# 2012 Water System Plan Update (Agency Review Draft)





CH2MHILL®

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*Agency-Review DRAFT*

City of Bellingham

# 2012 Water System Plan Update

December 2012

This document has been prepared under the direction of a registered professional engineer.


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P.O. Box 91500
BELLEVUE, WA 98004

# Executive Summary

## ES-1 Introduction

This update of the City's 2009 Water System Plan was undertaken primarily to incorporate the planned implementation of Dissolved Air Flotation (DAF) at the Whatcom Falls Water Treatment Plant. This update includes analysis related to this key treatment issue that arose since completion of the 2009 Water System Plan, as well as analysis related to recent modifications to the distribution system related to distribution system water quality. Much of the content of the 2009 Water System Plan remains valid – other than where it is revised herein – and continues to document the City's overall plan for its water system. This document is hereby referred to herein as the Water System Plan Update (WSP Update) and is intended to complement and supplement the 2009 Water System Plan to form the City's overall water system planning approach for the 6-year and 20-year planning horizons – beginning in 2013.

## ES-2 Water Use

The WSP Update includes water use data from 2008, 2009, 2010, 2011, and partial data from 2012. The 2009 Water System Plan included historical water use data only through 2007. The additional years of historical water use data, combined with the data presented in the 2009 Water System Plan as well as water use data from the 1990s enables identification of changing trends in water use. The most notable trend in historical water use downward with respect to maximum day demand (MDD) and flat to slightly declining for average day demand (ADD) – despite the fact that population and water service connections have increased. Historical water use is presented in Figure E-1.

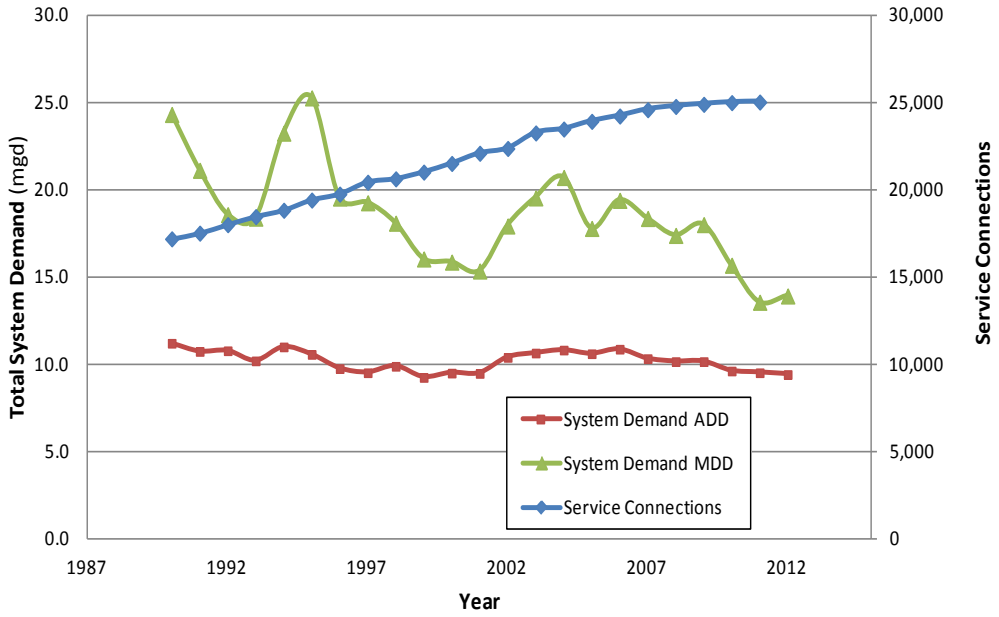



FIGURE E-1
**Historical Water Use and Service Connections**

Future water use was estimated by escalating the 2012 ADD equivalent to an annual population growth rate of 1.3 percent. This 1.3 percent annual growth rate is just over half as much as the 2.5 percent annual growth

rate that was used in the 2009 Water System Plan for estimating future water use, and reflects an updated measure and understanding of local growth trends. Estimated future water use is presented in Table E-1. It is important to estimate future water use as accurately as possible to assess the need for infrastructure improvements. Updated historical and estimated future water use is substantially less than the same from the 2009 Water System Plan. These updates resulted in the deferral distribution system pumping and storage improvements.

TABLE E-1
**Estimated Future ADD, MDD, ERUs, and WTP Production**

| | Total System Demand | | | |
|---|---|---|---|---|
| Year | ADD (mgd) | MDD (mgd) | Equivalent Residential Units (ERUs) | WTP Production (mgd) |
| 2012 | 9.4 | 14.0 | 47,236 | 14.6 |
| 2018 | 10.2 | 16.7 | 51,042 | 17.3 |
| 2022 | 10.8 | 17.5 | 53,749 | 18.2 |
| 2032 | 12.2 | 20.0 | 61,159 | 20.8 |

# ES-3 Distribution System Analysis

The major elements that comprise the City's distribution system are storage reservoirs, pump stations, and distribution system pipelines. The City's water storage and pump station facilities were evaluated based on updated actual water use and updated estimates of future water use, which resulted in deferral of improvement needs presented in the 2009 Water System Plan.

The bulk of the City's distribution system storage is contained within its lowest pressure zone – the 276 North Pressure Zone. Water flows into this zone by gravity from the Whatcom Falls Water Treatment Plant. Relatively small storage reservoirs serve higher-elevation pressure zones. Pump stations lift water to these higher-elevation pressure zones. Because most all of the City's pump stations have capacities greater than peak hour demand within the pressure zones they supply, storage from the lower 276 North Pressure Zone can be counted on to serve these upper-elevation pressure zones.

The updated pump station and storage evaluation completed as part of this WSP Update resulted in the improvements presented in Table E-2. However, none of these improvements are planned within the 6-year planning horizon.

TABLE E-2
**Summary of Planned Pumping and Storage Improvements**

| Improvement | ID Number |
|---|---|
| **Pumping** | |
| Kearney Road Pump Station | PS-1 |
| Balsam Lane Pump Station Capacity Expansion | PS-2 |
| 40th Street Pump Station | PS-3 |
| 980 Pump Station | PS-4 |
| King Mountain Pump Station | PS-5 |
| **Storage** | |
| Samish Hill Reservoir | ST-1 |
| King Mountain Reservoir | ST-2 |

# ES-4 Treatment Analysis

In late July and August of 2009 the filters at the City's WTP began clogging much earlier in filter runs than typical. Filter runs became substantially shorter than normal, requiring more frequent filter backwashing. The result of shorter filter runs and increased filter backwashing was greatly reduced WTP capacity – to the point the City implemented mandatory water restrictions, for the first time, to reduce customer demand. It should be noted that voluntary water restrictions are implemented each summer as a means of encouraging conservation during this time of typically-high customer water demand. The water restrictions were successful in reducing customer demand to match WTP capacity. Toward the end of August and into September, filter runs gradually began to return to normal and customer demand dropped, as it customarily does at that time of the year.

Filter clogging was attributed to algae in Lake Whatcom. Monitoring revealed higher than typical counts of most algae species. Although the reasons for the intense algae bloom of the summer of 2009 is the subject of varied speculation, historical and on-going algae monitoring shows that summertime algae blooms in Lake Whatcom have been increasing over the past decade. It is speculated that despite efforts to reverse this trend, summertime algae blooms in Lake Whatcom will continue to increase in intensity and duration over the near-term future. Increased Lake Whatcom algae could again result in summertime algae blooms that prevent the WTP from treating sufficient supply to meet customer demand in the future.

In response to the 2009 algae event, the City completed a study that is presented in a report entitled "Filter-Clogging Algae Mitigation Evaluation," dated June 2012 – hereinafter referred to as the Algae Mitigation Report. The Algae Mitigation Report evaluated treatment, intake, and lake management improvements and included a recommendation for the City to implement Dissolved Air Flotation (DAF) to mitigate adverse algae conditions. As presented in the Algae Mitigation Report, DAF was determined to be the technically superior treatment approach with respect to mitigating the algae problem, as well as being one of the lower cost treatment alternatives. DAF was also determined to be technically superior and far less costly than any of the intake alternatives. Lake Management was determined to be inadequate as a stand-alone mitigation approach because of the many years that will pass before improved water quality with respect to algae will be observed.

In general, the schedule for DAF implementation includes preliminary and detailed design beginning in 2014 – including the DOH-required submittals for the Project Report and the Construction Documents. Construction and commissioning would begin in late 2015 and extend into 2017.

# ES-5 Improvement Program

The Improvement Program presented in Table E-3 replaces what was developed for the 2009 Water System Plan. The largest capital improvement over the 6-year planning horizon is the implementation of DAF at the Whatcom Falls Water Treatment Plant.

# ES-6 Financial Program

The City recently completed a rate study for its water and sewer utilities, entitled "2012 Water and Sewer Rate Update." The study presented a 6-year financial plan from 2013 through 2018. Key findings and recommendations resulting from the study include rate increases of 9.0% in 2013, 8.0% per year from 2014 through 2016, 6.0% for 2017 and 2018. The rate study included accounting for capital investment that matches the quantity presented in the Improvement Program in Table E-3. The rate increases planned for implementation by the City are anticipated to be more than adequate to cover utility expenses, including planned capital improvements

TABLE E-3
**Improvement Program**

| Project | ID Number | Total Project Cost | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 – 2032 |
|---|---|---|---|---|---|---|---|---|---|
| Kearney Road Pump Station | PS-1 | -- | -- | -- | -- | -- | -- | -- | X[1] |
| Balsam Lane Pump Station Capacity Expansion | PS-2 | -- | -- | -- | -- | -- | -- | -- | X |
| 40th Street Pump Station | PS-3 | -- | -- | -- | -- | -- | -- | -- | X |
| Future 980 Pump Station | PS-4 | -- | -- | -- | -- | -- | -- | -- | X |
| King Mountain Pump Station | PS-5 | -- | -- | -- | -- | -- | -- | -- | X |
| Samish Hill Reservoir | ST-1 | -- | -- | -- | -- | -- | -- | -- | X |
| King Mountain Reservoir | ST-2 | -- | -- | -- | -- | -- | -- | -- | X |
| Dissolved Air Flotation | T-1 | $11,000,000 | -- | $500,000 | $1,000,000 | $6,000,000 | $3,500,000 | -- | -- |
| Marietta Re-Chlorination Station | T-2 | -- | -- | | | | | | X |
| Disinfection Improvements | T-3 | $1,000,000 | | $100,000 | $200,000 | $700,000 | | | |
| Screening Relocation Improvements | T-4 | $2,000,000 | | $250,000 | $250,000 | $1,500,000 | | | |
| Water System Plan Update | PN-1 | $100,000 | -- | -- | -- | -- | -- | $100,000 | -- |
| Metering Program | M-6 | $8,500,000 | -- | $2,500,000 | $2,500,000 | $2,500,000 | $1,000,000 | -- | -- |
| Annual Water Main Replacement Program | PL-1 | $12,000,000 | $2,000,000 | $2,000,000 | $2,000,000 | $2,000,000 | $2,000,000 | $2,000,000 | -- |
| **Total** | **--** | **$34,600,000** | **$2,000,000** | **$5,050,000** | **$4,750,000** | **$12,700,000** | **$6,500,000** | **$2,100,000** | **--** |

[1] Each of the projects designated with an "X" in the timeframe beyond the 6-year planning horizon were not incorporated into the financial program for the water utility. Therefore, estimated costs were not developed for these improvements.

# Contents

**List of Tables**



**List of Figures** *(Figures 3-1, 3-2, 3-3, 3-6 and 5-1 can be found at the end of this WSP Update.)*



**Appendices**

# 1. Introduction

The City of Bellingham (City) hereby updates its Water System Plan, which was completed in September 2009. The Washington State Department of Health (DOH) water system identification number for the City's municipal system is 05600.

This update does not replace the 2009 Water System Plan in its entirety, but instead provides updated analysis related to a key treatment issue that arose since completion of the 2009 Water System Plan, as well as recent modifications to the distribution system related to distribution system water quality. Much of the content of the 2009 Water System Plan remains valid – other than where it is revised herein – and continues to document the City's overall plan for its water system. This document is hereby referred to herein as the Water System Plan Update (WSP Update) and is intended to complement and supplement the 2009 Water System Plan to form the City's overall water system planning approach for the 6-year and 20-year planning horizons – beginning in 2013.

In support of the treatment and distribution elements cited above, the City's historical and estimated future water use have been supplemented with updated information. The resulting improvements from the treatment and distribution analysis comprise a revised Improvement Program, which is presented herein – replacing the one in the 2009 Water System Plan. In support of the new Improvement Program, a summary of the City's financial strategy is summarized herein.

In summary, this WSP Update is comprised of updates to the following elements of the 2009 Water System Plan:

- **Water Use:** This WSP Update incorporates recent water use information and provides a revised estimate of future water use projections for the overall system and hereby replaces those elements from the 2009 Water System Plan. Other water use elements from the 2009 Water System Plan remain valid.
- **System Analysis:** This WSP Update includes hydraulic analysis of the distribution system (pipelines, pump stations, storage reservoirs) that reflects recent piping modifications within the distribution system. Facility description from the 2009 Water System Plan has not been repeated herein and remains valid. In addition to the analysis of the 2009 Water System Plan, analysis related to water age within the distribution system was completed because of recent related water quality impacts associated with loss of chlorine residual.
- **Treatment Analysis:** This WSP Update includes discussion of the planned dissolved air flotation (DAF) system to address annual summertime Lake Whatcom algae blooms that reduce capacity at the Whatcom Falls Water Treatment Plant (Plant). The City began planning for this improvement after the summer of 2009, during which Plant capacity was reduced to the point customer demand could not be met – resulting in the need for mandatory water restrictions. The DAF improvement was not included in the 2009 Water System Plan because the 2009 Water System Plan had been completed prior to the summertime algae bloom. This planned improvement is the primary stimulus for this WSP Update. This WSP Update also includes evaluation of the need for additional filtration capacity based on updated water use estimates.
- **Improvement Program:** The Improvement Program developed for this WSP Update reflects the updated analyses presented herein. This Improvement Program hereby replaces the 2009 Improvement Program in its entirety.

- **Financial Program:** Simultaneous to the completion of this WSP Update, the City completed a rate study for its water and wastewater utilities. The results of the rate study, entitled "2012 Water and Sewer Rate Update," which includes increased water rates to cover escalating costs and near-term capital improvements, are briefly summarized herein.

# 2. Water Use

Updated historical and projected City water use is presented in this section. This section includes water use data from 2008, 2009, 2010, 2011, and partial data from 2012. The 2009 Water System Plan included historical water use data only through 2007. The additional years of historical water use data, combined with the data presented in the 2009 Water System Plan as well as water use data from the 1990s enables identification of changing trends in water use. The additional years of historical water use data also support estimating future water use because these same trends can be incorporated into those estimates.

## 2.1 Historical Water Use

Historical water use is presented in Table 2-1 and Figures 2-1 and 2-2. From this table and these figures, several trends are identifiable, including:

- Steadily increasing service connections since 1990 with a reduced rate of increase in service connections over the past few years.
- Average Day Demand (ADD) for the City's system has declined overall since 1990 as well as in the past few years.
- Similar to ADD but at a greater rate, Maximum Day Demand (MDD) for the City's system has declined overall since 1990 as well as in the past few years.
- Per-connection ADD and MDD water use has declined steadily and substantially since 1990.
- The MDD/ADD demand ratio has declined over the years, which reflects the more-rapid decline in MDD than ADD.
- Water treatment plant (WTP) production at the Whatcom Falls WTP has declined over the years in parallel with the decline in MDD. The City generally operates the WTP to match system demand on a daily basis.
- Water use data from 2008 through 2012 – data that was not available for the 2009 Water System Plan – reflects decline in each of the water use metrics presented in Table 2-1. This recent decline has a substantial impact on estimates of future water use.

Overall, it is clear that despite growth in population, which is reflected in the growth in number of service connections, total water use has been declining. There is both a decline in overall system ADD and MDD, but a much greater decline in MDD. The reason for this decline is the marked reduction in the quantity of water used per connection, which generally reflects the ever-increasing awareness of individual customers to conserve and use water wisely. These trends are reflected in many other communities throughout western Washington – particularly as it relates to reductions in MDD, which results primarily from reduced summertime outdoor watering.

The extent to which the further reduction in per-connection water use continues into the future is uncertain. However, the City's ongoing program to convert two thirds of its customers, which are currently unmetered, to metered customers will likely lead to further per-connection water use reductions and could potentially result in negligible growth in overall system ADD and MDD for several years to come.

TABLE 2-1
**Historical Water Use**

| Year | Service Connections | Total System Demand ADD (mgd) | Total System Demand MDD (mgd) | Per-Connection Demand ADD (gpcpd) | Per-Connection Demand MDD (gpcpd) | Demand Ratio MDD/ADD | WTP Production (mgd) |
|---|---|---|---|---|---|---|---|
| 1990 | 17,173 | 11.2 | 24.3 | 652 | 1,415 | 2.17 | 25.3 |
| 1991 | 17,498 | 10.7 | 21.1 | 613 | 1,206 | 1.97 | 21.9 |
| 1992 | 17,985 | 10.8 | 18.6 | 598 | 1,032 | 1.72 | 19.3 |
| 1993 | 18,447 | 10.2 | 18.4 | 552 | 995 | 1.80 | 19.1 |
| 1994 | 18,810 | 11.0 | 23.2 | 584 | 1,235 | 2.12 | 24.2 |
| 1995 | 19,394 | 10.6 | 25.3 | 544 | 1,302 | 2.39 | 26.3 |
| 1996 | 19,736 | 9.7 | 19.5 | 494 | 989 | 2.00 | 20.3 |
| 1997 | 20,416 | 9.5 | 19.2 | 465 | 942 | 2.03 | 20.0 |
| 1998 | 20,611 | 9.9 | 18.1 | 479 | 877 | 1.83 | 18.8 |
| 1999 | 20,996 | 9.2 | 16.0 | 440 | 763 | 1.74 | 16.7 |
| 2000 | 21,493 | 9.5 | 15.8 | 441 | 737 | 1.67 | 16.5 |
| 2001 | 22,076 | 9.5 | 15.3 | 429 | 694 | 1.62 | 15.9 |
| 2002 | 22,352 | 10.4 | 17.9 | 464 | 801 | 1.73 | 18.6 |
| 2003 | 23,240 | 10.6 | 19.5 | 457 | 840 | 1.84 | 20.3 |
| 2004 | 23,464 | 10.8 | 20.7 | 460 | 882 | 1.92 | 21.5 |
| 2005 | 23,905 | 10.6 | 17.8 | 443 | 743 | 1.68 | 18.5 |
| 2006 | 24,210 | 10.9 | 19.4 | 448 | 800 | 1.79 | 20.2 |
| 2007 | 24,573 | 10.3 | 18.3 | 420 | 746 | 1.78 | 19.1 |
| 2008 | 24,759 | 10.1 | 17.4 | 410 | 702 | 1.71 | 18.1 |
| 2009 | 24,880 | 10.1 | 18.0 | 408 | 723 | 1.77 | 18.7 |
| 2010 | 24,978 | 9.6 | 15.7 | 384 | 627 | 1.63 | 16.3 |
| 2011 | 25,011 | 9.5 | 13.5 | 380 | 541 | 1.43 | 14.1 |
| 2012 | -- | 9.4 | 13.9 | -- | -- | 1.48 | 14.5 |

1. Abbreviations: mgd = million gallons per day; gpcpd = gallons per connection per day

2. WTP Production = Total System MDD plus 4% to account for uses at the Whatcom Falls WTP, including filter backwashing, filter-to-waste, and other minor uses prior to delivery to customers.

3. The 2012 MDD was a recorded value on August 3, 2012.

4. The number of service connections for 2012 was assumed to be unchanged from the end of 2011 (25,011) - reflecting slowing growth and poor economic conditions. The actual number at the end of 2012 was not available at the time this data was assembled.

5. The estimated 2012 ADD was estimated to be 99.3% of the 2011 ADD based on a comparison of the first 7 months of available water use data from 2012 and the same data from 2011.

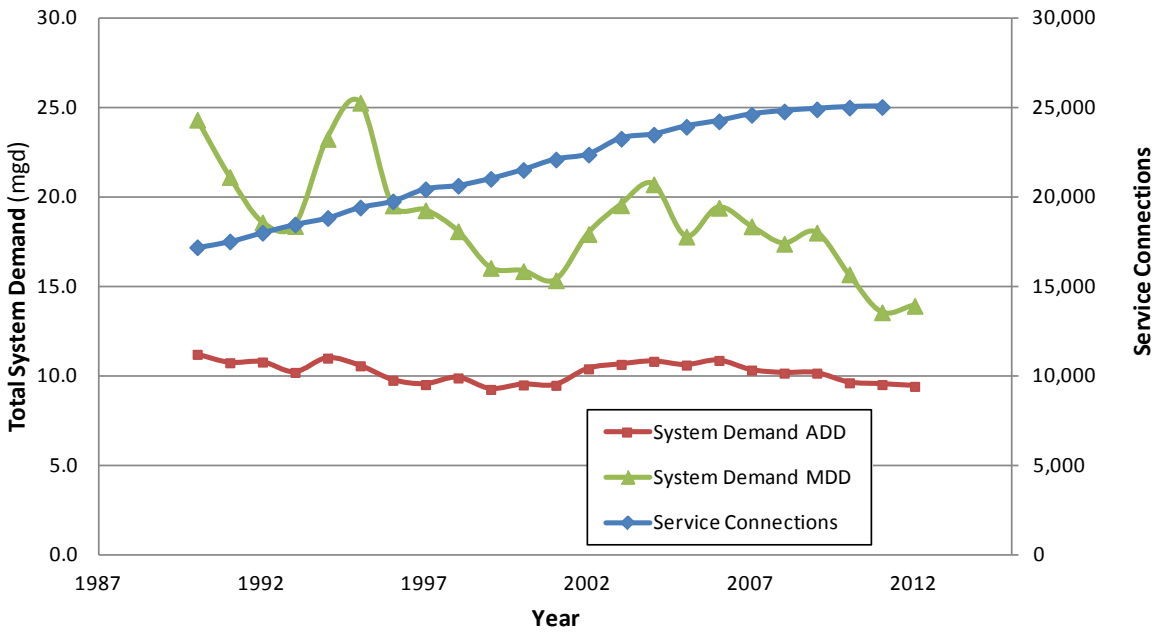



FIGURE 2-1
**Historical Water Use and Service Connections**

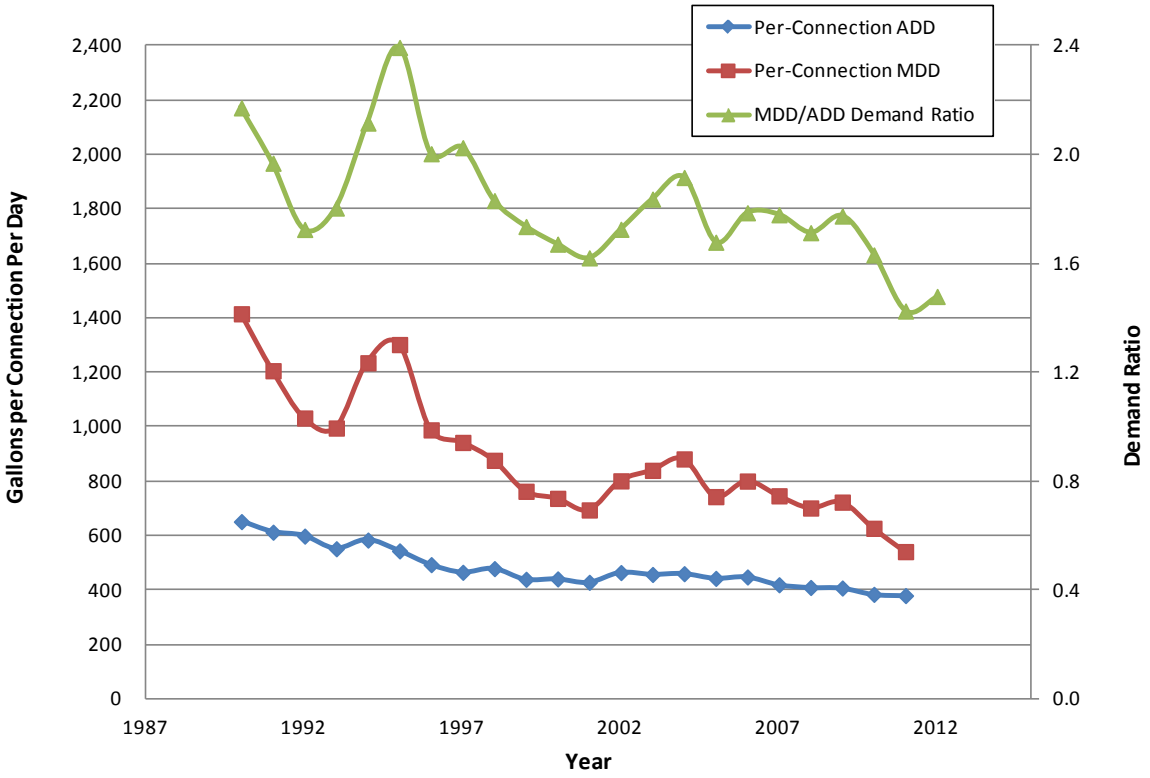



FIGURE 2-2
**Historical Per-Connection Water Use and Demand Ratio**

## 2.2 Estimated Future Water Use

Projected water use is presented in Table 2-2 – extending from the current year, 2012, through the 20-year planning horizon. Because the 2012 calendar year was not complete at the time this WSP Update was prepared, an entire year of actual ADD for 2012 was not available; however, it was estimated to be slightly less than the ADD for 2011 – by 0.7 percent. This estimate was developed after a review of master meter data at the water treatment plant for the first 8 months of 2012 showed that water use for this 8-month period was 99.3% of water use for the same period in 2011.

TABLE 2-2
**Estimated Future ADD, MDD, ERUs, and WTP Production**

| | Total System Demand | | | |
|---|---|---|---|---|
| **Year** | **ADD (mgd)** | **MDD (mgd)** | **Equivalent Residential Units (ERUs)** | **WTP Production (mgd)** |
| 2012 | 9.4 | 14.0 | 47,236 | 14.6 |
| 2018 | 10.2 | 16.7 | 51,042 | 17.3 |
| 2022 | 10.8 | 17.5 | 53,749 | 18.2 |
| 2032 | 12.2 | 20.0 | 61,159 | 20.8 |

1. The estimated 2012 ADD was estimated to be equal to the 2011 ADD multiplied by 1.2% based on a comparison of date from the first 7 months of 2011 and 2012.

2. The 2012 MDD was a recorded value on August 16, 2012, as presented in Table 2-1.

3. The 2018 and 2032 MDDs were estimated using the average of the MDD/ADD demand ratios for 2007 through 2012 (using estimated 2012 ADD) multiplied by the corresponding 2018 and 2032 ADDs.

4. Future ERUs were estimated using the 199 gpd/ERU value from the 2009 Water System Plan.

5. WTP Production = Total System MDD plus 4% to account for WTP uses.

6. 2018 and 2032 estimates of ADD and ERUs are based on an annual population growth rate of 1.5%.

Actual MDD data for 2012 was available at the time this WSP Update was prepared, as presented in Table 2-1. However, future MDD was not estimated based on this 2012 MDD value. MDD is more affected by seasonal weather conditions and therefore subject to greater year-to-year variability than ADD. Future MDD was estimated by applying an average of the MDD/ADD demand ratio from the last few years (2007 through 2012) to the estimated future ADD values for 2018 and 2032. This approach reduces the impact of the very low MDD values from 2010, 2011, and 2012 which resulted from unseasonably cool summers. At the same time, however, this approach provides an accounting of the longer-term and recent decline of the City's MDD. It appears that the trend toward reduced MDD can be attributed, in part, to unseasonably cool summers during the 2010 to 2012 period as well as longer-term changes in customer water use.

Future water use (6-year, 10-year, and 20-year projections) was estimated by escalating the 2012 ADD equivalent to an annual population growth rate of 1.3 percent. This population growth rate estimate represents the annualized increase associated with the latest growth rate estimates adopted by the City for utility planning as well as the City's overall Comprehensive Plan. This 1.3 percent annual growth rate is just over half as much as the 2.5 percent annual growth rate that was used in the 2009 Water System Plan for estimating future water use, and reflects an updated

measure and understanding of local growth trends. The estimated future water use presented in Table 2-2 is approximately 60 percent of what was estimated in the 2009 Water System Plan. This much-lower estimate of future water use results, in part from a lower ADD baseline starting point, but more-significantly from the lower annual growth rate.

It is important to estimate future water use as accurately as possible to assess the adequacy of water rights as well as the need for infrastructure improvements. Although not specifically addressed in this WSP Update, the City has adequate municipal water rights to meet its current and projected ADD and MDD. With respect to infrastructure need, however, an accurate estimate of future MDD is of primary importance because MDD is used as the key criterion to establish the capacity of supply and treatment improvements.

# 3. Distribution System Analysis

Analysis of the City's distribution system capacity, incorporating distribution system improvements since 2009 and updated water use, is presented in this section. The major elements that comprise the City's distribution system are storage reservoirs, pump stations, and distribution system pipelines. The City's water storage and pump station facilities were evaluated based on the updated actual water use and updated estimates of future water use, which resulted in changes from the improvement needs presented in the 2009 Water System Plan.

The analysis presented herein is for capacity purposes, only, and does not address condition-related facility issues. The City is initiating an Asset Management Program that will continue through 2013 to identify condition-related facility improvement needs for its drinking water and wastewater facilities. Upon its completion, the results of that program will be incorporated into the City's Water Plan.

The City's distribution system pipelines were not evaluated with respect to capacity as part of this WSP Update because the City's actual water use has declined what was documented in the 2009 Water System Plan, updated estimates of future water use are much lower than in the 2009 Water System Plan, and because there have been no changes to fire flow requirements. As a result, the distribution system pipeline analysis presented in the 2009 Water System Plan remains valid, even though somewhat conservative. No system improvements or modifications are warranted or planned because of distribution system pipeline capacity deficiencies.

In addition to the storage and pumping evaluation presented herein, a distribution system water age evaluation was undertaken because of recent concerns relating to maintaining a chlorine residual within the distribution system at the Marietta Reservoir and Kearney Road Reservoir. The purpose of the water age evaluation was to develop a relative comparison of reservoir residence time for existing and potential alternative configurations. The objective of reducing water age is to facilitate maintaining a detectable chlorine residual within the distribution system, which is required.

The analysis presented herein is based on updated water use, as presented in Section 2, which includes substantial reductions in average and peak water use in recent years and more modest projections of growth in water use than what were presented in the 2009 Water System Plan. The analyses were based on current water use as well as projected water use for the 6-, 10-, and 20-year planning horizons. Distribution of water use throughout the water system remains the same as developed for the 2009 Water System Plan.

The City's latest service area map, pressure zone map, and hydraulic profile are presented at the end of this WSP Update as Figures 3-1, 3-2, and 3-3, respectively. These figures reflect recent changes in the City's service area via annexation and distribution system modifications in the vicinity of the Kearney Road Reservoir and James Street Pump Station.

## 3.1 Pressure Zone Demands

The system-wide existing and projected water use is summarized in Section 2 and was used for analyzing the overall system. However, water use for individual pressure zones is also necessary to analyze pumping, storage, and pipeline facilities. A summary of the current pressure zone average day demands (ADDs), as developed from existing customer billing records and meter locations, is presented in Table 3-1. Also presented in Table 3-1 is estimated future ADD on a per-zone basis based on a distribution of growth anticipated by the City. The combined estimated growth in water use for the City is the same as that presented in Table 2-2.

TABLE 3-1
**Summary of ADD per Pressure Zone** (gallons per minute)

| Pressure Zone | 2012 | 2018 | 2022 | 2032 |
|---|---|---|---|---|
| 276 North[1] | 2,917 | 3,152 | 3,172 | 3,427 |
| 350 Cordata[2] | 804 | 869 | 1,107 | 1,410 |
| 457 South[3] | 1,335 | 1,443 | 1,442 | 1,550 |
| 460 King Mountain | 9 | 10 | 41 | 73 |
| 519 Dakin & Consolidation[4] | 826 | 893 | 905 | 934 |
| 780 Birch Street | 10 | 11 | 16 | 28 |
| 541 College Way | 52 | 56 | 56 | 56 |
| 696 Padden Yew | 282 | 305 | 336 | 389 |
| 730 Alabama Hill | 221 | 239 | 276 | 330 |
| 830 Reveille[5] | 17 | 19 | 63 | 108 |
| 873 Governor Road[5] | 53 | 57 | 106 | 179 |
| Total | 6,527 | 7,053 | 7,507 | 8,486 |
| Total (mgd) | 9.4 | 10.2 | 10.8 | 12.2 |

[1] Includes demands for Montgomery Road Water Association, Water District #2, and LWW&SD.

[2] Includes demands for Deer Creek Association.

[3] Includes demands for California Street Water Association.

[4] Includes demands for the 660 Huntington Pressure Zone, LWW&SD, Water District #7, and Glen Cove Cooperative.

[5] The 830 Reveille Pressure Zone and the 873 Governor Road Pressure will be combined to 870 Samish Hill Pressure Zone within the 20-year planning horizon.

## 3.2 Pump Stations

Description of the City's pump stations is presented in the 2009 Water System Plan. The only changes to the City's pump stations since 2009, include: (1) the addition of the Samish Crest Pump Station, which provides domestic service for 20 new houses adjacent to the existing Parkhurst Reservoir; and (2) the re-connection of the James Street Pump Station suction from the 276 North

Pressure Zone to the 519 Dakin & Consolidation Pressure Zone. The Samish Crest Pump Station does not provide fire flow to the 20 houses; but instead, fire flow protection is provided from a private fire system supplied from a fire department connection just down-slope from these 20 homes – within the 873 Governor Road Pressure Zone.

Capacity analyses of the City's major pump stations were based on the updated water use information summarized in Section 2 are presented in the subsections below, after a discussion of evaluation methodology. Pumping deficiencies identified are summarized in Section 3.6.1 and planned improvements for mitigating these deficiencies are presented in Section 3.7.1.

### 3.2.1 Capacity Evaluation Methodology

The pump station capacity evaluation accounts, where applicable, for pumped zones that are supplied from the zone into which the pump station being evaluated supplies. In other words, a pump station at a lower elevation within the overall water system must not only have the capacity to supply water to the pressure zone it directly discharges to, but also to all of the pumped zones above, that draw water from pressure zone being directly supplied. Pump stations are required, at a minimum, to meet the maximum day demand (MDD) of the pressure zone they supply, in addition to the demands of pressure zones above – as discussed above. The difference in demand from the pressure zone between the peak hour demand (PHD) and MDD is supplied from the storage that establishes the hydraulic grade line of the pressure zone and provides directly, stored supply. Pressure zones that are directly served by storage are referred to as "open" zones while pressure zones that do not have storage within the zone are referred to as "closed" zones.

Pump stations that supply open zones are evaluated with respect to their "firm" capacity, as opposed to their total capacity. Total capacity refers to the capacity of a pump station with all pumps operating. Firm capacity refers to the capacity of a pump station with the largest pump out of service. This capacity evaluation approach is described in the Washington State Department of Health Design Manual.

Pump stations supplying closed zones must have the capacity to supply peak hour demand (PHD) – not just maximum day demand (MDD). As stated above, the difference between PHD and MDD is typically provided by distribution system storage, which is not available in closed zones. In addition to PHD, pump stations supplying closed zones must meet fire flow demand requirements within each pressure zone. Pump stations serving closed zones are required to be equipped with a backup power supply, which is the case for the City's pump stations serving these zones.

Where two pump stations supply a particular zone, they were evaluated with respect to their combined capacity as though they are a single, combined pump station. This is a valid evaluation approach in recognition that each pump station does <u>not</u> need to completely redundant to each other – each having the capacity to meet the demand needs of the pressure zones they supply. In fact, because they are physically remote from each other, two separate facilities already have a slight inherent increase in redundancy and reliability than a single, larger-capacity facility. Since the two facilities are evaluated with respect to their capacity as a single, combined pumping facility, their combined firm capacity (capacity with the largest pump out of service) is defined by removing only the largest of the pumps from the two facilities (one pump total) from service.

A summary of key evaluation elements of the pump stations evaluated are presented in Table 3-2. For those locations where two pump stations directly supply a pressure zone, both pump stations are listed together in the first column of Table 3-2. This applies to the Dakin & Consolidation Pump Station and the Woburn Pump Station, which both pump to the 519 Dakin & Consolidation Pressure Zone. This also applies to the Consolidation Pump Station and the 38th Street Pump Station, which both pump to the 696 Padden Yew Pressure Zone.

TABLE 3-2
**Major City Pump Stations[1]**

| Pump Station(s) | Zone Supplied from Pump Station | Higher-Elevation Pressure Zones Served from Supplied Zone | Pumps to a Reservoir? | Demand Capacity Criterion |
|---|---|---|---|---|
| Otis Street[2] | 457 South | 541 College Way<br>696 Padden Yew;<br>873 Governor Road;<br>830 Reveille;<br>980 Samish Crest | Yes | MDD |
| Dakin & Consolidation PS; Woburn PS[2] | 519 Dakin & Consolidation | 696 Padden Yew;<br>730 Alabama Hill;<br>780 Birch Street;<br>660 Huntington;<br>830 Reveille;<br>873 Governor Road;<br>980 Samish Crest | Yes | MDD |
| James Street | 530 King Mountain | None | No | PHD |
| College Way | 541 College Way | None | No | PHD+FF |
| Short Street | 350 Cordata | None | No | PHD+FF |
| Consolidation PS; 38th Street PS | 696 Padden Yew | 873 Governor Road;<br>830 Reveille | Yes | MDD |
| Birch Street | 780 Birch Street | None | No | PHD+FF |
| Balsam Lane | 730 Alabama Hill | None | No | PHD+FF |
| Governor Road | 873 Governor Road | 980 | Yes | MDD |
| Huntington | 660 Huntington | None | No | PHD |
| Reveille | 830 Reveille | None | No | PHD+FF |

[1] The Huntington, Samish Heights, Raymond, and Bonanza pump stations are very small pump stations that do not provide fire flow and serve areas that are not anticipated to grow substantially. All but the Huntington pump station are anticipated to be decommissioned and replaced within the 20-year planning horizon.

[2] The 696 Padden Yew Pressure Zone and the three higher-elevation pressure zones supplied from the 696 Padden Yew Pressure Zone can be supplied either via the Consolidation Pump Station or the 38th Street Pump Station. As a result, for the purpose of this analysis (and as an element of conservatism) the demand associated with these pressure zones was accounted in the evaluation of both the Otis Street Pump Station and the combined evaluation of the Dakin & Consolidation Pump Station / Woburn Pump Station.

### 3.2.2 Otis Street

As shown in Table 3-3, the Otis Street pump station has adequate capacity through the 6-year, 10-year, and 20-year planning period to meet the demands of the 457 South Pressure Zone. No capacity improvements to the Otis Street pump station are needed.

TABLE 3-3
**Otis Street Pump Station Capacity Evaluation** (gpm)

| Demand/Capacity | 2012 | 2018 | 2022 | 2032 |
|---|---|---|---|---|
| Demand (MDD) Required[1] | 2,837 | 3,066 | 3,252 | 3,667 |
| Existing Total Capacity | 7,000 | 7,000 | 7,000 | 7,000 |
| Existing Firm Capacity | 5,500 | 5,500 | 5,500 | 5,500 |
| Excess (Deficient) Capacity | 2,663 | 2,434 | 2,248 | 1,833 |

[1] Includes MDDs for 457 South, 541 College Way, 696 Padden Yew, 873 Governor Road, and 830 Reveille

### 3.2.3 Dakin & Consolidation; Woburn Street

The Dakin & Consolidation Pump Station (formerly referred to as the Dakin & Yew Pump Station) is the primary pump station serving the 519 Dakin & Consolidation Pressure Zone (formerly the 519 Dakin & Yew Pressure Zone). The Woburn Street Pump Station serves as a redundant backup pump station. The two smaller, normal-operating pumps at the Woburn Street Pump Station are periodically operated manually to maintain operating condition and aid circulation of the distribution system. The two larger, high-flow pumps are controlled by a low pressure sensor on the discharge of the pumps that could initiate service in the event of a fire flow condition. As a result, the Woburn Street Pump Station typically only operates during such low pressure conditions.

As shown in Table 3-4, the combined capacity of these two pump stations far exceeds the required demands of the 519 Dakin & Consolidation Pressure Zone and each of the pressure zones above that are served directly or indirectly from the 519 Dakin & Consolidation Pressure Zone for each of the planning horizons listed. The 696 Padden Yew, 830 Reveille, and 873 Governor Road Pressure Zones

TABLE 3-4
**Dakin & Consolidation Pump Station; Woburn Street Pump Station Capacity Evaluation** (gpm)

| Demand/Capacity | 2012 | 2018 | 2022 | 2032 |
|---|---|---|---|---|
| Demand (MDD) Required[1] | 2,312 | 2,499 | 2,733 | 3,012 |
| Existing Total Capacity | 12,900 | 12,900 | 12,900 | 12,900 |
| Existing Firm Capacity | 10,900 | 10,900 | 10,900 | 10,900 |
| Excess (Deficient) Capacity | 8,588 | 8,401 | 8,167 | 7,888 |

[1] Includes MDDs for 519 Dakin & Consolidation, 696 Padden Yew, 730 Alabama Hill, 780 Birch Street, 830 Reveille, and 873 Governor Road.

were included in the capacity evaluation presented in Table 3-4, as an element of conservatism, even though the 696 Padden Yew Pressure Zone (and the small zones above it) is also served from the 457 South Pressure Zone via the 38th Street Pump Station. No capacity improvements are planned at either the Dakin & Consolidation Pump Station or the Woburn Street Pump Station.

### 3.2.4 James Street

The James Street Pump Station supplies the 530 King Mountain Pressure Zone from the 519 Dakin & Consolidation Pressure Zone. Supply via the 519 Dakin & Consolidation Pressure Zone instead of the 276 North Pressure Zone is a modification the City completed in 2011, as described previously. The 530 King Mountain Zone is a closed zone; it is not served directly by storage. The James Street Pump Station must meet the peak hour demand (PHD) of the 530 King Mountain Pressure Zone. In addition, because it supplies a closed zone it would typically be required to have fire flow capacity to meet fire demands. However, the James Street Pump Station does not have fire flow capacity. To alleviate this deficiency, in 2011 the City extended the 519 Dakin Yew Pressure Zone to much of the 530 King Mountain Pressure Zone area to provide fire flow. Consequently, the James Street Pump Station is not required to provide fire flow capacity.

As shown in Table 3-5, the James Street Pump Station has adequate capacity to meet the domestic PHD needs of the 530 King Mountain Pressure Zone through the 10-year planning horizon. However, by the 20-year planning horizon, capacity expansion will be necessary.

TABLE 3-5
**James Street Pump Station Capacity Evaluation** (gpm)

| Demand/Capacity | 2012 | 2018 | 2022 | 2032 |
|---|---|---|---|---|
| Demand (PHD) Required[1] | 22 | 24 | 101 | 180 |
| Existing Total Capacity | 240 | 240 | 240 | 240 |
| Existing Firm Capacity | 120 | 120 | 120 | 120 |
| Excess (Deficient) Capacity | 98 | 96 | 19 | (60) |

[1] Closed zone (not served directly by storage). Fire flow is not required because it is served by a parallel distribution piping system extended from the 519 Dakin & Consolidation Pressure Zone.

### 3.2.5 Short Street

The Short Street pump station supplies water to the 350 Cordata Pressure Zone from the 276 North Pressure Zone, and is the only means of boosting water to this zone. The 350 Cordata Pressure Zone is a closed zone; it is not served directly by storage. The Short Street Pump Station must meet the peak hour demand (PHD) of the 350 Cordata Pressure Zone. In addition, because it supplies a closed zone, it must also provide fire flow capacity to meet fire demands.

As shown in Table 3-6, the Short Street Pump Station has adequate capacity to meet the domestic PHD needs as well as the fire flow needs of the 350 Cordata Pressure Zone through the 10-year planning horizon. However, by the 20-year planning horizon, some minor capacity expansion is anticipated to be necessary based on growth projections used. This estimated future need will be

TABLE 3-6
**Short Street Pump Station Capacity Evaluation** (gpm)

| Demand/Capacity | 2012 | 2018 | 2022 | 2032 |
|---|---|---|---|---|
| Demand (PHD) Required | 1,978 | 2,138 | 2,724 | 3,470 |
| Demand (Fire Flow) Required | 3,500 | 3,500 | 3,500 | 3,500 |
| Combined Demand Required | 5,478 | 5,638 | 6,224 | 6,970 |
| Existing Total Capacity | 9,250 | 9,250 | 9,250 | 9,250 |
| Existing Firm Capacity | 6,750 | 6,750 | 6,750 | 6,750 |
| Excess (Deficient) PHD Capacity | 1,272 | 1,112 | 526 | (220) |

re-evaluated in the future based on actual water use information at that time as well as updated growth projections at that time.

It should also be noted that the City recently installed the Kellogg PRV that enables water from the 519 Dakin & Consolidation Pressure Zone to flow into the eastern-most end of the 350 Cordata Pressure Zone. This PRV provides an emergency back-up supply (not full-capacity) in the event there's a problem with the Short Street Pump Station. This PRV will also allow water into the 350 Cordata Pressure Zone during very high demand within the zone, including a fire flow condition.

### 3.2.6 College Way

The College Way Pump Station supplies water to the 541 College Way Pressure Zone from the 457 South Pressure Zone, and is the only means of boosting water to this zone. The 541 College Way Pressure Zone is a closed zone; it is not served directly by storage. The College Way Pump Station must meet the peak hour demand (PHD) of the 541 College Way Pressure Zone. In addition, because it supplies a closed zone, it must also provide fire flow capacity to meet fire demands. As shown in Table 3-7, the 541 College Way pump station has sufficient capacity through the 6- , 10-, and 20-year planning periods. No improvements are planned over the 20-year planning horizon.

TABLE 3-7
**College Way Pump Station Capacity Evaluation (gpm)**

| Demand/Capacity | 2012 | 2018 | 2022 | 2032 |
|---|---|---|---|---|
| Demand (PHD) Required | 128 | 138 | 138 | 138 |
| Demand (Fire Flow) Required | 2,000 | 2,000 | 2,000 | 2,000 |
| Combined Demand Required | 2,128 | 2,138 | 2,138 | 2,138 |
| Existing Total Capacity | 3,400 | 3,400 | 3,400 | 3,400 |
| Existing Firm Capacity | 2,400 | 2,400 | 2,400 | 2,400 |
| Excess (Deficient) PHD Capacity | 272 | 262 | 262 | 262 |

### 3.2.7 Consolidation; 38th Street

The Consolidation and 38th Street pump stations supply water to the 696 Padden Yew Pressure Zone from the 519 Dakin & Consolidation Pressure Zone and the 457 South Pressure Zone, respectively. The 696 Padden Yew Pressure Zone includes; therefore, fire flow capacity is not required from these two pump stations because it is provided from storage. As shown in Table 3-8, the combined capacity of Consolidation Pump Station and the 38th Street Pump Station are adequate to meet the estimated future demands of the 696 Padden Yew Pressure Zone as well as the higher-elevation zones that are supplied from the 696 Padden Yew Pressure Zone.

TABLE 3-8
**Consolidation Pump Station; 38th Street Pump Station Capacity Evaluation (gpm)**

| Demand/Capacity | 2012 | 2018 | 2022 | 2032 |
|---|---|---|---|---|
| Demand (MDD) Required[1] | 562 | 607 | 798 | 1,033 |
| Existing Total Capacity | 1,900 | 1,900 | 1,900 | 1,900 |
| Existing Firm Capacity | 1,400 | 1,400 | 1,400 | 1,400 |
| Excess (Deficient) Capacity | 838 | 793 | 602 | 367 |

[1] Includes MDDs for 696 Padden Yew, 830 Reveille, 873 Governor Road, and 980 Pressure zones.

### 3.2.8 Birch Street

The Birch Street Pump Station supplies water to the 780 Birch Street Pressure Zone from the 519 Dakin & Consolidation Pressure Zone, and is the only means of boosting water to this zone. The 780 Birch Street Pressure Zone is a closed zone; it is not served directly by storage. The Birch Street Pump Station must meet the PHD of the 780 Birch Street Pressure Zone. In addition, because it supplies a closed zone, it must also provide fire flow capacity as well to meet fire demands.

As shown in Table 3-9, the 780 Birch Street pump station has sufficient capacity through the 6-, 10-, and 20-year planning periods. No improvements are planned over the 20-year planning horizon. It should also be noted that service from the Birch Street Pump Station and the 780 Birch Street Pressure Zone will be extended in the future to five existing residences currently served by two small booster pumps (Raymond Pump Station and Bonanza Pump Station; refer to Figure 3-3).

TABLE 3-9
**Birch Street Pump Station Capacity Evaluation** (gpm)

| Demand/Capacity | 2012 | 2018 | 2022 | 2032 |
|---|---|---|---|---|
| Demand (PHD) Required | 25 | 27 | 39 | 69 |
| Demand (Fire Flow) Required | 750 | 750 | 750 | 750 |
| Combined Demand Required | 775 | 768 | 776 | 796 |
| Existing Total Capacity | 2,340 | 2,340 | 2,340 | 2,340 |
| Existing Firm Capacity | 1,240 | 1,240 | 1,240 | 1,240 |
| Excess (Deficient) PHD Capacity | 465 | 472 | 464 | 444 |

### 3.2.9 Balsam Lane

The Balsam Lane pump station supplies water to the 730 Alabama Hill Pressure Zone. It is the only means of boosting water to this zone. The 730 Alabama Hill Pressure Zone is a closed zone; it is not served directly by storage. The Balsam Lane Pump Station must meet the PHD of the 730 Alabama Hill Pressure Zone. In addition, because it supplies a closed zone, it must also provide fire flow capacity as well to meet fire demands.

As shown in Table 3-10, the Balsam Lane pump station has adequate capacity to meet PHD requirements of the 730 Alabama Hill Pressure Zone. However, it does not currently have adequate capacity to meet the combined PHD and fire flow requirement. This deficiency will increase as growth continues in the 730 Alabama Hill Pressure Zone.

TABLE 3-10
**Balsam Lane Pump Station Capacity Evaluation (gpm)**

| Demand/Capacity | 2012 | 2018 | 2022 | 2032 |
|---|---|---|---|---|
| Demand (PHD) Required | 544 | 588 | 678 | 813 |
| Demand (Fire Flow) Required | 1,500 | 1,500 | 1,500 | 1,500 |
| Combined Demand Required | 2,044 | 2,088 | 2,178 | 2,313 |
| Existing Total Capacity | 2,200 | 2,200 | 2,200 | 2,200 |
| Existing Firm Capacity | 1,600 | 1,600 | 1,600 | 1,600 |
| Excess (Deficient) PHD Capacity | (444) | (488) | (578) | (713) |

### 3.2.10 Governor Road

The Governor Road pump station supplies water to the 873 Governor Road Pressure Zone, which is supplied directly by storage from the Parkhurst Reservoir. The recently completed Samish Crest Pump Station is also served from the 873 Governor Road Pressure Zone, and it supplies the new 980 Pressure Zone. The Samish Crest Pump Station is considered to be a “temporary” pump station to serve approximately 20 additional houses that are at too high an elevation to be supplied from the 873 Governor Road Pressure Zone.

As shown in Table 3-11, the Governor Road Pump Station has adequate capacity to meet the MDD capacity need of the Governor Road Pressure Zone through the 10-year planning horizon. Beyond that, additional capacity will be necessary. However, long-term utility planning for this area by the City includes eventual replacement of the Governor Road Pump Station, the Parkhurst Reservoir, and the new Samish Crest Pump station with newer, larger-capacity facilities that will meet the needs of the broader area and enable combination of the 830 Reveille Pressure Zone and 873 Governor Road Pressure Zone.

When future development proceeds at the higher elevations just to the north of the 873 Governor Road Pressure Zone, it will serve as a catalyst to combine the 873 Governor Road Pressure Zone and the 830 Reveille Pressure Zone into a single, new 870 Samish Hill Pressure Zone. This new 870

TABLE 3-11
**Governor Road Pump Station Capacity Evaluation** (gpm)

| Demand/Capacity | 2012 | 2018 | 2022 | 2032 |
|---|---|---|---|---|
| Demand (MDD) Required[1] | 87 | 94 | 152 | 472 |
| Existing Total Capacity | 1,460 | 1,460 | 1,460 | 1,460 |
| Existing Firm Capacity | 360 | 360 | 360 | 360 |
| Excess (Deficient) Capacity | 273 | 266 | 208 | (112)[2] |

[1] Includes MDDs for 873 Governor Road and 980 Pressure zones.

[2] The Governor Road Pump Station is expected to be abandoned and replaced by the new 40th Street Pump Station and 870 Samish Hill Reservoir before there is a capacity deficiency at the Governor Road Pump Station.

Samish Hill Pressure Zone will be served by a new reservoir, the 870 Samish Hill Reservoir, and will be supplied from a new pump station (40th Street Pump Station) to be located at the site of the existing 40th Street Reservoir. Development at even higher elevations, including the homes served from the existing, temporary Samish Crest Pump Station, will be combined into a new, expanded 980 Pressure Zone. This new 980 Pressure Zone will be a closed zone and will be supplied from a new pump station (Future 980 Pump Station) located at the site of the new 870 Samish Hill Reservoir.

No specific development proposals or plans for the area exist at this time. However, development in this area is expected to prompt the need for the 870 Samish Hill Reservoir, the 40th Street Pump Station, and the Future 980 Pump Station sometime between the 6- and 20-year planning horizons.

### 3.2.11 Reveille

The Reveille Pump Station supplies water to the 830 Reveille Pressure Zone from the 696 Padden Yew Pressure Zone and is the only means of boosting water to this zone. The 830 Reveille Zone is a closed zone; it is not served directly by storage. The Reveille Pump Station must meet the PHD of the 830 Reveille Pressure Zone. In addition, because it supplies a closed zone, it must also provide fire flow capacity as well to meet fire demands.

As shown in Table 3-12, the Reveille Pump Station has adequate capacity meet PHD requirements through the 6-year planning horizon. However, sometime after that (depending on actual growth and development within the 830 Reveille Zone), additional pumping capacity will be necessary. Unless the 870 Samish Hill Reservoir and associated facilities are in place (refer to discussion above for the Governor Road Pump Station), the City will expand the capacity of the pump station by replacing the smaller (100-gpm) of the two existing pumps with a larger pump to meet projected PHD. The City does not intend to modify the pump station to provide fire flow because fire flow capacity is forthcoming once the 870 Samish Hill Reservoir is completed and placed into service.

TABLE 3-12
**Reveille Pump Station Capacity Evaluation** (gpm)

| Demand/Capacity | 2012 | 2018 | 2022 | 2032 |
|---|---|---|---|---|
| Demand (PHD) Required | 43 | 46 | 109 | 267 |
| Demand (Fire Flow) Required | 750 | 750 | 750 | 750 |
| Combined Demand Required | 793 | 796 | 859 | 1,017 |
| Existing Total Capacity | 300 | 300 | 300 | 300 |
| Existing Firm Capacity | 100 | 100 | 100 | 100 |
| Excess (Deficient) PHD Capacity | (693) | (696) | (759) | (917) |

## 3.3 Storage

Description of the City's distribution system reservoirs is presented in the 2009 Water System Plan. There have been no storage volume additions or subtractions since the 2009 Water System Plan. As is required, the City's overall water system was evaluated with respect to required storage volume, and individual pressure zones served directly (or indirectly as in closed zones) from storage were also evaluated with respect to required storage volume. Many of the City's pressure zones are not served directly from storage, which is acceptable if the pump station supplying these zones is designed and operated appropriately to meet PHD plus fire flow. Some of these zones are planned to be served directly from new storage in the future, but the timing for these improvements is dependent on the pace of growth within these closed zones. Per-zone storage evaluations were not undertaken for closed zones because in most cases they will continue to remain as closed zones. In cases where closed zones could be modified to be served directly from storage, the precise volume of storage needed will be assessed when development is imminent.

The updated storage evaluation, based on the updated demands presented in Table 3-1 herein, is presented in Tables 3-13 through 3-18. It should be noted that surplus storage available in the City's 276 North Pressure Zone is accounted in higher-elevation pressure zones, as described in the subsections below, which is appropriate given the generous capacity of the pump stations lifting water to these upper pressure zones. This apportionment of the City's storage resources is critical to avoid over-counting the need for additional storage at higher elevations.

The methodology for determining the required storage volume for each pressure zone is presented in the 2009 Water System Plan. Note that fire suppression volume is based on the fire flow requirements for each pressure zone, as presented in the 2009 Water System Plan, multiplied by two hours.

Storage deficiencies identified in the subsections below are summarized in Section 3.6.2. Planned improvements for mitigating these deficiencies are presented in Section 3.7.2.

### 3.3.1 System-Wide

A summary of the storage evaluation for the overall system is presented in Table 3-13. As shown in Table 3-13, there is adequate total storage within the existing overall system through the 10-year planning horizon. After that, additional storage is projected to be required. These projected storage needs will be met with storage implemented in response to development pressure. This additional future storage will be added to the existing system where it is needed, within pressure zones that need additional storage, not within pressure zones that already have excess storage. The general location and capacity of future storage is identified in the per-zone storage evaluation sections below.

TABLE 3-13
**System-Wide Storage Evaluation** (million gallons)

| Storage Component | 2012 | 2018 | 2022 | 2032 |
|---|---|---|---|---|
| Operational | 1.65 | 1.65 | 1.65 | 1.65 |
| Equalization | 1.28 | 1.39 | 1.48 | 1.67 |
| Standby | 18.80 | 20.31 | 21.63 | 24.44 |
| Fire Suppression | 0.42 | 0.42 | 0.42 | 0.42 |
| Total Required | 21.73 | 23.35 | 24.75 | 27.76 |
| Available[1] | 23.19 | 25.69 | 25.69 | 25.69 |
| Surplus (Deficit) | 1.46 | 2.34 | 1.08 | (2.07) |

[1] Available storage includes the 1.18 MG of dead storage at Marietta Reservoir. It also includes the subtraction of 5 million gallons of volume dedicated to chlorine contact storage at Whatcom Falls II in 2012 and 2.5 million gallons of chlorine contact storage in future years. The future reduction in chlorine contact storage results from reduced requirements associated with the implementation of the planned Dissolved Air Flotation project (refer to Section 4.1 for further discussion).

### 3.3.2 276 North

A summary of the storage evaluation for the 276 North Pressure Zone is presented in Table 3-14. As shown in Table 3-14, there is surplus storage in the 276 North Pressure Zone through the 20-year planning horizon. However, it must be noted that most of this surplus storage is available for use by higher-elevation pressure zones that are served directly from the 276 North Pressure Zone. This is true as long as the pump stations supplying these higher-elevation pressure zones have adequate capacity to provide the required PHD for these zones, which is the case for both zones. The two higher-elevation pressure zones that depend on this surplus storage are the 519 Dakin & Consolidation Pressure Zone and the 457 South Pressure Zone. The surplus storage in the 276 North Pressure Zone is adequate to meet the storage needs of these two other zones through the 10-year planning horizon. However, surplus storage from the 276 North Pressure Zone is also available to the higher-elevation pressure zones that are served from these two pressure zones. The availability of surplus storage from the 276 North Pressure Zone has been accounted for in the storage evaluations presented herein of each of the pressure zones that have storage reservoirs. These pressure zones include: 457 South, 519 Dakin & Consolidation, 696 Padden Yew, and 873 Governor Road.

TABLE 3-14
**276 North Pressure Zone Storage Evaluation** (million gallons)[1]

| Storage Component | 2012 | 2018 | 2022 | 2032 |
|---|---|---|---|---|
| Operational[2] | 0.00 | 0.00 | 0.00 | 0.00 |
| Equalization | 0.73 | 0.79 | 0.85 | 0.97 |
| Standby | 10.74 | 11.61 | 12.44 | 14.14 |
| Fire Suppression | 0.42 | 0.42 | 0.42 | 0.42 |
| Total Required | 11.48 | 12.40 | 13.18 | 15.11 |
| Available[2] | 19.01 | 21.51 | 21.51 | 21.51 |
| Surplus (Deficit) | 7.54 | 9.11 | 8.33 | 6.40 |

[1] Includes the demands of the 350 Cordata Pressure Zone, which is a closed zone served directly from the 276 North Pressure Zone.

[2] Operational storage is zero because the storage reservoirs in the 276 North Pressure Zone is supplied by gravity and no operational volume is necessary. However, as described in Table 3-13, a portion of Whatcom Falls II Reservoir is dedicated to meeting disinfection contact requirements (CT requirements) – 5 million gallons in 2012 and 2.5 million gallons in future years, after DAF has been implemented.

### 3.3.3 457 South

A summary of the storage evaluation for the 457 South Pressure Zone is presented in Table 3-15. As shown in Table 3-15, there is insufficient storage in the 457 South Pressure Zone. However, as stated above, there is surplus storage in the 276 North Pressure Zone, which supplies the 457 South Pressure Zone via the Otis Street Pump Station. The Otis Street Pump Station has adequate pumping capacity to meet the PHD requirements of the 457 Pressure Zone, which enables accounting surplus storage from the supplying 276 North Pressure Zone to the 457 South Pressure Zone.

TABLE 3-15
**457 South Pressure Zone Storage Evaluation** (million gallons)[1]

| Storage Component | 2012 | 2018 | 2022 | 2032 |
|---|---|---|---|---|
| Operational | 0.75 | 0.75 | 0.75 | 0.75 |
| Equalization | 0.27 | 0.30 | 0.29 | 0.32 |
| Standby | 4.00 | 4.32 | 4.32 | 4.63 |
| Fire Suppression | 0.30 | 0.30 | 0.30 | 0.30 |
| Total Required | 5.02 | 5.36 | 5.45 | 5.69 |
| Available | 1.70 | 1.70 | 1.70 | 1.70 |
| Surplus (Deficit) | (3.32) | (3.66) | (3.75) | (3.99) |
| Transfer from 276 North | 3.32 | 3.66 | 3.75 | 3.99 |
| Resulting Surplus (Deficit) | 0 | 0 | 0 | 0 |
| Remaining in 276 North | 4.22 | 5.45 | 4.58 | 2.41 |

[1]Includes the demands of the 541 College Way Pressure Zone, which is a closed zone served directly from the 457 South Pressure Zone.

### 3.3.4 519 Dakin & Consolidation

A summary of the storage evaluation for the 519 Dakin & Consolidation Pressure Zone (formerly the 519 Dakin & Yew Pressure Zone) is presented in Table 3-16. As shown in Table 3-16, there is insufficient storage in the 519 Dakin & Consolidation Pressure Zone. However, as stated above, there is surplus storage in the 276 North Pressure Zone, which directly supplies the 519 Dakin & Consolidation Pressure Zone via the Dakin & Consolidation Pump Station and the Woburn Street Pump Station. These two pump stations have adequate pumping capacity to meet the PHD requirements of the Dakin & Consolidation Pressure Zone, which enables accounting surplus storage from the supplying 276 North Pressure Zone to the 519 Dakin & Consolidation Pressure Zone.

TABLE 3-16
**519 Dakin & Consolidation Pressure Zone Storage Evaluation** (million gallons)[1]

| Storage Component | 2012 | 2018 | 2022 | 2032 |
|---|---|---|---|---|
| Operational | 0.39 | 0.39 | 0.39 | 0.39 |
| Equalization | 0.21 | 0.22 | 0.23 | 0.25 |
| Standby | 3.07 | 3.32 | 3.50 | 3.93 |
| Fire Suppression | 0.42 | 0.42 | 0.42 | 0.42 |
| Total Required | 3.67 | 3.94 | 4.13 | 4.58 |
| Existing Storage | 1.50 | 1.50 | 1.50 | 1.50 |
| Surplus (Deficit) | (2.17) | (2.44) | (2.63) | (3.08) |
| Transfer from 276 North | 2.17 | 2.44 | 2.63 | 3.08 |
| Resulting Surplus (Deficit) | 0 | 0 | 0 | 0 |
| Remaining in 276 North[2] | 2.05 | 3.01 | 1.93 | (0.67)[3] |

[1] Includes demand for the 730 Alabama Hill, 780 Birch Street, 660 Huntington, and 530 King Mountain pressure zones, which are all closed zones served directly from the 519 Dakin & Consolidation Pressure Zone.

[2] These values include the subtraction of surplus 276 North storage capacity to entirely mitigate the deficit in the 457 South Pressure Zone over the 20-year planning horizon.

[3] This deficit is shown as being in the 276 North Pressure Zone given the high pumping capacity from the 276 North Pressure Zone to the 519 Dakin & Consolidation Pressure Zone. However, this future deficiency could also be addressed with new storage in the 519 Dakin & Consolidation Pressure Zone.

Note that the remaining storage in the 276 Pressure Zone, as presented in Table 3-16 includes meeting the full storage deficit for the 457 South Pressure Zone of the 20-year planning horizon. Therefore, the storage needs of the 519 Dakin & Consolidation Pressure Zone can only be met through the 10 year planning horizon. After that, additional storage is projected to be necessary.

### 3.3.5 696 Padden Yew

A summary of the storage evaluation for the 696 Padden Yew Pressure Zone is presented in Table 3-17. As shown in Table 3-17, there is insufficient storage in the 696 Padden Yew Pressure Zone. However, as stated above, there is surplus excess storage in the 276 North Pressure Zone, which directly supplies the 519 Dakin & Consolidation Pressure Zone and the 457 South Pressure Zone. The 696 Padden Yew Pressure Zone is supplied from the combined capacity of the

TABLE 3-17
**696 Padden Yew Pressure Zone Storage Evaluation** (million gallons)[1]

| Storage Component | 2012 | 2018 | 2022 | 2032 |
|---|---|---|---|---|
| Operational | 0.07 | 0.07 | 0.07 | 0.07 |
| Equalization | 0.06 | 0.06 | 0.08 | 0.08 |
| Standby | 0.86 | 0.93 | 1.15 | 1.12 |
| Fire Suppression | 0.18 | 0.18 | 0.18 | 0.18 |
| Total Required | 1.00 | 1.07 | 1.30 | 1.27 |
| Existing Storage | 0.80 | 0.80 | 0.80 | 0.80 |
| Surplus (Deficit) | (0.20) | (0.27) | (0.42) | (0.47) |
| Transfer from 276 North | 0.20 | 0.27 | 0.42 | None |
| Resulting Surplus (Deficit) | 0 | 0 | 0 | (0.47) |
| Remaining in 276 North[2] | 1.85 | 2.74 | 1.51 | (0.67)[3] |

[1] Includes demand for the 830 Reveille Pressure Zone, which is a closed zone served directly from the 696 Padden Yew Pressure Zone.

[2] These values include the subtraction of surplus 276 North storage capacity to entirely mitigate the deficit in the 457 South Pressure Zone over the 20-year planning horizon, as well as meeting the storage deficit of the 519 Dakin & Consolidation Pressure Zone through the 10-year planning horizon.

[3] As stated in Footnote 3 of Table 3-16, this deficit is shown as being in the 276 North Pressure Zone. However, this deficiency could also be addressed in part or in whole with new storage in the 519 Dakin & Consolidation Pressure Zone, the 457 South Pressure Zone, or the 696 Padden Yew Pressure Zone, or the future 870 Samish Hill Pressure Zone.

Consolidation Pump Station and the 38th Street Pump Station, which are supplied from the 519 Dakin & Consolidation Pressure Zone and 457 South Pressure Zone, respectively.

Consequently, even though the surplus storage in the 276 North Pressure Zone has already been accounted in evaluating the storage needs of the 519 Dakin & Consolidation Pressure Zone and the 457 South Pressure Zone, there remains additional surplus capacity, as presented in Table 3-16, after the storage deficits of these two pressure zones are met through the 10-year planning horizon but not for the 20-year horizon. There is adequate surplus storage capacity from the 276 North Zone through the 6-year planning horizon to meet the storage deficiencies of the 519 Dakin & Consolidation Pressure Zone, the 457 South Pressure Zone, as well as the higher-elevation 696 Padden Yew Pressure Zone. It is possible to account the remaining surplus capacity from the 276 North Pressure Zone in the 696 Padden Yew Pressure Zone because the combined capacity of the Consolidation Pump Station and the 38th Street Pump Station meet the PHD requirements of the 696 Padden Yew Pressure Zone.

In summary, no additional storage is needed for the 696 Padden Yew Pressure Zone through the 10-year planning horizon.

### 3.3.6 873 Governor Road

A summary of the storage evaluation for the 873 Governor Road Pressure Zone is presented in Table 3-18. As shown in Table 3-18, there is a slight storage deficiency in the 873 Governor Road Pressure Zone. However, as stated above for the 276 North Pressure Zone, and re-iterated for the 519 Dakin & Consolidation Pressure Zone, the 457 South Pressure Zone, and the 696 Padden Yew

TABLE 3-18
**873 Governor Road Pressure Zone Storage Evaluation (million gallons)**

| Storage Component | 2012 | 2018 | 2022 | 2032 |
|---|---|---|---|---|
| Operational | 0.06 | 0.07 | 0.07 | 0.07 |
| Equalization | 0.01 | 0.01 | 0.02 | 0.06 |
| Standby | 0.12 | 0.13 | 0.25 | 0.83 |
| Fire Suppression | 0.09 | 0.09 | 0.09 | 0.09 |
| Total Required | 0.19 | 0.22 | 0.34 | 0.96 |
| Existing Storage | 0.18 | 0.18 | 0.18 | 0.18 |
| Surplus (Deficit) | (0.01) | (0.04) | (0.16) | (0.78) |
| Transfer from 276 North | 0.01 | 0.04 | 0.16 | None |
| Resulting Surplus (Deficit) | 0 | 0 | 0 | (0.78) |
| Remaining in 276 North | 1.84 | 2.7 | 1.35 | (0.67) |

Pressure, there is surplus storage 276 North Pressure Zone that be accounted in the 873 Governor Road Pressure Zone through the 10-year planning horizon. Refer to the discussion above for the 696 Padden Yew Pressure Zone regarding how surplus storage can be accounted in the 696 Padden Yew Pressure Zone. The 873 Governor Road Pressure Zone is supplied from the 696 Padden Yew Pressure Zone via the Governor Road Pump Station. The Governor Road Pump Station has sufficient capacity to meet PHD to transfer the surplus storage from the 276 North Pressure Zone to the 873 Governor Road Pressure Zone.

In summary, similar to the 696 Padden Yew Pressure Zone, no additional storage is needed for the 873 Governor Road Pressure Zone through the 10-year planning horizon. However, similar to the 696 Padden Yew Pressure Zone, additional storage for the 20-year horizon, is projected to be necessary.

## 3.4 Water Age Analysis

The City has observed a loss of chlorine residual at the Kearney Road Reservoir and the Marietta Reservoir – both serving the City's 276 North Pressure Zone. Neither of these reservoirs have pump stations that directly draw water from them to higher pressure zones. Therefore, these reservoirs experience limited turnover unless water level in the entire 276 North Pressure Zone, including at Whatcom Falls Reservoir I and Whatcom Falls Reservoir II is purposely drawn down by reducing production at the Whatcom Falls Water Treatment Plant to a level below customer water usage for several days. Limited turnover in the reservoirs results in elevated water age, a resulting loss of chlorine residual, and a corresponding potential for bacteriological contamination.

Over the past two years, on a weekly basis, the City draws down reservoir levels in the 276 North Pressure Zone on a weekly basis to promote turnover of the reservoirs. This operational approach has resulted in maintaining chlorine residual throughout the system. The City plans to continue this operational approach indefinitely, as long as it remains successful. However, the City has also evaluated alternative improvement approaches to enhance water age conditions at both Marietta Reservoir and Kearney Road Reservoir. Some of these improvement approaches are either

underway or planned for implementation, while others will only be implemented if determined in the future to be necessary.

In addition to drawing down the reservoirs in the 276 North Pressure Zone, including the Marietta Reservoir, to enhance maintenance of a chlorine residual, the City has modified the single-inlet/outlet reservoir connection so that the inlet is on one side of the reservoir and the outlet on the other. Check valves restrict inlet water flows into the reservoir to the inlet line and outlet water flows to the separate outlet line. In tandem with this improvement, the City plans to change its primary supply location to Water District No. 2 from the Marine Dr/Bennett Dr meter location to near the outlet of the Marietta Reservoir. Supplying Water District No. 2 from the Marietta Reservoir will increase the volume of water flowing through the Marietta Reservoir and reduce water age at this location.

At the Kearney Road Reservoir, where chlorine residual has fallen at times to undetectable levels on the outlet of the reservoir, the City has analyzed the impact of installing a small pump station that would lift water from the outlet of the Kearney Road Reservoir to the 519 Dakin & Consolidation Pressure Zone. This pump station would force water to flow through the Kearney Road Reservoir and substantially reduce water age. Because the 519 Dakin & Consolidation Pressure Zone is already served from two other large-capacity pump stations, this new pump station could be a relatively simple station with two equal-sized, single-speed pumps operated as the primary means of lifting water to the 519 Dakin & Consolidation Pressure Zone. On-site back-up power would not be necessary because of the surplus of existing pumping capacity. Alternatively, should the City decide to implement this improvement, the discharge of the pump station could be to the 350 Cordata Pressure Zone instead of the 519 Dakin & Consolidation Pressure Zone. A pump station supplying the 350 Cordata Pressure Zone would be somewhat more complicated with either a re-circulation loop for single-speed pumps or variable speed drives. The better discharge alternative would need to be evaluated closer to the time of implementation in consideration of development pressure and patterns in the local area. If discharge is to the 519 Dakin & Consolidation Pressure Zone, control of the existing Dakin & Consolidation Pump Station and Woburn Street Pump Station would be revised to provide peak demand and fire flow capacity, periodic operation, and redundant back-up operation.

Water age was modeled to evaluate the beneficial impacts of the improvements described above at the Marietta Reservoir and Kearney Road Reservoir sites using the City's existing distribution system hydraulic model. The results of the modeling are presented in Figure 3-4 for the Marietta Reservoir and Figure 3-5 for the Kearney Road Reservoir.

What is clear from Figure 3-4 is that water age at the Marietta Reservoir will continue to be elevated. This reservoir is located at the end of the distribution system with minimal use nearby to promote cycling or turnover. Whether or not the improvements described above are enough to enable maintenance of a detectable chlorine residual is uncertain. If after implementation of the improvements, it is still not possible to maintain a detectable chlorine residual, a re-chlorination station will be necessary at the Marietta Reservoir. If a re-chlorination station is determined to be necessary, it will be implemented, but for the purposes of this planning effort, it is assumed that it will not be necessary and therefore is not included in the Improvement Program within the 6-year planning horizon. If needed, the new re-chlorination station could be comprised of a small pre-engineered building housing a chlorine metering pump, a chlorine residual analyzer, SCADA monitoring, and space for two 55-gallon drums of sodium hypochlorite.

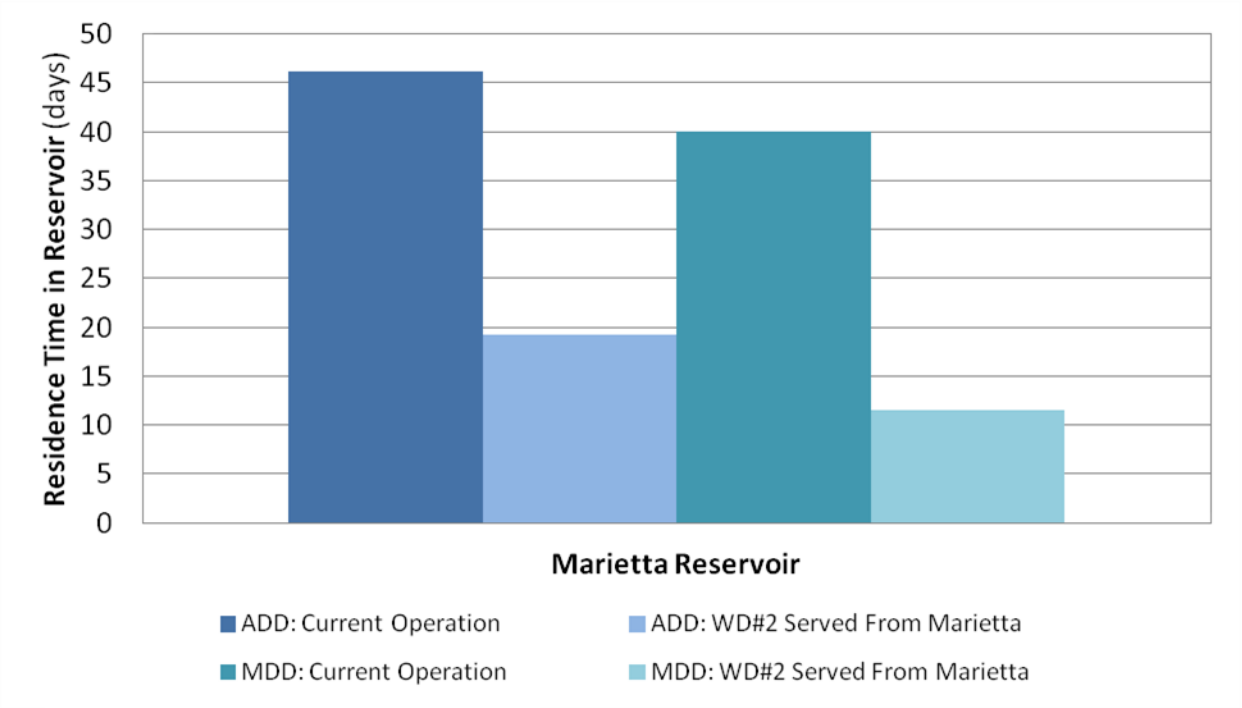



FIGURE 3-4
**Marietta Reservoir Water Age Evaluation**

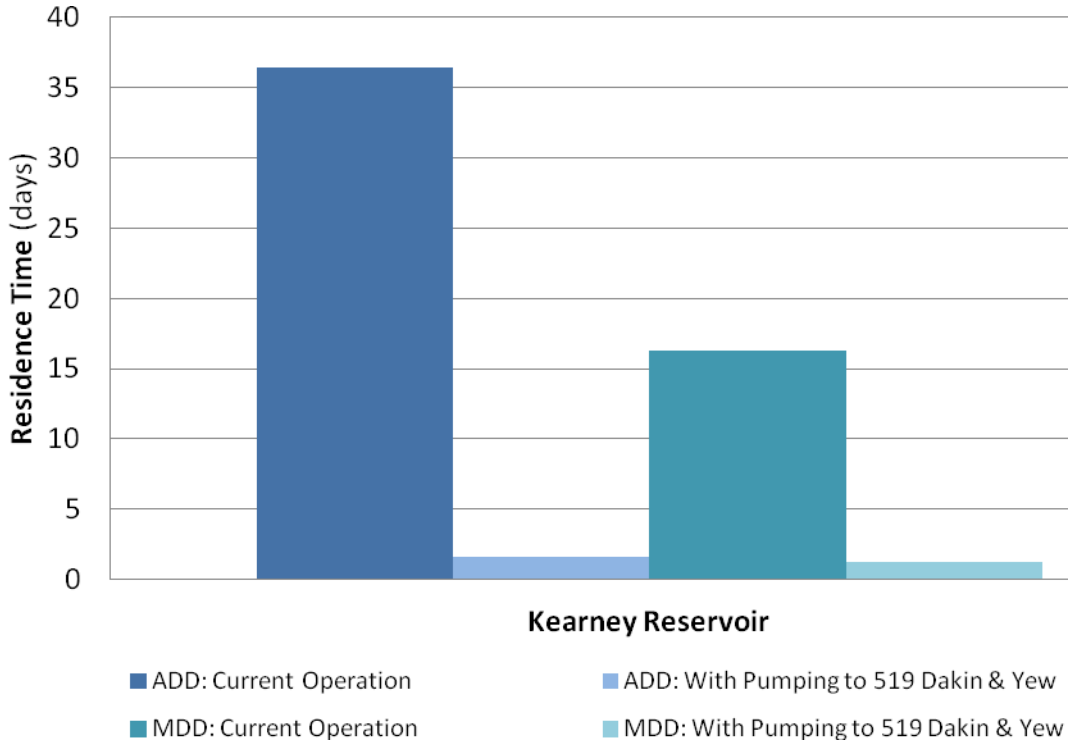



FIGURE 3-5
**Kearney Road Reservoir Water Age Evaluation**

As presented in Figure 3-5, for the Kearney Road Reservoir, the potential new pump station to the 519 Dakin & Consolidation Pressure Zone drastically reduces water age and could enable maintenance of a chlorine residual at this location. Supplying the 519 Dakin & Consolidation Pressure Zone from the Kearney Road Reservoir instead of the existing pump stations increases water age within the 519 Dakin & Consolidation Pressure Zone by up to two days under ADD conditions. However, this additional water age would not be expected to create any water quality challenges.

## 3.5 Anticipated Development / Planned Improvements

The City regularly receives development interest and proposals throughout the City. Where such development is relatively small and involves filling in small undeveloped portions of already-developed areas, the need for additional water system infrastructure is minimal and typically limited to pipeline extensions. In these cases, development does not prompt the need for additional pumping and storage facilities. However, where development proposals are more extensive and reach to areas lacking water service, additional pumping and storage facilities are typically needed in addition to pipeline extensions.

The addition of these pumping and storage facilities must be thoughtfully planned and coordinated with other, existing storage and pumping facilities to avoid excessive facility redundancy and the associated service inefficiency and higher operating costs. Via comprehensive, pro-active utility planning, the City incorporates pumping and storage infrastructure needs for these more extensive development proposals, where applicable, into mitigating other known or anticipated system deficiencies and improving overall system efficiency. In other words, in some cases it is possible to address pumping or storage deficiencies within the existing system with pumping and storage facilities that serve new development.

Two particular areas within the City where development interest has existed for several years, are the King Mountain area on the north side of the City and the Samish Hill area east of Interstate 5 and north of Lake Padden, just to the east of the 696 Padden Yew Zone. Water service to these two development areas is presented in the two sections below.

### 3.5.1 King Mountain Area

The King Mountain area is situated primarily to the north of the 350 Cordata Pressure Zone and west of the existing 530 King Mountain Pressure Zone. Lower-elevation portions of the King Mountain area could be served in the near-term future from the 350 Cordata Pressure Zone, or with recent extension of the 519 Dakin & Consolidation Pressure Zone, service directly from that zone is possible.

Development at higher elevations on King Mountain would require a new continuously-operating pump station serving a closed pressure zone. This pump station, referred to hereinafter as the King Mountain Pump Station, would be situated at the Kearney Road Reservoir Site and would lift water from the outlet of the Kearney Road Reservoir at a hydraulic gradient of 276 feet elevation to a hydraulic gradient of 630 feet elevation. Alternatively, suction to this pump station could be from the 519 Dakin & Consolidation Pressure Zone at or near the Kearney Road Reservoir, or more likely adjacent to the existing James Street Pump Station. In either case, a new transmission pipeline

connected to the pump station discharge would be necessary to connect the new pump station to the distribution area. Evaluation of these two alternatives will be undertaken at the time planning for development in this area is initiated.

Additional storage at King Mountain is not currently necessary. However, if at some point in the longer-term future, storage is needed to mitigate a system-wide need, a new storage reservoir could be implemented to serve the existing 350 Cordata Pressure Zone, which is a closed zone – not served directly from a storage reservoir. The City has identified this potential future reservoir as the King Mountain Reservoir. Tentatively, the overflow elevation of this reservoir would be 370 feet, and it would serve to raise the hydraulic gradient of the existing 350 Cordata Pressure Zone to 370 feet. It would be supplied from the existing Short Street Pump Station with minor facility modifications. Additional distribution system pipeline improvements may be necessary to improve flow from the Short Street Pump Station to the new reservoir, which would need to be evaluated during the planning phase for this potential future project.

Raising the gradient to 370 feet elevation would expand the reach of the future 370 Cordata Pressure Zone to the west side of King Mountain. The volume of the potential future King Mountain Reservoir will be determined closer to the time it is implemented. Additionally, alternative locations (even locations beyond the King Mountain area) will be evaluated if/when additional storage is determined to be necessary for the overall water system.

### 3.5.2 Samish Hill Area

The more-southerly area of development interest exists between the existing 830 Reveille Pressure Zone and the 873 Governor Road Pressure Zone. The addition of a future storage reservoir, a future pump station, and associated connecting transmission pipeline to serve this higher-elevation area will enable combination of the 830 Reveille Pressure Zone and the 873 Governor Road Pressure Zone into a new 870 Samish Hill Pressure Zone. Doing so will result in fire flow capacity to the existing 830 Reveille Pressure Zone and enable replacement of the Reveille Pump Station, Parkhurst Reservoir, and Governor Road Pump Station. The new, replacement facilities will include a single, new pump station at the 40$^{th}$ Street Reservoir site (future 40$^{th}$ Street Pump Station), a single new storage reservoir (future Samish Hill Reservoir) that would have an overflow elevation of 870 feet, and a connecting transmission pipeline between the two. The volume of this reservoir will be determined closer to the time of its implementation. These additional facilities are necessary to extend service to most of the Samish Hill area. However, if development of the Samish Hill area does not occur, these additional facilities will not be necessary, including the Samish Hill Reservoir.

In addition, the existing 980 Pressure Zone that was recently extended from the 873 Governor Road Pressure Zone via the Samish Heights Pump Station, which does not have fire flow capacity, would be replaced by a new pump station lifting water to a larger 980 Pressure Zone area. This new pump station is referred to as the “980 Pump Station,” and it would have fire flow capacity and supply all of the surrounding higher-elevation areas that are too high to be served from the future Samish Hill Reservoir.

## 3.6 Summary of Pumping and Storage Deficiencies

Pumping and storage deficiencies identified via the evaluations presented in the sections above are summarized in Table 3-19. Note that there are no storage deficiencies projected within the 6-year planning horizon and only two pumping deficiencies projected within the 10-year planning horizon. More discussion of these deficiencies is presented in the subsections below. The future Kearney Road Pump Station is not addressed in this section because it is not a deficiency related to an existing pump station, but instead an improvement to alleviate the excessive water age issue at Kearney Road Reservoir.

TABLE 3-19
**Summary of Pumping and Storage Deficiencies (gpm for pumping and million gallons for storage)**

| Deficiencies | 2012 | 2018 | 2022 | 2032 |
|---|---|---|---|---|
| **Pumping** | | | | |
| Short Street | -- | -- | -- | 220 |
| James Street | -- | -- | -- | 60 |
| Balsam Lane | 444 | 488 | 578 | 713 |
| Governor Road | -- | -- | -- | 112 |
| Reveille | 693 | 696 | 759 | 917 |
| **Storage** | | | | |
| System Wide | -- | -- | -- | 2.07 |
| 276 North Pressure Zone[1] | -- | -- | -- | 0.67 |
| 696 Padden Yew Pressure Zone | -- | -- | -- | 0.47 |
| 873 Governor Road Pressure Zone | -- | -- | -- | 0.78 |

[1] Refer to Tables 3-14 through 3-18 for review of how the transfer of surplus storage in the 276 North Pressure Zone results in an estimated future deficiency in the 276 North Pressure Zone. Estimated future deficiency in the 276 North Pressure Zone is anticipated to be corrected by additional storage in higher-elevation pressure zones – not additional storage in the 276 North Pressure Zone.

### 3.6.1 Pumping

The only deficiencies at existing pump stations within the 10-year planning horizon are at Balsam Lane and at Reveille. In these two cases, the deficiencies exist now, and in both cases PHD needs are met, but the combined fire flow / PHD requirement is not met. Deficiencies were identified at the 20-year planning horizon for these two pump stations, as well as for three other pump stations – Short Street, James Street, and Governor Road. Discussion of how the City plans to address each of these deficiencies is presented in Section 3.7.1.

### 3.6.2 Storage

No storage deficiencies are identified within the 10-year planning horizon. At the 20-year planning horizon the projected total storage deficiency will be approximately two million gallons. Storage deficiencies are shown in Table 3-19 at the 20-year planning horizon for the overall distribution system, the 276 North Pressure Zone (because of transfers to higher pressure zones), the 696 Padden Yew Pressure Zone, and the 873 Governor Road Pressure Zone. Surplus storage from the

276 North Pressure Zone was used, to the extent available, to mitigate deficiencies for all of the higher-elevation pressure zones.

The projected future storage needs at the 20-year planning horizon, as presented in Table 3-19, are planned to be met via storage improvements that will be needed to accommodate development, as described in Section 3.5, in the Samish Hill area and/or on King Mountain. The timing and pace of development in these areas is uncertain at this time. In the event growth does not occur in these areas soon enough to enable the associated storage facilities to mitigate any storage deficiencies within the City's overall system that might exist at the time, storage volume expansion could be pursued by replacing one or more existing, smaller reservoirs within the upper-elevation pressure zones with larger ones. This would also be an opportunity to replace a future aging and deteriorating storage reservoir with a larger, new reservoir.

## 3.7 Planned Pumping and Storage Improvements

The planned distribution system improvements presented in this section are based on the evaluations presented in Sections 3.2, 3.3, and 3.4 and the resulting deficiencies summarized in Section 3.6. Where applicable and practical, the deficiencies summarized in Section 3.6 will be addressed in coordination with anticipated development presented in Section 3.5. The planned improvements presented herein include only one pumping improvement to be implemented within the 6-year planning horizon. The remainder of the improvements will be implemented at an unspecified time after the 6-year planning horizon.

Discussion of these improvements is presented in Sections 3.7.1 and 3.7.2 and a summary of the improvements is presented in Section 3.7.3.

### 3.7.1 Pumping Improvements

The pump station deficiencies identified in Table 3-19 are planned to be addressed as described below:

- **Short Street Pump Station:** This projected 20-year deficiency will be addressed with the addition of the King Mountain Reservoir, which will add storage to the existing closed 350 Cordata Pressure Zone. The new King Mountain Reservoir will have an overflow elevation of 370 feet elevation to extend the reach of the existing 350 Cordata Pressure Zone. The existing Short Street Pump Station will not need to simultaneously provide fire flow and PHD and therefore will no longer have a capacity deficiency.
- **James Street Pump Station:** This projected 20-year deficiency will be addressed in the long-term future by the replacement of the existing pumps with pumps of higher capacity. In the event that development high on the west side of King Mountain results in a new King Mountain Pump Station (refer to Section 3.5.1 and below in this section) and a new closed pressure zone, the existing 530 King Mountain Pressure Zone would be incorporated into the new 630 King Mountain Pressure Zone and the existing James Street Pump station would be removed from service.
- **Balsam Lane Pump Station:** This deficiency is planned to be addressed by replacement of the existing pumps with pumps of higher capacity. An additional pump will not be necessary, but

improvements to electrical switchgear and connecting piping will be necessary. This improvement is planned to be implemented beyond the 6-year planning horizon when the existing pumps have reached their useful service life.

- **Governor Road Pump Station:** This projected 20-year deficiency will be addressed with the new storage and pumping facilities associated with the anticipated new development in the Samish Hill area. With the implementation of this new development, the Governor Road Pump Station will be replaced by a new, higher-capacity pump station at the 40th Street Reservoir site – the 40th Street Pump Station.
- **Reveille Pump Station:** Similar to the projected 20-year deficiency at the Governor Road Pump Station, the current deficiency at the Reveille Pump Station will be addressed with the new storage and pumping facilities associated with the anticipated new development in the Samish Hill area. With the implementation of this new development, the Reveille Pump Station will be replaced by a new, higher-capacity pump station at the 40th Street Reservoir site – the 40th Street Pump Station.

In addition to the pumping improvements described above that address deficiencies with existing pump stations. The City has identified a potential improvement, the **Kearney Road Pump Station,** that it will consider implementing in the future if deemed necessary to reduce excess water age at the Kearney Road Reservoir, as described in Section 3.4. This potential pump station is included for implementation within the 20-year planning horizon, but is not budgeted within the 6-year planning horizon.

Three additional pump stations will be necessary to support long-term future growth in the two development areas described in Section 3.5. The timing for each of these future pump stations depends on the timing and pace growth and development, but each are anticipated beyond the 6-year planning horizon. These three pump stations are described below:

- **40th Street Pump Station:** This pump station will be necessary to lift water to the future Samish Hill Reservoir, which is described in Section 3.5.2 above and in Section 3.7.2 below. It will be situated at the existing 40th Street Reservoir Site and lift water from the 696 Padden Yew Pressure Zone. It would have a capacity of approximately 1,500 gpm and be equipped with three equal-sized (500 gpm) pumps. A transmission pipeline from this pump station to the new Samish Hill Reservoir would also be included as part of this project.
- **980 Pump Station:** As described in Section 3.5.2, this pump station would supply development at the highest elevations in the Samish Hill area – elevations too high to be served from the future 870 Samish Hill Pressure Zone. It would be situated at the future Samish Hill Reservoir site and be supplied from that reservoir. New distribution system piping would convey water from this pump station to new service connections.
- **King Mountain Pump Station:** As described in Section 3.5.1, this pump station would supply development at the highest elevations on King Mountain and would be situated at the Kearney Reservoir Site. It could be developed as an expansion of the planned Kearney Road Pump Station, housed within the same building, or it could be developed as a stand-alone pump station elsewhere on or near the same site, or adjacent to the existing James Street Pump Station. The King Mountain Pump Station will be a more complex pump station than the Kearney Road Pump Station, and it is not anticipated to be needed until beyond the 6-year

planning horizon. This new pump would include a new transmission pipeline extending from the pump station discharge to the new King Mountain distribution system.

### 3.7.2 Storage Improvements

The storage deficiencies identified in Table 3-19 for the 20-year planning horizon are planned to be addressed as part of the anticipated development on King Mountain and in the Samish Hill area. No storage deficiencies were identified within the 6-year and 10-year planning horizon. Therefore, no specific reservoir improvements are identified for this timeframe. The two reservoirs associated with the King Mountain development area and the Samish Hill development area, include: the **King Mountain Reservoir** and **Samish Hill Reservoir**, respectively. These two reservoirs are anticipated to meet the projected 20-year deficiencies presented in Tables 3-19 for the water system as a whole, as well as for the identified per-zone deficiencies. The **King Mountain Reservoir** will be supplied from the existing Short Street Pump Station, with some minor improvements, and the project will require some distribution system capacity improvements to enable effective filling from the Short Street Pump Station. The timing of these two reservoirs is based primarily on the timing of development, but is generally anticipated beyond the 6-year planning horizon.

### 3.7.3 Summary of Pumping and Storage Improvements

A summary of planned pumping and storage improvements is presented in Table 3-20. Improvements (additions) that impact the City's distribution system hydraulic profile are reflected in Figure 3-6 at the of this WSP Update. The decommissioning of pumping and storage facilities described above are also reflected in the hydraulic profile.

TABLE 3-20
**Summary of Planned Pumping and Storage Improvements**

| Improvement | ID Number |
|---|---|
| **Pumping** | |
| Kearney Road Pump Station | PS-1 |
| Balsam Lane Pump Station Capacity Expansion | PS-2 |
| 40th Street Pump Station | PS-3 |
| 980 Pump Station | PS-4 |
| King Mountain Pump Station | PS-5 |
| **Storage** | |
| Samish Hill Reservoir | ST-1 |
| King Mountain Reservoir | ST-2 |

# 4. Treatment Analysis

In late July and August of 2009 the filters at the City's WTP began clogging much earlier in filter runs than typical. Filter runs became substantially shorter than normal, requiring more frequent filter backwashing. The result of shorter filter runs and increased filter backwashing was greatly reduced WTP capacity – to the point the City implemented mandatory water restrictions, for the first time, to reduce customer demand. It should be noted that voluntary water restrictions are implemented each summer as a means of encouraging conservation during this time of typically-high customer water demand. The water restrictions were successful in reducing customer demand to match WTP capacity. Toward the end of August and into September, filter runs gradually began to return to normal and customer demand dropped, as it customarily does at that time of the year.

Filter clogging was attributed to algae in Lake Whatcom. Monitoring revealed higher than typical counts of most algae species. Although the reasons for the intense algae bloom of the summer of 2009 is the subject of varied speculation, historical and on-going algae monitoring shows that summertime algae blooms in Lake Whatcom have been increasing over the past decade. It is speculated that despite efforts to reverse this trend, summertime algae blooms in Lake Whatcom will continue to increase in intensity and duration over the near-term future. Increased Lake Whatcom algae could again result in summertime algae blooms that prevent the WTP from treating sufficient supply to meet customer demand in the future.

In response to the 2009 algae event, the City completed a study that is presented in a report entitled "Filter-Clogging Algae Mitigation Evaluation," dated June 2012 – hereinafter referred to as the Algae Mitigation Report. The Algae Mitigation Report included a recommendation for the City to implement Dissolved Air Flotation (DAF) to mitigate adverse algae conditions.

The purpose of this section is two-fold:

- **Dissolved Air Flotation:** Formally incorporate DAF into the City's water system planning strategy and reference the alternative evaluation and pilot testing work supporting the planned implementation of DAF.
- **Filtration Capacity:** Address the need for additional filtration capacity at the WTP in light of recent water use trends as well as the City's plan to implement DAF.

These two topics are addressed in the following subsections.

## 4.1 Dissolved Air Flotation

As presented in the Algae Mitigation Report, several alternatives to mitigate the adverse impacts of Lake Whatcom algae on WTP capacity were evaluated. The alternatives evaluated were grouped into three main categories, treatment, intake, and lake management, and are presented in Table 4-1. In addition to the alternatives in Table 4-1, the "No Action" alternative was included in a Triple Bottom Line Plus evaluation phase to establish a lowest-cost baseline for comparison.

Each of the treatment alternatives evaluated are commonly used in the municipal water treatment industry and are commonly-considered alternatives for algae removal. Each would be implemented somewhere at the existing WTP site. Each of the intake alternatives includes withdrawing water

TABLE 4-1
**Summary of Alternatives Evaluated**

| Treatment | Intake | Lake Management |
|---|---|---|
| Dissolved Air Flotation | Secondary Intake via In-Water Pipeline | Lake Management |
| Ballasted Sedimentation | Secondary Intake via Over-Land Pipeline | |
| Plate and Tube Settling | New Dual-Intake System | |
| Upflow Clarification | | |
| Conventional Sedimentation | | |
| Micro-Screening | | |
| Ozonation | | |
| Additional Filters | | |

from Lake Whatcom at a location different from the existing intake location that has a substantially lower concentration of algae. Each of the intake alternatives includes the capability to withdraw water at more than one depth. The Lake Management alternative is essentially the ongoing Lake Whatcom Management Program, which comprises the City's, Whatcom County's, and Lake Whatcom Water and Sewer District's ongoing and long-term efforts to improve Lake Whatcom water quality. Lake management will continue to be implemented regardless of the results of the evaluation. It was included as part of the mitigation evaluation to assess whether it could be successful as a stand-alone approach instead of a complementary approach to a treatment or intake approach.

As presented in the Algae Mitigation Report, DAF was determined to be the technically superior treatment approach with respect to mitigating the algae problem, as well as being one of the lower cost treatment alternatives. DAF was also determined to be technically superior and far less costly than any of the intake alternatives. Lake Management was determined to be inadequate as a stand-alone mitigation approach because of the many years that will pass before improved water quality with respect to algae will be observed.

In recognition that DAF was the best approach for mitigating the adverse impacts of Lake Whatcom algae, DAF was pilot tested during the late summer of 2011. Pilot testing showed DAF to be effective at mitigating the algae impacts – restoring filtration capacity to levels when algae concentrations in Lake Whatcom are negligible. The results of the pilot testing are included under separate cover, entitled: "Whatcom Falls Water Treatment Plant Dissolved Air Flotation Pilot Testing," dated March 2012. This same pilot testing report is also appended to the Algae Mitigation Report.

The City intends to pursue the design and construction of a new DAF facility in a phased approach. The phased approach will be based on an initial two-train DAF facility with easy expansion for a future third train, which would likely not be needed for many years into the future. Each of the trains would have a nominal capacity of 10 mgd. The timing for the third train would depend on the intensity of algae blooms in the future in combination with growth in water use. The phased implementation of DAF minimizes the initial capital cost of a DAF facility and eliminates the potential for constructing more DAF capacity than is necessary.

This phased DAF-implementation approach complements the City's on-going commitment to lake management, water quality improvement in Lake Whatcom, and TMDL compliance via the Lake

Whatcom Management Program. Over the long-term future, as phosphorous-reducing lake management measures demonstrate success at improving water quality and reducing algae blooms, the need for further expansion of the initial phase of DAF implementation could potentially be avoided entirely.

In general, the schedule for DAF implementation includes preliminary and detailed design beginning in 2014 – including the DOH-required submittals for the Project Report and the Construction Documents. Construction and commissioning would begin in late 2015 and extend into 2017.

In addition to the planned DAF improvement, the City will undertake two related projects that will be precipitated by DAF implementation. First, the existing gas chlorine system at the Plant does not include a chlorine neutralization system. Upgrading this condition or switching to an alternative disinfection system, such as bulk sodium hypochlorite or on-site generated hypochlorite will need to be addressed simultaneous to DAF implementation. The project will include evaluation of alternative disinfection systems and design and construction of an upgrade of the existing system or a new system. Obtaining a building permit for the new DAF facility is anticipated to prompt the upgrade of the existing chlorine system. This project is referred to in the Improvement Program as "T3: Disinfection Improvements."

Second, the existing Screen House facility upstream of the Plant is an aging structure whose current primary function is screening to keep fish and large debris out of the Plant. Its traveling screens are 70 years old and are in relatively good condition, but the City intends to pro-actively move this screening function to the Plant – just upstream of the DAF process. Other component elements of the Screen House facility are showing signs of deterioration. Once the screening function has been relocated to the future DAF facility at the Plant, the City plans to bypass the Screen house facility. The bypass improvements will include new buried pipelines and valves that will connect to the existing pipelines leading to the Plant and to the industrial (untreated) supply system. This project is referred to in the Improvement Program as "T4: Screening Relocation Improvements."

An additional benefit of the DAF facility is added chlorine disinfection contact credit. Currently, the City is required to provide "1-log" of chlorine disinfection for giardia inactivation, which is the requirement for filtration facilities without pre-filtration clarification processes. This disinfection contact is provided in the Whatcom Falls II Reservoir. The City reserves the bottom 5 million gallons of the reservoir to ensure sufficient chlorine contact volume. With the addition of DAF, the City will be eligible to receive from DOH an addition 0.5-log credit for giardia inactivation, which will reduce the volume it needs to reserve in Whatcom Falls II Reservoir to 2.5 million gallons. This reduction in storage volume allocated to chlorine contact helps to defer the need for additional distribution system storage. This reduction is acknowledged in the footnote of Table 3-13 and is accounted throughout the storage evaluation presented in Section 3.3.

## 4.2 Filtration Capacity

A description of the City's Whatcom Falls Water Treatment Plant is presented in Section 3.3.2 of the 2009 Water System Plan. When the WTP is not being adversely impacted by algae, it has a capacity of 24 mgd with one of its six filters out of service for backwashing.

The 2009 Water System Plan identified the need for additional filtration capacity based on the projected intersection of estimated water use and the 24-mgd capacity of the WTP. That project

intersection was 2014. As stated above in Section 2.2 of this WSP Update, the updated estimated future water use is much less than what was estimated in the 2009 Water System Plan. The 20-year estimate of WTP production is 20.8 mgd, which is less than the 24-mgd capacity of the WTP with one filter out of service for backwashing. Therefore, discounting the impact of algae on the WTP capacity, there is no need to add new filters at the WTP.

However, summertime algae blooms do adversely impact filtration capacity at the WTP. The magnitude of reduced capacity depends on the severity and intensity of the algae bloom, which is different each summer. Only in the summer of 2009 has algae reduced WTP capacity to a point below total customer demand. Therefore, the only data point reflecting the extent to which WTP capacity was reduced by algae is from the summer of 2009.

During the summer of 2009, mandatory water restrictions, were implemented when the WTP could not meet customer demand, which was approximately 17 mgd at the time the mandatory water restrictions were implemented. One day after mandatory water restrictions were implemented, customer demand dropped to approximately 10 mgd. Operations staff adjusted the filter loading rate to as high as 4.82 gallons per minute per square foot (gpm/sf) to maximize plant capacity to meet the reduced demand. It was not possible to increase the filter loading rate beyond this point because of the excessive filter backwash frequency. Filter run times had reduced to 3.5 hours during this time from a typical summer run time of 15 hours. The result was a WTP capacity of approximately 10 mgd under the algae conditions observed in early August of 2009.

It should be noted that the impact of algae on the capacity of the WTP is extremely variable – depending heavily on actual algae biomass as well as algae species configuration. The WTP capacity of 10 mgd in 2009 represents an apparent historical “maximum-impact” administered by Lake Whatcom algae. The impact of Lake Whatcom algae on WTP capacity has been less severe in 2010, 2011, and 2012 than in 2009, even though there was substantial reduction in WTP capacity during these past three years. The WTP production capacity was adequate during these years because peak summertime customer demand was relatively low in comparison to previous years.

The addition of DAF is necessary to mitigate the adverse impacts of summertime algae blooms will be completely mitigated and enable the filtration capacity at the WTP to be 24-mgd based on a maximum filter loading rate of 6 gallons per minute per square foot (gpm/sf). Consequently, given the City’s plan for implementing DAF over the next few years, there is no need for additional filtration capacity at the WTP within the 6-year and 20-year planning horizons.

# 5. Improvement Program

The Improvement Program presented herein replaces what was developed for the 2009 Water System Plan. The Improvement Program from the 2009 Water System Plan is presented in Appendix A with comments regarding the status of each of the listed projects. Note that most of the projects presented in Appendix A were not undertaken because anticipated development did not occur and because actual water use and estimated future water use are lower than cited in the 2009 Water System Plan.

Each improvement project is designated with an improvement project number related to the type of improvement to facilitate referencing between the narrative discussion presented in Sections 3 and 4, Table 3-20, Table 5-1, and Figure 5-1 (at the end of this WSP Update). The improvements are identified with a letter designation relating to improvement type, as listed below:

- Treatment (T)
- Storage (ST)
- Pumping (PS)
- Pipeline (PL)
- Metering (M)
- Planning (PN)

The schedule for implementation of the Improvement Program is presented in Table 5-1. Estimated project costs presented in Table 5-1 are planning-level Class V estimates as defined by the Association for the Advancement of Cost Engineering International (AACEI).

The estimated costs were prepared for guidance in utility budgeting and securing adequate funding based on information available at the time of the estimate. The final cost of the project will depend upon the actual labor and material costs, competitive market conditions, implementation schedule, and other variable factors. As a result, final project costs will vary from the estimates presented herein.

TABLE 5-1
**Improvement Program**

| Project | ID Number | Total Project Cost | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 – 2032 |
|---|---|---|---|---|---|---|---|---|---|
| Kearney Road Pump Station | PS-1 | -- | -- | -- | -- | -- | -- | -- | X[1] |
| Balsam Lane Pump Station Capacity Expansion | PS-2 | -- | -- | -- | -- | -- | -- | -- | X |
| 40th Street Pump Station | PS-3 | -- | -- | -- | -- | -- | -- | -- | X |
| Future 980 Pump Station | PS-4 | -- | -- | -- | -- | -- | -- | -- | X |
| King Mountain Pump Station | PS-5 | -- | -- | -- | -- | -- | -- | -- | X |
| Samish Hill Reservoir | ST-1 | -- | -- | -- | -- | -- | -- | -- | X |
| King Mountain Reservoir | ST-2 | -- | -- | -- | -- | -- | -- | -- | X |
| Dissolved Air Flotation | T-1 | $11,000,000 | -- | $500,000 | $1,000,000 | $6,000,000 | $3,500,000 | -- | -- |
| Marietta Re-Chlorination Station | T-2 | -- | -- | | | | | | X |
| Disinfection Improvements | T-3 | $1,000,000 | | $100,000 | $200,000 | $700,000 | | | |
| Screening Relocation Improvements | T-4 | $2,000,000 | | $250,000 | $250,000 | $1,500,000 | | | |
| Water System Plan Update | PN-1 | $100,000 | -- | -- | -- | -- | -- | $100,000 | -- |
| Metering Program | M-6 | $8,500,000 | -- | $2,500,000 | $2,500,000 | $2,500,000 | $1,000,000 | -- | -- |
| Annual Water Main Replacement Program | PL-1 | $12,000,000 | $2,000,000 | $2,000,000 | $2,000,000 | $2,000,000 | $2,000,000 | $2,000,000 | -- |
| **Total** | **--** | **$34,600,000** | **$2,000,000** | **$5,050,000** | **$4,750,000** | **$12,700,000** | **$6,500,000** | **$2,100,000** | **--** |

[1] Each of the projects designated with an "X" in the timeframe beyond the 6-year planning horizon were not incorporated into the financial program for the water utility. Therefore, estimated costs were not developed for these improvements.

# 6. Financial Program

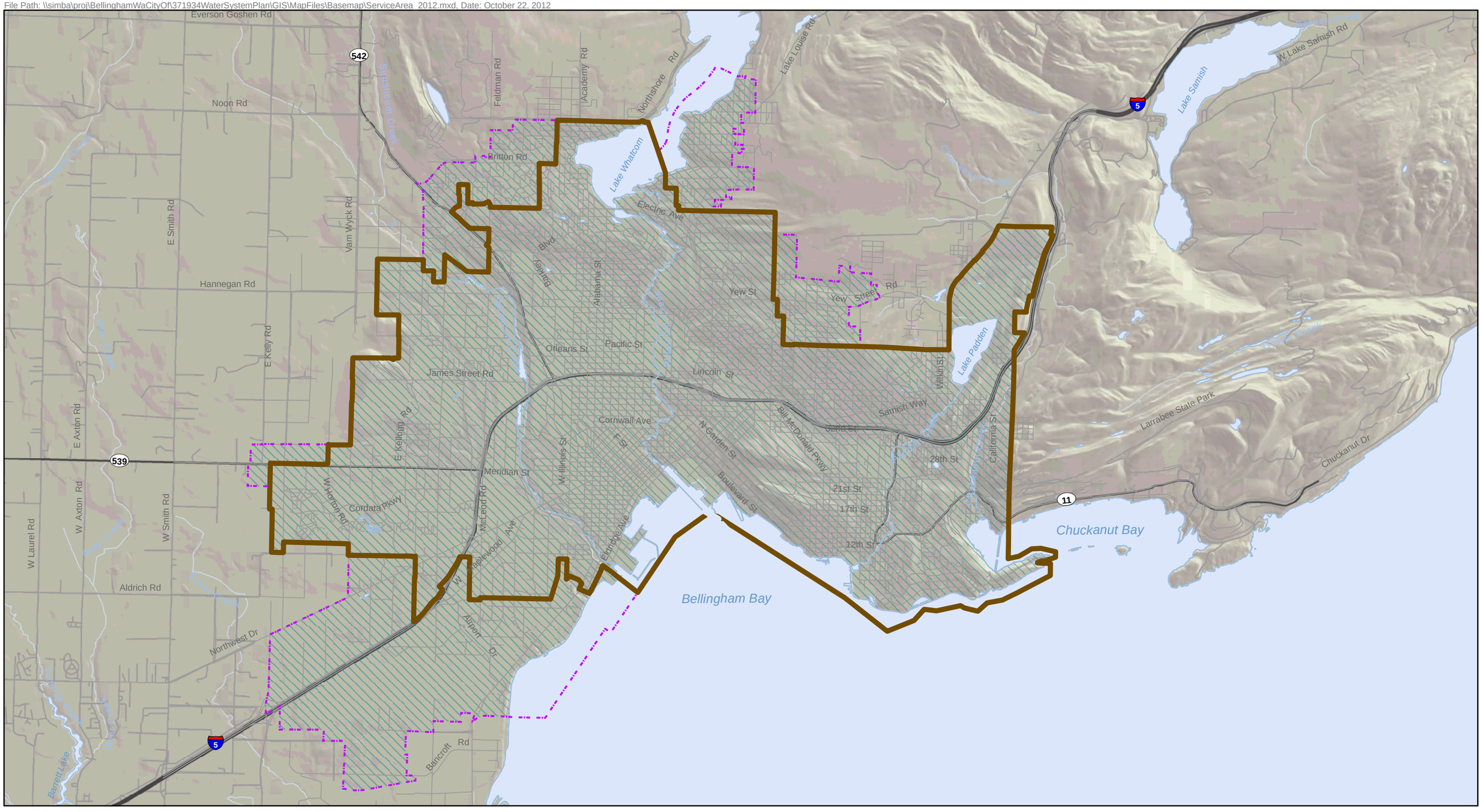
The City recently completed a rate study for its water and sewer utilities, entitled "2012 Water and Sewer Rate Update." A copy of the executive summary of the rate study is included as Appendix B. The study presented a 6-year financial plan from 2013 through 2018. Key findings and recommendations resulting from the study include rate increases of 9.0% in 2013, 8.0% per year from 2014 through 2016, 6.0% for 2017 and 2018. Key factors prompting the need for these increases include:

- **O&M:** Operating costs are expected to increase by 2% – 5% per year, with a higher near-term impact due to costs associated with the metering program. When the metering program has been completed (by 2017), these incremental costs are expected to go away.
- **Debt:** The proposed 2013 – 2018 water utility capital funding strategy contemplates a total of $35.5 million in revenue bond proceeds (net of issuance costs and reserve requirements) to fund the projected capital costs. An $11.6-million bond issue in 2015 is expected to increase the water utility's annual debt burden by about $983,000 per year beginning in 2016; a 2018 bond issue of $23.9 million would increase annual debt service by an additional $2.1 million (for a total of $3.1 million per year by the end of the study period). In addition, with the planned transfer of $5 million of existing bond proceeds from the sewer utility to the water utility, the water utility is assumed to fund a proportionate share of debt service on the 2011 Revenue Bond. In the near-term, this amounts to about $270,000 per year.
- **Capital:** Consistent with prior recommendations, the forecast incorporates a policy to fund system reinvestment through water rates. The prior water rate study completed in 2007 established an annual funding level based on annual depreciation expense, net of debt principal. However, given the projected increases in debt service discussed above, this analysis reflects a revised benchmark (50% of annual depreciation expense) to stabilize the annual funding level. By the end of the study period, the annual transfers for system reinvestment are projected to increase to about $1.4 million. This is in addition to cash funding provided through system development charges.
- **Reserve Funding:** Consistent with the prior study, this analysis reflects a policy assumption that the water utility maintains an operating (or "working capital") reserve with a balance sufficient to cover 60 days of projected operating expenses. Because the City has currently been maintaining an operating reserve balance of 5% (about 18 days) of budgeted expenses, this analysis phases in the higher reserve target over several years. In addition, this analysis introduces a separate "rate stabilization reserve" intended to provide additional security against revenue risk associated with volumetric revenues, preserving the City's ability to meet its debt obligations even in low sales years. The target balance for this reserve is 50% of annual debt service for debt issued on or after January 1, 2011. Debt issued prior to 2011 is not included in this calculation because the covenants for that debt do not allow use of a rate stabilization reserve to meet bond coverage requirements.
- **Expansion of Reduced-Rate Program:** This study included the evaluation of the incremental impact of expanding the City's reduced-rate program based on the low-income threshold established by Whatcom County ($35,000 per year). Based on staff recommendations, the adopted rates assume that this program is expanded.

The rate study included accounting for capital investment that matches the quantity presented in the Improvement Program in Table 5-1. Because the rate study was completed just prior to completion of this WSP Update, it also includes some planned improvements from the 2009 WSP Update that are no longer anticipated within the 6-year planning horizon. As a result, the rate increases planned for implementation by the City are anticipated to be more than adequate to cover utility expenses, including planned capital improvements.

# Figures

File Path: \\simba\proj\BellinghamWaCityOf\371934WaterSystemPlan\GIS\MapFiles\Basemap\ServiceArea_2012.mxd, Date: October 22, 2012




Source: City of Bellingham (2009) and Whatcom County (2006).

City Limits
Urban Growth Area
Retail Service Area

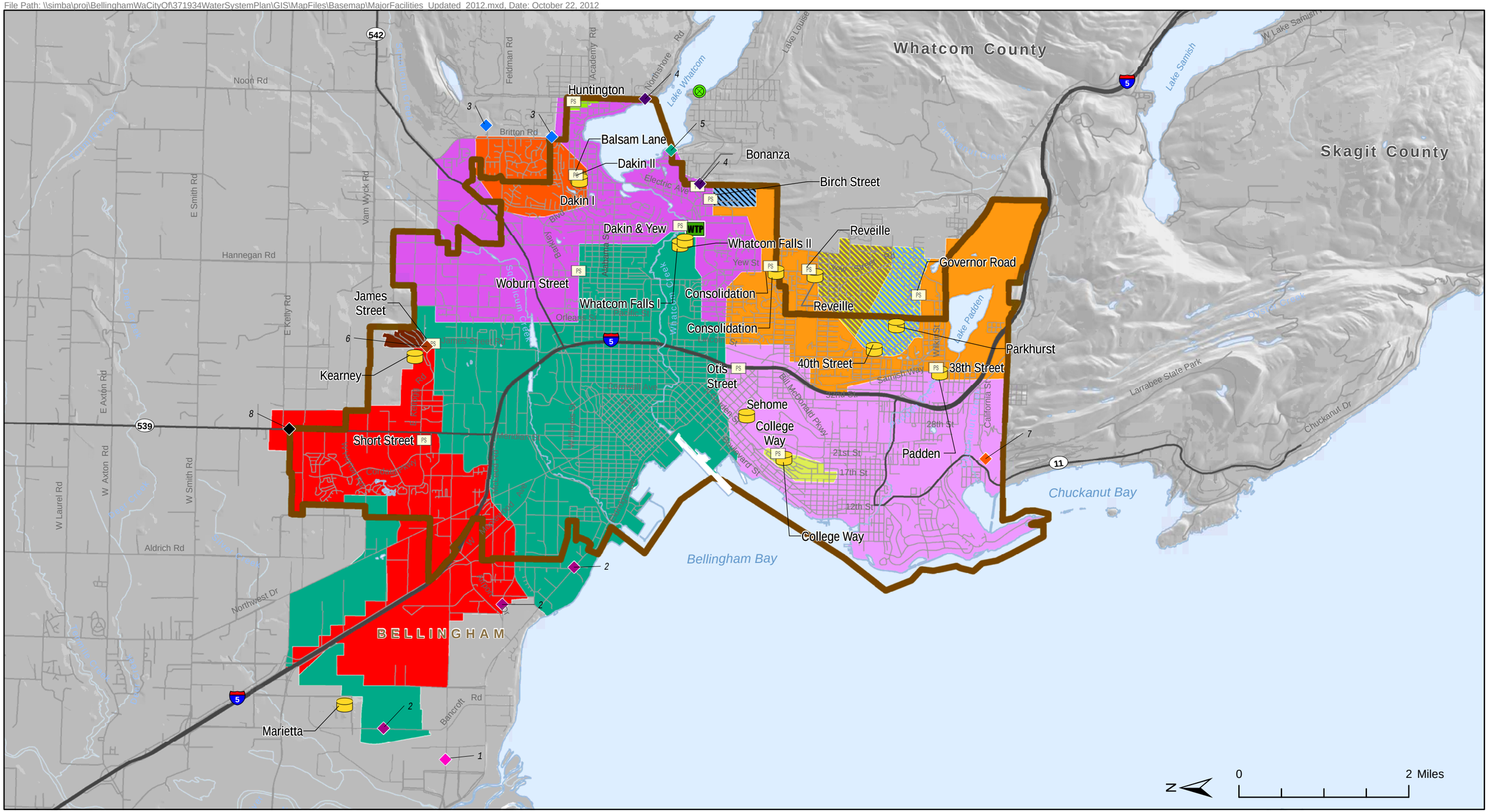
N

0 2 Miles

**Figure 3-1**
**Service Area**
*City of Bellingham*
*2012 Water System Plan Update*



CH2MHILL




***Pressure Zone***

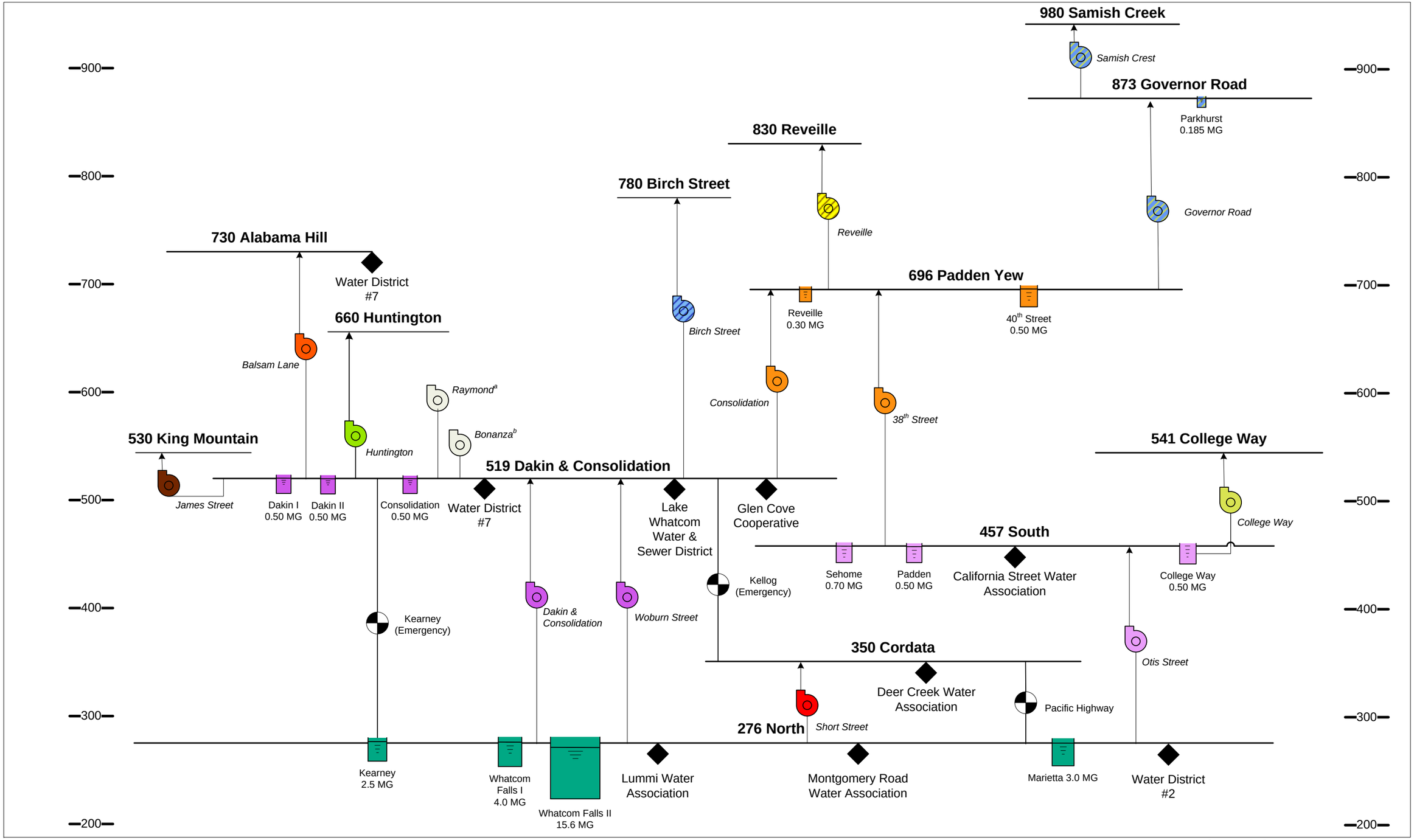
- 730 Alabama Hill
- 780 Birch Street
- 580 College Way
- 350 Cordata
- 519 Dakin Yew
- 873 Governor Road
- 660 Huntington
- 460 King Mountain
- 276 North
- 696 Padden Yew
- 830 Reveille
- 457 South

***Intertie Type***

- 1= Lummi Water Association
- 2= Water District #2
- 3= Water District #7
- 4= Lake Whatcom Water and Sewer District
- 5= Glen Cove Cooperative
- 6= Montegomery Road Water Association
- 7= California Street Water Association
- 8= Deer Creek Water Association

- Intake
- Pump Station
- Reservoir
- Water Treatment Plant
- City Limits

**Figure 3-2**
**Major Facilities and Pressure Zones**
*City of Bellingham*
*2012 Water System Plan Update*

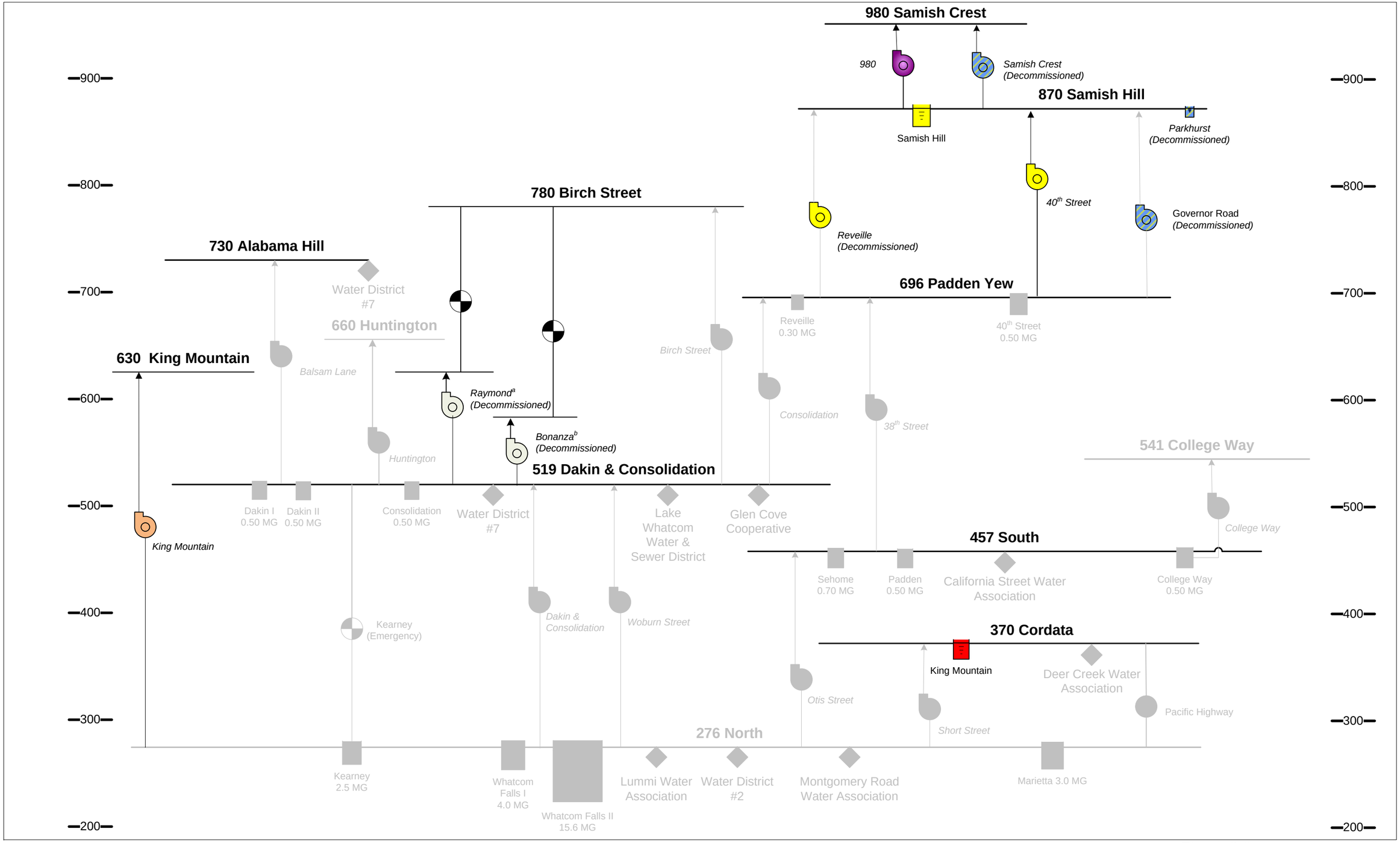



[a] Raymond pump station serves 1 home.

[b] Bonanza pump station serves 4 homes.

**Figure 3-3**
**Existing Hydraulic Profile**
*City of Bellingham*
*2012 Water System Plan Update*

CH2MHILL




**Pressure Zone**

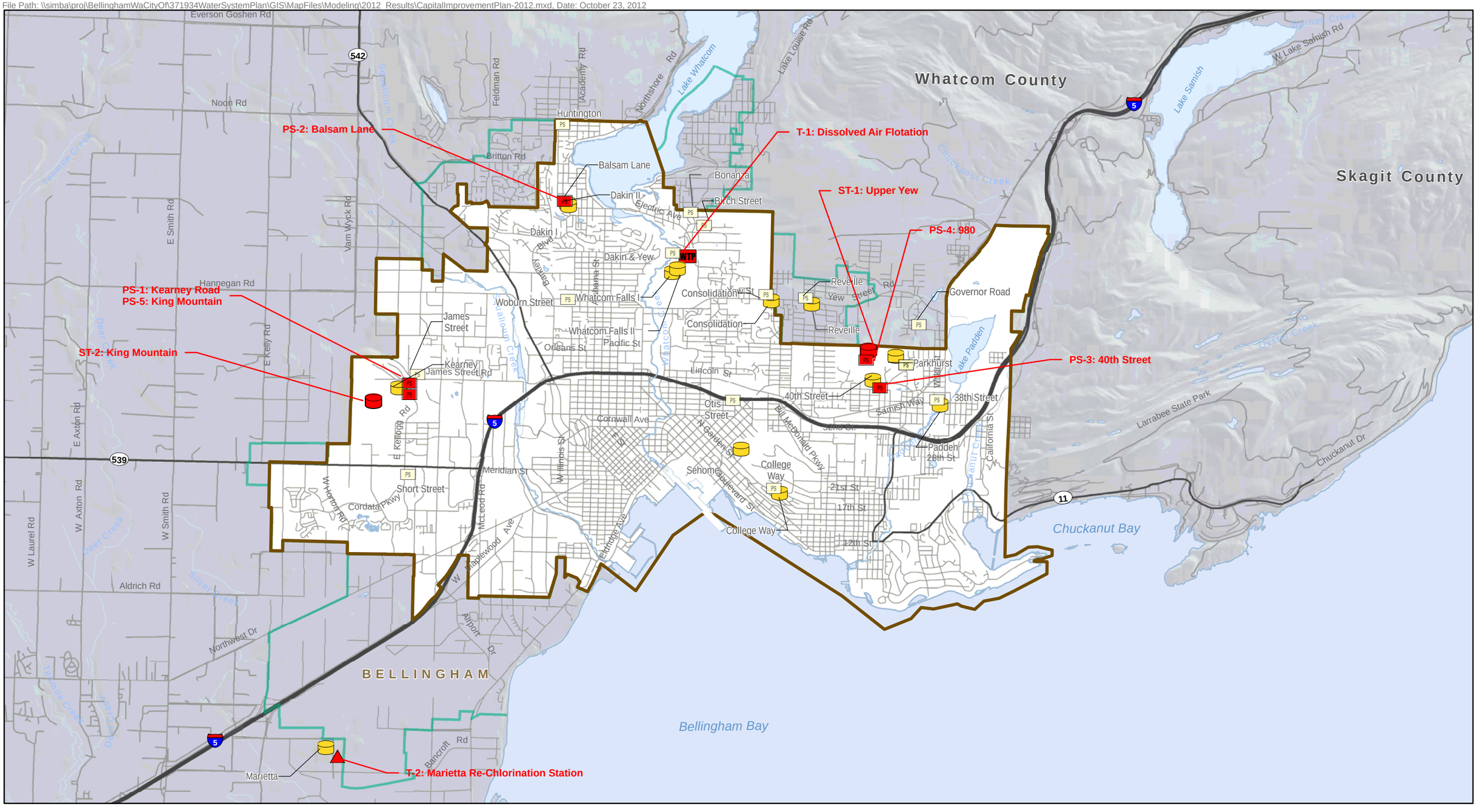
Reservoir | *Pump Station* | Intertie | PRV

[a] Raymond pump station serves 1 home.

[b] Bonanza pump station serves 4 homes.

**Figure 3-6**
**Future Hydraulic Profile**
*City of Bellingham*
*2012 Water System Plan Update*

CH2MHILL




Pump Station
Reservoir
Water Treatment Plant Improvement
Pump Station Improvement
Storage Improvement
Re-chlorination Station Improvement
Existing Retail Service Area
City Limits

N

0 2 Miles

**Figure 5-1**
**2012 Improvement Program**
*City of Bellingham*
*2012 Water System Plan Update*

# APPENDIX A
# Status of 2009 Water System Plan Improvement Program

## Appendix A - Status of Improvement Program from 2009 Water System Plan

| Project | ID Number | Project Cost | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 - 2028 | Status/Comments |
|---|---|---|---|---|---|---|---|---|---|---|
| 870 Upper Yew Reservoir, 1.35 MG | ST-1 | $5,919,000 | | | | | | | $5,919,000 | Not completed/lower-than-anticipated development pressure |
| 460 King Mountain Reservoir, 1.9 MG | ST-2 | $6,340,000 | | | | $450,000 | $5,890,000 | | | Not completed/lower-than-anticipated development pressure |
| Padden Reservoir: 457 South, 2.5 MG | ST-3 | $8,997,000 | | | | | | | $8,997,000 | Not completed/lower-than-anticipated development pressure |
| 730 Alabama Hill Reservoir, 1.5 MG | ST-4 | $4,858,000 | | | | | | | $4,858,000 | Not completed/lower-than-anticipated development pressure |
| 519 Dakin & Yew Reservoir, 2.2 MG | ST-5 | $5,937,000 | | | | | | | $5,937,000 | Not completed/lower-than-anticipated development pressure |
| New 40th Street Pump Station | PS-1 | $2,664,000 | | | | | | | $2,664,000 | Not completed/lower-than-anticipated development pressure |
| New Kearney Road Pump Station | PS-2 | $4,250,000 | | $300,000 | $3,950,000 | | | | | Not completed/lower-than-anticipated development pressure |
| Consolidation Pump Station Upgrade | PS-3 | $1,295,000 | | | | | | | $1,295,000 | Not completed/lower-than-anticipated development pressure |
| Reveille Pump Station Upgrade | PS-4 | $1,503,000 | | | | | | | $1,503,000 | Not completed |
| 950 Rezone Area Constant Pressure PS | PS-5 | $1,705,000 | | | | | | | $1,705,000 | Not completed/lower-than-anticipated development pressure |
| New James Street Pump Station | PS-6 | $3,210,000 | $230,000 | $2,980,000 | | | | | | Not completed/revised improvement executed |
| 870 Upper Yew Reservoir West Connection | PL-1 | $1,702,000 | | | | | | | $1,702,000 | Not completed/lower-than-anticipated development pressure |
| 870 Upper Yew Reservoir East Connection | PL-2 | $1,689,000 | | | | | | | $1,689,000 | Not completed/lower-than-anticipated development pressure |
| King Mountain Reservoir West Connection | PL-3 | $2,853,000 | | | | | | | $2,853,000 | Not completed/lower-than-anticipated development pressure |
| Transmission Main to 950 Rezone Area | PL-4 | $459,000 | | | | | | | $459,000 | Not completed/lower-than-anticipated development pressure |
| Yew Street Transmission Main Extension | PL-5 | $2,060,000 | | | | | | | $2,060,000 | Not completed/lower-than-anticipated development pressure |
| Annual Main Replacement | PL-6 | $9,500,000 | $1,500,000 | $600,000 | $2,600,000 | $1,600,000 | $1,600,000 | $1,600,000 | | Completed/ongoing |
| Sunset Drive Phase 2 Water Mains | PL-7 | $300,000 | $300,000 | | | | | | | Completed |
| Mt Baker Highway Replacement II | PL-8 | $900,000 | | | $100,000 | $400,000 | $400,000 | | | Completed |
| Filtration Rate Increase[2] | TR-1 | X | | | | | | | | Not completed/reduced water use |
| Filter Addition[2] | TR-2 | X | | | | | | | X | Not completed/reduced water use |
| WTP: Air Scour System | TR-3 | $950,000 | $950,000 | | | | | | | Completed |
| Hydraulic Model, 3-yr Updates | PN-1 | $100,000 | | $100,000 | | | | | | Completed |
| Metering Program | M-1 | $9,000,000 | | | $2,000,000 | $2,000,000 | $2,000,000 | $3,000,000 | | Underway |
| Nooksack Diversion Passage | DV-1 | $10,000,000 | | | | | | $10,000,000 | | Not completed/inadequate funding participation by other entities |
| | | **TOTALS** | **$2,980,000** | **$3,980,000** | **$8,650,000** | **$4,450,000** | **$9,890,000** | **$14,600,000** | **$41,641,000** | |

# APPENDIX B
# 2012 Water and Sewer Rate Study
## *(Executive Summary only)*

City of Bellingham, WA

# Final Draft Report for 2012 WATER & SEWER RATE UPDATE

August 2012

FCS GROUP
7525 166th Avenue NE, Suite D-215
Redmond, WA 98052
T: 425.867.1802 | F: 425.867.1937

Redmond Town Center
7525 166th Ave. NE., Suite D-215
Redmond, Washington 98052
T: 425.867.1802 F: 425.867.1937

225 Bush Street
Suite 1825
San Francisco, California 94104
T: 415.445.8947 F: 415.398.1601

4380 SW Macadam Avenue
Suite 220
Portland, OR 97239
T:503.841.6543 F: 503.841.6573

FCS GROUP
Solutions-Oriented Consulting

August 27, 2012

Mr. Bob Bandarra, Superintendent of Operations
City of Bellingham
210 Lottie Street
Bellingham, WA 98225

Subject: 2012 Water & Sewer Rate Update

Dear Mr. Bandarra:

FCS GROUP is pleased to submit this final draft report documenting the findings and recommendations of the 2012 Water & Sewer Rate Update conducted for the City of Bellingham. Enclosed is a description of the background and methodology followed for each major task in the study, a discussion of findings and policy implications, and a description of the final recommendations.

It has been a pleasure to work with City staff on this effort. We look forward to working with you in the future, and we encourage the City to direct any comments or questions regarding this study to us at (425) 867-1802.

Sincerely,

| | | |
|---|---|---|
| Ed Cebron | Gordon Wilson | Chris Gonzalez |
| Principal | Project Manager | Project Consultant |

# EXECUTIVE SUMMARY

The City engaged FCS GROUP in February 2012 to perform a comprehensive rate study for its water and sewer utilities. The rate study includes the following components:

- A review of water and sewer utility revenue requirements incorporating:
  - A revised metering schedule reflecting the conversion of the City's unmetered water customers to metered water service by January 22, 2017, as required by the Water Use Efficiency Rule established by the Washington State Department of Health
  - Recent trends in water demands suggesting that per capita water usage has been declining, and will continue to decline
  - Recent economic conditions that have impacted both the behavior of existing customers and the addition of new customers to the water and wastewater systems
  - A change in customer service policy to allow credit cards to be used for monthly utility payments without a separate transaction fee
- Development of recommended water and sewer rates based on projected revenue needs and an updated cost-of-service analysis for each utility
  - For water, shifting separately metered condos from the non-single family to the single-family customer class

In addition to development of projected rates, this report addresses the following elements:

- A review of the City's cost of providing fire protection service, in response to the Washington State Supreme Court's decision in *Lane v. Seattle*
- An update of rates for untreated water service
- An update of sewer rates for the City's special industrial users (SIUs)
- A potential expansion of the existing low-income discount program
- The rate impact of monthly billing

We are preparing separate issue papers that discuss:

- An update of water and sewer SDCs to reflect current estimates of the City's investment in infrastructure and system growth
- A review of the City's methodology for recovering costs from Lake Whatcom Water & Sewer District (LWWSD)
- Development of a wholesale water rate to facilitate possible water sales to other communities

This study developed a multi-year financial plan integrating these various elements, projecting operating and capital costs for the six-year planning period from 2013 to 2018.

Key findings and recommendations resulting from the study include:

**Water**

- Overall water rate revenue should be increased by 9.0% in 2013, 8.0% per year from 2014 – 2016, and by 6.0% per year from 2017 – 2018. Key factors that drive these adjustments are:
  - ***O&M:*** Operating costs are expected to increase by 2% – 5% per year, with a higher near-term impact due to costs associated with the metering program. When the metering program has been completed (by 2017), these incremental costs are expected to go away.
  - ***Debt:*** The proposed 2013 – 2018 water utility capital funding strategy contemplates a total of $35.5 million in revenue bond proceeds (net of issuance costs and reserve requirements) to fund the projected capital costs. An $11.6-million bond issue in 2015 is expected to increase the water utility's annual debt burden by about $983,000 per year beginning in 2016; a 2018 bond issue of $23.9 million would increase annual debt service by an additional $2.1 million (for a total of $3.1 million per year by the end of the study period). In addition, with the planned transfer of $5 million of existing bond proceeds from the sewer utility to the water utility, the water utility is assumed to fund a proportionate share of debt service on the 2011 Revenue Bond. In the near-term, this amounts to about $270,000 per year.
  - ***Capital:*** Consistent with prior recommendations, the forecast incorporates a policy to fund system reinvestment through water rates. The prior water rate study completed in 2007 established an annual funding level based on annual depreciation expense, net of debt principal. However, given the projected increases in debt service discussed above, this analysis reflects a revised benchmark (50% of annual depreciation expense) to stabilize the annual funding level. By the end of the study period, the annual transfers for system reinvestment are projected to increase to about $1.4 million. This is in addition to cash funding provided through SDCs.
  - ***Reserve Funding:*** Consistent with the prior study, this analysis reflects a policy assumption that the water utility maintains an operating (or "working capital") reserve with a balance sufficient to cover 60 days of projected operating expenses. Because the City has currently been maintaining an operating reserve balance of 5% (about 18 days) of budgeted expenses, this analysis phases in the higher reserve target over several years. In addition, this analysis introduces a separate "rate stabilization reserve" intended to provide additional security against revenue risk associated with volumetric revenues, preserving the City's ability to meet its debt obligations even in low sales years. The target balance for this reserve is 50% of annual debt service for debt issued on or after January 1, 2011. Debt issued prior to 2011 is not included in this calculation because the covenants for that debt do not allow use of a rate stabilization reserve to meet bond coverage requirements.
  - ***Expansion of Reduced-***Rate Program: This study included the evaluation of the incremental impact of expanding the City's reduced-rate program based on the low-income threshold established by Whatcom County ($35,000 per year). Based on staff recommendations, the adopted rates assume that this program is expanded.
- The water rate schedule shown in **Table EX-1** is recommended for adoption as inside-City rates. Per City policy, outside-City customers would pay rates that are 1.5 times the rates shown in **Table EX-1**.

## Table EX-1: Summary of Proposed 2013 – 2018 Inside-City Water Rates

| Single-Family Residential & Water Districts | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|
| **Unmetered Single-Family** | | | | | | | |
| Monthly Flat Rate: | | | | | | | |
| Single-Family Residence | $29.96 | ***$32.66*** | ***$35.27*** | $38.09 | $41.14 | ***All Customers Are Metered*** | |
| Duplex | $59.92 | ***$65.31*** | ***$70.54*** | $76.18 | $82.28 | | |
| **Transitional Single-Family** | | | | | | | |
| Monthly Fixed Rate | | | | | ***Combined With Metered Single-Family Residential Rates*** | | |
| 5/8" Meter | $11.61 | ***$16.33*** | ***$17.90*** | $19.35 | | | |
| 3/4" Meter | $15.97 | ***$22.46*** | ***$24.62*** | $26.62 | | | |
| Volume Rate per ccf | $1.53 | ***$1.27*** | ***$1.42*** | $1.64 | | | |
| **Metered Single-Family & Water Districts** | | | | | | | |
| Monthly Fixed Rate: | | | | | | | |
| 5/8" Meter | $11.61 | ***$13.10*** | ***$14.21*** | $15.42 | $19.35 | $20.33 | $21.46 |
| 3/4" Meter | $15.97 | ***$18.02*** | ***$19.55*** | $21.21 | $26.62 | $27.97 | $29.52 |
| 1" Meter | $24.69 | ***$27.85*** | ***$30.23*** | $32.78 | $41.15 | $43.24 | $45.64 |
| 1-1/2" Meter | $46.51 | ***$52.47*** | ***$56.94*** | $61.76 | $77.52 | $81.44 | $85.98 |
| 2" Meter | $72.68 | ***$82.00*** | ***$88.98*** | $96.51 | $121.13 | $127.27 | $134.36 |
| 3" Meter | $142.49 | ***$160.76*** | ***$174.44*** | $189.21 | $237.48 | $249.52 | $263.41 |
| 4" Meter | $221.02 | ***$249.35*** | ***$270.57*** | $293.48 | $368.37 | $387.03 | $408.58 |
| 6" Meter | $439.16 | ***$495.45*** | ***$537.62*** | $583.14 | $731.93 | $769.02 | $811.83 |
| Volume Rate per ccf: | | | | | | | |
| Metered Single-Family Residential | $1.53 | ***$1.58*** | ***$1.63*** | $1.67 | $1.72 | $1.82 | $1.94 |
| Water Districts | $1.53 | ***$2.18*** | ***$2.94*** | $3.82 | $4.10 | $4.38 | $4.67 |

| Non-Single-Family & Irrigation | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|
| **Multi-Family, Non-Residential, & Irrigation** | | | | | | | |
| Monthly Fixed Rate: | | | | | | | |
| 5/8" Meter | $19.51 | ***$21.00*** | ***$21.75*** | $22.39 | $25.56 | $28.32 | $30.86 |
| 3/4" Meter | $27.82 | ***$29.95*** | ***$31.01*** | $31.93 | $36.44 | $40.39 | $44.01 |
| 1" Meter | $44.45 | ***$47.85*** | ***$49.55*** | $51.01 | $58.22 | $64.53 | $70.32 |
| 1-1/2" Meter | $86.01 | ***$92.59*** | ***$95.88*** | $98.70 | $112.66 | $124.86 | $136.06 |
| 2" Meter | $135.89 | ***$146.28*** | ***$151.49*** | $155.94 | $178.00 | $197.27 | $214.97 |
| 3" Meter | $268.90 | ***$289.46*** | ***$299.76*** | $308.58 | $352.23 | $390.36 | $425.38 |
| 4" Meter | $418.54 | ***$450.54*** | ***$466.57*** | $480.30 | $548.24 | $607.59 | $662.10 |
| 6" Meter | $834.21 | ***$898.00*** | ***$929.95*** | $957.32 | $1,092.71 | $1,211.02 | $1,319.66 |
| 8" Meter | $1,333.00 | ***$1,434.93*** | ***$1,485.99*** | $1,529.71 | $1,746.06 | $1,935.11 | $2,108.70 |
| 10" Meter | $2,081.10 | ***$2,240.24*** | ***$2,319.94*** | $2,388.21 | $2,725.98 | $3,021.12 | $3,292.14 |
| 12" Meter | $2,829.39 | ***$3,045.74*** | ***$3,154.11*** | $3,246.93 | $3,706.15 | $4,107.41 | $4,475.88 |
| Volume Rate per ccf: | | | | | | | |
| Multi-Family & Non-Residential | $1.53 | ***$1.63*** | ***$1.77*** | $1.93 | $1.94 | $1.94 | $1.97 |
| Irrigation | $2.30 | ***$2.30*** | ***$2.30*** | $2.30 | $2.30 | $2.30 | $2.35 |
| **Untreated Water** | | | | | | | |
| Monthly Fixed Rate: | | | | | | | |
| 5/8" Meter | | ***$16.80*** | ***$17.40*** | $17.91 | $20.45 | $22.66 | $24.69 |
| 3/4" Meter | | ***$23.96*** | ***$24.81*** | $25.54 | $29.15 | $32.31 | $35.21 |
| 1" Meter | | ***$38.28*** | ***$39.64*** | $40.81 | $46.58 | $51.62 | $56.26 |
| 1-1/2" Meter | | ***$74.07*** | ***$76.70*** | $78.96 | $90.13 | $99.89 | $108.85 |
| 2" Meter | | ***$117.02*** | ***$121.19*** | $124.75 | $142.40 | $157.82 | $171.98 |
| 3" Meter | | ***$231.57*** | ***$239.81*** | $246.86 | $281.78 | $312.29 | $340.30 |
| 4" Meter | | ***$360.43*** | ***$373.26*** | $384.24 | $438.59 | $486.07 | $529.68 |
| 6" Meter | | ***$718.40*** | ***$743.96*** | $765.86 | $874.17 | $968.82 | $1,055.73 |
| 8" Meter | | ***$1,147.94*** | ***$1,188.79*** | $1,223.77 | $1,396.85 | $1,548.09 | $1,686.96 |
| 10" Meter | | ***$1,792.19*** | ***$1,855.95*** | $1,910.57 | $2,180.78 | $2,416.90 | $2,633.71 |
| 12" Meter | $13,359.00 | ***$2,436.59*** | ***$2,523.29*** | $2,597.54 | $2,964.92 | $3,285.93 | $3,580.70 |
| Volume Rate per ccf: | | ***$1.30*** | ***$1.42*** | $1.54 | $1.55 | $1.55 | $1.58 |
| 0 - 296,000 ccf per Month | $0.070 | | | | | | |
| > 296,000 ccf per Month | $0.756 | | | | | | |

*Outside-City rates are 1.5 times the rates shown above.*

The rate forecast shown in **Table EX-1** reflects:

- Across-the-board increases to the unmetered rate structure, based on the aggregate rate revenue increases of 9.0% in 2013, and 8.0% per year from 2014 – 2016. Based on the planned metering schedule, no customers will be in this class beyond 2016.
- Separation of water districts from other single-family customers. A review of recent water consumption patterns suggests that the water districts served by the City use water in a materially different way than the City's other metered single-family customers. These districts equate to roughly 300 homes based on the master meters that are tracked in the City's billing system, but appear to be using as much water as 2,100 homes. Consequently, the proposed rate structure improves equity by establishing a separate rate structure for these districts. Note that this study also included the development of a potential resale rate structure for future wholesale customers, which could also serve as a basis for recovering costs from these customers.
- Introduction of a customer class for newly metered customers, designed to recover approximately 65% of costs from fixed charges and 35% from volume rates. Excluding water districts from other single-family residences as discussed above, the existing metered single-family rate structure currently generates about 56% of its revenue from fixed charges – under the proposed strategy, it would gradually increase its reliance on the fixed charge until it reaches the 65% target after three years. After three years the two customer classes would be merged. This three-year transition period in which there would be two single-family metered classes moderates the increases to both groups – those who are moving from unmetered to metered, and the existing metered customers whose rates will be shifting to a greater reliance on fixed charges.
- Linking of the untreated water rate structure to the non-residential rate structure. Because roughly 20% of the revenue requirement is attributable to water treatment, the untreated water rate structure is set at 80% of the non-residential rate structure. The City's current untreated water customer will pay significantly less under this structure, which is an equitable outcome given that the existing structure is primarily a fixed rate and was based on the historical demand patterns of a different (and significantly larger) industrial customer. In addition to improving equity, this change also makes it easier to attract future customers for untreated water.

**Sewer**

- Overall sewer rate revenue should be increased by 6.5% in 2013 (the increase in the previously adopted 2013 rate structure), 8.0% in 2014, 7.0% per year from 2015 – 2016, 6.0% in 2017, and 4% in 2018. The key factors driving the proposed adjustments are:
  - ***O&M:*** Operating costs are generally expected to increase by 2% – 5% per year.
  - ***Debt:*** The proposed 2013 – 2018 sewer utility capital funding strategy contemplates a total of $32.2 million in debt proceeds (net of issuance costs and reserve requirements) to fund projected capital costs. Public Works Trust Fund (PWTF) loans are assumed to account for $13 million of this debt, adding about $740,000 to the sewer utility's annual debt service burden beginning in 2014. The remaining $19.2 million is assumed to come from additional bond issuance from 2015 – 2018, which is expected to add about $1.6 million to the sewer utility's annual debt service. As previously noted, the sewer utility's annual debt service is reduced to account for a transfer of $5 million of bond proceeds (and related debt service obligations) to the water utility.
  - ***Capital:*** Consistent with prior recommendations, the forecast incorporates a policy to fund system reinvestment through sewer rates. The sewer rate study done as part of the

City's 2009 Comprehensive Sewer Plan established an annual funding level based on annual depreciation expense, net of debt principal. For consistency with the water utility, this analysis reflects a revised benchmark, 50% of annual depreciation expense. By the end of the study period, annual transfers for system reinvestment are projected to increase to about $2.1 million.

- ***Reserve Funding:*** Consistent with the prior study, this analysis reflects a policy assumption that the sewer utility maintains an operating (or "working capital") reserve with a balance sufficient to cover 60 days of projected operating expenses. In addition, this analysis introduces a separate "rate stabilization reserve" that intends to provide additional security against revenue risk associated with volumetric revenues, preserving the City's ability to meet its debt obligations even in low sales years. The target balance for this reserve is 50% of annual debt service. The sewer utility's sole outstanding revenue bond allows the use of a rate stabilization reserve.

- The sewer rate schedule shown in **Table EX-2** is recommended for adoption as inside-City rates. Consistent with City policy, outside-City customers would pay rates that are 1.5 times the rates shown in **Table EX-2**.

**Table EX-2: Summary of Proposed 2013–2018 Inside-City Sewer Rates**

| Sewer Rate Structure | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|
| **Single-Family Residential** | | | | | | | |
| Monthly Flat Rate: | | | | | | | |
| Single-Family Residence | $33.23 | ***$33.97*** | ***$35.07*** | $37.24 | $39.47 | $41.66 | $43.16 |
| Unmetered Duplex | $66.46 | ***$67.94*** | ***$70.15*** | $74.48 | $78.95 | $83.32 | $86.31 |
| **Multiple Dwelling Units** | | | | | | | |
| Monthly Fixed Rate | $33.23 | ***$33.97*** | ***$35.07*** | $37.24 | $39.47 | $41.66 | $43.16 |
| Volume Rate per ccf (> 8 ccf per Month) | $3.49 | ***$4.09*** | ***$4.66*** | $4.99 | $5.43 | $5.80 | $6.07 |
| **Domestic-Strength Non-Residential** | | | | | | | |
| Monthly Fixed Rate | $33.97 | ***$33.97*** | ***$35.07*** | $37.24 | $39.47 | $41.66 | $43.16 |
| Volume Rate per ccf (> 8 ccf per Month) | $3.82 | ***$4.09*** | ***$4.66*** | $4.99 | $5.43 | $5.80 | $6.07 |
| **Medium-Strength Non-Residential** | | | | | | | |
| Monthly Fixed Rate | $19.60 | ***$33.97*** | ***$35.07*** | $37.24 | $39.47 | $41.66 | $43.16 |
| Volume Rate per ccf (> 8 ccf per Month) | $2.45 | ***$4.09*** | ***$4.66*** | $4.99 | $5.43 | $5.80 | $6.07 |
| **High-Strength Non-Residential** | | | | | | | |
| Monthly Fixed Rate | $19.60 | ***$33.97*** | ***$44.35*** | $56.84 | $59.84 | $62.97 | $65.23 |
| Volume Rate per ccf (> 8 ccf per Month) | $2.45 | ***$4.09*** | ***$6.09*** | $7.83 | $8.44 | $8.98 | $9.40 |

The rate forecast shown in **Table EX-2** reflects:

- Creation of three strength classes for non-single-family customers.
  - Domestic-Strength Non-Residential: Includes metered duplexes, residential properties with multiple dwelling units, and the City's current commercial customers. Based on system planning criteria in the City's Comprehensive Sewer Plan, this class (and the single-family residential class) is assumed to generate wastewater with an average concentration of 235 mg/L of biochemical oxygen demand (BOD) and 270 mg/L of suspended solids (SS).
  - Medium-Strength Non-Residential: Includes customers that generate wastewater averaging between 250 mg/L and 500 mg/L of BOD and/or between 300 mg/L and 500 mg/L of SS. Based on average strength ratings of the customers included in this

class, this class is assumed to generate wastewater with an average strength of 355 mg/L of BOD and 155 mg/L of SS for the purpose of allocating costs.

– High-Strength Non-Residential: Includes customers that generate wastewater averaging over 500 mg/L of BOD and/or SS. Based on average strength ratings of the customers included in this class, this class is assumed to generate wastewater with an average strength of 1,131 mg/L of BOD and 235 mg/L of SS for cost allocations.

With respect to the strength standards, a customer's higher strength rating defines their class. For example, a customer generating wastewater with an average strength of 320 mg/L of BOD and 150 mg/L of SS would be grouped in the "medium-strength" class. It is worth noting that in this analysis, the "medium-strength" and "high-strength" classes only include special industrial users (SIUs) due to a lack of data identifying the business types (and related wastewater strengths) of specific commercial customers. As a future enhancement to this structure, the City should consider reviewing its commercial customer base and moving certain types of businesses to higher strength classes based on their average strength ratings. With this change, it would be prudent for the City to develop a list of best-management practices (BMPs) that customers can follow to be considered for reclassification into a lower strength class.

- Elimination of the industrial strength surcharges included in the existing SIU rate structure ($0.19 per pound of BOD; $0.16 per pound of SS). City staff indicated that the City has not actually been able to impose these surcharges due to an inability to directly measure BOD and SS discharges with the equipment currently in place. The proposed rate structure uses average BOD and SS discharges as the basis for developing differential fixed and volume-based rates.

- For 2013, the fixed charge for domestic-strength non-residential customers is kept at its current level. The fixed charges for single-family and multiple-dwelling-unit customers are increased to match the domestic-strength fixed charge, based on the assumption that these three classes generate wastewater of comparable strength. The SIU rates are increased to match the domestic-strength residential rates. For 2014 – 2015, the high-strength non-residential rates are phased to reflect the differential BOD and SS discharges. The other rates are adjusted accordingly to generate the targeted amount of revenue. A review of the costs allocated to the medium-strength class suggested that based on estimated BOD and SS loadings, its rates should be approximately the same as the domestic-strength rates. Consequently, the rate forecast shown in **Table EX-2** reflects the assumption that medium-strength rates are equal to domestic-strength rates through 2018. It is worth noting that the medium-strength class' wastewater characteristics may change if the City expands the class (the medium-strength class now includes only one customer), possibly warranting a separate rate structure in the future.

- Consider a more detailed review of the City's state excise tax reporting practices. A cursory review of City tax worksheets found that the City might have an opportunity to reduce its tax expenses, given various deductions and exemptions allowed under State law. This review may also provide the supporting documentation that the City would need in order to request a refund from the Department of Revenue for historical tax payments. The findings presented in this report assume the implementation of the identified refinements moving forward, but do not incorporate an assumed refund of past payments.