basis. This will provide the flexibility to use debt or capital reserves in lieu of operating reserves to cover the cost and allow a moderated approach to replenishing reserves out of rates.

C. *Asset Replacement Reserves*

Utility funds will maintain separate Asset Replacement Accounts to provide a source of funding for future replacement of operating equipment and systems.

Anticipated replacement costs by year for the upcoming 20-year period, for all Utility asset and equipment items, will be developed as a part of each biennial budget preparation process. Budgeted contribution to the Asset Replacement Account will be based on the annual amount needed to maintain a positive cash flow balance in the Asset Replacement Account over the 20-year forecast period. At a minimum, the ending Asset Replacement Account balance in each Utility will equal, on average, the next year's projected replacement costs for that fund.

The Utilities Department will observe adopted Equipment Rental Fund (ERF) and Information Services budget policies and procedures in formulating recommendations regarding specific equipment items to be replaced.

Discussion:

Providing reserves for equipment and information technology systems replacement allows monies to be set aside over the service life of these items to pay for their eventual replacement and alleviate one-time rate impacts that these purchases might otherwise require. Annual revenues set aside for this purpose will be based on aggregate Utility asset replacement cash flow needs over the long-term forecast period, instead of individual asset replacement amounts. This strategy will allow Utilities to minimize the progressive build-up of excess Asset Replacement Account balances that would result from creating and funding separate reserve accounts for individual Utility asset and equipment items.

Chapter 3 Basic Planning Data

Bellevue's water service area experienced significant population growth throughout the 2000s, particularly in downtown Bellevue. Although the recession slowed growth in 2008-2009, Bellevue's service area population continues to expand and is projected to approach 180,000 by 2040. Most of the anticipated growth will occur Downtown and in the Bel-Red Corridor.

This chapter discusses recent trends in population and water consumption, establishes criteria for per capita and seasonal demands, and projects future population and water demands over 6, 10 and 20-year planning periods.

3.1 Current Population

Recent historical population and employment estimates for Bellevue's direct retail water service area are provided in Table 3-1 and Figure 3-1. This data is provided by the City of Bellevue Planning & Community Development Department (PCD). "SF" and "MF" refer to populations living in single-family and multi-family housing units, respectively. "Jobs" refers to employment.

Table 3-1: Recent Water Service Area Population and Employment

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
SF	93,400	93,291	93,769	94,107	94,053	95,911	95,811	96,420	97,109	97,160
MF	37,822	40,101	40,817	41,819	42,869	42,647	43,852	44,565	45,713	48,078
Jobs	125,234	131,982	138,592	143,077	136,739	134,004	136,827	140,052	138,394	145,238

Figure 3-1: Recent Water Service Area Population and Employment

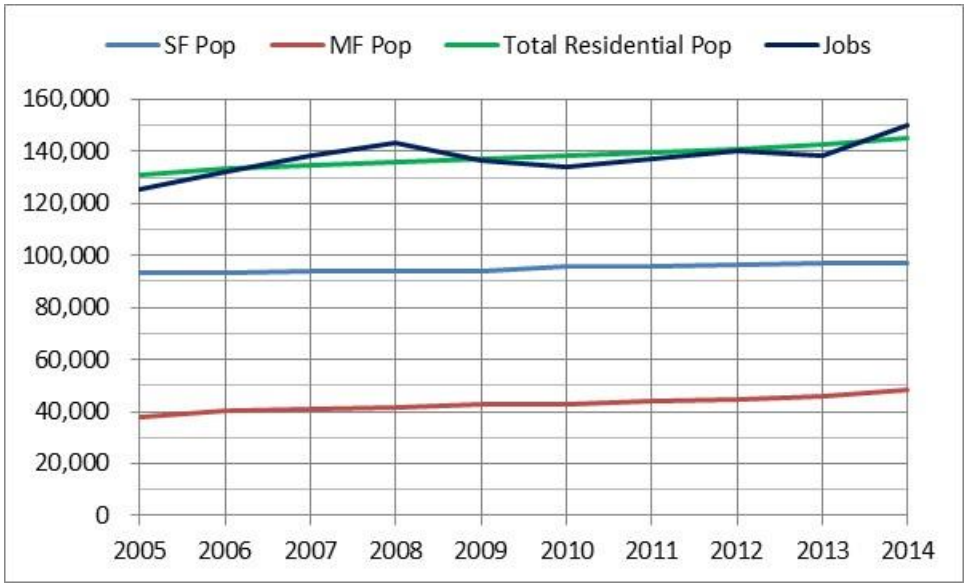


Table 3-2 shows current estimates of average household size and employee density throughout the City of Bellevue, as provided by the City of Bellevue Planning and Community Development Department (PCD). It is assumed that similar household size is also applicable in water service areas outside the City of Bellevue (Clyde Hill, Medina, Hunts Point, Yarrow Point, and unincorporated King County). These figures are used for overall system planning only; localized variations in household size and density should be considered for design purposes.

Table 3-2: Average Household Size and Employee Density

	Current PCD Estimate	2006 Water Comprehensive Plan Estimate
Population Per Household		
Single-Family	2.8	2.7
Multi-Family	1.9	1.8
Employees per 1,000 square feet		
Downtown Office	3.7	3.1
Downtown Retail	3.0	2.5
Office (Outside Downtown)	3.1	3.1
Retail (Outside Downtown)	2.6	2.5
Industrial	1.6	1.7

For the purpose of water demand projections, it is assumed that average household size and employee density will remain stable.

Service Connections

Table 3-3 and Figure 3-2 show the number of active retail customer accounts in Bellevue's water service area during January of each year 2005-2014. For the purpose of this WSP:

- "Retail" refers to direct water sales to customers within Bellevue's service area. Retail volumes do not include water wheeled to other utilities, or non-revenue demands.
- "Wheeled" refers to water that passes through one utility to another. Some amount of water originating in SPU's supply pipelines is wheeled both into and out of Bellevue. CCUD and Kirkland wheel water to Bellevue, while Bellevue wheels water to Redmond and Issaquah (Beaux Arts and/or WD117 during emergencies).
- "Wholesale" refers to the total amount of water flowing into Bellevue's water distribution system from the regional supply. This includes retail and non-revenue demands, plus any water wheeled by Bellevue to adjacent utilities.

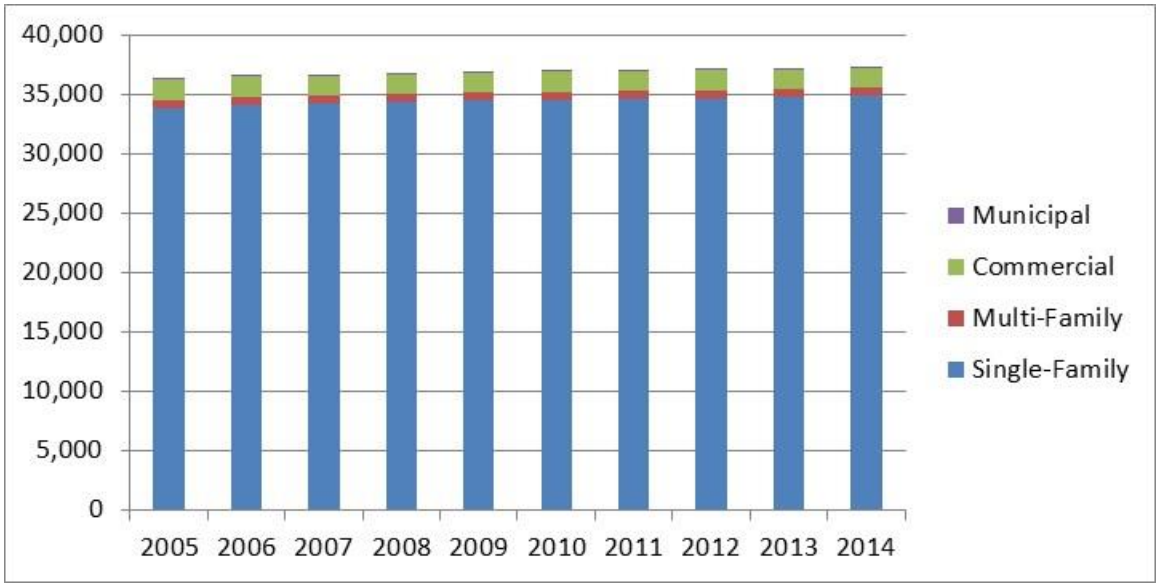
Table 3-3: Number of Retail Customer Accounts

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Single-Family	33,919	34,196	34,292	34,438	34,544	34,600	34,673	34,725	34,793	34,997
Multi-Family	657	653	651	645	644	644	650	654	655	657
Commercial	1,711	1,716	1,665	1,668	1,676	1,675	1,669	1,667	1,664	1,645
Municipal	166	166	144	143	145	138	138	137	140	143
Total Accounts	36,453	36,731	36,752	36,894	37,009	37,057	37,130	37,183	37,252	37,442

The number of accounts shown is less than the actual number of meter connections, because many commercial and multi-family customer accounts have multiple meters (e.g. for multiple buildings, separate domestic vs. irrigation, etc). The meter count is discussed in Chapter 6.

The vast majority of customer accounts are for single-family residences, because each household has an account. Although the numbers of multi-family and commercial accounts are small (compared to single-family), each account typically serves a large population, so the number of accounts does not correlate to population or water use. For this reason, Equivalent Residential Units (described later in Chapter 3), which do correlate directly to water demand, are used to compare consumption between various types of customers.

Figure 3-2: Number of Retail Customer Accounts



Although the number of multi-family and commercial accounts have remained relatively stable or declined, multi-family population and employment have grown substantially (as discussed below), possibly due to volatility in rental occupancy rates, or due to redevelopment with larger buildings, which may have only one account.

Table 3-4 shows single-family housing statistics for the 2005-2014 period. This data is necessary to calculate Equivalent Residential Units, as described below.

Table 3-4: Single-Family Housing and Occupancy

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
SF Units	35,764	35,754	35,812	35,867	35,930	35,940	36,029	36,089	36,124	36,203
Occupancy	95.1%	94.4%	94.5%	94.3%	94.2%	95.9%	95.6%	96.0%	96.7%	96.6%
SF Households	33,994	33,739	33,825	33,836	33,841	34,472	34,443	34,637	34,924	34,978
Vacant SF Units	1,769	2,015	1,987	2,032	2,089	1,468	1,586	1,452	1,200	1,225
Pop/SF Household	2.75	2.77	2.77	2.78	2.78	2.78	2.78	2.78	2.78	2.78

3.2 Current Water Demand

Table 3-5 shows the annual volume of wholesale water delivered to the City from 2005-2014. This "wholesale" volume represents all water flowing into Bellevue's water distribution system from the regional supply, including water that is subsequently sold to Bellevue's retail customers, water wheeled to Issaquah and Kirkland, and non-revenue demand (described in Chapter 5).

Table 3-5: Wholesale Water Supply Volumes (MG)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
SPU Inlets	5,749	5,994	5,749	5,730	5,913	5,330	5,569	5,535	5,710	5,794
Kirkland (1)	12.5	14.9	14.3	12.9	31.2	16.5	13.1	12.8	14.3	13.3
CCUD (1)	134	195	193	167	176	147	154	166	160	168
Total	5,895	6,204	5,957	5,910	6,120	5,493	5,736	5,714	5,884	5,975

(1) Wheeled water from SPU

More information on historical demands and long-term effects of conservation are in Chapter 5.

Water Demand by Customer Class

Table 3-6 shows annual retail water consumption trends by customer class, from 2005-2014. The Commercial + Municipal category includes all non-residential customers. This data includes all demands (domestic and irrigation) billed to each the class of customer.

Table 3-6: 2005-2014 Billed Retail Consumption (MG)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Single-Family										
Domestic w/Irrigation	2,600	2,822	2,588	2,488	2,648	2,334	2,301	2,391	2,360	2,423
Irrigation Only	23	30	29	23	26	19	20	23	23	24
Multi-Family										
Domestic w/Irrigation	985	1,008	973	979	981	992	1,030	1,083	1,082	1,101
Irrigation Only	56	70	63	53	73	45	46	58	58	64
Commercial + Municipal										
Domestic w/Irrigation	1,222	1,252	1,232	1,194	1,169	1,125	1,149	1,183	1,201	1,193
Irrigation Only	209	273	239	209	269	180	203	237	229	263
Total Retail Demand	**5,097**	**5,455**	**5,125**	**4,946**	**5,168**	**4,695**	**4,749**	**4,976**	**4,954**	**5,069**

Although irrigation is metered separately for most commercial and multi-family customer accounts, nearly all single-family customer accounts (and some commercial and multi-family accounts) have a single meter for both domestic and irrigation demands. Single-family accounts consume roughly half of Bellevue's total billed water consumption, so a large portion of irrigation demands cannot be clearly distinguished from domestic demands. Volumes from dedicated irrigation-only meters represent a limited portion of total irrigation demands.

Table 3-7 and Figure 3-3 show recent per capita water consumption trends by customer class (all demands including domestic and irrigation). Per capita and per employee demands are calculated by dividing total billed consumption (Table 3-6) by the total estimated population (Table 3-1) provided by the Planning & Community Development Department).

Table 3-7: 2005-2014 Per Capita Retail Consumption (gal/day)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Single-Family per Resident	76.9	83.8	76.5	72.9	77.9	67.2	66.4	68.4	67.2	69.0
Multi-Family per Resident	75.4	73.6	69.6	67.4	67.4	66.6	67.2	70.0	68.3	66.4
Commercial + Municipal per Job	31.4	31.7	29.1	26.8	28.8	26.7	27.1	27.7	28.3	26.6
Equivalent Residential Unit	211	232	212	203	216	187	185	190	186	192

These figures show a continued, significant decline in per capita consumption, particularly for single-family households. Historically, single-family per capita demands were consistently higher than for multi-family housing, however consumption appears to have converged and is now approximately the same for SF vs MF. The overall decline in per capita water demands is discussed further in Chapter 5.

Figure 3-3: 2005-2014 Per Capita Retail Consumption

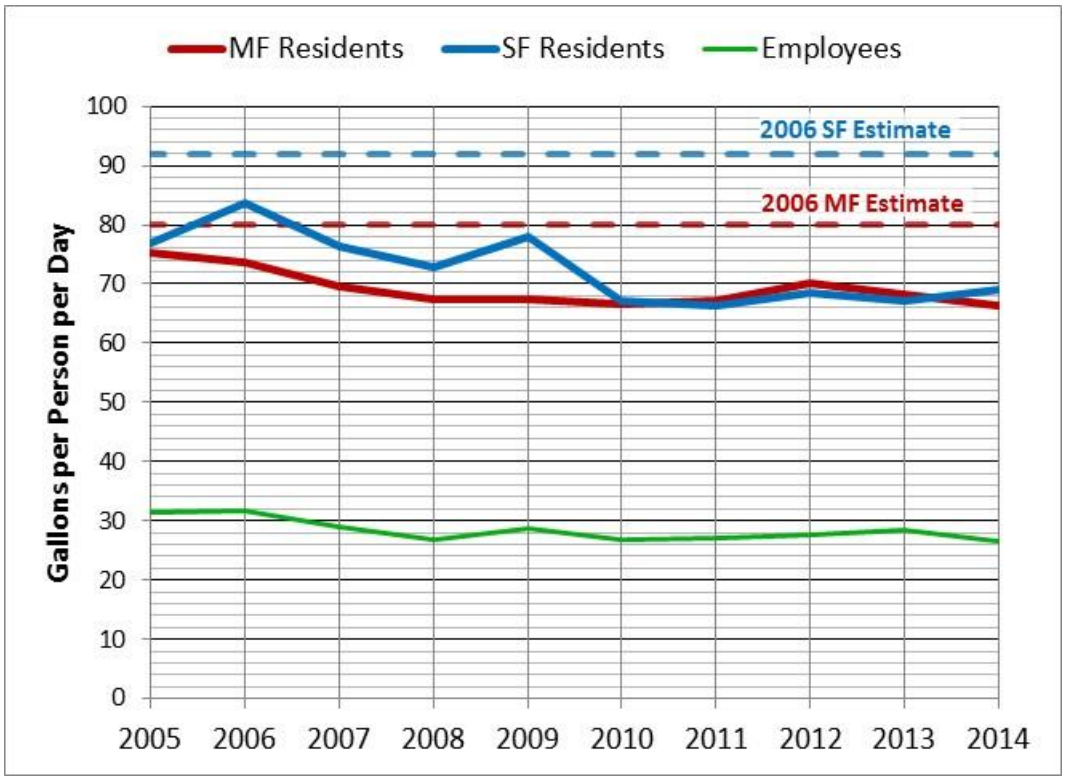
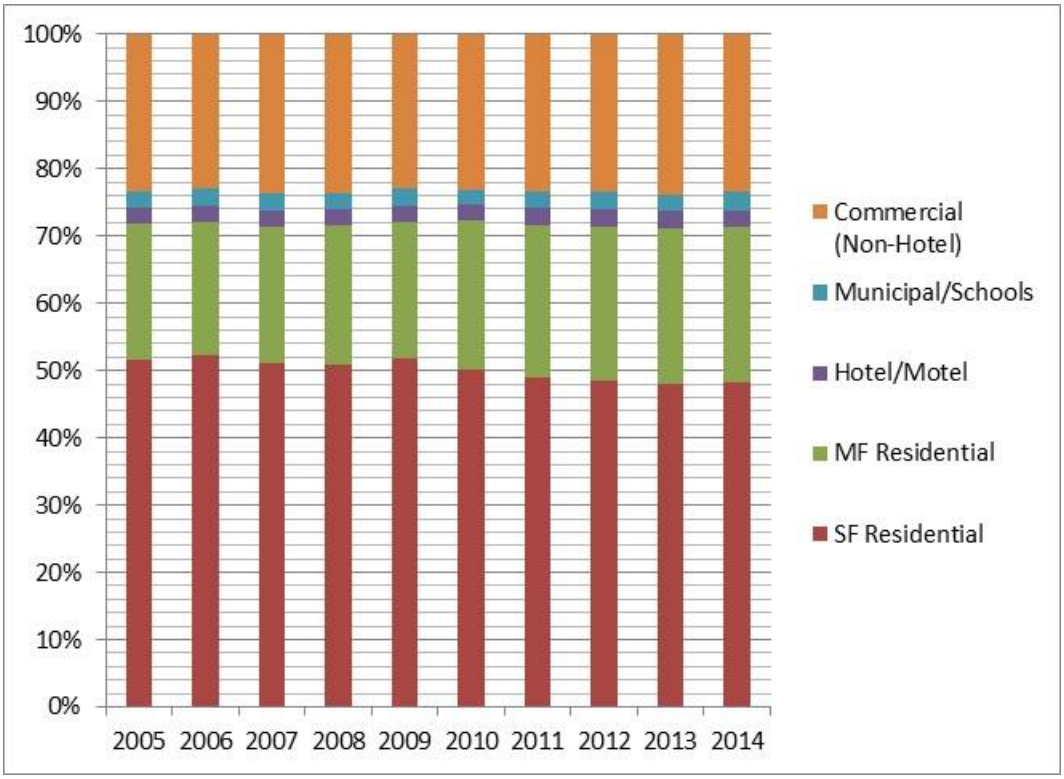


Figure 3-4 shows percent of retail consumption by customer class. Hotel/Motel demands are included in "Commercial + Municipal" in Tables 3-6 and 3-7.

Figure 3-4: Percent of Retail Consumption by Customer Class



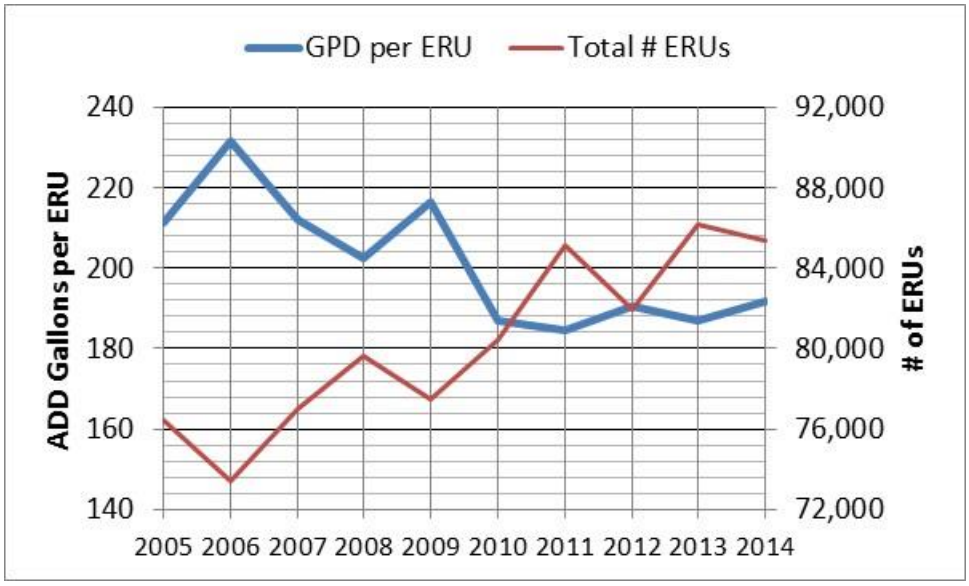
Equivalent Residential Units

An Equivalent Residential Unit (ERU) is the typical amount of water used by an occupied single-family housing unit. An ERU can be established for average day demand (ADD) and for maximum day demand (MDD).

ERUs provide a baseline unit to normalize multi-family, commercial and non-revenue water demands, for comparison with single-family demands. ERUs can provide a deeper understanding of total system demand for a diverse customer base and facilitate forecasting of water supply needs.

Figure 3-5 shows ADD per ERU in gallons per day (GPD) in Bellevue's service area, and the total number of ADD ERUs supplied to Bellevue (including water wheeled to adjacent utilities). ADD ERU represents the average single-family per capita demands (Table 3-7) times the average single-family household size (Table 3-4). The total number of ADD ERUs represents the total system demand divided by the ADD ERU.

Figure 3-5: Equivalent Residential Units



The total number of ERUs will vary inversely to some extent with the relative consumption of single-family residential accounts (compared to other types of accounts) if other, non-SF consumption remains stable, as shown by the inverse shape of the lines in Figure 3-5. This occurs because as the volume of an ERU increases, multi-family and commercial accounts with stable water demand will consume fewer ERUs, and visa versa (despite consuming the same volume of water).

Figure 3-6 shows the total number of ERUs broken down by wholesale consumption, including retail sales (in Bellevue's service area), sales of water "wheeled" to other utilities, and non-revenue volume. The relatively high non-revenue volume observed in 2011 may explain the spike in number of ERUs that year.

Figure 3-6: Equivalent Residential Units by Wholesale Category

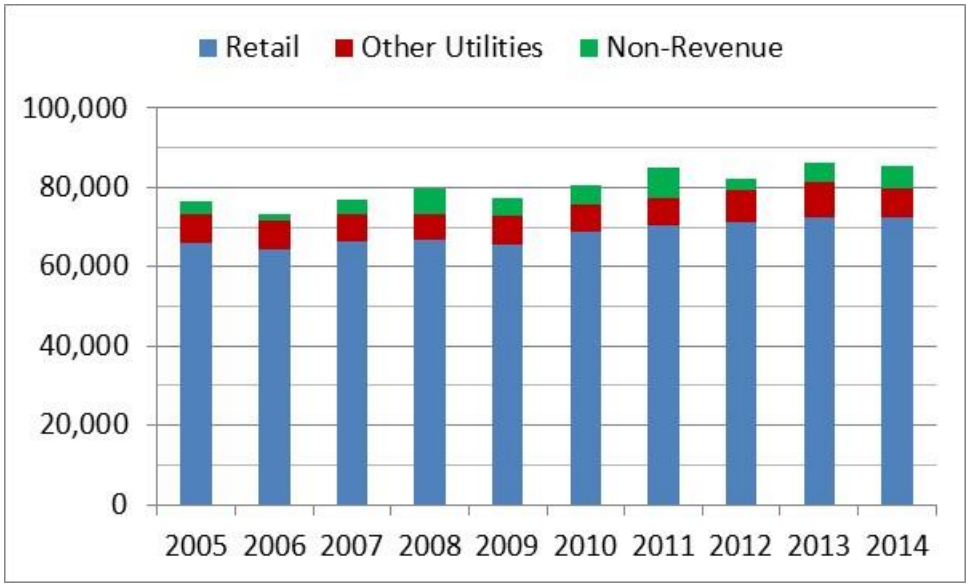
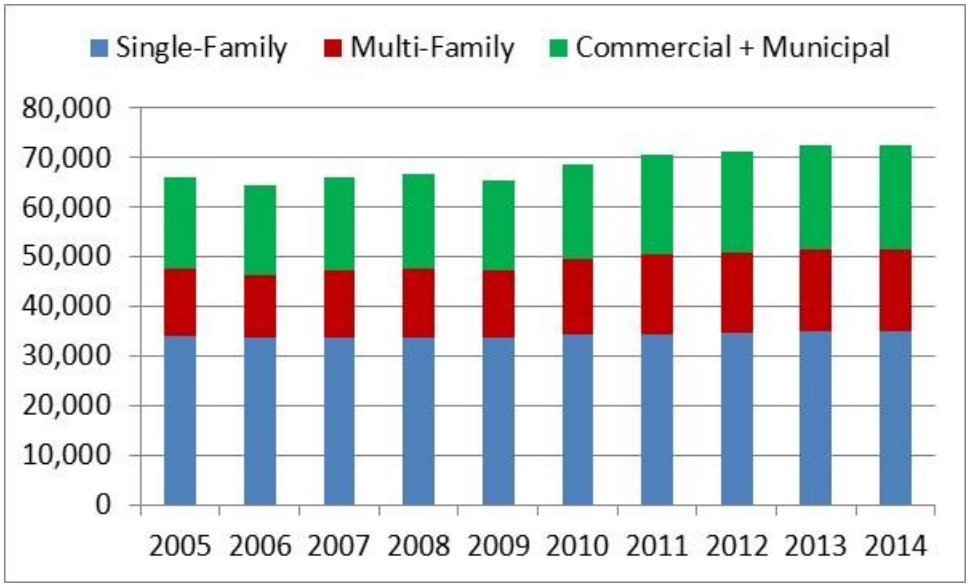


Figure 3-7 shows the total number of retail-only ERUs (ERUs for billed usage in Bellevue's water service area) broken down by customer categories.

Figure 3-7: Equivalent Residential Units by Retail Category



Demands from Adjacent Utilities

Table 3-8 summarizes recent demands (retail and wholesale) and non-revenue consumption. The South Cove area of Issaquah is included with direct retail sales in this table, because this area is currently in Bellevue's service area.

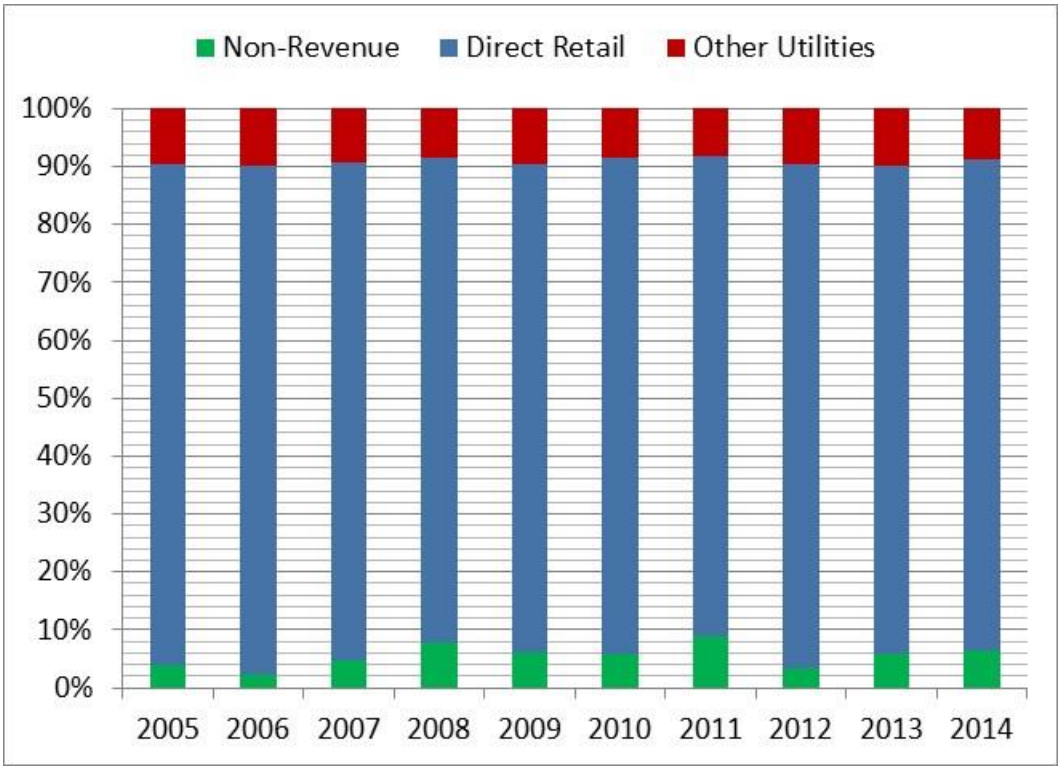
Table 3-8: Water Sales and Consumption (MG)*

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Direct Retail	5,095	5,455	5,124	4,946	5,165	4,695	4,749	4,976	4,953	5,068
Redmond	528	564	507	464	543	430	436	514	547	482
Issaquah	37.8	45.3	40.5	40.0	42.3	40.5	35.5	38.8	39.0	40.1
Beaux Arts	1.47	0.54	0.80	0.04	2.16	0.13	0.50	0.00	0.65	0.37
Non-Revenue	233	140	284	459	367	327	515	185	343	384
Total	5,895	6,204	5,957	5,910	6,120	5,493	5,736	5,714	5,883	5,975

* WD117 (Hilltop) intertie is unmetered, for emergency use only (no billed consumption).

Figure 3-8 shows the percent of total consumption by retail, wheeled and non-revenue demands. Wholesale demand wheeled to adjacent utilities is consistently 9% to 10% of total demand.

Figure 3-8: Percent of Total Consumption by Category



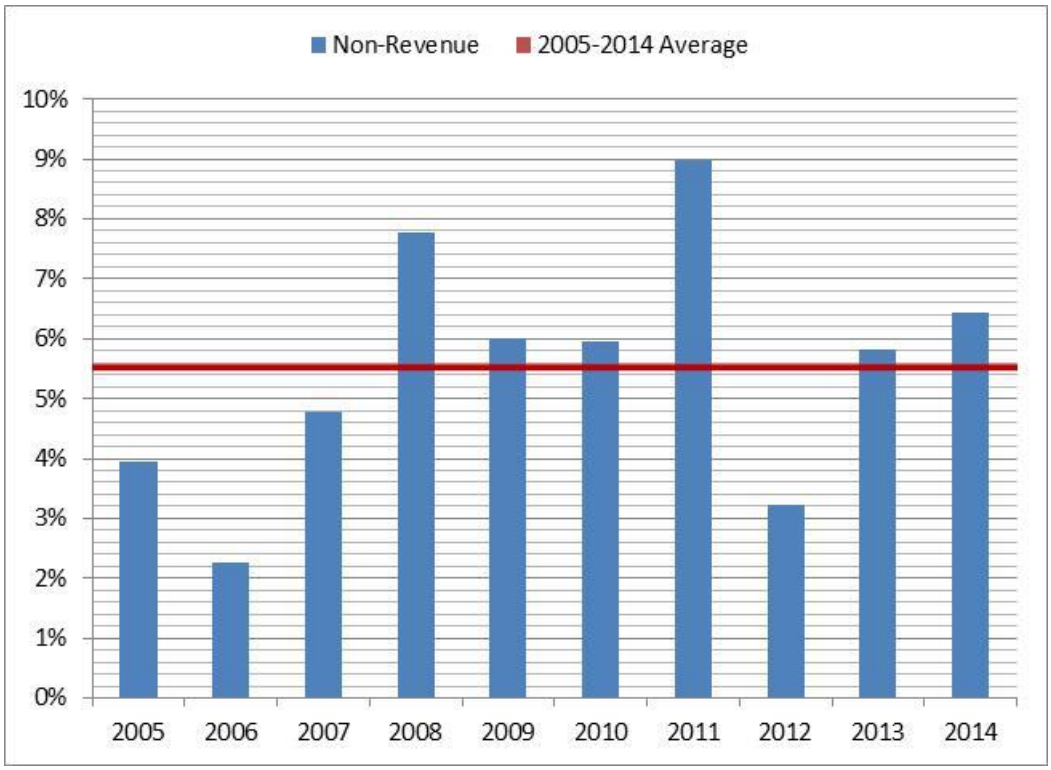
Non-Revenue Demands

Non-revenue flow includes unbilled metered consumption (typically water operations such as flushing and tank draining), unbilled unmetered consumption (such as fire fighting and firefighter training), apparent losses such as meter inaccuracies or unauthorized consumption (theft), and real losses such as water main breaks, reservoir overflows, or general distribution system leakage. The term “non-revenue” is consistent with AWWA’s

terminology[1], and more accurately describes this volume of water than other common terms. The terms "un-accounted for water" or "distribution system leakage" (DSL) are not used in this Plan to avoid confusion, since some of the water is accounted for, and not all of it is leakage.

Bellevue's non-revenue flow ranged from 2.3% to 9.0% of overall consumption during 2005-2014, with an average of 5.5% over this period. This is low compared to the regional average of approximately 10.5% in King, Pierce, and Snohomish Counties[2]. There is no national standard, but the guidance given by various states for maximum non-revenue flows is typically between 10-15%[3]. DOH requires certain measures be taken when non-revenue flow exceeds 10%, as discussed in Chapter 5. A recent nation-wide benchmarking study found that median non-revenue flow for similar utilities was 10.1%[4].

Figure 3-9: Non-Revenue Water Volume (% of Total)



[1] AWWA Manual M36 – Water Audits and Loss Control Programs
[2] Water Supply Forum. *2009 Outlook*.
[3] EPA, *Control and Mitigation of Drinking Water Losses in Distribution Systems*, EPA 816-R-10-019, November 2010.
[4] 2011 Benchmarking Performance Indicators for Water and Wastewater Utilities Survey and Analysis Report. AWWA, 2013.

For future system-wide projected non-revenue demands, 6% is the recommended estimate for Bellevue's system. Although higher non-revenue flows (up to 9%) did occur in 2008, 2011 and 2014, those were relatively low to average-demand years. For system-wide forecasting of water supply needs, application of non-revenue flows higher than 6% to a high-demand year (similar to warm-weather years 2006 or 2009) would be overly conservative. However, for localized analysis, 9% non-revenue demands may be appropriate to account for potential localized variations, since the sources of these demands are not well understood.

Additional detailed information on non-revenue flow is provided in Chapter 5.

3.3 Seasonal Variations in Demand

Figure 3-10 shows the total volume of water purchased by Bellevue for each month during the 2005-2013 period, including non-revenue demands and water wheeled to adjacent utilities. This chart demonstrates the typical pattern of seasonal demand changes.

Figure 3-10: 2005-2013 Monthly Total Consumption

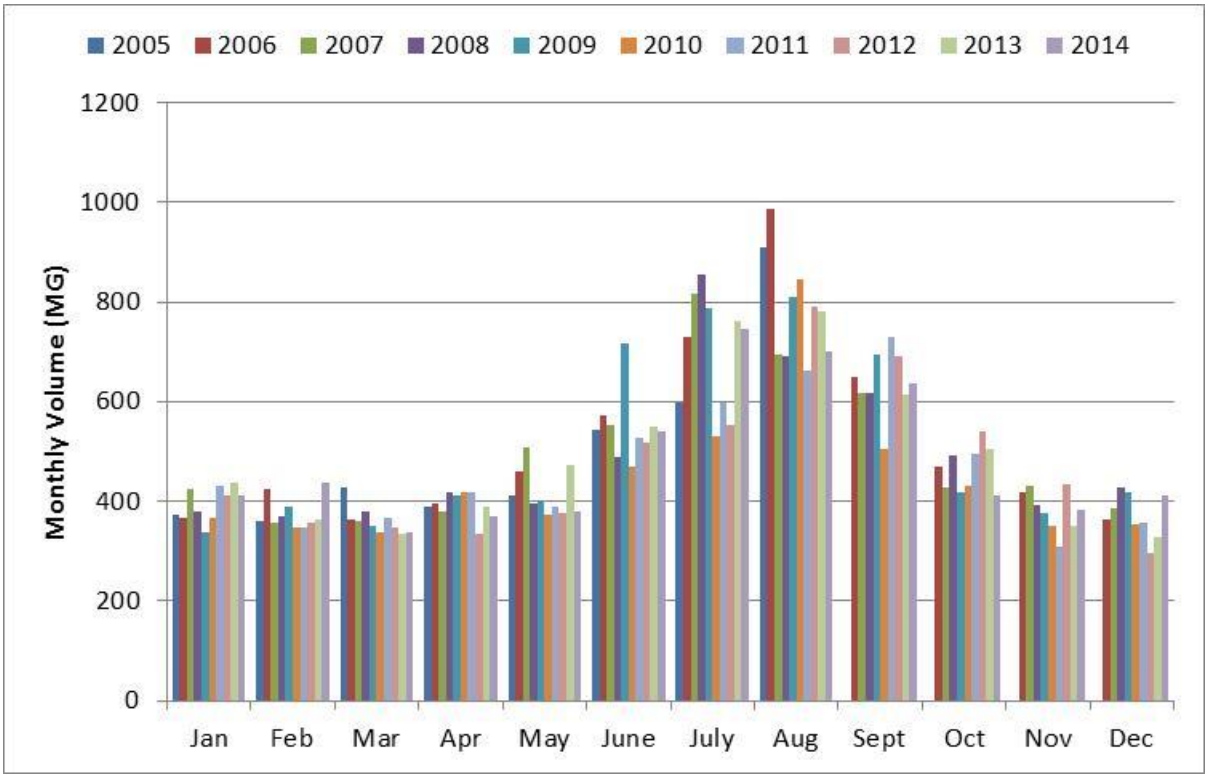


Figure 3-11 shows the same data in a line graph format, and adds the average monthly volume (thick black line) during the same period.

Figure 3-11: 2005-2013 Average Monthly Consumption

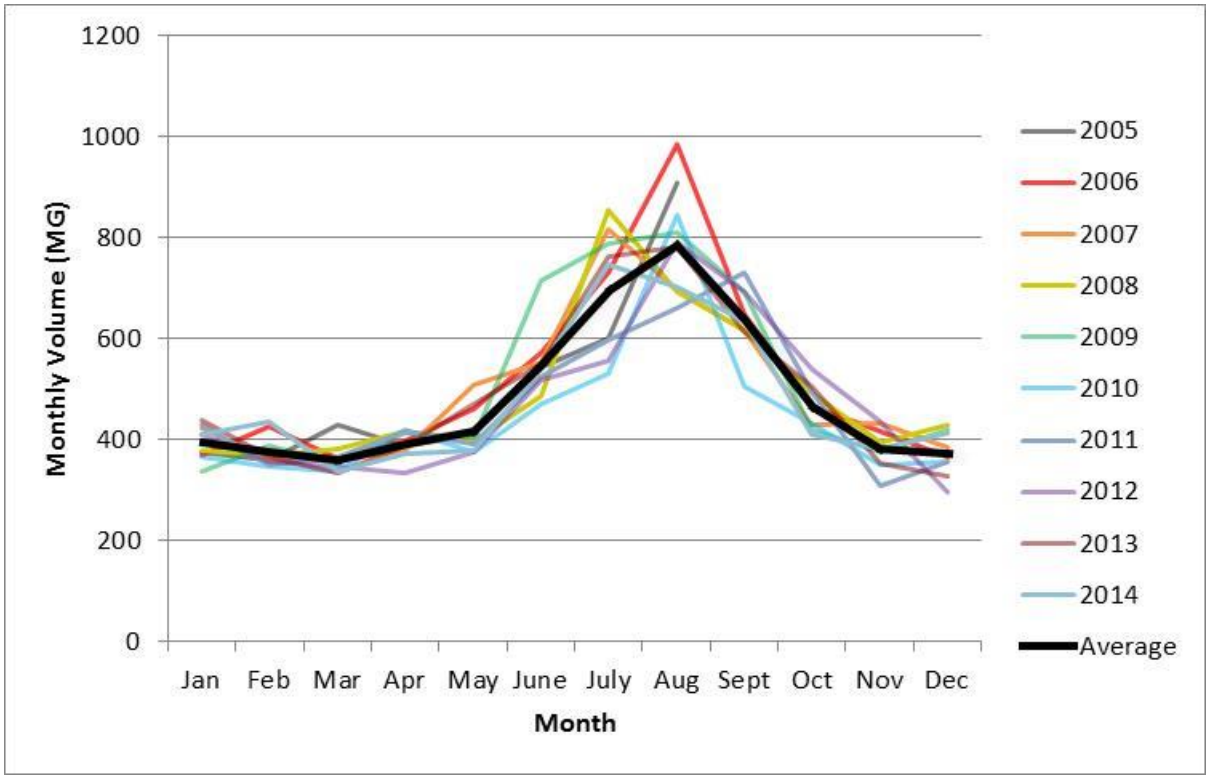


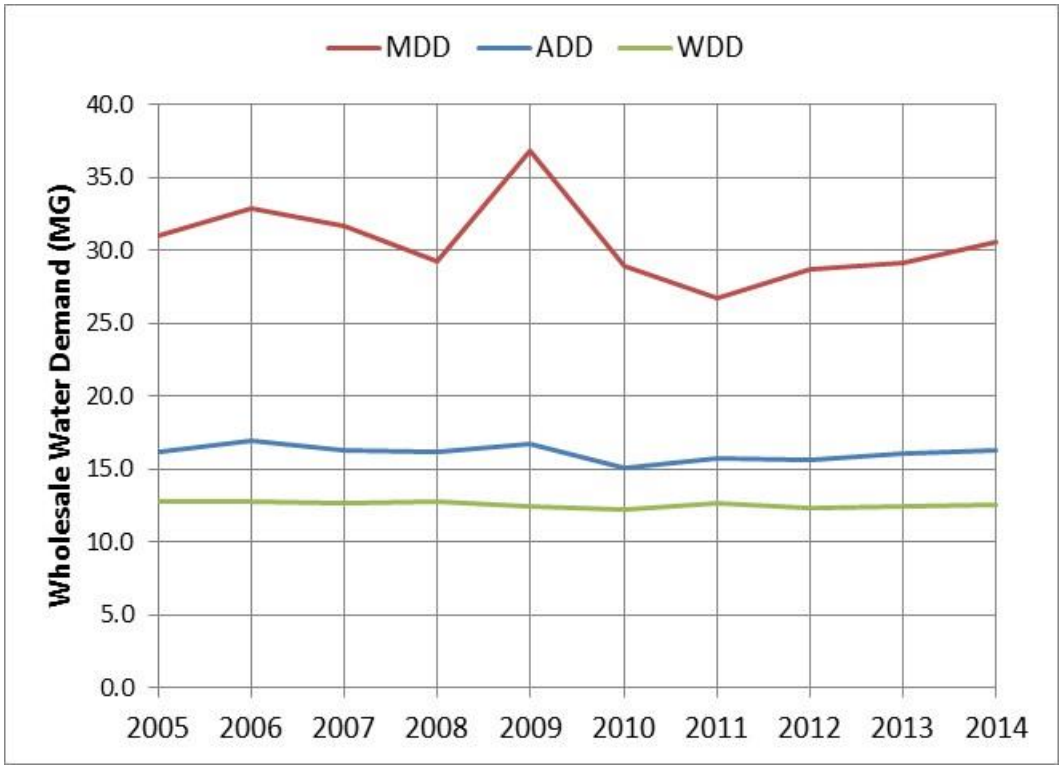
Table 3-9 and Figure 3-12 show the total system ADD, MDD, and winter day demand (WDD) from 2005 to 2014. This volume includes all water purchased by Bellevue, including wheeled wholesale volume and non-revenue demands. Bellevue established WDD to represent the average demand each year during November through April, when demand is typically stable and minimal in the local service area (as evident in Figure 3-10). WDD is also useful in estimating domestic sewage flows.

Table 3-9: Average Day, Maximum Day, and Winter Day Demands (MG)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
ADD	16.2	17.0	16.3	16.1	16.8	15.0	15.7	15.6	16.1	16.3
AMD	491	517	496	492	510	458	478	476	490	498
MDD	31.0	32.9	31.7	29.2	36.8	29.0	26.7	28.7	29.2	30.6
(Date)	Aug 5	July 24	July 11	July 16	July 29	Aug 16	Sept 7	Aug 17	July 24	July 16
MMD	811	830	724	776	876	737	750	761	792	792
WDD	12.8	12.7	12.7	12.8	12.4	12.2	12.6	12.4	12.5	12.6
MDD/ADD	1.92	1.94	1.94	1.81	2.20	1.92	1.70	1.84	1.82	1.87
MMD/AMD	1.65	1.61	1.46	1.58	1.72	1.61	1.57	1.60	1.62	1.59
WDD/ADD	0.79	0.75	0.78	0.79	0.74	0.81	0.80	0.79	0.78	0.77

For 2015, MDD is estimated to be 31.8-MG on July 6.

Figure 3-12: Average Day, Maximum Day, and Winter Day Demands (MG)



Despite significant, sustained population growth every year from 2006-2014, and a general trend of increasing employment (employment dipped temporarily from 2008 to 2010), total ADD and MDD in Bellevue's system remained generally stable during this period.

Figure 3-12 shows that WDD is relatively very stable from year-to-year. Therefore, annual variations in total consumption and ADD generally result from fluctuating summer water demands. It is assumed that these yearly demand variations occur due to relative summer weather patterns and irrigation demand.

Figures 3-13 and 3-14 compare wholesale water purchases to observed temperature data. Max temperature and cooling degree days (CDD) are as observed at the National Oceanic and Atmospheric Administration's (NOAA) SEA-TAC Airport measuring station.

Figure 3-13: MDD vs. Max Temp

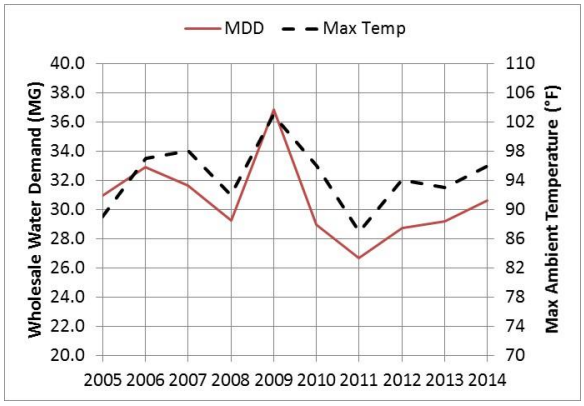
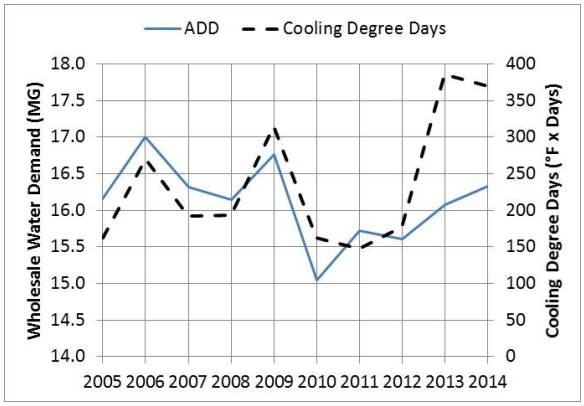


Figure 3-14: ADD and Cooling Degree Days



Maximum temperature reflects the hottest day each year, and appears to correlate fairly well with Bellevue's MDD, the day of highest water demand, in Figure 3-13.

Figure 3-14 compares Bellevue's ADD to CDD, a measure of relative heat intensity of the entire summer season. This figure suggests that ADD and CDD are usually well correlated, although this correlation broke down somewhat in 2013 and 2014. CDD is a unit of measure used to estimate power consumption for air conditioning. Total CDD equals the cumulative sum of [average daily temperature minus 65° F] for each day with average temperature above 65°. CDD may be more appropriate than average temperature for comparing to ADD, because it is not skewed by other seasons with stable, temperature-independent water demands, but includes hot days that may occur in other seasons. CDD only reflects hot weather periods, when water demand appears to be correlated to temperature.

Seasonal demand data presented above has been incorporated into analysis of water supply and storage needs, as described in Chapter 4.

3.4 Diurnal Variations in Demand

Water customers have a normally predictable and repeatable pattern of water usage throughout a typical day. This is referred to as a diurnal pattern. Diurnal patterns vary according to the type of customer (commercial, residential, etc) and seasonally, but for large sample sizes, diurnal patterns tend to be generally similar among water users in the same customer class on the same day.

It is important to understand diurnal patterns in any water system, to plan for adequate supply, storage capacity, and pipe sizing to accommodate the peak flows in the system. Diurnal patterns also affect water quality parameters such as water age and reservoir turnover. Water industry standards, such as AWWA Manuals of Practice M22, M31 and M32, and the Washington State Department of Health (DOH) Water System Design Manual (WSDM) all require that diurnal patterns be considered in water system planning.

Diurnal patterns are typically graphed as a unitless "Peaking Factor" (PF). PF is the ratio of actual instantaneous demand to the average demand for the same set of data on the same day. For instance, PF shown in Figure 3-15 is the recorded demand at each hour divided by MDD for the respective year (MDD is the average daily flow on the maximum day).

In addition to a system-wide MDD diurnal evaluation, two recent diurnal studies were conducted to understand typical customer-specific demand patterns in low- and high-demand seasons. The customer-specific studies had a limited sample set (hotel, office, retail, school, and multi-family housing accounts equipped with Sensus Omni Meters; single-family customers located in CL500), but comprise the best currently available information, and reflect actual customer demands. Prior to installation of Omni Meters (beginning in 2009), the City did not have the capability to directly record hourly water usage for specific customer types.

System-Wide Maximum Demand Day Diurnal Evaluation

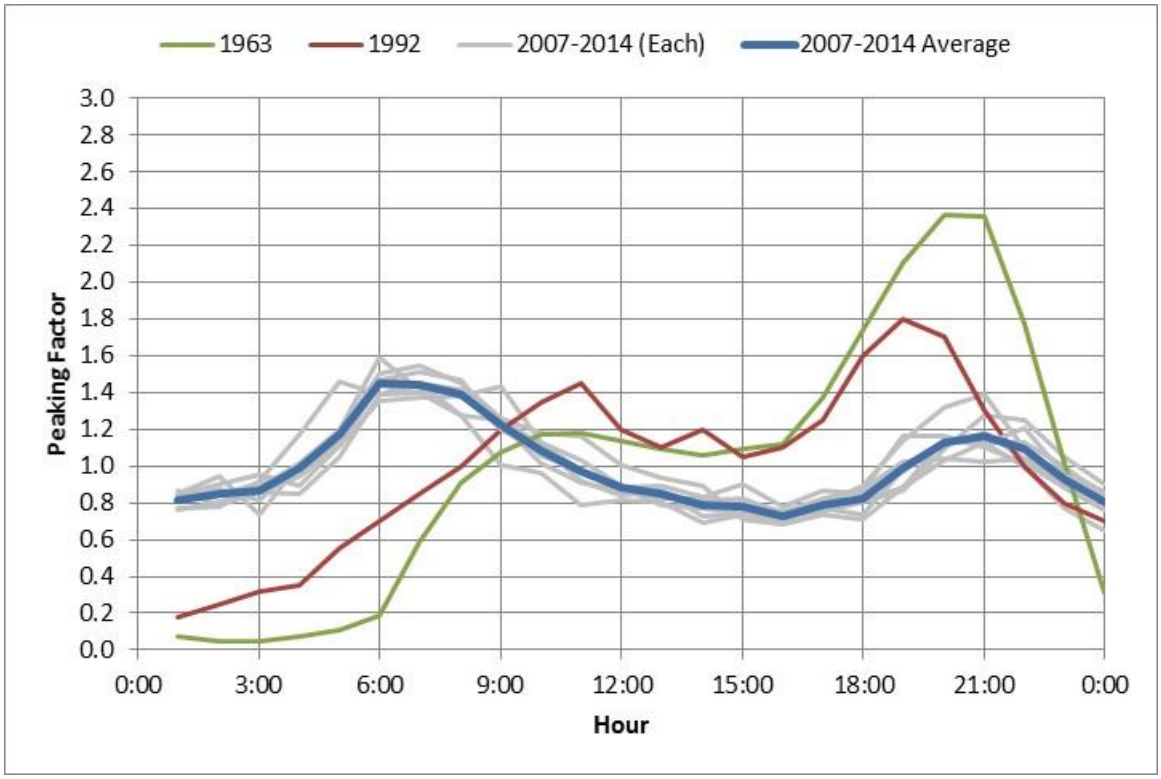
Hourly system-wide water demands[1] were observed for each maximum demand day from 2007 to 2014, as shown in Figure 3-15. Individual patterns for each year (grey lines) are relatively consistent and well-correlated; the average pattern during this period is shown in blue. Observed patterns from 1963[2] and 1992[3] are also added to provide historical context, and to contrast the significant changes in demand patterns over multiple decades.

[1] 2007-2014 system-wide demands shown are the total volumes supplied through regional water supply inlets, plus the change in reservoir volume throughout the system for each hour. This excludes demands in the NH320, NH380, NH470, NH580 or RH545 pressure zones, which are served by CCUD or Kirkland.

[2] Plan and Program for Water System Development. King County Water District No. 97 (Lake Hills Water District), February 1963.

[3] Water Comprehensive Plan. City of Bellevue, 1992.

Figure 3-15: Recent and Historical Maximum Demand Day Diurnal Patterns



System-wide demand patterns may be useful for analysis of overall water supply needs, but does not account for localized differences that affect smaller areas of the system. To plan for infrastructure serving smaller areas, it is necessary to account for localized, specific variations in demand patterns.

Customer-Specific Summer Diurnal Demand Study

Diurnal water demand patterns of a limited number of customers were observed for the period of June 30 through August 27, 2014, to assist in hydraulic modeling of summer demands based on type of customer. Detailed results are provided in Appendix F.

Figure 3-16 shows the aggregate peaking factors for all user classes studied on the MDD (July 16, 2014). These PFs are based on a limited sample set across locations throughout Bellevue's water service area, and should not be used for design purposes or for facility sizing, because they may not reflect localized demand patterns. These PFs are recommended only for general system-wide modeling of MDD inside Bellevue's service area, and may not reflect other utilities' customer demands.

Figure 3-16: Observed 2014 MDD Diurnal Patterns

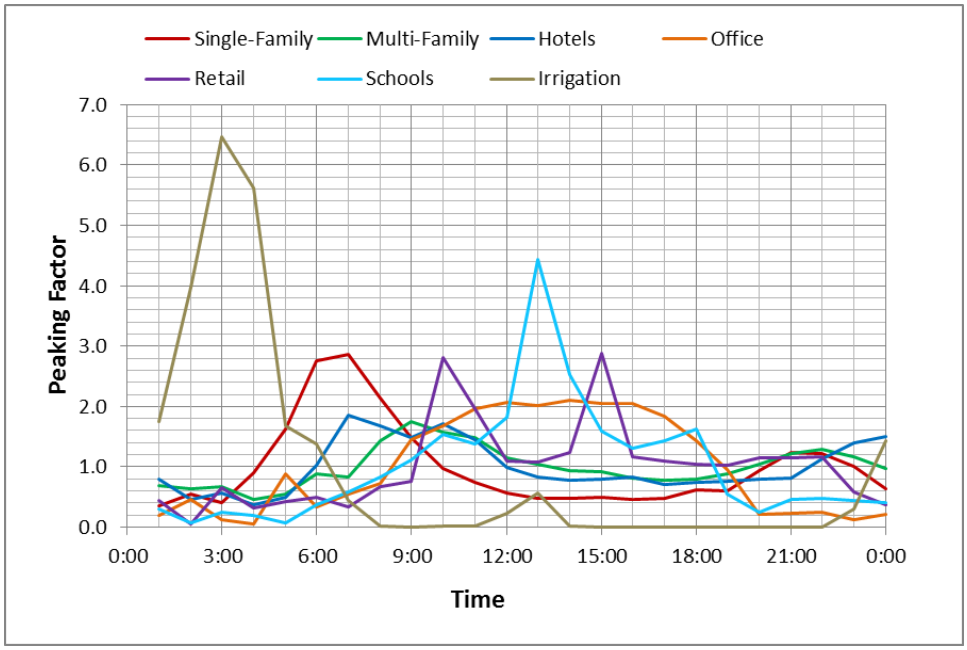
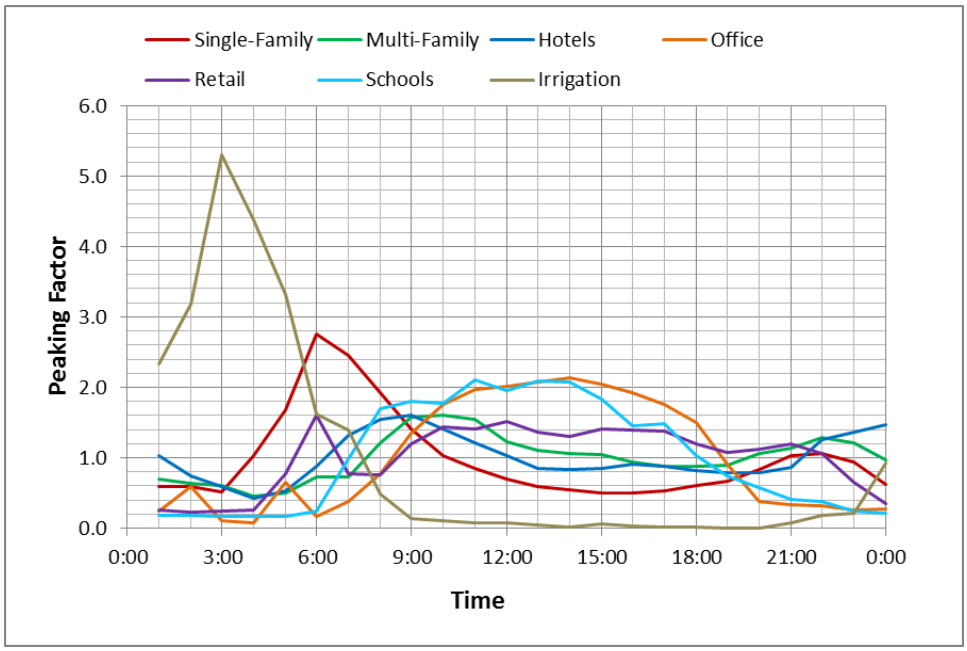


Figure 3-17 shows the overall aggregate peaking factors for an average day over the entire study period, for several customer classes. These PFs are recommended for general system-wide summer EPS modeling of Bellevue's service area, but not for design or facility sizing.

Figure 3-17: Average Observed Summer Diurnal Patterns (All Days)



The summer diurnal demand study demonstrated clearly that large, commercial irrigation accounts now operate primarily on programmable irrigation controllers, typically in the early morning (2:00-4:00 am). Compared to winter demands, single-family accounts had a much sharper morning peak, presumably related to irrigation patterns (single-family meters typically record domestic and irrigation demands). Multi-family and office domestic diurnal patterns are relatively consistent between winter and summer, which may be due to separate metering for irrigation demands. For hotels, observed summer PFs were higher during holidays and weekends (compared to weekdays), whereas the opposite occurred in winter, suggesting more leisure travel in summer versus more business travel during winter.

Table 3-10 shows observed maximum summer weekday PFs by customer class. The aggregate data is based on the total flow for all meters. Individual meters are also shown, to demonstrate that significant localized variation exists even within the same customer class, as sample sizes get smaller.

Table 3-10: Maximum Observed Summer Peaking Factors

	Aggregate (Entire Sample)		Individual Meters	
Customer Class	Maximum Observed PF	Peak Time at Hour Ending	Highest Peak PF	Lowest Peak PF
Irrigation	6.67	3:00 AM	16.3	3.90
Single-Family	3.12	6:00 AM	N/A	N/A
Multi-Family	1.75	9:00 AM	7.27	1.64
Hotels	1.92	7:00 AM	3.43	2.17
Office	2.17	2:00 PM	3.10	2.12
Retail	4.65	6:00 AM	4.95	3.22
Schools	4.44	1:00 PM	7.38	2.85

Although total system irrigation is combined into general system-wide peaking factors (MDD shown in Table 3-9 and peak hour shown in Figure 3-15), the data in Table 3-10 assists in peak demand forecasting for individual irrigation systems.

Customer-Specific Winter Diurnal Demand Study

Diurnal water demand patterns of a limited number of customers were observed for the period of December 15, 2013 through January 19, 2014, to assist in hydraulic modeling of winter demands based on type of customer. Detailed results are provided in Appendix G.

Figure 3-18 shows the aggregate winter weekday peaking factors for all user classes studied, during non-holiday weeks (weekdays adjacent to Christmas and New Year's Day are excluded). These PFs are higher than for average winter days, and are recommended for calibrating winter weekday hydrant test data and for winter extended period simulation (EPS) modeling scenarios lasting less than 7 days.

Figure 3-18: Observed Winter Weekday Diurnal Patterns

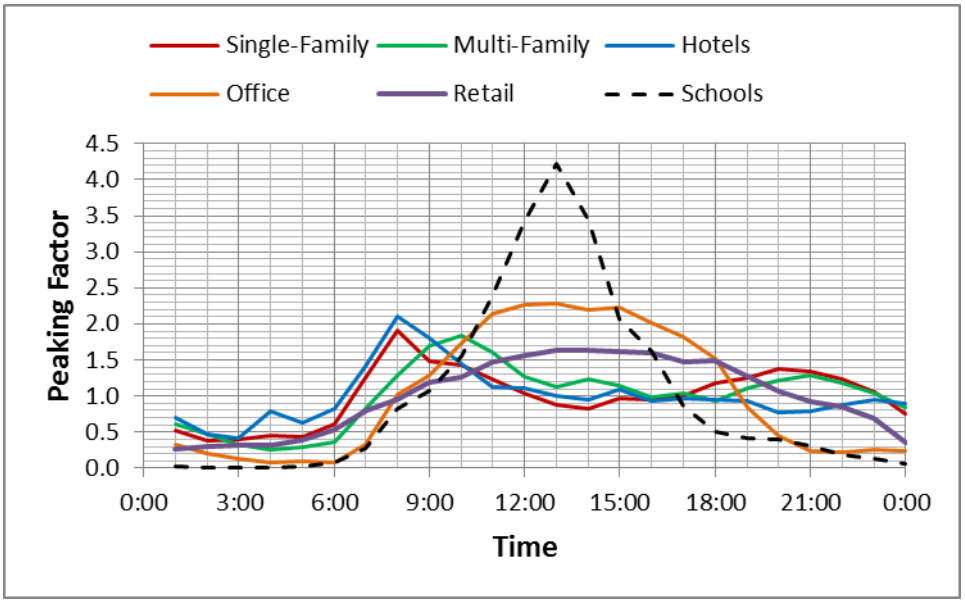
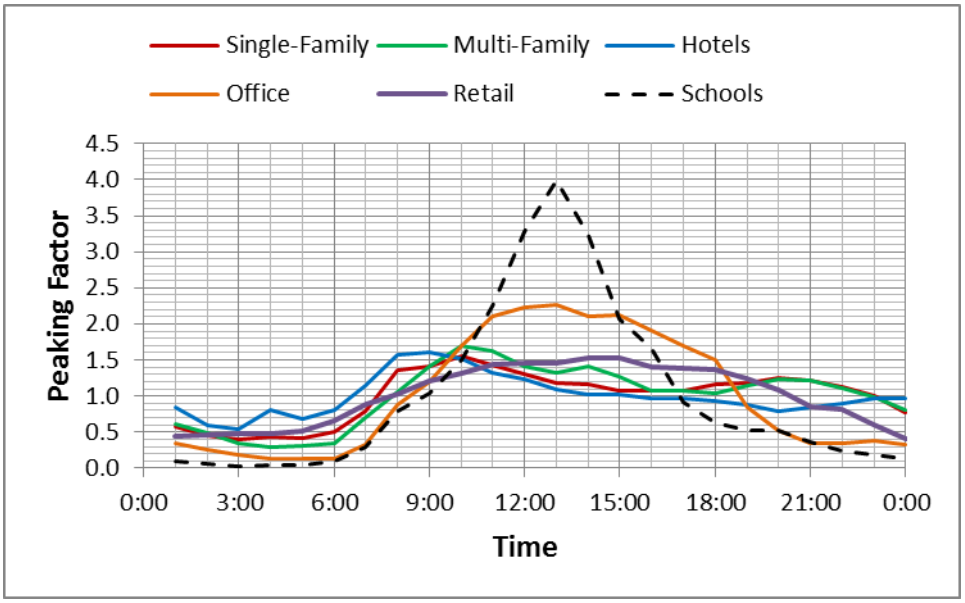


Figure 3-19 shows the overall aggregate peaking factors for an average day over the entire study period (including weekends and holidays), for several customer classes. These PFs are recommended only for use in Winter EPS modeling scenarios lasting 7 days or longer, because they average all days (holidays, weekends, and weekdays).

Figure 3-19: Average Observed Winter Diurnal Patterns (All Days)



Winter diurnal patterns are useful for calibration, water quality analysis and EPS modeling scenarios, but should not be used for water system design purposes or for facility sizing, since they do not reflect peak, warm-weather demand periods.

Table 3-11 shows observed maximum winter weekday PFs by customer class. The aggregate data is based on the total flow for all meters. Individual meters are also shown, to demonstrate that significant localized variation exists even within the same customer class, as sample sizes get smaller.

Table 3-11: Maximum Observed Winter Weekday Peaking Factors

	Aggregate (Entire Sample)		Individual Meters	
Customer Class	**Maximum Observed PF**	**Peak Time at Hour Ending**	**Highest Peak PF**	**Lowest Peak PF**
Single-Family	1.92	8:00 AM	N/A	N/A
Multi-Family	1.85	10:00 AM	2.74	1.57
Hotels	2.11	8:00 AM	2.60	1.75
Office	2.28	1:00 PM	3.59	2.20
Retail	1.64	2:00 PM	5.78(1)	1.66
Schools	4.22	1:00 PM	4.80	3.50

1. Retail peak PF occurred on Christmas. Peak flow *rate* occurred Christmas Eve.

3.5 Water Demand Projection Criteria

Table 3-12 summarizes updated criteria for demand projections, based on the range of recent consumption volumes shown previously. These criteria are intended for system-wide modeling, but are not appropriate in all cases. For large customers with unusual demands, such as food & beverage production and hospital facilities, actual observed meter data should be used. For facilities with large non-employee populations, such as schools, separate class-specific criteria should be developed, or actual meter readings should be used. For design of localized utility infrastructure projects such as pump stations and reservoirs, design criteria should be designed based on location-specific water usage.

Table 3-12: Recommended Average Day Water Use Projection Criteria

	High Demand Year (Recommended for Capacity Analysis)	Low Demand Year (Use for Water Quality Analysis)	2006 Water Comprehensive Plan Estimate
Single-Family Residential	84 gpcd	66 gpcd	92 gpcd
Multi-Family Residential	75 gpcd	66 gpcd	80 gpcd
Employee	32 gpcd	27 gpcd	90 gal/1,000 sf
ERU	232 gpd	185 gpd	248 gpd
Non-Revenue	6%-9%*	3%	8.5%
MDD/ADD	2.2	1.7	2.25
WDD/ADD	N/A	0.75	N/A

*6% recommended for system-wide demand projections, 9% for localized analysis

Recently observed high-demand year ADD is recommended as criteria for facility sizing and fire flow analysis, because facilities are required to meet minimum standards during peak hour and maximum day demand during peak years. Bellevue's 2006 Water Comprehensive Plan projected future customer demands based on the peak demand year (2003) during the previous planning period (1997-2003). This same approach is recommended for the 2015 Water System Plan for the purpose of sizing water distribution facilities, using the peak year from the period of 2005-2013. Due to long-term trends in water usage, it is assumed that older data (pre-2005) is obsolete for the purpose of future projections.

Minimum observed (low-demand year) ADD is recommended as criteria for water quality analysis, because these conditions cause minimal system turnover and maximum water age, the least-optimum scenario for water quality. Increasing water age is correlated with lower chlorine residual (greater potential for microbial contamination), and with higher concentrations of disinfection by-products.

The ratio of MDD/ADD and WDD/ADD are calculated based on the historical ratio of total wholesale water purchased by the City. This data reflects overall system-wide consumption (Bellevue retail demands and non-revenue flows, plus sales to neighboring utilities), and therefore it is assumed that it can be applied to all customer classes. The criteria for MDD/ADD ratio, 2.2 and 1.7, are the maximum and minimum observed during the period 2005-2014, respectively.

3.6 Projected Population

Table 3-13 shows projected population and employment in Bellevue's retail water service area. 2012 population is estimated by PCD based on development data, corrected to correlate with the 2010 U.S. Census. Population for the years 2020, 2030 and 2040 are based on the updated forecast data released by Puget Sound Regional Council (PSRC) in 2014, and refined by PCD based on localized City of Bellevue zoning and Comprehensive Plan data shown in Figures 3-20 and 3-21, as well as zoning data provided by other municipalities within the service area. Population data for the years 2024 and 2034 have been linearly interpolated to approximate the 10-year and 20-year timeframes.

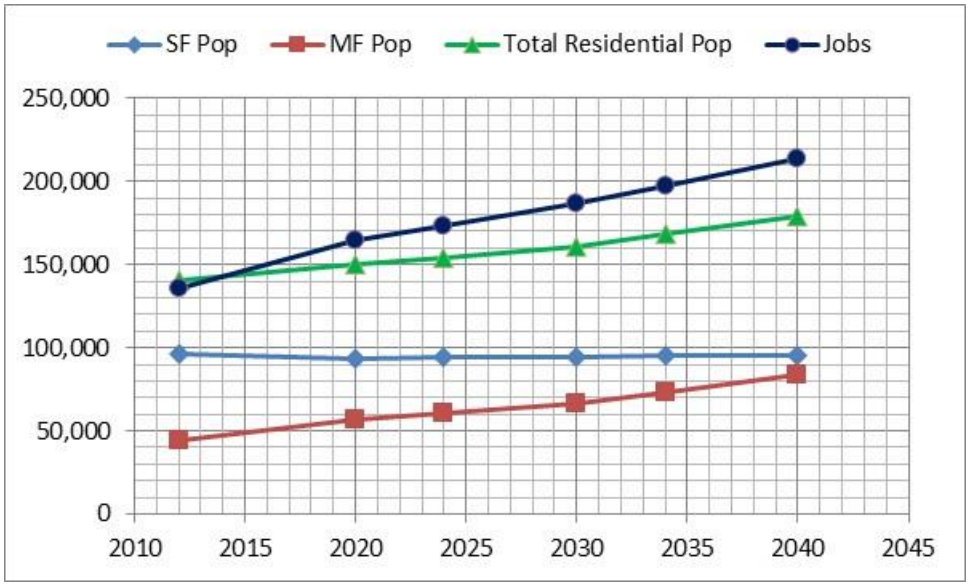
Table 3-13: Projected Water Service Area Population and Employment

	2012	2020	2024	2030	2034	2040
Single-Family Population	96,086	93,715	94,067	94,595	94,967	95,526
Multi-Family Population	44,565	56,449	60,377	66,269	73,310	83,872
Total Residential Population	140,651	150,163	154,444	160,864	168,278	179,398
Jobs	136,108	164,407	173,483	187,098	197,744	213,714

2012 estimates include the South Cove area of Issaquah (approximate population 4,000), which is currently in the City of Bellevue water service area, but 2020-2040 estimates do not include South Cove (this accounts for the decrease in SF population from 2012-2020). The City of Issaquah has approached the City of Bellevue regarding assumption of this area into Issaquah's water service area, and the assumption is scheduled to occur in January 2017. This area may be isolated from Bellevue following the assumption and supplied from the City of Issaquah, or it may continue to be supplied from Bellevue for some time. For all future projections, it is assumed that South Cove will be removed from Bellevue's direct retail service area, but that Bellevue will continue to provide water ("wheel") to South Cove by contract with the City of Issaquah.

Figure 3-22 shows projected retail water service area population and employment. Single-family population shows a slight decrease from 2012 to 2020 due to the City of Issaquah's planned assumption of the South Cove portion of the service area (approx. population 3,500 SF, 500 MF) in 2017.

Figure 3-22: Projected Water Service Area Population and Employment



3.7 Projected Water Demand

Table 3-14 shows projected average day demand (ADD), during both a high-demand year and a low-demand year (as defined in Table 3-12), without additional efficiency savings. Future residential, commercial and municipal demand estimates are based on the population and employment projections provided by PCD (Table 3-13), and on per-capita demand criteria shown in Table 3-12. Non-revenue demands are projected as 6%, consistent with recent years.

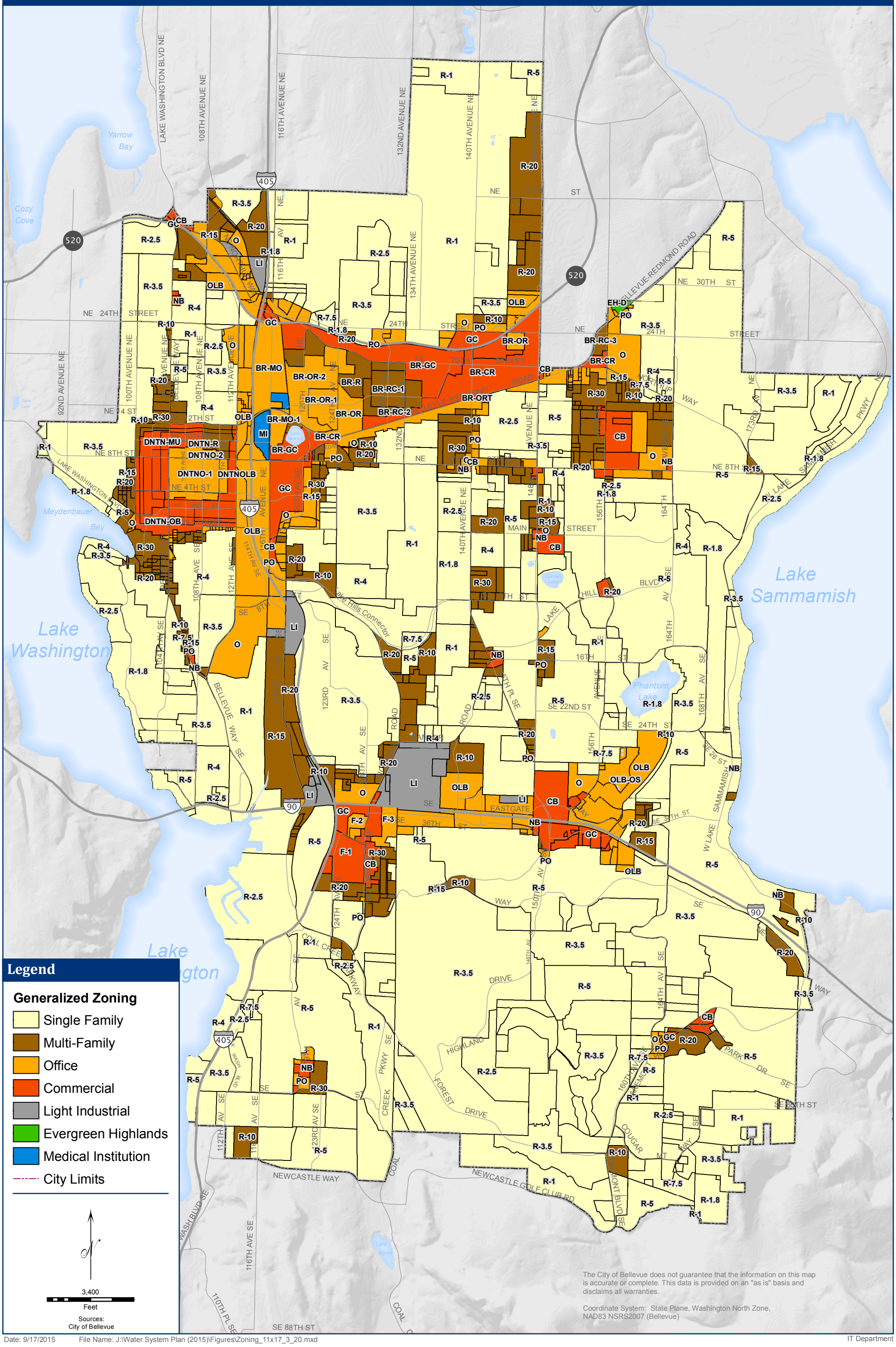
Table 3-14: Projected Total Wholesale ADD, without Add'l Conservation (MGD)

	2020		2024		2034	
	High	Low	High	Low	High	Low
Single-Family Residential	7.87	6.19	7.90	6.21	7.98	6.27
Multi-Family Residential	4.23	3.73	4.53	3.98	5.50	4.84
Commercial & Municipal	5.26	4.44	5.55	4.68	6.33	5.34
Wheeled	3.32	2.45	3.69	2.90	4.60	4.01
Non-Revenue	1.11	0.92	1.15	0.95	1.26	1.05
Total	21.8	17.7	22.8	18.7	25.7	21.5

Current Generalized Zoning

Figure 3-20

City of Bellevue
GIS Services



Legend

Generalized Zoning

- Single Family
- Multi-Family
- Office
- Commercial
- Light Industrial
- Evergreen Highlands
- Medical Institution
- City Limits

3,400
Feet

Sources:
City of Bellevue

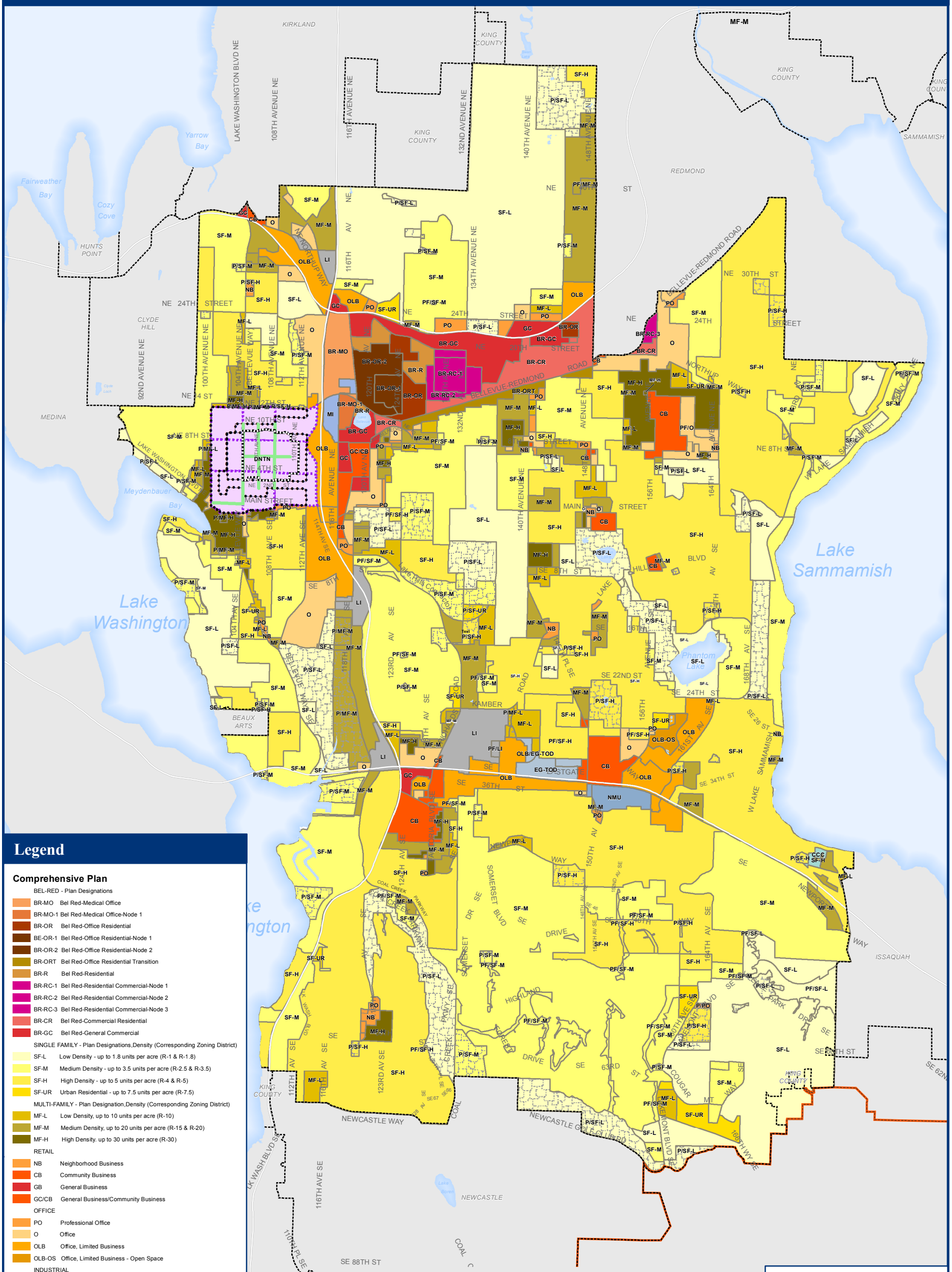
Date: 9/17/2015 File Name: J:\Water System Plan (2015)\Figures\Zoning_11x17_3_20.mxd

IT Department

Comprehensive Land Use Plan for Future Development

Figure 3-21

City of Bellevue
PCD Services



Legend

Comprehensive Plan

BEL-RED - Plan Designations

- BR-MO Bel Red-Medical Office
- BR-MO-1 Bel Red-Medical Office-Node 1
- BR-OR Bel Red-Office Residential
- BE-OR-1 Bel Red-Office Residential-Node 1
- BR-OR-2 Bel Red-Office Residential-Node 2
- BR-ORT Bel Red-Office Residential Transition
- BR-R Bel Red-Residential
- BR-RC-1 Bel Red-Residential Commercial-Node 1
- BR-RC-2 Bel Red-Residential Commercial-Node 2
- BR-RC-3 Bel Red-Residential Commercial-Node 3
- BR-CR Bel Red-Commercial Residential
- BR-GC Bel Red-General Commercial

SINGLE FAMILY - Plan Designations,Density (Corresponding Zoning District)

- SF-L Low Density - up to 1.8 units per acre (R-1 & R-1.8)
- SF-M Medium Density - up to 3.5 units per acre (R-2.5 & R-3.5)
- SF-H High Density - up to 5 units per acre (R-4 & R-5)
- SF-UR Urban Residential - up to 7.5 units per acre (R-7.5)

MULTI-FAMILY - Plan Designation,Density (Corresponding Zoning District)

- MF-L Low Density, up to 10 units per acre (R-10)
- MF-M Medium Density, up to 20 units per acre (R-15 & R-20)
- MF-H High Density. up to 30 units per acre (R-30)

RETAIL

- NB Neighborhood Business
- CB Community Business
- GB General Business
- GC/CB General Business/Community Business

OFFICE

- PO Professional Office
- O Office
- OLB Office, Limited Business
- OLB-OS Office, Limited Business - Open Space

INDUSTRIAL

- LI Light Industrial

MEDICAL INSTITUTION

- MI Medical Institution

OTHER

- DNTN Downtown
- EG-TOD Eastgate Transit-Oriented Development
- NMU Neighborhood Mixed Use
- CCC Camp and Conference Center
- Downtown Signature Streets
- Downtown Perimeter Area
- Downtown Core Area
- Downtown Neighborhoods
- Urban Growth Area Boundary
- City Limits

0 1,300 2,600 5,200 Feet

Sources
City of Bellevue

* Plan revisions as of 8/3/2015

Date: 10/14/2015 File Name: J:\Water System Plan (2015)\Figures\CompPlanMap_11x17_Fig3-21.mxd

As described in Section 3.2, irrigation demands cannot be clearly distinguished from domestic for most single-family customers, nor for multi-family and commercial demands without a separate irrigation meter. Therefore, for system-wide demand projections, irrigation consumption is included in the total demand per customer class, and is reflected in seasonal and daily peaking factors.

Wheeled demands include Redmond's Overlake neighborhood and Issaquah's Lakemont, Glacier Ridge and South Cove neighborhoods. Projections for Overlake are based on projected population and commercial building area provided by the City of Redmond's Planning Department, which was then converted to demand using Bellevue's demand criteria. Projections for Issaquah's Lakemont and Glacier Ridge areas are based on the number of ERUs projected by the City of Issaquah, up to the contract limit (400 and 700 ERUs, respectively), with the same gal/ERU assumed as Bellevue's service area (Table 3-x). Projections for South Cove were based on modified PSRC population projections provided by PCD, and the same demand criteria used for Bellevue. South Cove is included in the "wheeled" projection for 2020+, but not 2012, because it is currently part of Bellevue's retail water service area.

Figure 3-23 shows the projected range of total ADD, before and after additional conservation. Recent actual ADD is also shown for context. Projections without conservation correspond to the data in Table 3-14. Conservation criteria for reduced demands are described in Chapter 5.

Figure 3-23: Projected Total Wholesale ADD (MG)

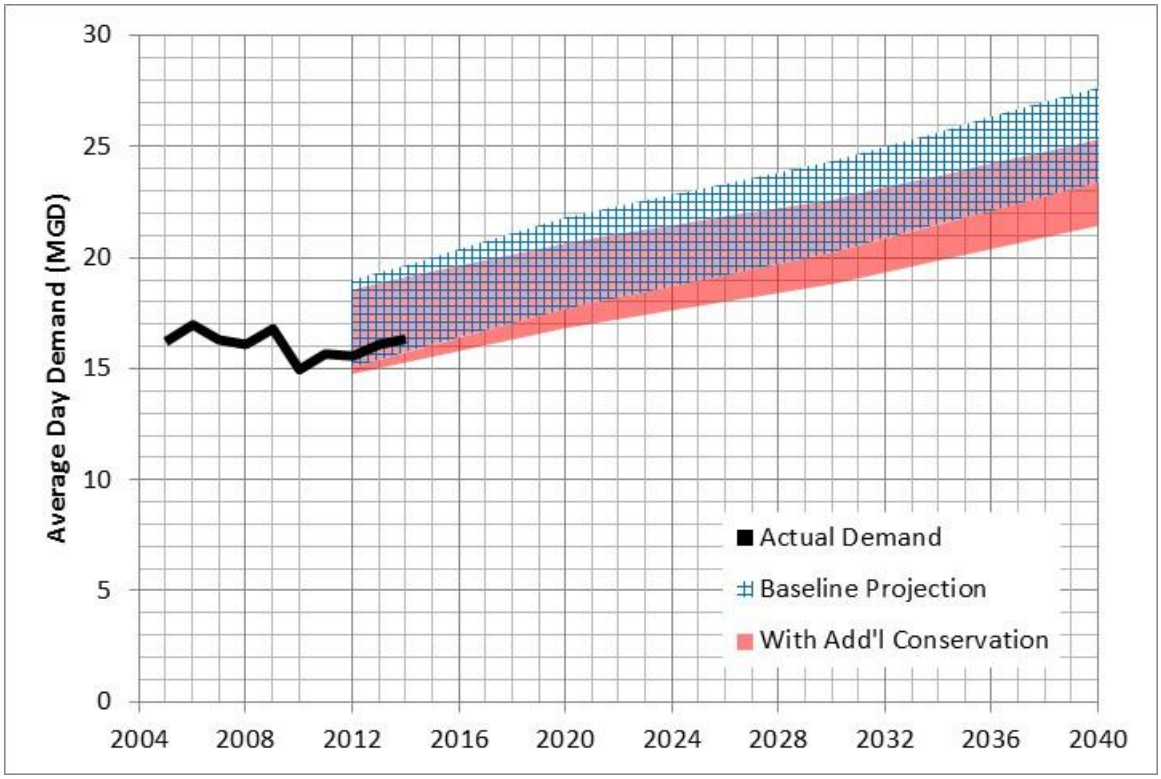


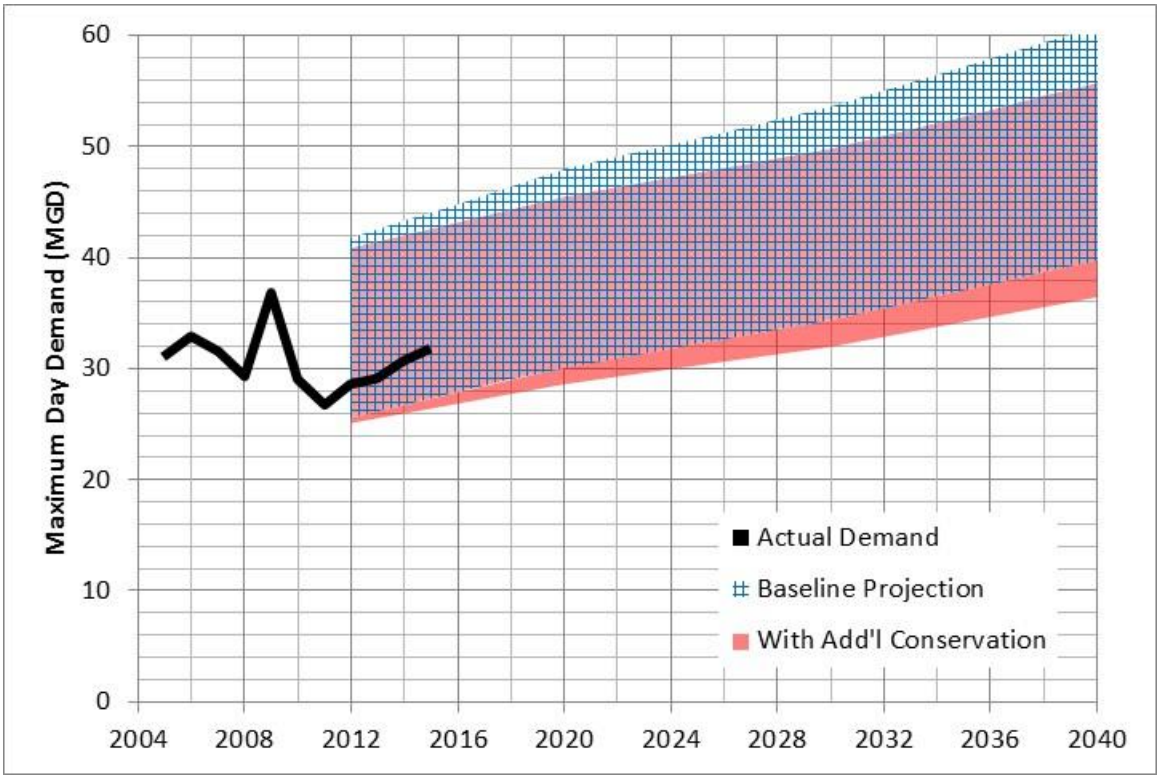
Table 3-15 shows projected MDD, based on ADD (Table 3-14) escalated by the MDD/ADD ratios shown in Table 3-12.

Table 3-15: Projected Total Wholesale MDD, without Add'l Conservation (MG)

	2020		2024		2034	
	High	Low	High	Low	High	Low
Single-Family Residential	17.3	10.5	17.4	10.6	17.6	10.7
Multi-Family Residential	9.31	6.33	9.96	6.77	12.1	8.23
Commercial & Municipal	11.6	7.55	12.2	7.96	13.9	9.08
Wheeled	7.30	4.17	8.11	4.93	10.1	6.81
Non-Revenue	2.44	1.56	2.53	1.61	2.78	1.78
Total	47.9	30.1	50.2	31.8	56.5	36.6

Figure 3-24 shows the projected range of total MDD, before and after additional conservation. Recent actual MDD is also shown for context. Projections without conservation correspond to the data in Table 3-15. Conservation criteria for reduced demands are described in Chapter 5.

Figure 3-24: Projected Total Wholesale MDD (MG)



Tables 3-16, 3-17 and 3-18 show projected 6-year (2020), 10-year (2024) and 20-year (2034) population and employment, with the corresponding range of projected ADD and MDD for each pressure zone. The “High” and “Low” projected flows are based on the criteria in Table 3-12, and include the projected demands plus assumed non-revenue flow. For zones that wheel flow to Redmond and/or Issaquah, those demands are listed separately from Bellevue’s.

Data sources for population and employment are listed below. Source data was linearly interpolated when years did not match the 6-, 10- and 20-year planning dates (2020, 2024, and 2034):

- For areas in Bellevue’s existing service area (including the South Cove area of Issaquah), population and employment projections were provided by PCD, based on adjusted PSRC projections.
- Population projections for Issaquah’s Lakemont and Glacier Ridge areas are roughly estimated based on existing flows. The City of Issaquah does not have current population estimates specific to these areas, and projects no additional local growth, so existing flow is used to estimate future flow (population estimates are for information only, and not used to project flow in these two areas). Lakemont is assumed to be all multi-family population, based on existing zoning. Glacier Ridge is assumed to be all single-family.
- Redmond flow projections are interpolated between (1) recent minimum and maximum wheeled volumes to Redmond in Table 3-8 and (2) estimated 2030 demands. 2030 demands were estimated based on 2030 housing units and commercial space projections provided by the City of Redmond Planning Department, adjusted to historical occupancy rates, then converted to water demand using Bellevue’s criteria to estimate flow. Flows were then interpolated to 2020 and 2024, and extrapolated to 2034.

For simplicity, projected flows in Tables 3-16, 3-17 and 3-18 are estimated using system-wide average per capita ADD and MDD, and do not account for localized differences. These tables are intended for system-wide planning purposes only, and should not be used for the design or sizing of infrastructure serving smaller areas. Local per capita water consumption volumes and diurnal patterns vary from the system-wide average, and should be evaluated as part of facility design.

The numbers of ERUs shown in Tables 3-16, 3-17 and 3-18 may vary based on factors not directly related to demands, including the relative distribution of residential and commercial development. The ERU unit quantity (gal/day) is based on single-family household demand, but the number of ERUs is determined based on applying that unit quantity to all demands (including multi-family and commercial). The relative magnitude of the single-family, multi-family and commercial customer base may vary substantially from zone to zone. For these reasons, the # of ERUs in a high-demand year may be equal to or less than the number of ERUs in a low-demand year in some instances. More information on how ERUs are calculated is provided in Section 3.2.2.

Table 3-16: 2020 (6-Year) Retail Demand Projections per Pressure Zone

Pressure Zone	SF Pop	MF Pop	Jobs	ADD (MGD)		MDD (MGD)		No. of ERUs	
				High	Low	High	Low	High	Low
BF220	0	565	3,981	0.181	0.154	0.397	0.262	778	832
BV400	6,721	22,597	97,548	5.724	4.860	12.594	8.263	24,674	26,272
CL335	4,599	48	840	0.443	0.350	0.976	0.596	1,911	1,894
CL500	2,353	8	845	0.240	0.190	0.527	0.323	1,033	1,027
CM1000	926	1,122	250	0.181	0.151	0.398	0.257	779	816
CM1150									
Bellevue	1,065	0	119	0.099	0.078	0.218	0.133	428	423
Issaquah[1]	1,070	0	0	0.090	0.072	0.198	0.122	387	387
CM1300	580	0	120	0.056	0.044	0.123	0.075	241	239
CM1465	198	0	16	0.018	0.014	0.040	0.024	79	78
CM1575	221	0	10	0.020	0.016	0.044	0.027	87	86
CO380	220	210	51	0.038	0.032	0.084	0.054	164	171
CO440	199	2	8	0.018	0.014	0.040	0.024	78	77
EG300	261	16	28	0.026	0.020	0.056	0.035	110	110
EG370	439	0	36	0.040	0.032	0.089	0.054	174	172
EG400	44	133	35	0.016	0.013	0.035	0.023	68	73
EG440	625	17	53	0.059	0.047	0.130	0.079	254	252
EG590E	713	30	66	0.068	0.054	0.150	0.092	295	292
EG590W	716	2	63	0.066	0.052	0.146	0.089	286	282
EG630	176	3	15	0.016	0.013	0.036	0.022	71	70
EN300	3,118	246	592	0.318	0.253	0.701	0.431	1,373	1,369
FA293	830	1,729	7,681	0.474	0.400	1.042	0.680	2,041	2,164
FA460	745	688	1,149	0.161	0.134	0.353	0.227	692	722
FH1100	117	0	6	0.011	0.008	0.023	0.014	46	45
FH465	183	0	3	0.016	0.013	0.036	0.022	71	70
HP250	621	0	81	0.058	0.046	0.128	0.078	251	248
HV1080	251	0	22	0.023	0.018	0.051	0.031	100	99
HV1115	245	0	3	0.022	0.017	0.048	0.029	95	93
HV1175	498	9	26	0.046	0.036	0.101	0.062	199	196
HV700	1,372	315	166	0.153	0.123	0.337	0.209	661	666
HV940	235	0	7	0.021	0.017	0.047	0.028	91	90
KC300	1,112	52	243	0.112	0.089	0.246	0.151	482	479
KC450	2,803	2,891	2,329	0.560	0.467	1.233	0.793	2,415	2,522
LH380	703	19	72	0.067	0.053	0.147	0.090	288	285
LH435	2,148	8	370	0.205	0.162	0.451	0.275	884	876
LH520									
Bellevue	23,469	16,447	33,644	4.555	3.769	10.021	6.407	19,633	20,373
Issaquah[2]	0	530	0	0.044	0.035	0.097	0.060	190	190
Redmond[3]	8,775	9,680	40,000	2.829	2.064	6.224	3.509	12,194	11,157
MB252	1,908	5,170	4,864	0.749	0.637	1.647	1.082	3,226	3,441

[1] Bellevue wheels water to Issaquah's Glacier Ridge area via CM1150.

[2] Bellevue wheels water to Issaquah's Lakemont area via LH520.

[3] Redmond's Overlake area is served via jointly owned (Bellevue/Redmond) facilities in the LH520 zone.

Table 3-16: 2020 (6-Year) Retail Demand Projections per Pressure Zone

Pressure Zone	SF Pop	MF Pop	Jobs	ADD (MGD)		MDD (MGD)		No. of ERUs	
				High	Low	High	Low	High	Low
MD230	32	0	9	0.003	0.003	0.007	0.004	14	14
NH320	310	8	2	0.028	0.022	0.062	0.038	122	121
NH380	383	12	34	0.036	0.029	0.080	0.049	157	155
NH470	3,276	1,005	571	0.392	0.317	0.863	0.539	1,691	1,713
NH580	2,892	126	518	0.286	0.227	0.630	0.386	1,234	1,226
NS200	1,088	166	224	0.118	0.094	0.260	0.161	509	511
PP550	1,627	449	1,203	0.222	0.180	0.489	0.307	958	975
PP600	254	7	0	0.023	0.018	0.051	0.031	100	99
PP670	1,634	0	306	0.156	0.123	0.344	0.210	674	668
RH545	198	0	6	0.018	0.014	0.039	0.024	77	76
RM330	278	0	15	0.025	0.020	0.056	0.034	109	108
RM400	725	14	64	0.068	0.054	0.150	0.091	294	291
RV300	818	1,285	2,707	0.268	0.225	0.589	0.383	1,154	1,219
SA270									
Bellevue	2,159	315	617	0.239	0.191	0.526	0.325	1,030	1,035
Issaquah[1]	3,488	514	68	0.355	0.283	0.781	0.481	1,530	1,529
SH450	41	0	3	0.004	0.003	0.008	0.005	16	16
SS1000	2,486	27	224	0.232	0.183	0.510	0.311	1,000	989
SS550	1,528	5	181	0.143	0.113	0.315	0.192	617	610
SS700	1,906	0	181	0.176	0.139	0.388	0.236	761	751
SS850	7,667	149	1,328	0.742	0.587	1.633	0.998	3,199	3,173
SS940	225	3	250	0.029	0.023	0.064	0.039	124	125
SU1060	173	3	48	0.017	0.014	0.038	0.023	75	74
SU1100	258	0	98	0.026	0.021	0.058	0.036	114	113
SU1350	440	0	74	0.042	0.033	0.092	0.056	180	179
WD340	135	0	3	0.012	0.010	0.027	0.016	52	51
WD400	678	541	167	0.109	0.090	0.241	0.154	472	489
WD450	1,616	7	175	0.151	0.119	0.332	0.202	651	643
YB300	82	0	13	0.008	0.006	0.017	0.010	34	33
YP220	390	3	45	0.037	0.029	0.081	0.049	158	156
Totals	107,046	67,176	204,476	21.9	17.8	48.2	30.7	94,430	96,275

[1] Projections assume the South Cove area of Issaquah continues to be served by SA270 following assumption by the City of Issaquah. Issaquah may isolate South Cove from Bellevue and provide water from the BIP.

Table 3-17: 2024 (10-Year) Retail Demand Projections per Pressure Zone

Pressure Zone	SF Pop	MF Pop	Jobs	ADD (MGD)		MDD (MGD)		No. of ERUs	
				High	Low	High	Low	High	Low
BF220	0	565	4,090	0.184	0.157	0.405	0.267	794	849
BV400	6,751	25,561	104,593	6.203	5.273	13.647	8.964	26,738	28,503
CL335	4,599	49	840	0.444	0.350	0.976	0.596	1,912	1,895
CL500	2,353	8	847	0.240	0.190	0.527	0.323	1,033	1,028
CM1000	926	1,122	250	0.181	0.151	0.398	0.257	779	816
CM1150									
Bellevue	1,079	0	119	0.101	0.079	0.221	0.135	433	428
Issaquah[1]	1,070	0	0	0.090	0.072	0.198	0.122	387	387
CM1300	601	0	120	0.058	0.046	0.127	0.078	249	247
CM1465	220	0	16	0.020	0.016	0.045	0.027	87	86
CM1575	233	0	11	0.021	0.017	0.047	0.028	91	90
CO380	228	210	62	0.039	0.033	0.086	0.055	169	176
CO440	199	2	8	0.018	0.014	0.040	0.024	79	78
EG300	262	17	28	0.026	0.020	0.056	0.035	111	110
EG370	439	0	36	0.040	0.032	0.089	0.054	174	172
EG400	45	133	35	0.016	0.013	0.035	0.023	68	73
EG440	627	17	53	0.059	0.047	0.130	0.079	255	253
EG590E	716	31	66	0.069	0.054	0.151	0.092	296	293
EG590W	718	2	63	0.066	0.052	0.146	0.089	286	283
EG630	176	3	15	0.016	0.013	0.036	0.022	71	70
EN300	3,140	247	613	0.321	0.255	0.707	0.434	1,384	1,381
FA293	835	1,801	7,745	0.482	0.407	1.060	0.693	2,077	2,203
FA460	745	689	1,149	0.161	0.134	0.353	0.227	692	722
FH1100	117	0	8	0.011	0.008	0.024	0.014	46	46
FH465	183	0	4	0.016	0.013	0.036	0.022	71	70
HP250	621	0	81	0.058	0.046	0.128	0.078	251	248
HV1080	251	0	22	0.023	0.018	0.051	0.031	100	99
HV1115	245	0	4	0.022	0.017	0.048	0.029	95	94
HV1175	519	9	27	0.048	0.038	0.106	0.064	207	205
HV700	1,392	316	175	0.156	0.125	0.342	0.212	670	675
HV940	235	0	8	0.021	0.017	0.047	0.028	92	90
KC300	1,133	53	257	0.114	0.091	0.251	0.154	493	490
KC450	2,812	2,892	2,355	0.562	0.468	1.237	0.796	2,423	2,530
LH380	703	20	72	0.067	0.053	0.147	0.090	288	286
LH435	2,153	8	370	0.206	0.162	0.452	0.276	886	878
LH520									
Bellevue	23,482	16,926	34,895	4.637	3.840	10.201	6.527	19,986	20,754
Issaquah[2]	0	530	0	0.044	0.035	0.097	0.060	190	190
Redmond[3]	8,775	12,791	44,000	3.196	2.508	7.031	4.263	13,776	13,557
MB252	1,918	5,510	5,272	0.790	0.673	1.739	1.144	3,407	3,637

[1] Bellevue wheels water to Issaquah's Glacier Ridge area via CM1150.

[2] Bellevue wheels water to Issaquah's Lakemont area via LH520.

[3] Redmond's Overlake area is served via jointly owned (Bellevue/Redmond) facilities in the LH520 zone.

Table 3-17: 2024 (10-Year) Retail Demand Projections per Pressure Zone

Pressure Zone	SF Pop	MF Pop	Jobs	ADD (MGD)		MDD (MGD)		No. of ERUs	
				High	Low	High	Low	High	Low
MD230	32	0	12	0.003	0.003	0.007	0.004	14	14
NH320	321	8	2	0.029	0.023	0.065	0.039	127	125
NH380	384	12	35	0.036	0.029	0.080	0.049	157	156
NH470	3,285	1,064	578	0.398	0.322	0.876	0.547	1,716	1,740
NH580	2,900	129	537	0.288	0.228	0.633	0.388	1,240	1,233
NS200	1,096	166	224	0.119	0.095	0.261	0.162	512	514
PP550	1,633	449	1,220	0.223	0.181	0.491	0.308	962	980
PP600	255	7	0	0.023	0.018	0.051	0.031	101	100
PP670	1,641	0	317	0.157	0.124	0.346	0.211	678	672
RH545	203	0	6	0.018	0.014	0.040	0.025	79	78
RM330	273	0	15	0.025	0.020	0.055	0.033	108	106
RM400	730	14	64	0.069	0.054	0.151	0.092	296	292
RV300	830	1,286	2,747	0.270	0.227	0.595	0.387	1,203	1,192
SA270									
Bellevue	2,169	315	625	0.240	0.192	0.528	0.327	1,035	1,040
Issaquah[1]	3,493	514	69	0.355	0.283	0.782	0.482	1,532	1,531
SH450	43	0	4	0.004	0.003	0.009	0.005	17	17
SS1000	2,491	27	228	0.233	0.183	0.512	0.312	1,002	991
SS550	1,533	5	181	0.143	0.113	0.316	0.192	618	612
SS700	1,909	0	181	0.177	0.139	0.389	0.237	762	753
SS850	7,679	149	1,328	0.743	0.588	1.635	0.999	3,204	3,177
SS940	225	3	250	0.029	0.023	0.064	0.039	124	125
SU1060	173	3	48	0.017	0.014	0.038	0.023	75	74
SU1100	259	0	98	0.026	0.021	0.058	0.036	114	113
SU1350	440	0	74	0.042	0.033	0.092	0.056	180	179
WD340	135	0	3	0.012	0.010	0.027	0.016	52	52
WD400	680	541	167	0.110	0.091	0.241	0.154	473	489
WD450	1,618	7	175	0.151	0.119	0.333	0.203	652	644
YB300	82	0	13	0.008	0.006	0.017	0.010	34	33
YP220	390	3	45	0.037	0.029	0.081	0.049	158	156
Totals	107,403	74,214	217,555	22.9	18.8	50.5	32.3	98,906	101,715

[1] Projections assume the South Cove area of Issaquah continues to be served by SA270 following assumption by the City of Issaquah. Issaquah may isolate South Cove from Bellevue and provide water from the BIP.

Table 3-18: 2034 (20-Year) Retail Demand Projections per Pressure Zone

Pressure Zone	SF Pop	MF Pop	Jobs	ADD (MGD)		MDD (MGD)		No. of ERUs	
				High	Low	High	Low	High	Low
BF220	0	565	4,381	0.194	0.165	0.427	0.281	865	867
BV400	6,860	35,566	123,891	7.668	6.537	16.870	11.114	34,143	34,245
CL335	4,599	52	840	0.444	0.351	0.976	0.596	1,975	1,837
CL500	2,353	8	852	0.240	0.190	0.528	0.323	1,068	997
CM1000	926	1,122	250	0.181	0.151	0.398	0.257	805	791
CM1150									
Bellevue	1,121	0	119	0.104	0.082	0.229	0.140	464	430
Issaquah[1]	1,070	0	0	0.090	0.072	0.198	0.122	387	387
CM1300	662	0	120	0.063	0.050	0.139	0.085	281	261
CM1465	301	0	16	0.027	0.022	0.060	0.037	122	113
CM1575	251	0	14	0.023	0.018	0.050	0.031	102	94
CO380	235	210	85	0.041	0.034	0.089	0.057	181	176
CO440	199	2	8	0.018	0.014	0.040	0.024	81	75
EG300	262	18	28	0.026	0.020	0.057	0.035	115	107
EG370	439	0	36	0.040	0.032	0.089	0.054	180	167
EG400	47	133	35	0.016	0.014	0.035	0.023	71	71
EG440	634	19	53	0.060	0.047	0.132	0.080	267	248
EG590E	723	33	66	0.069	0.055	0.153	0.093	309	288
EG590W	724	2	63	0.067	0.053	0.147	0.090	298	276
EG630	178	3	15	0.017	0.013	0.037	0.022	74	69
EN300	3,173	250	652	0.326	0.259	0.716	0.440	1,450	1,357
FA293	852	1,976	7,916	0.503	0.426	1.107	0.724	2,241	2,231
FA460	745	689	1,149	0.161	0.134	0.353	0.227	715	700
FH1100	117	0	13	0.011	0.009	0.024	0.015	49	45
FH465	183	0	6	0.017	0.013	0.036	0.022	74	68
HP250	621	0	83	0.058	0.046	0.128	0.078	260	241
HV1080	251	0	22	0.023	0.018	0.051	0.031	103	96
HV1115	245	0	6	0.022	0.017	0.049	0.030	98	91
HV1175	523	10	29	0.049	0.038	0.107	0.065	216	200
HV700	1,464	318	192	0.163	0.131	0.358	0.222	725	684
HV940	235	0	10	0.021	0.017	0.047	0.029	95	88
KC300	1,165	57	285	0.118	0.094	0.260	0.160	527	493
KC450	2,846	2,893	2,423	0.568	0.473	1.249	0.803	2,527	2,475
LH380	703	21	72	0.067	0.053	0.147	0.090	298	277
LH435	2,168	9	370	0.207	0.163	0.456	0.278	922	856
LH520									
Bellevue	23,530	18,453	38,238	4.877	4.046	10.729	6.878	21,713	21,194
Issaquah[2]	0	530	0	0.044	0.035	0.097	0.060	190	190
Redmond[3]	8,775	17,900	60,000	4.113	3.615	9.048	6.146	17,728	19,541
MB252	1,952	6,600	5,976	0.904	0.772	1.990	1.313	4,027	4,044

[1] Bellevue wheels water to Issaquah's Glacier Ridge area via CM1150.

[2] Bellevue wheels water to Issaquah's Lakemont area via LH520.

[3] Redmond's Overlake area is served via jointly owned (Bellevue/Redmond) facilities in the LH520 zone.

Table 3-18: 2034 (20-Year) Retail Demand Projections per Pressure Zone

Pressure Zone	SF Pop	MF Pop	Jobs	ADD (MGD)		MDD (MGD)		No. of ERUs	
				High	Low	High	Low	High	Low
MD230	32	0	18	0.003	0.003	0.008	0.005	16	15
NH320	360	8	2	0.033	0.026	0.072	0.044	147	136
NH380	387	13	37	0.037	0.029	0.081	0.049	164	152
NH470	3,318	1,167	598	0.410	0.332	0.902	0.564	1,825	1,739
NH580	2,903	136	573	0.290	0.230	0.638	0.391	1,290	1,204
NS200	1,107	166	224	0.120	0.096	0.264	0.163	534	502
PP550	1,654	449	1,254	0.226	0.184	0.498	0.312	1,008	962
PP600	257	7	0	0.024	0.019	0.052	0.031	105	97
PP670	1,664	0	337	0.160	0.126	0.352	0.215	713	663
RH545	221	0	6	0.020	0.016	0.044	0.027	89	82
RM330	258	0	15	0.024	0.019	0.052	0.032	105	97
RM400	742	15	64	0.070	0.055	0.153	0.093	310	288
RV300	849	1,287	2,854	0.276	0.232	0.607	0.394	1,228	1,215
SA270									
Bellevue	2,203	315	646	0.244	0.195	0.537	0.332	1,086	1,023
Issaquah[1]	3,511	514	71	0.356	0.284	0.784	0.483	1,590	1,491
SH450	46	0	6	0.004	0.003	0.010	0.006	19	18
SS1000	2,495	27	236	0.233	0.184	0.513	0.313	1,038	963
SS550	1,540	5	181	0.144	0.114	0.317	0.193	642	595
SS700	1,914	0	181	0.177	0.140	0.390	0.237	789	731
SS850	7,723	150	1,328	0.747	0.591	1.644	1.005	3,327	3,095
SS940	225	3	250	0.029	0.023	0.064	0.039	129	121
SU1060	173	3	48	0.017	0.014	0.038	0.023	77	72
SU1100	261	0	98	0.027	0.021	0.059	0.036	119	111
SU1350	440	0	74	0.042	0.033	0.092	0.056	186	173
WD340	135	0	5	0.012	0.010	0.027	0.016	54	50
WD400	682	542	167	0.110	0.091	0.242	0.154	489	475
WD450	1,622	7	175	0.151	0.119	0.333	0.203	674	625
YB300	82	0	14	0.008	0.006	0.017	0.011	35	32
YP220	390	3	45	0.037	0.029	0.081	0.049	163	151
Totals	108,326	92,256	257,821	25.8	21.6	56.8	36.5	114,291	113,842

[1] Projections assume the South Cove area of Issaquah continues to be served by SA270 following assumption by the City of Issaquah. Issaquah may isolate South Cove from Bellevue and provide water from the BIP.

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Chapter 4 System Analysis

Bellevue's water system has been evaluated based on the City's policy criteria (Chapter 2), asset management program (Chapter 8), and applicable regulations in the following areas:

- Water Quality
- Supply Inlet Capacity
- Treatment
- Metering & Billing
- Distribution System Capacity
- Storage Capacity
- Condition
- Emergency Preparedness
- Wells
- Property Management

4.1 Water Quality Analysis

Bellevue's water quality programs and procedures are described in Chapter 7. Specific potential water quality problems are described below.

Chlorine Residual

Bellevue's water system includes legacy infrastructure inherited from multiple different water districts, which were not historically coordinated nor designed to optimize water quality. These facilities were originally designed to deliver water from different sources at different locations (local wells), at lower pressure, and with more conservative demand projections, compared to current conditions (SPU supply, 30-psi minimum, declining per-capita demands). As a result, some reservoirs are periodically isolated and/or have low turnover rates, and certain extremities in the system have older water age during winter low demand periods.

Bellevue's water quality meets DOH water quality standards (Chapter 7). However, in order to maintain acceptable chlorine residuals, Bellevue sometimes uses strategies such as pumping down reservoirs (to force turnover) or seasonal flushing solely to reduce water age (unrelated to normal flushing to clean pipes).

Areas susceptible to low chlorine residuals include areas served by Cougar Mountain #3 Reservoir and, to a lesser extent, the South Cove area and Clyde Hill 465 Standpipe. A project proposed to access dead storage in Clyde Hill 465 standpipe (described later) should improve circulation through that reservoir and improve water quality. Water quality in

South Cove has been effectively managed with operational adjustments. Therefore, Cougar Mountain #3 and surrounding areas should be the focus of analysis to improve chlorine residuals.

In order to mitigate potential water quality risks and to improve operational efficiency, it is recommended that the City conduct an engineering evaluation at relevant problem sites, and implement the resulting solutions. Alternatives could include:

- Maintain status quo (monitor, flush, wait for development to increase water usage)
- Install permanent generators to reduce the local need for fire storage (allow less stored water, which reduces water age)
- Construct dedicated fill and draw pipelines to force reservoir turnover
- Boost chlorine

It is also recommended that the City avoid excessive reservoir storage to mitigate chlorine decay and optimize water quality.

Air & Vacuum Release Valves

Bellevue conducted a survey of its air release valves in 2014-2015 to assess condition and suitability. In particular, valves also equipped with a vacuum release function (air & vacuum release valves) were inspected for potential risks of cross-connection. Of the 275 air release valves in Bellevue's inventory, the following was observed in the survey:

- 121 meet current Bellevue Engineering Standards
- 65 require some degree of improvements to meet Engineering Standards, but are not considered a cross-connection risk
- 6 were confirmed not to exist (removed) or are abandoned
- 22 were shut off due to deficiencies that could present a cross-connection risk, but are not yet fully abandoned (requires separation from the system)
- 61 could not be located (may or may not have been demolished or abandoned)

It is recommended that the noted deficiencies be addressed through selective abandonment or rehabilitation, as appropriate. In addition, valves that aren't yet accounted for should be located or confirmed not to exist, and the inventory should be updated.

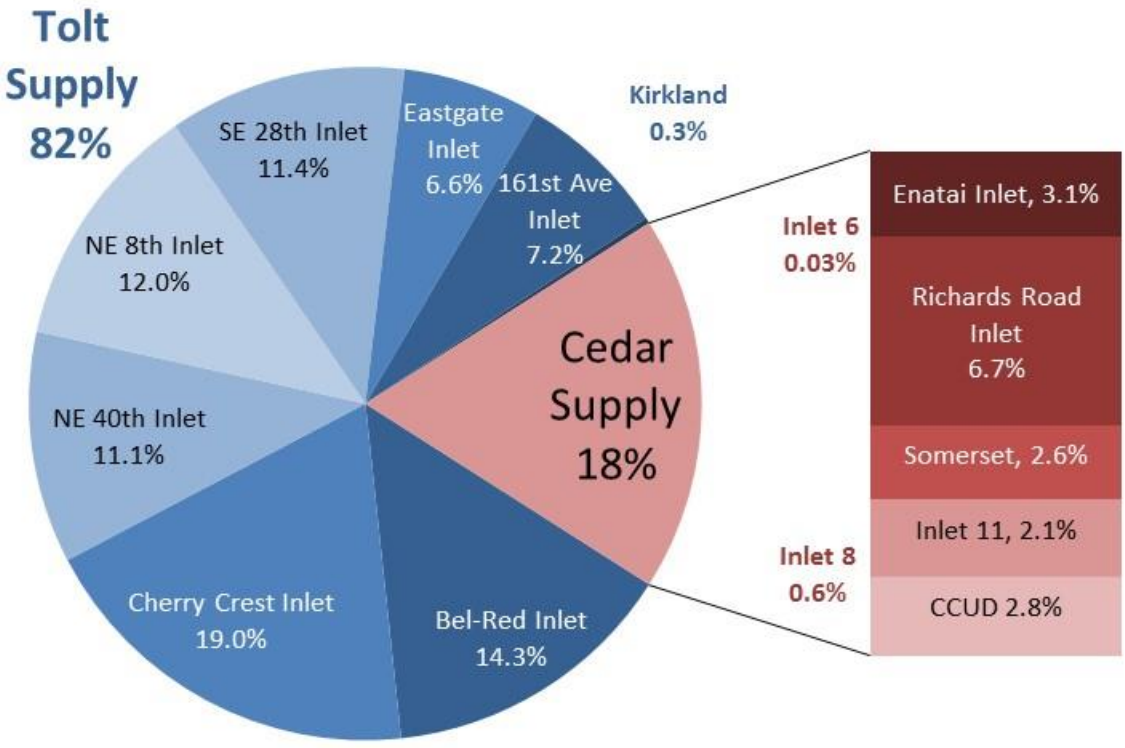
In addition, Bellevue reviewed Engineering Standards and determined that a vacuum release function is not typically necessary in most distribution system applications, because potential water quality risks may outweigh the relatively low risk of pipe collapse. The vacuum function is still necessary in applications such as large diameter and/or low pressure transmission mains, pump cans, wet wells, and other isolated locations. For general use at distribution system high points, Bellevue will assess whether an air release valve without the vacuum release function is most appropriate on a case-by-case basis.

4.2 Supply Inlet Capacity

Bellevue is one of several purveyors in the Seattle area that are members of Cascade Water Alliance (Cascade). Bellevue purchases its water from Cascade, and Cascade is responsible for planning and developing the long-term water supplies for all of its members, including Bellevue.

Currently, the water supplied to Bellevue by Cascade is purchased from Seattle Public Utilities (SPU), and originates from SPU's Cedar and Tolt supplies. About 82% of the water supplied to Bellevue comes from the Tolt supply, with the remaining roughly 18% from the Cedar supply. Figure 4-1 shows the water source and average relative portion of Bellevue's supply received from each inlet during the period 2005-2014. Additional information on the Tolt and Cedar water supplies is available in SPU's 2013 Water System Plan.

Figure 4-1: Relative Proportion of Bellevue's Supply by Inlet Station and Source



Cascade's regional supply options are identified in their TSP and include supply from one or more of the following:

- Lake Tapps
- Seattle Public Utilities' Cedar River Supply
- Seattle Public Utilities' Tolt River Supply
- Tacoma Water Division Second Green River Diversion Supply
- Snoqualmie River Aquifer (North Bend)
- Supplies Associated with reuse and reclaimed supply

To support regional supply objectives, Bellevue participates in Cascade's regional water conservation program to supplement its local conservation program.

Cascade is responsible for securing adequate supply of water for its members. Analysis by Cascade indicates that additional regional water supply may be needed after the 20-year planning period. Cascade has completed the purchase of Lake Tapps, including associated water rights, to meet this long term need. Additional information is available in Cascade's TSP and in Appendix H.

Bellevue Utilities will continue to coordinate with Cascade and other utilities to provide adequate and reliable water supply.

Although adequate quantities of water supply have been secured by Cascade for its members over the 20-year planning horizon, sufficient hydraulic capacity is needed at Bellevue's supply inlets to deliver this water from regional transmission lines to Bellevue's distribution system.

Table 4-1 shows the contractually guaranteed flow at minimum HGL, estimated capacity, and peak observed flow during the period of 2006-2014 (peak flows are not available prior to 2006). The contractually guaranteed flows are not based on capacity, but represent allocation of the SPU-Cascade declining block contract, allocated proportionally to inlets based on actual supply allocation in 2004. SPU allows higher flows to occur, as demonstrated by the peak flows in Table 4-1. In the future, as the supply of water from SPU to Cascade declines based on the block contract, Cascade will supply additional water from another source. See Appendix H and Cascade's TSP for additional information.

Table 4-1: Water Supply Inlet & Intertie Capacities

Station Name	Contract Stipulations Min Guaranteed[1] Flow (gpm)	@ HGL (ft)	Design Capacity[2] (gpm)	Hydraulic Capacity @ Min Supply HGL[3] (gpm)	2006-2014 Max Flow Observed (gpm)
161st Ave Inlet	1,940[4]	N/A[5]	1,940	3,500	3,544
Bel Red Inlet	4,200	470	5,300	11,000	7,841
Cherry Crest Inlet	3,900	455	5,300	6,000	6,332
Eastgate Inlet	2,300	525	3,900	3,900	4,783
Enatai	800	420	1,200	3,700	1,704
Inlet #11	1,400	425	2,900	3,800	2,702
Inlet #6	[6]	440	N/A	0[7]	864
Inlet #8	625	435	1,300	2,100[8]	861
NE 40th Inlet	3,800	500	5,300	6,000	6,127
NE 8th Inlet	3,000	460	4,720	4,720	4,821
Richards Road	1,300	425	2,200	2,500	2,333
SE 28th Inlet	2,700	470	3,800	3,800	3,574
Somerset	800	435	2,200	2,400[8]	2,730
CCUD (#4 and #5)	[9]	[9]	1,458	[9]	[10]
Kirkland S1	469	[11]	469	[11]	[10]

1. The contractually guaranteed flows and HGLs listed do not imply hydraulic capacity. Actual HGL and hydraulic capacity are higher. See Volume 3.
2. Design capacity based on the lesser of (1) max wheeled flows (CCUD, Kirkland), (2) hydraulic capacity, or (3) 8-ft/s max velocity in transmission piping during normal conditions per DOH recommendation.
3. Hydraulic capacity is estimated at minimum observed HGL in the upstream supply pipeline (TESSL/CESSL) and normal pressure downstream of the inlet (or firm pump capacity where applicable). Actual capacity will be higher than shown when upstream TESSL/CESSL HGL is higher than minimum, or when all pumps are running (where applicable).
4. 161st Inlet shares the BIP with Issaquah and SPWSD. Total guaranteed flow allocated to the BIP is 5,810 gpm shared by all 3 utilities. City of Bellevue share is not stipulated by contract (assumed 1/3 of total).
5. Minimum guaranteed HGL in the BIP is 525 ft near Eastgate Inlet. HGL at 161st Ave inlet is lower.
6. Inlet #6 is operated only as backup supply in case of fire or other emergency. No min flow is stipulated.
7. Minimum seasonal CESSL (upstream) HGL is less than the normal NH470 (downstream) HGL. Inlet #6 is not available for any service during these seasonal, high-demand conditions.
8. Inlet #8 and Somerset Inlet share common dual 8" connections to CESSL. Hydraulic capacity is adjusted to cumulative flow of approximately 4,500 gpm.
9. CCUD total inlet capacity is 4,285-gpm to serve both CCUD and wheeled water to Bellevue. Bellevue's agreement with CCUD does not stipulate a specific limit to Bellevue's share of inlet capacity, but CCUD projects adequate inlet capacity to serve all needs beyond the 20-year planning period. Design capacity is based on CCUD's projected 2033 wheeled flows to Bellevue (CCUD 2013 Water & Sewer System Plan).
10. CCUD and Kirkland master meters do not have live telemetry. Actual peak flows are unknown.
11. Per contract, Bellevue has a 13.4% share of Kirkland's Supply Station 1. Kirkland has estimated the inlet capacity at 3,500-gpm (City of Kirkland Comprehensive Water System Plan).

Tables 4-2 and 4-3 show the projected ADD and MDD by operating area for a high demand year (using criteria in Table 3-12). This information consolidates the projected demands by pressure zone (Tables 3-16, 3-17, and 3-18) into the larger operating areas that share common supply inlet stations.

Table 4-2: Projected "High Year" ADD by Operating Area (gpm)

Operating Area	2020	2024	2034
West	6,121	6,493	7,611
East	6,404	6,719	7,534
South	2,689	2,717	2,777
Total	15,214	15,929	17,923

Table 4-3: Projected "High Year" MDD by Operating Area (gpm)

Operating Area	2020	2024	2034
West	13,467	14,285	16,744
East	14,088	14,783	16,576
South	5,915	5,977	6,110
Total	33,470	35,045	39,430

Analysis shows significant growth in volumes wheeled to Redmond's Overlake-Viewpoint area through Bellevue's EOA due to a recent re-zone by the City of Redmond. Growth in WOA demands are driven by growth in Downtown Bellevue, as well as the recently re-zoned Bel-Red neighborhood and Wilburton.

Inlet design capacity was analyzed in comparison to projected flows for each operating area. The following design criteria applicable to the inlet stations are generally accepted industry standards, and are recommended by DOH[1]:

- Source capacity to supply ADD flow with the largest source out of service.
- Total capacity to supply MDD flow plus replenish fire suppression storage within 72 hours.

Table 4-4 shows the projected ADD inlet capacity surplus, based on existing inlet design capacity minus projected ADD for the 6, 10, and 20-year planning periods. The projected surplus in all operating areas exceeds the largest inlet design capacity, so adequate redundancy exists for ADD conditions during the 20-year planning period.

[1] DOH Water System Design Manual, 2009. Section 5.7.1.

Table 4-4: Projected ADD Inlet Capacity Surplus/Deficit (gpm)

Operating Area	Existing Design Capacity	Surplus or Deficit 2020	2024	2034
West	14,000	7,879	7,507	6,389
East	19,159	12,755	12,440	11,625
South	8,828	6,139	6,111	6,051
Total	41,987	26,773	26,058	24,064

Table 4-5 shows the projected MDD inlet capacity surplus/deficit based on existing inlet design capacity, minus projected MDD for the 6, 10, and 20-year planning periods, minus 450-gpm to replenish fire storage. The largest fire demand per IFC is 8,000-gpm for 4 hours (1.92-MG), which could be replenished over 72 hours at approximately 450-gpm to meet DOH requirements.

Table 4-5: Projected MDD Inlet Capacity Surplus/Deficit with Fire (gpm)

Operating Area	Existing Design Capacity	Surplus or Deficit 2020	2024	2034
West	14,000	83	-735	-3,194
East	19,159	4,621	3,926	2,133
South	8,828	2,463	2,401	2,268
Total	41,987	7,167	5,592	1,207

Table 4-5 indicates a deficit in WOA inlet capacity after approximately 2020, and a 55% reduction in EOA surplus from 2020 to 2034 (primarily due to growth in Redmond). The following is recommended based on these results:

- **Install additional inlet capacity to serve the WOA by 2020, to resolve the projected water supply deficit. CIP W-104 has been established for this purpose (see Chapter 9).**
- **Monitor growth in Redmond's Overlake-Viewpoint area, to evaluate potential future EOA inlet capacity needs.**

4.3 Treatment

100% of Bellevue's water is treated at either the Cedar Water Treatment Facility or the Tolt Water Treatment Facility. Information on these facilities is available in SPU's 2013 Water System Plan.

Bellevue coordinates demand projections with Cascade to ensure adequate current and future treatment capacity. More information on Cascade's supply and treatment portfolio is available in Cascade's Transmission & Supply Plan.

Bellevue's drinking water quality meets applicable regulations, and Bellevue Utilities does not normally provide additional treatment to water received through the regional supply inlets (from Cascade/SPU) or through interties with adjacent utilities (CCUD, Kirkland, Redmond). Supplemental chlorine may be added if necessary to maintain chlorine residual in certain areas.

4.4 Metering & Billing

Small meters are installed, maintained, and when necessary replaced by O&M staff, as discussed in Chapter 6. Large commercial water meters (defined as 3" diameter and larger) are maintained by O&M staff, but when replacement is necessary the work is typically performed by a contractor, due to the extensive site work and large vaults that are typically required. Due to larger volumes and higher consequence of metering inaccuracies, Bellevue has prioritized large meters for more frequent testing by O&M (see Chapter 6) and established a CIP program W-98 to replace aging commercial meters (see Chapter 9).

Customer meters are currently read on a bi-monthly frequency. Most meters are read manually, with readings stored temporarily in Radix handheld data loggers, then downloaded into the City's billing software system (CIS Infinity) for analysis and production of customer bills. Some large commercial meters are read via touch read technology, which allows reading from outside the meter vault (through the hatch). Five employees allocate approximately 55% of their time to meter reading (2.7 full-time equivalents, FTEs). Meter reading accuracy is estimated to be 99.75%. Customers can use the web-based MyUtilityBill system to manage their account over the Internet and get bi-monthly reads.

Challenges associated with Bellevue's current meter reading program include significant labor costs, aging meter infrastructure, and problems associated with the bi-monthly meter reading frequency. Customer leaks are typically undetected until an unexpectedly large bill is received. There are also some indications that as the older style meters age, their accuracy is affected so they may tend to slightly under-report consumption. Customers often do not have access to or know how to read their meters.

Bellevue currently uses a proprietary billing system called CIS Infinity, which is more than a decade old and obsolete relative to current technology. Challenges associated with Bellevue's current billing system include manual data entry, lack of historical account data, inefficiencies handling billing problems or multiple payment options, negative feedback about the City's website and MyUtilityBill, and an inability to accommodate recurring credit card payments (only one-time). Bellevue has found that customer expectations are evolving to include real-time access to metering information (not currently available to Bellevue or to customers), and account access through smart phones and other mobile devices.

Advanced Metering Infrastructure

In 2014, Bellevue conducted a preliminary evaluation of the costs and benefits of converting to advanced metering infrastructure (AMI) technology. This evaluation found that AMI would require significant upfront capital costs (with impacts to water rates), but significant savings in ongoing operations over time. Benefits of AMI would include labor reduction, real-time access to meter reading data, earlier proactive detection of customer leaks, faster response to customer inquiries, backflow detection, flexibility in billing dates, reduced vehicle & fuel costs and emissions, reduced safety risks for City staff, elimination of meter access challenges, and potentially improved billing accuracy (lower apparent losses and non-

revenue demands) due to newer meter technology. AMI would also provide a wealth of data not currently available for use in water system planning and hydraulic modeling.

As a result of this evaluation, the City is preparing a feasibility study of available AMI technologies. Pending the results of that study, the City is considering deployment of an AMI system beginning in 2017.

4.5 Distribution System Capacity

Bellevue continually evaluates its water distribution system to provide customer service and accommodate industry standards for pressure and flow. Typically, hydraulic modeling is used for capital planning and to analyze fire flow availability for developers and homeowners. The City also uses hydraulic modeling to analyze water age, service reliability, and other system characteristics.

Hydraulic Modeling

The City recently updated its hydraulic modeling software, re-built the distribution system model with current as-built GIS data, and calibrated the model based on O&M settings and field testing. This work increased confidence in modeling results, reduced risk, and improved functionality and efficiency.

Innovyze Infowater software was procured to replace the City's aging EPANET modeling platform, following an analysis of the costs vs. benefits and return on investment. EPANET lacks significant functionality, which required the City to rely on consultants to complete basic modeling tasks that could be performed easily in-house with better software. Analysis also showed that substantial labor savings in automatic fire flow analysis alone would pay for the cost of the improved software. The software upgrade and model re-build has provided additional unanticipated benefits and process improvements, such as diagnosis of previously unknown system deficiencies and iterative QA/QC of the as-built piping data.

The City conducted system-wide hydrant flow and static pressure tests in 2013 and early 2014, to calibrate the new hydraulic model. Seventy flow tests were conducted in 45 of the City's pressure zones. An additional 29 pressure monitoring tests (without flow) were conducted in 29 zones, using continuous data loggers manufactured by Telog. Testing locations are shown in Figure 4-2. The City used BMPs to protect downstream property and fish habitat, flushed lines to maintain water quality, and worked with nearby property owners as appropriate to avoid false fire alarms.

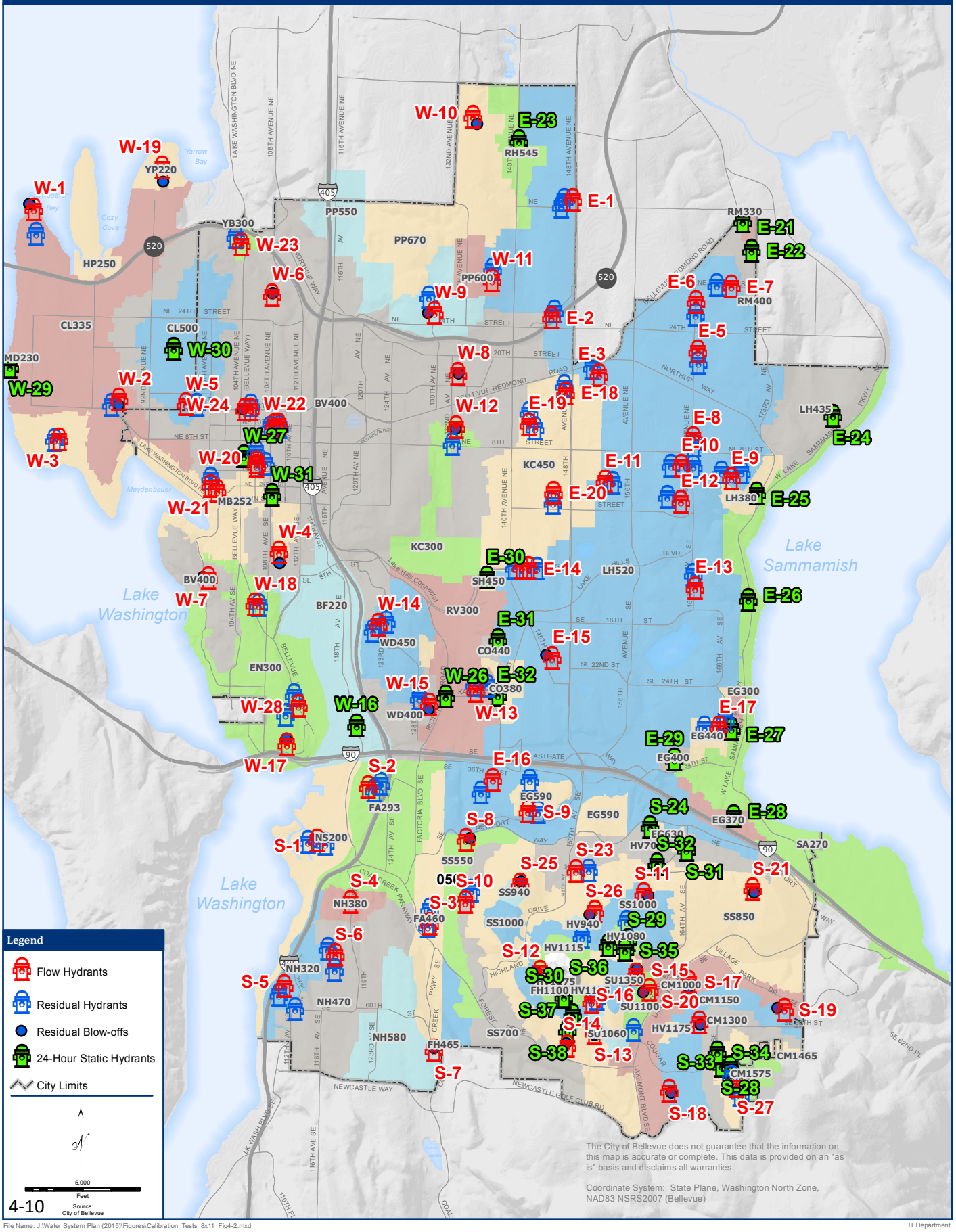
Following system-wide testing, observed telemetry and field calibration data were used to build and calibrate the model per AWWA recommendations[1]. This successful calibration work correlated well with field data.

[1] AWWA Manual M32 Computer Modeling of Water Distribution Systems

Hydraulic Model Calibration Test Locations

Figure 4-2

City of Bellevue
GIS Services



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IT Department

Fire Flow

Bellevue Utilities Department routinely analyzes the available fire flow (AFF) at fire hydrants and at private connections to the system (for fire suppression systems). This information is required for new building construction to comply with Fire Code, and is frequently provided to the Fire Department and private developers.

AFF is the maximum demand at a given location that meets the required minimum pressure (20 psi) and maximum velocity (10-ft/s) criteria throughout the system. AFF is not the actual flow that would occur during a fire event. Actual flow from a hydrant depends on numerous factors, including zone HGL and localized system demands at the time of the event, size and type of hydrant, length and orientation of the fire hose, elevation of the fire hose nozzle, etc.

The City's policies pertaining to fire flow (found in Chapter 2) establish that developers are responsible for improvements needed to meet Fire Code requirements on their property. However, the Fire Flow Improvement Program policy establishes a goal that the City will provide a minimum of 1,000-gpm AFF throughout the entire service area. Historically, Bellevue has worked toward this goal over time primarily through CIP W-16 Small Diameter Water Main Replacement, which increases hydraulic capacity while also replacing aging AC mains. Approximately 96% of customer accounts now have at least 1,000-gpm AFF. Some areas have less than 1,000-gpm due to system settings or legacy pressure zone boundaries, rather than pipe size limitations. In these cases, it is recommended that the City's new hydraulic model be used to identify operational changes and other infrastructure improvements (besides AC main replacement) that will achieve the minimum 1,000-gpm objective.

For the purpose of design, the City uses a 10 ft/s maximum velocity constraint for fire flow analyses. This results in an artificially low reporting of fire flows in some areas, but is used as a conservative measure to plan for protecting AC pipe, which may be vulnerable to main breaks following high velocity events.

Hydraulic analyses of the City's system (see Figure 4-3) show that the following areas do not meet the minimum 1,000-gpm AFF criteria:

- **Cougar Mountain**

  The southern-most portion of CM1465 temporarily has low AFF because PRV #179 has been taken off-line to mitigate operational difficulties at Cougar Mountain #3 Pump Station. PRV #179 should be returned to service in 2018 following rehabilitation of Cougar Mountain #3 Pump Station.

- **Pikes Peak 550 Zone**

  A large portion of PP500 has limited AFF due to a localized high point near NE 28th St & 127th Ave that drops to 20 psi in modeling simulations. Although other areas may have sufficient pressure and transmission capability, this high point limits AFF in those other areas, since 20 psi must be maintained throughout the entire system.

  Options to increase AFF in PP500 could include (1) pipe size increases to reduce head loss due to friction, (2) shifting zone boundaries so that the high point is served by PP670 instead of PP550, and/or (3) increasing pressure in PP550. Increasing pressure in PP550 may require raising the elevation of the new Pikes Peak Reservoir when it is replaced (see condition assessment below), and may require installation of individual PRVs at service connections that are increased above recommended pressures.

- **Eastgate 300 Zone**

  Week-long static pressure recordings in 2014 revealed that EG300 was being operated lower than historical records indicated. Pressure was above the minimum required 30-psi under normal conditions, however calibrated model analysis indicated that the available fire flow was below 1,000-gpm.

  In 2015, the settings at PRV stations that supply EG300 were increased to address this fire flow deficiency. This zone should be monitored to avoid excessive pressures at lower elevations, and to confirm adequate fire flow.

- **Lake Hills 380 Zone**

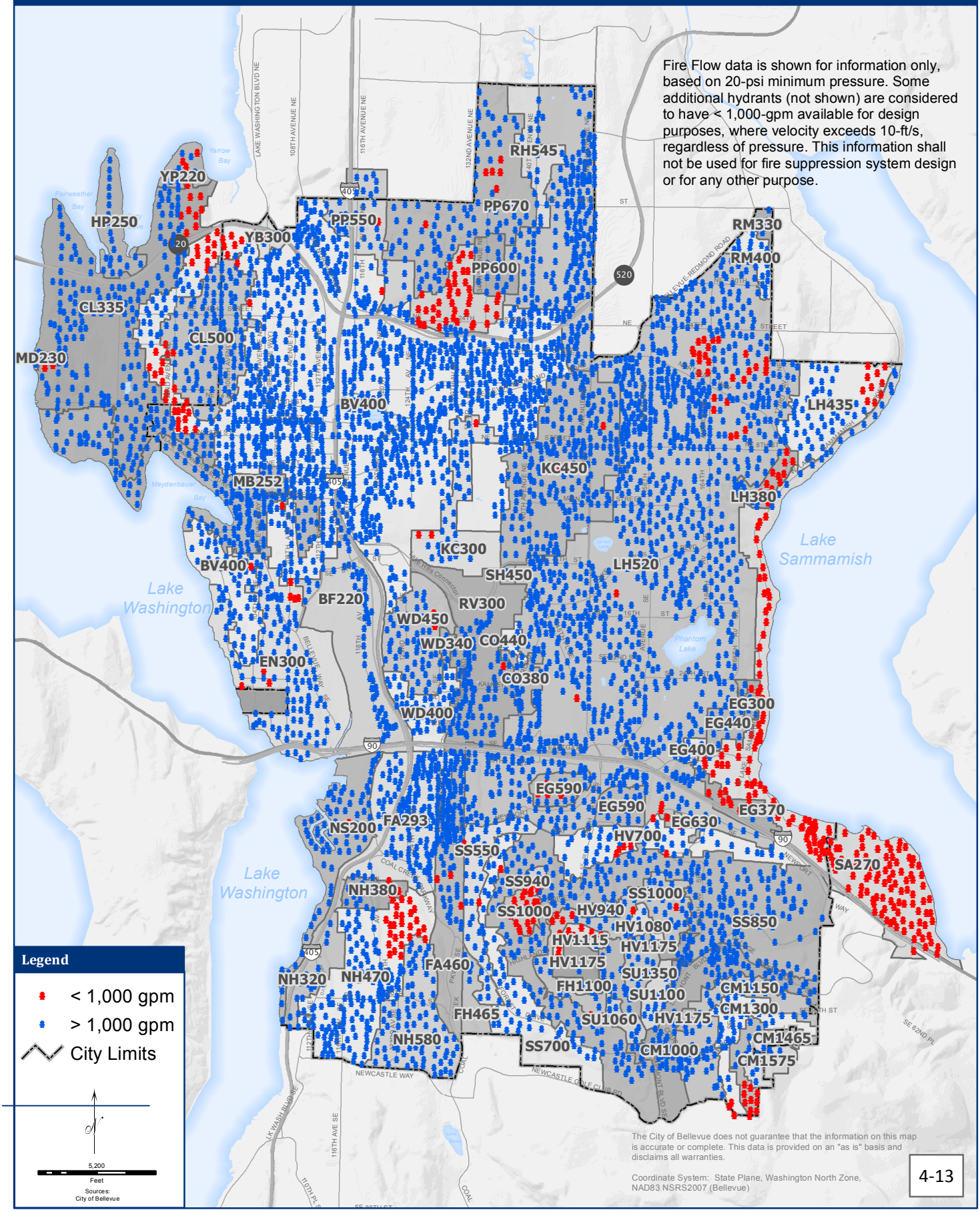
  Fire flows in LH380 are limited by pressure at higher-elevation customers along NE 7th Place and NE 8th Street. These customers have acceptable normal pressure slightly above 30-psi, but significantly restrict fire flow in most of LH380, because residual pressure drops to 20-psi in fire flow simulations.

  Fire flows in LH380 could be improved by adding another PRV station near NE 8th Street, or by moving PRV #69 during future rehabilitation. This could be done concurrently with pressure improvements along 171st Place (see next Section).

Available Fire Flow

Figure 4-3

City of Bellevue GIS Services



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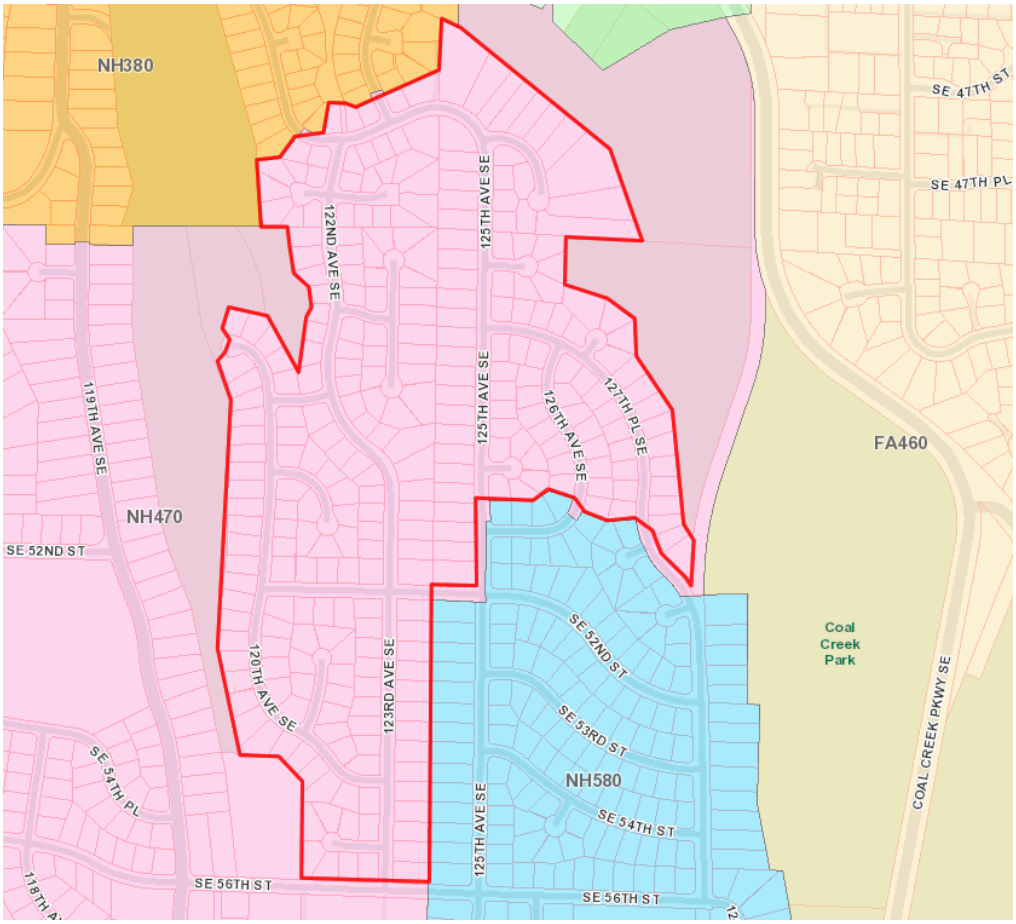
- **Newport Hills 470 Zone**

The red outlined portion of NH470 in Figure 4-4 includes approximately 285 housing units and has AFF less than 1,000-gpm. Additionally, this area is fed by a single 6" AC main, so it exceeds the City's maximum criteria of 250 customers supplied by a single source (Service Reliability policy). Historically this area was also fed by water supply Inlet #7 (shown in Table 1-1) operated by CCUD, however that inlet was taken out of service prior to assumption by the City. Inlet #7 was supplied by the TESSL, which has insufficient pressure to supply the NH470 zone during summer, so it would be seasonally unavailable in any case.

Figure 4-4: NH470 Fire Flow and Service Reliability Deficiency



The AFF deficiency in this area will be resolved when the 6" AC main is replaced as part of the CIP W-16 program, however that will not resolve the service reliability deficiency. To provide resiliency through a second supply to this area, the City could (1) modify regional water supply contracts, replace abandoned infrastructure and add pumping capacity to restore service at Inlet #7, or (2) add a PRV station to supply water from NH580.

- **Clyde Hill**

  The CL500 pressure zone currently has reduced fire flow during the hours of 11:00 pm to 7:00 am, when the zone is allowed to "float" on the 465 standpipe to create turnover in the standpipe. This fire flow deficiency can be resolved concurrent with water quality improvements and while accessing dead storage in the 465 standpipe, by connecting the standpipe to the BV400 zone, as recommended in Section 4.6.

- **Sammamish 270 Zone**

  Large portions of SA270 have severely limited AFF due to two localized high points that drop to 20 psi in modeling simulations. One high point is on 170th Pl SE, northeast of Weowna Park. The second high point is located along West Lake Sammamish Pkwy in Issaquah. Although other areas may have sufficient pressure and transmission capability, these high points limit AFF in the entire SA270 zone, since 20 psi must be maintained throughout the entire system.

  Raising the pressure in SA270 would improve AFF, however that would reduce or eliminate water turnover in Sammamish Reservoir, negatively impacting water quality in the South Cove area due to increased water age. This water quality risk may not be acceptable, because winter chlorine residual in this area is already low. Raising pressure would also likely require installation of individual PRVs at some customer connections, and may increase the risk of high-consequence AC main failures in sensitive areas.

  Fire flows are also restricted in the vicinity of Weowna Park due to limited capacity in the 6" AC main in West Lake Sammamish Parkway.

  A combination of capital improvements and operational changes has been proposed (including a new South Cove pressure zone) to mitigate the fire flow deficiency in SA270, as described in Appendix I and in the discussion of available pressure below.

- **Northwest Bellevue**

  Portions of BV400 in Clyde Hill and in the vicinity of Vineyard Crest in Bellevue have limited AFF due to a single 4" AC main in Belfair Ln that supplies this area. This deficiency was recently revealed when the hydraulic model was re-built with the latest available as-built data; it was previously believed to be 6".

  To resolve this deficiency, replacement of the 4" AC main with 8" DI could be accelerated. Alternatively, a 12" AC main in Park Road that currently operates as a dead end in the CL500 zone could be connected to BV400 using existing infrastructure. Conversion of the 12" main to BV400 would also improve water age, and may allow for the 4" AC main to be abandoned. It is recommended that both alternatives be evaluated for customer impacts and ancillary effects prior to implementation.

- **Horizon View 1115 Zone**

  HV1115 includes homes along 145th Place SE, SE 50th Street, and SE 51st Street. Fire flows are low in this zone primarily due to the existing small diameter AC mains. These mains will be replaced as part of CIP W-16 Small Diameter Water Main Replacement.

- **Somerset**

  SS1000 is a large, non-contiguous pressure zone. Fire flow is limited in the SS1000 area west of Highland Drive. Zone HGL cannot be increased without infrastructure modifications, because lower-elevation portions of the zone already experience excessive pressure (see Table 4-6). Additional analysis is necessary to determine the appropriate mitigation measures, which may include adjusting PRV settings and changing zone boundaries.

Available Pressure

Using the new model, Bellevue evaluated the required minimum HGL and recommended maximum HGL for each zone under normal operating conditions (not during a fire), based on the maximum and minimum customer elevations. The City then compared this to the range of calibrated model results and to actual HGL data collected by O&M staff. Results of this analysis are presented in Table 4-6. Calibrated model pressures are shown in Figure 4-5.

The City requires individual PRVs be installed at all new connections where system pressure exceeds 80 psi, in conformance with Uniform Plumbing Code 608.2.

Table 4-6: Pressure Zone HGL

Pressure Zone	Service Elev Min	Service Elev Max	Min Req'd HGL at Max Elev (30 psi)	Observed HGL[1]	Calibrated Model Pressure (psi) Min	Calibrated Model Pressure (psi) Max
BF220	20	130	199	199	*30*[(2)]	152
BV400	28	317	386	388	31	152
CL335	26	247	316	328	37	129
CL500	210	388	457	490	40	123
CM1000[3]	729	913	982	1039	55	135
CM1150	864	1066	1136	1153	35	124
CM1300[3]	993	1187	1256	1253	36	118
CM1465	1191	1365	1434	1452	39	114
CM1575	1324	1446	1516	1575	58	111
CO380	184	280	349	370	38	79
CO440	197	319	388	400	42	90
EG300	83	173	242	281	47	83
EG370[3]	115	266	335	364	43	100
EG400	168	307	376	386	41	105
EG440[3]	124	313	382	410	39	125
EG590[3]	363	480	549	575	39	101
EG630	375	483	552	612	56	91
EN300	25	174	243	279	46	118
FA293	68	217	286	287	32	96
FA460	153	336	405	450	47	127
FH465	270	360	429	None	49	88
FH1100	889	987	1056	1087	43	86
HP250	20	60	129	217	81	99
HV700	390	613	682	705	37	133
HV940	738	811	880	942	58	90

[1] Observed HGL location is typically different from the min/max elevation. HGL varies some within each zone.
[2] See discussion below.
[3] CM1000, CM1300, EG370, EG440, EG590, NH320 and NH380 each include separate, non-contiguous areas that operate independently at similar HGL (See Figure 1-6). These non-contiguous areas are consolidated in the table above for simplicity, but are analyzed separately in the hydraulic model.

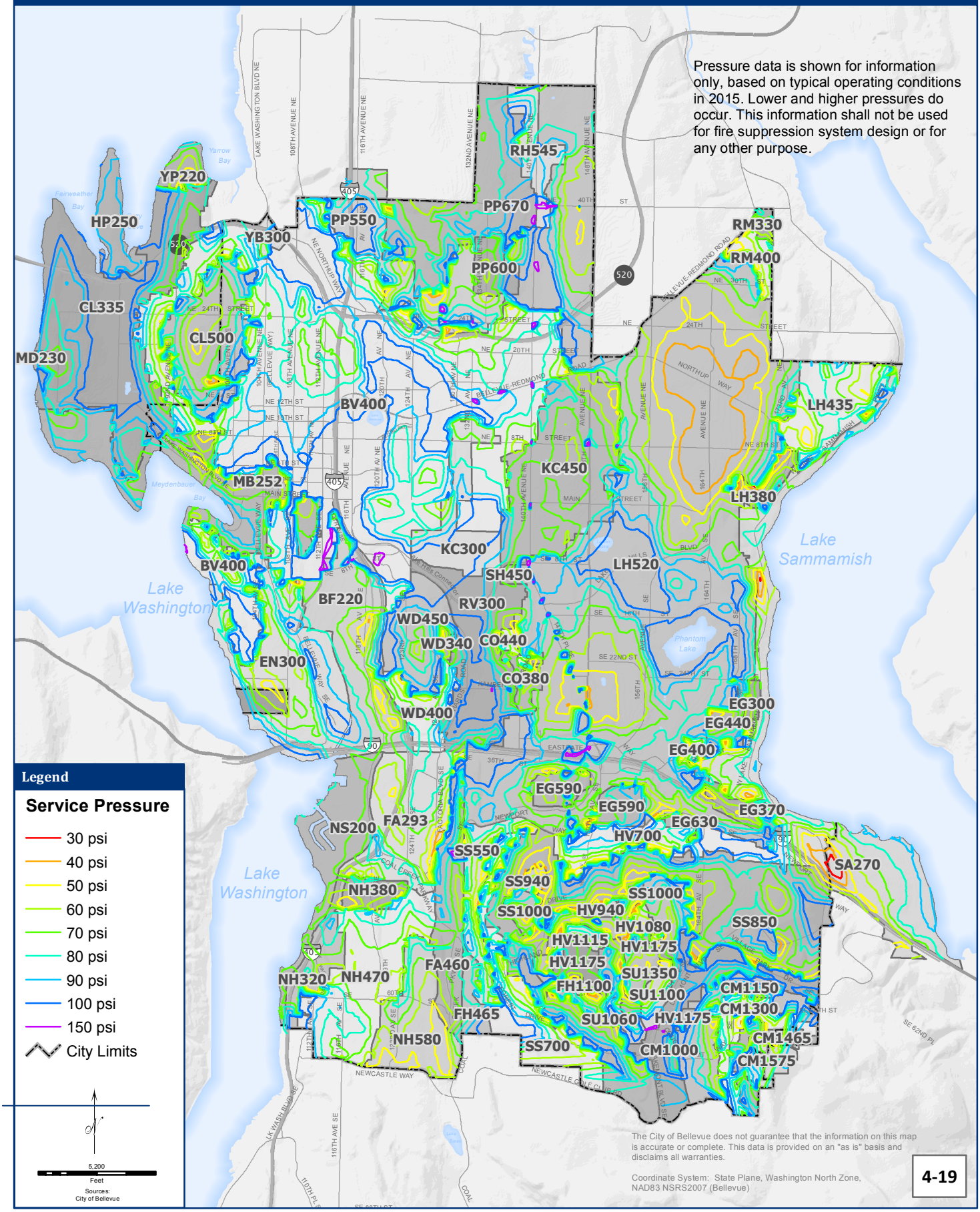
Pressure Zone	Service Elev Min	Service Elev Max	Min Req'd HGL at Max Elev (30 psi)	Observed HGL[1]	Calibrated Model Pressure (psi) Min	Calibrated Model Pressure (psi) Max
HV1080	861	979	1048	1072	38	89
HV1115	876	981	1051	1112	58	104
HV1175	915	1102	1171	1170	30	110
KC300	34	168	238	288	54	112
KC450	204	337	406	451	45	102
LH380	114	310	379	366	*23*[(2)]	107
LH435	149	330	399	416	43	116
LH520	180	446	515	515	*32*[(2)]	147
MB252	20	166	235	246	40	117
MD230	34	144	214	251	46	94
NH320[3]	99	250	319	345	41	102
NH380[3]	186	290	359	381	40	84
NH470	206	364	434	484	49	118
NH580	350	450	519	552	44	87
NS200	20	65	134	192	58	77
PP550	235	470	539	550	33	135
PP600	320	460	529	586	49	117
PP670	296	530	599	645	36	151
RH545	310	310	379	545	57	104
RM330	126	202	272	300	43	91
RM400	189	300	369	374	39	84
RV300	41	200	269	310	45	114
SA270	40	219	289	252	*22*[(2)]	95
SH450	250	256	325	470	66	69
SS550	320	476	545	549	35	102
SS700	430	611	680	699	38	115
SS850	531	774	843	846	31	135
SS940	754	783	852	885	39	57
SS1000	710	910	979	None	30	114
SU1060	743	962	1031	1059	45	139
SU1100	802	976	1045	1077	43	118
SU1350	1059	1190	1259	1294	48	104
WD340	148	226	295	None	44	78
WD400	99	250	319	350	46	112
WD450	182	330	399	442	42	117
YB300	116	165	234	305	60	81
YP220	23	125	194	202	36	80

1. Observed HGL location is typically different from the min/max elevation. HGL varies some within each zone.
2. See discussion below.

Calibrated System Pressure

Figure 4-5

City of Bellevue GIS Services



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Based on review of actual operational conditions, it is recommended the some closed zones (zones without a reservoir; fed by PRVs or pumps) either have settings re-adjusted or the zones be re-named closer to the actual operating HGL. These include CO440, HP250, SS940, SU1350, and WD400. Settings adjustment should consider impacts to fire flows, and the maximum pressure in the zone as well as minimum. More hydraulic analysis will be necessary to develop specific recommendations for each zone. In addition, adjustment of zone boundaries should be considered to alleviate low-pressure areas, where feasible.

Table 4-6 and Figure 4-5 show multiple pressure zones with low or high (or both) pressures:

- **Bellefield 220 Zone**

  BF220 was connected to NS200 when Inlet Station #10 was decommissioned and nearby piping was reconfigured. This added some system redundancy but lowered pressure in BF220. Connection between these zones should be re-considered, because a limited number of customers along 118th Ave NE are now at or below 30 psi, and since adequate redundancy already exists (without the connection) due to numerous PRVs into both zones.

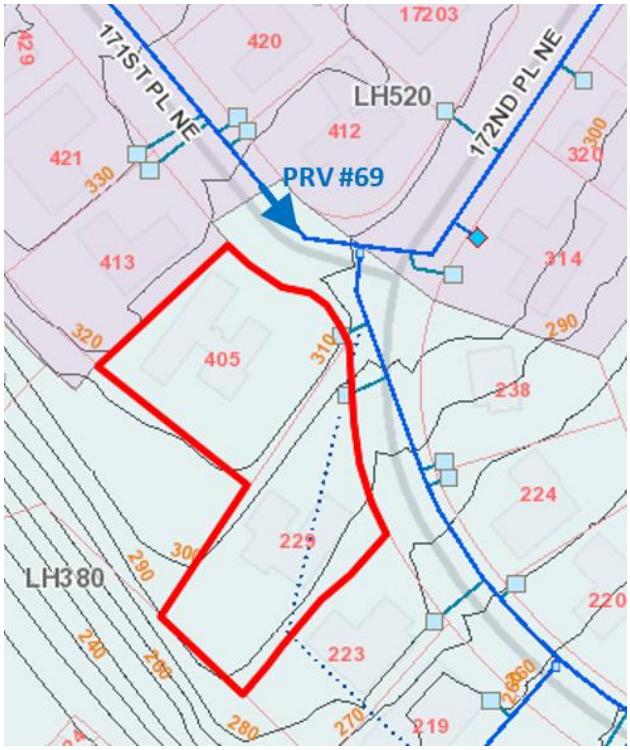
  It is recommended that the implications to water quality (dead ends, etc) and available fire flow be analyzed first before eliminating the BF220/NS200 connection. If appropriate, facilities should be added and/or valves closed to isolate the zones.

- **Lake Hills 380**

  Two customers (shown in red in Figure 4-6), immediately downstream of PRV #69 on 171st Place NE, have service pressures less than 30-psi. Ground elevation drops steeply (and pressure increases) downstream of this location.

  Low pressures in this area can be resolved by increasing PRV settings, however that could risk over-pressurizing customer connections at lower elevations in LH380. Alternatively, PRV #69 could be moved during the next scheduled rehabilitation, and these customers connected to the higher-pressure LH520 zone.

Figure 4-6: LH380 Low Pressure Area



- **Crossroads Area**

  The existing LH520 Zone (including the Crossroads area) meets the minimum 30 psi pressure requirement established by DOH and City policy. However, the Crossroads area experiences lower pressure than other parts of the City, and localized customer complaints about low-pressure have been received.

  In 2013 the City commissioned an evaluation by RH2 Engineering, Inc. (Appendix J) to analyze creation of a new Crossroads 560 zone, which would operate at roughly 20- to 25-psi higher pressure than LH520 at that time. Three alternatives were identified, ranging in cost from $12.3M to $21.6M. Although the addition of some isolation valves, check valves and PRV stations accounted for some costs, most of the estimated costs were driven by several miles of new water main that would be necessary in order to maintain existing fire flows in surrounding areas of LH520.

  In 2013 the City also changed operation of LH520 on a trial basis, to create a more moderate increase of roughly 5- to 8-psi. This involved raising PRV settings and pump operating setpoints. Although the pressure increase is slight, no immediate capital investments were required. The downsides of this strategy include energy-inefficient operation (more frequent pump operation, at higher TDH), risks of over-pressurizing customer connections at lower elevations (individual customer PRVs may be necessary), and problems associated with isolating Newport Reservoir and Parksite Reservoir due to closed altitude valves to avoid overflowing tanks (older water age from lack of turnover; hydraulic transients and surges due to lack of open water surface). This strategy was implemented and is still ongoing. Further analysis is recommended to mitigate potential water quality and hydraulic impacts.

  In 2014, a CIP project was proposed to create the Crossroad 560 zone as part of Bellevue's bi-annual One City budgeting process. This project was rejected because the existing LH520 zone already met DOH and City requirements, due to its high cost, and because a more modest increase in pressure was already accomplished via operational changes. Further consideration of a new 560 zone is not recommended at this time.

- **Sammamish 270 Zone**

  Two higher-elevation areas with pressure below 30 psi have been identified in SA270. One low-pressure area is located along 170th Pl SE in Bellevue, northeast of Weowna Park in Bellevue. The second low-pressure area is located along West Lake Sammamish Pkwy in Issaquah, near Lakemont Blvd and the City Limits. Customers in both areas use private booster pumps to increase their service pressure, but local fire hydrants are limited to the pressure available in the system. In addition to low pressure under normal conditions, these locations severely limit the fire flow available to the rest of SA270, as described previously and in Appendix I.

Analysis of water system operation indicates that SA270 is operated at low pressure to protect water quality. The overflow elevation of Sammamish Reservoir (which serves SA270) is 260-feet, significantly lower than the elevation required to serve the highest customer at 30-psi, as indicated in Table 4-6. In order to allow reservoir level fluctuation and create water turnover (to limit water age and maintain chlorine residuals), SA270 is typically operated even lower, in the range of 248-253 feet +/-. This mode of operation protects water quality but has the negative side effects of low pressure and fire flow.

A combination of capital improvements and operational changes has been identified that will address existing SA270 pressure and fire flow deficiencies, while meeting water quality goals. These improvements include adding a new PRV station near Timberlake Park in Issaquah to form a new pressure zone in the South Cove neighborhood of Issaquah, which includes Sammamish Reservoir. The new pressure zone in Issaquah would be operated near HGL 250, consistent with current operations, while pressure upstream in SA270 (which would include both current low-pressure areas) could be increased without affecting reservoir turnover. This project would also give Issaquah control over operation of Sammamish Reservoir, which will be assumed by Issaquah as part of the South Cove assumption. Prior to raising pressure in SA270, Bellevue should balance the potential risks to AC mains in the area, and evaluate whether some customers may need individual PRVs. More information is provided in Appendix I.

4.6 Storage Evaluation

DOH[1] requires that water utilities analyze and provide adequate volume for five storage components: operational, equalizing, emergency/standby, fire, and dead storage.

The City teamed with Carollo Engineers in 2014 to evaluate Bellevue's storage needs. The evaluation consisted of two parts: First, the City's criteria for calculating required storage were reviewed and updated. Second, a reservoir sizing and storage volume analysis was conducted.

Storage Criteria

DOH requirements, industry standards[2], and the storage criteria used by other utilities locally and nationwide were reviewed for comparison with the City's previous criteria. Bellevue Fire Department also participated and provided input on local policy. Carollo's criteria review and recommendations were provided Technical Memorandum 2A – Storage Criteria (attached in Appendix K). Table 4-7 shows the previous criteria, and the new criteria selected by the City. Criteria development is described below.

[1] DOH Water System Design Manual, 2009, Chapter 9.
[2] Ten-State Standards. Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers, 2012.

Table 4-7: Storage Criteria

Storage Component	Previous Criteria	New Criteria
Operational	Assumed Not Applicable	Pump on/off (where applicable) 2-3 feet buffer (all tanks)
Equalizing	20% of MDD	25% of MDD (SF Areas) 10% of MDD (Mixed-Use)
Emergency/Standby	200 gal/ERU; Separate from Fire storage (not nested)	200 gal/ERU; Separate from Fire storage (not nested)
Fire	5,500 gpm for 5 hours in each operating area; Assume adequate transmission capacity between zones.	Largest fire per IFC Table B105.1 in each Storage Region based on zone-by-zone hydraulic analysis
Dead Storage	Assumed Not Applicable	Volume available only at < 20 psi

Carollo found that the City's previous criteria met DOH requirements and were consistent with other utilities in general. However, the City determined that the previous criteria were based on some incorrect assumptions about Bellevue's system:

- Operational: Previously the City did not take operational storage into account, effectively assuming that equalizing storage is used up to the overflow elevation.

  The City has some tanks that do operate with pump operational storage, so the City decided it is appropriate to allocate that volume as operational.

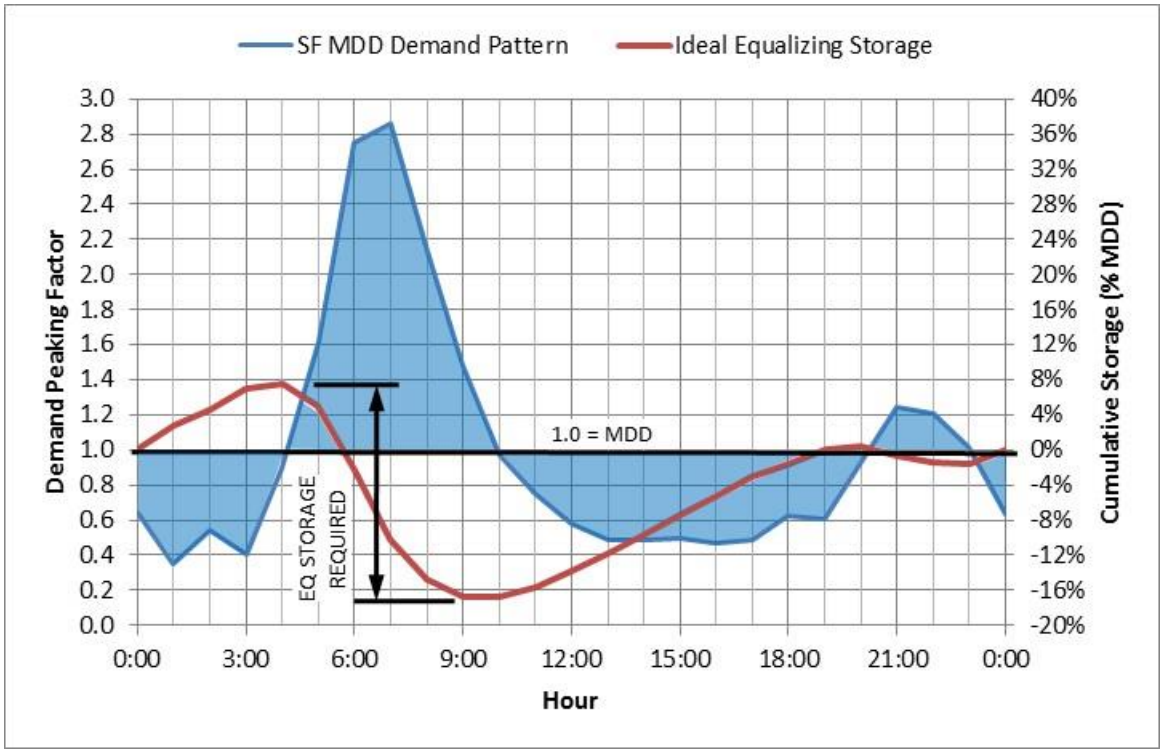
  In addition, review of telemetry data showed that the City typically never operates any tanks to the overflow elevation, but leaves a 2-3 feet buffer to avoid overflow or for other operational reasons. The City opted to count the 2-3 feet buffer as operational storage, even though it does not meet the typical definition of operational storage, because it is empty 100% of the time and therefore not available for equalizing.

- Equalizing: While the previous equalizing criteria (volume of 20% x MDD) met DOH requirements, it was based on diurnal patterns estimated in 1992 (shown in Figure 3-15) and substantially out-of-date. The City performed an internal MDD diurnal study (Appendix F) and subsequent equalizing criteria evaluation (Appendix L) to update the criteria.

  Equalizing storage is calculated as the difference between maximum and minimum cumulative storage volumes, assuming water supply with constant flow. Graphically, the ideal storage curve (red line in Figure 4-7 and 4-8) represents the negative cumulative area (blue shading) between the diurnal demand curve and the theoretical constant MDD supply (PF = 1.0), similar to an integration in calculus.

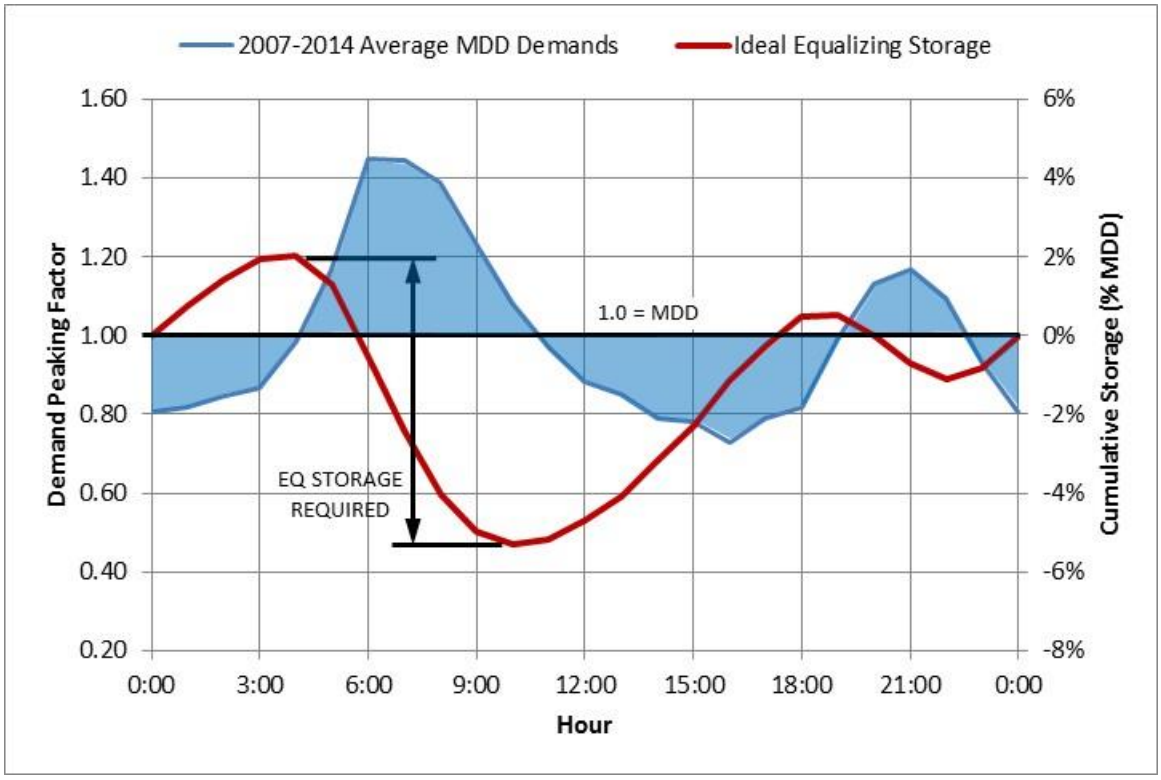
For areas that serve predominantly single-family housing, the City determined that 25% x MDD is an appropriate volume, based on observed single-family diurnal patterns. The analysis shown in Figure 4-7.

Figure 4-7: 2014 Single-Family Residential MDD Diurnal Pattern and Equalizing Volume



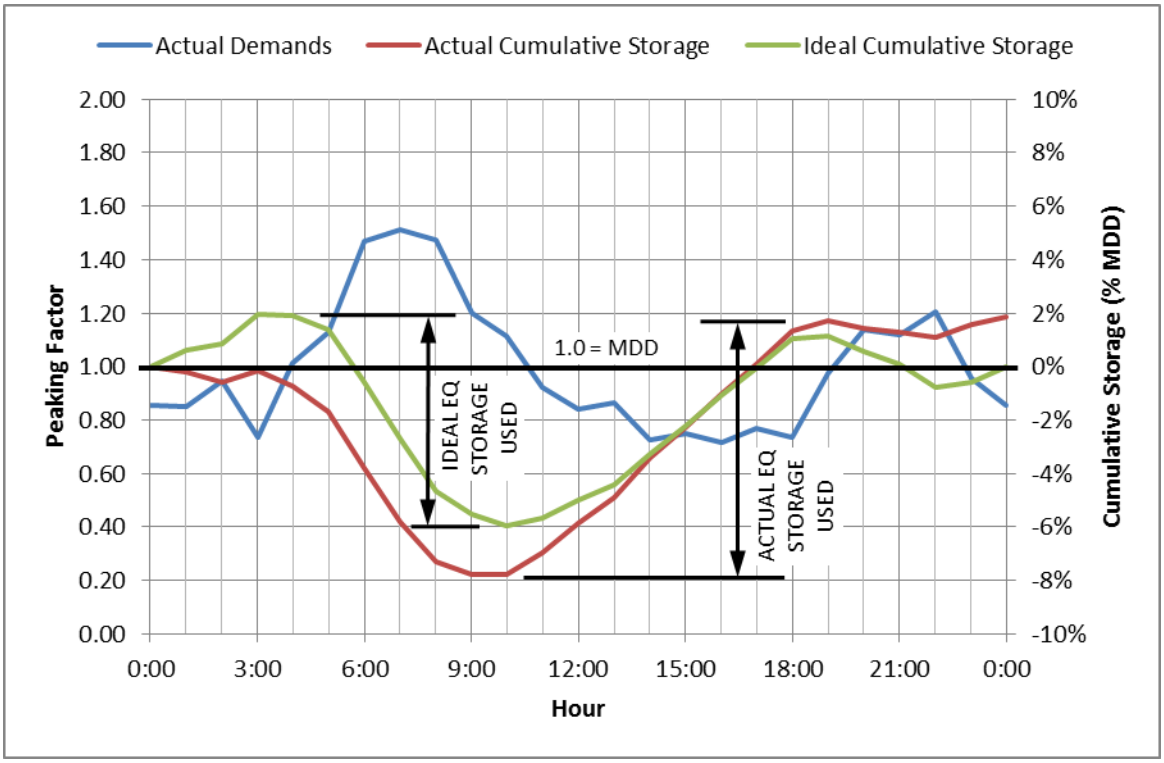
For areas with a diverse customer base representative of the entire system, the City determined that 10% x MDD is appropriate. System-wide MDD demands (including supply inlet flows +/- reservoir volume fluctuations) from 2007-2014 were analyzed as shown in Figure 4-8. On average, less than 8% x MDD is needed for equalizing based on the system-wide demand pattern, but up to approximately 10% may actually be used, possibly due to non-equalizing factors (valve or pump settings; maintenance activities; water quality optimization; daily change in the overall storage in the system; etc).

Figure 4-8: 2007-2014 Average System-Wide MDD Diurnal Pattern and Equalizing Volume



The City checked telemetry records of the actual storage used, to verify the estimated equalizing storage requirement. Figure 4-9 shows the 2014 system-wide MDD diurnal demand curve, and a comparison of the ideal versus actual equalizing volume.

Figure 4-9: 2014 MDD Ideal Equalizing Volume and Actual Volume Used



The comparison of MDD ideal calculated equalizing storage needs to actual storage used was repeated for each year 2007-2014. Tabular results are shown in Table 4-8.

Table 4-8: MDD Ideal Equalizing Volume and Actual Volume Used

	Ideal EQ Volume	Actual Used Volume
2007	7.6%	8.3%
2008	8.0%	8.7%
2009	7.0%	8.3%
2010	9.6%	10.5%
2011	7.1%	6.0%
2012	7.5%	6.3%
2013	6.2%	5.9%
2014	7.9%	9.7%
Average	**7.6%**	**7.9%**

Based on these results, 10% x MDD adequately meets system-wide equalizing storage needs (excluding localized SF areas described above). The actual volume used slightly exceeded 10% on only one maximum demand day (August 16, 2010), when MDD was lower than average (would be < 10% MDD in a high-demand year), and much of this volume was consumed because NE 40th Reservoir was pumped down to force turnover for water quality reasons.

- Emergency/ Standby: The City elected to maintain the minimum recommended[1] storage criteria of 200 gal/ERU, for systems with more than one source (TESSL and CESSL). This volume is approximately equal to one day of service at ADD, as shown in Figure 3-5.

  The risk of a water supply emergency to Bellevue is mitigated by the presence of two independent sources (the Tolt and Cedar River watersheds), by significant additional storage upstream in the regional system (SPU's Eastside Reservoir in Bellevue), and by existing water rights. Well supplies can provide water locally, independently and perpetually during a water supply emergency, lessening the need for standby storage.

  The City also elected to continue its practice of counting emergency/standby storage and fire storage separately. DOH allows water utilities to "nest" these two storage components (use the larger to satisfy both), but the City uses the cumulative sum of both, to accommodate a fire during a supply emergency.

- Fire: Previously the City assumed adequate transmission capacity between zones within each of the three operating areas (shown in Figure 1-5), and assumed a maximum fire demand of 5,500 gpm for 4 hours in each operating area. Neither of these assumptions appeared to be valid after detailed analysis.

  Zone-by-zone Reservoir Sizing and Storage Volume Analysis (Technical Memorandum No. 2B in Appendix K) found that due to limitations in transmission capacity, storage was not equally available within each operating area. Instead, smaller "storage regions" were identified (shown in Figure 4-10), in which storage can realistically be used to fight a fire throughout.

  The City analyzed the 5,500 gpm for 4 hours, and found that it was a simple rule of thumb based on invalid assumptions, and not endorsed by the Fire Marshall. The previous assumption was that private fire suppression systems (sprinklers, etc) or fire protection materials were used by developers to limit the required fire flow to no more than 5,500 gpm. However, the Utilities Department's analysis of King County Tax Assessor records, confirmed by the Fire Department, found buildings in the City's service area that would require a fire flow up to the IBC maximum 8,000 gpm for 4 hours. It is important to note that per City policy, the fire flow requirement for each

[1] DOH Water System Design Manual, 2009. Section 9.04.

building is the fire flow available at the time of construction, so the City is not required to make improvements in response to changing Codes.

Reservoir Sizing and Storage Volume Analysis

Following the selection of updated criteria by the City, a zone-by-zone Reservoir Sizing and Storage Volume Analysis was conducted (Technical Memorandum No. 2B; see Appendix K).

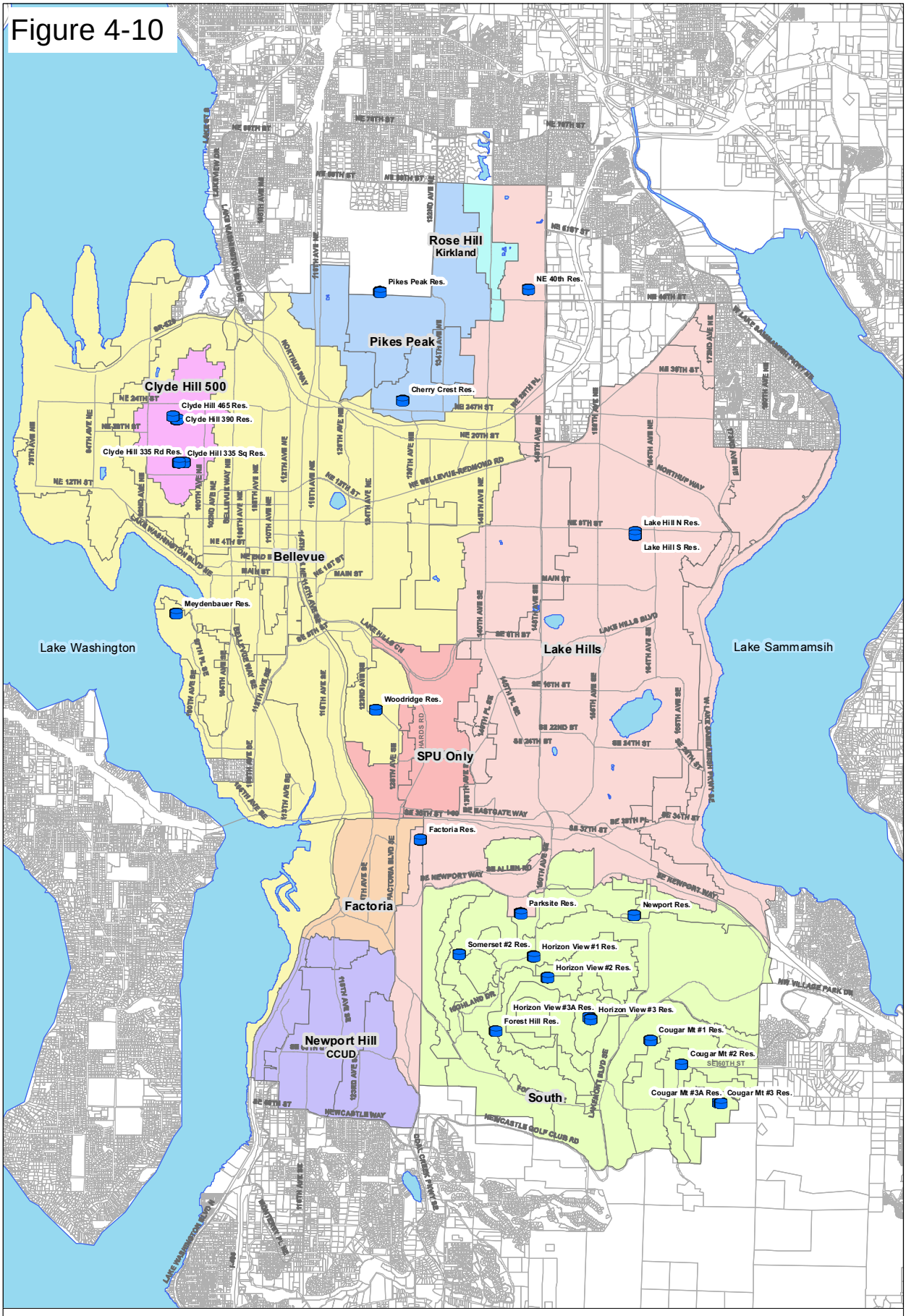
Nine discreet storage "regions" (shown in Figure 4-10) were identified to establish geographical areas for storage analysis. Storage is these regions is fully shared between pressure zones. Previously, the City had assumed that storage was shared throughout the three operating areas (WOA, EOA and SOA), however analysis revealed that some zones within operating areas lack full access to storage elsewhere due to transmission capacity limitations.

Although the Lake Hills Region wheels water to the City of Redmond's Overlake area, Redmond's demands are not considered in the storage evaluation, because Bellevue is not responsible for providing storage for Overlake. It is assumed that Redmond will construct storage as needed to meet the needs of growth in Overlake. Redmond owns a 44% share of volume in NE 40th Reservoir, which was excluded from the storage evaluation (only Bellevue's 56% share was considered in the evaluation).

Storage is included in the storage evaluation to serve customers in Issaquah's Lakemont Triangle (LH520, Lake Hills Storage Region) and Montreux/Glacier Ridge (CM1150, South Storage Region) neighborhoods, because Issaquah pays a wheeling charge that includes access to storage in Bellevue's system. Bellevue is responsible for providing storage for these customers in Issaquah, per agreement.

Sammamish Reservoir volume and future wheeled flows to Issaquah's South Cove area have been excluded from the storage evaluation, because it is anticipated Issaquah will assume the local water system and operate its own storage with Sammamish Reservoir.

Figure 4-10



Legend

- Reservoirs
- Arterials
- Water Bodies

Water Storage Region

- Bellevue
- Clyde Hill 500
- Factoria
- Lake Hills
- Newport Hill
- Pikes Peak
- Rose Hill
- SPU Only
- South
- Parcels

Feet
0 2,500 5,000

Water Storage Regions
Water System Plan Update
City of Bellevue

carollo

The City's updated storage criteria were then applied to determine the storage needs for each region, for comparison with existing storage volumes. Tables 4-9, 4-10 and 4-11 indicate the storage balance by region for the 6-, 10- and 20-year planning periods.

Table 4-9: Current 6-Year Storage Balance (2020)

Storage Region (mg)	Existing Storage (mg)	Total Required Storage[1] (mg)	Storage Excess or Deficiency[1] (mg)
Bellevue	12	11.7	0.3
Clyde Hill 500	0.7	1.1 (0.4)[2]	-0.4 (+0.3)[2]
Pikes Peak	0.8	1.2	-0.4
Lake Hills	13.3[3]	10.4	2.9
Rose Hill	0.5[3]	0.5	0
South	8.4	7.6	0.8
Factoria	2.3	2.1	0.2
Newport Hills	3.1	3.0	0.1
SPU-Only	0	1.2 (0.6)[4]	-1.2 (-0.6)[4]
Total	41.1	38.8 (37.5)	2.3 (3.6)

Table 4-10: Current 10-Year Storage Balance (2024)

Storage Region (mg)	Existing Storage (mg)	Total Required Storage (mg) [1]	Storage Excess or Deficiency[1] (mg)
Bellevue	12	12.3	-0.3
Clyde Hill 500	0.7	1.1 (0.4)[2]	-0.4 (+0.3)[2]
Pikes Peak	0.8	1.2	-0.4
Lake Hills	13.3[3]	10.5	2.8
Rose Hill	0.5[3]	0.5	0
South	8.4	7.7	0.7
Factoria	2.3	2.1	0.2
Newport Hills	3.1	3.0	0.1
SPU-Only	0	1.2 (0.6)[4]	-1.2 (-0.6)[4]
Total	41.1	39.6 (38.3)	1.5 (2.8)

[1] Volumes in parentheses (#.#) reflect reduced storage requirements following recommended improvements.
[2] Clyde Hill region includes 0.2-MG fire + 0.5-MG dead storage not needed if merged with Bellevue region.
[3] Rose Hill Region provides 1-MG of emergency storage to Lake Hills Region.
[4] SPU-Only region includes 0.6-MG fire storage, which will no longer be needed if merged with other regions.

Table 4-11: Current 20-Year Storage Balance (2034)

Storage Region (mg)	Existing Storage (mg)	Total Required Storage[1] (mg)	Storage Excess or Deficiency[1] (mg)
Bellevue	12	14.1	-2.1
Clyde Hill 500	0.7	1.1 (0.4)[2]	-0.4 (+0.3)[2]
Pikes Peak	0.8	1.2	-0.4
Lake Hills	13.3[3]	10.8	2.5
Rose Hill	0.5[3]	0.5	0
South	8.4	7.7	0.7
Factoria	2.3	2.2	0.1
Newport Hills	3.1	3.1	0.0
SPU-Only	0	1.2 (0.6)[4]	-1.2 (-0.6)[4]
Total	41.1	42.8 (40.2)	-0.8 (+0.5)

Potential strategies to address projected storage deficits are described below:

- **Bellevue Region**

  The Bellevue region is projected to have a storage deficit in approximately 2022. If WD400 is moved from the "SPU Only" region to the Bellevue region (as described below), then the Bellevue region's deficit will be accelerated to 2020. The following capital improvements are recommended by 2020:

  - Increase EOA-WOA transmission capabilities, to make excess storage in the Lake Hills region available to the Bellevue region (see Appendix M).
  - Add yard piping connection and a new PRV to access 0.5-MG dead storage at Clyde Hill 465 Standpipe.

  Following these proposed projects, construction of additional storage to serve the Bellevue region may still be necessary prior to 2034, if the Clyde Hill 500 and SPU-Only regions are merged into the Bellevue Region (0.8-MG additional Bellevue region deficit, as described below).

- **Clyde Hill 500 Region**

  The Clyde Hill 500 storage region consists of the CL500 pressure zone, which is normally served by Clyde Hill Pump Station. Required storage is approximately 0.6-MG, including 0.4-MG for equalizing and emergency/standby, and 0.2-MG for fire. However, local storage for CL500 (0.7-MG Clyde Hill 465 Standpipe) also includes 0.5-MG dead storage and has limited functionality, because it is only available when the Clyde Hill pumps are off (storage is only available at very low pressure). Previously it was assumed that CL500 shared storage with the rest of the WOA, however the new storage analysis revealed a

local deficit in fire storage, and insufficient firm capacity at Clyde Hill Pump Station to compensate after storage is depleted in Clyde Hill 465 Standpipe.

Due to lack of available land and the elevation required, construction of storage to serve a 500' HGL in Clyde Hill does not appear to be feasible. Therefore it is recommended that the Clyde Hill 500 region storage deficit be resolved by increasing firm pumping capacity to CL500, potentially during the next Clyde Hill Pump Station rehabilitation. This would effectively eliminate the Clyde Hill 500 storage region and merge CL500 into the Bellevue Region. This change would add 0.4-MG required storage to the Bellevue storage region, but also add 0.7-MG available storage (effectively reduce the deficit by 0.3-MG), since the entire Clyde Hill Standpipe would be available (no dead storage).

- **Pikes Peak Region**

  The Pikes Peak storage region consists of the PP550, PP600 and PP670 pressure zones, which include storage in Pikes Peak Reservoir. Although Pikes Peak Reservoir has a nominal capacity of 1.0-MG, it can only be filled to roughly 0.75-MG due to seismic deficiencies, so the current level of service is less than originally constructed. Previously it was assumed that the Pikes Peak region shared storage with the rest of the WOA, however the new storage analysis revealed a local deficit in fire storage due to a lack of backup power at Cherry Crest Pump Station[1], making Pikes Peak Reservoir the only reliable local source of water in a water supply outage[2].

  The localized deficit in fire storage serving the Pikes Peak region can be resolved if the existing seismically-deficient 1.0-MG tank (0.75-MG usable capacity) is replaced, by increasing capacity to 1.25-MG. Alternatively, reliable fire pumping capacity could be provided at Cherry Crest Pump Station, however that would require expanded pumping facilities in Cherry Crest Park, plus the addition of a 200-kW (estimated) diesel backup generator at the park, with weekly generator exercise to maintain reliable power.

  The City should consider various options to address the localized Pikes Peak region storage deficiency when addressing the existing seismically-deficient tank.

- **Newport Hills Region**

  The Newport Hills region consists of the NH320, NH380, NH470 and NH580 pressure zones. Water assets in these areas were transferred to Bellevue from Coal Creek Utility District as part of the CCUD assumption in 2003. This region is served exclusively by storage in CCUD.

[1] On-site backup power is recommended by DOH and AWWA in order to consider pumps available to provide fire flow, per DOH (WSDM Section 5.7.1) and AWWA Manual M31 (4th Ed, p. 35).
[2] The 670 Pump Station has reliable on-site backup power and supplies PP670 from the TESSL. However, DOH (WSDM Section 9.3.1) requires fire storage analysis assume the largest local source (TESSL) is out of service.

A total of 3.05-MG of storage is available for Bellevue's use in CCUD's 440 Reservoir and 580 Reservoirs, per the partial assumption agreement (see Volume 3). This contractual volume is adequate to provide for the full required volume of 3.0-MG in the Newport Hills Region throughout the 20-year planning period.

CCUD currently does not use the full capacity of its reservoirs, in order to limit water age and optimize water quality [1]. Although the contractual agreement does not indicate "on paper" that Bellevue has access to storage in CCUD's other reservoirs, this storage is realistically available, as CCUD's zones are connected. Bellevue will work with CCUD to optimize water quality provided to customers in Bellevue with available storage volume.

- **SPU Only Region**

  The SPU Only region, consisting of RV300, WD340 and WD400, has a storage deficit of 1.2-MG after the 6-, 10- and 20-year planning periods (negligible growth is projected). This includes 0.6-MG for equalizing and emergency/standby needs, and 0.6-MG fire storage needs. If these pressure zones are combined with another storage region, then fire storage would be shared, and the deficit for these zones becomes 0.6-MG (0.4-MG RV300, < 0.2-MG WD400, and 0.02-MG WD340). The following system improvements should be considered to potentially eliminate the SPU Only storage region and provide access to storage for RV300, WD340 and WD400:

  - RV300: Adjust PRV #40, #158 and #86 settings, so RV300 is served primarily from LH520 (via CO440 and CO380), with the Richards Rd inlet serving as emergency backup supply. This may require transmission improvements to avoid pressure fluctuations in CO440 and/or CO380. This would transfer 0.4-MG required storage to the Lake Hills storage region.
  - WD400: Evaluate adjusting the settings for PRVs that serve WD400, so the zone is served primarily from WD450 through PRV #12, with Richards Rd Inlet PRVs #9 and #11 serving as emergency backups. This would require additional power consumption and potential more maintenance at Woodridge Pump Station, and may require larger capacity at PRV #12 at the next scheduled rehabilitation. This would add 0.2-MG to the storage deficit in the Bellevue region.
  - WD340: In the event of a water supply outage, this zone can be combined with RV300 (at slightly lower pressure) by manually opening an existing zone valve. The City could continue to rely on SPU only for normal demands in WD340 due to its small size (projected 53 ERUs in 2034), but replace the zone valve with a check valve to provide emergency supply (automatically) from RV300. A PRV from WD450 could be added, or no improvements made. Projected ADD by 2034 in WD340 is less than 10-gpm, so the cost to implement improvements may outweigh any potential benefits.

[1] CCUD 2013 Water & Sewer System Plan.

Table 4-12 shows the modified storage balance by region for the 20-year planning period, if all recommendations are implemented:

Table 4-12: 20-Year Storage Balance (2034) after Improvements

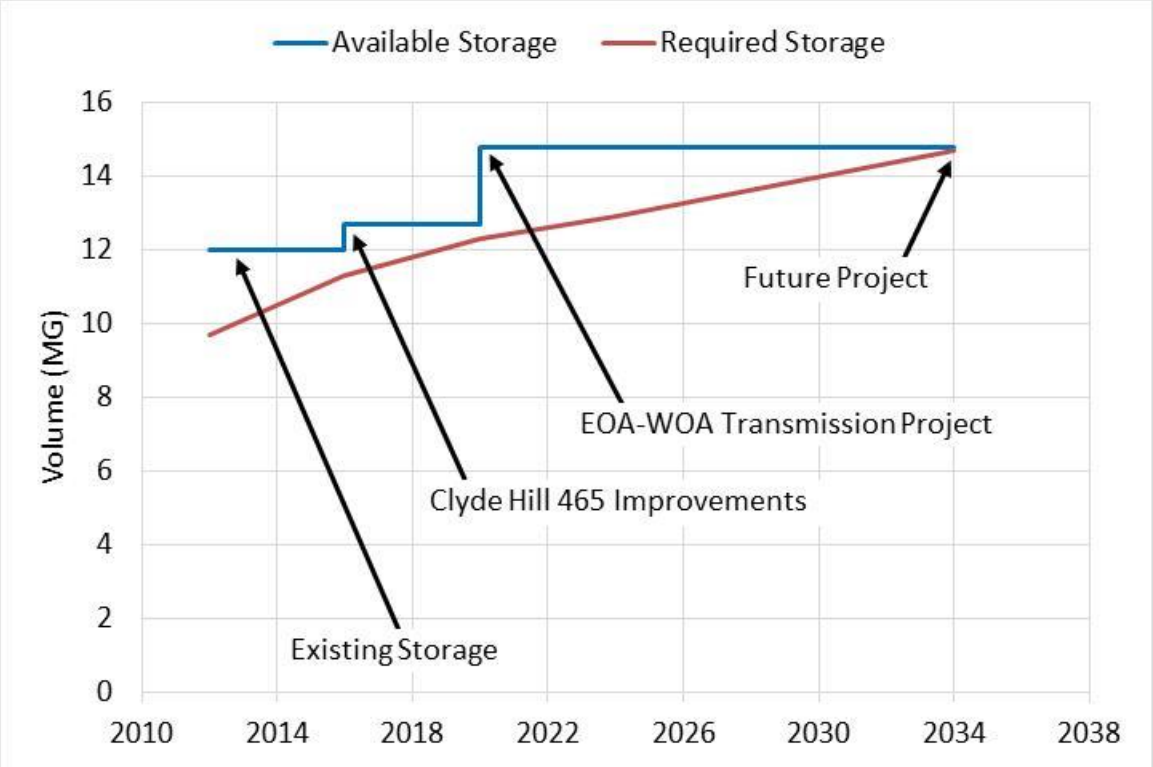
Storage Region (mg)	Available Storage (mg)	Total Required Storage (mg)	Storage Excess or Deficiency (mg)
Bellevue	14.8[1,2]	14.7[3,4]	0.1
Clyde Hill 500	---	---	---
Pikes Peak	1.2[5]	1.2	0.0
Lake Hills	11.2[1]	11.2[6]	0.0
Rose Hill	0.5	0.5	0.0
South	8.4	7.7	0.7
Factoria	2.3	2.2	0.1
Newport Hills	3.1	3.1	0.0
SPU-Only	0	0.01[4,6,7]	-0.01
Total	41.5	40.6	0.9

Table 4-12 indicates that the Bellevue Region's storage needs would be satisfied through 2034 if all recommendations are implemented. No deficit would be projected to occur until approximately 2036. The City's next Water System Plan will re-evaluate growth projections and the appropriate options at a future time.

[1] Volumes shown include 2.1-MG emergency storage in Lake Hills Region made available to Bellevue region by the EOA-WOA transmission project.
[2] Includes 0.7-MG existing Clyde Hill storage made available to Bellevue Region.
[3] 0.4-MG equalizing & standby storage for CL500 is transferred from Clyde Hill Region to Bellevue Region.
[4] 0.2-MG equalizing & standby storage for WD400 is transferred from SPU-Only Region to Bellevue Region.
[5] Assumes new 1.25-MG Pikes Peak Reservoir to replace existing 1.0-MG (0.75-MG usable) tank.
[6] 0.4-MG equalizing & standby storage for RV300 is transferred from SPU-Only Region to Lake Hills Region.
[7] Remaining deficit in SPU-Only region results from WD340 (53 ERUs) and does not include 0.2-MG fire storage. Emergency/Standby and fire storage for WD340 would be provided by RV300 if check valve is added.

Figure 4-11 shows the projected storage requirement and storage available in the Bellevue Region, with recommended improvements.

Figure 4-11: Bellevue Region Storage Balance



4.7 Condition Assessment

Bellevue's water utility infrastructure is evaluated periodically for renewal and replacement (R&R), regardless of capacity needs. Additional information on R&R is provided in Chapter 8.

Inlet Stations

Bellevue's existing inlet stations are periodically surveyed and maintained as PRV stations, as described in Chapter 6. However, no asset management program has been developed to fund ongoing R&R of inlet stations, which are more critical than PRV stations and have unique requirements such as meters and telemetry.

Three existing inlet stations have been identified as deficient:

- Richards Road Inlet: Rehabilitation of this inlet station has been incorporated into the 2015 PRV Replacement program.
- NE 40th Inlet: Piping inside the NE 40th Inlet meter vault has visible joint deflection, which likely exceeds manufacturer limits. This piping may be at risk of failure, and could create a safety hazard in the vault. Additionally, the vault is located in the NE

40th westbound lane of traffic, which requires traffic control and lane closure of a busy commuter corridor for access. It is recommended that the displaced pipe be replaced, and the meter be replaced with two meters, located (1) inside the 670 Pump Station and (2) at the NE 40th Reservoir site, to avoid traffic delays and hazards.

- Enatai Inlet: Bellevue's meter at Enatai Inlet Station is only intermittently functional, so SPU meter readings are often relied on. Additionally, the vault does not meet current Code or Bellevue's Engineering Standards for access, and the PRV at the station is minimally accessible due to lack of clearance.

It is recommended that NE 40th and Enatai inlet station rehabilitations be prioritized to address these reliability and safety deficiencies.

Distribution System Piping

Bellevue's methods for pipeline condition assessment, estimating useful life and prioritizing pipe replacement are described in Chapter 8. CIP W-16 funds pipeline replacement, as described in Chapter 9.

When appropriate, AC main replacement is often accelerated concurrent with sidewalk or street paving projects, to reduce grind & overlay pavement costs and neighborhood impacts. This benefits utility rate payers, because the significant roadway pavement restoration costs are reduced or eliminated, and benefits the Transportation Department because the risk of water main breaks and need to replace pipe below new pavement is reduced. Costs are shared fairly and equitably between the Utilities Department and the Transportation Department, recognizing the forfeited remaining asset life of the old piping as well as the value of new piping.

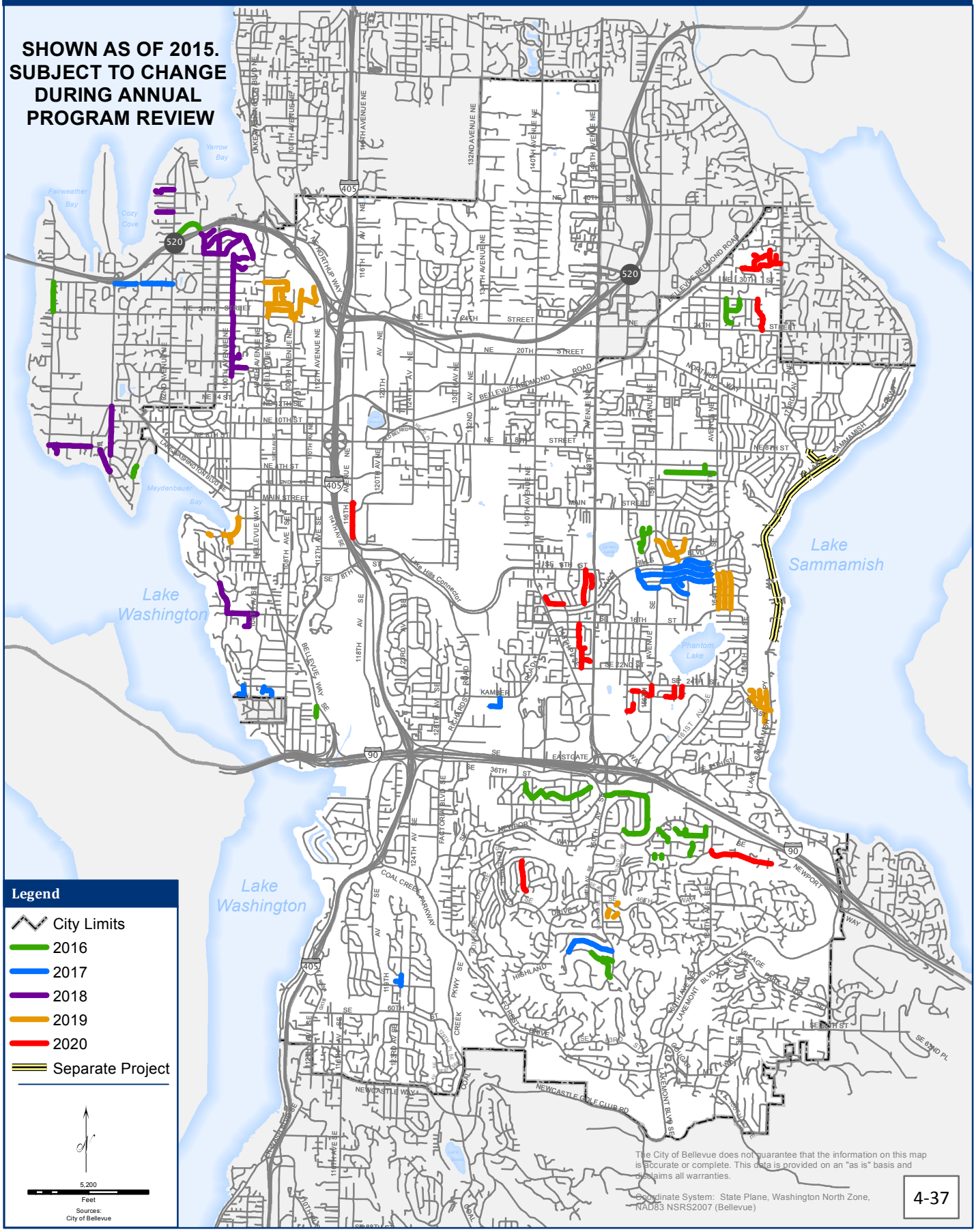
Each year a new, tentative 5-year water main replacement plan is developed. Figure 4-12 shows the draft 2016-2020 water main replacement map. Actual sites typically change somewhat due to project-specific factors or new information that affects site prioritization.

A 2012 landslide and water main break along West Lake Sammamish Blvd forced multiple home evacuations and closed a portion of the road (a major commuting arterial) for a period of months. This area includes homes adjacent to steep slopes that become saturated during the rainy season. Although it is unclear whether the landslide might have triggered the main break (rather than pipe condition), the City is reconsidering the potential risk of a main break in the remaining pipe along West Lake Sammamish Pkwy, due to the severity of damage resulting from the 2012 event. It is recommended a more comprehensive risk evaluation be performed for the remaining AC pipes in West Lake Sammamish Blvd, and if appropriate, replacement of this pipe be accelerated.

Draft 2016-2020 Water Main Replacement Program

Figure 4-12

City of Bellevue GIS Services



File Name: J:\Water System Plan (2015)\Figures\Main_Replace_Fig4-12.mxd

Fire Hydrants

Bellevue has a limited number of older two-port hydrants still in the system, which restrict flow compared to modern hydrants and require special adapters. A CIP program is in place to replace all two-port hydrants with the current standard design (see Chapter 9).

Bellevue's current standard for new fire hydrants includes two 2-1/2" National Standard Thread (NST) hose ports and one 5-1/4" port with the City of Seattle Standard (SST) thread pattern. Most existing fire hydrants have pumper ports with the SST thread pattern, although roughly 900 hydrants still exist in Bellevue's service area that utilize the Pacific Coast Thread (PCT) pattern.

Bellevue Utilities evaluated the possibility of changing the thread pattern on the pumper port from SST to NST, and/or installing Storz adapter connection devices to improve inter-agency compatibility for regional fire events. However, Bellevue Fire Department indicated that SST are preferred due to maintenance.

The City's fire hydrants vary widely in manufacturer and lineage. O&M staff identified a significant inefficiency in owning, operating and maintaining such a wide variety of hydrants, many of which require unique spare parts, tools and staff training needs. To improve future operational efficiency while still allowing market competition, the list of acceptable hydrant manufacturers in the Engineering Standards was reduced to 3.

Isolation Valves

Isolation valves serve multiple functions. Normally-closed "zone valves" separate pressure zones, but allow for connection in abnormal conditions. Normally-open valves serve to limit the area (and number of customers) affected during planned and unplanned shutdowns, and also facilitate uni-directional flushing activities. Isolation valves are not frequently used, but are periodically actuated to verify operation, as described in Chapter 6.

Isolation valves are not as critical as PRVs or check valves, since they are not relied on to provide fire flows. However, failure of the isolation valve packing (leakage out of the system), or leakage at the seating surface (leakage across a closed valve, within the system) does impact efficiency of operations and customer service. Leakage through stem packing can create icy surfaces on streets and sidewalks, and contribute to non-revenue flows. Zone valves that leak from a higher pressure zone to a lower zone require additional pumping energy. During a planned or unplanned shutdown, significantly more customers can be affected if the nearest valve is not functional or the seat leaks excessively.

It is recommended that an asset management program be established for isolation valves. The City maintains an inventory of every isolation valve, including work order records in Maximo and mapping in GIS, and performs condition assessment during scheduled maintenance, but does not currently dedicate budget for isolation valve repairs.

Check Valves

Check valves are installed in several locations between pressure zones throughout the City, in place of zone isolation valves. They stay closed during normal conditions, but open to allow flow from a normally lower-HGL zone to augment supply to the higher-HGL zone in case of a severe loss of pressure. Some are relied on to actuate during a fire flow event.

Bellevue maintains an inventory of check valves, but check valves are not considered in the R&R program. In addition, maintenance is limited due to field conditions. Some check valves are inaccessible and un-serviceable due to limited clearance in existing manholes and vaults.

It is recommended that an asset management program and a scheduled maintenance program be established for check valves.

Reservoirs

Bellevue's reservoirs are regularly inspected, as described in Chapter 6, and funding is set aside for renewal & replacement as described in Chapter 8. Small reservoir repairs such as joint sealing (for concrete tanks), touch-up paint (for steel tanks), and repairs to reservoir appurtenances (ladders, screens, hatches, etc) are generally made as-needed through the O&M budget based on routine observations. Larger repairs such as re-coating or structural retrofits are budgeted in advance.

Table 4-13 shows the status of steel reservoir lining and coating. The scope, schedule and prioritization of future projects will be established as needs are assessed. Steel reservoir re-lining and re-coating projects are currently funded through the City's O&M budget (not through CIP). These projects do not include structural modifications or replacement of the reservoir.

Table 4-13: Steel Reservoir Lining and Coating Age

Reservoir	Year Built	Last Exterior Coating	Last Interior Lining
Clyde Hill 335 Round	1952	1987	2014
Clyde Hill 465	1958	2010	1996
Cougar Mountain 3	1997	2005	1997
Cougar Mountain 3A	1997	2005 (Sides)	1997
Crossroads North	1959	2000	2011
Crossroads South	1962	2000	1983
Factoria	1981	2005 (Roof) 2015 (Touch-up)	2005
Horizon View 1	1963	Unknown	1989
Horizon View 2	1963	Unknown	1991
Parksite	1964	2011	1986
Pikes Peak	1968	1981	2013 Touch up
Woodridge	1956	2005	2001

Horizon View 1, Horizon View 2 and Pikes Peak reservoirs are all scheduled to be replaced within the 6-year planning period due to seismic deficiencies (see Table 4-14), so are unlikely to be re-lined or re-coated.

Cougar Mountain 3A Reservoir is known to have significant interior coating defects, and is currently off-line. Re-lining of this tank is not currently a high priority because the tank is small (300,000-gallons) and the local area has excess storage capacity even with it off-line (South Storage Region, Tables 4-9, 4-10 and 4-11). However, lining repairs should be made to allow continuous use of the tank and increase redundancy for storage on Cougar Mountain.

Bellevue also shares costs with CCUD for coating CCUD's 440 and 580 reservoirs, which serve Bellevue's Newport Hills Storage Region. CCUD's 440 Reservoir is scheduled for complete re-coating and re-lining in 2016.

Engineering consultants have performed multiple structural and seismic evaluations of Bellevue's reservoirs, and many of the recommended projects have been completed, as described in Chapter 8. Table 4-14 shows the near-term future recommended reservoir rehabilitation projects. The scope, schedule and prioritization of future projects will be established as needs are assessed. The required programmatic rehabilitation of all 25 reservoirs (plus a portion of an additional 4 reservoirs operated by CCUD and Kirkland) is assumed, and is funded continuously through CIP W-85 Structural/Seismic Reservoir Rehabilitation program, as described in Chapter 9.

Table 4-14: Proposed CIP W-85 Structural/Seismic Reservoir Rehabilitation Projects

Reservoir	Recommendations	Scheduled Completion	Estimated Cost
Horizon View #1	Add storage; resolve seismic deficiency	Late 2016	$1,780,000
NE 40th	Roof Repair	Late 2015	$100,000
Somerset #2	Seismic Retrofit	Late 2015	$60,000
Horizon View #2	Add storage[1]; resolve seismic deficiency	2021	$830,000
Somerset #1	Abandon Reservoir, Repurpose or sell land	TBD	$670,000
Somerset #3	Abandon Reservoir, Repurpose or sell land	TBD	TBD
Pikes Peak	Add storage[1]; resolve seismic deficiency	2018	$2,130,000

1. Estimated cost is to replace with existing volume (does not include additional storage; size TBD).

Kirkland's South Reservoir, which is jointly owned by Bellevue (13.4%) and Redmond (29.4%), has not been evaluated for seismic resiliency. The Bellevue/Kirkland/Redmond Joint Board has proposed to perform an evaluation of this facility to identify deficiencies. The evaluation has not yet been funded, but is anticipated to occur within the next 6-years.

Pump Stations

The City worked with Kennedy/Jenks Consultants to complete a Water Booster Pump Station Evaluation in 2010. The purpose of this evaluation was to identify and prioritize necessary pump station improvements. Pump stations were given an objective numerical rating based on relative physical condition, operations needs/capabilities, and maintenance requirements; after which the rating was weighted based on the relative criticality of each station (lack of redundancy, etc). The lowest-rated stations were then recommended for rehabilitation.

Existing Horizon View #1 Pump Station

Existing Clyde Hill Pump Station

The 6 lowest-rated stations were (in order of priority):

1. Horizon View #3
2. Newport
3. Horizon View #1
4. Cougar Mountain #2
5. Clyde Hill
6. Pikes Peak

Subsequent to the Water Booster Pump Station Evaluation, numerous operational deficiencies became apparent at Cougar Mountain No. 3 Pump Station, which was prioritized for earlier rehabilitation.

Table 4-15 shows the near-term recommended pump station rehabilitation projects. The scope, schedule and prioritization of future projects will be established as needs are assessed. The required programmatic rehabilitation of all 22 pump stations maintained by Bellevue is assumed, and is funded continuously, through CIP W-91 Water Pump Station Rehabilitation program, as described in Chapters 8 and 9.

Table 4-15: Recommended Pump Station Rehabilitation Projects

Pump Station	Recommendations	Scheduled Completion	Estimated Cost
Newport		Complete (2013)	
Horizon View #3	VFDs, backup power	Late 2015	$1,500,000
Horizon View #1	Replace pump station	Late 2016	$3,778,600
Cougar Mountain #3	VFDs, backup power, surge mitigation, etc	2017	$1,349,000
Cougar Mountain #2	VFDs, backup power, building upgrades	2019	$800,000
Clyde Hill[1]	VFDs, add pump, pressure relief	2020	$280,000
Pikes Peak	Replace pump station	2018	$3,550,000

1. Estimated cost is to replace with existing capacity (does not include additional capacity to increase fire flow).

Pressure Reducing Valves

Table 4-16 lists the tentative PRV station replacement projects scheduled during the 2015-2021 CIP window. PRV station replacement typically includes new valves, but may also include structural repairs or replacement of the vault, site improvements, and/or safety and access improvements. The PRV station replacement schedule is typically prioritized and triggered based on station attributes such as age, condition, safety concern, etc, but may also be influenced by transportation projects, similar to AC main replacement. When appropriate, PRV replacement may be accelerated concurrent with sidewalk or street paving projects, to reduce pavement grind & overlay costs and neighborhood impacts.

Table 4-16: Recommended PRV Station Rehabilitation Projects

PRV Station No.	Asset No.	Install Year	Proposed Replacement Year	Station Age at Replacement
066	100895	1972	2016	44
038	100872	1974	2016	42
073	101060	1974	2016	42
088	101058	1976	2017	41
093	101078	1978	2017	39
054	100900	1979	2017	38
096	101085	1979	2018	39
102	101069	1979	2018	39
103	100959	1979	2018	39
098	101073	1980	2019	39
105	101113	1980	2019	39
107	101182	1982	2019	37
108	101183	1982	2020	38
109	101184	1982	2020	38
111	101195	1982	2020	38
112	101186	1982	2021	39
114	101188	1982	2021	39
031	101062	1983	2021	38

4.8 Emergency Preparedness

Section 6.4 describes the City's emergency operations procedures. In order to improve system reliability and resiliency, some additional analysis and capital improvements are recommended, as described below.

Electrical Supply Reliability

The most densely populated portions of Bellevue's service area are served by gravity supply inlets and gravity reservoirs, which are generally unaffected by power outages. However, higher elevation areas rely on intermittent pumping to fill local reservoirs, and some "closed" zones rely on continuous pumping service at all times, as indicated in Table 1-3.

For most of Bellevue's pump stations, some downtime is acceptable due to available reservoir storage. Most pump stations are equipped with receptacles to accommodate quick connection to a portable generator. Currently the City's water utility has two portable generators, stored at Horizon View #2 (200 kW) and Cougar Mountain #1 (125 kW). Pump stations that are critical, either due to the size of population served or due to lack of downstream storage (requiring continuous service), have on-site generators installed. Table 1-6 indicates the backup power availability at each pump station.

Recent hydraulic modeling indicates a potential vulnerability of the SOA to water supply disruption due to power outages during the high-demand season, if water usage is not significantly curtailed. Although several recent power outages (including the 5+ day event in 2006) have not resulted in any water supply disruption, these all occurred due to storms during the low-demand season, and required extensive 24-hour/7-day efforts by City staff to maintain service. Among the three pump stations supplying SS850, which subsequently serves all of Cougar Mountain and the Horizon View & Somerset areas, only Newport Pump Station has an on-site backup power supply. Adding backup power at both Somerset Inlet + Somerset #2 pump stations and/or at both Parksite + HV1 pump stations would substantially improve reliability for the entire SOA.

It is recommended that Bellevue perform a risk-based evaluation of vulnerability during power outages. The evaluation should consider:

- Adding permanent on-site power on a prioritized basis
- Purchasing additional portable generators
- Developing a plan for alternative water service to affected customers in the case of extended outage (no additional backup power)

Seismic Resiliency

Since the 1990s, Bellevue's ongoing CIP W-85 Structural/Seismic Reservoir Rehabilitation has identified and addressed seismic deficiencies specific to the City's reservoirs. Some reservoirs identified for seismic improvements in W-85 have not yet been retrofitted or replaced, but are scheduled for near-term replacement. See Table 4-14 and Section 8.3.

An overall seismic evaluation of Bellevue's distribution system piping was last conducted in 1996. Many of the recommendations of that study have been implemented, but not all of them. Since that time, seismic codes and industry standards have evolved, soil mapping has improved, and the City has built an extensive GIS database of utility infrastructure. It is recommended that a new distribution system seismic resiliency study be conducted, to leverage newly available information, enhance emergency preparedness, and conform to current industry standards.

The City is participating in a regional seismic vulnerability assessment as part of the Central Puget Sound Water Supply Forum. This assessment will evaluate regional utility vulnerabilities and criticality using American Lifelines Alliance and FEMA's Hazus methodology, with a focus on major water supply and transmission infrastructure. It is recommended that Bellevue perform its own updated system-wide seismic vulnerability assessment, which incorporates the results of the regional Water Supply Forum study.

Emergency Interties

Connections with adjacent utilities are encouraged when opportunities arise, as described in the Service Reliability Policy. Currently, emergency interties exist between Bellevue and Kirkland, Redmond, CCUD, Beaux Arts and Hilltop/WD117, as indicated in Table 1-2.

A new emergency intertie has been proposed in Points Drive, between Bellevue's system and Kirkland. This would benefit both utilities, and could provide service (at lower pressure) to customers in Yarrow Point in case piping across SR520 is out of service. This could be constructed as part of the local AC main replacement scheduled for late 2016 (Figure 4-12).

4.9 Wells

The City's wells and water rights are valuable assets. Recently, the City has investigated how these assets might be leveraged to improve the City's water security, reliability, and independence. Bellevue's water rights assessment is attached as Appendix C.

In 2014, the geotechnical engineering firm GeoEngineers performed drawdown testing and analysis of available yield at the City's emergency wells. The findings of this analysis include:

- WD97 Wells No. 5, No. 6 and No. 7 all have sufficient capacity to continuously produce the allotted water right at each (500 gpm, 600 gpm, and 700 gpm, respectively).
- WD97 Well No. 3 production failed to reach the instantaneous water right of 850 gpm. Head losses were relatively low, and the well screen appeared to be blocked by sediment and debris, so the low yield could be related to condition of the well screen itself rather than transmissivity (capacity of the soil). GeoEngineers recommended rehabilitation of the well.

Robinson-Noble Inc., a separate geotechnical engineering consultant, performed an Emergency Well Evaluation for the City in 2014 (attached as Appendix N). The purpose of this evaluation was to identify potential future uses of the City's existing wells and ground water rights. Specifically, three potential future uses were identified:

- Emergency Only: This strategy is consistent with current use of the wells. Emergency use could be expanded by adding drive-up facilities to accommodate water pick-up during a crisis event. The wells would not have the capability to pump into the distribution system.
- Backup Supply: Under this scenario, the wells would be physically separated from the distribution system, but could be quickly connected by installing a spool piece of pipe and activating local disinfection facilities. The wells could then supply limited water to the piped distribution system in the case of a water supply disruption. The wells could also serve in an emergency only capacity.
- On-Line Supply: This would put the wells on-line and continuously supply water to the distribution system. This option would require water treatment, and may affect the aesthetics of water in blended zones. This type of supply would also have ramifications on regional water supply agreements and would require substantially more water quality sampling and reporting.

Wellhead protection has been identified as a challenge due to existing and historical use of the well sites. A Wellhead Protection Plan (WPP) has not yet been required by DOH due to the limited approved use of the wells, however a WPP will be needed prior to expanded use. A WPP would likely require modification of existing well sites to incorporate wellhead protection, or development of new wells at alternative suitable sites nearby.

The Emergency Well Evaluation also found that WD97 Well No. 1 was never fully decommissioned. The consultant recommended fully decommissioning this well and applying to transfer water rights to a new well location.

It is recommended that the City perform more detailed evaluations to better understand the potential costs, impacts and opportunities associated with well development, including:

- Assessment of probability and risk of disruption to existing water supplies (SPU)
- Legal assessment of potential to transfer existing rights to new wells at different locations
- Siting study to understand feasibility of existing sites and identification of alternative sites
- Water quality implications (treatment, monitoring, aesthetics, corrosion potential, etc)
- Hydraulic impacts to the system
- Production cost to supply well water

Consistent with new policies regarding the wells and water rights, the City will continue to assess the benefits of well development and the appropriate level of investment to optimize the use of wells and water rights.

4.10 Property Management

Land availability for future water system facilities is limited in Bellevue, due to local land values and a lack of suitable vacant or under-developed properties. It is recommended that the City analyze the long term need for real property to support continued water service delivery, then develop and maintain an updated property management plan. The property management plan would support decisions regarding whether to retain or acquire properties proactively or as opportunities arise.

4.11 Summary of Recommendations

Large potential capital recommendations in this chapter are summarized below. This list does not include alternatives that address deficiencies but require further analysis. Smaller recommendations that can be accomplished through existing CIP programs, or that do not immediately affect funding are also not listed:

- Evaluate alternatives to improve chlorine residuals, and implement proposed solutions.
- Complete air & vacuum release valve evaluation and improvements.
- Expand inlet capacity to the WOA.
- Implement Advanced Metering Infrastructure (AMI) throughout the system.
- Construct NH470 fire flow & reliability improvements
- In cooperation with the City of Issaquah, add a PRV and separate South Cove pressure zone, to improve fire flow and pressure in SA270.
- Use the City's new hydraulic model to identify operational changes and infrastructure improvements to achieve the minimum 1,000-gpm objective throughout the service area.
- Increase access to storage in multiple Storage Regions:
    - Bellevue (includes Downtown, Bel-Red, Wilburton, etc)
    - Pikes Peak
    - Clyde Hill 500 (via increased pumping capacity)
    - SPU-Only (RV300, WD400, WD450)
- Reservoir replacement or rehabilitation indicated in Table 4-14.
- Pump station replacement or rehabilitation indicated in Table 4-15.
- Rehabilitate NE 40th Inlet Station and Enatai Inlet Station.
- Evaluate risk of remaining AC pipe in West Lake Sammamish Pkwy, and prioritize replacement if appropriate.
- Create an isolation valve asset management program, and prioritize rehabilitation.
- Create a check valve asset management program, and prioritize rehabilitation.
- Re-Line Cougar Mountain 3A Reservoir.
- Evaluate needs for backup power.
- Perform a system-wide seismic resiliency evaluation.
- Evaluate optimum use of Bellevue's existing water rights, and add infrastructure as needed.

Existing CIP programs for renewal & replacement are also recommended to continue, as described in Chapters 8 and 9.

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Chapter 5 Water Use Efficiency Program

Bellevue partners with Cascade to promote the wise use of water, as described in the City's water utility policies (Chapter 2) and below. Partly due to these efforts, as well as changes to building codes, housing stock, and efficiency standards for household appliances, customer demand patterns have changed rapidly. The City is adapting its operations and long-term capital planning to take advantage of these changes, while responding to new challenges such as revenue pressure and winter water age.

5.1 Water Use Efficiency Program

WAC 246-290 requires that public water utilities:

- Publicly establish water savings goals for their customers.
- Evaluate or implement specific water savings measures to achieve customer-based goals.
- Develop a Water Use Efficiency (WUE) planning program to support the established goals.
- Install meters on all customer connections by January 22, 2017.
- Achieve a standard of no more than 10% water loss.
- Report annually on progress towards achieving these goals.

Bellevue's City Code Section 24.02.200 prohibits the waste of water:

24.02.200 Water conservation – Waste of water.

The waste of water supplied by the utility is prohibited at all times. Waste of water includes, but is not limited to, continuous application of water to lawns or landscaping that results in excessive puddling or runoff of water, failure to repair leaking water service lines and irrigation systems, application of water to impervious surfaces other than for cleaning purposes, and all other applications of domestic water that do not result in a beneficial use of the city's public water supply. (Ord. 5963 § 1, 2010.)

Water Savings Goals

As Cascade's largest member, Bellevue's goal is to contribute a proportionate share of Cascade's water use efficiency savings in Bellevue's water service area.

In 2007, Cascade adopted the following short-term water efficiency goal:

Cascade will dedicate resources necessary to achieve a cumulative combined Member savings of 1 million gallons per day on an annual basis and 1.45 million gallons per day during the peak season by 2014.

With the ongoing conservation of Bellevue and Cascade's other members, Cascade's 2014 WUE goal was achieved.

Table 5-1 shows the future demands projected by Cascade for all of its members, with and without additional conservation, through 2060[1]. The % reduction in water demand shown below is reflected in Bellevue's projections shown in Figure 3-23 and Figure 3-24.

Table 5-1: Cascade Water Alliance Long-Term Water Use Efficiency Goals

	Without Conservation		With Conservation		Difference		% Reduction	
Year	ADD	MWD	ADD	MWD	ADD	MWD	ADD	MWD
2010	41	77.91	40.5	76.95	-0.5	-0.96	1.2%	1.2%
2012			Interpolated				2.0%	2.0%
2020	43.49	82.63	41.3	78.47	-2.19	-4.16	5.0%	5.0%
2024			Interpolated				5.8%	5.8%
2030	50.13	95.26	46.6	88.54	-3.53	-6.72	7.0%	7.1%
2034			Interpolated				7.6%	7.6%
2040	56.01	106.42	51.3	97.47	-4.71	-8.95	8.4%	8.4%
2050	63.45	120.56	57.9	110.01	-5.55	-10.55	8.7%	8.8%
2060	71.36	135.58	65.3	124.07	-6.06	-11.51	8.5%	8.5%

Water Savings Measures

Bellevue and Cascade use multiple measures to achieve our water savings goals.

Bellevue's tiered rate structure encourages water efficiency. For residential accounts, volume rates increase above the tiered thresholds of 11 CCF, 17 CCF, and 45 CCF (CCF = 100 cubic feet = 748 gallons). For non-residential accounts, higher rates apply for irrigation meters than for domestic meters. For non-residential accounts with no separate irrigation meter, water rates increase during summer to encourage irrigation efficiency.

Table 5-2 shows the current tiered rate structure adopted for 2015.

[1] Transmission and Supply Plan, Table 4-5. Cascade Water Alliance, July 2012.

Table 5-2: 2015 Tiered Rate Structure Volume Charges ($ per CCF)

WATER UTILITY

WATER UTILITY RATES [BI-MONTHLY CHARGES]

DOMESTIC METERS	
5/8" OR 3/4"	$40.19
1"	$71.13
1-1/2"	$120.34
2"	$184.94
3"	$404.04
4"	$595.27
6"	$1,114.24
8"	$1,733.40
10"	$2,434.58
DOMESTIC/ FIRE COMBO METER	
1"	$43.12
1-1/2"	$47.44
2"	$66.44
CAPITAL RECOVERY CHARGE (WATER)	
SFE (SINGLE FAMILY EQUIVALENT) PER MONTH FOR 10 YEARS	$29.06

IRRIGATION METERS	
5/8" OR 3/4"	$40.19
1"	$71.13
1-1/2"	$120.34
2"	$184.94
3"	$404.04
4"	$595.27
6"	$1,114.24
8"	$1,733.40
10"	$2,434.58
SERVICE CHARGE FOR PRIVATE FIRE PROTECTION	
5/8" OR 3/4"	$22.01
1"	$25.56
1-1/2"	$29.21
2"	$39.19
3"	$112.55
4"	$139.72
6"	$203.17
8"	$275.60
10"	$339.04

CONSUMPTION CHARGES (VOLUME CHARGES PER CCF)	
SINGLE FAMILY	
0 - 11 CCF	$3.16
12 - 17 CCF	$4.00
18 - 45 CCF	$5.26
OVER 46 CCF	$7.50
MULTI FAMILY	
ALL NON-SUMMER CONSUMPTION	$3.96
ALL SUMMER CONSUMPTION (JULY TO OCTOBER)	$5.42
NON-RESIDENTIAL	
ALL NON-SUMMER CONSUMPTION	$3.98
ALL SUMMER CONSUMPTION (JULY TO OCTOBER)	$5.45
IRRIGATION	
IRRIGATION CCF	$7.39

Cascade Water Alliance administers numerous conservation programs on behalf of Bellevue. Some of these programs include:

- **Gardener Classes**. Cascade offers free gardening classes at various community centers and nurseries throughout its members' service areas. Classes focus on a variety of topics, but fall into two general subject areas. The first series of classes, focusing on garden design, native plants and sustainability, are taught by master gardeners and horticulturalists. The second series of classes provide information on irrigation options.
- **Natural Yard Care Education**. Cascade's website provides educational information regarding watering practices, soil health, composting, plant selection, and mulching. This is provided to encourage both water conservation, through reduced home irrigation, and groundwater protection through reduced fertilizer and pesticide use.
- **School Programs**. Cascade partners with Nature Vision, a non-profit organization that provides a range of 1-hour environmental education programs in local schools, including several water conservation and source protection-related programs. In "Water Cycle", students play the role of a water drop through the various stages of the hydrologic cycle. "Enviroscape" uses a tabletop model to inform students about watersheds and pollution sources. "Water Supply" explores our water's path from mountains to faucet. "Water Conservation" encourages sustainability of water resources, and "Groundwater" describes groundwater and the importance of wells to our community.
- **School Demonstration Projects**. Cascade offers assistance in setting up rainwater harvesting and drip irrigation systems at eligible schools with garden sites.
- **WaterSense Partnership**. As part of Cascade's partnership with the EPA WaterSense program, free showerheads, faucet aerators, toilet leak detection dye kits, shower timers and other conservation items are provided at no cost to eligible homeowners.
- **Built Green & WaterSense New Homes Incentive Program**. Cascade has initiated an incentive program for builders who combine both Built Green and WaterSense certifications for new single-family and multi-family homes. The current incentive is $1,000 per home. Approximately 2500 higher efficiency fixtures were installed in 2014.
- **Commercial Fixture Installation**. Cascade installed more than 2100 new higher efficiency aerators, showerheads, and pre rinse spray valves at various commercial establishments this year.

WUE Planning Program

Bellevue and Cascade plan to continue their successful collaborative approach to accomplishing WUE goals in the future. This will include refinement of the water savings measures currently in place as described above, and establishment of updated goals.

In October 2013 Cascade adopted a single, regional water efficiency savings goal on behalf of all its members for the planning period 2014 – 19. The goal is a cumulative savings of 0.6 million gallons per day on an annual basis and 1.0 million gallons per day on a peak season basis by 2020. In 2014 Cascade achieved a savings of 178,000 gallons per day on an annual basis, or about 30% of its six-year annual savings goal.

Major program activities for the 2014 – 19 period will include:

- Irrigation evaluations and retrofit projects
- Water audits and retrofits for selected properties
- Toilet, showerhead, and faucet aerator replacements and incentives
- Education through schools, gardening classes, community events, and industry training.
- Collaborations with organizations such as Built Green, Puget Sound Energy, Seattle Tilth, EPA, and Washington State Nursery and Landscaping Association to promote efficiency and sustainability in current and future water-use practices.

Cascade has $843,000 budgeted annually for its WUE program for 2015-2016.

Metering

All of Bellevue's water sources are metered. Information on regional water supply inlet meters is shown in Table 1-1. Metered connections to adjacent utilities are shown in Table 1-2.

Bellevue meters all domestic and irrigation customer connections, satisfying the metering requirements of WAC 246-290. More information on customer metering is provided in Sections 3.1, 3.2, 4.4 and 6.3.

Fire sprinkler connections typically are not metered, due to no anticipated demands and the relatively high cost of a meter and vault installation for these large pipelines. However, a "tattletale" device is typically installed at the backflow preventer to indicate if any usage does occur.

Where practicable, water consumed for controlled water utility maintenance activities (flushing, disinfection, reservoir draining, etc) is directly metered. However where direct metering is not feasible, volumes are calculated based on tank level, dimensions, etc, and later accounted for when reporting non-revenue flow.

Some known water demands are unmetered, such as fire fighting, water main breaks, and limited other uses. These flows are approximated based on the best available information, such as local pressure, main size, flow duration, etc, and also accounted for when reporting non-revenue flow.

Water Loss

Overall statistics for Bellevue's non-revenue flow (as a % of total water supplied) during the 2005-2014 period are provided in Chapter 3. Non-revenue flow includes authorized, un-billed consumption as well as water loss.

Beginning in 2009, Bellevue began tracking these volumes in greater detail. Table O-1 through O-6 in Appendix O show the City's annual water balance in AWWA's format[1] from 2014 back to 2009.

Some non-revenue water demand may be due to meter inaccuracies and not actual water loss. It is anticipated that the implementation of AMI (Section 4.4) and large commercial meter replacement (Section 8.6) may reduce apparent non-revenue demands.

Annual Reporting

Annual reporting of Bellevue's WUE measures is currently performed by Cascade, based on Annual Member Surveys provided by the City. Prior to 2010, Bellevue WUE measures were reported by SPU, based on wholesale customer survey forms provided by the City.

Bellevue's annual surveys and wholesale customer survey forms for water usage in calendar years 2005 through 2014 are provided in Appendix P.

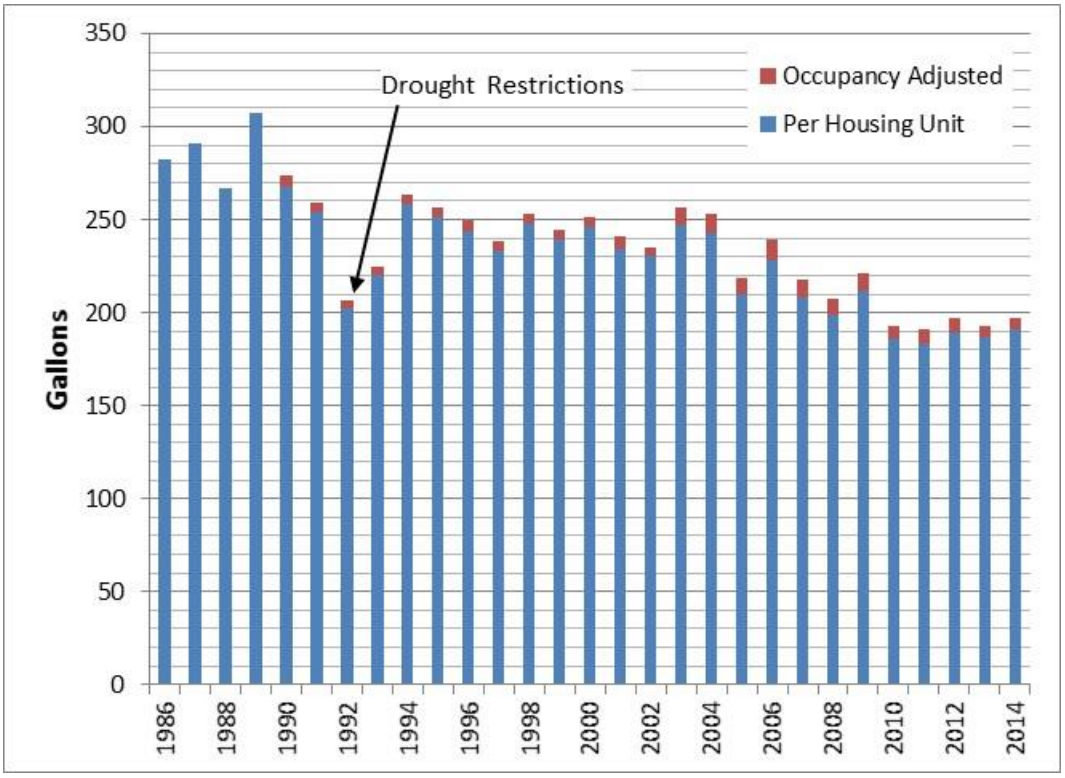
5.2 Water Supply and Demand Characteristics

Recent trends for total consumption as well as diurnal and seasonal demand patterns are described in Chapter 3. Longer-term trends and the effects of conservation are discussed below.

Approximate single family residential water consumption trends over time are shown in Figure 5-1. This data does not represent ERUs (a precise ERU estimate is in Figure 3-5), but represents total retail demand per SF billing account, plus a rough adjustment for occupancy rates. Assumed occupancy rates are extrapolated to the entire service area based on data for the City of Bellevue only (service area-wide occupancy data is not available). The information is presented this way to match the historical data shown in the 2006 Water Comprehensive Plan in a consistent format, but updated with recent years and an adjustment to account for fluctuations in vacancy.

[1] AWWA Manual M36 – Water Audits and Loss Control Programs. 3rd Ed, 2009.

Figure 5-1: Average Daily SF Residential Consumption per SF Account



Although drought restrictions (1992) and increased consumption during hot summer years (2006 and 2009) are reflected in Figure 5-1, a general long-term trend toward lower single-family residential water consumption per account is apparent. It is unclear to what extent this can be attributed to the City's conservation programs, rate structure, or to higher-efficiency plumbing fixtures installed in new housing stock.

Figure 5-2 shows trends in multi-family water consumption over time. These numbers represent billed MF retail consumption per estimated number of MF units provided by PCD. Similar to Figure 5-1, the adjustment for assumed occupancy rates is based on the City of Bellevue only, extrapolated to the entire service area.

Figure 5-2: Average Daily MF Residential Consumption per Total # of MF Units

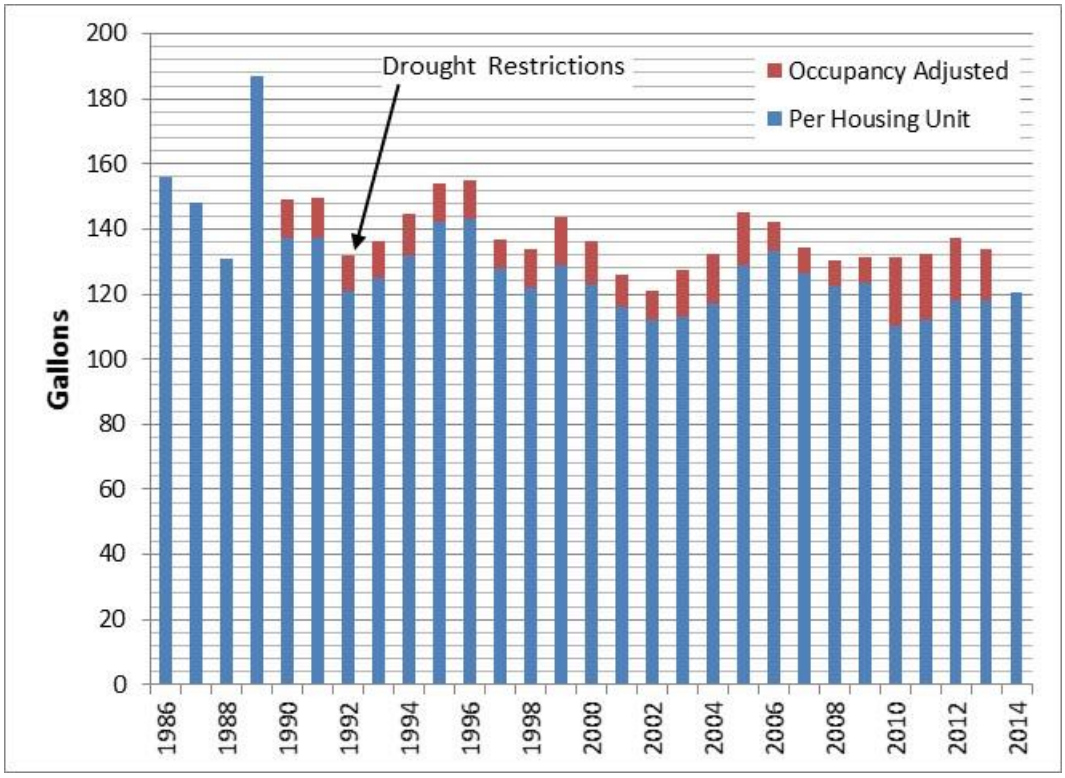
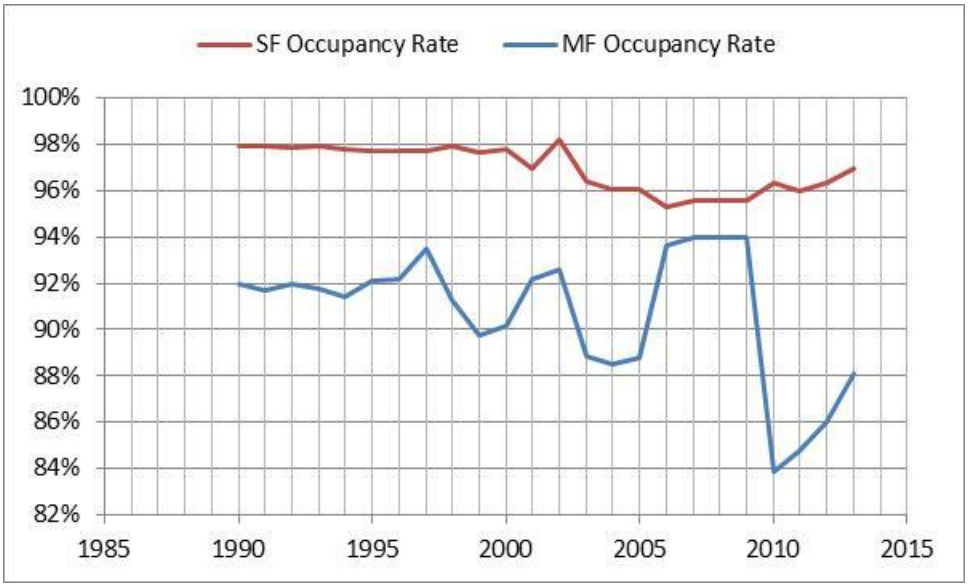


Figure 5-3 shows SF and MF occupancy rates in the City of Bellevue (only) since 1990. This data does not include other parts of the water service area (Points communities, South Cove, etc), but reflects the majority of Bellevue's retail water sales, such that it is assumed that this percent occupancy can be applied over the entire service area.

Figure 5-3: Recent City of Bellevue Residential Occupancy Rates



Due to the recent stabilization of per capita water demands (2010-2014 in Figure 5-1), it is recommended that additional conservation not be assumed for the purpose of sizing new facilities. Although a slight long-term trend toward lower multi-family residential water consumption may be apparent, both per capita (Figure 3-3) and per MF housing unit consumption (Figure 5-2) show fairly stable water usage during the past 10 years, with slight increases from 2010-2014. Single-family consumption (Figure 5-1) showed a similar plateau during this period, with slight increases per household from 2010-2014.

5.3 Reclaimed Water

Bellevue participated in Cascade's reclaimed water evaluation[1], which identified potential sources and customers for reclaimed water. Potential sources include KCWTD's South Treatment Plant in Renton, and King County's Brightwater Treatment Plan near Woodinville.

The City has also completed an update of King County's Reclaimed Water Checklist (Appendix Q), which evaluates the 20 largest customer accounts by volume for potential reclaimed water demands. Bellevue's largest customers are not potential candidates for reclaimed water because they use water for food & beverage processing or for medical purposes. However, some significant irrigation customers were identified.

At this time, reclaimed water does not appear to be an economically viable option in Bellevue due to the cost of building transmission pipelines and the de-centralized location of potential irrigation customers. However, the City continues to work with Cascade and KCWTD to evaluate feasible opportunities.

5.4 Shortage Management Plan

Bellevue recently updated its Shortage Management Plan to maintain consistency with SPU's Water Shortage Contingency Plan[2] and Cascade's Shortage Management Plan[3]. These three plans delineate each utility's responsibilities in a water shortage, including media relations, customer outreach, enforcement, operational changes, and other measures to curtail water demands.

Bellevue's new Shortage Management Plan is attached in Appendix R.

[1] Transmission and Supply Plan, Appendix D. Cascade Water Alliance, July 2012.
[2] 2007 Water System Plan, Appendix I.D. Seattle Public Utilities, July 2006.
[3] Transmission and Supply Plan, Appendix C. Cascade Water Alliance, July 2012.

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Chapter 6 Operation and Maintenance

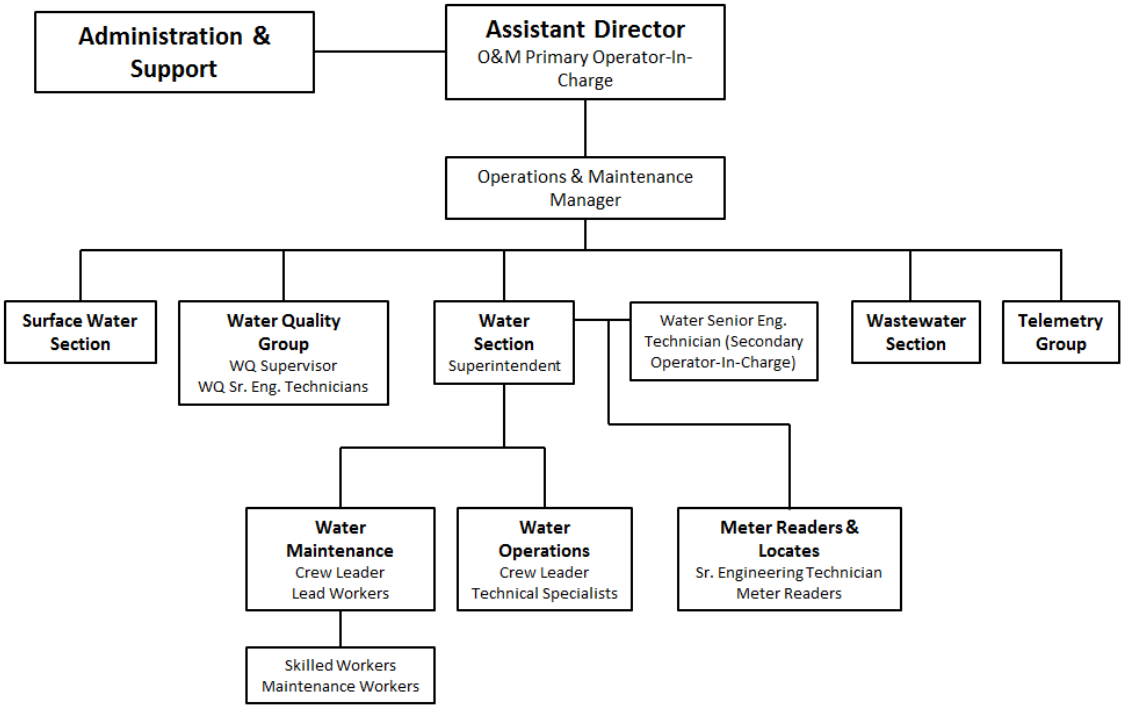
This chapter discusses current City of Bellevue water utility operations and maintenance programs. A description of the Utilities Department's overall organizational structure, including the role of the O&M Division is provided in Chapter 1.

The City of Bellevue Utilities Department is accredited by the American Public Works Association (APWA) as being in compliance with internationally developed and accepted standards for water utility operations. The City's O&M Water staff operate and maintain the water system in accordance with City policy, accepted industry standards, and DOH requirements.

6.1 Water System Management and Personnel

Figure 6-1 shows the overall structure and leadership of Bellevue's Utilities Department. For clarity, detailed staff information is not shown for the Wastewater or Storm & Surface Water sections, or for administrative & support staff.

Figure 6-1: O&M Division Organization Chart



This chapter focuses on the Water Section within O&M. Chapter 7 focuses on the Water Quality Group and water quality related programs.

6.2 Operator Certification

Table 6-1 lists the titles, certification and number of filled positions for current water system staff in the O&M Division. Staff continually maintain this certification through continuing education. The definition and duties of certified waterworks operators are defined in WAC 246-292.

Table 6-1: Current O&M Water Section Staff

Position Title	Certification	Number of Positions
O&M Assistant Director[1]; Primary Operator in Charge	WDM 4, CCS	1
O&M Manager[1]	None	1
Water Superintendent	WDS	1
Water Quality Supervisor[1]	WDM 2, CCS, BAT	1
Water Quality Senior Engineering Technician[1]	WDM 4, CCS, WTPO 3	1
Water Quality Senior Engineering Technician[1]	WDM 2, CCS, WTPO in training, BAT	1
Water Senior Engineering Technician	Expired	1
Water Senior Engineering Technician	WDS, CCS, WDM2	1
Water Maintenance Crew Leader	WDS, CCS	1
Water Operations Crew Leader	WDS, CCS, WDM2	1
Water Technical Specialist	WDS, CCS, WDM2	1
Water Technical Specialist	WDS	4
Water Lead Worker	WDS	5
Water Skilled Worker	WDS	6
Water Skilled Worker	WDS, CCS	1
Water Maintenance Worker	None	3
Meter Reader	None	5

1 O&M Assistant Director, O&M Manager, and Water Quality staff provide support for all 3 Bellevue utilities, including water, sewer and stormwater.

A former O&M Senior Engineering Technician with WDM 4 certification now works as the City's Asset Manager in the Director's Office (see Figure 1-2), and is available to serve O&M needs during an emergency.

6.3 Maintenance and Repair Procedures

Bellevue's O&M staff operate and maintain the existing water distribution system, while also assisting with rapid system growth and the extension of service to new or redeveloping customers. Staff are also available and trained to support Transportation during snow and ice events as well as 24/7 emergency response. Procedures for many routine O&M tasks are documented in formal standard operating procedures (SOPs), some of which are included in Appendix S.

Bellevue's employees are provided with appropriate safety and personal protective equipment for the tasks and work environments they encounter as part of their jobs. Staff are also provided with necessary training to ensure that they understand and practice all applicable safety regulations.

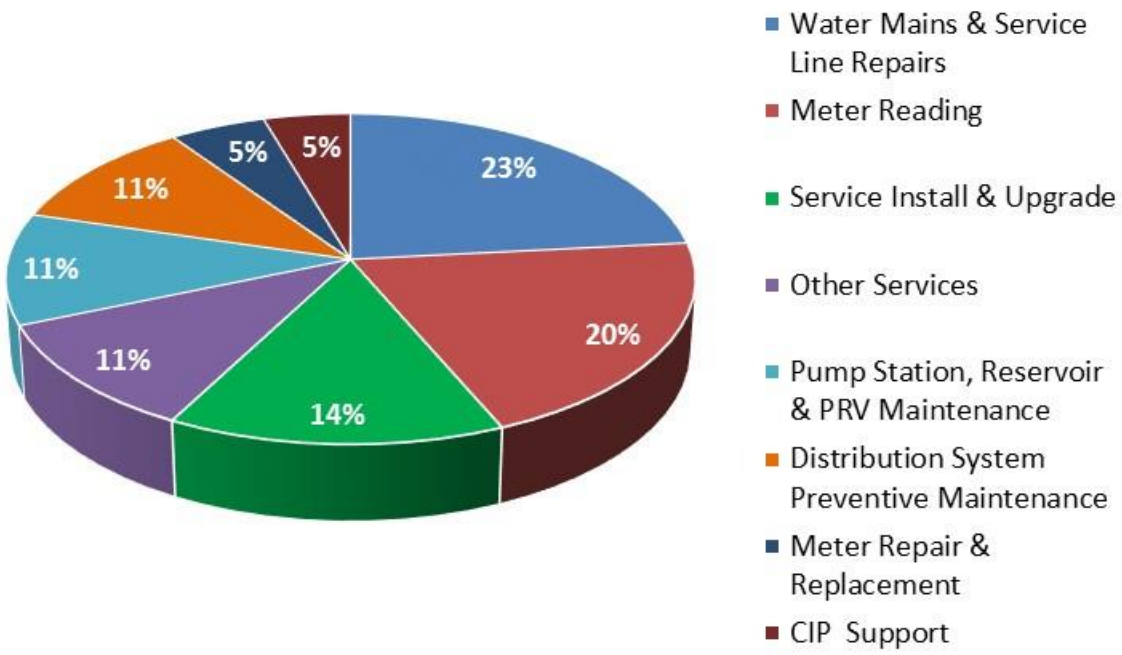
When local water service is interrupted for any reason, the Utility's standard procedure is to work continuously until service is restored. Dedicated staff are on call 24 hours a day so that necessary repairs to the system can be made promptly.

Preventive maintenance consists of regularly servicing pumps and motors, PRVs, exercising valves and fire hydrants, cleaning reservoirs, and flushing water mains. It is essential for the proper and efficient operation of the water system, and for optimizing the useful life of infrastructure. Maintenance procedures are defined in SOPs and/or operations & maintenance manuals for each facility.

O&M establishes goals for maintenance intervals based on industry standards, manufacturer recommendations, asset risk & criticality, and available resources. O&M has the flexibility to optimize or defer lower-priority maintenance activities in order to respond to emergencies, developer extensions, or special projects. Actual maintenance achievements are documented and tracked in the City's Covalent performance management system, and are reviewed annually to assess whether staffing levels and the goals themselves are still appropriate.

Figure 6-2 shows the most recent (2014) distribution of O&M labor in the City's O&M Water Section.

Figure 6-2: 2014 O&M Workload (% of Total Labor Hours)



O&M procedures for specific types of assets and facilities are described in the following pages. Recent statistics are shown from 2011 (first year of current data tracking methods) through 2014.

Service Connections

Service connections generally include piping from the water main to the customer's meter or fire suppression system. In 2014 there were more than 42,000 active service connections in the City's service area. The number of connections exceeds the number of accounts, because many commercial and multi-family customers have multiple service connections (e.g. irrigation and/or fire suppression, separate from domestic supply). There are also more service connections than meters, because fire suppression systems typically have separate service connections that are not metered.

O&M staff perform service connection relocations and upgrades (to serve redevelopment of existing properties), as well as new service installations (on previously undeveloped properties). Figures 6-3 and 6-4 show recent service connection statistics.

Figure 6-3: Service Upgrades & Relocations

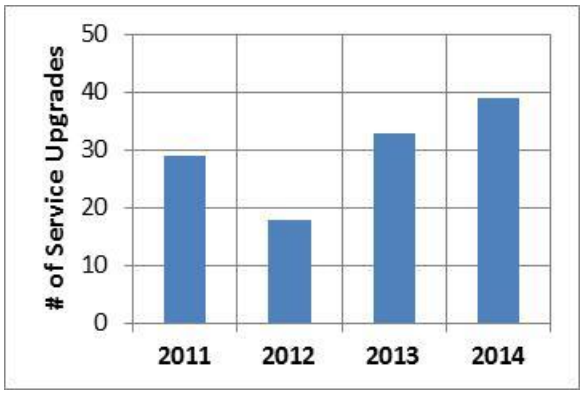
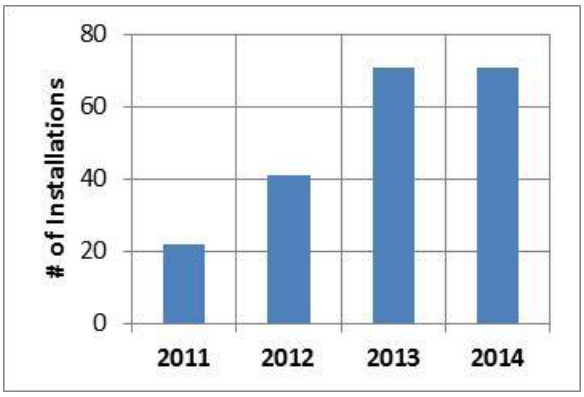
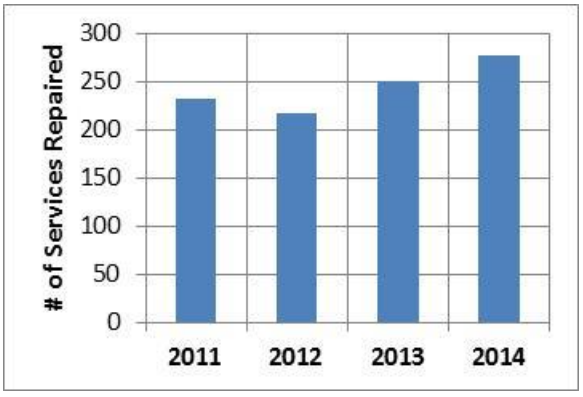


Figure 6-4: New Service Installations



Service connections generally require little maintenance once installed, although failure at service saddles (connections to the water main) occasionally cause leakage due to corrosion, disturbance (from nearby construction, etc) or other factors. Often what is initially believed to be a water main break can actually be a failed saddle. Figure 6-5 quantifies recent service connection repairs. These repairs are all performed by

Figure 6-5: Service Repairs



O&M staff, and are separate from the contracted work performed under CIP W-99 Water Service Line and Saddle Replacement Program.

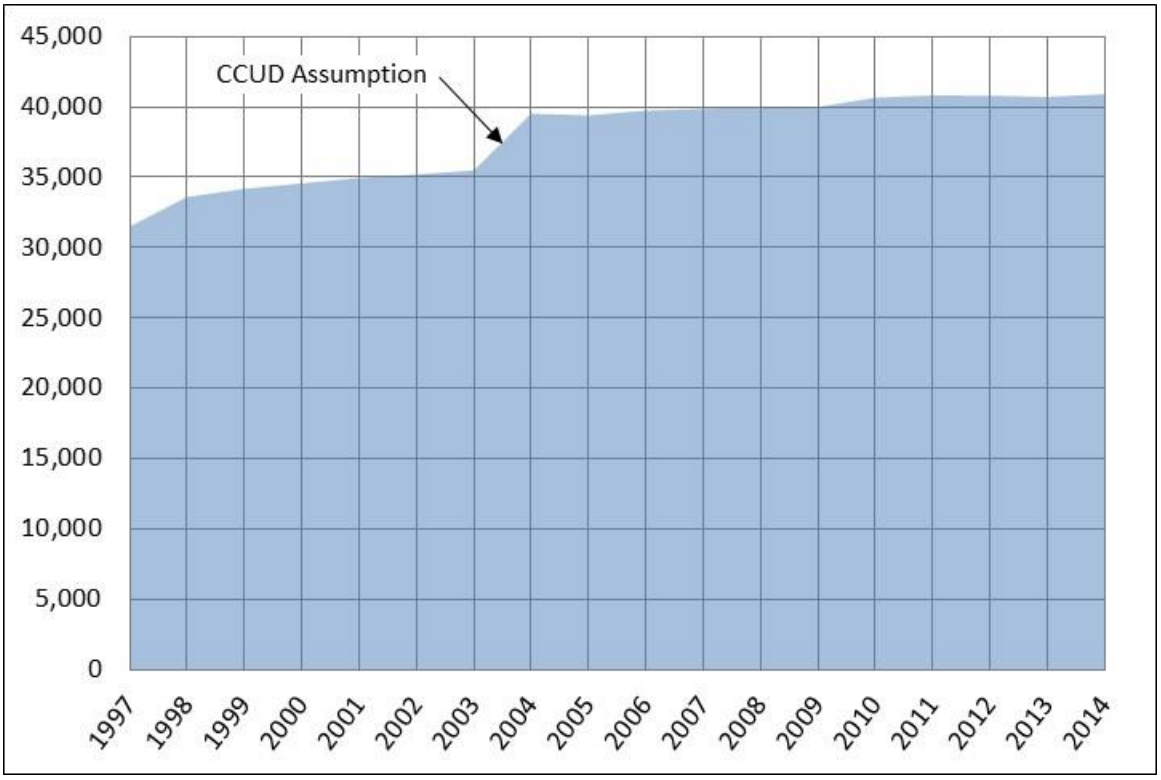
The City also replaces service saddles during water main replacement, and when appropriate may evaluate replacement of aging service saddles when potential coordination opportunities arise, such as adjacent projects in the ROW.

Customer Meters

O&M is responsible for installing, reading, and maintaining all commercial and domestic meters. They work closely with utility Billing staff to assure customers are billed accurately on a bi-monthly cycle. In addition to normal meter reading and maintenance, meter reading staff are responsible for meter turn-on/shut-off when an account is opened or closed, and field response when necessary due to billing questions or problems.

In 2014, O&M's staff of 5 meter readers performed over 247,000 reads on nearly 41,000 meters. This level of staffing has remained constant since 2004, following the assumption of CCUD assets within the City of Bellevue (see Figure 6-6).

Figure 6-6: Meter Reading Workload



O&M staff perform both replacement of aging customer meters ("Change-outs") and the installation of new meters ("drop-ins"). Old meters 2" diameter and smaller are currently replaced on an as-needed basis, while AMI is being considered (a proactive replacement

program will be implemented when new meter standards are established). New drop-in meter installation workload varies based on development activity. Actual recent workload statistics for small meters (≤ 2-inch diameter) are shown in Figures 6-7 and 6-8. The Water Meter Installations SOP in Appendix S describes this work in more detail.

Figure 6-7: Small Meter Replacement

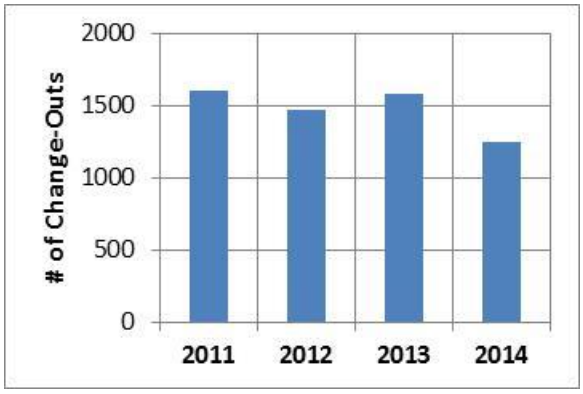
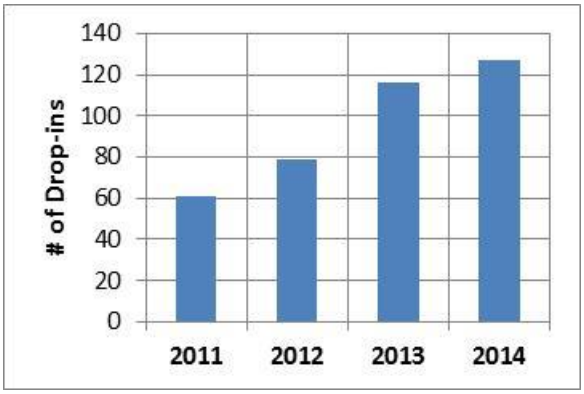
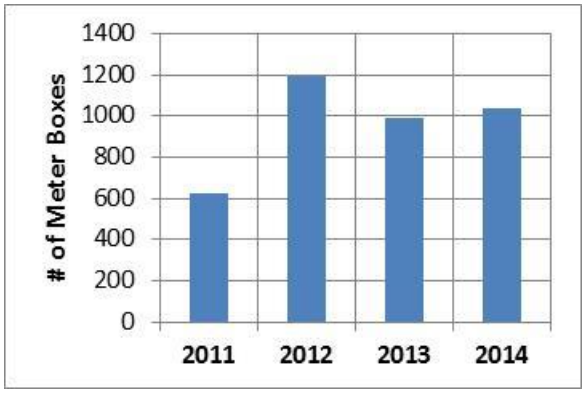


Figure 6-8: New Small Meter Installations



O&M staff perform meter box maintenance. For small meters, this work includes box adjustment, internal cleaning, external clearing, etc, as well as replacement of the box lid and/or inspection plates when required. Figure 6-9 shows recent statistics.

Figure 6-9: Meter Box Maintenance



Bellevue has approximately 300 “large” commercial meters (3” diameter and larger). O&M’s current practice is to survey and test each commercial meter for accuracy every five years, although AWWA and meter manufacturers typically recommend annual testing. The City will re-evaluate the appropriate testing frequencies as part of the AMI assessment and development of the 5-Year Strategic Asset Management Roadmap (see Chapter 8). Figures 6-10 and 6-11 show recent meter survey/testing and repair statistics, respectively.

Figure 6-10: Commercial Meter Surveys

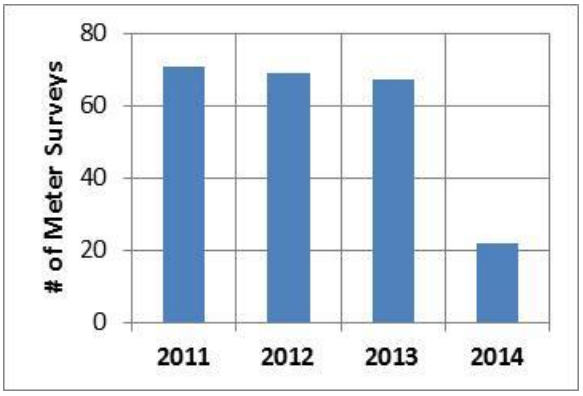
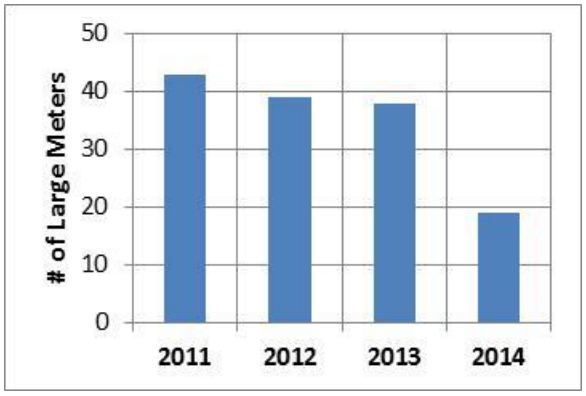


Figure 6-11: Large Meter Repair/Change-out

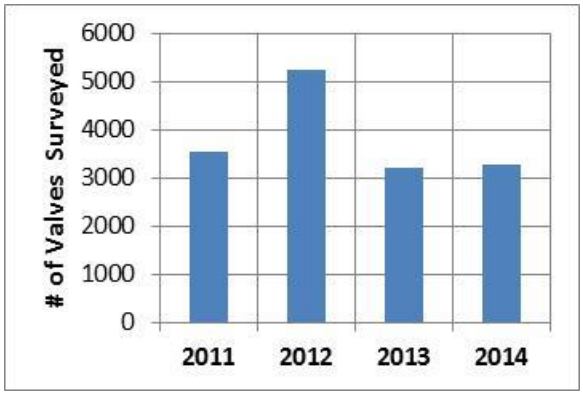


Isolation Valves

Each valve is inventoried with a unique asset number in the City's Maximo database, and mapped in the City's GIS geodatabase. Work order history and information such as the type of valve, size, number of turns to close, etc is stored in Maximo.

O&M conducts routine surveys of all isolation valves in the system, as described in the Valve Survey SOP in Appendix S. O&M has a current annual goal of surveying and fully exercising 33% of distribution system isolation valves (each valve every three years). Figure 6-12 shows recent valve survey statistics.

Figure 6-12: Valve Surveys



AWWA[1] recommends that gate valves be exercised from full open to full close and back to open at least once every five years, with a less intensive visual inspection performed annually. Bellevue performs a full valve survey every three years, which combines visual observation and exercise into one visit.

O&M also performs isolation valve repairs as needed. Currently O&M staff record observed deficiencies during valve survey (e.g. valve not seating properly or water leaking through) for later repair. Valve repair workload varies on a priority basis, depending on other workload.

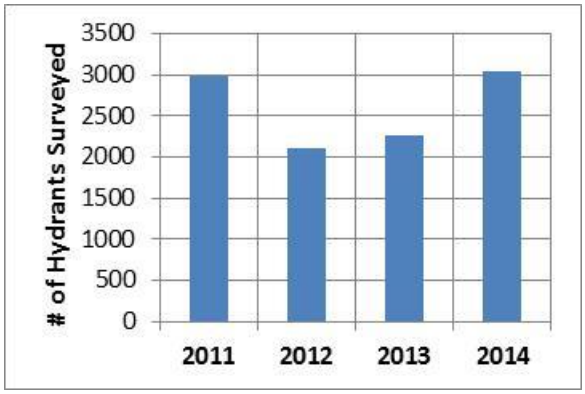
[1] AWWA Manual M44 Distribution Valves: Selection, Installation, Field Testing, and Maintenance

Fire Hydrants

Each public fire hydrant is inventoried with a unique asset number in Maximo, and mapped in the City's GIS geodatabase.

O&M's goal is to survey each public hydrant every other year. Hydrant surveys include full operation of the hydrant, plus inspection. Potential concerns such as leaks, difficulty opening or closing, drain malfunction, lack of visibility or access, etc are documented and flagged for follow-up. The Fire Hydrant Survey SOP is included in Appendix S. Figure 6-13 shows recent hydrant survey statistics.

Figure 6-13: Fire Hydrant Surveys



AWWA[1] recommends annual hydrant inspection, or semi-annual inspection in freezing climates. Hydrant manufacturers[2,3] typically recommend semi-annual inspection and operation.

Figures 6-14 and 6-15 indicate the quantity of hydrants for which additional maintenance or repair was performed. Hydrant maintenance may include cleaning, lubing, painting and/or rotating the hydrant, cleaning & adjusting of the foot valve box, and/or clearing a three-foot radius of overgrowth to meet Fire Code requirements. Hydrant repair includes more major work such as parts replacement of fire hydrant assembly, foot valve and or piping. Maintenance or repair might also include adjusting the ground surface. Currently the City's goal is to repair inoperable hydrants within 10 business days of discovery, with more minor work orders addressed on a priority basis.

The City's fire hydrant inventory includes a wide variety of different hydrant models, sizes, and manufacturers. This lack of consistency reduces O&M productivity and efficiency, due to the need for separate spare parts, training and maintenance procedures for each unique type of hydrant. The City recently reduced the number of acceptable fire hydrant manufacturers in the Water Engineering Standards, to address performance issues and to help mitigate the ongoing, long-term inefficiency of maintaining excessive different types of hydrants, however this will not affect the near-term hydrant workload.

[1] AWWA Manual M17 Installation, Field Testing and Maintenance of Fire Hydrants
[2] Operation and Maintenance Manual, Waterous 5-1/4" Pacer Fire Hydrant. American Flow Control, 2014.
[3] WaterMaster 5CD250 Installation, Operation & Maintenance Manual. EJ Group (E. Jordan Iron Works), 2015.

Figure 6-14: Hydrant Maintenance

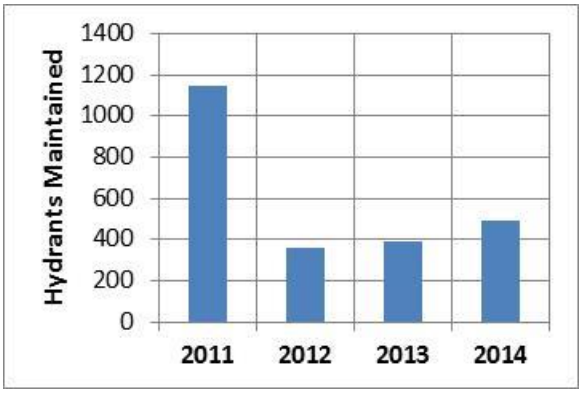
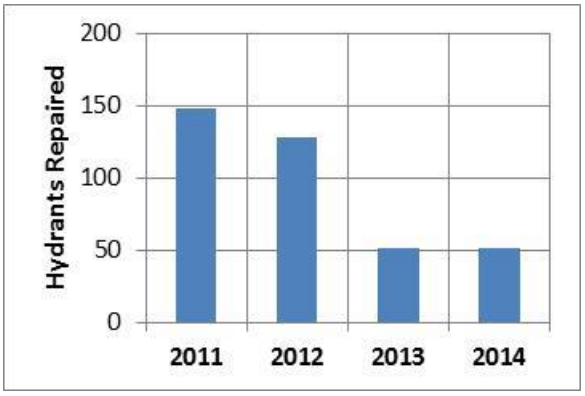


Figure 6-15: Hydrants Repairs

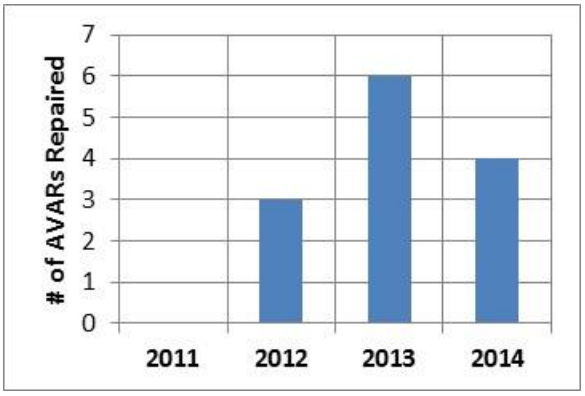


Air Vacuum/ Air Release Valves

Each air vacuum/ air release valve (AVAR) is inventoried with a unique asset number in Maximo. AVARs do not require extensive maintenance, but are repaired when necessary. Figure 6-16 shows recent repair statistics.

O&M performed a system-wide survey of AVAR installations in 2015 to evaluate potential water quality risks. This evaluation is discussed in Chapter 4.

Figure 6-16: AVAR Repairs

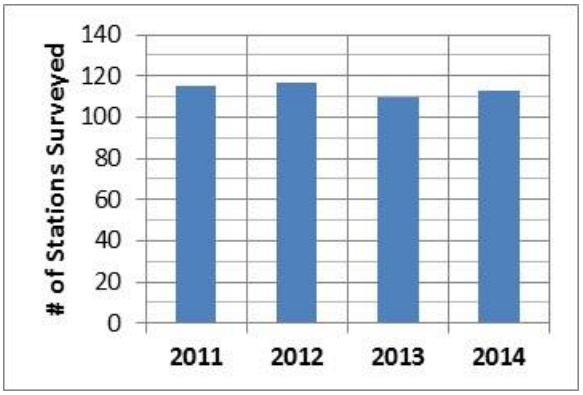


Pressure Reducing Valves

Each PRV station and inlet station is inventoried with a unique asset number in Maximo (shown in Table 1-7). Individual valves, including parallel low flow (2" to 3" diameter) and high flow (6" to 8" diameter) PRVs and settings are listed as attributes, along with ancillary equipment such as pressure relief valves. Work order history is also stored in Maximo.

PRV stations and Inlet stations (which include PRV valves) are typically surveyed on an annual basis. PRV surveys include only a visual check to identify access problems, leaks, plugged drains, hatch/vault condition, etc, and do not include valve maintenance. Figure 6-17 shows recent PRV and inlet station survey statistics.

Figure 6-17: PRV and Inlet Station Surveys



Figures 6-18 and 6-19 indicate the quantity of valves in inlet stations and PRV stations (most PRV stations include 2 pressure reducing valves) for which additional maintenance or repair was performed. PRV maintenance includes replacement of diaphragms & other rubber parts, inspection of all metal parts (with replacement when necessary), removal of debris from controls & copper piping, and valve setting adjustment. PRV repair includes major repair and replacement of valves and/or components such as the vault and access hatch.

Figure 6-18: PRV Maintenance

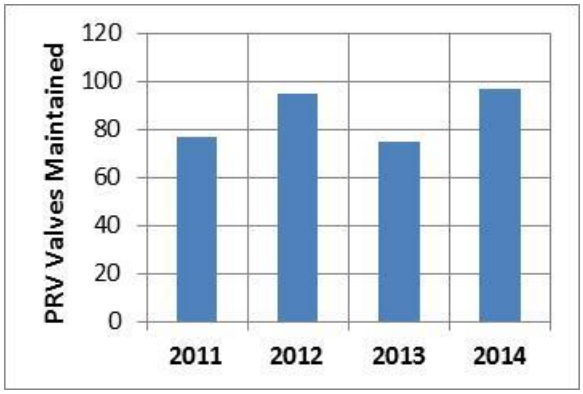
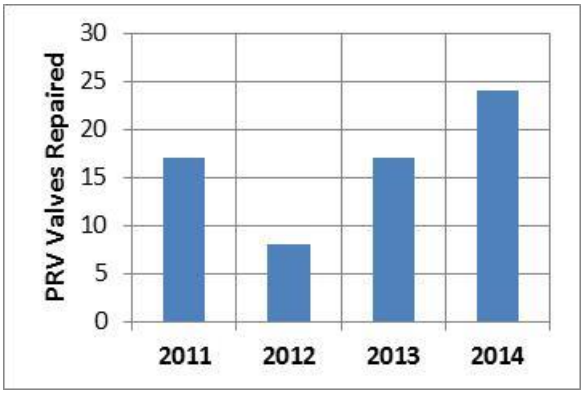


Figure 6-19: PRV Repairs



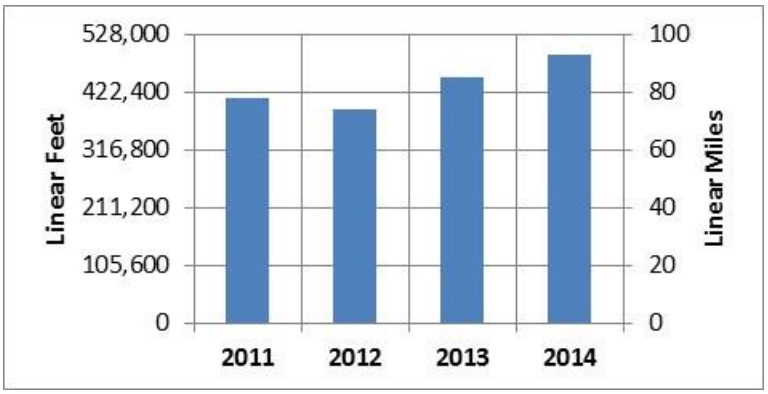
PRV maintenance intervals depend on valve function and criticality, but maintenance for each valve normally occurs every five years. Typically 20% of the system's PRVs are serviced each year. Inlet stations are assigned the highest priority.

Manufacturer recommendations for PRVs maintenance are evolving as valve materials change. For instance, newer epoxy coated valves may not need a complete disassembly and parts replacement every 5 years. PRV maintenance intervals may be re-evaluated as part of O&M optimization and the City's ongoing asset management program.

Distribution System Piping

The City monitors, operates and maintains the pipeline system on a continual basis. Uni-directional flushing is performed on all water mains to maintain water quality, in accordance with the zone flushing SOP included in Appendix S. The City's goal is to flush each main every six years, or an average of 17% of pipes (by length) each year. Recently, between 12-16% of pipeline mileage has been flushed each year, as shown in Figure 6-20.

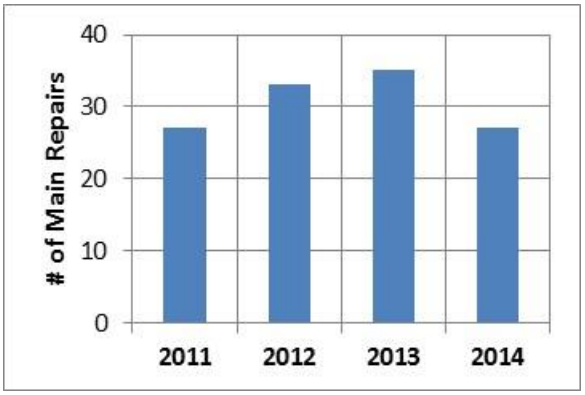
Figure 6-20: Water Main Flushing Statistics



During water main flushing, water is discharged to sewer and/or to storm drains, depending on local drainage infrastructure. When discharging to storm drains, the City de-chlorinates water flushed from water mains using an environmentally-sensitive method. Appendix S includes the potable water dechlorination SOP.

O&M staff also perform repairs in the case of observed defects. Figure 6-21 shows recent statistics on water main repairs, which include not only main breaks but also more minor repairs (data specific to water main breaks can be found in Chapter 8).

Figure 6-21: Water Main Repairs



Distribution system piping is mapped according to the best available information, and continually updated based on as-built data from public and private development projects. Each stretch of piping between significant fittings (isolation valves, hydrant stubs, customer connections, tees/crosses, etc) is inventoried with a unique asset number in Maximo and mapped in the City's GIS system. When available, this information includes year of installation, pipe material, diameter, and other parameters such as lining material. Work order history is also stored in Maximo for each asset, as applicable.

Reservoirs

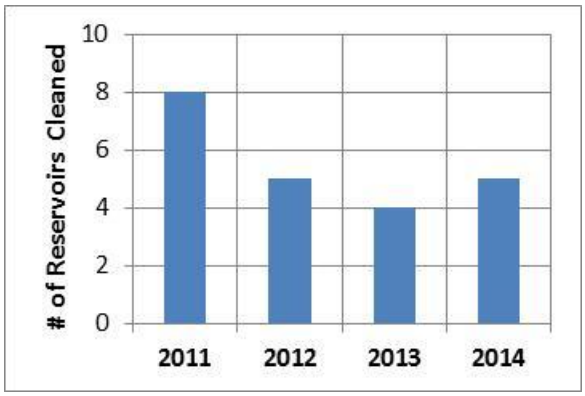
Each reservoir site is surveyed weekly by O&M staff, including a visual inspection of the grounds and perimeter. Reservoir survey statistics are combined with pump station surveys (see discussion in the next page), because these inspections are typically concurrent. A complete list of reservoir survey tasks is provided in the Pump and Reservoir Run SOP in Appendix S. AWWA[1] recommends that reservoirs be inspected at least monthly, or weekly if possible, and Bellevue meets this recommended inspection interval.

Additional reservoir site visits are conducted if an alarm requiring a response is triggered. In addition, annual inspections are performed to trip and test alarms, and check cathodic protection (of steel reservoirs) for normal operation.

Bellevue's telemetry system continually monitors and records the water level in each storage reservoir. If a problem occurs, the telemetry system triggers an alarm and O&M staff respond as appropriate. Telemetry staff perform an annual site visit at each reservoir to trip alarms and test

Figure 6-22: Reservoir Cleaning

Steel and concrete reservoirs are typically drained, cleaned, and inspected for structural integrity every five years. This includes inspection by Engineering and Water Quality staff. The numbers of recent cleanings completed are shown in Figure 6-22.



Figures 6-23 and 6-24 show the labor hours spent performing reservoir maintenance and minor repairs, respectively. Maintenance includes roof cleaning, clearing downspouts, maintenance of fall prevention systems, and other non-repair tasks. Minor reservoir repair work includes fixing broken ladders, cathodic protection systems, damaged vents or failed paint. More significant reservoir repairs are typically performed by contractors.

[1] AWWA Manual M42 Steel Water Storage Tanks

Figure 6-23: Reservoir Maintenance

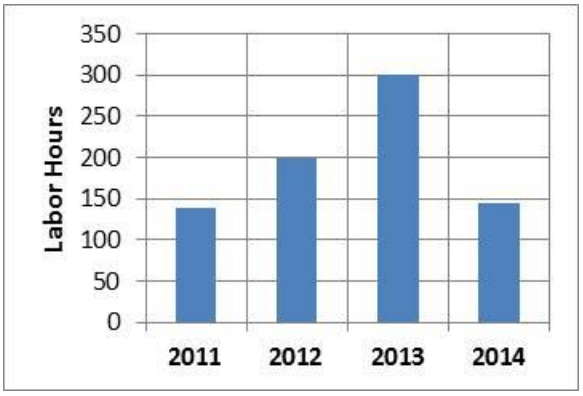
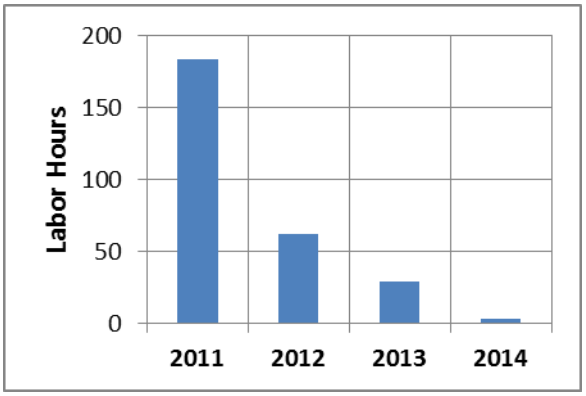


Figure 6-24: Reservoir Repairs

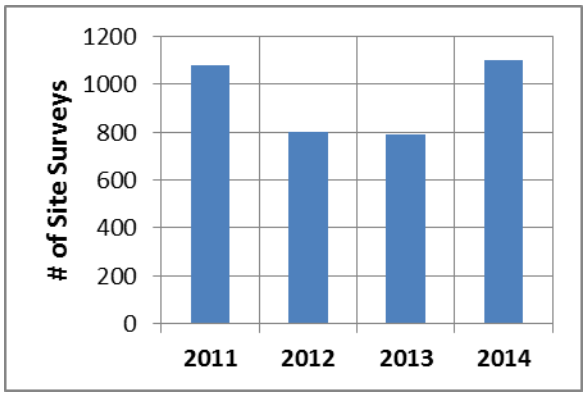


Minor reservoir repairs (Figure 6-24) are typically not critical to safety or public health, and are performed on a priority basis, so that O&M staff have flexibility to address the most critical needs. The reduced number of repairs performed by O&M in 2014 reflects increased workload on higher-priority tasks. Major or more critical repairs (not shown in Figure 6-27) are typically performed by contractors and/or managed by the Engineering Division.

Pump Stations

Each pump station is surveyed weekly by O&M staff, as shown in Figure 6-25 (this includes reservoir surveys; typically on the same sites). Survey tasks are described in the Pump and Reservoir Run SOP in Appendix S. During these visits, diesel-driven pumps and generators are exercised, visual checks are made of the grounds, and the station is observed for security issues, leaks, unusual odors, noise, etc.

Figure 6-25: Pump Station & Reservoir Surveys



Additional site visits are conducted as required for longer-term maintenance needs, or if triggered by an alarm. All pump motors are lubricated and load tested annually, with other maintenance performed as needed.

On-site generators are maintained by a contracted service provider, including a semi-annual oil change at each. Portable generators are maintained by City of Bellevue Fleet Services.

Figure 6-26 shows O&M labor hours for pump station building & grounds maintenance, such as sweeping, cleaning, graffiti removal, and similar activities. Figure 6-27 shows labor maintaining pump station components, including pumps, motors, valves and generators.

Figure 6-26: Pump Station Building & Grounds Maintenance

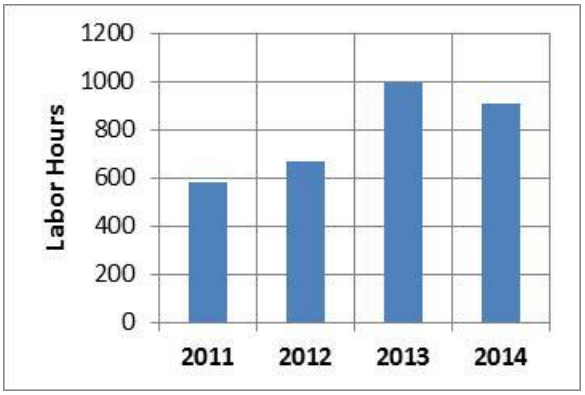
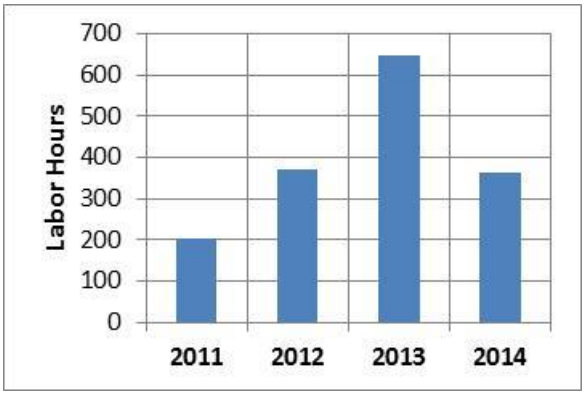


Figure 6-27: Pump Station Component Maintenance



In addition to the general maintenance activities described above, O&M staff perform some repairs to pump station buildings (including fences and gates), and some minor pump & motor repairs, including components such as shafts and couplings. Major pump station upgrades or repairs are typically performed by contractors.

Emergency Wells

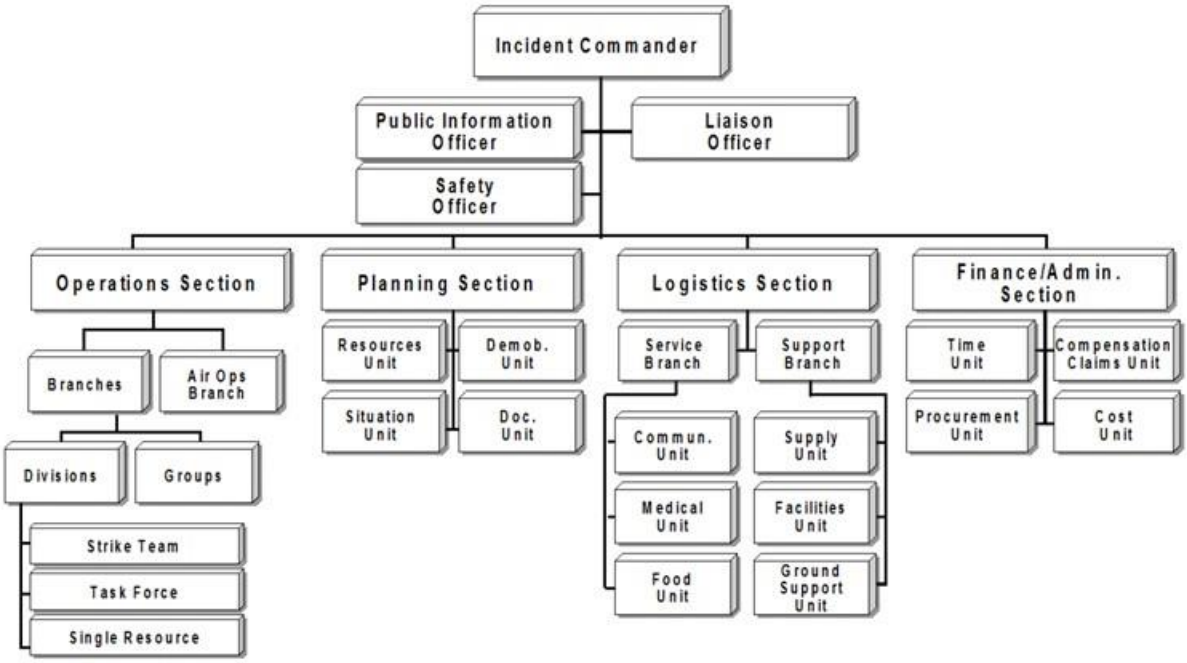
O&M Staff perform quarterly sampling, maintenance and site surveys at the emergency well locations. The site surveys include an inspection for security concerns (vandalism, etc) and/or maintenance problems (excess vegetation, etc). Maintenance includes pumping the well to confirm operation and obtain representative groundwater. Quarterly sampling is conducted for coliform and nitrate.

Annually, O&M staff perform an extended survey. The annual survey includes all quarterly tasks, plus a sanitary inspection of vent screens and seals around well access boxes, a check for new threats within the wellhead protection radius, and any evidence of ponding water. Annual surveys also include an extended flush of the well and sampling for complete inorganics (IOCs), volatile organics (VOCs), and synthetic organics (SOCs).

6.4 Emergency Operations

The City of Bellevue Fire Department, Office of Emergency Management maintains an Emergency Operations Center (EOC), to coordinate City-wide response from all departments in the event of a large emergency or disaster. When activated, the EOC operates within the Federal Emergency Management Agency's (FEMA) National Incident Management System (NIMS) Incident Command System (ICS) framework, to allow consistency between government agencies during incident response. Figure 6-28 shows the basic ICS command structure. Appropriate City staff from all departments, including Utilities, are required to complete the City's on-site EOC training and FEMA's ICS training courses, in preparation for City-wide emergency response.

Figure 6-28: ICS Command Structure



The Utilities Department also maintains its own Emergency Management Plan, known as the "Red Book". The Red Book documents roles and responsibilities, communications procedures, contact information, inventories of equipment & facilities, and other relevant information specific to the Utilities Department. The Red Book is updated annually.

During a minor emergency such as a water main break, the EOC is not typically activated, and Utilities Department responds in accordance with the procedures in the Red Book. If the EOC is activated, the Red Book may be incorporated into the EOC's Incident Action Plan.

Water Supply Emergencies

Bellevue's response to water supply shortages is guided by the City's Shortage Management Plan, attached as Appendix R. During a supply shortage, SPU and Cascade are responsible for coordinating regional response activities, while Bellevue is responsible for customer service within the local service area and coordination with local media.

Water Quality Emergencies

Bellevue maintains a Water Quality Emergency Response Plan, as part of the Red Book.

Water Main Break Response

The City has developed an SOP for response to water main breaks (see Appendix S), to ensure the protection of drinking water quality and public health. This SOP utilizes current best management practices, national research findings, and guidance provided by DOH.

In addition to regularly updating the internal SOP, the City participated in Water Research Foundation's 2010 study "Effective Microbial Control Strategies for Main Breaks and Depressurization", and is assisting DOH with the development of new guidance documents for main break response.

Power Outages

Water is distributed in Bellevue's service area by gravity (through pressure reducing valves) and/or by pumps driven with electric motors. Although most of Bellevue's water customers can be fully served by gravity, significant portions of the service area are at higher elevations that require electrical power for water service via pumps, as shown in Table 1-3.

In order to provide continuous service at higher elevations during a power outage, backup power is required. All of the City's normally-operated pump stations have either a permanent, on-site backup diesel generator, or a receptacle for connection to a portable generator, as shown in Table 1-6. Backup power cannot currently be provided at NE 8th Inlet or SE 28th Inlet pump stations, but these are typically gravity-only facilities (pumping is generally not needed). O&M's Water Section currently maintains two portable generators.

In the event of a localized power outage, Utilities staff respond as appropriate to maintain service, in accordance with the Red Book. When a wider, regional power outage occurs, the EOC will be activated and all City departments coordinate resources as appropriate and on a priority basis in the NIMS/ICS structure. The City's critical emergency response facilities have reliable on-site backup power that is exercised weekly.

The City's most significant power outage event occurred following the windstorm of December 14-15, 2006. All of the City's facilities lost external power, and relied on backup generators, where available. Most facilities had no external power for several days, and some lost power for more than a week. Uninterrupted service was maintained throughout 100% of Bellevue's water service area during this event, due to low seasonal water demands and staff working extended 12-hour shifts on an extended 24/7 basis. Despite O&M's success in maintaining service, the event revealed some vulnerabilities in the delivery of water to the SOA during an extended power outage, and an evaluation of power supply resiliency and redundancy is recommended, as discussed in Chapter 4.

Security

The City has instituted multiple security measures to manage the potential risks of vandalism and sabotage to water infrastructure or customer service. The City's water security system has been reviewed and evaluated using the US Department of Homeland Security Cyber Security Evaluation Tool (C.S.E.T) 4.0, using the AWWA Cybersecurity Tool (2014 release), and as a part of the City's APWA accreditation.

Security for the City's SCADA network is provided by isolating the system, controlling access, regularly scanning internal and external drives, and similar measures. The SCADA system has no internet connectivity, to preclude the opportunity for system hacking. Credentials are required both to physically access the SCADA computers, and to log into the system. File transfer to/from the system is only allowed on USB drives that have been scanned and certified "clean" by the City's telemetry security group.

Physical security is provided at water system sites through locks, intrusion alarms, and other measures. Alarms are sent to pagers as well as to the SCADA system.

For security reasons the City's GIS data is not generally available, except as needed to conduct the City's business, as required for public records requests, or for other legitimate purposes, such as coordination with private utilities (Puget Sound Energy, CenturyLink, etc) to avoid underground conflicts. Requests for GIS data are each documented and require a statement of the intended use. The City reviews each request, and when approved, provides only the necessary portion of the system.

6.5 Recordkeeping, Reporting, and Customer Service Requests

Work requests are scheduled by O&M according to priority. Emergency request response is immediate. Secondary priority response is typically within forty-eight hours.

Bellevue has used Maximo software as its maintenance management information system since 1999. The program is accessible at personal computers throughout the City. Maximo integrates operations and maintenance planning, budgeting, and performance reporting, while maintaining records of activities in a consistent format. The system tracks how actual performance compares to plan with respect to infrastructure maintenance, customer service demand, and costs. The Maximo database includes an inventory of the City's assets, records of maintenance activities (known as Work Orders), and allocation of labor, equipment, materials, and contracted services.

Bellevue Utilities' Maximo database is used to track service work orders from both internal and external customers. Work orders from internal customers are typically feedback from City staff who notice maintenance needs while in the field. Work orders from external customers can include some customer complaints (taste, odor, loss of pressure, etc), but also feedback such as missing valve box covers and leaking meters. Work orders are frequently generated by a phone call to customer service staff, but are often generated through the City's "MyBellevue" mobile phone application.

Bellevue is looking to improve its use of Maximo to enhance the City's asset management capabilities and interface better with the City's GIS and mapping data, billing systems, and other City software applications. The MyBellevue smart phone application has allowed customers to directly generate work orders. The City's Utilities Mobile Initiative is evaluating tablet devices for O&M field crews, to allow real-time data entry & retrieval, and to reduce or eliminate the office data entry time currently necessary at the end of each day.

The volume of data generated in the Utilities Department is substantial and includes utility billing and customer information, work orders, design and as-built drawings and specifications, water quality monitoring, telemetry (supply inlet flow and pressures, reservoir levels, pump station operation and flow rates, event and alarm data, etc). Most of this information is computerized; however it is maintained in separate databases due to software limitations and/or security requirements. Improving access to data and computer mobility is one of the potential process improvements being evaluated by the City.

Figure 6-29 shows trends in customer service requests (non-billing related). These requests can be related to leaks, water pressure, water quality (taste and odor), damaged or leaking hydrants, valve box problems, etc. Customers are notified when the request is logged and completed, and also during response if coordination with the customer is necessary.

Figure 6-29: Customer Service Requests (Non-Billing)

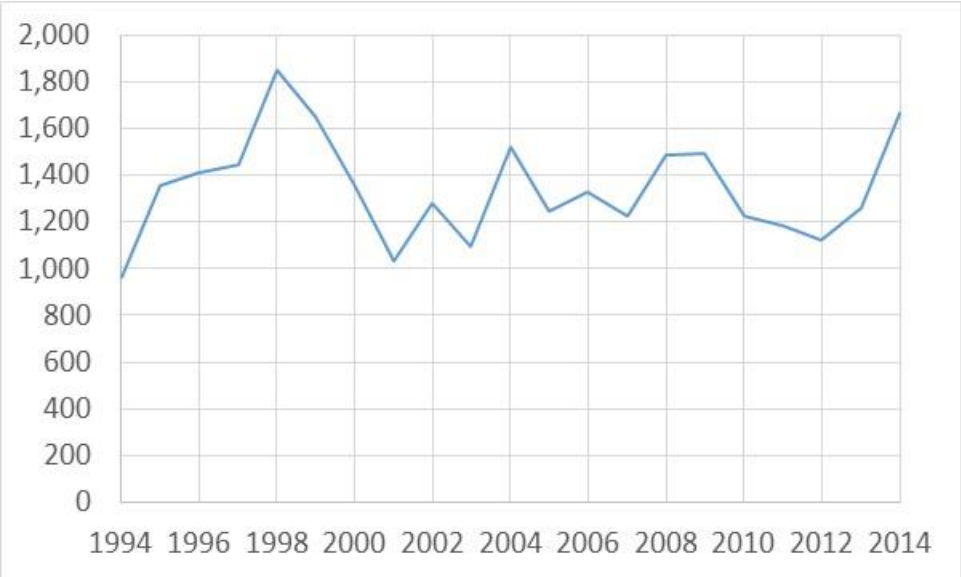
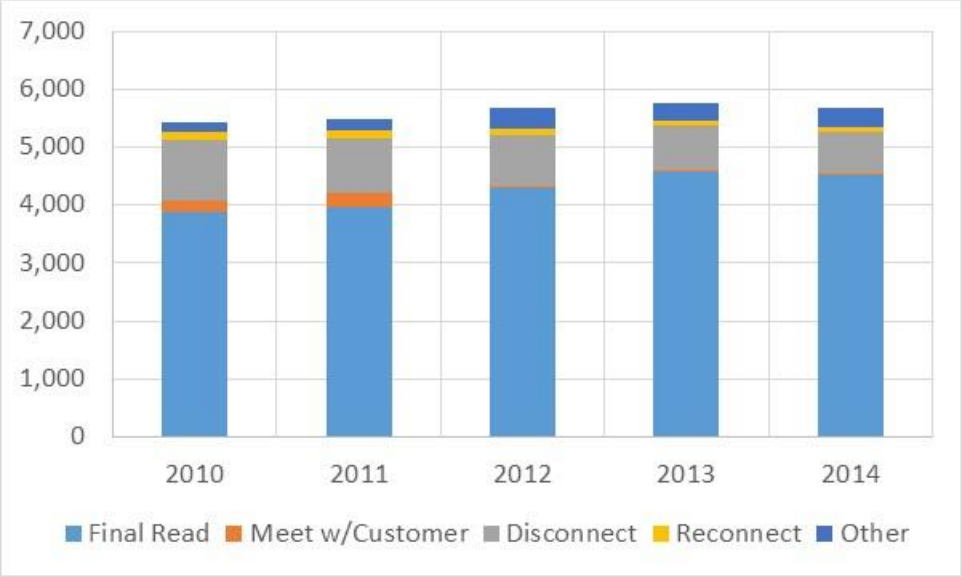


Figure 6-30 shows statistics for billing-related work orders. Most billing-related work orders are internal requests by the Utilities RMCS division. However, some billing work orders are generated by customers, such a requests for temporary service shutoff, reading verification (in the case of unexpected billing volumes), or requests associated with site demolition or redevelopment.

Figure 6-30: Billing-Related Work Orders



6.6 Summary of O&M Needs

Some needs and opportunities specifically affecting O&M's Water Section are summarized below.

- The City lacks a formalized, regular maintenance program for:
  - Check valves
  - Air/vacuum release valves
- Some of O&M's internal goals are not met every year due to unexpected workload.
- Meter reader workload is at capacity.
- The wide variety of different model fire hydrants creates inefficiencies in maintenance, staff training, and spare parts procurement.

General water system deficiencies and opportunities are described in Chapter 4.

Chapter 7 Water Quality

This Chapter evaluates the City of Bellevue's compliance with applicable state and federal drinking water regulations. The discussion includes the following:

- Drinking Water Regulations
- Drinking Water Quality Compliance
    - Surface Water Treatment Rule
    - Total Coliform Rule
    - Lead and Copper Rule
    - Disinfection Byproduct Rule
    - Phase II Rule - Asbestos
    - UCMR3 Rule
    - Fluoride
    - Cross Connection Control
    - Consumer Confidence Reports
    - Public Notification Rule
- Customer Service
- Anticipated Regulations

DOH performs periodic sanitary survey inspections of the system. DOH comments from the most recent sanitary survey are attached in Appendix T.

7.1 Drinking Water Regulations

Washington State drinking water suppliers are subject to both federal and state drinking water regulations. At the federal level, the Safe Drinking Water Act (SDWA) (1974) and SDWA Amendments (1986 and 1996) assign the United States Environmental Protection Agency (EPA) the responsibility of developing and administering national standards for drinking water quality. Table 7-1 lists current federal drinking water regulations developed as part of the SDWA and amendments and indicates which regulations apply to source and treatment or to the distribution system.

Table 7-1: Federal Drinking Water Quality Regulations

Rule (Date Effective)	Parameters Regulated	Requirements Apply Primarily to…
National Primary Drinking Water Regulations (1976)	Physical and chemical	Treated water
Total Trihalomethane Rule (1979)	Trihalomethanes	Distribution system[1]
Phase I (VOCs) and Phase II and Phase V (IOCs and SOCs) - (1989 and 1993, respectively)	Volatile Organic Chemicals (VOCs), Inorganic chemicals (IOCs), and Synthetic Organic Chemicals (SOCs)	Treated water[2]
Surface Water Treatment Rule (1990)	Turbidity, disinfection, viruses, *Giardia lamblia*, and disinfectant residual	Source and treated water[3]
Total Coliform Rule (1990)4	Coliform	Distribution system
Lead and Copper Rule (1992) and Lead and Copper Rule Minor Revisions (2000))	Lead and Copper and treatment for corrosion control	Treated water and at customers' taps
Interim Enhanced Surface Water Treatment Rule (2002)	Turbidity and *Cryptosporidium*	Source and treated water
Arsenic Rule (2002)	Arsenic	Treated water
Stage 2 Disinfectant/Disinfection By-Products Rule (2006)	Disinfectant Residual, Total Trihalomethanes, and Haloacetic Acids	Distribution system
Radionuclides Rule (2003)	Radionuclides	Treated water

1. Replaced by the Stage 1 Disinfectant/Disinfection By-Products Rule in 2004 which was replaced by the stage 2 rule in 2006
2. Asbestos is monitored in the distribution system.
3. A disinfectant residual must be present in 95% of samples collected monthly at coliform monitoring sites or heterotrophic plate count levels must be less than or equal to 500 colony forming units per mL.
4. The Revised Total Coliform Rule (RTCR) goes into effect April, 2016.

DOH is the primacy agency responsible for ensuring state drinking water laws are implemented and enforced. Washington State must adopt laws at least as stringent as federal regulations. When a federal drinking water law has yet to be included in state drinking water codes, drinking water suppliers are responsible for meeting federal regulatory requirements as put forth by the EPA.

WAC 246-290 - Group A Public Water Systems incorporates federal drinking water requirements. Bellevue is a Group A system; defined as a drinking water system that provides service to 15 or more service connections used by year-round residents for 180 or more days within a calendar year, or regularly serving at least 25 year-round residents (in residence at least 180 days per year).

Since Bellevue does not own and/or operate any primary drinking water supply sources, it is not responsible for monitoring at the source(s) or directly after treatment for purchased water. As a consecutive system that purchases water from another utility, Bellevue is responsible for monitoring

and maintaining compliance with drinking water regulations that apply to distribution system water quality. In some cases, Bellevue is required to perform monitoring to assess the effectiveness of treatment techniques.

Bellevue's compliance with these regulations is detailed below.

7.2 Drinking Water Quality Compliance

Bellevue purchases 100% of its water from Cascade and provides no additional treatment. Currently, Cascade supplies Bellevue with water purchased from SPU. During typical operations, water is supplied from both the Cedar and South Fork Tolt Rivers. The Cedar supply is a treated, but unfiltered drinking water supply while the Tolt River water has been filtered since the Tolt Water Treatment Facility came online in 2001. See Section 4.2 for additional information.

With respect to the quality of the drinking water provided, Cascade's contract with member agencies states:

> "Cascade shall be responsible for water quality that meets or exceeds all federal or state requirements at the point of delivery from Cascade to the Member, consistent with applicable laws and regulations. Cascade assumes source water quality responsibility and liability with respect to Water Supply Assets under its ownership or control (including water wheeled to a Member utility through another Member's facilities). Cascade is also responsible for preparing and carrying out water quality activities compatible with the water quality requirements of Regional water suppliers integrated with Cascade's system (i.e. Tacoma, Everett, and Seattle)."

While Cascade is responsible for ensuring the quality of water reaching its Member utilities Cascade plans to purchase most of its water from SPU during the next 20 years. Clearly defined roles and responsibilities with respect to water quality management will be particularly important.

WAC) 246-290 requires the following of systems that are selling and/or receiving water:

- Source water monitoring – Utilities are responsible for conducting monitoring per regulations for drinking water supply sources under their control. For regulations with population-dependent monitoring requirements, these utilities are to meet requirements for the entire population served by the source of supply. This does not apply to systems that wheel water.
- Distribution system monitoring – Utilities that receive and distribute water are responsible for meeting water quality requirements in the distribution system.

Therefore, SPU (or any future water supplier to Cascade) is responsible for ensuring that its sources, treatment processes, and finished water meet applicable state and federal water quality regulations to the point of connection with the city of Bellevue. Bellevue is responsible for ensuring compliance

with water quality regulations that apply to drinking water throughout the distribution system, from the point of supply to the point of use with the customer.

Surface Water Treatment Rule

Regulatory Requirements

Although Bellevue does not currently have any of its own primary source waters feeding our distribution system we do receive water that originates from a surface water supply. Federal Surface Water Treatment Rules (SWTRs) apply to water systems that utilize surface water supplies or groundwater under the influence of a surface water body and include the following:

- Surface Water Treatment Rule – June 1989
- Interim Enhanced Surface Water Treatment Rule – December 1998
- Long Term 1 Enhanced Surface Water Treatment Rule – January 2002
- Long Term 2 Enhanced Surface Water Treatment Rule – January 2006

After treatment, the SWTRs require monitoring for disinfectant residuals at entry points to the distribution system and specify that the concentration cannot be less than 0.2 mg/L for more than 4 hours at those locations.

Additionally, systems must monitor for disinfectant residuals in the distribution system. Distribution system monitoring must take place at the same location and frequency as Total Coliform Rule (TCR) sampling and residual disinfectant concentrations must be detected in at least 95 percent of the samples each month for 2 consecutive months. Systems may measure HPC (heterotrophic plate count) in lieu of disinfectant residuals. If HPC is less than 500 colonies/ml, the site has the equivalent of a “detectable residual”.

Bellevue Status

From 2009 through 2014, Bellevue maintained compliance with the disinfectant residual monitoring portion of this regulation. Chlorine residuals were detectable in at least 95% of the samples collected. In addition, Bellevue had results from 92 HPC analyses from water throughout the distribution system. The results showed no HPC was found in 77 of the samples (84%). In 15 HPC occurrences the highest result was 12 (the remainder were 1 or 2).

Total Coliform Rule

Regulatory Requirements

The Total Coliform Rule (TCR), which was published in 1989, sets both health goals (Maximum Contaminant Level Goals) and legal limits (Maximum Contaminant Levels) for the presence of total coliforms in drinking water. The rule also details the type and frequency of testing that water systems must undertake. The rule applies to all public water systems

(PWSs). The TCR requires systems to monitor their distribution system for coliforms, which are bacteria used to indicate the presence of potentially harmful bacteria such as E. coli. Under this rule, there are two types of violations: acute and non-acute. An acute maximum contaminant level (MCL) violation for coliform is the presence of fecal coliform or E. coli in a repeat sample, or coliform presence in a repeat sample collected as a follow-up to a sample indicating the presence of fecal coliform or E. coli. A non-acute MCL violation for coliform occurs when a system that collects 40 or more coliform samples per month has more than 5.0% of the routine samples taken in one month test positive for the presence of total coliform.

*** EPA revised the 1989 TCR on February 13, 2013 intended to improve public health protection and the implementation of the rule by States and PWSs. PWSs and primacy agencies must comply with the requirements of the Revised Total Coliform Rule (RTCR) by April 1, 2016. Until then, PWSs and primacy agencies must continue complying with the 1989 TCR.

Bellevue Status

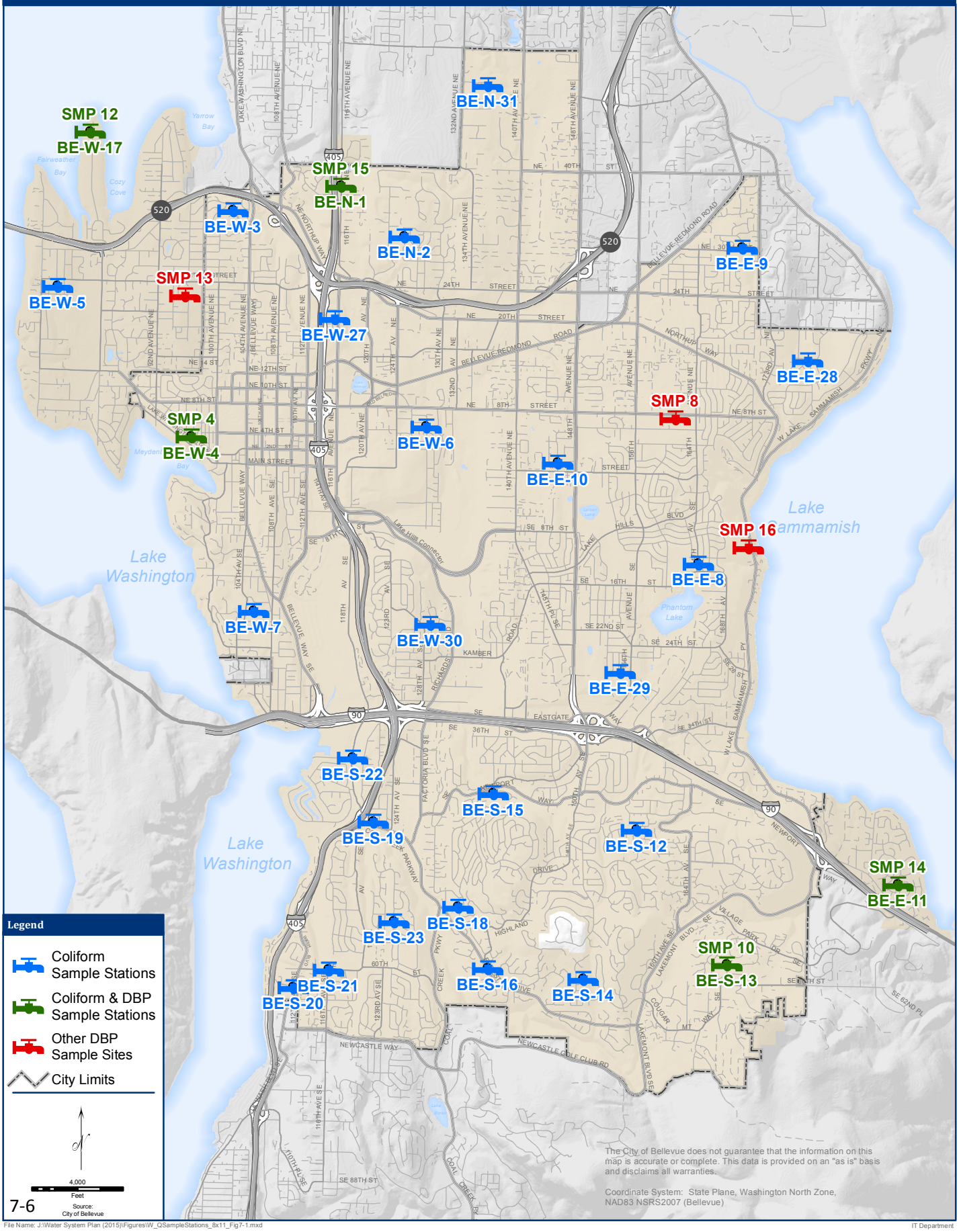
Bellevue is one of approximately 27 water systems and districts that receive water from sources treated and operated by SPU. SPU and its wholesale customers have been part of a regional, DOH-approved, coliform monitoring program since 1972. As part of the regional program, SPU collects the routine monthly samples, while wholesale customers are responsible for installing and maintaining designated coliform monitoring sample stands, and for collecting any repeat samples when necessary. Samples are currently collected at 23 sample stands, shown in Figure 7-1.

Under this agreement, SPU and its purveyors sample at a rate of 70% of samples required by the Total Coliform Rule. Due to population growth over the past several years the number of coliform samples required to be collected in Bellevue's distribution system increased from 120 per month (84 with reduced monitoring) to 150 per month (105 with reduced monitoring). This increase was initiated in May of 2012. Bellevue currently supplies water to a full time residential population of 142,900 and regular nonresidential users of 106,000. The minimum number of routine samples collected within Bellevue's distribution system is 105 per month (70% of the 150 samples required for systems serving 220,001 to 320,000 customers). Samples are currently collected at 23 sample stands under a regional monitoring program with SPU as approved by the Department of Health.

Water Quality Sample Stations

Figure 7-1

City of Bellevue
GIS Services



The City of Bellevue does not guarantee that the information on this map is accurate or complete. This data is provided on an "as is" basis and disclaims all warranties.

Coordinate System: State Plane, Washington North Zone, NAD83 NSRS2007 (Bellevue)

File Name: J:\Water System Plan (2015)\Figures\W_QSampleStations_8x11_Fig7-1.mxd

IT Department

Bellevue's approved Coliform Monitoring Plan (CMP) is attached as Appendix U (an updated CMP is being developed for completion in 2016). The CMP covers the following topics:

- Compliance requirements, sampling procedures, and reporting to the State;
- Public notification for acute and non-acute violations;
- Relevant system maps; and
- City, DOH, and adjoining system contacts.
- Bellevue's strategy for compliance with the Revised Total Coliform Rule and changes to the regional monitoring program requirements imposed by DOH.

Bellevue has been in compliance with the TCR since 1998. During this time period, there have been 22 positive coliform samples. In only one occurrence has a repeat sample been coliform positive. Bellevue has never exceeded more than 3% of monthly coliform samples positive. Between 1998 and 2014, approximately 0.02% of coliform samples were positive.

As a result of an undetermined E.coli event in another water system in the regional coliform monitoring program, DOH initiated review of the participating systems' coliform monitoring plans. Bellevue agreed to add an additional 9 samples stands and remove the reduced monitoring as an allowance. The CMP covers in detail Bellevue's strategy for meeting new DOH expectations.

Lead and Copper Rule

Regulatory Requirements

Lead and copper enter drinking water primarily through plumbing materials. Exposure to lead and copper may cause health problems ranging from stomach distress to brain damage. On June 7, 1991, EPA published a regulation to control lead and copper in drinking water. This regulation is known as the Lead and Copper Rule (also referred to as the LCR or 1991 Rule). The treatment technique for the rule requires systems to monitor drinking water at customer taps. If lead concentrations exceed an action level of 15 ppb or copper concentrations exceed an action level of 1.3 ppm in more than 10% of customer taps sampled, the system must undertake a number of additional actions to control corrosion. If the action level for lead is exceeded, the system must also inform the public about steps they should take to protect their health and may have to replace lead service lines under their control.

Bellevue Status

A regional, DOH-approved lead and copper monitoring program was adopted by SPU and its purveyors in 1992. This type of program is appropriate because SPU applies corrosion control as part of their drinking water treatment. Monitoring was initiated in 1992 and conducted most recently in both 2011 and 2014. Due to low concentrations found in past sampling efforts Bellevue is on reduced monitoring. The 50 samples collected every three

years from Bellevue's system are pooled with the rest of SPU's direct service and wholesale customer samples. Table 7-2 shows the results of Bellevue's last two sampling efforts and shows compliance with both the lead and copper action levels throughout the testing periods.

Table 7-2: 2011 and 2014 Lead and Copper Monitoring Results

Parameter	Action Level	90th Percentile - 2011	90th Percentile - 2014	# of Homes Exceeding Action Level - 2011	# of Homes Exceeding Action Level - 2014
Lead (mg/L)	0.015	0.0070	0.0044	4	1
Copper (mg/L)	1.3	0.13	0.16	0	0

Disinfection By-Product Rule

Regulatory Requirements

The Stage 2 Disinfectants and Disinfection Byproducts Rule (Stage 2 Rule) sets monitoring requirements for Trihalomethanes (THMs) and Haloacetic Acids (HAAs) which are the two most common disinfection byproducts (DBPs) formed when chlorine is added to drinking water as a disinfectant. EPA published the Stage 2 Rule in January 2006 and Washington State assumed responsibility for the Stage 2 Rule on January 4, 2010. The Stage 2 Rule applies to all community and non-transient non-community Group A water systems that deliver water continuously treated with a primary or residual disinfectant other than ultraviolet light. The MCL for TTHMs has been set at 80 µg/L and the MCL for HAA5s is 60 µg/L.

Bellevue Status

Seattle Public Utilities adds chlorine to the treated source water as a disinfectant and to also maintain a disinfectant residual as water flows through the distribution system. Bellevue Utilities collects both THM and HAA samples on a quarterly basis at eight different approved locations throughout the city as currently required. The historical results of this sampling show that DBP concentrations across the city are well below the MCL and hover just above the trigger for reduced monitoring approval. Water systems become eligible for reduced monitoring when locational running annual average concentrations fall below 40 ug/L for THMs and 30 ug/L for HAAs. Recent results are shown in Table 7-3.

Table 7-3: Disinfection Byproduct Sampling Results 2009 - 2014

Year	THM MCL (µg/L)	Annual Average and Range	HAA MCL (µg/L)	Annual Average and Range
2009 - 2013	80	Average = 29.5 Range = 10.5 – 49.6	60	Average = 26.2 Range = 12.5 – 43.4
2014	80	Average = 31.2 Range = 18.5 – 39.9	60	Average = 29.7 Range = 16.8 – 44.6

Phase II Rule - Asbestos

Regulatory Requirements

The Safe Drinking Water Act requires EPA to determine the level of contaminants in drinking water at which no adverse health effects are likely to occur. These non-enforceable health goals, based solely on possible health risks and exposure over a lifetime with an adequate margin of safety, are called maximum contaminant level goals (MCLG). The Phase II Rule, the regulation for asbestos, became effective in 1992. EPA regulates asbestos in drinking water to protect public health as it may cause health problems if present in public or private water supplies in amounts greater than the drinking water standard set by EPA. Because asbestos fibers are resistant to heat and most chemicals they have been mined for use in more than 3,000 products, including roofing materials, brake pads, and cement pipe often used in distributing water to communities. The MCL for asbestos is 7 million fibers per liter (mf/L) and the MCLG is also 7 mf/L.

Bellevue Status

Approximately 42% of Bellevue's distribution system piping (by length) is comprised of AC pipe. (AC pipe is being replaced with ductile iron pipe at a rate of approximately five miles per year.). Because Bellevue still has AC pipe in the distribution system there is a requirement to monitor for asbestos during each nine-year compliance cycle, with the most recent cycle being January 2011 through December 2019. Bellevue conducted the required asbestos monitoring in December of 2011 and the sample results indicated that the asbestos level was below detection, which is consistent with past monitoring.

Unregulated Contaminant Monitoring Rule

Regulatory Requirements

The 1996 SDWA amendments require that once every five years EPA issue a new list of no more than 30 unregulated contaminants to be monitored by PWSs. The first Unregulated Contaminant Monitoring Rule (UCMR 1) was published on September 17, 1999, the second (UCMR 2) was published on January 4, 2007 and the third (UCMR 3) was published on May

2, 2012. This monitoring provides a basis for future regulatory actions to protect public health. UCMR 3 requires PWSs to monitor for 30 contaminants (28 chemicals and two viruses) under each of the three lists:

- Assessment Monitoring (List 1 Contaminants)
- Screening Survey (List 2 Contaminants)
- Pre-Screen Testing (List 3 Contaminants)

Bellevue Status

Under new language in the UCMR3 regulation, as a consecutive system the City of Bellevue is required to collect samples for both List 1 and List 2. Because Bellevue receives water from two different sources, the Tolt and Cedar, Bellevue was required to collect sampling specifically for each source and respective distribution system. Samples were collected from 2013 through 2014 on a quarterly basis (May, Aug, Nov, Feb). Samples were collected from inlets with the highest demand and then a representative distribution location for each source. Results are shown in Table 7-4.

Table 7-4: Unregulated Contaminants Sampling Results

	Average	High	Low
Chromium (Total)[1,2]	0.26 ug/L	0.32 ug/L	0.22 ug/L
Chromium – 6	0.11 ug/L	0.18 ug/L	0.069 ug/L
Strontium	24.25 ug/L	30.0 ug/L	13.0 ug/L
Vanadium	0.41 ug/L	0.61 ug/L	Not Detected

1 EPA has a drinking water standard of 100 micrograms per liter (ug/L) for total chromium, which includes all forms of chromium including chromium-6.

2 Although Chromium – 6 may occur naturally in the environment, Bellevue's is a result of the oxidation of total chromium.

EPA used the information from this sampling to make a determination to move strontium to a primary drinking water regulation, with a final rule expected in 2019 and routine monitoring required thereafter.

Fluoride

Regulatory Requirements

Fluoridation of drinking water began in the United States in 1945 after extensive studies showed that fluoride helped prevent tooth decay. EPA regulates fluoride in drinking water to protect public health as it may cause health problems if present in public or private water supplies in amounts greater than the drinking water standard set by EPA. The MCLG and MCL for fluoride are both 4.0 mg/L. EPA has also set a secondary standard for fluoride at 2.0

mg/L or 2.0 ppm. Secondary standards are non-enforceable guidelines regulating contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water. In 2011, the U.S. Department of Health and Human Services, Centers for Disease Control and Prevention (CDC) and the EPA announced a proposed recommended level of fluoride in drinking water of 0.7 parts per million (ppm). HHS formalized this recommendation in 2015.

Bellevue Status

Fluoridation of the Seattle water supply began in 1970 after a referendum vote in 1968 directed the City of Seattle to fluoridate the drinking water. In 2011, in response to the revised EPA guidance, SPU adjusted its fluoride level from 1.0 ppm to 0.8 ppm, closer to the CDC recommendation, but within the range of 0.8 to 1.3 ppm allowed by DOH. SPU may reduce this concentration to 0.7 ppm if DOH revises its minimum standard to match the CDC recommendation.

Cross Connection Control

Regulatory Requirements

WAC 246-290-490 requires purveyors to develop and implement a written Cross Connection Control (CCC) program to protect the PWS from contamination via cross connections. The specific purpose of a CCC program is to protect public health by helping to ensure the quality of water delivered to customers. This is accomplished by protecting the collection, treatment, storage and distribution facilities under the control of the purveyor from contamination via cross connections.

In addition to the written program plan, the regulations specifically require purveyors to implement their CCC programs. Implementation activities include, but are not limited to:

- Hazard surveys;
- Installation of backflow preventers to protect the PWS;
- Establishing a record-keeping system;
- Tracking assembly test reports; and
- Public education.

Bellevue Status

Bellevue Utilities has implemented a CCC program (see Appendix V) with the authority established by City Ordinance No. 24.02.190. The written City of Bellevue Cross Connection Control Program conforms to WAC 246-290-490(3) minimum elements of a cross-connection control program. The Senior Engineering Technician (SET) for Water Quality is the designated Cross Connection Control Specialist program administrator, and is the citywide lead for this program. This position prepares and administers program guidelines,

documents, standard operating procedures and reports to DOH on the annual progress of the cross connection control program.

Consumer Confidence Reports

Regulatory Requirement

EPA's 1998 Consumer Confidence Report (CCR) Rule, requires community water systems to provide an annual CCR on the source of their drinking water and levels of any contaminants found. The annual report must be supplied to all customers and include:

- The type of water served (such as groundwater, surface water, water from another system) and the name and location of its source.
- Regulated and unregulated contaminants detected in the water, their concentrations, and the allowable federal or state standard.
- DBPs or microbial contaminants, their concentrations and the applicable standard.
- Descriptions of possible health effects of contaminants in drinking water at concentrations greater than the federal or state health standard.
- Identification of the likely source of contamination.
- Violations of any monitoring, reporting, treatment, or record-keeping requirements.
- Opportunities for public involvement and water system contact information.

State and federal drinking water rules require community water systems to produce and distribute an annual CCR to customers by July 1. The rules also require water systems to provide a copy of their CCR to DOH by July 1, and a CCR certification form no later than October 1.

Bellevue Status

Bellevue is in compliance with the CCR Rule. Annual CCRs have been published and distributed to all customers as required by July 1 and are provided to all customers via direct mail, the City's website, the City's newsletter, and are made available at city owned facilities including City Hall and community centers.

In 2013 EPA began allowing electronic delivery of CCR's in addition to traditional mail and web postings. An independent research firm was retained to poll Bellevue customers as to their preferences for receiving the annual report electronically. Sixty-three percent of the 403 Bellevue residents polled preferred receiving the printed report in the mail as opposed to electronic delivery. Print copies of the report continue to be mailed to customers.

Public Notification Rule

Regulatory Requirement

Public Notification is intended to ensure that consumers will always know if there is a problem with their drinking water. These notices immediately alert consumers if there is a serious problem with their drinking water that may pose a risk to public health. They also notify customers if their water does not meet drinking water standards, the water system fails to test its water, or if the system has been granted a variance (use of less costly technology) or an exemption (more time to comply with a new regulation).

Public Notification has always been part of the SDWA and in 2000, EPA revised the existing Public Notification Rule to better tailor the form, manner, and timing of the notices to the relative risk to human health. The revised rule makes notification easier and more effective for both water systems that must do the notification and to their customers.

EPA specifies three categories, or tiers, of public notification. Depending on what tier a violation or situation falls into, water systems have different amounts of time to distribute the notice and different ways to deliver the notice:

- Immediate Notice (Tier 1) – Notification within 24 hours
- Notice as Soon as Possible (Tier 2) – As soon as possible but within 30 days of violation
- Annual Notice (Tier 3) – Up to a year to provide notice of violation

Bellevue Status

Bellevue is in compliance and has no drinking water violations that require public notice.

7.3 Summary of Monitoring Requirements

Table 7-5 summarizes current monitoring requirements applicable to Bellevue. EPA and DOH have authority to require additional sampling, such as candidate contaminants listings (UCMR3).

Table 7-5: Summary of Distribution System Monitoring Requirements

Parameter	Regulatory Requirement	Location	Frequency
Lead and Copper	Lead and Copper Rule	Customer taps	Every three years
Asbestos	Phase II Rule	One site representative of each source and in areas of the distribution system known to contain asbestos cement water mains	Once every nine years. Next monitoring is required in the nine year period after 2020.
Total Coliform	Total Coliform Rule	Approved locations throughout the water distribution system as defined by the city's Coliform Monitoring Plan	105 samples per month under reduced monitoring. Without reduced monitoring there would be 150 samples per month required
Chlorine Residual	SWTR	Approved Total Coliform Rule locations throughout the water distribution system	105 samples per month. Increased May 2012 due to population growth
Disinfection Byproducts (TTHM and HAA5)	Stage 2 DBP Rule	Approved locations throughout the water distribution system	Quarterly

Bellevue uses three State-certified laboratories to perform water quality analysis. Their contact information is listed below:

Seattle Public Utilities – Water Quality Laboratory
800 S. Stacey St.
Seattle WA 98134
206-684-3000

Washington State Department of Health – Public Health Laboratories
1610 NE 150th Street
Shoreline WA 98155-9701
206-418-5400

Am Test Laboratories
14603 NE 87th St.
Redmond WA 98052
425-885-1664

7.4 Summary of Regulatory Status

Review of water quality data collected between 1999 and 2014 indicates that Bellevue complied with all applicable federal and State drinking water regulations. Table 7-6 summarizes those regulations and Bellevue's compliance status.

Table 7-6: Summary of Applicable Regulations and Compliance Status

Regulation	Requirements	Status	Compliance?
Phase II Rule	Monitor distribution system for asbestos	Meets MCL	Yes
Surface Water Treatment Rule	Monitor chlorine residuals throughout the distribution system	Meets minimum Cl2 requirement	Yes
Total Coliform Rule	Written Plan and Monitoring	Monitors throughout distribution system as part of SPU regional program Meets MCLs	Yes
Stage 2 Disinfectants and Disinfection Byproduct Rule (Stage 2 DBP rule)	Monitoring	Monitored at representative distribution system locations. Met MCL.	Yes
Lead and Copper Rule	Monitoring	Monitors as part of SPU regional program Meets MCLs	Yes
Unregulated Contaminate Monitoring Rule 3	Monitoring and Reporting	Monitoring study completed and submitted	Yes
CCR and Public Notification Rules	Annual Reports and Reporting as needed	Consumer Confidence Reports published annually	Yes

7.5 Customer Service

Customer-based water quality complaints and concerns are recorded in the City's Maximo database. When the cause of the complaint originates in the publicly-owned distribution system, the situation is mitigated by the City. If the complaint is a private property concern, the City provides suggestions to the customer for resolution. When appropriate, water samples are collected and analyzed by a certified laboratory.

Review of customer complaint data indicates that Bellevue typically receives less than 130 water quality complaints per year, or about 1 per 1,000 customers. The vast majority of these are

associated with clarity of the water, and are typically caused by construction or main breaks occurring nearby. Taste and odor are typically the second and third most common complaints. The occurrence of these calls has increased, possibly due to water conservation causing increased water age.

Complaints of air in the water system average about 5 per year and generally spike in the fall. Improperly installed landscape irrigations systems being winterized are thought to be the primary cause of these complaints.

7.6 Anticipated Regulations

New or revised SDWA regulations are anticipated in the near future that will impact Bellevue. It is important that Bellevue continue to track the development of these regulations which affect distribution system monitoring and compliance.

Unregulated Contaminant Monitoring Rule 4

The SDWA requires the EPA to establish criteria for monitoring unregulated contaminants in drinking water. Monitoring varies based on system size, source water, and contaminants likely to be found. Per SDWA, EPA is required to issue, every five years, a list of not more than 30 unregulated contaminants to be monitored by PWSs. The third and most recent rule (UCMR 3) was published on May 2, 2012. The fourth (UCMR 4) is scheduled to be published by December 2016.

Revised Total Coliform Rule (RTCR)

The RTCR establishes a MCL for E. coli. It uses E. coli and total coliforms to initiate a "find and fix" approach to address fecal contamination that could enter into the distribution system. It requires PWSs to perform assessments to identify sanitary defects and subsequently take action to correct them. Beginning April 1, 2016 PWSs must comply with the RTCR requirements unless DOH selects an earlier implementation date. A detailed discussion of the RTCR will be included in Bellevue's updated CMP (available in 2016).

Strontium

In October 2014 EPA reported a preliminary determination to regulate strontium in drinking water. Strontium is a naturally occurring element that, at elevated levels, can impact bone strength in people who do not consume enough calcium. Strontium was sampled under the UCMR3 Rule, and was detected in all the samples collected in Bellevue's water system, with an average concentration of 24 ug/L. Final regulation of Strontium is expected in 2019. Bellevue is expected to be in compliance with monitoring requirements.

Perchlorate

Modeling research is being conducted to understand the impacts to infants prior to implementation of the rule. Final rule expected in 2018/19.

Long Term Lead and Copper Rule Revisions

Revisions are related to issues regarding replacement of lead service lines and should not affect Bellevue, as Bellevue has no known lead service lines. The final rule is expected in 2018 or 2019.

Carcinogenic VOCs (cVOCs)

Decisions are being made regarding which contaminant to include in the expanded group of VOCs. A final rule is expected in 2017 or 2018. Additional monitoring will likely be required by SPU, not Bellevue.

Hexavalent Chromium

Risk assessment is not complete but EPA is required to move forward with rule. Outcome is unknown but could be addressed in update to the total chromium regulation. A final rule is expected in 2019 or 2020. Bellevue may be required to participate in this sampling.

Nitrosamines and Chlorate

These contaminates are expected to be considered in EPA's next six year review of all regulations. This review should be completed by the end of 2015. Final determination of a rule is expected by 2019 or 2020. Additional monitoring, if necessary will likely be required by SPU, not Bellevue.

Group A Public Water Supplies

State level updates for WAC 246-290 are currently ongoing regarding the following topics:

- Water System Planning
- Disinfection
- Revised Total Coliform Rule
  - Minor state level changes expected to be proposed soon after federal regulation is implemented
- Drinking Water State Revolving Fund
- Drinking Water Laboratory certification
- Revised fluoride levels based on new HHS recommendation

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Chapter 8 Asset Management

The asset management approach to utility infrastructure seeks to provide a desired level of service at the lowest life-cycle cost. Life-cycle costs include not only the costs to finance, build and maintain infrastructure, but also the potential risks associated with failure or a loss of service. Bellevue currently has a well-established Asset Management Program (AMP) as described below, which is modeled after EPA's Asset Management Framework.

Bellevue will be performing a gap analysis during 2015-2016 to verify that the AMP continues to meet goals and conform to industry standards. A consultant has been retained to develop an overall 5-Year Strategic Asset Management Roadmap (Roadmap) for all 3 of the City's utilities. The AMP will be further advanced or developed based on the Roadmap recommendations, including creation of individual Strategic Asset Management Plans (SAMPs) for specific types of assets.

8.1 Asset Management Framework

Bellevue's existing AMP implements all ten core processes of EPA's Asset Management Framework:

1. Inventory Assets
2. Assess Condition
3. Determine Residual Life
4. Determine Life Cycle Costs
5. Set Target Level of Service
6. Determine Business Risk Exposure
7. Determine Appropriate Maintenance
8. Determine Appropriate CIP
9. Determine Utility Funding Strategy
10. Build the Asset Management Program (implement and improve)

Inventory Assets

Bellevue's water utility assets include piping, valves, fire hydrants, pump stations, reservoirs, and associated infrastructure. Bellevue's asset inventory is essentially complete, and is continually updated. Most assets have unique identification numbers, providing a way to easily associate asset with relevant information in Maximo and the City's GIS database.

Assess Condition

Condition assessment is used to estimate the remaining life of an asset until rehabilitation or replacement is required. Bellevue's O&M staff routinely assesses the condition of major assets, such as pump stations and reservoirs, as described in Chapter 6. More rigorous engineering evaluations are also conducted periodically or when needed (see Section 4.6).

Condition assessment for buried assets is limited due to lack of access to buried pipe, valves and service saddles, and typically relies on "potholes" or observations of previously failed or replaced assets. Bellevue's biggest challenge in this area is obtaining useful information on the condition of its AC water pipe. Bellevue currently runs a full range of tests on failed AC pipe, when available. Figure 8-1 shows a cement mortar leach test, which uses dye to indicate the presence of calcium. Visual and manual observation in potholes is the only non-destructive way the City has assessed AC pipe condition while the pipe is in service. Non-invasive acoustic technology is being evaluated by the City as another non-destructive condition assessment tool.

Figure 8-1: Cement Mortar Leach Test on AC Main

Determine Residual Life

The residual life (a.k.a. remaining effective or useful life) refers to the amount of time remaining until an asset is anticipated to fail or stop functioning. Bellevue typically uses the age and material of an asset to estimate the average life expectancy, and then adjusts for other site-specific factors (local history of failures or condition reports, soil type, presence of ground water, etc.).

Determine Life Cycle Costs

Economic, social, and environmental costs all affect decisions for management of assets. Asset life cycle costs begin when a need for the asset is identified, and they accumulate throughout the life of the asset, including needs justification, design, construction, operation, maintenance, condition assessment, risk management, renewal, replacement, and disposal. Risk management includes an evaluation of environmental and social costs which generally involve a disruption of service or impact to habitat. All costs must be accounted to determine the real cost of owning and operating assets. As part of the development of the AMP, Bellevue is developing a more formalized process for capturing life cycle costs.

Set Target Level of Service

Bellevue has established various target levels of service. These levels of service represent choices made by the Utility to focus efforts and resources. They communicate Utility understanding of customer expectations and regulatory requirements. Target levels of service are intended to balance service expectations with the cost of providing that service. They affect asset inventory, residual life, life cycle costs, business risk exposure, maintenance activities, CIP proposals, and funding requirements.

Two levels of service that directly affect customers are the number of unplanned water service interruptions (outages) and the frequency of water main breaks. Figure 8-2 shows the recent quantity of unplanned outages per customer in Bellevue. Figure 8-3 shows recent self-reported statistics from other local utilities for water main breaks per length of pipe.

Figure 8-2: Bellevue Service Area Unplanned Water Service Outages per 1,000 Customers

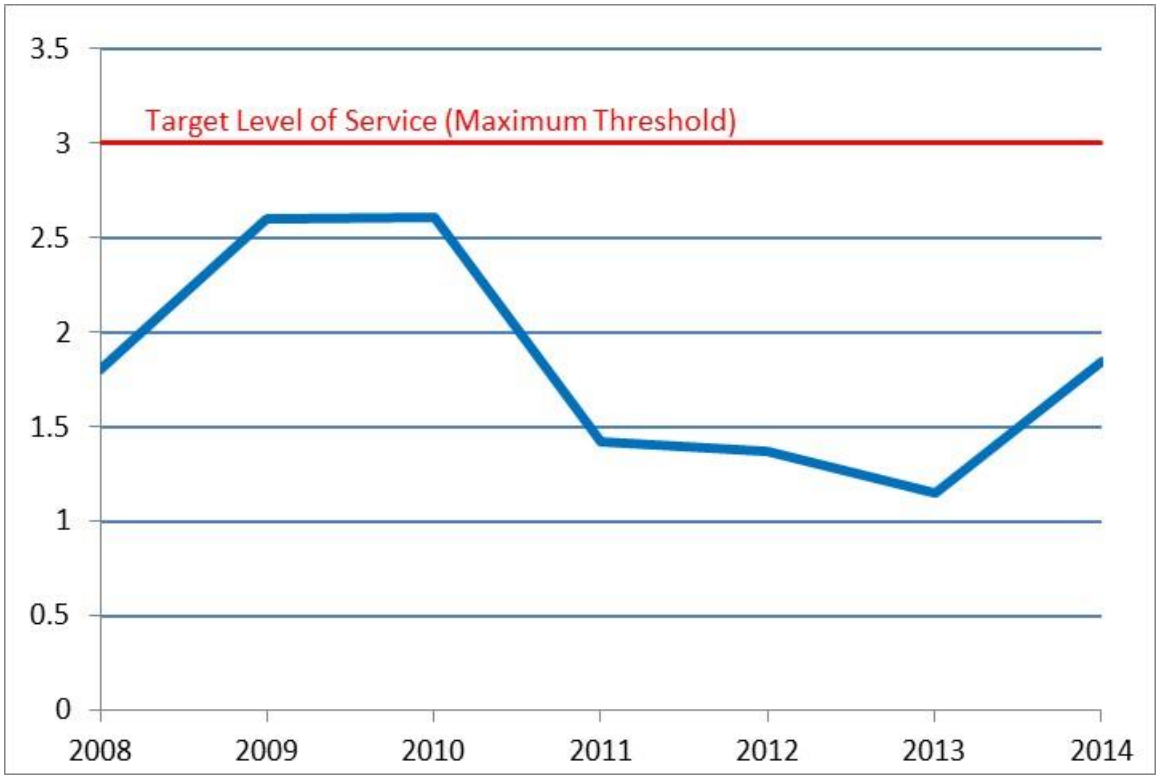
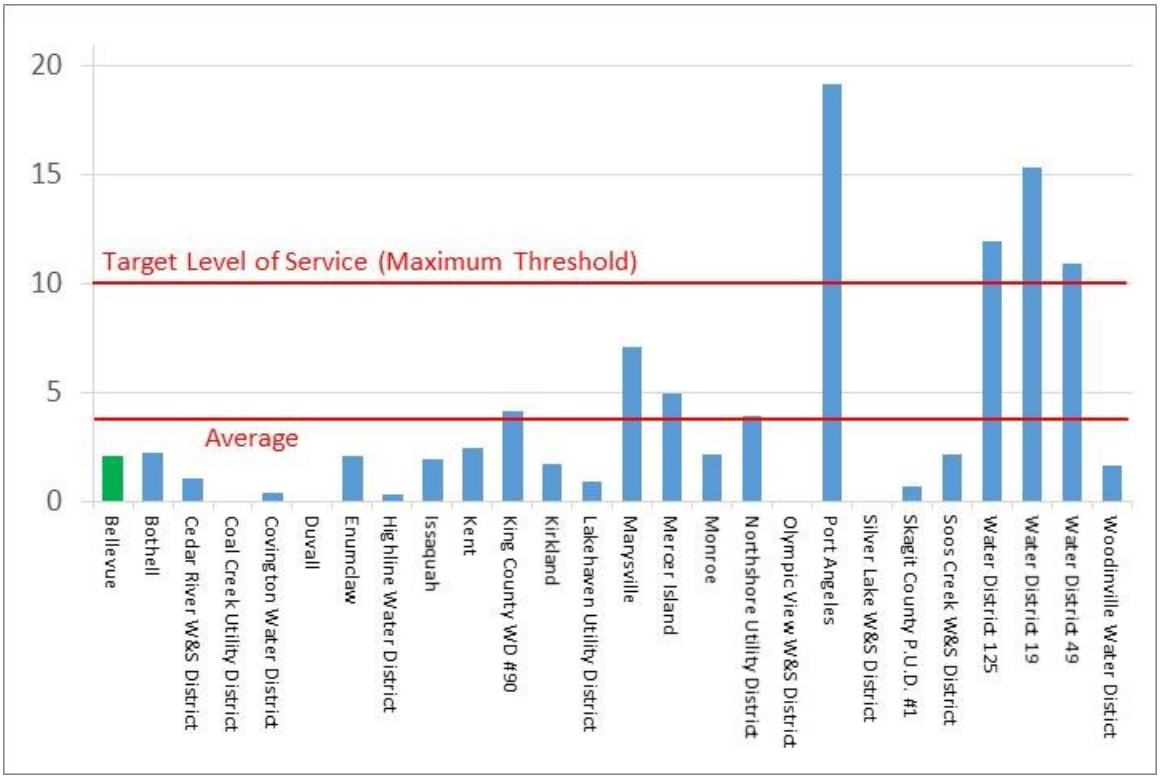


Figure 8-3: Comparative Local Water Main Break Frequency (per 100 Miles of Pipe)



Determine Business Risk Exposure

Risk exposure is influenced by both the likelihood and consequence of asset failure. Threats that may cause asset failure could include natural events (earthquakes, landslides), external impacts (poor pipe bedding, construction disturbance), severity of use (cavitation, hydraulic transients and surge), asset deterioration due to age, or other factors.

For the purpose of ranking the relative risk of each asset, risk is quantified using the following formula:

Risk = (Probability of Failure) X (Consequence of Failure)

Probability of failure is estimated based on observed conditions (when available) and relative failure history of nearby and/or similar assets. Consequence of failure approximates the economic (e.g., potential claims), environmental (e.g., sensitive area damage), and social (e.g., park or road closure) costs of failure.

The application of probability and consequence of failure to pipelines, reservoirs and pump stations is discussed in Section 8.2, 8.3 and 8.4.

Determine Appropriate Maintenance

Each year, Bellevue develops an Operations and Maintenance Annual Plan. This plan identifies operations and maintenance needs, and the resources required to meet those needs for the coming year. Current O&M practices are described in Chapter 6.

Determine Appropriate Capital Improvements

Every two years, Bellevue updates its CIP Plan. The CIP identifies and justifies the planned capital projects and programs over the next rolling seven year period, to accommodate growth, implement City policy, and address renewal & replacement (R&R) needs. Additional information on the CIP is provided in Chapter 9.

The AMP establishes R&R targets that form the basis for ongoing CIP programs. Table 8-1 shows the targets relevant to reservoirs and pump stations.

Table 8-1: Renewal & Replacement Targets

	Target	2014 Result
% of Pump Stations Rehabilitated within 25 Years	76%	71%
% of Reservoirs without Significant Structural Deficiencies	80%	84%
Miles of Water Main Replaced	3.5 Miles*	3 Miles

* Increasing to 5-miles by 2018. See Chapter 9.

Determine Utility Funding Strategy

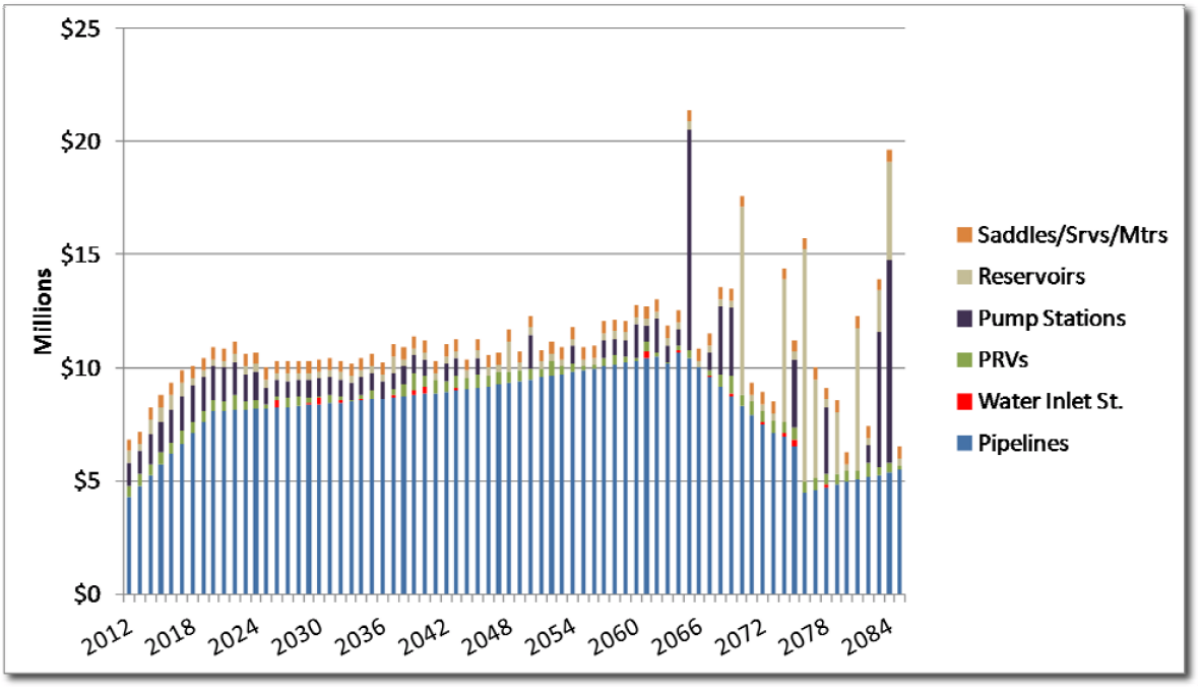
Bellevue established a renewal and replacement (R&R) account in the 1990s to address anticipated future asset needs. While the CIP funds current investments (7-years), the R&R account is used to supplement rate revenue to meet forecasted large capital expenditure needs over the next 75-years. The R&R account should therefore provide better rate stability and generational equity over time.

More information is provided in Chapter 2 (Waterworks Utility Financial Policies) and in Chapter 10. Figure 8-4 shows long-term projected revenue and expenses, based on a review of Bellevue's AMP performed by HDR Engineering, Inc. in 2012 (see Appendix W). Costs shown in Figure 8-4 are for R&R of existing infrastructure only, and do not include projects required to expand capacity or accommodate growth.

Implement and Improve the Asset Management Program

The AMP continually evolves based on new condition assessment data and emerging industry practices. In addition to annual internal AMP review by City staff, HDR was retained in 2015 to provide a more comprehensive Roadmap for the AMP. The Roadmap will result in a 5-year plan with 15 specific areas of focus for each of Bellevue's wet utilities (water, sewer and stormwater).

Figure 8-4: Projected 75-Year R&R Expenditures



A discussion of current management strategies for pipes, reservoirs, pump stations, pressure reducing valves and large commercial meters follows.

8.2 Pipeline Renewal and Replacement

Tables 8-2 and 8-3 list criteria and relative scoring used to prioritize pipeline replacement based on risk (probability of failure x consequence of failure). This data is input into a GIS model that calculates a prioritization score for each pipe segment. These factors are reviewed periodically and can be adjusted as priorities change or new information becomes available. Most pipeline replacement is performed based on this methodology, however some pipelines rank higher due to unforeseen external factors, such as opportunities to reduce neighborhood impacts by coordinating with Transportation projects.

Table 8-2: Pipeline Failure Probability Factors

Criteria	Scoring	Data Source
Baseline Score	10	
# of Previous Failures:		
Within 300 feet	+ (# x 2.5)	Maximo Database joined with GIS
Within 3,000 feet	+ (# x 0.5)	Maximo Database joined with GIS
Failed Test or Observed "Soft" Pipe Within 300 feet	+ 5	Maximo Database joined with GIS
O&M Identifies Need	+ 15	O&M Feedback
Pipe Age		
1949 or Earlier	+ 10	As-Built GIS Data
1950-1959	+ 5	As-Built GIS Data
1960-1969	+ 2.5	As-Built GIS Data
Slope		
< 5%	0	Elevation Contours
5% to 40%	+ 0.5 to + 3.5	Elevation Contours
> 40% or Landslide Area	+ 5	King County Critical Areas GIS

Table 8-3: Pipeline Failure Consequence Factors

Criteria	Scoring	Data Source
Zoning (if Scoring > Slope)		
Residential	$8,000 [1]	PCD GIS Data
Commercial or Other	$25,000 [1]	PCD GIS Data
Type of Road or ROW		
Residential or Pedestrian	$500	Bellevue GIS Data
Collector Arterial	$10,000	Bellevue GIS Data
Minor Arterial	$25,000	Bellevue GIS Data
Major Arterial	$50,000	Bellevue GIS Data
Freeway	$100,000	Bellevue GIS Data
Pipe Capacity	(Dia - 4 x $5,000) [2]	As-Built GIS Data
Slope (if Scoring > Zoning)[1]		
< 10%	+0 [1]	Elevation Contours
10% to 20%	$15,000 [1]	Elevation Contours
20% to 30%	$25,000 [1]	Elevation Contours
30% to 40%	$50,000 [1]	Elevation Contours
> 40%	$100,000 [1]	King County Critical Areas GIS
Nearby Critical Locations		
Police Stations	$25,000	Bellevue Fire Dept GIS Data
Fire Stations	$25,000	Bellevue Police Dept GIS Data
Schools	$25,000	King County Land Use GIS Data
Hospitals	$50,000	King County Land Use GIS Data
Assisted Living Centers	$25,000	King County Land Use GIS Data
Electrical Substations	$25,000	King County Land Use GIS Data
Olympic Pipeline	$500,000	Olympic Pipeline Co. GIS Data
City Parks	$10,000	Bellevue Parks Dept GIS Data
Wetlands	$50,000	Bellevue GIS Data
Streams	$50,000	Bellevue GIS Data

1. The larger value resulting from zoning or slope is used to adjust scoring (not cumulative).
2. Diameter measured in inches. Generally, 4" is the smallest size main in Bellevue's system.

8.3 Reservoir Structural Evaluation and Rehabilitation

CIP W-85 Structural/Seismic Reservoir Rehabilitation was created to mitigate earthquake damage to reservoirs and maintain reliability following seismic events. The program should continue as noted below, until all reservoirs conform to current seismic Codes.

In 1993, the City of Bellevue authorized Kennedy/Jenks Consultants to conduct a Reservoir Seismic Vulnerability Study. The study looked at 21 of the City's 26 reservoirs. The study did not include five recently constructed reservoirs (Horizon View 3a, Cougar Mountain 1, 2, 3, and 3a) since they were built to seismic design standards in place at the time. The consequence of failure and the seismic vulnerability of each reservoir in the study was quantified and a priority rating assigned. Reservoirs with an overall priority rating of low or low to moderate were not considered for further analysis.

To obtain a low or low to moderate overall rating, required that the reservoir have a low seismic vulnerability and/or low failure consequence rating. A total of 12 reservoirs were identified as requiring more detailed analysis.

In 1995, KCM completed detailed structural analysis of the three highest priority reservoirs. Based on those results, the City completed seismic improvements as follows:

- Clyde Hill 465: Seismic Improvements completed in 1996.
- Cherry Crest: The reservoir was replaced in 1999.
- Meydenbauer 252: The reservoir was replaced in 2004.

In 1999 Montgomery Watson completed a detailed structural analysis of the next 7 reservoirs on the priority listing. Based on those results, the City completed seismic improvements as follows:

- Horizon View 1: The reservoir will be replaced in 2016-2017.
- Lake Hills North: Seismic improvements were completed in 2000
- Lake Hills South: Seismic improvements were completed in 2000
- Parksite: Seismic improvements were completed in 2001
- Pikes Peak: Replacement of the reservoir is scheduled during the 2015-2021 CIP period.
- Somerset 1 Reservoir has been abandoned.
- Woodridge: Seismic improvements were completed in 2001

The City has budgeted approximately $5.95 million (2015 dollars) for reservoir structural rehabilitation and replacement during the current 7 year (2015-2021) CIP planning period (See Chapter 9). Specific project scopes, expenditures and schedules will be developed and adjusted as the results of each reservoir's specific improvement needs are determined.

8.4 Pump Station Evaluation and Rehabilitation

Kennedy/Jenks Consultants performed condition assessment of all of the City's pump stations (excluding 161st Avenue Inlet Pump Station) in 2007, and developed a prioritized list of recommended station rehabilitation projects. Pump station prioritization has been adjusted slightly based on new information since that time. Additional information is provided in Section 4.7.

The City has set aside approximately $13.67 million (2015 dollars) for this work during the current 7 year (2015-2021) CIP planning period, in CIP W-91 Water Pump Station Rehabilitation (See Chapter 9). Specific project scopes, expenditures and schedules will be developed and adjusted as the results of each pump station's specific improvement needs are determined.

8.5 Pressure Reducing Valves

Bellevue's current asset management strategy for PRV stations consists of CIP W-67 PRV Rehabilitation and Replacement (described in Chapter 9). The program was established in 1991 to address increasing maintenance and reliability concerns as PRV stations approach the end of their useful life. It is recommended that this program continue indefinitely to maintain service reliability.

Bellevue is also evaluating the potential to integrate maintenance optimization into an overall SAMP for PRV stations. Currently, inspection and maintenance intervals (described in Chapter 6) are generally applied to all PRVs, regardless of criticality. As part of the new Roadmap, Bellevue will consider the most appropriate strategies to prioritize maintenance activities.

8.6 Large Commercial Meters

Bellevue owns and maintains approximately 312 large commercial meters (greater than 3"), accounting for nearly 30% of the total volume of water sold. A 2003 Water Loss Study identified that older commercial meters 3-inches and larger may significantly under-register flows, and become less accurate over time. The study suggested the meters may under-read as much as 102 million gallons annually (retail value ~$400,000, or about 1.7% of current typical volumes). The revenue lost by the meter inaccuracies affects both the water and sewer utilities, since sewer rates are based on winter water usage.

The current strategy for rehabilitation and repair is to address large meters through CIP W-98 Replacement of Large Commercial Water Meters. This program was established in 1991 to address increasing maintenance, obsolescence, safety, and reliability concerns at these facilities. It is recommended that this program continue as a means of maintaining the reliability and accuracy of commercial meters, but that it be evaluated to ensure cost-effectiveness.

8.7 Service Saddles

Each individual service line is connected to a water main by a service saddle. Service saddles can have variable service life, due to varying soil conditions and pipe materials. The average expected life is 40-50 years with newer stainless steel saddles expected to last at least 85 years.

Saddle and service line failures require emergency response, result in customer water service disruption until the line is repaired, and can damage roadways and private property. CIP program W-99 was established to address the increasing need for replacement of aging and deteriorating service saddles and associated service lines.

Chapter 9 Capital Investment Program

9.1 System Design Standards

The City's Water Engineering Standards are updated annually, and can be publicly accessed at the City of Bellevue Utilities website. These standards include requirements for contracting, drawings & specifications, construction materials & methods, and some planning criteria. Current Water Engineering Standards are attached as Volume 4.

9.2 2015-2021 Capital Investment Program

The City of Bellevue updates its Capital Investment Program (CIP) budget every 2-years. Table 9-1 shows the City's currently adopted drinking water CIP projects and programs. Appendix X describes recently completed projects.

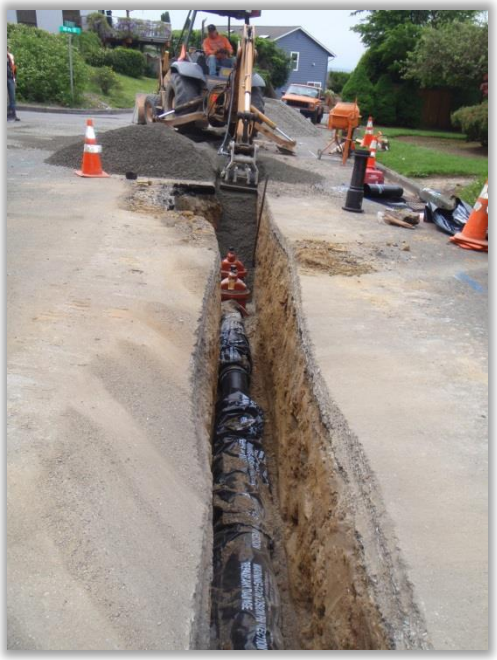
Table 9-1: Current 2015-2021 CIP Budget

CIP Plan No.	Project Name	2015-2021 Budget
W-16	Small Diameter Water Main Replacement	$60,769,000
W-67	Pressure Reducing Valve (PRV) Rehabilitation	$2,855,000
W-69	Minor Water Capital Improvement Projects	$1,605,000
W-82	Fire Hydrant Improvements	$621,000
W-85	Structural/Seismic Reservoir Rehabilitation	$5,949,000
W-91	Water Pump Station Rehabilitation	$13,671,000
W-98	Replacement of Large Commercial Water Meters	$3,838,000
W-99	Water Service Line and Saddle Replacement Program	$1,771,000
W-103	Increase Reservoir Storage for West Operating Area	$2,993,000
W-104	Increase Water Supply for West Operating Area	$5,229,000
W-105	Water Facilities for NE Spring Blvd Multi-Modal Corridor	$1,648,000
W-106	Utility Facilities for NE 4th St Extension	$295,000
W-107	East Link Water Relocation	$2,630,000
TOTAL		$103,874,000

W-16 Small Diameter Water Main Replacement

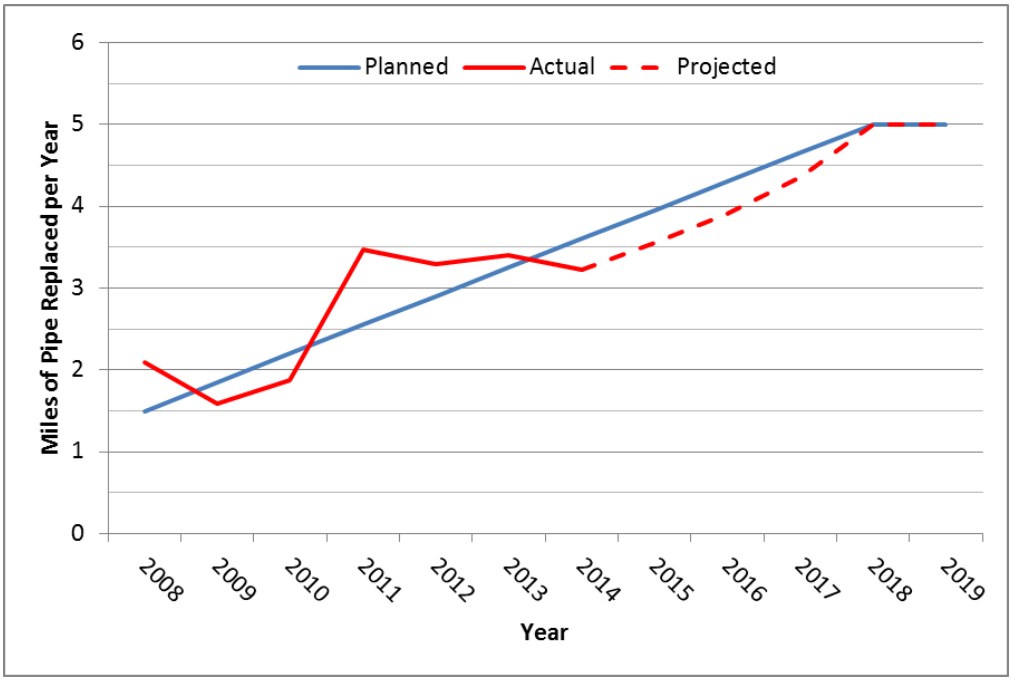
This program focuses primarily on replacing small diameter asbestos cement (AC) pipe, while also providing a secondary benefit of increased fire flow. Pipes are selected for replacement based on risk of failure (likelihood and consequence), failure history, and coordination with other construction, such as planned street overlays (which reduce restoration costs). Chapter 4 and Chapter 8 provide additional information.

Figure 9-1 shows recent and proposed annual length of AC main replacement. The previous rate of approximately 1 mile/year was not sustainable for a system of Bellevue's size (> 600 miles of pipe); it implied that each pipe should last 500 to 600 years. Investment is being ramped up to 5 miles/year by 2018, and will then be adjusted with inflation to maintain the 5 miles/year replacement rate. At that rate, pipe would be replaced on average every 100-125 years.



AC Main Replacement

Figure 9-1: Recent and Proposed AC Main Replacement



W-67 Pressure Reducing Valve Rehabilitation

PRV Vault Replacement

This ongoing program consists of the rehabilitation or replacement of old and deteriorating PRV stations throughout the water service area. The number of PRV stations that are rehabilitated varies from year to year based on the annual program budget and site-specific rehabilitation costs, but is typically 3 per year. Replacement criteria include service requirements, safety, maintenance history, age, and availability of replacement parts.

W-69 Minor Water Capital Improvement Projects

This ongoing program pays for small improvements to Bellevue's water system to resolve deficiencies, improve efficiencies, or resolve maintenance problems, often in conjunction with other programs such as the Transportation overlay program. Projects are prioritized based on criteria including public safety/property damage, maintenance frequency, operator safety, environmental risk, reliability and efficiency gains, coordination with other city projects or development activity, and level of service impact.

W-82 Fire Hydrant Improvements

This program improves fire flow and reduces emergency response time, by replacing non-standard hydrants with Bellevue's current standard hydrants. The older hydrants have outdated two-port connections that limit fire flow, and require special adapters to attach fire hoses.

As of 2014, there were 22 remaining 2-port hydrants. Based on the current budget, these should be replaced by 2019.

Fire Hydrant Replacement

W-85 Structural/Seismic Reservoir Rehabilitation

This ongoing CIP program funds reservoir retrofit or replacement to avoid or mitigate earthquake damage, and ensures reservoirs can maintain at least a minimal level of system functionality following a seismic event. It also funds reservoir rehabilitation for age or use related deterioration. Additional information is provided in Chapter 4 and Chapter 8.

W-85 does not address system-wide seismic resiliency, disaster response, or water loss due to pipeline breakage, but focuses solely on reservoir structures. A separate evaluation of system-wide seismic resiliency is recommended, as described below and in Chapter 4.

W-91 Water Pump Station Rehabilitation

This program was established in 2005 to rehabilitate pump stations based on prioritized needs. Improvements can range from basic refurbishment to complete reconstruction. The rehabilitation work may include replacing mechanical and electrical equipment, adding on-site emergency power generation, resolving structural deficiencies and Code compliance issues.

Chapter 4 and Chapter 8 provide additional information.

Newport Pump Station Rehabilitation

W-98 Replacement of Large Commercial Water Meters

This program systematically replaces high-volume commercial water meters (3-inch and larger) as their performance accuracy declines. This investment ensures equitable water charges by accurately measuring the water consumed. This results in more accurate rate allocation among user classes (residential and commercial customers), and should reduce non-revenue demands. More information is in Section 8.6.

A secondary program benefit is to resolve safety issues at 75 of the meters, which cannot currently be read remotely. Many of these oldest meters are in vaults that need to be replaced to accommodate the new meters, and to meet current safety/access standards. Vault replacement adds to the complexity and cost. The current budget funds replacement of 3-4 meters/year for locations where the vault must be replaced.

W-99 Water Service Line and Saddle Replacement Program

This program replaces aging and deteriorating customer service lines (the pipes between the water main and customer meter), and service saddles (the component connecting the customer service line to the water main). The City is responsible for maintaining approximately 33,000 water services and saddles. Specific projects will be identified through a service saddle condition assessment program (proactive) or by actual saddle failure (reactive).

New Service Line and Saddle

This program should be periodically assessed to verify that it cost-effectively meets its objectives.

W-103 Increase Reservoir Storage for West Operating Area

This project includes siting studies, hydraulic analysis, design and construction of facilities to increase access to storage in the WOA due to anticipated growth. As described in Chapter 4, access to additional storage is required by approximately 2022 in the Bellevue Storage Region, and prior to 2020 in the Pikes Peak and Clyde Hill storage regions.

This project was recommended in both Bellevue's 1998 and 2006 Water Comprehensive Plans, and has already been adopted by Bellevue City Council. The project need has been re-affirmed (see Chapter 4) based on updated analysis, accounting for appropriate storage sizing criteria, revised growth projections and changing water consumption.

W-104 Increase Water Supply for West Operating Area

This project will provide additional inlet capacity required to meet peak water supply needs, in response to population growth in the Downtown, Bel-Red, and Wilburton areas. It will also improve water supply reliability and redundancy during low demand periods. Additional capacity is required by 2020, as described in Chapter 4.

This project was recommended in both Bellevue's 1998 and 2006 Water Comprehensive Plans, and has already been adopted by Bellevue City Council. The project need has been re-affirmed (see Chapter 4) based on updated analysis, accounting for revised growth projections and changing water consumption. Although per-capita consumption has dropped (see Chapter 3), population growth has significantly exceeded previous projections, making the project recommendations still valid.

W-105 Water Facilities for NE Spring Blvd Multi-Modal Corridor

This project provides funds for the design and construction of new water facilities concurrent with the design and construction of the Spring Boulevard Multi Modal corridor. The corridor will consist of a new street, bikeways, pathways, and the new East Link light rail. This project will eventually design and construct approximately 2 miles of 12 and 16 inch water main.

W-106 Utility Facilities for NE 4th St Extension

This project will design and construct approximately 1,400 feet of new 12 inch or 16 inch water main within the new NE 4th Street right-of-way (ROW). Extension of NE 4th Street across the Burlington Northern railroad ROW provides a unique opportunity for system improvement, as the railroad ROW bisects the City, separating downtown from Bellevue's primary water source (SPU's TESSL). The City is severely restricted in its ability to construct utilities across the railroad ROW. This project will improve fire flow availability and add redundancy in case any one of the mains that cross the railroad need to be taken out of service. The Utilities and Transportation Departments are collaborating to ensure that utility construction is cost-efficient and complements the City's overall neighborhood goals.

W-107 Sound Transit East Link Corridor within Bellevue City Limits

This project funds the depreciated value of aging infrastructure replaced by new facilities as required to accommodate Sound Transit's (ST) East Link light rail project. Although the utility relocations are necessary only because of East Link, Bellevue also benefits from receiving new infrastructure, and therefore shares a portion of construction costs. W-107 reflects the value of the benefit received by Bellevue.

9.3 New Recommendations

Table 9-2 summarizes the new projects and programs recommended in Chapter 4 and Chapter 8. The source of funding and budget process (CIP vs. operating budget) will be determined during each bi-annual budget update.

Table 9-2: Proposed New Capital Projects and Programs

WSP Section	Description	Estimated Budget[1]	Applicable Policy
4.1	Air & Vacuum Release Valve Improvements	$370,000	Water Quality Responsibility; Cross Connection Control
4.4	Advanced Metering Infrastructure (AMI)[2]	$22,800,000	Efficient Water Use
4.5	Fire Flow Improvements	$1,050,000	Service Pressure and Flow; Service Reliability; Fire Flow Improvement Program
4.6	Access Storage for RV300, WD340, WD400	$830,000	Drinking Water Storage for Emergency Supply Outages
4.7	Inlet Station Rehabilitation	$2,100,000	Service Reliability; Financial Policies/ Capital Investment Program Policies
4.7	West Lake Sammamish AC Main Replacement	$5,000,000	Service Reliability; Financial Policies/ Capital Investment Program Policies
4.7	Isolation Valve Replacement Program	TBD[3]	Service Reliability; Efficient Water Use
4.7	Check Valve Replacement Program	TBD[3]	Service Reliability; Fire Flow Responsibility; Emergency Preparedness
4.7	Re-Line Cougar Mountain 3A Reservoir	$250,000	Service Reliability; Financial Policies/ Capital Investment Program Policies
TOTAL		$32,400,000	

[1] Estimated budget is estimated planning-level cost in 2015 dollars, for general information only. Costs will be refined as project scopes are developed, and adjusted for budgeting purposes during the City's bi-annual CIP and operating budget update.
[2] Includes AMI capital costs only. Does not reflect projected savings in ongoing operating costs. Estimated total 20-year cost (including ongoing operations) for AMI is $8.4M above current baseline 20-year cost.
[3] Costs for recommended new asset management programs are not known at this time. If appropriate, budget will be proposed as part of future CIP update(s).

Multiple engineering evaluations are recommended in Chapter 4, as shown in Table 9-3. Based on the results of these evaluations, additional capital projects or programs may be recommended in future CIP updates, however those cannot be identified at this time.

Table 9-3: Proposed Engineering Evaluations

WSP Section	Description	Estimated Budget[1,2]	Applicable Policy
4.1	Chlorine Residual Evaluation	$50,000	Water Quality Responsibility
4.8	Backup Power Evaluation	$50,000	Emergency Preparedness; Service Reliability
4.8	System-Wide Seismic Resiliency Evaluation	$500,000	Emergency Preparedness;
4.8	Emergency Well Development	$350,000	Emergency Preparedness; Water Shortage Response; Water Rights
TOTAL		$950,000	

9.4 20-Year Recommendations

The funded CIP projects W-103, W-104, W-105 and W-106 described above satisfy the needs of projected growth through the 20-year planning period, as discussed in Chapter 4. Therefore, only ongoing R&R programs can be recommended at this time for the 10- to 20-year period (2024 to 2034).

R&R revenues are in place and built into the current rate structure per the Financial Policies (Chapter 2) and as described in Chapter 10. R&R expenditures have been projected for 75-years as described in Chapter 8. Funding projections should be continually updated every 2-years as part of the City's biannual budgeting process.

[1] Estimated budget is estimated planning-level cost in 2015 dollars, for general information only. Estimated budget includes both consulting fees and City staff labor.
[2] Estimated costs are for engineering evaluation only. Recommendations and costs to implement capital improvements are unknown at this time and will be developed during the evaluation. If appropriate, budget for capital improvements will be proposed as part of future CIP update(s).

Chapter 10 Financial Information

This chapter summarizes the current and forecasted financial strength of Bellevue's Water Utility and its funding strategy for recommended investments through the 20-year planning period.

Additional information, including an evaluation of water rate affordability, is available in the Utilities Department's annual Utilities Business Profile, which is publicly available at the Utilities Department website (http://www.bellevuewa.gov/about-utilities.htm). The Financial section (pages 16-20) of the 2015 Utilities Business Profile is also attached at the end of this chapter for reference.

10.1 Current Financial Status

Table 10-1 summarizes actual cash-basis revenues, expenses, and fund balances for the Water Utility for the most recent 8-year period. Over this period, the Utility fund balance, which represents total unexpended resources carried forward to future years, increased from $11.2 million at the beginning of 2006 to a current balance of $13.0 million at the end of 2013. This is consistent with reserve polices in place since 1992 and adjustments made to those policies in 2004 to account for the change in the Utility's wholesale suppliers. These adjustments increased reserve requirements due to differences in lags between wholesale expenses and revenue collections as well as the "take or pay" nature of the contract with the Utility's new wholesale water supplier.

During 2006 through 2013, a total of $56.2 million was transferred to the Utility Capital Improvement Fund to finance budgeted capital project expenses. These transfers represent approximately 19% of total water utility expenses for the 8-year period.

TABLE 10-1

City of Bellevue
Water Utility Fund
Actual Revenues, Expenses & Fund Balances by Year
2006 Through 2013

	Thousands of Dollars							
	2013 Actuals	2012 Actuals	2011 Actuals	2010 Actuals	2009 Actuals	2008 Actuals	2007 Actuals	2006 Actuals
BEGINNING FUND BALANCE	$ 11,160	$ 11,090	$ 10,201	$ 11,379	$ 15,419	$ 15,215	$ 13,069	$ 11,198
ANNUAL REVENUES:								
Water Service	$ 41,693	$ 37,362	$ 33,314	$ 33,662	$ 32,408	$ 28,446	$ 27,911	$ 29,332
Interest on Investments	49	40	90	164	211	478	680	532
Connection Fees	2,850	1,164	1,079	846	784	1,998	3,470	2,173
Other Revenues	4,391	4,741	3,560	3,850	2,002	2,154	2,026	1,615
Sub-Total	$ 48,984	$ 43,306	$ 38,044	$ 38,522	$ 35,406	$ 33,076	$ 34,088	$ 33,652
ANNUAL EXPENDITURES:								
Wholesale Water Purchases	$ 16,987	$ 16,105	$ 15,286	$ 15,190	$ 13,832	$ 11,090	$ 11,306	$ 11,654
Personnel Expense	6,687	6,339	6,019	6,003	6,041	5,702	5,057	4,742
Other Maintenance & Operating Expense	14,595	11,753	11,051	10,334	8,161	9,701	10,478	9,663
Capital Outlay	681	25	117	135	283	91	32	167
Transfers to Capital Project Fund	8,175	8,982	4,650	8,007	11,019	6,256	5,036	5,496
Debt Service Expense	30	30	31	31	31	32	32	32
Sub-Total	$ 47,156	$ 43,234	$ 37,155	$ 39,700	$ 39,367	$ 32,872	$ 31,941	$ 31,755
ENDING FUND BALANCE	$ 12,988	$ 11,162	$ 11,090	$ 10,201	$ 11,458	$ 15,419	$ 15,215	$ 13,094

10.2 Financial Outlook

Table 10-2 presents a projection of annual utility revenues, expenses, and fund balances for the next 10 years, based on the 2014 adopted budget amounts and changes expected to occur in various categories over the subsequent 10-year period as a result of new customers, general inflation, and other related factors. This type of forecast is routinely used by utility staff to develop rate adjustment proposals and to assess the impact of changing budget assumptions on future rate requirements.

Some key assumptions used to forecast future annual revenues and expenses that appear in Table 10-2 are outlined below:

1. Growth in total water utility customers offset by reduced water consumption levels will result in net 0.0% growth from 2014 through 2024, based on historical and projected averages.

2. Interest and other revenue sources will grow by an average of 0.8% per year, based on historical trends and projected fund balances.

3. Wholesale water costs for 2014 through 2024 are expected to increase approximately 4.0% per year. Consistent with Utility financial policies (see Chapter 2), these increases will be "passed through" to the customer via Utility rate increases.

4. Personnel costs will increase an average of 4.3% per year, based on historical trends and projected increases in benefit costs.

5. Other maintenance and operations and capital outlay expenses will increase an average of 2.1% per year, based on historical trends and projected increases in the Seattle Consumer Price Index (CPI-U).

6. Water rate increases are projected each year from 2015 - 2024 to cover the impact of anticipated wholesale water rate increases and the cost of local program operations.

TABLE 10-2

City of Bellevue
Water Utility Fund
Forecasted Revenues, Expenses & Fund Balances by Year
2014 Through 2021

	Thousands of Dollars										
	2014 Amended Budget	2015 Forecast (1)	2016 Forecast	2017 Forecast	2018 Forecast	2019 Forecast	2020 Forecast	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast
BEGINNING FUND BALANCE	$ 8,560	$ 10,758	$ 10,877	$ 11,754	$ 11,768	$ 12,973	$ 14,202	$ 15,263	$ 16,370	$ 17,741	$ 17,690
ANNUAL REVENUES:											
Water Service	$ 41,846	$ 44,042	$ 46,243	$ 48,588	$ 51,047	$ 53,370	$ 55,796	$ 58,384	$ 60,505	$ 62,580	$ 64,786
Interest/Other Revenues	7,835	6,895	7,080	7,470	7,642	7,848	8,071	8,286	8,507	8,738	8,941
Sub-Total	$ 49,681	$ 50,937	$ 53,323	$ 56,058	$ 58,689	$ 61,218	$ 63,867	$ 66,670	$ 69,012	$ 71,318	$ 73,727
ANNUAL EXPENDITURES:											
Wholesale Water Purchases	$ 18,209	$ 18,918	$ 19,505	$ 20,300	$ 21,125	$ 21,983	$ 22,874	$ 23,802	$ 24,767	$ 25,771	$ 26,816
Personnel Expense	7,072	7,737	8,073	8,286	8,504	8,728	8,964	9,206	9,455	9,711	9,975
Other Maintenance & Operating Expense	15,249	14,002	14,155	14,758	15,384	16,006	16,660	17,350	17,989	18,632	19,308
Capital Outlay	39	189	39	1,274	241	181	295	205	100	1,588	386
Transfers to Capital Project Fund	9,315	9,971	10,674	11,425	12,230	13,091	14,013	15,000	15,330	15,667	16,012
Debt Service Expense	30	-	-	-	-	-	-	-	-	-	-
Sub-Total	$ 49,914	$ 50,817	$ 52,446	$ 56,043	$ 57,484	$ 59,989	$ 62,806	$ 65,563	$ 67,641	$ 71,369	$ 72,497
ENDING FUND BALANCE	$ 8,327	$ 10,878	$ 11,754	$ 11,769	$ 12,973	$ 14,202	$ 15,263	$ 16,370	$ 17,741	$ 17,690	$ 18,920

(1) The beginning fund balance in 2015 does not equal the budgeted ending fund balance in 2014 because revised estimates for 2014 indicate a greater than anticipated ending fund balance as a result of increased water sales and lower expenses.

10.3 Funding for Capital Investment

Transfers to the capital improvement fund included in Table 10-2 represent anticipated funding needs for projects in the current (2015-2024) CIP. These will be updated to reflect the recommendations cited in this plan for future budget and rate projections (see Chapter 7 – Asset Management).

Potential means of funding these recommendations include re-allocating funds from other lower-priority projects identified in the CIP, obtaining low-interest public works trust fund loans for projects satisfying necessary eligibility requirements, adopting additional water service rate increases to provide additional resources for capital project support, or using funds from the R&R Account for eligible projects (see next section).

10.4 Funding for Renewal and Replacement

Financial policies adopted in 1995 and revised in 1998 established a Renewal and Replacement (R&R) account to assist with the funding of these projects over a long term replacement period (75 years with policy recommendations on a 20-year horizon). In the early years, significant balances will be accumulated which will be used to fund capital investments during periods of high expenditures. The revised financial policy relies on this R&R account, in conjunction with rates, to fund capital replacement and does not plan to use debt except to provide rate stability in the event of significantly changed circumstances, such as disasters or external mandates.

All connection charge revenues, and other one-time sources of funds, including ending fund balances higher than budgeted, will be deposited to the R&R Account. Figure 10-1 shows the generalized flow of the Utility's revenues and expenses, including R&R. Table 10-3 shows the projected balances in the account from 2014-2024.

Additional information on R&R is provided in Chapter 7 – Asset Management.

Figure 10-1: Revenue and Expense Flow Chart

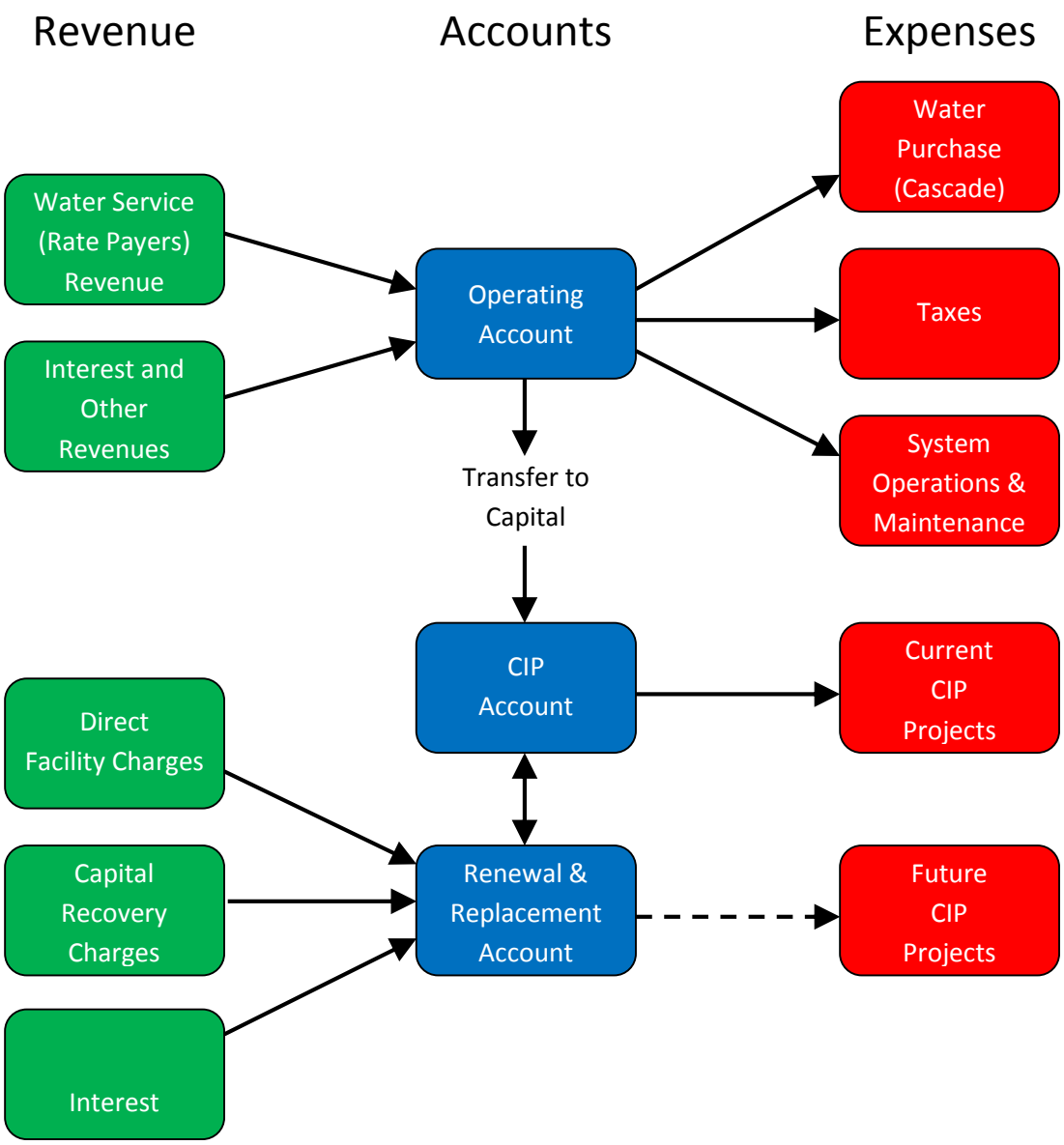


TABLE 10-3

City of Bellevue
Water Utility Renewal and Replacement Account
Forecasted Revenues, Expenses & Fund Balances by Year
2014 Through 2021

	Thousands of Dollars										
	2014 Amended Budget	**2015 Forecast**	**2016 Forecast**	**2017 Forecast**	**2018 Forecast**	**2019 Forecast**	**2020 Forecast**	**2021 Forecast**	**2022 Forecast**	**2023 Forecast**	**2024 Forecast**
BEGINNING FUND BALANCE	$ 27,948	$ 37,071	$ 34,410	$ 33,477	$ 32,399	$ 30,915	$ 29,956	$ 30,240	$ 31,436	$ 32,094	$ 34,205
ANNUAL REVENUES:											
Direct Facility Charges	35	35	35	35	30	25	15	-			
Capital Recovery Charges	1,225	1,248	1,234	1,115	923	799	772	749	748	742	712
Contribution from Rates/Other Sources	9,315	9,971	10,674	11,425	12,230	13,091	14,013	15,000	15,330	15,667	16,012
Interest on Investments	207	436	704	771	738	710	721	738	761	794	848
Sub-Total	$ 10,782	$ 11,690	$ 12,647	$ 13,346	$ 13,922	$ 14,625	$ 15,521	$ 16,488	$ 16,838	$ 17,202	$ 17,572
ANNUAL EXPENDITURES:											
Renewal & Replacement Projects	$ 12,318	$ 14,351	$ 13,580	$ 14,424	$ 15,405	$ 15,585	$ 15,237	$ 15,292	$ 16,180	$ 15,091	$ 15,127
Other	2,630	-	-	-	-	-	-	-			
Sub-Total	$ 14,948	$ 14,351	$ 13,580	$ 14,424	$ 15,405	$ 15,585	$ 15,237	$ 15,292	$ 16,180	$ 15,091	$ 15,127
ENDING FUND BALANCE	$ 23,782	$ 34,410	$ 33,477	$ 32,398	$ 30,915	$ 29,956	$ 30,240	$ 31,436	$ 32,094	$ 34,205	$ 36,650

10.5 Debt Status and Credit Worthiness

As listed below, the Utility's Public Works Trust Fund Loan reached maturity in 2014. There is no current debt, nor any projected debt for the remaining years in the forecast period.

Water Utility Debt Outstanding as of December 31, 2013

Bond Series	Issue Date	Original Issue Amount	Bonds Outstanding 12-31-13	Final Maturity Date
11994 Public Works Trust Fund Loan	1994	559,800	30,000	July 1, 2014

While they operate independently, the City's water, sewer, and storm and surface water utilities officially merged in 1980 into one combined "Waterworks Utility" for financial reporting purposes. This action has allowed the individual utilities to issue bonds at more favorable interest rates by presenting their combined financial resources and revenue generating capability as related debt security.

Bonds issued by the "Waterworks Utility" have earned very positive evaluation of credit worthiness by bond rating agencies, based on factors that include the financial position, reserve levels, and ratio of net annual operating revenues to annual debt service payments (that is, debt service coverage) for the three utilities as a whole. The Water Utility has no immediate plans to issue additional debt. However, if this action becomes necessary, the Utility can expect a proposed bond issue to receive a favorable credit rating and, therefore, to sell at lower interest rates than would otherwise be possible.

A comparative balance sheet and operating statement for the Waterworks Utility for the 8-year period from 2006 through 2013 are provided in Tables 10-4 and 10-5 on the following pages.

TABLE 10-4

City of Bellevue
Waterworks Utility
Comparative Balance Sheet

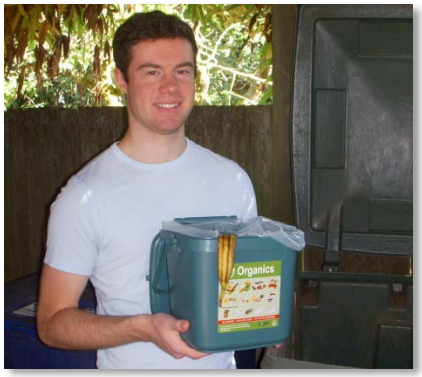
	Thousands of Dollars							
	2013 Actuals	2012 Actuals	2011 Actuals	2010 Actuals	2009 Actuals	2008 Actuals	2007 Actuals	2006 Actuals
Assets:								
Current Assets	$ 38,801	$ 37,134	$ 40,226	$ 34,016	$ 36,360	$ 41,900	$ 42,497	$ 35,947
Restricted Assets	122,804	123,541	101,887	92,078	77,334	60,602	52,191	45,928
Deferred Debits	-	-	204	213	293	362	204	247
Net Property, Plant & Equipment	285,270	258,451	251,817	245,864	234,585	225,449	209,246	199,620
Total Assets	$ 446,875	$ 419,126	$ 394,134	$ 372,171	$ 348,572	$ 328,313	$ 304,138	$ 281,742
Liabilities:								
Current Liabilities	$ 3,821	$ 5,231	$ 2,819	$ 2,395	$ 4,112	$ 3,688	$ 5,925	$ 5,019
Long-Term Liabilities	1,305	1,254	1,244	1,230	1,298	2,192	3,220	4,121
Total Liabilities & Deferred Credits	$ 5,126	$ 6,485	$ 4,063	$ 3,625	$ 5,410	$ 5,880	$ 9,145	$ 9,140
Fund Equity:								
Retained Earnings & Contributed Capital	$ 441,749	$ 412,641	$ 390,071	$ 368,546	$ 343,162	$ 322,433	$ 294,993	$ 272,602
Total Liabilities & Fund Equity	$ 446,875	$ 419,126	$ 394,134	$ 372,171	$ 348,572	$ 328,313	$ 304,138	$ 281,742

TABLE 10-5

City of Bellevue
Waterworks Utility
Operating Statement
(Years Ending December 31)

	Thousands of Dollars							
	2013 Actuals	**2012 Actuals**	**2011 Actuals**	**2010 Actuals**	**2009 Actuals**	**2008 Actuals**	**2007 Actuals**	**2006 Actuals**
Service Charges & Fees	$ 114,461	$ 103,357	$ 98,200	$ 92,867	$ 86,878	$ 79,276	$ 76,915	$ 76,442
Miscellaneous	4,097	2,274	1,741	1,450	1,415	2,761	3,615	2,739
Total Operating Revenue	$ 118,558	$ 105,631	$ 99,941	$ 94,317	$ 88,293	$ 82,037	$ 80,530	$ 79,181
Non-Operating Revenue	-	7,683	6,712	9,161	7,381	10,754	11,811	8,786
Total Revenue & Income	$ 118,558	$ 113,314	$ 106,653	$ 103,478	$ 95,674	$ 92,791	$ 92,341	$ 87,967
Administrative & General	$ 22,868	$ 20,184	$ 19,028	$ 17,991	$ 16,639	$ 16,806	$ 17,553	$ 14,757
Maintenance & Operations	65,853	60,436	58,204	55,352	51,964	45,462	45,405	43,019
Miscellaneous	7,805	10,125	7,896	4,750	6,345	6,274	6,988	6,659
Total Operating Expenses	$ 96,526	$ 90,745	$ 85,128	$ 78,093	$ 74,948	$ 68,542	$ 69,946	$ 64,435
Available for Debt Service	$ 22,032	$ 22,569	$ 21,525	$ 25,385	$ 20,726	$ 24,249	$ 22,395	$ 23,532
Actual Debt Service	$ 37	$ 38	$ 58	$ 124	$ 142	$ 145	$ 169	$ 143
Coverage	591.61	599.03	368.15	205.04	146.45	167.62	132.19	164.98

2015 Utilities Business Profile



City of Bellevue Utilities Department

A Nationally Accredited Public Utility Agency

Bellevue Utilities Financial Status

Major Issues

- Utilities services are both immediate and exceptionally long-range. Due to the long lives of our systems, our financial planning horizon extends 75 years.
- Because most Utilities systems are well past midlife, growth in maintenance and capital investments is inevitable. Capital programs will focus largely on renewal and replacement of aging infrastructure.
- The National Pollutant Discharge Elimination System Permit (NPDES) requirements, authorized by the Clean Water Act to protect surface waters, will have significant long-term impacts on the way the city does business, city expenses, and private development costs.

Financial Policies – Planning for the Future

The city's Drinking Water, Wastewater, and Storm and Surface Water Utilities were established with the goals of financial stewardship, self-sufficient funding, and comprehensive planning.

☙ The Tortoise, Not the Hare ❧

Bellevue Utilities Financial Policies:

- ***Plan for long term investment in infrastructure***
- ***Accumulate funds in advance of major expenses***
- ***Maintain existing levels of service by renewing and replacing systems***
- ***Keep rate increases gradual and uniform***
- ***Maintain equity – each generation should pay its fair share***
- ***Use debt sparingly and maintain financial flexibility***
- ***Pass wholesale costs through to customers***

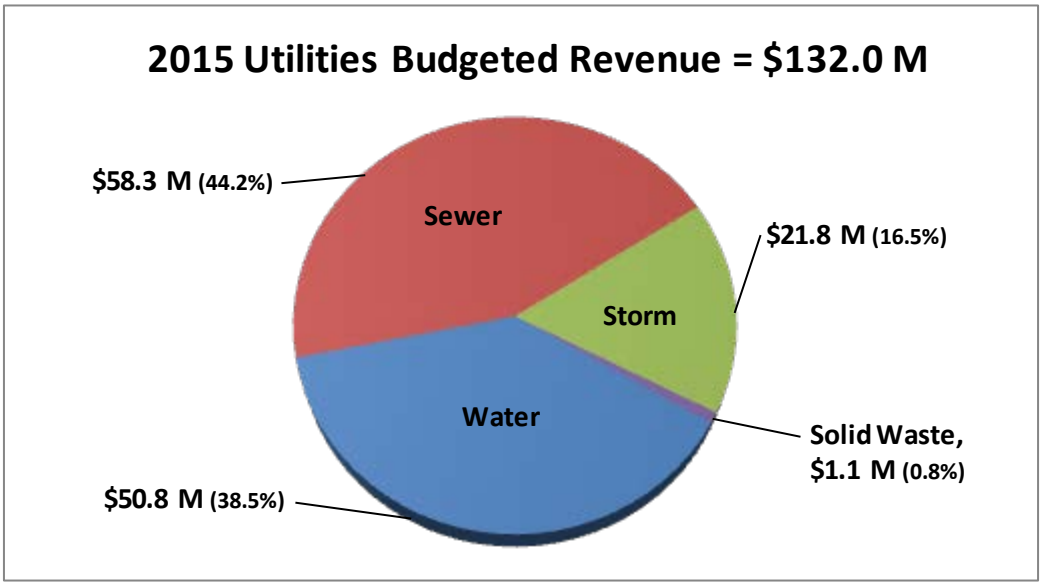
Utilities financial planning includes rate-setting and management of operating and renewal and replacement reserves. Short- and long-term planning serve as the foundation for these activities. Key financial operating and capital planning policies and practices, originally adopted by the City Council in the early 1990s, include:

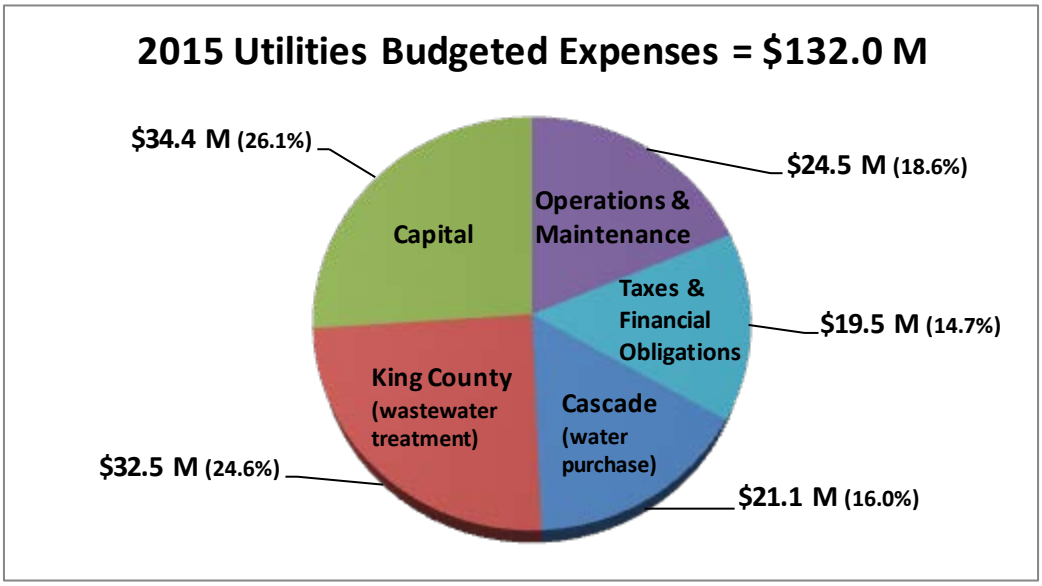
- **Rate-setting** – Rate revenues are the primary source of funding for Utilities. During the biennial budget process, the Environmental Services Commission reviews Utilities budgets and rates in detail and makes a recommendation to Council. The Council reviews and adopts rates every two years. Utilities rates are set as low as possible, while still allowing Utilities to accomplish ongoing operations, maintenance, repair, long-term renewal and replacement, system improvements, and its general business.

- **Reserves** – Reserves are purposefully set aside to help ensure uninterrupted service through normal fluctuations within the billing cycle, adverse financial performance, or significant failure of a Utilities system.

- **Capital Planning** – Bellevue Utilities is better prepared than most utilities to meet increasing infrastructure resource requirements due to the Renewal and Replacement Fund and Utilities use of long-term planning and a 75-year financial model.

Bellevue Utilities Financial Status





2015 Budgeted Equipment and Operating Reserves
($ in Millions)

	Water	Sewer	Storm	Solid Waste	Totals
Equipment Replacement	$2.6	$2.2	$2.9	$0.0	$7.7
Operations	8.3	4.1	1.4	1.1	14.9
Total Reserves	**$10.9**	**$6.3**	**$4.3**	**$1.1**	**$22.6**

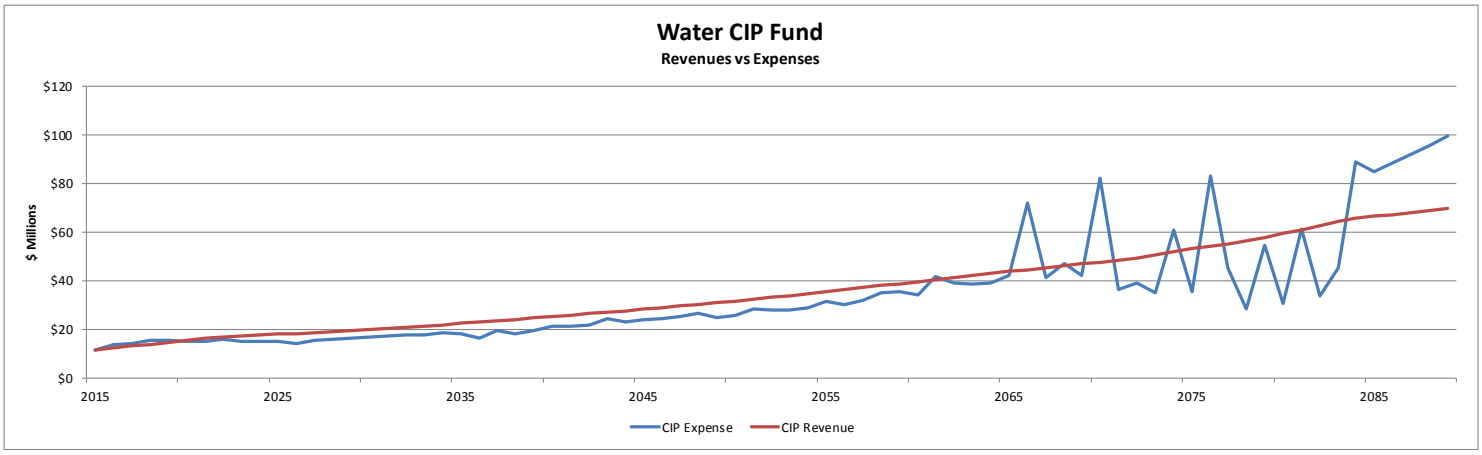
Bellevue Utilities Financial Status

Long-term Renewal and Replacement (R&R) Fund

In 1995, City Council created the renewal and replacement (R&R) fund to accumulate funds necessary to replace Utilities infrastructure as it ages. This account allows Utilities to:

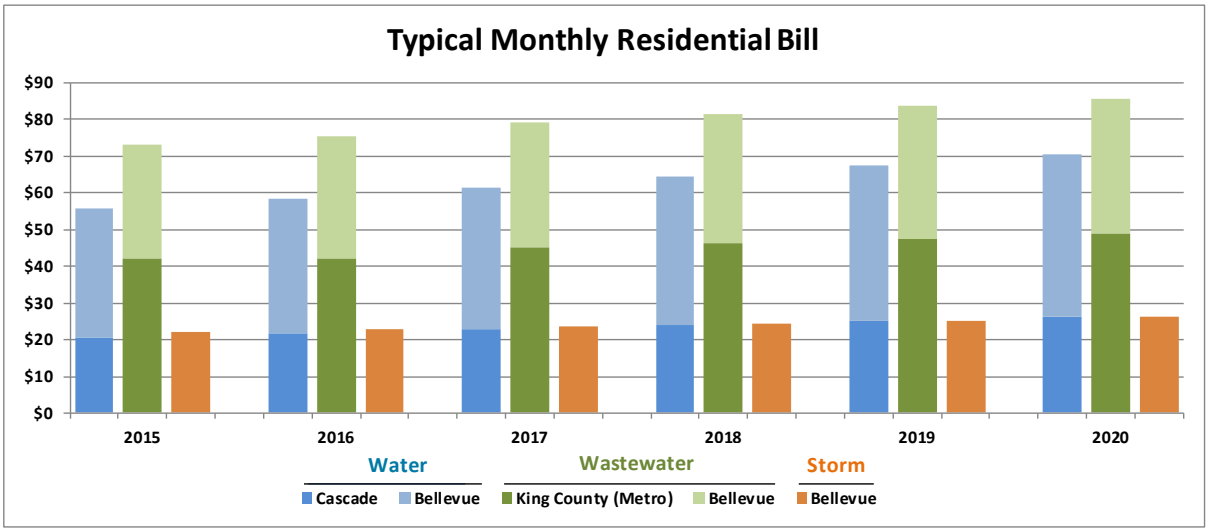
- Amortize major pending liabilities over a long time span, while maintaining current service levels.
- Keep rate increases gradual and uniform.
- Maintain equity – each generation should pay its fair share.

Spending on system renewal and replacement will increase significantly in the next ten years to adequately address the needs of aging infrastructure.



Business Line	2015 Budgeted R&R Fund Balances
Drinking Water	$34.4 M
Wastewater (Sewer)	$54.0 M
Storm & Surface Water	$46.2 M

Bellevue Utilities Financial Status

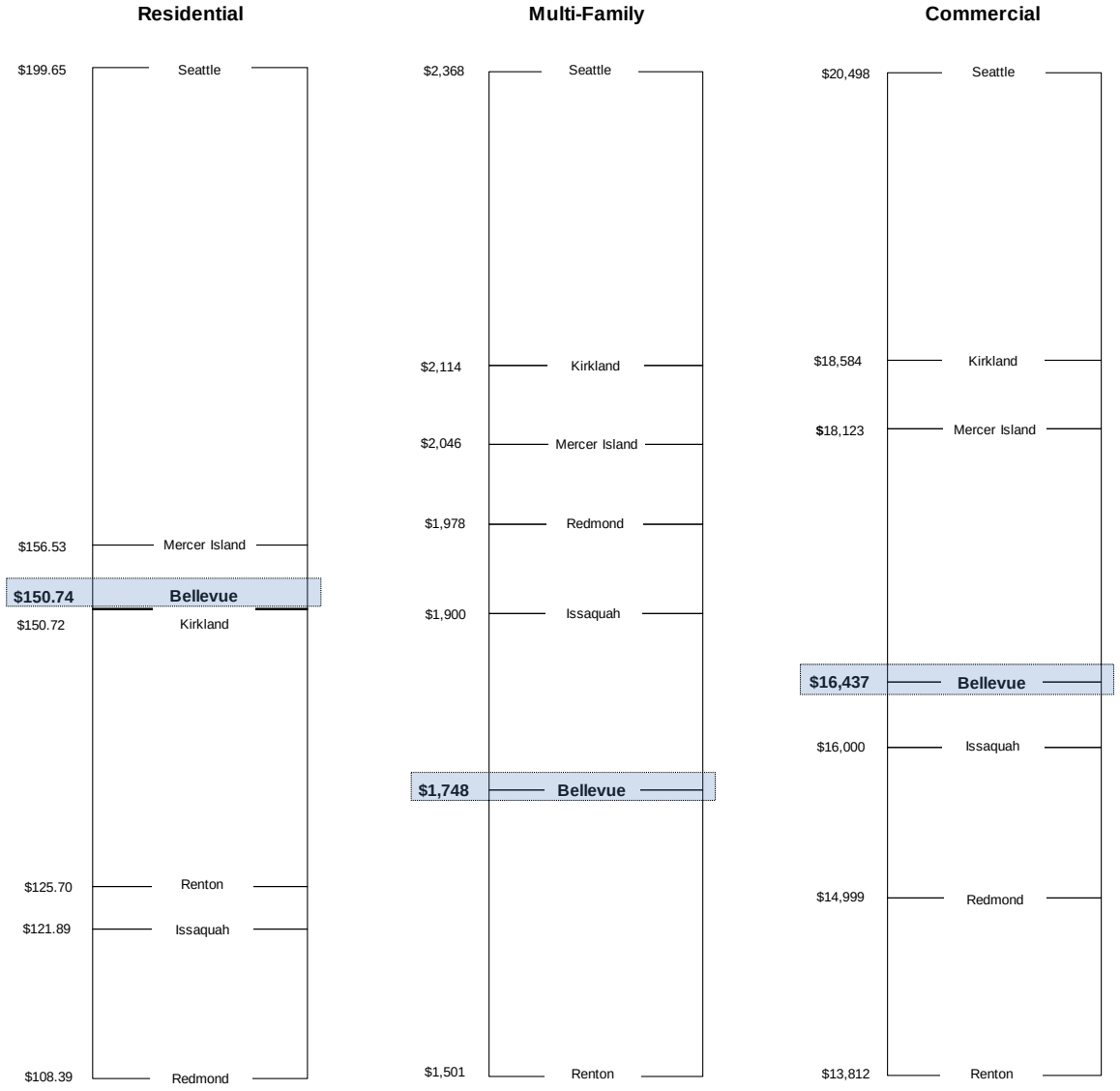


Typical Monthly Single-Family Residential Bill

Service Year		adopted 2015	adopted 2016	projected 2017	projected 2018	projected 2019	projected 2020
Water	Cascade	20.76	21.57	22.68	23.84	25.03	26.28
	Drinking Water Utility	34.79	36.87	38.68	40.59	42.30	44.08
	Total	55.55	58.44	61.36	64.43	67.33	70.36
	Total Rate Increase	5.2%	5.2%	5.0%	5.0%	4.5%	4.5%
Sewer	King County	42.03	42.03	45.05	46.26	47.50	48.77
	Wastewater Utility	31.10	33.32	34.06	34.99	35.95	36.93
	Total	73.13	75.35	79.11	81.25	83.45	85.70
	Total Rate Increase	6.5%	3.0%	5.0%	2.7%	2.7%	2.7%
Storm	Total	22.06	22.95	23.71	24.47	25.25	26.06
	Total Rate Increase	4.1%	4.1%	3.3%	3.2%	3.2%	3.2%
Total Monthly Bill		150.74	156.74	164.18	170.15	176.03	182.12
Total Rate Increase - All Three Utilities			4.0%	4.7%	3.6%	3.5%	3.5%

Bellevue Utilities Financial Status

WATER, SEWER AND STORM & SURFACE WATER UTILITIES
2015 COMBINED MONTHLY BILL COMPARISON



Comparisons based on the following criteria:

Water:	Consumption of 8.5 ccf/month, 3/4" meter
Wastewater:	Use of 7.5 ccf/month, bill includes Metro charge
Storm:	10,000 sq ft lot, moderately developed area